POPULAR WIRELESS WEEKLY, January 20, 1923.

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SPECIAL WIRELESS MAP (27" x 20") FREE INSIDE

TOGETHER WITH A FOUR-PAGE DIRECTORY OF AMATEUR STATIONS WITH CALL SIGNS AND ALL DETAILS

POPULAR WIRELESS

3d.

Weekly

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Jan. 20, 1923.

HOSPITAL PATIENTS LISTEN TO GRAND OPERA BY WIRELESS.

FOUR-PAGE SUPPLEMENT FOR BEGINNERS

(COMMENCES IN THIS ISSUE)

NEXT WEEK.

SECOND INSTALMENT OF BEGINNERS' SUPPLEMENT.

WHAT TYPE OF SET TO BUY.

This article will clearly explain how much you need spend for various wireless sets, and exactly what you will need if you are a certain distance from a broadcasting station.

Popular Wireless

TOPICAL NEWS AND NOTES.

NEXT WEEK.

"THE FUTURE OF BROADCASTING IN THE HOME."

An Interview with Senatore Marconi, who gives his views on the possibilities of broadcasting. (Special to POPULAR WIRELESS.)

"LISTENING TO OPERA BY WIRELESS."

Mr. Landon Ronald's opinion on broadcast music.

The First Radio Opera.

ALL those who listened-in to the first opera broadcasted by wireless in this country, must have felt a little surprised at the amazing success of the venture. The chatter of the audience, the "tuning-up" of the orchestra, the rap of the conductor's baton—the whole affair was a most delightful novelty.

* * *

An Orchestra Next?

WHEN you come to think of it, it is rather astonishing how well the voices in the first and succeeding operas broadcasted.

On the stage the various artistes were not only singing but acting as well; they moved about continually, turned their heads away from the microphones, and assumed all sorts of attitudes, yet the variation in the strength of their voices was not sufficient to render signals at all inaudible in my telephones.

Excellent as the results were, I feel sure that if the Queen's Hall orchestra are broadcast in the same way, the result will be better still, for the players retain their position throughout the programme.

* * *

That Rushing Noise.

THE rushing noise heard during the transmission of opera from Covent Garden via Marconi House will, doubtless, be put down to "landline" noises. As a matter of fact, it is caused by the amplifiers—which are of special design with a secretive inaccessibility—situated underneath the stage at Covent Garden. The circuits employed are of novel description; and special transformers are used for them in the actual wireless transmitting-room.

* * *

Better and Better.

I HEAR from a very authoritative source that 2 L O expects to be able to spring a surprise on the radio world shortly in respect of an entirely new type of microphone. Veritably it will be adding "super" to quality. The "voice" number "one" and "voice" number "two" tests recently carried out gave me the first clue. Ladies can change their names but seldom their personality. Did anyone else spot it?

* * *

To Be Exact.

2 L O is able to regulate the wave-length of its transmissions to the extent that accuracy is obtainable to a quarter of a metre. At the time of writing 2 L O's wave-length is exactly 373¼ metres—truly a micrometric adjustment!

WIRELESS IN THE HOME

By the Editor.

With this number of POPULAR WIRELESS is included a New Supplement for the absolute beginner, and a specially prepared Map of the radio stations in this country.

The new recruits to the ranks of wireless enthusiasts will find amusement and instruction not only in listening to the official broadcasting stations, but also in listening to amateur transmitting stations. Amateurs now work chiefly on an adjustment of 180 metres, but some may be heard on 400 metres.

* * *

Since broadcasting began the popularity of wireless has increased by leaps and bounds, so that at the time of writing these words it is estimated that there are 60,000 licensees in London alone. It is hard to say how many there are in the whole country, but 100,000 would be a moderate estimate.

The new amateur, once he has heard a broadcast concert on his set, naturally becomes all the keener. He wants to know the why's and wherefore's of wireless; how he can improve his set, and perhaps obtain an experimental licence.

POPULAR WIRELESS is at his service. No trouble is too great for us so long as we can be of assistance to our readers, and if there are any little problems—never mind how trivial—that are puzzling you, write in to POPULAR WIRELESS, and we will solve your difficulties for you by post—free of charge.

* * *

Special arrangements have been made by the staff of this paper in order to advise and assist readers who are anxious to purchase wireless sets. For details, see our Radio-torial Page.

If you want to have a receiver of your own but feel diffident about buying one without advice, just drop a line to the "Queries Department" of POPULAR WIRELESS, and we will assist you to our utmost.

* * *

The British Broadcasting Company has already given us a taste of its fare, and very excellent fare it is, too. The broadcasting of opera from Covent Garden by wireless was an innovation that took the country by storm; and the results have more than justified the experiment of bringing opera into thousands of homes by radio. So urge your friends to buy a receiver and enjoy the broadcasting. The more the merrier.

Wireless Control.

GREAT interest was evinced by the youngsters—and their parents—in the wireless controlled model train exhibited by Major Raymond Phillips on the Bassett-Lowke stand at the recent Model Engineer Exhibition at the Royal Horticultural Hall, London. Regular readers of POPULAR WIRELESS must have felt quite superior in their knowledge of "how it works," owing to the series of articles constructionally detailing the set that Major Phillips wrote specially for POPULAR WIRELESS.

* * *

A New Address.

I UNDERSTAND that owing to a considerable increase in business, Messrs. Radio Components, Ltd., have moved to larger and more convenient premises at 19, Rathbone Place, W.1. (3 minutes from Tottenham Court Road Tube Station).

* * *

Opera for Manchester.

IT is probable that when the opera company visits Manchester the same arrangements will be made as in London to broadcast the operas each evening. In the case of Manchester, however, the land line will be six miles long, as the Manchester station is some way from the theatre where the operas will be given.

* * *

For Traders and Manufacturers.

I AM advised that an association has recently been formed under the title of "The National Association of Radio Manufacturers," and that it comprises in its membership the principal British producers of radio apparatus.

The association has been brought into being for the purpose of preventing those chaotic conditions which inevitably arise in a new industry if the solution of all problems is left to individual effort.

It is interesting to note that the Radio Section of the "Daily Mail" Ideal Home Exhibition to be held at Olympia from March 1st to 24th (inclusive) will be under the control of the association. The arrangements include the acquisition of a theatre at Olympia capable of seating 1,000 people, in which radio demonstrations will be organised by the association throughout the period of the exhibition.

Messrs. Derbyshire & Co., Chartered Accountants, of 4, Southampton Row, London, W.C.1., are acting as secretaries to the newly formed organisation, and will be pleased to furnish further particulars to any duly qualified British manufacturers who would like to consider the question of membership.

A One-valve Set.

THE reception of the American broadcasting stations in England has been accomplished on a single-valve set that would appear to be quite authentic. I am emphasising the fact in an endeavour to decrease the "record-breaking" correspondence which I am receiving on this subject.

* * *

Have a Try.

TO go one better would demand a crystal set to accomplish the feat, but I really expect that somebody will go "that one," but, please, when doing so send the fullest possible details. I would like to possess such a set myself!

* * *

Speeding Up.

CAPTAIN LEWIS, the deputy director of programmes of the Broadcasting Company, has been personally conducting a series of experiments in voice transmission from Marconi House. Perhaps it has been noticed that he has, during the children's stories and news, been varying the quality and speed of articulation. He hopes to be able to considerably "speed-up" the transmission of such items.

* * *

The New Craze.

THE craze for wireless is spreading now more rapidly than ever. People are indeed going wireless mad and are forgetting their work. One business man has complained to Marconi House that wireless has been responsible for his wife neglecting her household duties. "At half-past five each evening," he wrote, "instead of my wife preparing the evening meal she sits down to 'listen-in.'" Perhaps before long we shall hear of wireless divorces.

* * *

The Latest.

I HEAR the B.B.C. are endeavouring to arrange for the transmission of "The Last Waltz" from the Gaiety Theatre. They have also other musical comedies in mind.

Doubtless we shall be pleasantly surprised before very long.

Sounding the Chimes at Marconi House.

Sunday Service.

THE decision of the B.B.C. not to transmit on Sundays during the hours of public worship will, I think, meet with universal approval. It has, however, taken the point out of Talbot O'Farrell's joke. Briefly, it is that Scotsmen are missing church and enjoying the service at home by wireless—and missing the collection. Even Scotch folk have been heard to laugh at this.

* * *

Even public houses are taking up wireless—a counter attraction to 30 under proof!

Some Applause.

ONE would have thought that to listen to the whole of "Faust" by radio would be a bit too much; but last Saturday I switched on at 7.15, and kept the loud speaker working until the curtain fell at 11.10. Mr. Robert Radford's voice was as clear and strong as a bell, and the applause—well, it was about as much as my Magnavox could carry!

"Siegfried" by Wireless.

ON the night Wagner's opera "Siegfried" was broadcast I took a Marconi portable set round to the home of Sir Landon Ronald, the famous conductor and composer. Sir Landon was delighted with the results and—but in next week's P.W. he himself will give his opinion of wireless music.

ARIEL.

Broadcasting Programmes

What you can hear every evening of the week on your set.

TELEPHONY AND MUSIC TRANSMISSIONS.

Station.	Call sign.	Wave-length in metres.	Remarks.
Marconi House, London, Broadcasting Station	2LO	369	Usually every evening, 5 to 5.45 p.m.; 7 and 9.30 News; 7.15 Orchestra; 8.25 to 10.30 Music.
Newcastle Broadcasting Station	5NO	400	6-10 p.m. (approx.).
Manchester Broadcasting Station	2ZY	385	Every evening, usually from 4.30 to 10 p.m.
Birmingham (Witton) Broadcasting Station	5IT	425	Every evening, usually from 6.30 to 10 p.m. (News, Concerts, etc.).
Croydon	GED	900	Throughout day to aeroplanes.
Writtle, Essex	2MT	400	Tuesdays, 8 p.m. (Concert.)
Paris	FL	2,600	11.15 a.m. Weather report; 6.20-7 p.m. Weather report and Concert; 10.10 Weather report.
Königswusterhausen	LP	2,800	Between 6 and 7 a.m., between 11 and 12.30, and between 4 and 5.30 p.m.
The Hague	PCGG	1,085	Sundays, 3 to 5 p.m. (Concert.)
Haren	OPVH	900	Practically every 20 minutes past each hour from 11.20 to 4.20, giving messages to aeroplanes on the Brussels-Paris, Brussels-London, and Brussels-Amsterdam lines.
Radio-Electrique, Paris	——	1,565	5.5 p.m. News Items; 5.15 to 6.10 Concert; 8.45 p.m. News Items; 9 to 10 p.m. Concert.

Note.—See announcements in daily Press for last minute alterations in times of Broadcasting Programmes.

NOTE.—The Bar Lightship, Liverpool, sends telephony at 7 a.m., 9 a.m., 11 a.m., 12 noon, 1 p.m., and every two hours until 9 p.m. Calls "Dock Office." Liverpool answers "Bar Ship."

In addition to the regular transmissions carried on between the British amateur stations, much telephone conversation may be heard from St. Inglevert (A M), Le Bourget (Z M), and Brussels (B A V). These stations are quite powerful, but they call for a little extra care in tuning. Wave-length, 900 metres.

All times given are G.M.T.

MUSIC BY WIRELESS.

By MARK HAMBOURG.

In the following article Mr. Mark Hambourg, the famous pianist, gives his opinion on the broadcasting of music by wireless. Mr. Hambourg listened-in to the grand opera transmitted from Covent Garden, via 2 L O, the other evening, and in the next column will be found an account of how a special demonstration set was fixed at Mr. Hambourg's house, and his candid opinion of the broadcast opera.—EDITOR.

IN a recent number of this journal, Mr. George Bernard Shaw suggested that broadcasting might prove of educational value if Sir Johnstone Forbes-Robertson were to recite good English to "listeners-in" for half an hour each day. As a rider Mr. Shaw added the belief that this would prove a "startling novelty" to most of the subscribers.

From the musical point of view there is no doubt but that broadcasting will, if conducted on the right lines, prove of great educational value; thousands of people, to whom Bach, Beethoven, and Mozart are only names, will learn to appreciate the difference between good and bad music; they will listen (in time) with infinite pleasure to the "Moonlight Sonata" in preference to "That Coal-Black Mammy of Mine"; and although—to borrow Mr. Shaw's own words—good music may prove a "startling novelty" at first, I believe a vast number of "listeners-in" will quickly learn to love it.

But on the other hand the musician has got to weigh the pros and cons of broadcasting very carefully. Is it going to pay him to be "exploited by wireless"? Will it induce people to attend his concerts? Personally, I think it will; for, as the love of good music is acquired, people who have hitherto not attended concerts will want to enjoy the pleasure of listening to those where first-class artists perform.

Bach Deposing Foxtrots.

To my mind this wireless broadcasting will undoubtedly prove a great educational factor in our lives. Whenever I see in the papers that a new pianist is to give a recital, I say to myself:

"All the better; the more musicians there are, the better for all of us, because our public will grow larger and larger, and good music will be more and more appreciated."

When listening to wireless music I think one of the most remarkable things about it is the fact that the actuality of the player is so distinctly conveyed to the vast, unseen audience. And the musician himself cannot but feel impressed by, and a little thrilled at, the knowledge that his music is being heard, perhaps, over hundreds of square miles—while the listener, even if familiarity has dulled the thrill and wonder of it a little, cannot fail to appreciate the fact that he is listening to an actual performance; that every note of the piece to which he is listening is being conveyed to him at such a speed that it reaches his ears at practically the same time as it reaches the ears of the musician himself.

It is this sense of individuality, and the appreciation of the actuality of the player, that will help to make wireless music popular. The musical education of the public by wireless cannot fail, providing those responsible for the programmes see to it that the right music is broadcasted by the right people.

Mr. MARK HAMBOURG.

Judicious selections from the great composers would help tremendously towards the musical education of a vast public. In time people will become as keen on the merits and demerits of Bach as they are now on the merits and demerits of the latest ballroom fox-trot.

BROADCASTING OPERA.

Mr. HAMBOURG "Listens-In."

By ARIEL.

WHEN it was announced by our good friends at 2 L O that Mozart's opera, "The Magic Flute," was to be broadcast by wireless on the evening of January 8th, I asked Mr. Mark Hambourg, the famous pianist, if he would care to "listen-in," and give POPULAR WIRELESS his opinion of the B.B.C.'s initial effort to broadcast opera.

Mr. Hambourg very kindly consented, and so I made arrangements accordingly.

Through the courtesy of the Marconi Company, I borrowed a six-valve portable receiver.

The set is contained in an ordinary suit case, with a loop aerial wound round the lid. Beyond two potentiometers for valve control there are no switches, or knobs to fiddle with, the frame aerial being fitted for 2 L O's wave-length.

Before the day fixed for the broadcasting of opera, I had tested this set out fairly exhaustively. I had gone a taxi ride with it, and heard the 7 o'clock news message from 2 L O perfectly. I took it into a Tube; but although signals came through, the local interference was, of course, very bad. Good signals, in fact, can be picked up on this extraordinarily amazing little set within a radius of about 20 miles of London. And no outside aerial or earth, ye proud owners of chimneypot masts and gaspipe earths.

Wonderful! Wonderful!

I arrived at Mr. Hambourg's house in Regent's Park at about 8 o'clock, and a few minutes later had arranged the set on a chair in his drawing-room, and handed Mr. and Mrs. Hambourg, their two daughters, and Lord Muir Mackenzie (who was also present) the telephone headpieces.

For a minute or so I felt rather chilly, because the only sound in the 'phones was a slight hiss. Mr. Hambourg looked at me a little quizzically, but just as I felt I should *have* to make an explanation along came 2 L O's cheery call, announcing we were now to be switched over to Covent Garden.

And then, quite clearly, we heard the chatter of the audience, the whimpering of the violins tuning up, and the joyous piping of the flutes and oboes and the throaty gurgle of the brass instruments. A sharp, sudden tap (the conductor's baton!), and the orchestra ceased their wailing, and a second later the overture to the opera came clearly to our ears.

Mr. Hambourg sat entranced. Every now and then, as he heard some favourite passage, he would beat time with his finger in sheer delighted amazement, and when the overture ceased and the sound of clapping reached our ears, he cried aloud:

"Wonderful! Wonderful!"

And, hardened wireless sinner that I am, his enthusiasm made me realise all over again the astounding perfection to which broadcasting has been brought in such a short space of time.

Concentrated Magic.

At dinner Mr. Hambourg had the portable set close by him on a chair, and so enjoyed his meal all the more to the charm of Mozart's opera.

"You know," said Mr. Hambourg, "if you'd brought this wireless set out two hundred years ago you'd have been burnt at the stake. Here am I, listening to an opera being picked up by an instrument in a suit case; no outside wires, no connections. Why, it's absurd!"

And Mr. Hambourg became quite excited as he stared at the portable receiver and the six twinkling little valves—a veritable box of concentrated magic. Mr. Hambourg was especially interested in noting how the various instruments in the orchestra broadcasted. He was especially charmed by the purity of the tones of the flute and clarionet. And when I left, Mr. Hambourg declared himself delighted and amazed at the clarity of the orchestral music and "human" feeling of the voices of the opera artistes.

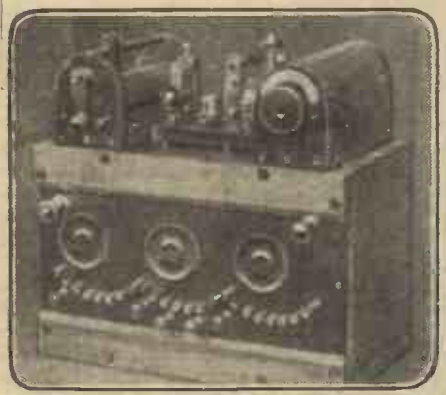
And I took Marconi's amazing box of tricks back home, glad to think that one of our great artistes had formed such a high opinion of the initial effort of the Broadcasting Company in transmitting grand opera by wireless.

THE ADVANTAGES OF HIGH-RESISTANCE 'PHONES.

THE beginner is frequently puzzled as to the reason why he is always advised to use high-resistance 'phones, instead of the cheaper low-resistance variety, either in a crystal set or when placed in series with the plate circuit of a valve.

The reason is comparatively simple. The telephone is an energy-operated device. The more power that can be applied to vibrate the diaphragms in the ear-piece the louder will be the resulting signals.

The energy utilised to vibrate the diaphragm is in the form of a magnetic field, created by the electric current flowing through the coils of the ear-piece. But the strength of this magnetic field depends upon two factors: (*a*) the actual strength of the



Home-made Crystal Set, by M. K. Holden, 165, Manchester Road, Mossley, near Birmingham

current, and (*b*) the number of turns of wire in the ear-piece coils. In other words, the magnetic field produced by the varying current depends upon ampere turns.

In the case of a single valve receiver, the current flowing through the telephone coils for a given grid potential will be inversely proportional to the total resistance of the plate circuit as a whole. The resistance in question is almost wholly made up of (R) the resistance of the internal plate-filament path of the valve and (r) the resistance of the ear-piece coils in the telephone.

The Useful Factor.

Taking the high-tension as 50 volts, and ignoring impedance effects, the steady plate current will be equal to $\frac{50}{R+r}$. The resistance R of the valve may be taken approximately as 58,000 ohms.

Now, if two telephones are compared, one say of 2,000 ohms resistance, and the other of 8,000 ohms, the current in one case will be $\frac{50}{58,000}$ 0·96 milliamps., whilst in the other case it will be $\frac{50}{58,000}$ or 0·86 milliamps.

Assuming for the sake of simplicity that the same thickness of wire is used in both types of ear-piece, the number of *turns* in the high-resistance 'phones will be *four* times that of the other.

So that the relative strengths of the magnetic pull upon the ear-piece diaphragms in the two cases will be as 4 × 0·86 is to 0·96—or roughly three and a half to one. The signal strength will be in the same proportion.

To put it in a nutshell the loss in current owing to the extra resistance introduced into the circuit by an 8,000 ohm pair of telephones is more than compensated by the extra number of turns of wire that are made available, the actual magnetic energy applied to the diaphragm depending not upon the current alone, but upon the ampere turns.

Exactly the same reasoning applies to a crystal circuit, and it may be shown mathematically that maximum efficiency is attained when the telephone resistance is made equal to half the total resistance of the circuit. Considerations of size and expense however limit the winding of such 'phones to the practical maximum of 8,000 ohms now in general use.

NOTES ON THE LONDON ETHER

By 2 G M

WE were speaking to one of the great unlicensed the other day. "Do you mean to say," said he, "that standing here in the Strand wireless waves from Marconi House will pass right through me on their way to Charing Cross?" We informed him that they certainly would, and moreover were he to swallow a small receiving set, he would, with the aid of an X-ray and a "shimmy" for adjusting purposes, be able to "soothe his savage breast" from within.

Thunder from 2 O N.

But what ignorance—what a pusillanimous outlook! Fancy restricting 2 L O's "harmonic dodger" to a run down the Strand to Charing Cross! Fancy not even crediting 2 L O's musically modulated wave with sufficient intelligence to take the 6.10 to Chislehurst!

The sooner the "man in the street" (not to mention that one in the Strand) realises that the London ether quivers regularly every evening with the tuneful melodies provided by 2 L O, and that both City and Suburbia can enjoy same with but the assistance of a crystal set and a 10s. licence, the sooner will he realise the beauty of the words of Moore, "And music too—heard far off, so far as to seem like the faint, exquisite music of a dream." That is until valve by valve he reaches six valves and a loud-speaker when all the neighbours will curse the power of his "gramophone."

Will that amateur who described 2 G M as a "low-lying station," at 11.10 a.m., 10th inst., please supply us with his identification number, as we wish to point out that his geography requires revision. Another station that must be at least temporarily nearer to Heaven than the majority, is doubtless 2 L P, who we understand has actually obtained successful results with an Armstrong super-regenerative circuit. Verily a triumph.

2 O N renews his activities at opportune hours with a diaphragm splitting note on 180 metres. With all due respect, our impression of 2 O N the other night was what might be expected from the coupling of the battered megaphone of a Mediterranean pilot to a stentorphone with a split diaphragm. Developments must be expected.

Seasonal Greetings.

2 O N must have discovered a radium spring or some potent source of atomic energy in his garden. We wonder if he remembers what Shakespeare said in the year 1602 regarding wireless telephony transmissions? The actual words were, if we remember aright, "Give us a taste of your quality, not power," but then we happen to be very close to this particular amateur lightning producer.

Talking about wireless and the noble bards, we wonder if Wordsworth was referring to 2 K T when he dejectedly exclaimed, "They should take who have power," because we heard 2 K T the other night pushing out his worst and flattest C.W. wave during 2 L O's transmission. We had written that "2 K T drops his fiddle and 'comes back' very creditably on 180 metres," but we must add that that remark must now be accepted with discretion, because his C.W. caused quite a lot of "—amming" upon that occasion.

