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AN INTERVIEW WITH DAME NELLIE MELBA.

POPULAR WIRELESS

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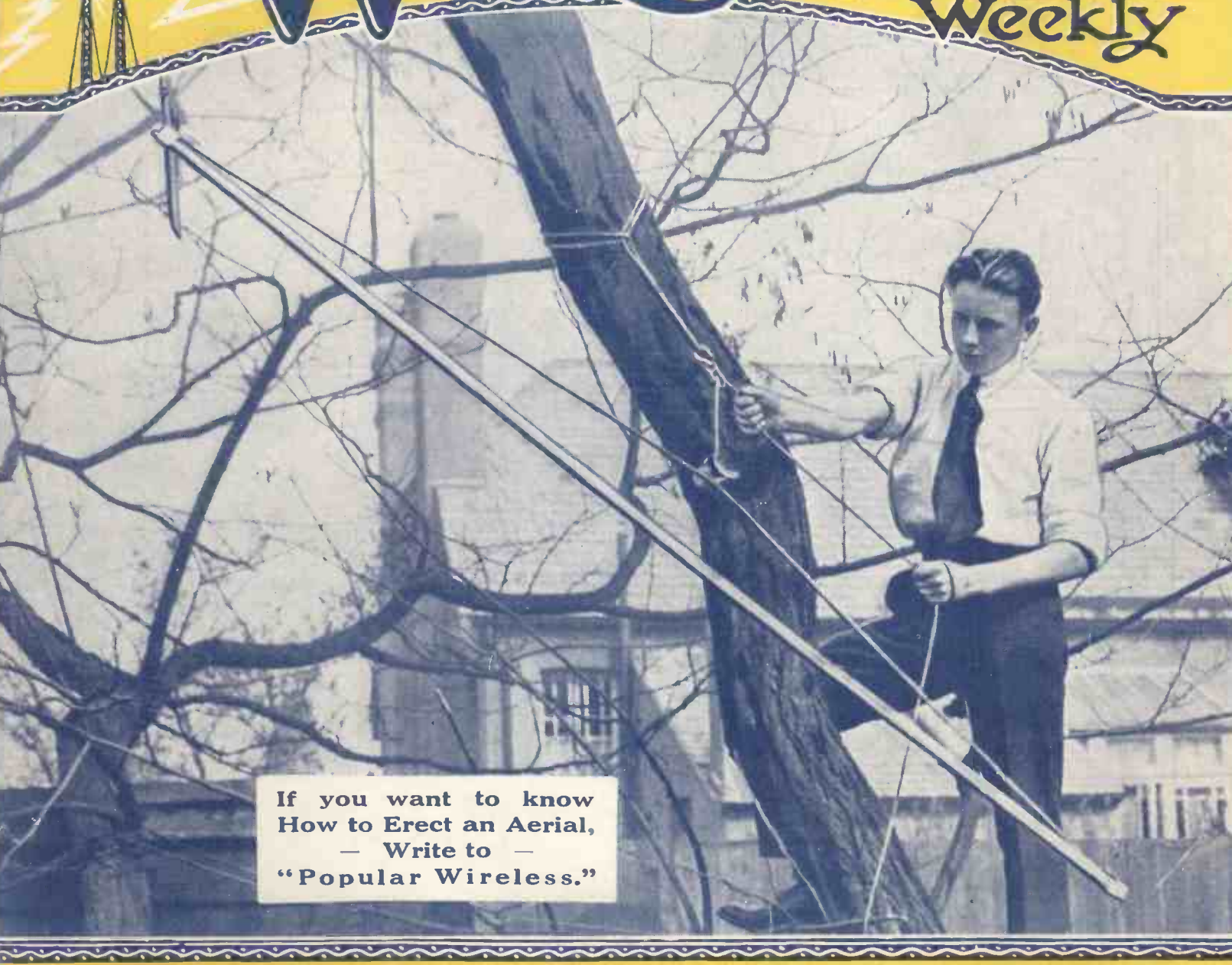


If you want to know
How to Erect an Aerial,
— Write to —
"Popular Wireless."

FEATURES IN THIS ISSUE.

NEXT WEEK.

MAKING HONEYCOMB AND BASKET COILS.

AN EMERGENCY RECEIVER.

USEFUL ADAPTATIONS FOR YOUR SET.

And Another Four-Page BEGINNERS' SUPPLEMENT.

Popular Wireless

TOPICAL NEWS AND NOTES.

NEXT WEEK.

WHAT I THINK OF BROADCASTING.
By Sir Landon Ronald.

THE PERFECT RADIO VOICE.
By a Physician.

THE VIBRATION.
By John Hill.

The Melba Fund.

I MENTIONED the other week that a Melba Fund had been started by grateful listeners-in. Contributions should be sent c.o. The British Broadcasting Co., Magnet House, Kingsway, London.

In an interview (printed on another page) Dame Nellie Melba deals with the recent success attained in broadcasting her voice from Covent Garden to listeners-in all over the country.

* * *

Bergen to U.S.A.

AS a result of the installation of a new valve set the wireless station at Bergen has repeatedly been in communication with American stations, whose signals have been distinctly heard.

Dame Nellie Melba.

The Bergen station has also been equally successful in transmitting replies, the American stations reporting that the signals were very distinct.

* * *

Radio in the Tube.

WIRELESS messages have done more than cross 3,000 miles of ocean. They have penetrated through rock and river to the depths of a New York subway.

Recently night engineers of the Interborough Rapid Transit Company, with a receiving set only 18 in. long and 7 in. wide and a loop aerial 4 ft. high, captured part of a concert being given in New York while their train was travelling at 40 miles an hour under the bottom of the East River. A few minutes later they caught part of the programme of the Kansas City broadcasting station 1,300 miles away. All the time there were going on around them the roar and din that make New York's subways one of the most terrible wonders of the world.

During most of the time the engineers heard with perfect clearness, though there was considerable interference by induction from passing trains and the motors in the train on which they were travelling.—From "The Times."

* * *

The Glasgow Station.

ACCEPTANCE of the offer made by the British Broadcasting Company (Limited) to erect a transmitting station at Port Dundas Electricity Power Station has been recommended to the Corporation of Glasgow by the Electricity Committee of the Corporation. Should the proposal be agreed to it is, I understand, the intention of the company to locate the plant for the production of the wireless waves in the sub-station at Port Dundas, and to erect the transmitting aerial between two of the tall chimney stalks of the station The company are prospecting for premises to serve as a studio or concert-room in a central part of the city. These premises will be linked up with the transmitting station, from which music and other matter will be broadcasted for the benefit of owners of receiving sets in and around Glasgow.

It is expected that arrangements will be made to broadcast the performances of the British National Opera Company on the occasion of their visit to the Coliseum, Glasgow, in March. This service would be arranged on lines similar to the broadcasting of the operas from Covent Garden, London, but the large number of amateurs who use the short-range receiving sets will, of course, share in the service when the operas are being transmitted from the local station.

* * *

Temporary Glasgow Station.

A TEMPORARY wireless broadcasting station was erected in Glasgow in connection with the recent motor exhibition held in that city. Under the call letters 2 B P, and on a wave-length of 410 metres, preliminary tests were carried out at six o'clock each night, followed by a concert at 7 p.m. throughout the exhibition week.

* * *

"The Diddlers."

EVERY advance in science appears to be accompanied by an advance in crime, and wireless does not prove to be an exception. It may not be realised by some that the "licence dodger" is liable to a £100 fine or even 12 months' hard labour, and that the authorities are elaborating a scheme for tracking them down. In itself, it may be thought that "licence dodging" is not a very serious thing, and anyway, "it's only diddling the authorities," but the serious aspect of unlicensed wireless and unregistered stations looms up very blackly in times of political and industrial stress, as was proved in the Great War and, later on, in Ireland.

* * *

His Unseen Friends.

SOME idea of the enormous number of listeners-in can be obtained from the fact that the operator at Eiffel Tower recently received the overwhelming number of 56,000 postcards in response to an appeal for criticisms. If he had had any previous doubts as to whether there were more than a hundred or so people listening to him broadcasting his weather reports, the dozen or so mail bags that arrived must have caused him to perform some mental arithmetic in noughts.

* * *

Tracked by Wireless.

THE Blackpool and Fylde Wireless Society have started a campaign to clear the ether of reaction fiends. The society intends giving full scope to several of its members who propose doing aerial detective work to track offenders and educate them. A repetition of the offence might, it is said, involve the withdrawal of the amateur experimental licence.

* * *

G. K. C. by Wireless.

MR. G. K. CHESTERTON, whose speech at the dinner of the London Burns gathering was broadcast recently from Prince's Restaurant via Marconi House, "came through" very clearly on my loud speaker, especially the chuckling of the gentleman who sat next to Mr. Chesterton while he was speaking!

* * *

Satire.

MR. CHESTERTON, who is, of course, a leading literary light of exceptional witty brilliance, regards wireless telephony from a real Chestertonian angle.

"It is strange," he said, "that science should have produced an instrument that can speak all over the world when the world has nothing to say. The gift would have been a priceless boon at different epochs of the world's history, but at the present time there is nothing of importance to broadcast!"

Waiting for Uncle Jeff's evening story.

NOTES AND NEWS.

(Continued from previous page.)

The King's Set.

I HEAR that a wireless set is to be installed in Buckingham Palace. Before long we shall probably be hearing a speech transmitted by the King from his own private broadcasting studio. The possibilities of this form of addressing vast crowds almost takes one's breath away.

* * *

Radio Receptions.

A LARGE reception was held last Friday at Australia House, to hear the B.B.C. concert of Australian "stars." The Prince of Wales was present, and listened-in with enjoyment.

* * *

Plans for Birmingham.

THE British Broadcasting Company has appointed Mr. Percy Edgar director of the Birmingham Broadcasting Station, a capacity in which he has acted during the experimental and formative period.

A suggested skeleton programme for the future is likely to include a "demonstration hour" (says the "Birmingham Post") for the benefit of shops dealing in wireless equipment, when prospective buyers and inquirers will be able to hear the sets offered for sale in actual use. At the moment, the only time when sellers of wireless gear can demonstrate the equipment is after 6.30 p.m., by which time closing hour is at hand. The demonstration will be followed by a children's hour from 5 to 6 p.m., when fairy stories, tales, and suitable music will be sent out. Women will be catered for between 6 and 6.30 p.m. in a "women's corner." The rest of the evening will probably be divided as follows:

6.30 to 7 p.m.—A talk on art, literature, and miscellaneous subjects.

7 to 7.15.—First news bulletin and announcements in connection with the station.

8 to 9 p.m.—Concert.

9 to 9.30 p.m.—A talk on subjects of general interest.

9.30 to 9.45.—Last news bulletin, etc.

9.45 to 10.30.—Concert.

The talks to be arranged will, it is hoped, include short addresses by politicians on such questions as the League of Nations. Other plans include a series of short addresses on Sunday nights by a clergyman with a gift for straight speaking, not necessarily on religious topics, but on subjects suitable for Sunday transmission. The talks will occupy only eight to ten minutes.

A photographer's impression of Mr. George Robey, the famous comedian, broadcasting one of his inimitable "turns" at Marconi House.

* * *

Radio Society of Great Britain.

THE annual conference of delegates from societies affiliated to the Radio Society of Great Britain was held at the Institution of Electrical Engineers recently, when Dr. W. H. Eccles, the newly elected president, delivered his presidential address. The annual dinner was held afterwards at the Waldorf Hotel. Dr. Eccles announced that the committee had decided to make an award annually of a Radio Society medal to any British subject who, in the opinion of the president and vice-presidents, performed the greatest service to radio science during the year. The retiring president, Admiral of the Fleet Sir Henry Jackson, presented a silver clock, on behalf of the society, to Mr. and Mrs. Philip Coursey, in recognition of the valuable work voluntarily done by them in connection with the recent successful tests in Transatlantic wireless telegraphy carried out by members of the society from Wandsworth, when, during ten successive nights, more than two thousand receptions of Transatlantic messages were recorded.

ARIEL.

The floral tribute presented to Dame Nellie Melba by appreciative "listeners-in."

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	2 L O	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	5 N O	400	As a rule from 7 to 10 p.m.
Manchester Broadcasting Station	2 Z Y	385	Every evening, usually from 6 to 10 p.m.
Birmingham (Witton) Broadcasting Station	5 I T	425	Every evening, usually from 6.30 to 10 p.m. (News, Concerts, etc.).
Cardiff Broadcasting Station	5 W A	395	Service commencing shortly.
Croydon	G E D	900	Throughout day to aeroplanes.
Writtle, Essex	2 M T	400	Tuesdays. 8 p.m. (Concert).
Paris	F L	2,600	11.15 a.m. Weather report; 6.20-7 p.m. Weather report and Concert; 10.10 Weather report.
Königswusterhausen	L P	2,800	Between 6 and 7 a.m., between 11 and 12.30, and between 4 and 5.30 p.m.
The Hague	P C G G	1,085	Sundays, 3 to 5 p.m. (Concert.)
Haren	O P V H	900	Practically every 20 minutes past each hour from 11.20 to 4.20, giving messages to aeroplane 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. No Broadcasting during hours of public worship on Sundays.

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.

THE ROMANCE OF UNSOLVED WIRELESS PROBLEMS.

By P. J. RISDON, F.R.S.A.

A well-known and popular contributor to this journal deals with some of the fascinating wireless problems that have yet to be solved.

TO some it might appear invidious to suggest that wireless has a more romantic side than any other branch of science. Yet, from one point of view, that scarcely seems to be an exaggeration. By this I do not mean merely the fact that music and messages can be borne on the wings of ether waves, so that one may listen in to broadcast concerts, and tune a receiving set so as to pick them up, at will, from different places hundreds of miles apart. Wonderful as it is, that is but a practical (and sometimes quite an unromantic !) result of pioneer work in wireless. For, who can doubt that scientists and wireless experts are as yet but on the fringe of the subject ?