He only possesses one gramophone record, we believe, so it would be useless for him to add an alternative attraction on 180 metres for the multitudinous "takers." Anyway, we hope 2 K T will never have the "pleasure" of hearing "The broken melody" from 2 L O.

Taking everything into consideration, we think it would be as well for 2 K T to pick up his fiddle again, at any rate, during broadcasting hours.

2 H Y really should not call his fellow electron pushers "Priceless old beans." It isn't done. It is almost as bad as "5 Pip Pip" with his "Closing down now, so smash smash, old valve."

2 L O has gathered together a splendid little drove of melody manufacturers who will creditably go down to posterity as the first British Wireless Orchestra. Also 2 L O's transmission leaves very little to be desired, and soon, no doubt, their youthful microphones will grow out of those delicate little lisps.

The Radio New Year programme broadcasted over that memorable 11.55 p.m. to 12.12 p.m. period from 2 L O was excellent. We believe feelings of trepidation were audibly expressed by just a few as to the possibility of the "reservoir" of that noble wind instrument, the bagpipes, which energetically performed upon that auspicious occasion, coming into fatal contact with a sharp end of 2 L O's famous "broken lead." That, of course, was all rot; and, anyway, the ever resourceful Mr. Burrows would have immediately been at hand with a small portion of stamp edging.

Shortly after 2 L O had gone to roost for the night, or rather morning, the ether commenced to tear itself to pieces with "Happy New Year, Old Man!" from a horde of diminutive broadcasting stations, classified officially as "10 watters." Sentiment was excellent in all cases, transmission excellent in a few cases, fair in many, but in the case of the rest—well, "Happy New Gear, Old Jam!"

WIRELESS STAGE "STUNTS."

By MAJOR RAYMOND PHILLIPS, I.O.M., late Member of the Inter-Allied Commission of Control.

IT is probably not generally known that wireless has for many years played an important part in connection with various stage stunts, more particularly those arranged to create an atmosphere of mystery. Many so-called spiritualistic manifestations have been effected by means of concealed wireless apparatus, and in big spectacular stage productions, remarkable and ingenious engineering feats are sometimes involved.

Interesting effects can be produced by means of what is technically known as the inductive method of transmission and reception. The latter functions on the same principle as the inductive phenomena between the primary and secondary windings of an ordinary induction coil. Two coils are used (each one separate from the other), one for transmitting, and the other for receiving. This method could scarcely be called wireless in the strict sense of the term, although there are no connecting wires between the transmitting and receiving coils and apparatus.

Those readers who wish to try the experiment can easily do so, as the transmitting coil may simply consist of 25 turns of double silk-covered copper wire, No. 18 gauge, wound in a circle 4 feet 6 inches diameter. A simple method for winding is to drive wire nails in an old door, or in a wall (if the landlord does not object), in a circle of the diameter specified, and lead the turns over the nails.

When the required number of turns have been wound, it will be necessary to wrap the coil with insulating tape, leaving say 12 inches of the terminal wires free for connecting in series with an ordinary telephone transmitter or microphone and battery.

The Talking Kettle.

The receiving coil can be wound 3 feet diameter with 70 turns of No. 20 gauge double silk-covered copper wire, and completed the same as the transmitting coil, except that it will only be necessary to connect an ordinary telephone receiver to this coil. A battery is not required.

If the transmitting coil with its microphone and battery is placed in one room, and the receiving coil with its telephone receiver placed in another room (the planes of both coils being parallel to one another), words spoken in the microphone will be distinctly heard in the telephone receiver attached to the receiving coil.

It will be understood that the transmitting and receiving coils can be made in various sizes according to the gauge of copper wire used, so that the experiment can be performed in such a manner as to completely mystify an audience.

For instance, a receiving coil might be neatly attached to a lady's skirt, and the terminal wires and telephone receivers connected therewith completely concealed.

With the introduction of a little trickery the lady would be in a position to reply to apparently impossible questions, as a confederate would, of course, communicate with her through the medium of a transmitting coil, microphone, and battery connected therewith, but also concealed.

Many years ago a papier mâché kettle was introduced. It contained a receiving coil and telephone receiver. Speech could be heard emitting from the spout of the kettle when a confederate spoke into the microphone attached to a transmitting coil, the latter of course being conccaled.

Illuminated Fairies.

The device caused a sensation at the time, many people believing that communication with "spirits" had actually been established, as the kettle could be carried about a room, and turned upside down. The receiving coil and telephone receiver were of course concealed (the kettle being provided with a false bottom), so that the interior could be examined with impunity.

Testing Loud Speakers by means of an instrument that photographs defects. The slightest "fault" is shown

With modern radio telephony, it is obvious that in future it will be possible to produce astounding effects.

A stunt I introduced in 1912 involved the genuine wireless control of lighting miniature electric lamps attached to the dresses of lady dancers. The feat presented some difficulties, as the source of power had to be provided from non-spillable types of accumulators.

The coherer, relays, and selector were contained in a neat box, the latter being attached to the back of a dress. The antenna at first consisted of two aluminium rods neatly bent to a suitable shape, but afterwards were arranged to represent wings, so that the dancers appeared as fairies.

With a stage suitably lighted, the effect was brilliant, as the dancers' dresses appeared to be enveloped in flames. From the foregoing remarks it will be apparent that the scope for wireless stage stunts is practically unlimited, but it must not be overlooked that the principal difficulty is to produce a demonstration which will entertain, amuse, and interest an audience.

As I have on many occasions been asked what led me to introduce so many novelties on a Music Hall stage, I will conclude this article by giving a brief account of the events which led to my first appearance at the London Hippodrome.

The Wireless Airship.

In 1906, when wireless, telepathy, and aviation were practically in their infancy, I commenced experimenting with the wireless control of mechanism, and subsequently succeeded in constructing a piece of apparatus which gave promising results.

After further experiments during 1907 to 1910, I constructed a wireless controlled airship, and wrote a letter to Mr. (now Sir) Oswald Stoll, asking if he could see his way to allow me to conduct "rehearsal" flights with my airship during the daytime in one of the theatres under his control. I received a reply by return granting the facilities asked for, and subsequently in reply to my telegram announcing that "rehearsals" were completed, I was asked to give a trial demonstration at the London Hippodrome on Friday evening, April 29th, 1910, between the performances at that theatre.

After the demonstration I was instructed to appear at the London Hippodrome on the following Monday, May 2nd, 1910, and thus for the first time in the history of the world, an airship was wirelessly controlled by me before an audience in a Music Hall. In my previous articles in POPULAR WIRELESS I have referred to many other demonstrations with apparatus which I have designed and constructed.

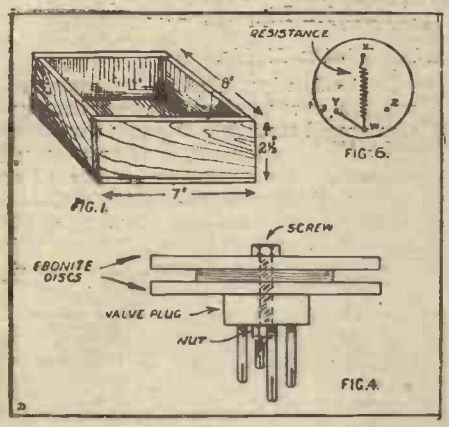
I shall shortly introduce further novelties which I hope torefer to at some future date.

HOW TO MAKE AN H.F. AMPLIFIER.

By H. G. HERSEY.

(Member of the Wireless and Experimental Association.)

WITH broadcasting an established fact we find ourselves working hard with the object of tuning up our sets not only to a wave-length but to the highest point of efficiency. It is now that we realise what a valuable asset to the apparatus reaction used to be; without it we find our single valve reduced to the level of a mere

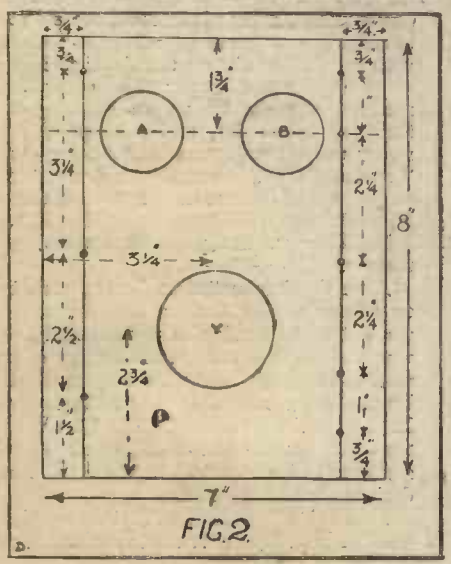


crystal, and costing no small sum for its extravagance in the way of filament current.

It is the object of this article to offer a few practical details towards the construction of a high frequency panel, this to be placed in front of our detecting valve, and to serve one or two important functions, such as amplifying the weakest of radio frequencies, thus giving our detecting valve something tangible to work with and resulting in an increase to the range of reception, also it will afford a ready means of introducing reaction in such a way as to conform to the Postmaster's requirements.

The Base and Panel.

A sheet of ebonite is purchased, 8 in. by 7 in. by ¼ in., and a base is made up from some hard wood to mount the ebonite upon. This base is shown in Fig. 1. The ebonite should next be marked out as in Fig. 2, and



we are ready to commence assembling the various components. The circles A and B represent the positions to be taken up by the two valve holders, the former for our valve and the latter to hold High Frequency Transformers of the 4-pin plug in type. The method of mounting these valve holders will be best solved by the reader, for there are so many patterns available, each having its particular arrangement for mounting.

The filament resistance is another factor calling for consideration; should the reader purchase an ex-Army filament resistance as with the detector panel, a method of mounting the same is shown in POPULAR WIRELESS, No. 26, page 569. If any other pattern is at hand undoubtedly the reader will soon see a way and means of attaching the same to his panel in the position Y.

The panel having been previously drilled along the sides for the 8 terminals, according to their size, also the holes for the wood screws around the edges, is now ready for the terminals and wiring.

Wiring and Connections.

The wire used should be of about No. 20 S.W.G. and well insulated, preferably systoflex or rubber covered. Commencing with the filament circuit a lead is taken from L T + terminal to the filament resistance, another from the resistance centre to the right hand side socket of valve holder A, a second connection is taken from L T − terminal to left hand filament socket.

The filament circuit complete can now be tested with a valve in position, its brilliancy being adjustable by the filament resistance. Having proceeded so far successfully we can commence wiring the various H F circuits. The F terminal is connected to the left hand filament socket, and the G terminal is connected to grid socket. The input side of the valve is complete, and we can now deal with the plate circuits.

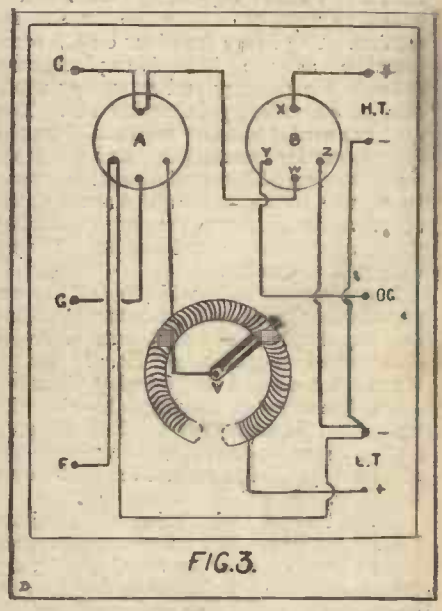
From the H T + terminal a lead is taken to valve holder B, socket X, Fig. 3. From socket W another is taken to the plate of the valve holder A, and also extended to terminal C. It is now observed that the plate current is broken between the points X, W −. It is here that we are to insert the primary coil of our transformer, resulting in a tuned anode circuit.

To complete the secondary circuit a lead is taken from the socket Y to the terminal O G (output to grid). The secondary winding of transformer is to be placed between points Y Z, and as the connection from Z must go to the filament of the detecting valve it can be conveniently taken to the L T − terminal of this panel. It now remains to connect H T − and L T − together and the wiring is complete. The panel can now be screwed to its base and papered flush with the woodwork, the latter being treated to varnish or polish to taste.

A number of high frequency transformers will be required to cover all wave-lengths, each having its particular range, which can be increased by placing a variable condenser across its primary, *i.e.*, between terminals H T + and C. The building of these transformers calls for no special skill or ability.

The reader should collect as many old valve bases as possible. (The local dealer will often provide these for a small sum.) It is the 4-pin plug we require as a means to mount our transformer upon.

A sheet of ebonite ⅛ in. thickness should be purchased, its size depending upon the number of transformers we desire to construct. The ebonite is cut into discs by means of a fret saw, and three discs clamped to a 4-pin plug make an ideal former in which to wind



our wires. A transformer to cover the broadcasting wave-lengths is made up as follows:

Two discs of ebonite are cut each 2¾ in. diameter, a third disc is cut 1¾ in. diameter; a hole is now drilled through the centre of each to take a small brass screw and nut, the length of screws to be ⅞ in. (a contact stud answers this purpose well). The valve plug is next taken, and a hole is drilled through its centre between the 4 pins, and the discs and plug should be assembled as in Fig. 4.

Test for Continuity.

A small hole should now be pierced through the bottom flange opposite the anode pin, and ½ in. from the circumference. A short length of No. 26 or 28 enamelled wire is passed through this hole to protrude beyond the flanges, and the inside end of the primary winding should be soldered to this, the joint being pulled in to the centre of the transformer with the outside end. We now wind on 80 turns of No. 38 S.W.G. D.S.C. wire for our preliminary winding. The depth of winding should be gauged and a hole pierced through the bottom flange opposite the grid pin.

A length of 26 enamelled wire is inserted and a connection made, the joint being insulated with paper and pulled to the coil.

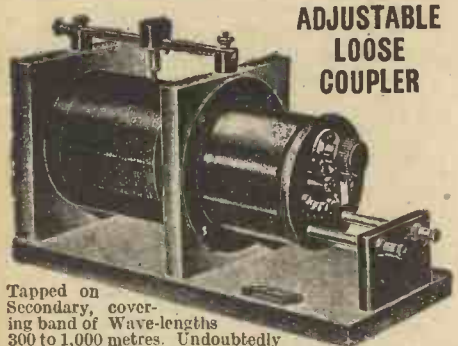
(*Continued on page 785.*)

Complete Clearance of Wireless Oddments at

GAMAGES SALE

This is a unique opportunity for you to secure Genuine Bargains in Wireless Apparatus. Gamages have large surplus stocks on hand which must be cleared, and in order to do this speedily, prices are cut to the lowest possible level. The goods offered are in every way new and perfect, being regular stocks, and you can order with every confidence of satisfaction being given, or your money returned in full.

ADJUSTABLE LOOSE COUPLER



Tapped on Secondary, covering band of Wave-lengths 300 to 1,000 metres. Undoubtedly the most efficient for shorter wave-lengths, especially with Crystal receivers

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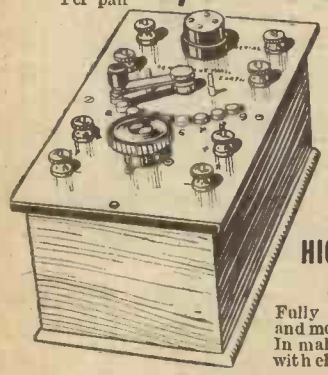
Cast Aluminium END HOOKS

For Aerial spreading. Secured by means of a screw.

Per pair **2/6**



Best Quality CRYSTALS

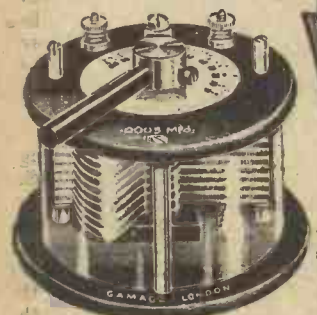
Fine large specimens each

Bornite	1/-
Copper Pyrites	1/-
Carborundum	1/-
Silicon	1/-
Tellurium	1/6
Permamite	2/6
Zincite	2/6

HIGH FREQUENCY AMPLIFIERS

Fully adjustable, and most efficient. In mahogany box with ebonite top. **70/-**

VARIABLE CONDENSERS



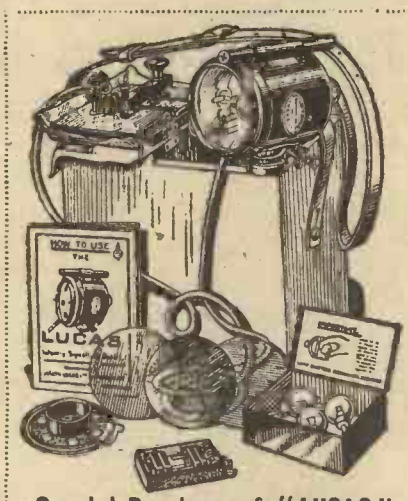
Faraday House Calibration. These condensers are the best obtainable. Of the best workmanship, electrically and mechanically perfect.

No. 1.—As illustrated. Circular, with polished ebonite top and base, celluloid container and engraved ivorine scale, ·00045 capacity. SALE PRICE **19/9**

·0003 capacity. As above but without long arm. SALE PRICE **17/9**

"SONUS" UNIT VALVE PANEL

When used with necessary batteries will convert crystal set into valve receiver. Comprises Valve Holder, Filament Resistance, Grid Condenser and Leak, 'Phone Condenser, and necessary terminals for connections with positions clearly engraved. Finished in polished mahogany and ebonite with heavy brass Terminals. SALE PRICE **27/6**



Special Purchase of "LUCAS" SIGNALLING OUTFITS

For Day or Night Signalling. Projects a very powerful straight beam of light that makes signalling readable at a distance of three miles in daylight. Three colour discs—Ruby, Green and Yellow—and reducing screen supplied for night use. Outfit consists of wooden carrying case with leather shoulder strap, containing lamp fitted with cable and two-pin plug, ball-jointed helio, tripod adapter, tube sight, steel earth spike, three spare bulbs, box of spare parts, tapping key and instruction book. Every Scout Troop should have one of these Ex-Government Sets. Offered at **15/9**

Carriage Extra.

12-volt Batteries for above 7/- each.

THE "PARLIPHONE" LOUD SPEAKER

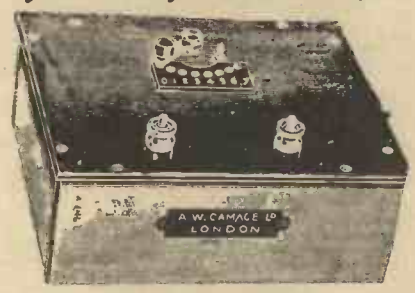
(*Prov. Patent No.* 21967)

NO METAL USED IN ITS CONSTRUCTION. EQUAL IN EFFICIENCY TO THOSE THREE TIMES THE PRICE.

Horn and stand moulded in one solid piece of Ebonite. Contains no receiver, but the interior is screwed and made to receive a Brown's Patent Standard Receiver. Thus by simply unscrewing one ear-piece from Headphones and inserting in the "Parliphone" an efficient Loud Speaker is obtained at a small cost. The remaining ear-piece can still be utilised for tuning in the ordinary way. As no metal is used in its construction, the objectionable metallic "ring" so common to most Loud Speakers is entirely obviated, the result being a rich mellow note without the slightest distortion.

PRICE **32/6**

Packing and Postage, 1s. 3d. extra.



HIGH TENSION BATTERY BOX

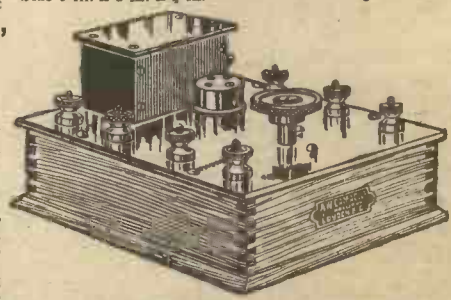
Improved design with base board and green baize bottom. Finished in polished mahogany with ebonite top. Designed to give total output of 105 volts varied in seven steps of 15 volts. SALE PRICE, container only **19/9**

Small size to take 60 volts, 4 tappings, container only. SALE PRICE **14/9**

SPECIAL HIGH-TENSION BATTERIES

Well known for their great efficiency, long life, and general adaptability. They can be easily connected together to form a suitable H.T. Battery for valve work, or we can supply them ready mounted in our special battery boxes. We are now able to offer these batteries at the low SALE PRICE of **2/2½**

Size 9 in. x 3 in. x ¾ in.



THIS AMPLIFIER WILL IMPROVE YOUR CRYSTAL SET TO A SURPRISING DEGREE

This single-stage Amplifier, finished in polished mahogany with ebonite top, and ebonite container for the transformer, forms a handsome and efficient instrument.

The transformer used is of a 4 to 1 ratio.

This amplifier will considerably increase volume of sound, thus making Telephony and Signals normally weak a pleasure to listen to. Price **42/-**

Extras: Valve, 15/-
High-Tension Battery, 15/-
Low-Tension Battery, 25/6

Post free.

Write for a Copy of Gamages New **WIRELESS CATALOGUE** Post free on request

A. W. GAMAGE, Ltd., HOLBORN, LONDON, E.C. 1.

HOW TO MAKE AN H.F. AMPLIFIER.

(*Continued from page 782.*)

The coil should be tested for continuity, and all being well should be bound carefully with cotton until covered up. A few small pieces of paraffin wax should now be placed upon the cotton, and a hot wire placed near the wax will cause the latter to melt and be absorbed by the cotton, thus sealing the primary winding and well insulating it from the secondary.

Winding H. F. Transformers.

The transformer should now be held out in front with the pins pointing toward you, the anode pin uppermost and grid beneath. The left hand side filament pin is to be used for inside secondary. A hole should be pierced and a length of 26 wire inserted as with the primary. Ninety turns should be wound on, care being taken to ensure that the winding is in the same direction as the primary. This completed, the ends should be soldered to their respective pins.

The secondary should now be bound with black cotton and waxed, the finished article presenting a neat appearance. The following data will be of great assistance to readers desiring to construct a number of transformers.

The figures given have been ascertained by the trial and error method, also without the aid of a variable condenser across their primary windings. A certain amount of latitude must be allowed these figures, the results varying according to many factors, such as tightness of windings and insulation factors.

No. of turns.	Inside flange diameter.	Outside flange diameter.	W/L
30	1¾ in.	2 in.	190/240
45	1¾ in.	2¼ in.	240/300
80	1¾ in.	2¾ in.	300/400
240	1¾ in.	3 in.	550/750
340	1¾ in.	3¼ in.	950/1200
900*	1¾ in.	3½ in.	2500/3500

* Width of winding ⅜ in.