A Dream of Ages.

Only a few days ago clear speech was received from New York on a six-foot frame aerial !

The romance of it all lies rather in the reflection of what has been revealed and achieved, and of impending and awe-inspiring discoveries, which the writer, for one, has no doubt whatever we are on the verge of now—discoveries which may throw light upon the secret of life itself. And even although some of them may not be the result of wireless investigation alone, they will be largely the result of achievement in the sphere of wireless endeavour. Indeed, as time goes on, one realises more and more how inseparable the (so-called) different branches of science really are, and how interdependent research workers in different fields have become.

Not to begin too far back, let us start with the thermionic valve. In this we have, surely, one of the most exquisite instruments ever devised by man. By means of it, electrons are forced to detach themselves from a tungsten wire, which may be no more than 1-2,000th of an inch in diameter, and to constitute, in what is virtually a vacuum, a path for an electric current.

When we consider that an atom—once supposed to be the minutest conceivable fraction of matter—is a coarse mass compared with an electron, and that electrons and magnetons are believed by many to constitute the ultimate source of all matter and even of energy, and that the thermionic valve constitutes a means of disintegrating matter into such an elementary condition, it is clear that we are faced with an actual scientific achievement somewhat analogous to the release of atomic energy. Moreover, it lands us in a field of research in which the dream of the old alchemists may be realised —the transmutation, for example, of base metals into gold, although that is but one of a multitude of possibilities.

Thus it may be said that the thermionic valve, developed for a special function in wireless, has already carried us into a new sphere of research, in which we stand, as yet, dazed—scarce able to grasp the vast possibilities opened up.

The story of the gradual development of wireless telegraphy, of the perfecting of instruments and appliances until at last there is no great practical difficulty in girding the earth in $\frac{1}{7}$th of a second, is too well known to need exposition here. The development of wireless telephony—speech and music—awaits but sufficient improvement in mechanical detail to attain the same range.

The first shock of excitement over, men turned their attention to further developments.

The objection was raised that the universal radiation of waves rendered it extremely difficult, if not impossible, for messages to be despatched which could not be picked up by any receiver on the line of march of the waves. It was found that, like those of light, electro-magnetic waves can be reflected and concentrated, and commercial services are now carried on by waves that travel in invisible beams, and can be directed at will from a transmitting to any receiving station, other stations being avoided, so that messages are only picked up by the one they are intended for.

A still further improvement is stated to have been recently invented by M. Belin, by means of which secret transmission can be effected, so that it will be absolutely impossible to tap messages sent by his apparatus.

Power and Pictures.

Although the printing, on board ship, of news received by wireless is not new, on the very day I began this article an important announcement was made in the "Daily Mail" to the effect that on no fewer than nine great ships in the Transatlantic service of the Cunard Company a full "Atlantic" edition of the "Daily Mail" will be printed daily—relying solely upon wireless for the reception of news.

Wireless can now be received by means of underground "aerials," by submerged submarines, and in mines in the bowels of the earth, for the ether permeates all liquid and solid, as well as gaseous, matter, and waves propagated in it will pass through solids as well as through the atmosphere. Again, the possibility of controlling any mechanism by wireless from a distant point has been proved beyond all question.

Touching on another aspect of the subject, there are some who believe that power will be transmitted by wireless—power sufficient to drive engines, for instance. Although the writer is not one of them, he is not, like others, prepared to deny the possibility of this; for if the mysterious ether, of which we talk so much and know so little, possesses the amazing properties—including almost incredible density—attributed to it by scientists, it may be capable of serving economically as a wave power medium, in somewhat the same manner that water was discovered by M. Constantinesco to be capable of transmitting power waves economically through pipes.

Herr Plauson, a German, has made extensive experiments for utilising atmospheric differences of potential, and his apparatus includes a device for converting such electrical energy into useful work by first converting it into ether waves.

Accustomed though we have become to the idea of wireless telegraphy and telephony, there remains other fascinating applications of wireless, at which inventors have been at work for half a generation. On one of these is the transmission of pictures. Hitherto no satisfactory method has been evolved, but in December last was announced the invention of a new and successful method of transmitting photographs by wireless.

Let us consider what this means. A newspaper correspondent at present despatches his communications from, say, Egypt, by wire or wireless, and it appears in the next morning's issue of our daily newspaper. But any photographs he may have taken have to be despatched by aeroplane or other means of conveyance, so that it may be days or weeks before they can be reproduced. But with an efficient wireless picture-transmitting apparatus, photographs of, say, treasures from the Luxor tomb, taken to-day, would appear in to-morrow morning's paper with the descriptive account.

Riddle of Life.

Everything we see—colour and form—is entirely the result of light waves reflected from it; it is but part of a continuous picture formed by Nature's cinematograph.

The day will surely come when, by means of cinematograph machines, almost continuous pictures will be taken, and transmitted by wireless, so that one will enter a cinema theatre, take a seat—not knowing what may appear on the screen—and witness soul-stirring events in distant parts of the world within a few seconds of their occurrence. Again, it will no doubt come to pass that we shall be able to converse with a person by wireless and see him at the same time.

It is quite impossible, in such an article as this, to ignore the spectrum, for it is the unknown portions of the spectrum that represent missing links between electro-magnetic waves and light and other vibrations, and it is possible in these unknown portions that we must seek for the elucidation of things that are at present mysteries—for the solution possibly of the riddle of life and death.

Another of the more fascinating and romantic possibilities of wireless—because of the essentially human element—lies in its application to telepathy. That there is some natural wave force at work, as between individuals, there can be no doubt whatever, whether we consider its result in thought reading, or in the phenomenon experienced by many persons from time to time, when, quite involuntarily, thoughts or impressions are conveyed to one another, though separated by thousands of miles.

Will it ever be possible so to apply wireless to thought waves as to cast them upon the ocean of ether—in much the same way that a message is flung into space—to be received again and reconverted into the sensation of thought.

Great as are the difficulties to be overcome to effect this, the problem is a fascinating one indeed; think of sitting in an armchair and, without a written or spoken word, communing in thought with another person at will—thousands of miles away !

What a prospect for fond hearts severed by distance but beating in unison !

SINGING TO THOUSANDS.

By DAME NELLIE MELBA, in an Interview with Ariel.

The thousands of "listeners-in" who heard Dame Nellie Melba singing at Covent Garden last week, will be interested in her opinions as to the possibilities of broadcasting. In this special interview granted to a representative of POPULAR WIRELESS—Dame Nellie Melba shows herself keenly interested in the art of broadcasting and the future that lies before it.

WHEN I called to keep my appointment with Dame Nellie Melba, who had kindly granted me an interview for POPULAR WIRELESS, I found the great singer resting after a rehearsal at Covent Garden. But I gained an immediate impression that she was intensely interested in broadcasting, and although, as most people know, she sang by wireless for "The Daily Mail" some time ago, I could see that the enormous interest in the success achieved by the broadcasting of "La Bohème" had impressed her deeply.

Melba—one speaks of this great artiste as one would speak of Caruso, Pachmann and Patti, without the superfluity of a prefix—Melba, when I asked her what she thought of the invention which enabled thousands of people all over the country to hear her voice, replied swiftly and almost excitedly.

"Extraordinary."

"It is the most marvellous invention of the age," she declared. "It is almost like magic; yet I suppose when one has studied the science of wireless everything connected with it seems quite ordinary and easily understood?"

"In a way," I replied, "one's enthusiasm is a little moderated when the mysteries are mysteries no longer—but it is certainly an instance where familiarity does *not* breed contempt."

Melba nodded.

"Is it true," she asked, "that my voice was heard as far away as Copenhagen?"

"And farther," I replied. "Reports have reached the editor of POPULAR WIRELESS, that your voice was heard from hundreds of places in Europe."

"It is so extraordinary how it carries so far," said Melba, with a puzzled little laugh. "I myself have had letters from people in all parts of England and Scotland, and a wire from Paris congratulating me, and saying that my voice was clearly heard. I feel so delighted to think that such a great multitude of people should have been able to listen to me when singing at Covent Garden, and that they heard not only my voice, but the *actual* words as clear as people sitting in the front row of the stalls."

"A Great Help."

I mentioned the fact that the microphones at Covent Garden were even closer to her than the people in the front row of the stalls, and that when she made her speech after the end of Act III. of "La Bohème" the other evening, I had heard every word, clearly and distinctly all over my drawing-room, from the loud speaker, as if she had been next to me.

Melba made a little gesture—a gesture that spoke in a language of its own—her wonder at the achievements of wireless. It was so eloquent that I knew how sincerely the knowledge of her broadcasting success had affected her. It is not given to many artistes to gladden the hearts of thousands of people at one operatic performance.

"And what effect do you think this broadcasting will have on musical art?" I asked.

"I am sure it will be of great help," Melba replied quickly. "If good music is given, it will help tremendously towards the education of large numbers of people with regard to good music. They will have opportunities of learning all that is best; they will be able to enjoy the finest operas. It cannot fail to do good, and to stimulate an even greater interest in the work of those splendid artistes in the British National Opera Co. The future of broadcasting is indeed a big one, and the responsibility vast."

CRYSTAL SET IMPROVEMENTS.

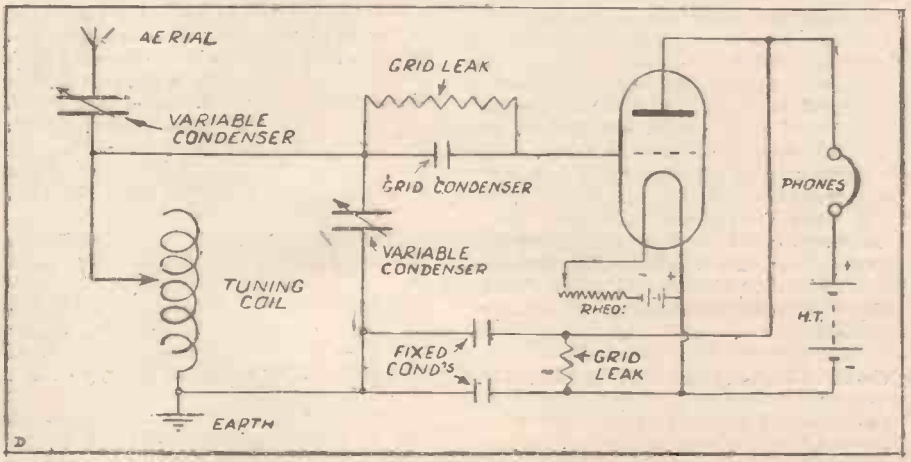
IN cases where a variable condenser is not provided with a simple crystal type of receiver, the addition of such will prove very useful. It will allow of finer tuning, and that in itself may tend to increase the strength of the signals received, and even the range of reception, because, generally speaking, telephony requires far sharper tuning than is necessary for spark reception; ·0003 mfds. would be a suitable value, and it can be connected right across the aerial and earth terminals.

The set may not be provided with a telephone condenser. Examine the telephone terminals and see if there is a wire running from each to a small flat immovable piece of apparatus. If there is no telephone condenser there will be but a single connection to each of the 'phone terminals. A telephone condenser does not affect either the wave-length range or the range of reception of a set, but improves the tone of the signals considerably. A small fixed condenser of about ·001 mfds. capacity of any type will answer the purpose, and the value is not at all critical.

Then comes the question of crystals. Some of the detectors supplied with B.B.C. sets are provided with good crystals, and some are not. No user of a crystal set is ever satisfied, or very rarely, that he is using the most suitable mineral for the purpose. If he is close to a broadcasting station, and signals are strong, he can afford to sacrifice sensitivity for stability. Curiously enough, it is rarely that both these useful points are possessed by one particular crystal. One of the most stable of crystals is the fused silicon when used in contact with a fine copper wire.

If the intending listener-in is situated somewhere towards the limit of a crystal set range for the reception of telephony—say about 15 or more miles from a broadcasting station—then he must be prepared to handle the more sensitive and less stable varieties if he desires to obtain results. Galena, with a fine German silver wire contact, is one of the most sensitive crystal detectors, but requires constant re-adjustment. In this case a buzzer for testing purposes is very useful. Refer to the short article on this subject in the first supplement.

Do not purchase a loose coupler type of crystal receiver unless it is possessed of both what is known as a change-over switch, and a testing buzzer embodied in its circuit—that is, unless you have had previous experience in tuning-in. Loose couplers are very efficient and useful, but generally necessitate about five different adjustments, all of which are liable to vary with each other, apart from that of the crystal.



This circuit, reproduced from the "Radio Digest Illustrated," presents some interesting possibilities in regenerative reception. The tuning unit comprises a single slide inductance coil with a .0005 mfd. variable condenser in the aerial circuit. A .0002 mfd. variable condenser is placed in parallel with the coil in order to allow very fine wave-length tuning.

The two fixed condensers have each a capacity of .005 mfd. while the grid leaks have a resistance of 2 megohms in the case of that placed across the fixed condensers and 1 megohm in the case of that placed across the grid condenser. The capacity of this latter is .00025 mfd. The valve should be fairly soft, and take about 30 volts on the plate.

Tuning is accomplished by means of the variable inductance and the parallel condenser, the series condenser having a fairly midway reading, together with a careful filament adjustment.

WIRELESS TELEPHONY FROM NEW YORK.

The success of the recent Transatlantic Telephony Tests marks another milestone in the progress of radio communication. The following article describes the reception of the American messages at the works of the Western Electric Co. at Southgate.

By ONE WHO WAS THERE.

IN the early morning hours of January 15th, for the first time in history, a human voice spoke by pre-arrangement in America, and was clearly heard in England.