The use of a variable condenser between terminals C and H T + will considerably increase the range of coils. It should not exceed ·0002 for the lower wave-lengths, and ·0005 for the higher wave-lengths, otherwise in the first instance tuning will be too critical, and in the latter the absorption too great.

The panels should be externally connected as in Fig. 5. The terminal F on the detector panel can be ignored. If a small coil be connected across the terminals R 1 and 2 of detecting panel and coupled back to the H F transformer in use, a beat frequency can be set up for the reception of C.W. signals, and if this coupling is loosened slightly to render the valves just off the oscillation point regeneration is effected for telephony without distortion, and should the set oscillate there will be no re-radiation in the aerial to cause annoyance to your neighbouring wireless friends.

On Long Wave-lengths.

Should the circuits oscillate without reaction when the primary of transformer is tuned closely with a condenser, a slight positive potential to the grid of the amplifying valve will put matters right. On the longer wave-lengths the reader may find the winding of coils tedious, and should he desire to use resistance capacity amplification it is only necessary to mount a suitable resistance upon a 4-pin plug between the anode and grid pins.

The grid pin and the filament pin, which will occupy socket Y, should be connected together, see Fig. 6. With this component it will be necessary to make one small alteration to the detecting panel by taking the grid leak lead off the terminal lettered G, and connecting the lead to the terminal F. This alteration will not effect the efficiency of the set for use with the transformers, but is most essential for the resistance component if used, the reason being that the grid of the detecting valve would otherwise be connected direct through the leak and the amplifying resistance to the H T + supply.

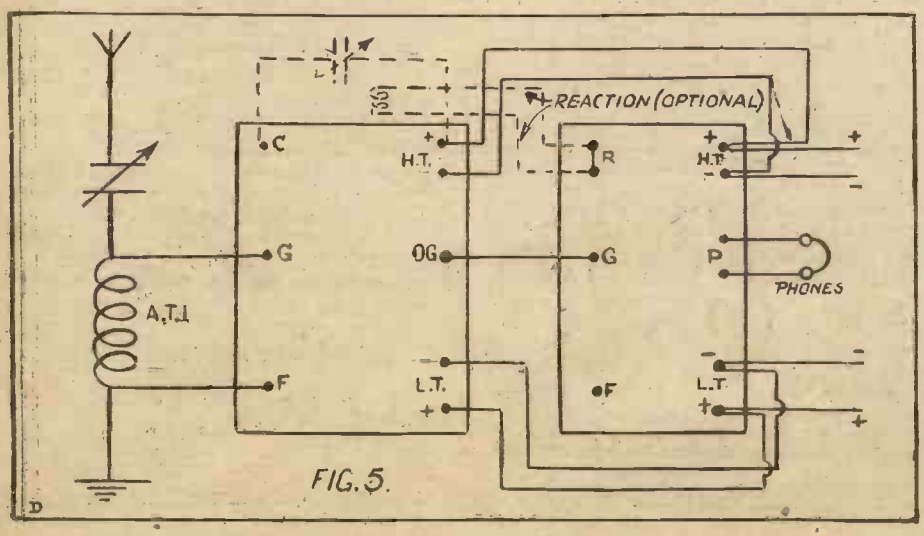
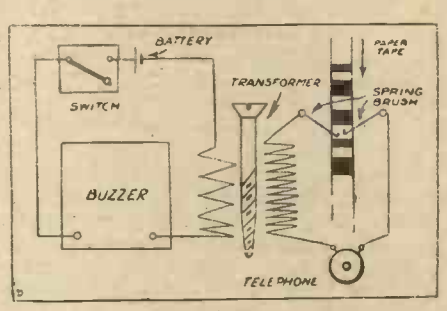


FIG. 5.

A SIMPLE AUTOMATIC TRANSMITTER.

By H. P. WARAN, M.A.Ph.D., F.Inst.P.

THE pleasures of listening in are never realised to the full extent until one is able to follow the numerous messages in Morse going on all the time. To those who have not yet acquired the art of Morse reception, an automatic transmitter, designed on the lines recently suggested by C. R. Palmer in the December 9th issue of POPULAR WIRELESS cannot but be of the greatest use. But those who have been trying similar ideas, for the purpose would have noticed that the process of perforating the tape with a knife, as suggested, is neither speedy nor satisfactory. Even though this difficulty can be overcome by using a pair of paper-punching pliers, it is not simple enough to suit the average experimenter.



Marking the Tape.

A very simple plan is to mark these dots and dashes on the paper tape, using one of the conducting paints of aluminium or gold that can be had for a trifling sum. Or they may simply be drawn across the tape (not along its length) as a wide patch with a soft pencil, using the following rules for the relative dimensions of dots, dashes, and spacing of the Continental code generally used.

1. A dash is equal to the length of three dots.
2. A space between two elements of a letter is equal to one dot.
3. A space between letters in a word is equal to one dash.
4. A space between words in a sentence is equal to two dashes.

In general a width of about ¼ in. is quite ample for a dot, and a sample of such a tape is shown in the diagram.

This simplified way of marking the tape is possible since in this design the current for actuating the buzzer has not to pass through this marking on the paper. From the diagram of connections it would be clear that the buzzer is working all the time, and that the signal circuit is coupled to it through a simple step-up transformer. The primary of the transformer is in series with the buzzer, while the secondary is in series with the telephone and a pair of contact brushes made out of a pair of springy brass wires, and mounted separated from each other by about ⅛ in. These brushes press on the paper tape, and as a signal-mark passes beneath them it closes the secondary cir-

(*Continued on next page.*)

THE WONDERFUL MICROPHONE.

By L. B. POWELL.

AMONG the thousands of people who spend their evenings listening to the broadcasting from London, Manchester, and Birmingham now, it is doubtful if there are many who know that these wonderful entertainments from space would not have been possible without a certain little instrument, to the perfection of which a number of scientists devoted their skill long before wireless was heard of. It is the microphone, which was used by the pioneers of ordinary telephone communication in the latter half of the last century.

The First Steps.

These men probably did not dream of the marvellous use to which it would be put seventy years later, yet by their efforts they contributed something of immense value to the science which enables man to fling his voice, the music of orchestras, and the chiming of clocks across thousands of miles of space.

For the microphone transforms sound waves into wireless waves, and it does so in a very delicate and sensitive manner. In the early experiments it was found that a piece of parchment or very thin metal, stretched over a frame, would vibrate when waves of sound struck it, in just the same way as the diaphragm of the human ear does. But the problem, in dealing with electricity, was how to superimpose these vibrations on the current pulses travelling along the wire.

Granules Replace Powder.

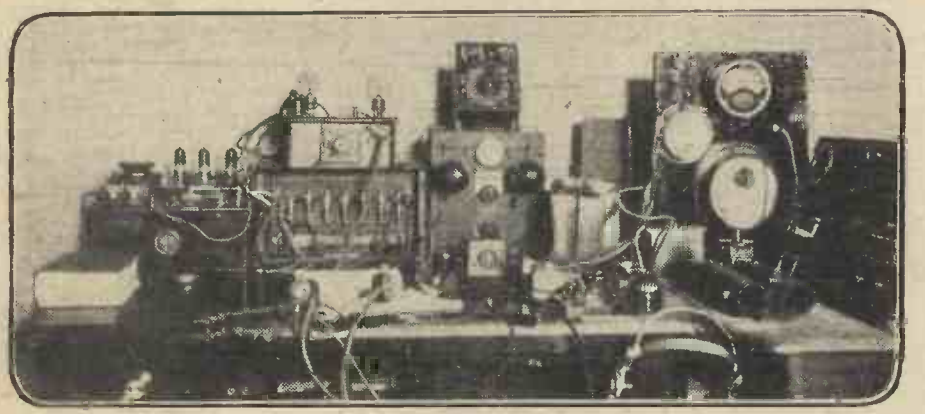
One way of doing this was to make the diaphragm the lid of a small box filled with powdered carbon, through which the current passed, and to this a mouthpiece was attached. The carbon, like every other conductor of electricity, offered a certain amount of resistance to the current, and this was varied each time a sound wave struck the diaphragm, by the particles jumping at each vibration. In this way the sound was carried to the receiving end, where the vibrations were reproduced, more or less accurately, in another diaphragm.

In microphones to-day carbon granules instead of powder are used with much better results. Sometimes, when a wireless concert is being transmitted, several microphones are placed in various parts of the room, so that an evenly balanced volume of sound is ensured.

Experiments with Jam-jars.

It was while experimenting with a microphone fifty years ago that David Edward Hughes, an American electrician, experienced phenomena which was probably the first actual "demonstration" of wireless communication. He found that the microphone was sensitive to what he called "sudden electrical impulses" proceeding from electrical machinery when in motion. One day he set an instrument working in his window, and took the microphone, with a battery attached, down the street. He was astounded to find the sounds still audible at a distance of a quarter of a mile.

The real significance of this incident was missed by many eminent scientists at the time, but it was a tiny hint of the wonders that were to follow, and marked the beginning of a period of research by many men, who adopted many different methods. Hughes himself made some important experiments afterwards. He was a remarkable man, for some of his tests were made with simple articles that lay near at hand, and jam jars, knitting pins, tins, and bits of string and cardboard formed part of the equipment of his laboratory. He died in 1900, just when Marconi's achievements were causing amazement in the scientific world.



Transmitting and Receiving Set at Station 2 J P, Mr. Michael Ellison's amateur station near Malton, Yorkshire.

Home-made set by Mr. S. H. Southard, 65, Whitistile Road, Brentford.

A SIMPLE AUTOMATIC TRANSMITTER.

(Continued from previous page).

cuit through the telephone, which gives a buzz as the signal.

The simple coupling transformer is easily made out of an empty cotton reel. An iron screw passing through its centre hole fixes it to the base-board, and forms the core as well. Four layers of about No. 24 double cotton-covered wire forms the primary winding, and twelve layers of No. 34 or 36 D.C.C. froms the secondary winding. A few layers of paper wound over the primary forms a useful insulation between primary and secondary, and the finished transformer may with advantage be given a bath in melted paraffin-wax before fixing it to the base-board with the screw.

High Speeds.

The use of a small electric motor for moving the tape past the brushes is apt to prove inconvenient for the average amateur who wants to save all his battery current for the valves. Such an elaboration becomes necessary only when one wants to practise reception at high speeds, for which uniformity of motion of the tape is essential. For the average experimenter starting to learn the code, the tape may simply be drawn past the brushes by hand, and at a later stage more conveniently wound on to a second reel fitted with a handle for rotating it.

CORRESPONDENCE.

To the Editor, POPULAR WIRELESS.

Dear Sir,—Perhaps it will interest you to hear that on the night of 27th–28th December I heard 2 L O very distinctly. I was using a loose coupled tuner with a four-electrode valve as amplifier, and had two pairs of telephones connected. At times signals were so strong as to be readable a foot away from the 'phones, and all the time they were wonderfully clear. The following night I again heard him and also 2 Z Y and 2 W P. The signals of the latter station were naturally not so strong as those of 2 L O, but, if anything they were more distinct.

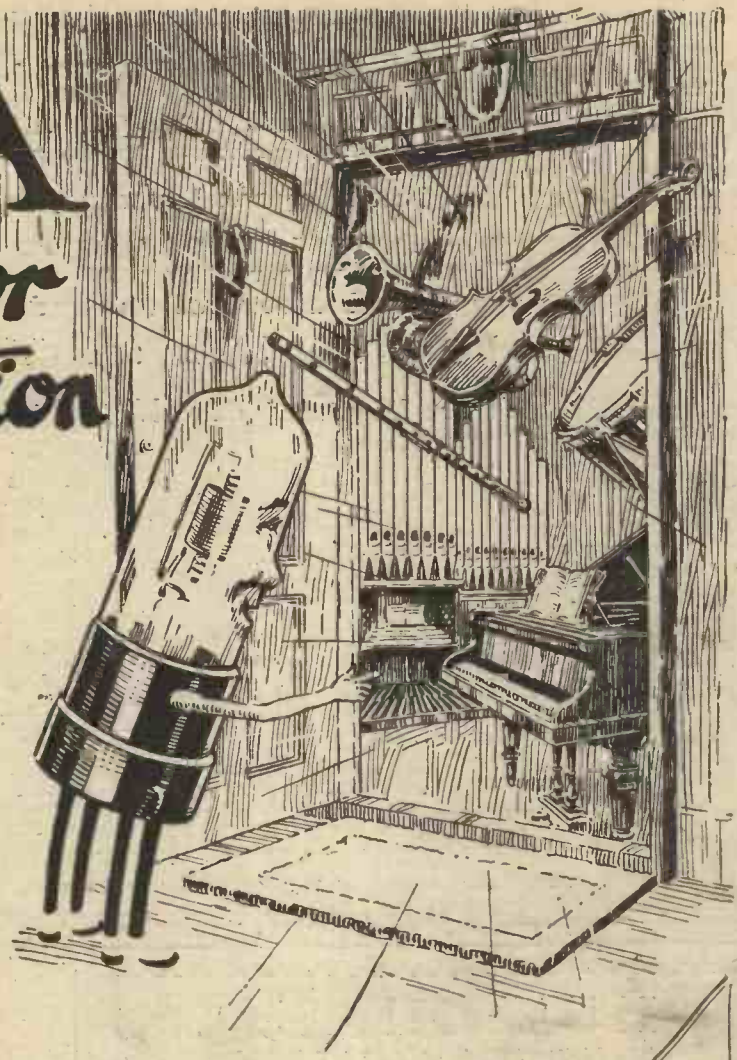
At 1.10 a.m. (G.M.T.) to-day, I heard music on a wave-length of 360 metres, but could not get any call sign. Can you give me any idea as to whom it may be? My H.T. battery was not functioning properly, but I hope for better luck to-night. The aerial is 40 ft. high and 80 ft. long, is badly screened, and is pointing due north and south. I am a regular reader of POPULAR WIRELESS, so if you have any comments to pass on this letter, I will look for them in that very useful journal.

Wishing you and your paper the best of luck in the New Year.

I am, yours sincerely,
A. H. G.
(Söderhamm, N. Sweden).

ORA

The Valve for perfect reception



A CONVINCING STATEMENT.

The International Meteorological Expedition operating in North West Perth, W. Australia, and using a portable wireless equipment, consisting of a 3-valve receiver with small portable aerial, received quite easily the time signals from **all the high power stations in the world.**

They reported very satisfactory results despite the fact that conditions were very unfavourable indeed.

Needless to say, Mullard "ORA" valves were used,

The admirable manner in which these valves sustained several trans-shipments, submersion in water during landing, and severe rough handling generally, is the subject of a very interesting letter sent to us recently by Mr. John Wishaw of Mount Lawley, Western Australia.

For receiving vocal and instrumental items you must have

MULLARD "ORA" VALVES

to get the best results.

Oscillates Rectifies Amplifies

Specially recommended where good amplification is required.

The "Ora" Valve requires about 3·8 volts on the filament and 30 volts or over between the anode and filament for efficient results.

Standard Price : : 15/- each.

The MULLARD "R" Valve

is now reduced in price from 22/6 to 17/6.

Mullard Radio Valve Co. Ltd.

(DEPARTMENT P.W.)

45, Nightingale Lane, Balham, S.W. 12

Contractors to H.M. Admiralty, War Office, Royal Air Force & Post Office.

Telephone:	Codes:	Telegrams:
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Trade Mark: RADIO MULLARD VALVE

Please send me post free

Quantity.	Description.	Price.
.....	"Telephone Head Sets	Type B, 25/-
.....	"ORA" Valves	15/- each
.....	Grid A Resistances	3/- "
.....	Anode A or B Resistances	3/- "
.....	BA Condensers .0003 mfd.	2/6 "
.....	Combined Resistance and Condenser	5/6 "
.....	Valve Bases with Terminals	5/- "
.....	Valve Sockets	1/3 "
.....	Terminal Clips	9d. per pair

Name and Address.....

To the MULLARD RADIO VALVE CO., LTD., 45, Nightingale Lane, Balham, S.W. 12.

P.W. (20.1.23.)

I enclose (Cheque, Money Order, P.O.) value ..... to cover the cost.

Name of usual Wireless Dealer.....

SEND THIS TO-DAY

HOW OPERA IS BROADCAST

By K. D. R.

THE Royal Opera House, Covent Garden, has seen a great change during the last week. The average theatre-goer would probably not notice the slightest difference, the auditorium looks the same; it seats the same number of people, but the keen observer would notice, projecting slightly above the footlights, four small discs.

What have they to do with it? Everything. It is those discs—or microphones, as they are properly termed—that have revolutionised Grand Opera. Wireless telephony has once again proved its boundless possibilities in the way of providing entertainment, and the British Broadcasting Company is to be congratulated upon the success of its latest venture—broadcast opera.

The Microphones

I had the privilege of representing POPULAR WIRELESS at Covent Garden, and at Marconi House, on the second night, when the selections from the opera "Hansel and Gretel" were broadcast.

At Covent Garden there are four microphones, connected in parallel, placed just above the footlights. They are of a special type, slightly less sensitive than those used in ordinary broadcasting, owing to the desire to cut out all the bad qualities that are liable to creep in on certain notes during the musical items.

These microphones have double faces, so as to be equally sensitive to sounds from the stage and from the orchestra pit. Underneath the stage are amplifiers, to which the microphones are connected, the amplifiers being connected by a specially laid cable to a transformer in the transmission room at Marconi House. There is also a telephone line from the prompter's box in the wings of the stage to the operators at 2 L O.

From the Opera House Mr. Jeffries, musical director and manager of the London broadcasting station, 'phones to the transmission room that the orchestra is about to commence the overture; power is switched on, the opening bars of the music crash out, and the broadcast opera commences.

Stand By!

Every note of the music can be heard over miles of country. Each instrument can be picked out, and at the end of the overture a great rushing sound, as of a sea breaking against the rocks, announces the applause of the audience in the theatre.

But the most wonderful part of the organisation is shown later on. Let us have a look at what is happening at 2 L O.

In the transmission room is an ebonite panel with two rows of switches, a telephone of ordinary type, and a pair of head 'phones. The telephone communicates with Mr. Jeffries at Covent Garden, and the switches connect the microphone in the footlights to special transformers in circuit with the transmitting valves. The headphones are connected to the microphones, and thus enable the transmitting staff to hear whether they are operating correctly.

The overture is being sent out to the thousands of listeners all over the country, when suddenly Captain Lewis, who is deputy director of programmes, and is in charge of the studio arrangements at Marconi House, receives a message from Covent Garden that the overture is nearly over—three more minutes only. Quickly he arranges the artists in the studio, and everything is put in readiness to begin the usual concert from 2 L O, as soon as the first portion of the opera is finished.

He grasps the switches in the transmission room. "Stand by!" he calls to the operators; then, "Over!" The opera music ceases, three switches fly back, a warning light in the studio lights up, and the announcer gives out the title of the first item.

Item follows item, until the time approaches when another scene from the opera is to be broadcast—the witch scene in "Hansel and Gretel."

Captain Lewis flies to the telephone and rings up the Opera House. "Hallo, Jeffries! How much more?" "Three minutes!" comes the reply. The studio is warned to be ready to close down the item now being broadcast. "Two minutes," comes from Mr. Jeffries.

"Close down," calls Captain Lewis to the studio; the artistes stop, and the switches connecting the studio to the transmitter are opened. Captain Lewis picks up a microphone in the transmitting-room: "Hallo, hallo, 2 L O calling. Stand by for the witches scene from the opera 'Hansel and Gretel,'" he announces.

"One minute," comes from the theatre. The operators stand by. The microphones from Covent Garden are switched in, and the power valves temporarily switched off. "Over!" calls Capt. Lewis; the switches are closed, the valves light up, and the next part of the opera is flashed through space.

The last notes die away. "Over!" and out comes the switch connecting the microphones at the Opera House, another switch connects up the studio and the transmitters, the little light in the studio shows "ready," and once more the concert goes on its way through the ether.

It is, indeed, a wonderful piece of organisation, and the technical staff and all who are responsible for its working are to be congratulated.

Discussing the matter of reports received on the transmission, Captain Lewis said: "I have hundreds of letters and cards from all parts of the South of England, reporting on the reception of the opera. Of course, a few give adverse criticisms, but the majority of my correspondents were delighted with the clearness of reception.

Wireless in History: Nero Listens-in while Rome Burns.

SOME FAMOUS WIRELESS PATENTS.

By A BARRISTER-AT-LAW.

THE birth of Wireless as a commercial proposition dates from the Marconi patent, No. 12039, filed on the 2nd of June, 1896, which describes the first use of a tuned insulated conductor (or antenna) in combination with a Hertzian transmitter, one end of the sparking appliance being connected to earth and the other to the elevated antenna.

Curiously enough, Popoff had previously used an extended conductor, or aerial, for *reception*, but this alone could have no appreciable effect in extending the possible range of signalling, so long as transmission was limited to the very small wave-lengths obtainable from a bare spark-oscillator.

Marconi's addition of a tuned aerial introduced the era of long-wave transmission, and marks an epoch in the history of wireless. In the first official trials in 1896, wireless signals were successfully transmitted over a range of two miles. The next year this was increased to thirty-four miles, and four years later signals were being successfully received from Poldhu over a distance of some two thousand miles.

Developing the Valve.

Before these results could be achieved, however, another remarkable invention had intervened. This was protected by the famous "four sevens" patent filed by Marconi on April 26th, 1900, in which for the first time a closed tuned circuit is coupled to a similarly-tuned open aerial circuit at the transmitting and receiving ends.

In the inventor's own words: "This arrangement enabled much more energy to be imparted to the radiator than heretofore, the closed circuit of the primary being a good conserver, and the open circuit of the secondary a good radiator of wave energy."

The next most important wireless patents, in historical order, are probably those relating to the first valve-detectors.

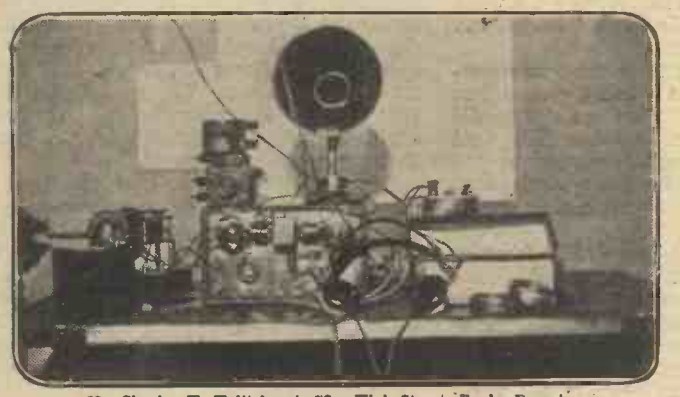
The original British patent for the two-electrode valve was filed by Professor Fleming on November 16th, 1904, No. 24850. About the same time Professor Lee de Forest, in America, was experimenting in the use of gas-filled bulbs for detecting radio-signals, and had filed several American patent applications to protect the results of his investigations. In one of these he claimed to have forestalled Professor Fleming, and very extensive litigation ensued between the two parties before their respective rights to priority could be determined.

Finally the American Courts held that de Forest's patents were intended to protect a device in which the detecting action took place by a process depending upon the conduction of an electric current through a gas-filled bulb by the effect of heat, whereas in Fleming's valve the action was entirely different—namely, a discharge of electricity (by means of the electron-flow between the filament and plate) through what was practically a perfect vacuum. Without actually stating that the de Forest patent was invalid because the description given in his specification was not sufficiently full and clear, the Courts hinted that this was so, and gave judgment in Fleming's favour.

Meanwhile de Forest had made some distinct improvements on the valve as originally invented by Fleming. In one instance he added a boosting or power battery to the plate circuit, so as to increase the signal strength; whilst, later, he added a third electrode or grid, thus evolving the modern form of three-electrode valve or amplifier.

Nevertheless, in view of the decision previously referred to, the Courts held that both these modifications were merely improvements upon Fleming's master patent, and could therefore only be made and held under license from him.

Following the extended use of the two and three electrode valves as detectors and amplifiers, the time came when it was found that they could also be made to serve as generators of continuous oscillations.



Mr. Charles H. Hollis's set, 78a, High Street, Poole, Dorset.

This discovery was of vital importance. Not only did it provide a more compact and economical form of high-frequency generator than any then known for the transmission of continuous-wave and tonic-train signals, but it opened up new fields of possibility in the shape of portable and comparatively inexpensive telephone transmitters. This application proved of particular value in making it possible to design wireless-telephony and long-range C.W. signalling sets for use in aircraft, where the question of weight is of primary importance.

Introduction of Reaction.

Apart from the increased demand thus created for valves for transmission work, it must also be remembered that, with the extension of the use of C.W. signalling, they found a further wide sphere of usefulness in heterodyne reception.

Having regard to all these facts, it is not, perhaps, surprising to find inventors treading very closely upon each other's heels in the struggle to claim priority for so vital an improvement.

The first mention of a valve capable of producing oscillations is apparently made in a patent, No. 13636, filed on June 12th, 1913, in the name of the Marconi Company and Chas. S. Franklin. The inventors, in their specification, state that they make "the circuit in which the magnified oscillations occur (plate circuit) react on the circuit in which the oscillations to be magnified occur (grid circuit) by coupling these circuits, either electrostatically or electromagnetically, to a certain degree."

It is further pointed out that by so coupling the circuits the system may be caused to produce continuous oscillations, and that this effect may be utilised to receive C.W. signals by the interference method (heterodyne).

In a somewhat later patent, filed on December 9th, 1913, by the Marconi Company and Henry J. Round, a specific claim is made to a valve in which the plate circuit is tuned to a frequency slightly different from that of the received waves, in order to secure heterodyne reception of continuous-wave signals by the use of a single valve.

Meanwhile the well-known American inventor, E. H. Armstrong (of super-regenerator fame) had been working on the same subject, and late in the year 1914 he filed a patent application claiming under the International Convention a priority date corresponding to that on which he first filed the corresponding specification in America, namely, December 18th, 1913.

In this application Armstrong claims a thermionic receiver of wireless signals in which the receiving circuit (grid) is linked to the detector circuit (plate) by a combined electrostatic and inductive coupling, in order to facilitate the transfer of the energy of the high-frequency oscillations from the plate or wing circuit to the grid circuit.

British Priority Claim.

In the course of this specification Armstrong makes reference to a previous American patent application, dated October 29th, 1913, in which a claim is made to the use of an audion, or three-electrode valve, for both amplifying and detecting wireless signals.

A British application was, in fact, made to cover this earlier American patent so late as July, 1920. For this application the inventor claims the early priority date of October 29th, 1913, under the provisions of certain War Emergency legislation framed in order to meet the case of inventors who found themselves unable by reasons arising from the state of war to attend to the formalities of filing patents, etc., in strict accordance with the statutory dates.

PETER PAN BY WIRELESS.

"Popular Wireless" interviews Miss Edna Best, this year's Peter Pan, who recently spoke to listeners-in at 2 L O.

"HALLO! Hallo! Hallo! Peter Pan will now speak to the children."

Thus was announced the never-dying favourite of all the pantomime seasons when he spoke by wireless on Boxing Night to the children listeners-in all over the country.

Not only the children listened eagerly to the short speech that followed, but thousands of grown-ups strained their ears to catch every word, and hundreds of loud-speakers were ringing with the clear boyish tones.

Miss Edna Best.

I, too, listened-in to Peter Pan, whose part this year is being taken by Miss Edna Best, and I doubt if I have ever heard a clearer, better delivered, or more perfectly modulated speech by wireless since the commencement of broadcasting. Unfortunately, it was all too short. There was a pause, and then Mr. Burrows's voice announcing regretfully that Peter Pan had vanished.

"It was Ghastly."

I determined to find out where he had gone and what were his feelings as he spoke to his invisible listeners over miles and miles of country. After a long search I found him at last in London, just as he had always appeared to us each Christmas, with his brown suit and fair hair, and I asked him what he thought of this further addition to life's pleasures—broadcasting—and how he liked his new experience of performing before such a vast but unseen audience.

"It was simply ghastly!" he said; "I felt awful. I was speaking into a small instrument, and wondering all the time how my words were sounding out there over all those miles of space. I wondered whether anyone was listening at all, or whether all my listeners had turned away in disgust.

"You see," he went on, "I couldn't tell at all how it was sounding, and when I stood up to speak it seemed so useless—not a soul to be seen, and a dead silence over everything. There was no stage, no audience, nothing but a small mouthpiece to speak into, and that awful stillness, and those heavily curtained walls all round.

"If I could have had some sort of receiver over my head, and heard my words as they were presumably being heard by my listeners, I should not have felt so unnerved; but to speak to hundreds of people—invisible—without the slightest idea of what they thought of it or how it sounded—it was ghastly! You see, I had not even their faces to go by—nothing but empty space—ugh!" And he shuddered at the recollection.

Captain Hook Ahoy!

I assured Peter that his voice came through beautifully clearly and that I had heard every word perfectly.

"So you have a receiving set," he said. "It must be awfully jolly to be able to sit at home and listen to the music and songs that are sent out each night. Wireless must be very fascinating and exceedingly interesting. But it is awful speaking at the transmitting-end, though," he added.

"Oh, yes, we had a rehearsal earlier in the day, and I was told how to stand and more or less what to expect, but it is a very peculiar sensation, and quite paralysing at first.

"I should very much like to have a wireless set," Peter continued. "Of course it's too late now, but I hope to have one of my own in my next Christmas stocking."

Then he added suddenly: "I must fly now—that Captain Hook wants watching"—and was gone. He had vanished as mysteriously and rapidly as he did from Marconi House on Boxing Night, but I hope we shall hear him again in the near future.

THE BRITISH BROADCASTING COMPANY.

THE details are to hand of the British Broadcasting Company, Limited, which was registered as a public company on December 15th, with a nominal capital of £100,000, in 100,000 Cumulative Ordinary shares of £1 each. The said shares confer on the holders thereof the right to receive out of the profits of the company a fixed cumulative dividend at 7½ per cent. per annum on the amounts paid up or credited as paid up thereon, but not to any further or other participation in profits.

The objects of the company are:—To acquire from H.M. Postmaster-General a licence, in such form and subject to such terms and conditions as he may from time to time prescribe, for the erection, establishment and operation within the United Kingdom of Great Britain and within Ireland of stations as a public utility service for the "broadcasting" supply to the public, by means of wireless telephony and/or wireless telegraphy of news, information, concerts, lectures, educational matter, speeches, weather reports, theatrical entertainments, and any other matter which for the time being may be permitted by or within the scope of the said licence; to equip and instal the said stations with all requisite or convenient plant and machinery, and to carry on (only so far as may be necessary or convenient for the furtherance of the objects of the company) the business of ironfounders, mechanical and electrical engineers, brass founders, metal workers, tool makers, wood workers, builders, etc.

Allotment of Shares.

The shares may be allotted or disposed of as the board may determine, provided that the board shall not without the previous written approval of H.M. Postmaster-General for the time being, allot more than 60,006 shares in the initial capital to the following six companies or their nominees, viz.:

Marconi's Wireless Telegraph Company, Limited.

Metropolitan-Vickers Electrical Company, Limited.

Radio Communication Company, Limited.

British Thomson-Houston Company, Limited.

General Electric Company, Limited.

Western Electric Company, Limited,

and that the board shall, up to a total of 39,994 shares, issue to applicants, being bona fide British manufacturers of wireless apparatus other than the above six companies, the full amount of shares (not exceeding 10,000 to any one such applicant) for which such applicants may apply.

The First Directors

Godfrey Chas. Isaacs, Marconi House, W.C. 2, director of Marconi companies.

John Gray, Crown House, Aldwych, W.C. 2, director of Shielton, Limited, Corbel, Limited, and the Hotpoint Electric Appliance Company, Limited.

Henry M. Pease, Norfolk House, W.C., managing director of Western Electric Company, Limited.

Sir William Noble, Magnet House, Kingsway, W.C., director of General Electric Company, Limited, and Walker-Western Company, Limited.

Major Basil Binyon, 34-5, Norfolk Street, W.C. 2, managing director of Radio Communication Company, Limited, and director of Mullard Radio Valve Company, Limited, C. F. Elwell, Limited, Radio Press, Limited, and London Radio College, Limited.

Archibald McKinsley, 4, Central Buildings, The Broadway, S.W., Metropolitan-Vickers Electrical Export Company, Limited, Cosmos Lamp Works, Limited, and Vickers, Australia, Limited.

Lord Gainford, Headlam Hall, Gainford, Durham.

The remuneration of directors is to be £200 each per annum (£500 for the chairman), free of income tax. The registered office is at 15, Savoy Street, W.C. 2.

A RADIO DIVINING ROD.

By A. H. DALY.

IT is quite possible that the day of the water divining-rod is past, and a new wireless invention will take its place. The divining-rod, as most people know, is a twig which, when carried by a person skilled in the art of water divining, will quiver and become agitated when that person is over a spring of water, even if this spring is some distance below the ground.

But the wireless substitute for this divining-rod will not only locate water, but also coal and other minerals, such as gold and silver; and, unlike the divining-rod, does not depend upon the vagaries of the "spirit world" for its successful functioning, but upon the scientific and well-known refractive properties of wireless waves.

The apparatus for water divining consists of a special type of powerful wireless transmitter and sensitive receiver. The transmitter radiates what is called a wireless beam—that is, the waves, by means of metal reflectors, are radiated in one particular direction, like the directive beam of a wireless lighthouse.

The receiver is similar in many respects to the usual wireless receiver, having direction-finding properties, but, in addition, has extremely sensitive instruments which operate a galvanometer. This galvanometer may be said to take the place of the pair of telephones used in ordinary wireless reception.

When it is necessary to find water in areas seemingly devoid of that liquid, two holes are dug in the ground a fixed distance apart. In one hole is placed the transmitter, in such a manner that the wireless beam will be radiated in the direction of the other hole, in which is placed the receiver.

When the transmitter is in operation, a large percentage of the beam, or wireless waves, passes through the earth in the direction of the receiver—for, although the earth is a conductor of electricity to a certain extent, and therefore tends to reflect or repel the waves, a certain amount of them will penetrate it for a considerable distance if they are powerful enough and sufficiently concentrated.

The Reflected Wave.

These waves, on being picked by the receiver in the other hole, do not affect the galvanometer, but are passed on to earth. This is done by a rejecting instrument similar to the old type of wireless rejector, which aimed at diverting atmospherics to earth to prevent interference with reception; but whereas the old rejector did not do what it was supposed to, this one does, and thus ordinary wireless waves from the transmitter have no effect on the galvanometer needle.

Imagine, however, that there is a spring of water situated somewhere between the two holes. (This water need not necessarily be situated in a direct line between the two holes, but can be some distance below or to the right or left of the transmitter, for the water will still come under the influence of the radiated waves, as the beam covers a considerable area.)

What will be the effect of this water on the radiated wireless waves?

In the first place, some of the waves will miss the water altogether, and on striking the receiver will pass through to earth without affecting the galvanometer. Other waves from the transmitter will strike the spring of water and be reflected back the way they came, for conductors such as water reflect wireless waves, so these waves will not reach the receiver at all.

A third portion of the waves, however, will also strike the water, but at such an angle that, instead of being reflected back, they will be refracted or bent out of their original course, and will pass on and enter the receiver. It is these bent or refracted waves which make water divining by wireless possible, for they act on the receiver and auxiliary instruments in such a way that the galvanometer is excited and the needle registers a current. Thus the operator at the receiving end knows that water is present between the two holes.

If no water is discovered between these two holes another hole is dug, in which is placed the receiver. The transmitter is left in its original hole, and the wireless beam refocused on this new hole. In this way a considerable area of ground can be surveyed with minimum trouble.

Locating Coal.

When locating new veins of coal or ore in existing mines, the transmitter is placed upon a truck and wheeled along one gallery, while the receiver is placed upon another truck and wheeled along a second gallery which is as nearly as possible parallel to the first gallery. At certain fixed points readings are taken, and if a movement of the galvanometer needle is observed, it is a sign that coal or ore is present.

It should be mentioned that electro-magnetic waves are not refracted by all minerals in the same manner. The degree of refraction varies, and by means of this variation it is possible to ascertain whether it is water, coal, or ore which is deflecting the waves from their proper course. This method of using the apparatus has been tried very successfully in potassium mines for locating the source of water which is tending to flood the mines.

Another way of using this apparatus, which is at present being tested, is in connection with a range of hills. The transmitter is placed in the valley on one side of the range and the receiver in the valley on the other side. In this way it is thought that it will be possible to ascertain what mineral deposit there is in the range of hills, although it should be mentioned that, up to the present, this arrangement has not been very successful, owing to the difficulty of getting sufficient of the beam to penetrate through the hills instead of taking the easier path over the summit.

Prospecting Simplified.

Although this apparatus is purely in its experimental stage, when we come to think of the amount of time and trouble, to say nothing of disappointment, which is the lot of those who look for the necessities of life, such as coal and water, or those more exciting minerals, gold and silver, it is possible to appreciate the vast and far-reaching importance which this new wireless invention will have on the whole world once it is made practicable for everyday use.

A high-speed ink recorder of radio signals. It can record 200 words a minute.

THE LURE OF WIRELESS

There is a strange fascination about Wireless. To "listen-in" to a voice speaking or singing many miles away is to wonder at the marvels of science. As a serious study, as a regular hobby, or simply as an amusement, Wireless is rapidly assuming a leading place in the social life of this country. Get in touch with us if you would know more about Wireless. Expert advice given free.

CATALOGUE
Post Free.
TRADE SUPPLIED.

THE DESKOPHONE SINGLE VALVE SET.

(Regd. Design No. 594025.)

The Deskophone Single Valve Set, made in our own workshops to our own registered design, is the last word in wireless apparatus. Made as illustrated, it includes—Accumulator, H.T. Battery, Headphones, Aerial, Lead-in Wire, Insulators, and Coil. It has been passed by H.M.'s Postmaster General (No. 1019). Made under licence from the Marconi Coy., approved by the B.B.C. and fully stamped.

Price - **£7 - 15 - 0**

Royalties 32/6 R Type Valve 17/6 each extra.

Set without accessories **£4 - 5 - 0**

AMPLIFIER

This Low Frequency Amplifier can be used in conjunction with the single or two-valve set. It considerably increases the volume of sound. Strongly recommended. Made under licence, etc., as above (P.O. No. 3042).

PRICE
£3 - 17 - 6
Royalties 22/6
R Type Valve 17/6 each extra.

THE DESKOPHONE TWO-VALVE SET.

The Deskophone two-valve set, tuner, high frequency amplifier, and detector. Complete with accessories as shown in illustration above of single valve set. Made under licence, etc., as above (P.O. No. 2020).

PRICE
£12 - 17 - 6
Royalties £3 - 0 - 0; R Type Valve 17/6 each extra.
Set without accessories
£9 - 17 - 6

THE HOLBORN RADIO CO., LTD.,

267, High Holborn, London, W.C. 1.

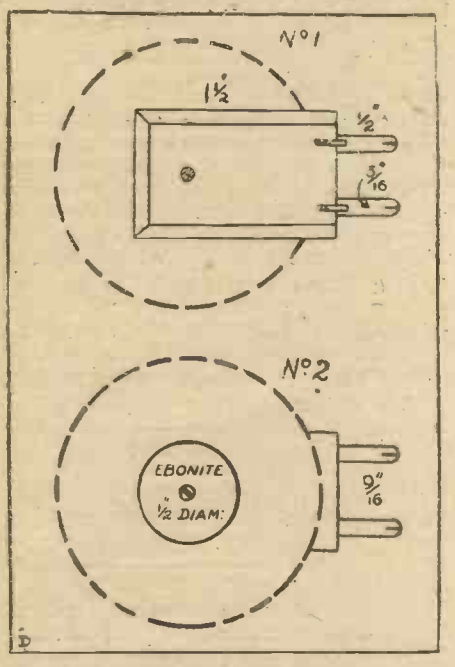
(Late of 8, High Holborn) *Telephone: Chancery 8163.*

A PAGE OF IDEAS FOR AMATEURS.

MOUNTING BASKET COILS.

MOST amateurs are aware of the difficulty of mounting basket, or pancake coils, as they are sometimes called. This type of coil is supposed to be the most efficient inductance in use at present, and would certainly be more generally used and more in favour but for the difficulty in mounting.

The sketch shows the method I have used for mounting them to fit a standard two-pin tuning-stand. The construction



is within the scope of most amateurs, and does not require many tools, and the cost is very little.

The materials required are some sheet ebonite about ⅛ in. thick, a few small screws about 6 B.A., 6 in. of 5/16 in. brass rod, and a cycle spoke 15 gauge; the latter is threaded 6 in. down. A cycle shop will supply the spoke and thread it for a few pence.

The ebonite is cut into strips 1 in. wide, and then cut into lengths to suit the coil to be mounted; each coil will require a different length. For a coil 2 in. in diameter a length 1½ in. wide will be required. Two holes are drilled in one end 5/16 in. apart and threaded, using a length of the spoke filed with flats to form a tap.

The brass rod is next cut into ⅝ in. lengths, and a small hole drilled in one end; a short piece (about ¼ in.) of spoke is cut off and soldered in the piece of brass, leaving a short length protruding to screw into the ebonite (see Sketch No. 1). If the threaded end is first dipped into shellac it will make a firm joint in the ebonite.

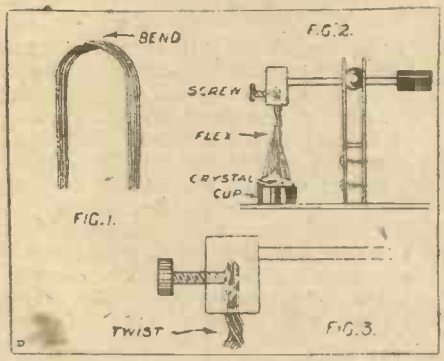
The edges of the latter are now bevelled, and a hole is drilled about 1½ in. from the end, and tapped to suit the screws intended to be used. Pieces of ebonite are then cut off slightly larger than the hole in the centre of coil, and a hole drilled in the centre; the ebonite is filed round and bevelled. This can be done quite easily, using a hand-drill, and mounting the ebonite on a small screw and fixing in the drill chuck. If a file is held on the ebonite, and the drill turned, quite a good circle can be made.

A MULTI CONTACT DETECTOR.

PROCURE about 1½ inches of ordinary wire flex, and separate about 12 of the fine wire strands. Double these over, as in Fig. 1, and push up into the position usually occupied by the cat's-whisker, and screw up firmly. Fig. 2.

Now twist the flex as in Fig. 3, in order to give the flex stability, and with the finger open the loose ends to form a brush, after neatly cutting level with a pair of scissors.

This method will find several sensitive spots immediately, and owing to the flexi-



bility of the wires, can be made to press firmly or lightly, according to the type of crystal used.

The spare flex not in use can be put aside ready to replace the one already made. Give the strands a rope-like twist so that they will not come apart.

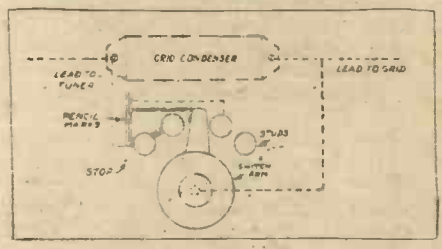
OLD DRY BATTERIES.

OLD dry batteries can often be transformed into quite useful wet ones. All that you have to do is to dissect the battery until you come to the zinc cells. A few holes are bored through this zinc cylinder—small holes—and also two or three through the top coating of pitch or whatever substance is used to seal the battery. The holes through the zinc should go well into the battery until the powdered carbon and manganese oxide is reached. The cells are now placed into vessels containing sal-ammoniac and water, and a complete Leclanchè battery is formed. Of course, the liquid should not cover the cells, but should not quite reach to the top of the zinc cylinders.

AN ADJUSTABLE GRID LEAK.

AS a wireless experimenter, I should like to explain the method adopted by myself of varying the grid leak. Having become annoyed at the far too frequent use of pencil and rubber, as a means of varying my grid leak when using different circuits, I decided that I should arrange some means whereby I could reduce, add, shorten, or cut out my leak altogether at a moment's notice.

I managed this in the following manner. Finding a suitable space on my panel, I made five holes to take a stud each, and another below, to take a switch arm. From the grid condenser on the tuner side I took a lead to the first tapping, and another lead from the switch arm to the grid side of the condenser. From the first stud to the second I made a thick, heavy pencil-mark—on the back of the panel, of course, taking care that it made good contact with the underside of the studs' washers. Then from



the first again to the third, I made a slightly lighter pencil-mark, and from the first to the fourth studs a lighter one still. The fifth stud I left by itself. A larger number of studs may, of course, be used, thus giving a greater range of variation to the leak.

When the grid leak is shortened by having the switch arm on the first stud, the condenser also becomes shortened, thus making a direct lead from the tuner to the grid. On the other hand, if the switch arm is on the last stud, the leak is cut out altogether, leaving the condenser only.

* * *

No wireless set looks really smart unless all the brass work is lacquered. This, of course, excludes the under parts of terminals, etc., where contact must be good—in this case no lacquer is employed. It is best when lacquering to put on a thin coat while the brass is cold, and then to warm it up until the lacquer melts. This is then cooled and the process repeated, the result being a very fine smooth surface.