At 2 a.m., by Greenwich mean time, a party of about fifty men sat with telephone receivers at their ears in a room at the New Southgate (Middlesex) works of the Western Electric Company. They heard first a voice, with an American accent, speaking steadily a series of American place names—"Buffalo, Philadelphia, Baltimore, Washington. . . ." Then, clear and strong: "This is Mr. Thayer, of the American Telephone and Telegraph Company, speaking from 195, Broadway, New York City, through the Rocky Point Station of the Radio Corporation of America."

The speaker went on to describe experiments in long-distance radio telephony made by the company in 1915, and wound up his opening address by saying:

"Beyond a small group listening for this message in England, I do not know whose ears this message may reach. To all who hear it, I wish health and prosperity. Will you who are now hearing it inform me that you have heard it, and tell me how clearly it came to you?"

At 3.57 a.m. the listening party, having laid aside the headphones, heard the same voice, even more clearly than the first time, through a loud speaker, replying to a message which had been telegraphed to Mr. Thayer from the works by British Press representatives, twelve minutes before. Mr. Thayer had been asked his opinion on the possibility of the Ku Klux Klan movement becoming popular in Europe.

It was these two happenings which most vividly impressed the minds and stirred the imagination of all who were privileged to attend the demonstration, of which they marked the beginning and the end.

Wonderful New Method.

The tests were carried out by the American Telephone and Telegraph Company and the Radio Corporation of America, in co-operation, with the object of determining the feasibility of commercial transatlantic radio telephony.

They were the outcome, explained Mr. F. Gill, European chief engineer of the Western Electric Company, who presided over the novel early morning meeting, of a great amount of research and steady development. The tests, of which that demonstration was a part, would probably extend over several months to come. Special transmitting apparatus had been installed at Rocky Point, Long Island, and connected with New York, roughly 70 miles distant, by telephone wires. The speakers were at 195, Broadway, New York. They were Mr. H. B. Thayer, president, and Gen. J. J. Carty, Mr. A. H. W. S. Giffard, and Mr. Blackwell, vice-presidents, of the American Telephone and Telegraph Company.

It was stated that the power used at Rocky Point was "several hundred" kilowatts, and the wave-length approximately 5,350 metres. High-power vacuum tubes were used. Their use, it was pointed out, had the great advantage that the production of high-frequency waves, suitably modulated for radio telephony, could be done more easily than with other standard apparatus. The transmitting station also employed the technical device of sending out only that component of the modulated wave which was essential for intelligible telephony. With the usual method of transmission not only this essential component, but one which contains no element of signalling at all, is radiated. The effect of the new method is that the same intelligibility was secured with an expenditure of only one-

The frame aerial and set used for the reception of the New York telephony.

fourth or one-fifth of the power previously required at the sending station.

The telephone transmitter used in the tests was able to supply 200 kilowatts to the antenna, which would be equivalent to at least 600 kilowatts in a system (if such existed) transmitting the complete modulated wave. Another advantage was that the range of frequencies occupied by the transmission was less than one half of that required by the ordinary methods.

The Transatlantic speeches were received on an eight-valve set, the aerial being an indoor frame six feet square, installed in a temporary hut near the new factory building of the Western Electric Company at New Southgate.

By arrangement with the Western Union Telegraph Company a line of the Transatlantic cable was specially kept open for the sending of confirmatory telegrams from New York, and of return messages from New Southgate. So exact was the organisation of this service that at 2.8 a.m., Greenwich time, a telegram came in to the works reporting that Mr. Thayer had finished his first speech at 2.6 a.m., Greenwich time. Two minutes was the average time occupied in the transmission of the shorter messages from either side.

There were long periods during which the speakers were heard better than are some orators in a great hall. Their remarks ranged from historical facts about their company, and its share in the development of radio telephony in America, and acknowledgments of the work of those responsible for the research which had led to that wonderful demonstration, to details about the weather in New York, American Press extracts, and after-dinner stories.

Through a Snowstorm.

At the beginning there was an appreciable amount of electrical disturbance, which prevented some who were not experienced listeners from hearing perfectly. The "old hands" at listening-in, however, were never in any doubt, as the copious notes of some of them showed. Gradually the audition improved until, even with the loud speaker, it was more distinct than on the average trunk telephone line, and never a word was missed by anyone. Perhaps Mr. Thayer's delivery was the best, for he was always heard without difficulty.

He reported once that it was raining in New York while he spoke, and that there had been a snowstorm during the day (Sunday). He had driven to the office through a heavy fall of snow.

Later, after various congratulatory messages had been telegraphed from New Southgate, by various members of the assembled company, including Senator Marconi, Major T. F. Purves, engineer-in-chief of the General Post Office, and Mr. O. B. Harriman, First Secretary of the American Embassy, Mr. Thayer remarked:

"Had I known that so many distinguished gentlemen in England were sitting up till two and three o'clock in the morning to hear me, I should not have spoken so seriously about my little experience in driving through a snowstorm. I apologise, particularly to Major Purves."

The gathering included Sir Evelyn Murray (secretary to the G.P.O.); Capt. Miles, R.N., representing the First Sea Lord; Capt. Blandy, representing the Air Ministry; Sir Arthur Shirley Benn, M.P. (president of the Associated Chambers of Commerce); Mr. Godfrey Isaacs; Mr. S. J. Goddard, vice-president of the Western Union Telegraph Company; Dr. H. W. Nichols (the radio transmission expert from America, largely responsible for the success of the demonstration); and several distinguished British engineers.

CARDIFF BROADCASTING STATION.

The following details are to hand concerning the broadcasting station at Cardiff. The station is now practically completed, and will be in operation very shortly.

BY OUR SPECIAL REPRESENTATIVE IN CARDIFF.

VERY shortly the new signal, 5 W A, will be radiated from Cardiff Broadcasting Station on a wave-length of 395 metres. Doubtless the event will produce in listeners-in to the first call a feeling of excitement such as astronomers must experience when a new star swims within their view.

The city has a prominent place in the history of wireless. Cardiffians should be proud of those facts which give their district a claim to provide a home for one of the first stations. Mr. Arthur Mee, of that great Welsh journal the "Western Mail," reminds us in a note of the intimate association of Wales, and particularly of Cardiff, with the development of telegraphy and telephony.