HAVE YOU IDEAS ?

Send along your wireless notions to POPULAR WIRELESS. If accepted they will be paid for at our usual rates. Articles should not exceed 500 words.

THE PROGRESS OF BROADCASTING.

By SIR WILLIAM NOBLE.
Chairman of the B.B.C. Committee.

THE British Broadcasting Company has now been launched; a chairman and six of the directors have been appointed. The chairman is Lord Gainford, whose excellent record in public work is a guarantee that the affairs of the new company will be conducted in a broadminded and business-like manner. The six directors so far appointed are Mr. Godfrey Isaacs, representing the Marconi Company; Mr. Archibald McKinstry, the Metropolitan-Vickers Company; Mr. John Gray, the British Thomson-Houston Company; Sir William Noble, the General Electric Company; Major Binyon, the Radio Communication Company; and Mr. H. M. Pease, the Western Electric Company. At the first statutory meeting to be held shortly, two more directors will be appointed by the firms in the company other than the six companies named.

Well Under Way

The registered offices of the company are at 15, Savoy Street, in premises belonging to the Institution of Electrical Engineers—a suitable home for such a company.

For the principal posts, the company has been fortunate in securing the services of able gentlemen, and these officers will now have the conduct of the business of the company.

Broadcasting stations have already been opened in London, Birmingham, Manchester and Newcastle-on-Tyne, and the initial steps have been taken for procuring premises for the installation of plant at the remaining our centres, viz., Plymouth, Cardiff, Glasgow and Aberdeen.

Preparing the Programmes.

The programmes at all the stations will be under the central control of the Director of Programmes. There will be two features in the programmes common to all the stations, namely, the broadcasting of the weather reports of the Air Ministry, and a synopsis of the world's news supplied by the four Press agencies, otherwise the programmes will vary with the locality of the station. What is suitable for London listeners-in may not be suitable for the Glasgow clientele, and what suits Wales may not suit Newcastle. Local conditions will play a large part in determining the character of the programmes. Every effort will be made to provide good programmes. The officers concerned with the provision of programmes will be ever on the alert to introduce new and novel features. Any suggestions made by listeners-in through your journal will receive careful consideration.

Some Tricky Points

There have been certain criticisms levelled at the committee, which has been in charge of the inauguration of a broadcasting service for this country, for the delay which has taken place in launching the scheme. The committee appreciated this feeling, but with the knowledge of the facts they were satisfied the time taken was fully justified by the results.

The committee had to reconcile many divergent interests in order to arrive at the desideratum of one broadcasting company for the whole country; it had to prepare the Articles of Association, and the Agreement between the company and its constituent members, and these documents had to receive the sanction of the Postmaster-General. The Post Office had to prepare a licence for the company, and this licence had to be considered in detail by the committee. Whilst the committee secured the pooling of all patents for transmission, they had to consider and agree to a licence from the Marconi Company for the receiving sets. Many other subsidiary points arose, and the committee had to deal with all these.

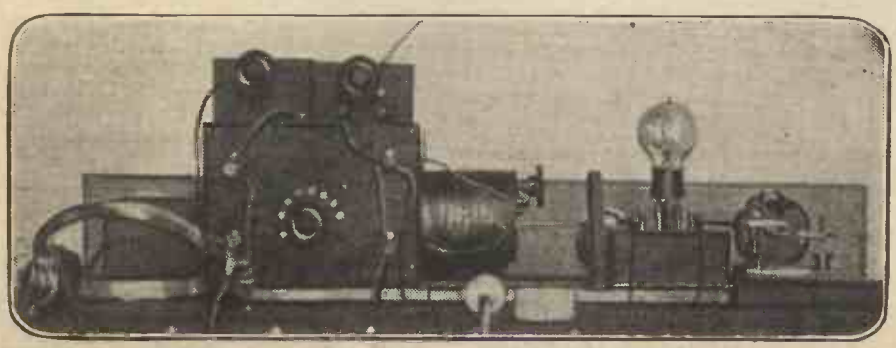
As chairman of the committee I can assure readers of POPULAR WIRELESS that there has been no undue delay in dealing with the work preliminary to the formation of the company.

"The Big Six."

There have been hints made that the committee had been secretive and had unduly considered the interests of the "Big Six" Companies. Such is not the case, as was testified publicly by Mr. Phillips of the Burndept Company, who represented on the committee the firms other than the six companies already named.

It should be remembered that the committee was appointed at a public meeting of manufacturers; and that the so-called "Big Six" guarantee the capital of £100,000 and any more money required to run the scheme successfully.

(*Concluded at foot of next column*).



Home-made set by Mr. S. Larkin, 23, Macching Road, Newhaven, Sussex.

SOME SATIRICAL ANSWERS.

By H. T. LEED.

"RADIOAC" (Bats Belfry).—The scratchings and cuts on your mahogany panel are not due to the depredations of the Radio Bug. Radio Bugs are essentially American, and provided you understand that language, you should consult an American dictionary to obtain a true definition of the term.

"EARTHPLATE" (Eyon-under-Rosebush).—The "grounds" to which you refer are in no way connected with coffee or tea. You state that the dictionary gives the meaning of this word as: "Grounds—House for sale, standing in own." We think from this that you must have consulted the wrong authority, and would advise you to try another book.

This word is of American origin—see reply to "Radioac."

Go To America!

"RADIOGONIOMETER (Frame).—(1) We are surprised that with a *nom de plume* like yours, you do not realise that the bulb mentioned is not for planting, either in flower-pots or garden beds. Your surmise that, when in bloom, it is used for hiding the position of the earth-plate is incorrect.

(2) There is more reason in your query concerning the expression, "VAKOOUM TOOB"; this is purely an American phrase—see reply to "Radioac."

"WIRELESS EXPERT" (Pye Square).—The expression

$$\frac{C^2+8^9-II}{9^2 \div C^7 \times III}$$

$$\frac{(6+2^3 \times 10^{47}}{}$$

is equivalent to the ordinary formula,

$$\frac{M \times 9-4^6-(8\times 7)}{K^8 \times 2^{10}\ \frac{1}{9}+\frac{8^2}{16^2}}$$

where K=2 condensers in series and one in parallel, and where M = grid leaks.

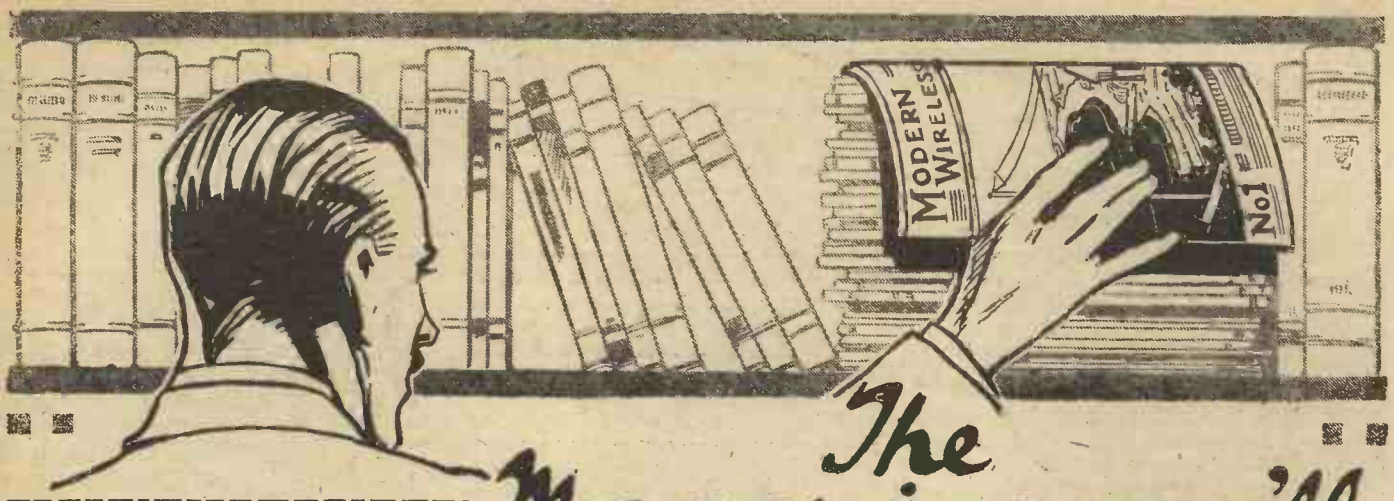
It is, of course, easily seen that to obtain the correct answer, which is the same in both cases, you merely divide the reciprocals by 2^2. The formula you give is not very well known in this country, being an American calculation—see reply to "Radioac."

"Interested" (Catford).—Yes, it is essential that the whisker should be detached (*i.e.*, plucked) from the cat before the best results can be expected from your crystal set. For correct definition of "cat whisker"—see "Radioac."

"HUMOURIST" (Broadrib).—It is apparent, from your remarks concerning a "tickler coil" that you are not familiar with—— Oh, *go* to America!

Already some interference with broadcasting is being experienced from inexpert amateurs, and the directors of the B.B.C. would be glad if as few amateurs as possible would carry out experiments during the broadcasting hours, 5 p.m. to 11 p.m.

The management hope to provide such high grade programmes that all those with wireless sets will be listening-in instead of experimenting during the hours when the broadcasting stations are in operation.



The Magazine you'll need for reference — so be sure you don't miss No. 1

CONTENTS OF No. 1.

HOW can I charge my Accumulator at home? Instead of buying Coils can I wind my own? How can I receive louder speech and music?

The answer to these and scores of many other similar questions will be found in No. 1 of the new monthly "Modern Wireless." If you don't need the information at the moment you are quite likely to want it later—therefore, if you are wise, you will keep every number handy for ready reference.

But be sure that you start with No. 1, so that your files will be complete.

Every month "Modern Wireless" will consist of over 100 pages (in No. 1 there are 112 pp.) of informative and dependable articles from the pens of the best-known Radio engineers and experimenters. If you wish to keep abreast of the wonderful developments that are daily taking place—you must take care not to miss a single issue.

MODERN WIRELESS

Edited by John Scott-Taggart, F. Inst. P., assisted by E. Redpath and Paul D. Tyers, and published on the 15th of every month.

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MARSHALL AD.

WIRELESS CLUB REPORTS.

The Editor will be pleased to publish concise reports of meetings of Wireless clubs and associations, reserving the right to curtail the report if necessary. Hon. secretaries are reminded that reports should be sent in as soon after a meeting as possible. Reports sent in cannot appear in this paper in less than ten days after receipt of same. An Asterisk denotes affiliation with the Radio Society of Great Britain.

South Shields and District Radio Club.

The eighth meeting of the club was held recently in the Liberal Club Buildings, Ocean Road, South Shields, which premises have been secured as temporary headquarters.

A new aerial has recently been erected, and this was tried out on a four-valve Burndept set, in conjunction with a Brown's microphone relay and loud speaker. Among the telephony stations heard were the new Broadcasting Stations at London and Manchester, and the experimental station of the Chase Radio Company, Newcastle, from which latter an enjoyable concert was received.

A two-valve resistance coupled set, of home construction, was next demonstrated by a member, and the London Broadcasting Station received. Considering the low wave-length of the station, this was considered quite an achievement for a resistance coupled set.

Hon. sec., Mr. J. A. Smith, 66, Salmon Street, South Shields.

Working Men's College Wireless Club, Crowndale Road, N.W.

The above club held its Second Annual Wireless and X-Ray Exhibition recently. We wish to thank Mr. Burnham (2 F Q), Blackheath, for his kindness in transmitting a concert to us that evening, which was received very well, except when the X-Ray coil was in action, which interrupted reception slightly.

Hon. sec., A. Fryatt.

Glasgow and District Radio Club.*

A highly successful exhibition was held by the club in the McLellan Galleries, Sauchiehall Street, recently. The exhibition was opened at twelve noon, and a steady stream of visitors were being admitted. The special features were the large trade show, all the latest in wireless being exhibited by about twenty firms, the local firms being very prominent. The club members' show was also fairly large, all types of ancient and modern apparatus being on view, and the workmanship of some was of high order.

Hon. sec., W. Yuill, 93, Holm Street, Glasgow.

Portadown Radio Association.

The inaugural meeting of above association has been held. The following office bearers were elected: President, W. M. Clow, Esq., J.P.; Hon. sec., Mr. W. A. Hayes; Joint treasurers, Capt. G. Lutton, H. M'Callum, Esq., B.A.; Committee, Messrs. W. J. Warren, M.A., C. Spence, W. Sprott, W. J. Parks, T. Leake, J. Richardson, J. Greer.

Hon. sec., W. A. Hayes, Moyallon, Portadown.

Northern Radio Society.

Recently a meeting was called at Church Schools, Meanwood, and Mr. Bull was elected chairman. He then pointed out the advantages afforded the amateur in forming a radio society in this district, and it was decided unanimously to form same. An election of officers then took place, and W. H. Turner, Esq., was elected president of the society.

Temp. hon. sec., C. V. Stead, 29, Shalebroke View, Chapeltown, Leeds.

The Finchley and District Wireless Society.*

The above society recently gave a demonstration at a bazaar, when musical transmissions were picked up from 5 C P, 2 W P, 2 M T and Marconi House (2 L O). Although there was a great deal of noise from a "fair" that was held overhead and from a band at the other end of a hall, the transmissions were heard quite clearly from a Brown's Loud Speaker.

Hon. sec., Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3. 'Phone, Finchley 1667.

Bromley Radio and Experimental Society.*

At a meeting of the society held recently at headquarters Mr. Allen demonstrated and explained his five-valve receiving set. The H.F. valve is arranged with tuned anode circuit, and he showed with diagrams the functioning of this and other parts of the apparatus. Telephony and music specially transmitted by 2 L O were afterwards successfully and clearly received on a loud speaker.

Hon. sec., J. F. Croome, 26, Wendover Road, Bromley, Kent.

The Ilford and District Radio Society.*

Mr. A. E. Gregory again delivered his lecture on the "Elementary Principles of the Valve," at a recent meeting.

Explaining briefly the electron theory and the emission of electrons from heated bodies, the lecturer proceeded to the theory of the two-electrode valve and its application as a detector. Next, the controlling effects on the electron stream, obtained by the insertion of the "grid," were shown and the increase in efficiency and range of application pointed out.

Characteristic curves and the method of obtaining them were fully dealt with, and the lecturer emphasised the importance of choosing a suitable portion of the curve to work on for different requirements.

The grid condenser and leak method of rectification were clearly explained by the aid of several diagrams.

Hon. sec., A. E. Gregory, 77, Khedive Road, Forest Gate, E.7.

North London Wireless Association.

At the association's meeting held recently, Mr. Hill gave a lecture on the Telephone System, External Working. Mr. Hill explained very clearly the system of distribution employed from the 800 pair cables leaving the exchange to the single pair for each line of the consumer. Although the subject dealt with was not strictly "Radio," it proved of great interest to the members, dealing as it did with an application of electricity with which we are all familiar.

Hon. sec., Mr. V. J. Hinkley, Northern Polytechnic, Holloway, N.1.

Walthamstow Amateur Radio Society.

At a recent meeting the society's three-valve set and loud speaker were used to demonstrate broadcasting reception. Very good results were obtained, the set working splendidly under the direction of Mr. Webb.

Hon. sec., R. H. Cook, 49, Ulverston Road, Walthamstow, E.17.

Streatham Radio Society, Streatham Hill College.

A weekly "informal" meeting was held at the Society's headquarters recently. Mr. Bevan Swift, A.M.I.E.E., gave the first of a series of lectures specially arranged for the younger amateur. Some of the more experienced, however, received an excellent "brushing up" on the lesser complicated fundamentals of Radio laws, such as the relation of wave-length to frequency, etc.

Hon. sec., S. C. Newton, A.M.I.E.E., "Compton," Pendennis Road, S.W.16.

Whitnash Radio Society.

The above society has been formed, and those interested who reside in the district are invited to join. A four-valve receiving set, with loud speaker, has been installed in the new St. Margaret's Hall.

Hon. sec., Robert R. Hall, The Gardens, Whitnash, Leamington.

Manx Radio Society.

Wireless amateurs who know the Isle of Man, and they must be many, will be interested to learn that the above society was inaugurated at a meeting held at 19, Hawarden Avenue, Douglas, at which there was a most gratifying attendance. The following officers were elected: chairman, Mr. H. Colebourn; sec., Mr. J. P. Johnson; committee, Messrs. Vick, Gelling, Downward, Axon, Craine, and Hinton.

RADIOTORIAL

All Editorial Communications to be addressed The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

I wonder how many of my readers realise the significance of the latest accomplishment of the British Broadcasting Company, namely, the adaptation of landline microphonic reproduction to transmission by wireless telephony.

This has made possible the broadcasting of Grand Opera straight from Covent Garden to the sets of thousands of Listeners-in. Whether or not you stop to consider the bare scientific side of this achievement, all of you will appreciate the fact that you are now able to enjoy a complete entertainment, as given in the leading opera house in the land, without leaving the comfortable warmth of your firesides.

THE EDITOR.

Questions Answered

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have decided to reply individually by post. A weekly selection of questions will, however, be printed on this page, together with the answers, for the benefit of readers of POPULAR WIRELESS in general. Questions should be clearly and explicitly written, and should be numbered and written on one side of the paper only.

All questions to be addressed to: POPULAR WIRELESS, Queries Dept., Room 132, The Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send necessary postage for reply.

W. E. (Kent).—Why is it that on my one-valve set I can hear Birmingham quite well, but Marconi House is very poor?

In all probability your set will not tune down to 360 metres successfully. Try a smaller coil as the A.T.I. and also try putting your condenser in series with the aerial and coil.

* * *

T. R. (Norwich).—My telephones have become very rusty, especially at the edges of the diaphragm. What is the best method of removing this?

The rusty parts should be carefully rubbed with a rag saturated in machine oil or with vaseline on it. In the case of the diaphragm, these should be placed on a perfectly level surface before the rubbing process is commenced, or you may injure them. Telephones should be frequently examined to see that rust is not forming.

"AMATEUR" asks for advice as to which licence he should apply for to cover his home-made crystal set.

You should apply to the Secretary, G.P.O., for an experimental licence form. This should be filled in as far as possible, and returned to the G.P.O., with the fee and full particulars of the set. It is just as well to ask for permission to use the set with an ordinary broadcasting licence if you feel *sure* you have no chance of obtaining a full experimenter's licence. With regard to the aerial, you should take full advantage of the limits allowed by the P.M.G. Do not forget that the 100 ft. allowed includes the height, the lead-in, and the total span of aerial from insulator to insulator. The number of wires used is immaterial.

* * *

D. W. (Rhondda).—What loading coil should I use for a crystal set, to tune up to 2,600 metres from 600 metres? (2) Would an electric light attachment be of use as an aerial arrangement for Cardiff broadcast reception?

A coil of about 400 turns of 24 S.W.G. enamelled wire, on a 5 in. by 11 in. former, should be ample. This should be tapped to studs so that fine tuning can be obtained. This coil will take you well above the Paris wave-length. (2) This type of aerial would be useless on a crystal set over the distance you propose to use it. You will need a good-sized outdoor aerial.

* * *

J. P. T. (Stockport).—I have a condenser of ·0002 mfd.; can I use this as a grid condenser? If so, what should be the resistance of my leak?

The condenser should be quite O.K. as a grid condenser, using a leak of 1 megohm.

* * *

"PIPER" (Dundee).—I am using a five-valve set that includes two high and two low frequency amplifiers. I am troubled with interference from some A.C. power mains. Would this be decreased without loss of signal strength by adding one high-frequency stage and cutting out one low-frequency stage?

The addition of another H.F. circuit would certainly help to filter out such interference; but, although it would also increase your possible range of reception, signals would not, generally speaking, be as loud, owing to the decrease in the stages of note magnification.

* * *

V. B. (Westcliff-on-Sea).—I am aware that it is a very near neighbour who is causing considerable interference in this district by badly handling his valve set. What steps should I take to prevent him doing it?

The best plan would be to call on him and amicably point out the annoyance that he is causing. If he is not tractable, and you are certain as to the identity of the offender, then you should communicate with the nearest wireless society, who would willingly take the matter up and endeavour to lessen what is becoming a general nuisance in some localities.

* * *

"VARIOMETER" (Norwood).—I am building a one-valve set for broadcast wave-lengths; can I use a variometer instead of a coil and condenser?

Yes; a variometer will give quite good results, especially on the low wave-lengths. For waves of 200–600 metres you should use about 35 turns of 22 on the primary and about 36 on the secondary. The dimensions of the formers should be about 5½ in. long by 4 in. diameter for primary, and about 3 in. long by 2½ in. diameter for the secondary. The windings are connected in series.

* * *

K. D. R. (St. Albans).—I have decided to use a tuned anode type of H.F. amplifier; can I use basket coils for the coupling?

We presume you mean the type of coupling using a single coil—tuned—and connecting the plate of the valve to the grid of the detecting valve direct through a condenser. Yes; the use of basket coils will give quite good results. Plug-in coils would perhaps be best, but you can also join a set of coils—up to 1,500 metres or so—in series and tune by means of a rotary switch and a ·0002 mfd. variable condenser. You will find the tuning very critical.

* * *

"TROUBLED" (Hatfield).—I am troubled by "spitting" noises all the time I am listening-in on a three-valve set. How can I cure this?

Probably the noises are due to one or more of the following causes: (1) The H.T. battery may have a faulty cell in it, or may be loosely connected. Test cells with a voltmeter and cut out the faulty one. (2) L.T. may be loosely connected or the accumulator over-charged. (3) There may be a break in some wire—possibly the telephone leads. Test carefully for a break on all connections—especially loose filament resistance contact, telephone leads, L.T. and H.T. battery connections. A larger condenser across the H.T. battery may cure the trouble if it is due to a poor H.T. battery. Use a ·05 condenser.

* * *

P. D. M. (Elstree).—I have two sets, a crystal and a one-valve, and I wish for louder signals. What ought I to add to each set for louder signals from London, and to be able to receive Birmingham?

For louder signals from 2 L O on the crystal add H.F.; in the case of the valve add L.F. for louder signals. To be able to hear Birmingham, however, you should use H.F. amplification on the valve. The reason why H.F. should be used for the crystal is that the range is rather far for crystal reception, and it is better in this case to amplify the incoming signals rather than the rectified signals, which would be the case if L.F. were used.

(*Continued on page 802.*)

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page* 800.)

F. H. V. (Sidmouth).—On my inductance coil which has two sliders I notice that the sliders make contact with more than one turn of wire at a time. Surely that is wrong?

It would be very difficult, practically impossible in fact, to construct the coil so that the sliders make contact with but one turn. It is that point that prevents the slider inductance coil assuming the efficiency of one that has unit tappings as there will always be on the former, small closed circuits consisting of the shorter turns, which will tend to reduce the efficiency of the coil.

* * *

L. N. H. (Edinburgh).—Would a single thread of a spider's web joined from my aerial to the tree stop me receiving signals? Lately I have had a lot of trouble with my set and have tried every possible thing, but still obtain signals only in short periods.

No, it is not probable that such a fine thread as that would cause complete failure even in wet weather when a fine film of moisture would collect on its very small surface. It would take quite a fair-sized web fairly heavily covered with moisture to cause very appreciable loss in efficiency. Possibly you have your aerial too close to that tree you mention. It should be kept well clear of the leaves and branches, although we are more of opinion that the fault exists in your set. Send along a diagram and full details and possibly we can locate it for you.

* * *

"PRIZESTAR" (Exeter).—Referring to your wired wireless article is it possible the ordinary wireless waves tend to follow telephone wires and railways and thus cause some of these "2 M T on one valve" freak results?

No, that is not at all probable, because in the ordinary course of events metallic conductors would tend to reflect wireless waves and not attract them.

* * *

B. F. M. (London, E.).—I have broken off and lost the small spiral of wire that was used to press against the crystal on my broadcast set. The crystal is greyish black in colour and was purchased from Gamages. Can you tell me what the wire is and how to fix on another piece?

Most probably it was German silver and in any case that metal will serve the purpose. Obtain three or four inches of this, 34 gauge, and form a little spiral by winding it on a nail of suitable size. Carefully "tin" one end and fix it to the brass arm with a small spot of soft solder.

* * *

A. P. (Oldham).—I am making that accumulator high tension unit described in POPULAR WIRELESS. Is the red lead put in the tubes in powder form?

No, in the form of a thick paste. The red lead in powder form is mixed with dilute sulphuric acid.

How many holes should be pierced in the tubes?

Providing they are very small holes the greater the number the better.

* * *

W. Y. (Manchester).—Why should it be advisable to put extra 'phones in series on a set instead of in parallel. Surely by placing them in series the resistance is increased and therefore current decreased?

Yes, but the resistance is not doubled. Whereas by placing them in parallel only half the current flowing in the circuit can pass through each pair of telephones, assuming them to be of similar resistance, by placing them in series there will be less current flowing through each than would flow through one, but not half for the following reason: Current equals voltage divided by resistance, but the latter factor must include the resistance of the crystal or valve which may be 10,000 ohms. It is obvious that by increasing the resistance by the addition of another pair of telephones, say 4,000 ohms, there will be less current, but to bring the current down to a half the additional resistance required would be 14,000 ohms—one pair of 'phones plus the resistance of the detector. Thus three additional 'phones could be placed in series and give the same signal strength as but one additional pair placed in parallel.

* * *

C. C. (Scarborough).—What form of circuit would you advise me to adopt using two valves with view to receiving the broadcasting?

A tuned circuit coupled H.F. stage and detecting would prove the most suitable for that purpose, although it would require some little experience in handling before the best results were obtained. It might be as well to commence with the usual H.F. transformer coupled circuit as even that will require fairly critical tuning.

* * *

B. N. T. (London, S.).—Can you tell me how many persons hold receiving licences in London?

The exact figures are not to hand, but the number exceeds 60,000.

* * *

"OSCILLATOR" (Tottenham).—Am I causing disturbance merely by using reaction, or is it only when my set "howls" audibly in the 'phones?

If reaction is employed carefully and judiciously, no interference will be caused. You must keep well clear of the oscillating point—as far away as possible so that during reception there is no possibility of mechanical vibration or proximity of your person (capacity effect) causing your set to oscillate. The latter condition is not always audible and you should acquaint yourself with the methods of determining the state. When spark stations come in with a rough note and telephony is distorted, or when a slight rushing noise is heard in the 'phones and a damp finger on the aerial terminal of the set cause a distinct click in the 'phones, you are energising your aerial and possibly causing interference. That is the condition you must avoid. If you cannot do so during the course of the transmissions, then you should dispense with reaction altogether.

* * *

"AMATEUR" (Manchester).—I have been told that to receive C W it is necessary to employ reaction, and yet I can hear C W stations on my set while broadcasting is on, and it very often jams. My set is a single valve without reaction and no twisted leads, etc., that might cause a capacity regeneration. Why is it?

No doubt it is due to the C W stations heterodyning with the carrier wave of the broadcasting station or the weak oscillation of a nearby amateur carelessly using reaction. Such heterodyne harmonics can be frequently heard very faintly on most valve sets, but are not generally strong enough to cause interference. Being so near to a broadcasting station you should discover quite a margin for tuning out such interference without losing at least 2 ZY as you will find the parasitic C W fairly sharp in tuning.

* * *

N. R. (Norwich) has assembled a two-valve set on one panel, and asks whether the pencil

(*Continued on page* 804.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page* 802.)

lines with which he marked out the under side of the ebonite will cause trouble?

Yes, unless very carefully removed they certainly will cause leakage. It will be well worth while to take down the set for the purpose of erasing them carefully.

* * *

R. U. L. (Broxbourne).—How much current is lost in the charging and discharging of accumulators?

Generally about 25 per cent.

* * *

"AMATEUR" (Northampton).—What is the use of the change-over switch in the loose coupler given in No. 23 of POPULAR WIRELESS?

To allow the telephones and crystal to be placed across either the primary or secondary coil. Thus it is possible to tune in the signals on the primary coil and condenser and then switch over and complete the tuning by adjusting the secondary circuit and coupling knowing that the signals have reached at least the primary circuit. Without such a switch the tuning in to stations on a two circuit receiver is very difficult and requires a fair amount of experience. The difficulty is greater with crystal sets of that type owing to the fact that there is the crystal adjustment to consider. A buzzer is also almost a necessity in this case.

* * *

L. T. M. (Oxford).—When listening-in on low wave-lengths, I frequently hear the carrier waves of some stations, but cannot hear their speech. Why is this?

It is quite likely that you are too far away to be able to pick up the speech, though the more pronounced carrier wave can be heard. Another reason may be that your set has not a very well-defined oscillation point, and this would mean, in the case of these distant stations, that as soon as you commenced to loosen the reaction coupling, you lost the carrier wave before your valves had really ceased to oscillate. To hear weak telephony it is often necessary that the valves have to be just off the oscillation point, and if this point is not well defined you will be unable to reach that adjustment.

* * *

S. E. B. (Doncaster).—While listening-in to the broadcasting the other night, the sounds gradually died away, so that I could only just hear them. I switched off for a few minutes and then tried again, when the same thing happened after a time. Why is this?

Very probably your accumulator is running down, you should test it with a voltmeter or hydrometer. The reading on the voltmeter should not be less than 1·8 per cell. In the case of the hydrometer it should not drop below 1.85. Remember that the voltmeter reading should be taken while the accumulator is actually on discharge. If your L.T. battery is O.K., the trouble may be due to a faulty, or unsuitable grid leak. Try the results of working with different values of leaks.

* * *

"HIGH TENSION" (Watford).—I have been troubled recently with a great deal of crackling noises in my set; is it likely to be either of my batteries? I cannot find any loose connections.

Most likely it is due to the H.T. battery. Test this with a voltmeter and cut out any defective cells. In testing, the voltmeter should be connected across each section of the battery which is probably divided into 3 or 6 volt sections. If any section is found to have dropped in voltage below 2 volts, in the case of the 3-volt sections, or below 4½ volts in the case of the 6-volt sections, cut this portion of the battery out, short circuit it by means of a piece of wire, connected from the plug of the best good cell to the plug of the next cell whose voltage is still O.K.

* * *

P. S. (Lewisham).—I have raised my aerial by about 10 feet, but the results do not appear to be so good as before. Why is this?

If you have altered the height of your aerial, you have also altered its capacity, and therefore, the natural wave-length of your aerial has been changed, Make sure, when you are tuning-in a station, that you allow for this variation. For instance, if you found the best tuning for Marconi House was on a certain stud with a certain condenser reading, you will very likely have to go on to another stud for the same station now that your aerial has been raised. In any case, the tuning position will be quite different.

FOR NEW READERS.

Special arrangements have been made by the Technical Staff of "Popular Wireless" to deal promptly and clearly with all questions sent in by new readers who have just bought, or who contemplate buying, a wireless set.

If you are in any difficulty with regard to wireless, write to us, and an answer will be sent free by post.

Tell your friends about this and the fact that a Special Beginners' Supplement commences in this issue.

J. A. E. (No Address).—In the erection of my aerial it is necessary to have it so that it is 50 feet long and parallel to some telephone wires which are 50 feet away, the only alternative is to run the wire less parallel, but that would mean bringing one end to within about ten feet of the 'phone wires. Would this latter be advisable?

In the circumstances it would not, but would be better to keep the aerial as far away as possible from the telephone wires along its whole length.

* * *

"AMATEUR" (Aberdeen).—What is the best crystal to use in the valve-crystal combination circuits?

Carborundum with a potentiometer and battery is the most suitable. Failing that, one of the treated galena crystals should be used, such as Permanite, Hertzite, etc. Sensitivity and stability should be aimed at in the detector of such a circuit.

(*Continued on page* 806).

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page* 804)

"WORRIED" (Blackheath).—Do you think that the fact that I am the other side of the Thames will affect results from Marconi House?

No; on the contrary, wireless waves will travel with less absorption over water than over land.

* * *

W. P. L (Blackpool).—How do they gauge the range of receiving instruments. Does this not depend to a great extent on the power of the transmitting station?

Yes, to a very great extent. When gauging the range of broadcasting apparatus a fair average of transmitting power is available, in that the power of the broadcasting stations is more or less similar. Even in this case there are many other more or less indeterminate factors to consider, such as atmospheric conditions, local conditions quite apart from the more controllable factors such as aerial efficiency, earths, etc, so that ranges of reception are always but an approximation.

NEXT WEEK.

"The future of Broadcasting in the Home."

A special interview with Senatore Marconi.

Tell your friends about the new Popular Wireless Supplement.

"AERIAL" (Southport).—1. What is the maximum height of an aerial for the reception of broadcasting allowed by the P.M.G.? 2. Have all sets to be marked with the B.B.C. stamp? 3. Is there any limit for the number of valves allowed for reception of broadcasting? 4. How far will a loud speaker receive from as compared with a telephone?

The total length of aerial used depends upon the height at which it is to be suspended. The measurements allowed by the P.M.G., 100 feet, include the length of aerial—from insulator to insulator; that is, the span—plus the length of lead in from aerial to the set, plus the maximum height above the ground. 2. All sets intended to be used under the broadcast licence should be stamped unless special permission to use a home-made set is obtained from the G.P.O. For full details, see our issue of Dec. 31st under the heading of "Home-made Sets." 3. No; any number of valves is allowed under the regulations, providing reaction is not used. 4. A loud-speaker considerably cuts down the range of a set. It reduces the range to about one-tenth of the distance over which signals can be received comfortably on a telephone.

* * *

E. M. F. (S. Devon).—I am building a four-valve set, two H.F. and one L.F. 1. Will it be necessary to shunt a variable condenser across the primary of the H.F. transformers? 2. Should fixed condensers be fixed across the L.F. primaries? 3. What value blocking condenser should be placed across the H.T. battery? 4. What value grid leak and condenser? 5. What value 'phones?

1. Yes, a variable condenser is desirable for fine tuning; use a ·0003 mfd. condenser. 2. Yes; these condensers should be connected across the L.F. primaries. About ·001 mfd. 3. About ·02 mfd. 4. A 2 megohm leak and a ·0003 mfd. condenser will be about correct, but different leaks should be tried, as the correct value varies considerably with the type of valve used. 5. 4,000 ohm 'phones will be quite O.K. For safety these may be used in conjunction with a telephone transformer of a ratio of 1—1.

* * *

"LICENCE" (Eltham).—I am doubtful about the licence problem. Being only 14 years of age, can I build my own set and still have an ordinary Post Office licence, or must I get an experimental licence?

You should read the article on "Home-made Sets and the P.M.G.," published in our issue of Dec. 31st. In any case, the licence would have to be taken out in your father's or guardian's name. With regard to

(*Continued on page* 808.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page 806.*)

the building of a set, application for permission for the use of such a set should be made to the Sec., G.P.O. This permission, if granted, will enable you to use the set with an ordinary licence obtainable at the Post Office. Failing this, you will have to apply to the Sec., G.P.O., for an experimental licence.

* * *

T. M. N. (Ilford).—How many turns to the inch are there of No. 26 DCC, 22 DCC, 28 DCC, 26 DSC, 30 DSC?

35, 24, 38, 45, and 65 turns per inch. That is more or less approximate as these figures are liable to slight variation with different makes of wire and tightness of winding.

* * *

T. E. (Leeds).—Will you give a list of the more efficient crystal combinations?

Copper pyrites pressing against zincite or bornite is the most efficient crystal combination detector, and is, in fact, the only one that can be classified as efficient. It is more generally known as the "Perikon" detector.

* * *

Y. H. (Doncaster).—Is a potentiometer and battery essential using a carborundum detector?

To obtain working results it is. By the way, there will be an article in POPULAR WIRELESS shortly, describing the construction of a potentiometer. Carborundum can be used without the applied potential to obtain quite good results in very rare cases, but only when a "freak" specimen of that substance is available. Also, we might mention that we have seen a set that gives very loud signals from 2 L O using a carborundum crystal without battery, and without either earth or aerial, but that particular set happens to be situated in the corridor outside the transmitting room at 2 L O.

* * *

R. P. (London, E.).—Could I charge a 2 volt accumulator from Leclanché batteries?

No; the current supplied by that type of battery is not sufficiently constant for the purpose you mention. Daniel cells, however, can be used if they are of a large capacity and of sufficient number to cover the voltage of the accumulators to be charged with 50 p.c. or so margin, as these cells are capable of producing a constant current for extended periods.

* * *

O. M. (Tooting).—How are honeycomb coils tuned—merely by induction?

No; a variable condenser is necessary for tuning purposes.

* * *

M. C. N. (Chester).—Must I have my earth connection to a spot directly under the aerial? Where do I apply for an experimental licence?

No, there is no absolute need for the earth connection to be directly under the aerial, but an advantage in efficiency is usually obtained by so doing. (2) The experimental licence application form can be obtained from the Secretary, G.P.O., London.

* * *

"AERIAL" (Newcastle).—I have a quantity of iron wire, which I should like to use as an aerial. Is this possible? It seems to me to have an advantage in tensile strength over the copper wire usually employed.

Iron wire is quite unsuitable for aerial purposes owing to its impedance. The high resistance, or impedance of the iron, would probably result in very poor results. If you feel that copper (stranded) wire is not strong enough, why not use phosphor-bronze or silicon-bronze. These have quite sufficient strength for the purposes of aerial wires.

* * *

Q. P. S. (Letchmore Heath).—I believe my accumulators are running down, but would like to make sure. What is the best method of testing the conditions of the cells?

The best test, in fact, the only really safe test, is by means of a hydrometer. You will find a suction hydrometer, Hick's type, can be obtained for a few shillings, and will be well worth getting. It consists of a glass tube with a rubber bulb, like a fountain-pen filler. In the tube are three glass beads, purple, blue and yellow. When acid out of the accumulator is sucked into the tube either one, two, or all the beads will float, according to the specific gravity of the solution. The yellow (bottom one) floats at 1.17, the blue at 1.185, and the purple at 1.2. Cells should not be allowed to discharge to a lower density than 1.18.

T/Y

POPULAR WIRELESS Beginners' Supplement

AN INTRODUCTION TO WIRELESS.

By MICHAEL EGAN.

PART 1.

BEFORE starting to explain anything about wireless, I want to say this to my readers. If you have been trying to learn wireless from a highbrow text-book, and if your efforts have only resulted in burdening your mind with a number of confusing technicalities, please try, here and now, to forget everything you have learned. If you start your study of wireless by blocking up the hall-door of your mind with a stack of cumbersome technicalities, you will leave no room for common sense to get in. And you won't go far in wireless until you have first learned to apply ordinary common sense to the ordinary common facts of the job. With this preliminary injunction, we will ring up the curtain on the very common-sensed questions:

"Well, what is wireless, anyway? What does it do? And how does it do it? What is it that actually happens when a wireless message is sent out by one station and picked up by another?" Let us try to answer these questions in simple, straightforward language.

Sound Waves.

When two people converse together they may be said to be communicating by wireless in the general sense of that term. That is, they exchange messages between one another without the use of wires. These messages are vocally transmitted and aurally received. I speak; my friend listens. In other words, I transmit, and my friend receives. Now what is it that I actually transmit when I talk to my friend? Do I send out "sounds" or "words" or "air waves"—or what? The answer is that I send out *energy* which travels in waves through the air. And that energy comes, in the first instance, from the stock of life energy that animates my body.

But what kind of mechanism do I employ in transmitting this energy from myself to my friend? Well, nature has endowed me with a very delicate apparatus for this purpose; it is situated in my throat. And my friend is similarly endowed with an equally sensitive receiving apparatus in his ear. When, for instance, I wish to transmit the first letter of the alphabet I simply vibrate the vocal chords in my throat. As these vibrate they send out energy-waves in all directions through the surrounding air.

A few feet away, my friend is standing. Some of these energy-waves strike the sensitive diaphragm of his ear and cause it to vibrate *at the same rate* as my vocal chords, thereby producing in his mind a certain sound impression which we denote by the sign "A." Now the "pitch" of this sound will vary according to the rate at which his diaphragm vibrates, which, in turn, will depend upon the rate at which my vocal chords vibrate.

Suppose, once more, that I vibrate my vocal chords at such a rate that there is produced in his mind the sound "doh" on the "tonic sol-fa" scale. If, now, I increase the vibrations of my vocal chords by a certain definite amount it will at once produce in his mind the sound "ray," and so on.

Human "Wireless."

The same holds good with ordinary speech. When I speak "in a low tone" it means that I am vibrating my vocal chords at a low rate. When I speak "in a high tone" it means that I am vibrating my vocal chords at a comparatively high rate.

Now this transmission and reception of wireless messages that goes on between two human beings in conversation is in many

The Thermionic valve, mounted on panel and ready to wire up to a set.

respects similar to what takes place between transmitting and receiving wireless stations. What are the essential factors in the system of "human wireless" communication we have just been considering? At the transmitting end we have (1) a couple of chords which are capable of being vibrated at different rates, and (2) a supply of energy which is capable of producing these vibrations. At the receiving end we have (1) a sensitive diaphragm which, when acted upon by the energy-waves set up in the surrounding air by the vibrating chords, will itself begin to vibrate "in sympathy," *i.e.*, at the same rate as the chords; and (2) we also have, behind this diaphragm, a special mechanism for converting the received energy into the sensation of "sound" within the mind.

Now, these same factors are required for wireless of the "non-human" variety. At the transmitting end there are (1) a number of wire chords (usually called the "aerial") which are capable of being vibrated at different frequencies; and (2) a supply of electrical energy which is capable of producing these vibrations. At the receiving end there is (1) a sensitive vibrator (also usually known as an aerial) which when acted upon by the energy waves sent out from the vibrating transmitting aerial, will itself begin to vibrate "in sympathy" with the latter; and (2) there is a special mechanism (usually called a "detector") for converting the received electrical energy into sound energy.

There is this difference between the two systems. In the case of "human wireless," the vibrations are what we may call physical vibrations. That is, the vibrating parts actually *move* backwards and forwards, or up and down, even though the movement is infinitesimally small. In "non-human wireless" the wires do not *move*, they vibrate *electrically*. Let me give one or two simple examples.

Suppose you had a rod of some particular kind of metal which you could heat and make cold, heat again and make cold again, in fairly rapid succession. On touching such a rod with your finger whilst this process was going on you would probably describe the sensation by saying: "This rod is *vibrating* with heat." You would, therefore, be experiencing *heat vibrations* in a stationary rod.

Respecting Sensitivity.

Similarly, if you were connected up to an electric circuit in which a slow vibratory electric current was flowing you would experience a series of "shocks," with intervening periods of "no-shock." In practical wireless work, however, transmitting aerials are vibrated at such terrific rates that none of our physical senses are capable of detecting the fact that they *are* vibrating. That is why special instruments have to be employed at the receiving station to detect the vibrations set up in the aerial by passing wireless waves.

To return for a moment to our example of human wireless: if my friend happens to be a little bit deaf—he will probably fail to hear me when I speak to him in my usual voice at a distance of 10 yards. On the other hand, if his hearing is unusually acute (*i.e.*, if he is endowed with a highly sensitive receiving apparatus in his ear) he will probably hear me over that distance even if I speak in a quieter voice.

Again, just as the distance over which we can communicate with each other is governed to some extent by the quality of *his* hearing, it is also affected by the quality of *my* voice, by the amount of energy I use to vibrate my vocal chords. Even if he is slightly deaf he will probably hear me over a distance of thirty yards if I "shout at the top of my voice." *Exactly* the same conditions obtain in connection with "non-human wireless," as we have chosen to call it for the moment. The sensitivity of receivers varies immensely. A "single-valve" receiver is a good deal more sensitive than a "crystal" receiver, and a "multiple-valve" receiver is more sensitive than either of these. Similarly with transmitters; the more "kilowatts" of electrical energy we use to vibrate an aerial, the longer the

(*Continued on next page.*)

THE BEGINNERS' INTRODUCTION TO WIRELESS.

(*Continued from previous page.*)

distance over which messages can be sent. There is yet another important point of similarity between the two systems. Should anything "stick in my throat" in such a way as to prevent my vocal chords from vibrating freely, I will not be able to speak loudly and clearly. Or, again, if my friend puts a finger in his ear he will prevent the energy waves from vibrating the diaphragm. He will, as we say, "shut out the sound of my voice."

What is Ether?

In the same way, receiving and transmitting aerials must be guarded from obstruction. That is why they have to be suspended carefully, so that they do not run any risk of coming in contact with trees, houses, etc. In other words, they have to be protected from a number of things which would prevent them from vibrating freely (electrically).

The analogy between these two systems of communication must be restricted, however. They differ in one important respect, although this difference is one which need not cause the beginner the slightest worry. The energy waves which result from human speech can only act through *air*. If the layer of air which surrounds our earth were suddenly dispersed completely, "sound" would cease to be possible. Not only would we be unable to hear each other speak, but we could no longer hear the roar of the traffic, nor even the report of a gun let off at a yard's distance. There would be "dead silence" everywhere. (Mind, we should still be able to *see* and *feel*, but we could no longer *hear*.)

Air, then, is essential to the transmission of those particular energy waves which rise to sound. But air is of no importance whatever to the transmission of those energy waves which are sent out from electrically vibrating wires. (This is also the case with reference to the energy waves which come to us from the sun and produce the sensations of "light" and "heat.") Even if there was no air, those energy waves could still pass freely over the earth. Moreover, they can pass *through* the earth—through anything, in fact.