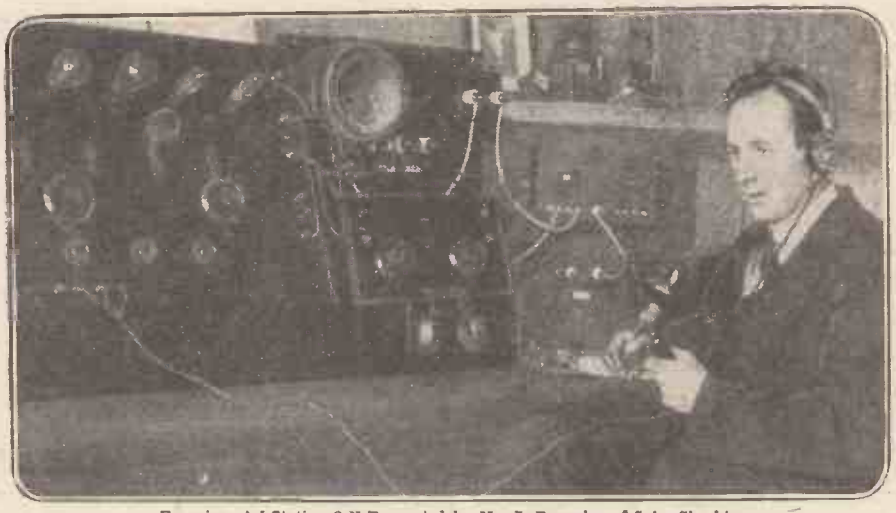
Reception in the Valleys.

The first trunk telephone line in the kingdom was laid between Cardiff and Newport, Mon., in 1881. Sir William Preece, a Welshman, carried out his classic experiments in wireless telegraphy between Lavernock and the Flat Holm; the latter an island just outside the famous coal port. Wireless telephonic communication between the "Western Mail" Offices and Newport, Mon., in 1912, was the first time in history for such a feat to be performed. Nor must it be forgotten that Hughes was a Welshman.

It is interesting in quite another way that close to the gates of the Cardiff Broadcasting Station are several streets named after noted engineers, such as Telford, the "Colossus of Rhodes," and George Stephenson, the inventor of the locomotive. These were pioneers in the age of steam, still holding its own in the volume of message carrying, yet slowly giving way to an era of electricity, in the course of which the hand-written word will tend to be used less and less. Instead of the steel road and snorting monster, we are going to communicate with each other by means of an invisible track and a noiseless instrument carried on the person—future Postmasters-General permitting.

One problem receiving attention at the moment is that of interference with reception. Intending listeners-in to the Cardiff Broadcasting Station may be somewhat daunted by the suggestion made that difficulties are likely to spring up in Glamorganshire owing to the volume of minerals in the county, and its mountainous contour.

The experience of the owner of a receiving set operated in a valley right in the coalfield may serve to allay uncomfortable feelings on this head. Reception from Birmingham is entirely satisfactory; that from Manchester, although not so clear, is not accompanied by much interference. In the opinion of the writer, who knows well the conditions under which the Welsh receiver referred to is working, the slight trouble may well arise in Manchester itself, where electrical power is employed on a considerable scale.



Experimental Station 2 N B, erected by Mr. J. Barnaby, of Sale, Cheshire.

There must be much electrical disturbance in Birmingham also, so it may be questioned as to how much the earth conditions between the points of transmission and reception may be responsible for the elimination, en route, of interference. It would not be surprising if Newport, Mon., listeners-in find interference arising from Cardiff, since from the Broadcasting Station and in the direction of Newport lie three miles of cable, underground and overhead, stretching to the Roath power station.

Bristol should have strong and clear reception from Cardiff.

The apparatus installed at the Cardiff station is identical with that used at Newcastle. The power is obtained from the Canton Power Station. This station was recently the principal generating station for Cardiff, but is now a "sub" to the Roath station. It is used for transforming the current generated at Roath. The aerial is attached to a 150-ft. chimney stack, similarly to the aerial at Newcastle.

RADIO COMMUNICATION ON LAND AND SEA.

By G. H. D.

IT is a well-known fact that wireless communication is much better over the sea than over land. This was first proved conclusively during the South African War, when attempts were made to establish wireless communication between various sections of the British army scattered over the veldt. The apparatus—which consisted of a coil transmitter and a coherer receiver—had, as it happened, been tested between a ship at sea and a shore station and had proved efficient up to a distance of 60 miles; but when tried on the dry veldt this range was reduced to less than half that distance.

Effect of Rain.

Later it was discovered in the case of land, communication was much better after heavy rains when the soil was well saturated—in fact the moister the ground the better the communication. For a long time these variations in wireless communication over the wet and dry portions of the earth completely puzzled scientists, but at length after much research it has been finally traced to the different effects of land and sea on wireless waves.

It has long been proved that non-conductors of the ordinary electric current permit freely of the passage of wireless waves. Now the crust of the earth is composed for the most part of materials such as carbonate of lime, quartz, silica, mica and marble—all of which in their pure state are non conductors of the ordinary electric current and therefore permit of the passage of wireless waves.

Consequently wireless waves travelling over dry ground will penetrate into the earth to a considerable extent provided the ground is dry enough. It follows, therefore, that a large amount of energy is lost owing to this penetration or absorption and the wave is greatly weakened.

Question of Wave-length.

What will happen, however, if a shower of rain falls on the ground? Once the rain has fallen a layer of conducting matter in the form of moisture is spread over the surface of the ground, for moisture is a fairly good conductor of electricity. Contrary to non conductors, conductors oppose the passage of wireless waves, so that comparatively speaking only a small portion of the wireless waves penetrate below the surface of moist soil, so there is not much loss of energy and the wave will travel farther with unimpaired strength.

With regard to wireless communication over the sea, this medium also being a fairly good conductor of electricity—much better than moist earth—it prevents any appreciable penetration of the waves, and therefore there is very little loss of energy by wireless waves travelling over the sea as compared with waves which travel over dry land.

It has been calculated by experts that waves of 300 metres penetrate into dry land to a depth of three or four hundred metres, whereas the penetration of waves of the same wave-length into the sea only reaches from about two to three metres.

SIMPLY MADE H.F. TRANSFORMERS.

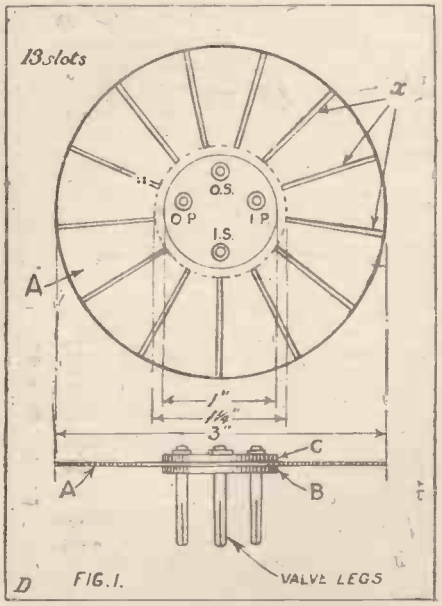
By H. EDLIN.

GENERALLY speaking, H.F. amplification is little used by amateurs, L.F. amplification being more adopted owing to the simple way in which it can be operated for all wave-lengths. It is, of course, known that H.F. amplification is practically useless for very short distances and where the transmitter is powerful, whereas this method of amplification is ideal for "bringing in" long-distance stations.

For example, the person with several stages of H.F. amplification is much more likely to receive the American amateurs in the Transatlantic tests than the person using L.F. circuits. It is the object of this short article, therefore, to give the amateur some practical data and suggestions for making H.F. transformers, which are the chief appliances needed, other than the valve itself, for building an H.F. amplifier.