I fancy I hear the enthusiastic reader murmur something about the "ether"? Well, if you must have it then, "ether" is the "medium" through which "wireless" waves move, just as air is the "medium" through which "sound" waves move. And now we have let ourselves in for the question: "What is ether?"

Here is the best answer that can be given to this absorbing problem at this stage: Wherever there is *space* there is *ether*. And by space, I don't merely mean space that is free of tables and chairs and houses. I include also the very space occupied by these things, and every "tiny dot" of space occupied by the whole universe. And wherever there is space wireless waves can move, *i.e.*, *through* tables and chairs and houses, *through* the "unoccupied" space from here to the Milky Way, *through* the Milky Way and on to the back o' beyond. All this, of course, provided you have a sufficiently powerful transmitter.

I would like to warn the reader at this point against falling into a very common error. When the aerial wire of a transmitting station is vibrated electrically, electric *currents* do *not* flow out through space. No *electricity* leaves the aerial. What *does* leave the aerial is a wave of energy, which, on striking the sensitive receiving aerial, sets up sympathetic *electrical* vibrations in *that*.

I have said above that these vibrations occur at such an extremely high rate that none of our physical senses are capable of detecting them. It is therefore necessary to employ, at the receiving station, special instruments for the purpose of changing these *rapid electrical* vibrations into *slow physical* vibrations which we can detect with our sense of hearing.

Once more, there is no reason for the beginner to anticipate any difficulty in understanding how electrical vibrations can be changed into physical (or mechanical) vibrations capable of producing sound. We have all, at some time or other, heard a kettle "singing" on the fire. Well, there is a simple example of *heat* being responsible for the production of *sound*. And heat waves follow the same general laws as wireless waves, so—why not?

Vibrations and Waves.

Now let us try to sum up the different operations necessary for the despatch of a radio telephonic message. Let us suppose that I am at the transmitting station, and that the reader is the listener at the receiving station. It is understood between us, in the first place, that I am going to vibrate my aerial at a certain rate. The reader will, therefore, by twiddling the handle on his receiver, adjust the sensitivity of his aerial to the point at which it will be most sympathetic to this rate of vibration.

I also adjust the sensitivity of my own transmitting aerial and connect it up to a supply of electricity. I then speak into a microphone (similar to that used in ordinary land-line telephony) which is connected up to the transmitting instruments which control the supply of electricity. The impact of the *sound* waves on the microphone instantly sets a special mechanism in motion which produces corresponding *electrical* vibrations in my aerial. These, in turn, give rise to energy waves which move out in all directions across the earth.

When these waves strike the reader's aerial they cause it to vibrate *electrically* and, except for a certain loss in strength, these vibrations are an exact reproduction of the vibrations in my transmitting aerial. The reader's receiving instrument ("valve" or "crystal," as the case may be), now transforms these *electrical* vibrations into *mechanical* vibrations, which are an exact reproduction of my voice.

I will conclude this article with a few remarks on the relative merits of receivers. I have already called attention to the fact that the total efficiency of a receiver depends not only on its own sensitivity, but also upon the power used by whatever transmitting station it happens to be receiving from at a particular moment. In the case of broadcasting stations, however, the power used will not be a variable quantity. The same amount of power will be used by all broadcasting stations at all times. The efficiency of a broadcasting receiver will therefore depend upon the sensitivity of the receiver itself.

Range of Sets.

Two kinds of receiving aerials can be used: (1) An outdoor aerial, comprising one or two long bare wires running parallel to the ground, and (2) an indoor aerial, comprising one long insulated wire wound several times round a rectangular frame which stands at right angles to the floor of the receiving-room. For the purposes of broadcast reception the former type of aerial is, if properly erected, a good deal more efficient than the latter. The aerial is the cheapest and, in many respects, the most important part of a receiving equipment. Therefore, your first consideration should be to erect the best aerial that the conditions of your environment and the P.M.G.'s restrictions will allow. If you have accommodation for an outdoor aerial, make it as high and as long as possible. If you decide on an indoor aerial, make the frame as big as possible—5, 6, or 7 ft. sq.

With a good outdoor aerial you will be able to pick up signals on a crystal receiver from a broadcast station within a radius of 10–15 miles. With a single valve receiver on the same aerial you will get really loud signals at that distance, and you should still be able to receive satisfactory signals at a distance of 40–50 miles. On a two valve receiver you will get loud signals from a broadcasting station 40 miles away, and you will not be out of range for intelligible signals at a distance of 100–130 miles.

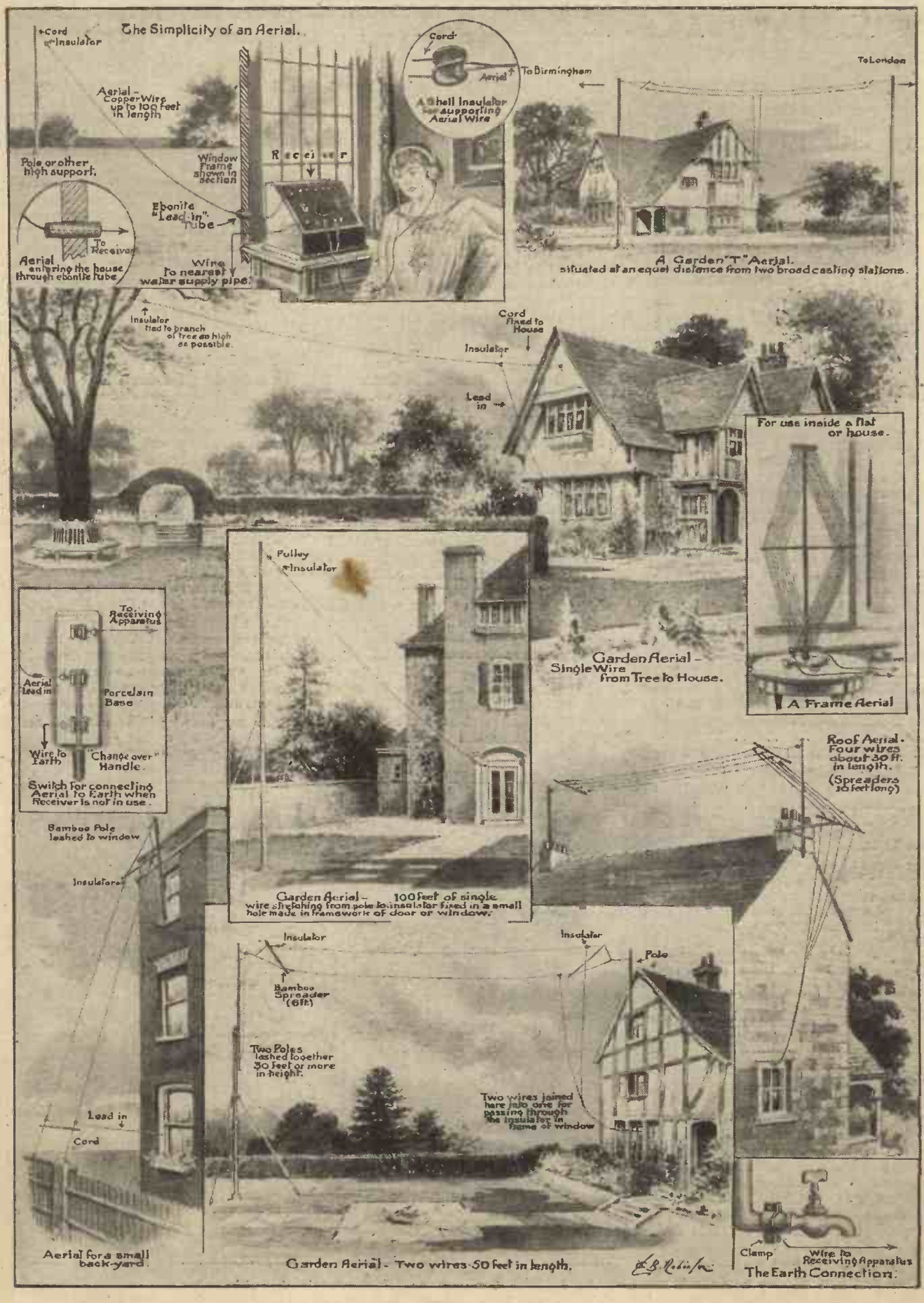
The best frame aerial will be useless in conjunction with a crystal. Even with a good frame aerial a single-valve receiver will not yield satisfactory results over more than a few miles. The maximum range with a two-valve receiver will be about 20 miles; and with a three-valve receiver about 45–55 miles. For really good results over long distances, 4, 5, or even 6 valves will be necessary.

(*To be continued.*)

Fixing in the Earth lead.

Send along your Wireless Photos to "Popular Wireless." If used we pay you **10/6.**

METHODS OF ERECTING AERIALS.



HOW TO ERECT AN AERIAL.

THERE are so many viewpoints from which one can take a first glimpse at the practical side of wireless communication, that the question of where to begin is by no means easy of solution. To the average "man in the street," however, radio telegraphy and telephony is invariably associated with a wire or wires suspended between masts or other supports above a wireless station, and it might be as well, therefore, to commence from this point. The antennæ or aerial, as it is more commonly called, is used either to radiate wireless waves or to receive them.

The Wire to Use.

There are several types of outdoor aerials which are capable of giving good results if sufficient care and thought is exercised in connection with their construction. The best wire to use for this purpose is stranded silicon bronze, phosphor bronze, or copper. The amateur will find, however, that to purchase, say, a 7 stranded silicon bronze aerial is a fairly costly business, and in these days of sensitive valve receivers, a simple single copper wire aerial will do all that could reasonably be expected of it provided that the set to which it is attached is in good working order. A good wire of about 16 gauge can be procured for about 2s. 6d. per 100 ft.

Other useful wires, together with their approximate cost, are as follows:—

100 ft. of Hard Drawn Copper wire, 7/22, together with two insulators .. .. 4/- to 5/-
100 ft. of Enamelled wire, 7/22, together with two insulators 5/- to 6/-
100 ft. of Bare Copper stranded, 7/22 .. .. 5/- to 6/-
100 ft. Silicon Bronze, 18 gauge 2/6 to 3/-

If desired, the wire could be treated with any damp proof solution against the weather without affecting its efficiency.

Various Types.

Four types of outdoor aerials, which can be successfully erected for the interception of wireless waves, are shown in the accompanying diagram. A is known as the "L" or "inverted L" type. This type of aerial is generally used by amateurs on account of its adaptability to back gardens, and the comparatively easy manner in which the down lead can be brought into the instrument room. B is an elaboration of the foregoing type, and is known as the "double wire" or "twin inverted L" type. For this form of aerial two wooden spreaders are necessary to keep the wires in proper position. They should be made of strong, well-seasoned wood, preferably ash, as the use of soft white wood for this purpose is not advisable. A certain amount of strain is placed on the spreader once the aerial is installed and tautened, and faulty or unseasoned spreaders would probably warp or snap owing to the action of the weather. The two spreaders should be long enough to keep the two wires at least 4 or 5 ft. apart.

C is known as the "T" type of aerial on account of its similarity to that capital letter when erected. This aerial will not usually be found so convenient to install as the single wire "L," although where both transmission and reception are performed by means of the same antennæ this kind of aerial will give as good results as any.

D is the double wire "T" type in the erection of which spreaders are also utilised in a manner similar to that of "L" aerials. This aerial is used principally on ships where the wireless cabin is often amidships, and therefore suitably placed for an aerial so constructed. It is also used on the roofs of high buildings or in the open country, anywhere, in fact, where space permits and the wireless room or cabin is conveniently placed to receive the lead in. When the double wire aerial is used the two wires should be parallel to each other in a horizontal plane, and stays will have to be introduced to keep the aerial in position.

Importance of Insulation.

An important point to remember is that the down lead of the "T" aerial should be attached exactly at the midway point of the horizontal wire or wires and not promiscuously connected to any point along the overall length. Careful attention should also be given to the insulation of the aerial. It must be remembered that the oscillations set up by the incoming waves are extremely weak, and no chance of leakage to earth should be permitted; all of the received energy, especially in the case of weak signals, being required to actuate the receiver.

Insulators, for preference, should be of china, ebonite, or of rope if the latter be treated with a thick solution of rubber. Any really satisfactory non-conductor of electricity is suitable for the purpose, provided good insulation between the aerial wire and supporting mast is obtained.

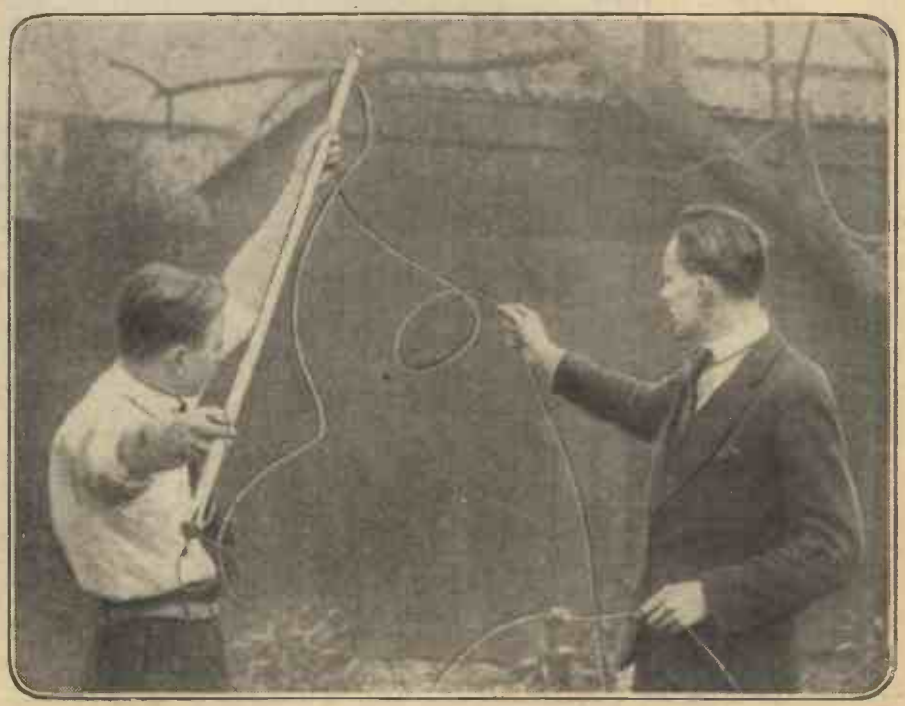
The aerial itself may be hoisted or lowered by means of a block and pulley fixed to the mast-head. The aerial should at all times be kept as far from buildings and trees as circumstances will allow, especially lead roofs, telegraph wires, or iron work, and should be elevated as high as possible. If it is desired to use a tree as an aerial support, the aerial proper should be so insulated that it does not in any way come into contact with the branches. A simple way to avoid this is to attach sufficient rope to the trunk of the tree to allow of the actual aerial swinging absolutely free.

The Down Lead.

In connecting the down lead to the flat top or horizontal wire or wires, the portion of the aerial to which it is proposed to make the joint should be thoroughly cleaned prior to soldering, and if necessary finally covered with insulation tape. When bringing the down lead from the aerial to the apparatus, make certain that it is well insulated from all parts of the building, including the actual point at which it enters. To obviate all danger of short circuiting the aerial to earth, use might be made of rubber covered or other insulated wire for that portion of the down lead in proximity to the house or receiving room.

The whole structure should also be periodically overhauled. For obvious reasons this is essential to the proper working of the station, and the aerial and all guy ropes should be thoroughly inspected for any sign of deterioration.

(This supplement will be continued next week.)



Two amateurs are shown here fixing the aerial wire to a spreader.

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Y/Y

"POPULAR WIRELESS"
DIRECTORY OF AMATEUR STATIONS.

NOTE.—A few stations given in this directory are not shown on the map, as details of position are unavailable.

Call Sign.	System.	Name.	Address.
2 A A	—	Radio Communication Co.	Slough Experimental Station, Slough.
2 A B	Sp., C.W. & R/T	H. de A. Donisthorpe	Cathcart St., London.
2 A F	C.W.	A. Rickard Taylor	49, Idmiston Rd., W. Norwood.
2 A G	C.W.	Ditto	Ditto.
2 A H	C.W.	—	Oxford.
2 A J	—	A. S. Atkins ..	16, Beauchamp Rd., Upper Norwood, S.E. 19.
2 A K	Sp., C.W. & R/T	R.M. Radio Ltd. ..	Townsend Mills, Worcester.
2 A L	C.W. & R/T ..	W. Halstead ..	Briar Rd., Thornton-le-Fylde, Chiswick.
2 A M	—	—	Marlborough College.
2 A N	C.W. & R/T ..	A. W. Sharman ..	1, Morella Rd., London, S.W.
2 A O	—	Reilly	Eastbourne.
2 A Q	Sp., C.W. & R/T	Davis	Thornton Heath, London, S.W.
2 A R	—	E. Gaze	3, Archibald St., Gloucester.
2 A T	—	Beresford	Birmingham.
2 A U	—	A. C. Bull	25, Fairland Road, West Ham, E. 15.
2 A W	C.W. & R/T ..	H. H. Burbury ..	Crigglestone, Wakefield.
2 A X	Sp.	G Sutton	18, Melford Rd., London, S.E. 22.
2 A Y	Portable Set ..	D. F. Owen	Limehurst, Sale, Manchester.
2 A Z	Sp., C W & R/T	William Le Queux	Guildford.
2 B C	C.W. & R/T ..	D. F. Owen	Limehurst, Sale, Manchester.
2 B M	C.W. & R/T ..	G. H. A. Whitehouse	25, Ennerdale Rd., New Brighton, Cheshire.
2 B O	R/T	Marconi Co.	(Private Call for 2 M T), Writtle, Essex.
2 B Z	C.W. & R/T ..	Basil Davis	Electric Pavilion, Marble Arch, London, W.1.
2 C D	C.W. & R/T ..	Burton-on-Trent Wireless Club	Headquarters: "Barton Daily Mail," High St., Burton-on-Trent.
2 C F	—	F. G. S. Wise ..	8, Vernon Rd., Hornsey, N. 8.
2 C H	C.W. & R/T ..	Science Society ..	The School, Oundle, Northants.
2 C I	Sp.	R. Brooks King ..	Widcombe, Taunton.
2 C Q	—	Elmer	Gernham House, Birchington.
2 C W	—	Com. Hippisley ..	Ston, Eastern Park, Bath.
2 C Z	Sp., C.W., T.T. & R/T	C. Atkinson	17, Beaumont Rd., Leicester.
2 D C	C.W. & R/T ..	M. Child	60, Ashworth Mansions, Maida Vale, London, W.
2 D D	Sp.	A. C. Davis	105, Brynland Av., Bristol.
2 D F	Reallotted to ..	Miller	Malden High St., Malden.
		Mitchell's Elec. & Wireless ..	188, Rye Lane, Peckham, S.E. 15.
2 D G	C.W. & S.P. ..	W. Barnet	63, Mount Rd., Parkwood Springs, Sheffield.
2 D H	(Portable) C.W. & Sp.	Ditto	Ditto.
2 D I	Ditto	Ditto	Ditto.
2 D J	C.W. & R/T ..	A. T. Lee	The Court, Alvaston, Derby.
2 D S	Sp., C.W. & R/T	E. Redpath	29, Niger St., Barrow-in-Furness.
2 D T	—	Barrow & Dist. W/T Assn.	Barrow.
2 D U	C.W. & R/T ..	Mr. Norbury ..	Beeston, Nottingham.
2 D V	—	Woodall	Bramhall, Cheshire.
2 D X	C.W. & R/T ..	W. K. Alford ..	"Rosedene," Camberley, Surrey.
2 D Y	—	F. Haynes	157, Phillip Lane, S. Tottenham, N. 15.
2 D Z	—	Ditto	26, Avenue Rd., S. Tottenham, N. 15.
2 F A	—	F. G. Bennett ..	16, Tivoli Rd., Crouch End, N. 8.
2 F B	Sp., C.W. & R/T	W. Ison	80, Harnham Rd., Salisbury.
2 F C	—	—	London, S.E.
2 F G	Sp., C.W. & R/T	L. McMichael ..	32, Quex Rd., W. Hampstead.
2 F H	C.W. & R/T ..	T. S. Rogers ..	2, Park Hill, Moseley, Birmingham.
2 F K	—	—	Ilford.
2 F L	Sp. & C.W. ..	C. Wilcox	21, George St., Warminster, Wilts.
2 F N	—	L. Baker	Ruddington, Notts.
2 F P	Sp., T.T., C.W. & R/T	F. Foulger	118, Pepys Rd., London S.E. 14.
2 F Q	Sp., C.W. & R/T	Burndept Ltd. ..	Experimental Station, Blackheath.
2 F R	Sp.	S. Rudeforth ..	54, Worthing St., Hull
2 F T	C.W. & R/T ..	Edinburgh & Dist. Rad. Soc.	Edinburgh.
2 F U	Sp., C.W. & R/T	E. T. Manly, Jr. ..	27, Home Park Road, Wimbledon Pk., S.W.19.
2 F W	Sp.	Rev. D. Thomas ..	St. Paul's B.P. Scouts, Bournemouth.
2 F X	Sp., C.W., T.T. & R/T	H. C. Binden ..	Bournemouth.
2 F Z	Sp., C.W. & R/T	Manchester W/T Soc.	Albion Hotel, Piccadilly, Manchester.
2 G D	—	Birmingham W/T Exp. Club.	Digbeth Institute, Birmingham.
2 G G	—	A. H. Kidd	4, Kensington Gate, London, W. 8.
2 G L	C.W. & R/T ..	W. J. Henderson .	2, Hollywood Rd., London, S.W. 10.
2 G N	—	Halifax W. Club ..	Clare Hall, Halifax
2 G P	Sp., C.W., T.T. & R.T.	W. Gaitland	Highbury, N.
2 G Q	Sp.	1st Taunton Scouts	Parish Buildings, Wilton.
2 G R	—	T. Forsyth	Ashington.
2 G S	(Portable) ..	Ditto	Ditto (Portable).
2 G U	—	Halifax W/T Club	Halifax.
2 G V	Sp., C.W. & R/T	Rev. J. Rigby ..	St. Lawrence Vicarage, Bristol.
2 G W	Sp., C.W. & R/T	Allan Cash	Foxley Mount, Lymn, Ches.
2 G Z	C.W. & Sp. ..	A. L. Megson ..	Bowden.
2 H A	C.W. & S.P. (Portable) ..	Ditto	Ditto.
2 H B	C.W. & Sp. ..	L. H. Lomas	Macclesfield.
2 H C	C.W. & Sp. ..	J. W. White ..	Windcombe Lodge, Bucklesbury, nr. Reading.
2 H F	—	W. G. Gold	Rosidale, Belwell Lane, Four Oaks, nr. Birmingham.
2 H G	—	T. Boutland, Sr. ..	Ashington.
2 H H	—	Ditto	Ditto.
2 H K	—	A. A. Campbell Swinton	40, Chester Sq., London, S.W.1.
2 H L	—	Ditto	Ditto
2 H O	—	—	Ilford.
2 H P	C.W. & R/T ..	H. C. Woodall ..	10, Holborn House, London, E.C. 1.