Arranging the Windings.

The former, on which the actual primary and secondary coils are wound, is very simple to construct, as will be seen from Fig. 1. A is a disc of fairly thick cardboard, which must be quite dry and preferably dipped in melted paraffin wax before winding is commenced. It is 3 in. in diameter, with another circle described concentrically with the circumference, 1¼ in. in diameter.



This should be easily understood by referring to the same diagram.

Thirteen equally spaced slots are then cut in the disc, as at X, from the circumference down to the smaller circle. They should be about ⅛ in. wide. Two discs of ⅛ in. ebonite, C and B, are then cut out 1 in. in diameter, and are placed above and below the cardboard and in the centre of it.

Holes are drilled at O.S., I.S., O.P., I.P., through both pieces of ebonite and the cardboard, so that four valve legs (which can be obtained at most wireless dealers) can easily pass through.

Each leg is then secured to the whole by screwing up the nuts on the top. The four valve legs should be fixed so that the complete former can be easily inserted into an ordinary valve holder or socket.

The next operation is winding the former, and this should be done very carefully. The wire used should be 40 or 42 S.W.G. silk covered. The winding is begun by soldering the end of the wire to valve leg I.P. and then winding in one slot, *out* the next slot, and so on in the same way as an ordinary basket coil, the piece of cardboard between two adjacent slots being the same as a peg in a basket coil former.

The winding should be continued until the required number of primary turns are completed. It should be noted that the number of turns counted from *one* side of the former is only *half* the number of actual turns because there is an equal number of turns on the other side of the former. The end of this primary winding is soldered on valve leg O.P. Several turns of silk are then wound on the former before the secondary winding is commenced.

To wind the secondary coil the end of the wire is soldered on the leg I.S., and the winding is proceeded with until the required number of secondary turns are in place, the end of the wire being soldered on the leg O.S. Both windings should be in the same direction, that is, both anti-clockwise, or both clockwise.

Number of Turns Required.

In the table, Fig. 2, the number of turns are given for approximate wave-lengths. These wave-lengths are obtained by using a variable condenser of ·0002 mfd. capacity in parallel with the primary of the transformer, although a smaller capacity condenser could be used with consequent reduction of wave-length. Similar transformers for higher wave-lengths can be constructed by experimenting with a greater number of turns, always keeping about 15 or 20 more turns in the secondary than in the primary.

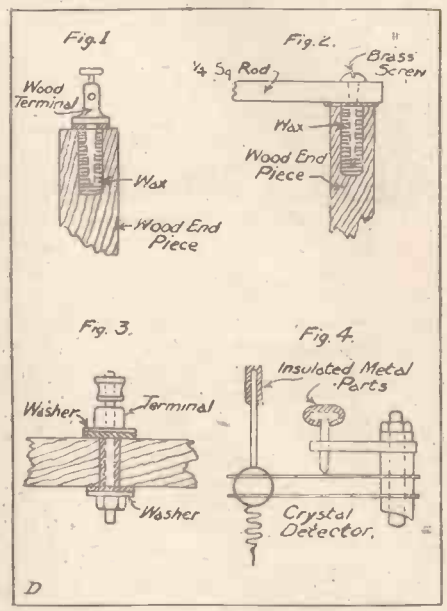
	1	2	3
Approx. Wave-length	200-350	300-450	400-600
Primary Turns	40	50	70
Secondary Turns ..	55	65	85

Fig. 2

INSULATION EFFICIENCY.

THE following method has been found very satisfactory in attaining high insulation efficiency at very low cost. Installations may be constructed extensively in wood and give results equal to those in which ebonite has been employed.

In the ordinary case where wood is employed it must be heated in an oven to dry out moisture, and then shellacked to prevent the moisture's re-entry. In the case under discussion the wood need not be so treated,



but one coat of shellac on it would be advantageous.

It is proposed to fix a wood terminal vertically on one end of a single layer inductance. Drill a quarter-inch hole in the desired position slightly deeper than the screw part on the terminal. Melt some sealing wax or a portion of an old gramophone record in a small tin. The tin should have a small lip so that wax will pour out easily.

When the wax is molten pour into the hole already drilled quite to the top. Insert terminal in the molten wax in the hole and hold in position. As the wax is just about to assume its final set a slight pressure on top of terminal should be given. It will be found that this makes a strong job, as the terminal cannot be removed easily unless the wax be re-heated (Fig. 1).

Knobs for Detectors.

Slider rods may be attached in like manner, always taking care that a slight thickness of wax separates the metal from the wood. Surplus wax that spreads out beyond the metal can be neatly trimmed off with a wood chisel (Fig. 2).

To fix ordinary type terminal the hole is drilled right through the wood and a washer larger than the hole is fixed on bottom end by a nut. Insert screw part of terminal in hole with washer at bottom side, pour in the molten wax and hold till set, then trim off (Fig. 3). Other uses may be found by the ingenious constructor.

For instance, the metal parts in a crystal detector (where adjustments are made) may have insulation sweated on to them by first coating the part required with shellac varnish and then applying molten wax—symmetry being attained by rapidly revolving, etc., whilst wax is cooling (Fig. 4).

To prevent adhesion of wax to metal, the metal should be oiled or greased; thus wax may be moulded.

"HOW FAR WILL IT SEND?"

By B. R. CUMMINGS, Radio Engineer General Electric Co.

An interesting article by an American Radio Engineer, dealing with some of the important factors affecting the range of a transmitting station. Amateurs who are interested in logging long-distance signals will learn much from this article.

ONE of the questions almost invariably asked by people who see or speak of a wireless transmitter is, "How far will it send?" This question is entirely justifiable, and the following brief review of the factors affecting the range of radio transmitters has been prepared in an effort to explain the hesitancy which is frequently shown by radio engineers in claiming any specific range for a wireless transmitter.

In the first place, a wireless transmitter will transmit several times as far at night as in daylight; it will transmit farther on a dark night than on a moonlight night. This is due to the fact that the sunlight and moonlight cause an ionization of the atmosphere which results in much greater losses than occur when such ionization is not present. The greatest ranges are obtained when the atmosphere between the transmitting and receiving stations is most nearly a perfect insulator.

Trouble with "Statics."

The range depends upon the nature of the territory lying between the transmitting and receiving station, the greatest ranges for a given power usually being obtained over water. Any metal, particularly iron or steel, lying between the stations will cause a loss of signal strength. Such metal may either be in the form of artificial structures such as buildings or building frameworks, or may be in the form of ore deposits. Some sections of the country are noted for their poor location for radio reception, and the cause of this can usually be traced to this reason.

In many places it is possible to receive effectively from all directions but one, and it is usually found that in this direction a metallic structure or a metal deposit is responsible for the lack of reception.