"POPULAR WIRELESS" DIRECTORY OF AMATEUR STATIONS—*Continued.*

Call Sign.	System.	Name.	Address.
2HQ	C.W. & S.P.	A. W. Faucett	11, Leigh Rd., Clifton, Bristol.
2HR	C.W. & R/T	F. O. Reid & Co.	Queen St., Kingsway, London, W.C. 2.
2HS	C.W., T.T., & R/T	G. W. Hale	51, Grafton Rd., New Malden, Surrey.
2HT	Sp., C.W. & R/T	R. H. Klein	18, Crediton Hill, W. Hampstead, N.W. 6.
2HV	—	Beresford Bros.	Bude St., Birmingham.
2HX	Sp., C.W. & R/T	F. A. Love	Guildford Pk. Rd., Guildford.
2IB	C.W. & R/T	W. Bemrose	Littlecover Hill, Derby.
2ID	C.W. & Sp.	E. S. Firth	Thames Ditton.
2IF	C.W. & R.T.	S. W. Bligh	2, North Lane, Canterbury.
2IH	—	Technical College	Cardiff.
2II	Sp.	Southport W/T Soc.	74a, Kensington Rd., Cardiff.
2IJ	(Portable)	Ditto	Ditto.
2IK	R/T	H. R. Goodall	Winchester Rd., Bassett, Southampton.
2IN	C.W., Sp. & R/T	J. E. Fish	"Thornleigh," Thornton-le-Fylde.
2IQ	C.W. & R/T	W. A. Ward	26, Marlborough Rd., Sheffield.
2IS	—	Rev. H. W. Doudney	St. Luke's Vicarage, Bath.
2IT	(Portable)	Ditto	Ditto.
2IU	—	G. A. E. Roberts	Twyford, Winchester.
2IV	Sp., C.W. & R/T	L. F White	Priory Rd., Knole, Bristol.
2IW	—	G. R. March	Twyford, Winchester.
2IX	C.W. & R/T	S. G. Taylor	Littlecover, Derby.
2IY	C.W. & R/T	J. Briggs	66½, Corporation St., Birmingham.
2JA	—	A. J. Atkins	St. Malo, Beauchamp Rd., Norwood.
2JF	Sp., C.W. & R/T	C. G. Williams	22, Scholar St., Sefton Park, Liverpool.
2JG	—	W. A. Seed	Crigglestone, nr. Wakefield.
2JH	—	C. Burrand Stefano	Willington St., Slough.
2JJ	Sp., C.W. & R/T	C. Worthy	4, Riversdale Road, Egremont, Wallasey.
2JK	Sp., C.W., T.T. & R/T	Philip R. Coursey	138, Muswell Hill Rd., London, N.10.
2JL	Sp., C.W. & R/T	G. G. Bailey	The Beeches, Cowley, Middlesex.
2JM	Sp., C.W. & R/T	G. G. Blake	10, Onslow Rd., Richmond, Surrey.
2JO	Sp., C.W. & R/T	J. W. Whiteside	30, Castle St., Clitheroe, Lincs.
2JP	Sp., C.W. & R/T	M. C. Ellison	Hutton's Ambo Hall, York.
2JU	Sp., C.W. & R/T	E. J. Pearcey	610, Fulham Rd., London, S.W.
2JV	Sp., C.W. & R/T	A. G. Robin	Station Rd., Epping.
2JW	C.W. & R/T	J. R. Barratt	Westgate Court, Canterbury.
2JX	C.W. & R/T	L. Vizard	12, Seymour Gardens, Ilford.
2JZ	C.W. & R/T	R. D. Spence	Araighead House, Huntly, Aberdeenshire.
2KA	Sp.	N. Curtis	Belvedere West, Taunton.
2KB	C.W., R/T & T.T.	W. E. Earp	675, Moore Rd., Mapperley, Nottingham.
2KD	C.W., R/T & T.T.	P. Denison	Saville Park, Halifax.
2KF	C.W. & R/T	J. Partridge	Park Rd., Merton, S.W.19.
2KG	Sp., C.W. & R/T	A. E. Hay	Abernant, Aberdare.
2KH	R/T	Ashley W/T Co.	Renshaw St., Liverpool.
2KK	—	Hutchinson & Co.	101, Dartmouth Rd., Forest Hill, S.E.23.
2KL	Sp.	F. Pemberton	50, Peak Hill, Sydenham.
2KM	Sp.	C. Stainton	44, Kimberley St., Hull.
2KN	C.W. & R/T	A. B. Day	Finchley.
2KO	C.W. & R/T	C. S. Baynton	48, Russell Rd., Moseley, Birmingham.
2KP	C.W. & R/T	E. Edwards	2, Yewtree Rd., Edgbaston, Birmingham.
2KQ	—	—	Wolverhampton.
2KS	Sp., C.W., T.T. & R/T	C. Clayton-Breakell	Mill Bank, Church St., Preston.
2KT	Sp., C.W. & T.T.	J. E. Nickless	83, Wellington Road, Snaresbrook, E.11.
2KU	Sp., T.T. & R/T	A. J. Selby	66, Edward St., Burton-on-Trent.
2KV	C.W. & R/T	W. J. Crampton	Weybridge.
2KW	C.W. & R/T	W. R. Burne	Thorold Grove, Sale, Cheshire
2KX	Sp., C.W. & R/T	W. Stannorth	Fern Bank, Blackburn.
2KY	C.W. & R/T	L. Pollard	209, Cunliffe Road, Blackpool.
2KZ	Sp., C.W. & R/T	B. Clapp	Brighton Rd., Purley.
2LA	C.W. & R/T	H. F. Yardley	121, Victoria Road, Headingly, Leeds.
2LB	Ditto	Ditto	6, Blenheim Terrace, Leeds.
2LF	Sp., & C.W.	P. Harris	Chilvester Lodge, Calne, Wilts.
2LG	C.W.	H. Whitefield	Primrose Lane, Hall Gr., Birmingham.
2LI	Sp., C.W. & R/T	H. E. Wilkinson	Lonsdale Rd., London, N.W.6.
2LK	T.T. & C.W.	S. Kniveton	Brooklands, Normanton, Yorks.
2LL	Ditto	Ditto	Ditto
2LO	R/T	Marconi	Marconi House, Strand, W.C.
2LP	Sp., C.W. & R/T	A W. Knight	26, Stanbury Rd., London, S.E.
2LQ	—	J. A. Henderson	Elm Hall Drive, Mossby Hill, Liverpool.
2LR	C.W. & R/T	J. Scott-Taggart	6, Beattyville Gdns., Ilford.
2LU	C.W. & R/T	W. A. Appleton	Wembley Park.
2LV	Sp., C.W. & R/T	W. R. H. Tingey	Queen St., Hammersmith.
2LW	Sp., C.W. & R/T	Ditto	Ditto
2LX	—	S. Skeet	120, Highcross St., Leicester.
2LY	R/T	H. H. Thompson	59, Redlands Rd., Penarth, Glamorgan.
2LZ	Sp., C.W. & R/T	F. A. Mayer	Stilemans, Wickford, Essex.
2MA	Sp.	P. S. Savage	14-16, Norwich Rd., Lowestoft.
2MB	C.W. & R/T	E. H. Jeynes	67, St. Paul's Rd., Gloucester.
2MD	Sp., C.W. & R/T	C. Chipperfield	Victoria Rd., Oulton Broad, Lowestoft.
2MF	C.W. & R/T	Marconi Scientific Instrument Co.	21-25, St. Anne's St., DeanSt., London, W.1.
2MG	C.W. & R/T	C. E. Miller	Arndene, Bearsden, nr. Glasgow.
2MH	R/T	A. Lawton	Brown Edge Vicarage, Stoke-on-Trent.
2MI	Sp., C.W. & R/T	L. McMichael	Stag Works, Kilburn, N.W.
2MK	—	A. W. Hambling	23, Winchester Ave., Brondesbury, N.W.6.
2ML	Sp., C.W & R/T	R. C. Clinker	Bilton, Rugby.
2MM	Sp., T.T., C.W. & R/T	C. C. A. Hines	Watley Twyford, Winchester.
2MO	Sp., C.W. & R/T	Burndept Ltd Exp. Stn.	Chiswick.
2MR	Sp., C.W. & R/T	R. H. Reece	The Corner House. 62, Addison Gdns., London, W.14.
2MS	Sp., C.W. & R/T	Ditto	"Basketts," Birchington, Kent.
2MT	Sp., C.W. & R/T	Marconi Scientific Inst. Co.	Writtle, nr. Chelmsford.
2MV	—	R. Wallis	Denk de Lion, Westgate-on-Sea.
2MY	C.W. & Sp.	H. M. Hodgson	Clifton House, Hartford, Cheshire.
2MZ	Sp., C.W. & R/T	J. Mayall	St. Paul's Rd., Gloucester.
2NA	C.W. & R/T	H. Frost	Longwood, Barr Cmn., Walsall.

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"POPULAR WIRELESS" DIRECTORY OF AMATEUR STATIONS—*Continued.*

Call Sign.	System.	Name.	Address.
2NB	—	J. W. Barnaby ..	Broad Rd., Sale, Cheshire.
2NC	—	J. Goodwin	Crown St., Duffield, Derby.
2ND	—	E. H. Pickford ..	6, Wilson Rd., Sheffield.
2NH	C.W. & R/T ..	A. R. C. Sherwood	41, Queen's Gate Gdns., London, S.W.
2NI	—	P. H. Lyne	Dartford & Dist. W/T Assn., London.
2NL	—	F. G. Hughes ..	129, Well Rd., Bath.
2NM	C.W. & R/T ..	G. Macuse	Queen's Pk., Caterham, Surrey.
2NN	—	Brig.-Gen. Palmer	Epping.
2NO	C.W., T.T. & R/T	H. R. Adams ..	Crescent Cabinet Works, Walsall.
2NP	C.W. & R/T ..	H. S. Treadwell ..	Middleton Cheney, Banbury.
2NQ	—	Norton	Woodside Rd., Kingston.
2NR	—	J. Knowles Hassall	Wooden Box, nr. Burton-on-Trent.
2NS	C.W. & R/T ..	M. Burchill	30, Leighton Road, Southville, Bristol.
2NY	C.W., T.T. & R/T	J. N. C. Bradshaw	Bilsboro, nr. Preston.
2NZ	C.W., T.T. & R/T	Ditto	Ditto
2OA	—	F. Townsend ..	46, Grove Lane, Ipswich.
2OD	C.W. & R/T ..	E. J. Simmonds ..	Meadowlea, Queensway, Gerrard's Cross
2OF	Sp., C.W. & R/T	H. C. Trent	Secondary School, Lowestoft.
2OG	C.W. & R/T ..	A. Cooper	16, Wentworth Rd., York.
2OI	C.W., T.T. & R/T	Colin Bain	Newcastle-on-Tyne.
2OM	C.W. & R/T ..	H. S. Walker ..	Park Bridge, Brentford, Middlesex.
2ON	Sp., C.W. & R/T	Major H. C. Parker	56, Shern Hall St., Walthamstow, E.17.
2OP	Sp., T.T., C.W. & R/T	G. Courtenay Price	8, Landsdown Terr., Cheltenham.
2OT	—	Ilford Radio Soc.	Ilford.
2OX	—	J. R. Ratcliffe ..	Elmden Wate, Green Road, Birmingham.
2OY	C.W. & R/T ..	Capt. E. J. Hobbs	4th Tank Battalion, Wareham.
2PA	Sp., C.W. & R/T	C. Z. Auckland & Son	395, St. John St., London, E. C.1.
2PB	C.W. & R/T ..	D. E. O. Nicholson	41, Up. Kennington Park Rd., Lambeth, S.E.11.
2PC	—	A. G. Davies.. ..	Redcote Park Rd., Timperley, Cheshire.
2PF	Sp.	F. Foulger	118, Pepys Rd., S.E.14.
2PG	—	B. Hisketh	High St., Chalvey, Slough.
2PI	Sp., C.W. & R/T (Portable)	—	Loughborough College, Leicester.
2PJ	Sp., C.W. & R/T	—	Do.
2PR	C.W. & R/T ..	A. E. Whitehead ..	King's Ride, Camberley, Surrey.
2PS	C.W. & R/T ..	J. H. Gill	18, Fourth Av., Sherwood Rise, Notts.
2PU	Sp., C.W. & R/T	C. R. W Chapman	44, Chaplin Rd., Wembley.
2PX	C.W. & R/T ..	H. H. Lassman ..	4, Avenue Rd., Barking Rd., E. Ham.
2PY	C.W., T.T. & R/T	H. Carter Bowles..	51, Gunerstone Rd., W. Kensington.
2PZ	—	A. Symonds	Addison Av., Holland Park.
2QD	—	Ayers	West Barnes Crossing, near Raynes Park.
2QH	C.W., T.T.&R/T	A. Hewins	42, St. Angushire Ave., Grimsby.
2QI	—	—	Balham.
2QJ	C.W. & R/T ..	H. R. Walton ..	70, Moorfield Rd., Pendleton, Manchester.
2QK	C.W. & R/T ..	J. Bever	85, Emm Lane, Bradford.
2QL	C.W. & R/T ..	R. J. Hibberd	Graywood School, Haslemere, Surrey.
2QN	Sp., C.W. & R/T	A. Hobday	Northdown Rd., Margate.
2QO	R/T	P. Pritchard ..	Broad St., Hereford.
2QP	C.W., R/T & Sp.	L. C. Grant	3, Langhorn St., Newcastle-on-Tyne.
2QQ	—	Burnham & Co. ..	Experimental, Wembley.
2QS	Sp., C.W. & R/T	S. Ward	339, Brixton Rd., London, S.W.9.
2QT	—	C. C. Barnett ..	Lower Farm, Nether Compton, Sherborne.
2QU	—	—	Blackheath.
2QV	R/T	Altrincham W/T Soc.	Plane Tree Rd., Hale, Cheshire.
2QY	—	—	London, N.W.6.
2RB	Sp., C.W. & R/T	H. B. Grylls	Carew Rd., Eastbourne.
2RD	C.W. & R/T ..	G. W. Fairall ..	27, Newbridge St., Wolverhampton.
2RC	—	E. W. Scammell ..	147, Solihall Rd., Sparkhill, Birm'ham
2RH	Sp.	H. A. Pound.. ..	101, High St., Broadstairs.
2RK	Sp.	A. E Blackall ..	7, Maple Rd., Surbiton.
2RM	C.W. & R/T ..	D. Cross	3, Norman Rd.,Heaton. Moor, nr. Stockport.
2RP	C.W. & R/T ..	F. W. Emerson ..	178, Heaton Moor Rd., Heaton Moor, nr. Stockport.
2RV	—	A. L. Rawlings ..	162, Burnt Ash Hill, Lee, S.E.
2RY	—	S. Hanley	Forbury, Kintbury, Berks.
2RZ	Sp., T.T., C.W. & R/T	Mr. Wood	50, Parker Rd., Winton, Bournemouth.
2SD	(Portable)	J. Mayall	Burfield, St. Paul's Rd., Gloucester.
2SF	C.W., T/T & R/T,	C. Midworth ..	4c, Vicarage Mansions, West Green, N.15.
2SH	C.W., T.T. & R/T,	F. L. Hogg	37, Bishops Rd., London, N.6.
2SI	Sp., C.W., T.T. & R/T	L. C Holton.. ..	112, Conway Rd., London, N.14.
2SK	—	K. G. Styles ..	52, Jerningham Rd., S.E.14.
2SL	—	A. G. Styles	"Kitscot," Maidstone, Kent.
2SP	C.W. & R/T ..	L. Mansfield ..	Ley Hey Park, Marple, Cheshire.
2ST	—	L. Lambert	46, Clarendon Rd., Holland Park.
2SX	C.W. & R/T ..	F. B. Baggs	24, Westhorpe St., London, S.W.15.
2SZ	Sp., C.W. & R/T	W. H. Brown ..	Mill Hill School, London, N.W.7.
2TA	C.W. & R/T ..	H. Andrews	8, North Grove, Highgate.
2TG	C.W. & R/T ..	Sheffield University	St. George's Sq., Sheffield.
2TH	C.W. (Portable)	Ditto	Ditto.
2TI	C.W. & R/T ..	H. Bevan Swift ..	49, Kingsmead Rd. Tulse Hill, S.W.
2TL	Sp., C.W. & R/T	E. V. R. Martin ..	128, Dairy House Rd., Derby.
2TN	C.W. & R/T ..	C. E. Stuart	Polesworth, Tamworth.
2TO	C.W. & R/T ..	F. Townsend ..	46, Grove Lane, Ipswich.
2TP	—	—	Putney, S.W.
2TV	—	E. W. Wood ..	68, Colwyn Rd., Northants.
2TW	(Portable) ..	Ditto	Ditto.
2TX	—	A. R. C. Johnston	Twyford Ave., Ealing.
2TZ	C.W. & R/T ..	E. Jones	Newholm, Hempshall Lane, Offerton, nr. Stockport.
2UA	C.W. & R/T ..	J. P. B. Barnes ..	38, Avenue Rd., Highgate.
2UG	C.W. & R/T ..	W. Humphreys Burton	103, Portland Rd., Nottingham.
2UJ	C.W. R/T & T.T.	L. R. Richards ..	25, Cholmeley Park, Highgate, N.6.

"POPULAR WIRELESS" DIRECTORY OF AMATEUR STATIONS—*Continued.*

Call Sign.	System.	Name.	Address.
2 U M	Sp., C.W. & R/T	H. Lloyd	3, Ventnor Place, Sheffield.
2 U S	C.W. & R/T ..	W. Soc. of Highgate	11, South Grove, Highgate.
2 U V	T.T., C.W. & R/T	W. Corsham	104, Harlesden Gdns., London, N.W.10.
2 U X	—	A. T. Headley ..	255, Galton Rd., Bearwood, Birmingham.
2 U Y	C.W. & R/T ..	W. Fenn	Holly Cottage, Polesworth, Tamworth.
2 V B	—	—	Shooter's Hill.
2 V C	—	A. S. Gosling ..	63, North Rd., W. Bridgeford, Notts.
2 V D	C.N. & R/T ..	Capt. E. L. Crowe	Juniper Rough, Hardrew, nr. Canterbury.
2 V F	C.W. & R/T ..	H. A. Blackwell ..	Whyte House, Bispham, Blackpool.
2 V I	—	Curtis	Tower Hall Lane, Walsall.
2 V M	C.W. & R/T ..	J. Lipowsky ..	614, Old Ford Rd., Bow, E.
2 V N	C.W. & R/T ..	H. Orury-Lavin ..	Old House, Sonning, Berks.
2 V P	—	P. G. A. H. Voigt..	121, Honor Park, S.E. 23.
2 V Q	C.W. & R/T ..	H. Old	St. Judas Ave., Maperley, Nottingham.
2 V S	—	—	Beulah Hill, W. Norwood.
2 V T	—	—	Ditto.
2 V W	C.W. & R/T ..	E. H. Robinson ..	125c, Adelaide Rd., N.W.3.
2 W B	Sp., T.T. & C.W.	George W. Jones ..	8, Rosebery St., Wolverhampton.
2 W D	C.W. & R/T ..	C. W. Clarabut ..	Beechcroft, Beverley Crescent, Bedford.
2 W M	Sp., C.W. & R/T	J. W. Pallett ..	24, Glenfield Rd., Leicester.
2 W N	—	A. H. Wilson ..	67, Broad St., Hanley, Stoke-on-Trent.
2 W Q	C.W. & R/T ..	C. H. Gardener ..	Denmark Hill, London.
2 W R	—	L. Burcham	Cheshunt Ave., Oulton Broad, Lowestoft.
2 X B	Sp., T.T. C.W. & R/T	A. T. Crancher ..	35, Douglas Rd., Highbury.
2 X D	C.W. & R/T ..	H. R. Gladwell ..	London Rd., Abidge, Essex.
2 X F	Sp., C.W. & R/T	E T. Chapman ..	Abbotsford, Supartarie Road, Poole.
2 X J	—	Sheffield Dist. W/T Society	—
2 X K		Ditto..	—
2 X R	—	—	Poplar.
2 X Z	C.W. & R/T ..	Lewis T. Dixon ..	4, Heythorp St., Southfields, S.W.18.
2 Y G	—	Wireless Equipt.Co. Ltd.	Charing Cross Rd., W.
2 Y H	—	Duveen	Marble Arch, W.1.
2 Y J	R/T	Wireless Equipt. Ltd.	90, Charing Cross Rd., London.
2 Y Q	—	W. P. Wilson ..	Christ Church Vicarage S. Norwood.
2 Y R	—	W. Pike..	Hounslow W. Soc., Council H., Hounslow
2 Y V	—	G. M. Whitehouse	Allport House, Cannock, Staffs.
2 Z C	—	General Radio Co.	Acton Lane, Harlesden, N.W.10.
2 Z D	—	A. Woodcock ..	1, Montague Rd., Handsworth, Bir'm.
2 Z K	C.W. & R/T ..	W. L. Turner ..	Purley Caldy, nr. Birkenhead.
2 Z Z	—	Fellows MagnetoCo.	Cricklewood.
5 A J	—	W. C. Barradough	61, Bridge St., Manchester.
5 A T	C W. & R/T ..	The Dubilier Condenser Co., Ltd.	Shepherd's Bush, London, W.
5 A Z	Sp., C.W. & R/T	F. Charnley	43, Reeds Avenue, Blackpool
5 B A	R/T	Capt. Stevens ..	Newcastle.
5 B H	Sp., C.W. & R/T	A. V. Simpson ..	28, Westgate, Burnley.
5 B L	—	Mrs. Vick	Gresham Rd., Hall Green, Birmingham.
5 B V	R/T	Ryan	66, Home Park Rd., Wimbledon Park, S.W.
5 C P	—	Fellows MagnetoCo.	Ealing.
B X H	—	Capt. C. H. Bailey	Cricklewell, Abergavenny.
K C LX	Sp.	Prof. Wilson ..	University of London, King's Col., London.

NOTE.—The above space is left for readers to fill in with details of other stations as they come to hand. Amateurs work chiefly on 180 metres nowadays, though some may be heard on 400 metres.