A wireless station which can be depended upon for reliable communication through the winter months for a given range, can only work effectively during the summer months over a fraction of this range, assuming that the power of the transmitter is not increased. This is not due to any diminution of signal strength, but to the percentage presence of so-called "static" disturbances during the summer months.

Static disturbances, which result in cracking, hissing, or grinding noises in the receiver headphones, frequently sufficient to make radio signals unintelligible, have been the subject of investigation and analysis for many years, during which time many attempts have been made to determine their origin and means for preventing their detrimental effect on radio reception. While some very special receiving equipments and antennæ system shave been devised to increase the ratio of signal strength to static strength (the so-called "signal-static ratio"), the most positive way of overcoming static seems to lie in transmitting sufficient power to make the radio signals intelligible even in the presence of static.

Points for Consideration.

This was the procedure followed for example at the Lafayette Station in Bordeau, France, which was built by the United States Navy Department during the war, for reliable communication in the event of the transatlantic cables being cut by the enemy. This station has a capacity of 1,200 kw, and was, when it was built, the largest wireless transmitting station in the world, and its capacity was made large primarily to insure trans atlantic communication during the summer months when static is most prevalent.

The range which is accomplished depends also, of course, upon the type of receiving equipment which is used, and upon the ability of the operator to use his equipment to best advantage. A receiver with one or more stages of amplification will receive stations which cannot be heard without such amplification, although there is a limit to the extent to which amplification can be used. It does not serve, for example, to overcome static disturbances, because such disturbances are amplified to the same extent as the radio signal itself, leaving the signal static ratio the same, and, therefore, not making the message any more intelligible.

The wave-length at which transmission is carried on is also an important factor in the range which can be realised with a given power. Energy radiated at short wave-lengths is absorbed to a much greater extent than energy at longer wave-lengths, and for this reason very long wave-lengths are usually used for a long distance, such as transoccanic communication.

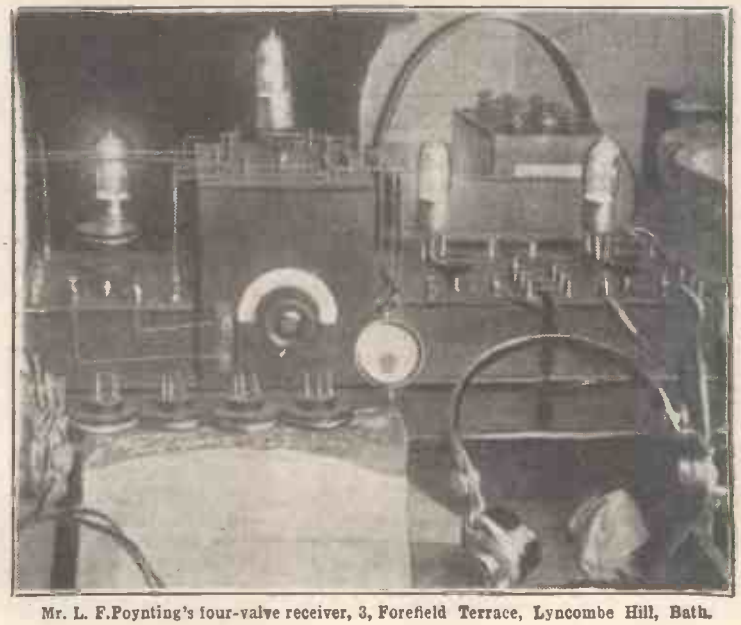
The personal equation of the receiving operator is of importance. Signals which are quite readable to some operators are absolutely unintelligible to others.

The number of stations which work in close proximity to each other also decrease ranges which would otherwise be obtainable, for many signals which have sufficient strength to be easily interpreted are unreadable by interference caused by other stations.

In general, therefore, in specifying the range of a wireless transmitter, it is necessary to specify whether transmission will be carried on in daytime or at night; in winter or summer seasons; the type of receiver, and the amount of amplification which will be used; the nature of the country lying between the transmitting and receiving stations; whether or not uninterrupted communication is required, or whether so-called "deferred service" is satisfactory; the wave-length upon which transmission will be carried on; the kind of transmission desired—that is, telephony, continuous wave telegraphy, or interrupted continuous wave telegraphy; the vicinity in which the transmitter will be located with respect to other transmitters; and lastly, but by no means of least importance, whether or not the range specified, even after the foregoing conditions are known, shall be a conservatiye one, or one which is the maximum which can be expected.

Some equipments will frequently transmit distances far greater than the rated range of the set. For example, a transmitter manufactured by the General Electric Company which is rated, under definite conditions, at 175 miles, has recently communicated by telephone over a distance of 4,050 miles. This performance was, of course, the result of an unusual combination of favourable conditions.

In view of the foregoing, anyone concerned in the range of radio stations should assure himself of the conditions under which the transmission has been or is to be carried on before arriving at any conclusions in regard thereto.

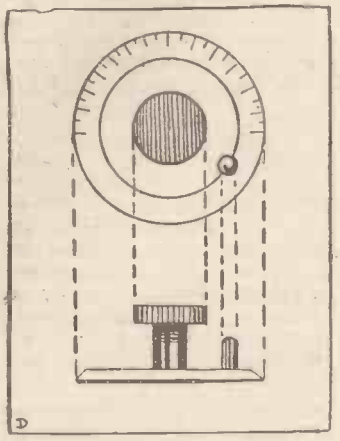


Mr. L. F. Poynting's four-valve receiver, 3, Forefield Terrace, Lyncombe Hill, Bath.

FOR FINE ADJUSTMENT

THE necessity for very fine adjustments on modern wireless receiving sets becomes more and more apparent every day, and, as a very slight alteration in the adjustment of a condenser may mean all the difference between the reception of excellent music, and the sound of hoarse mumblings, so may that little extra variation of the filament rheostat mean all the difference between a smoothly working valve and a catastrophe in the shape of a burnt-out bulb.

Bad adjustment cannot always be regarded as the fault of the operator, however, as in many instances, especially in the case



of new instruments, "tuning" knobs work stiffly, and being, as a rule, small in size, do not lend themselves to easy and rapid adjustments.

The illustration shows a method of obviating much of the difficulty experienced in this respect. Drill a small hole as near the edge of the dial as possible, that will take a ¼-in. screw. Then obtain a small knob, of the type used on the lighter pattern telegraph keys, and fit it into the hole.

It will be found that by the aid of the additional knob, a dial so treated becomes much easier to adjust, and correct "tuning" is comparatively easy of accomplishment.

REMOVING INSULATION.

MANY amateurs who make coils of the sliding contact variety experience difficulty in baring the turns in order that the slider may make proper contact with the wire of the coil. The following method is suggested as one way of overcoming the difficulty.

A thick cardboard cylinder of approximately the same diameter as the former of the coil is split along its length, and bound tightly over the entire coil, leaving a gap about ½ in. wide. A wooden block roughly ⅜ in. thick is then procured, and a sheet of emery-cloth firmly glued to one end. The insulation on the exposed part of the coil is then removed by means of the emery-cloth.

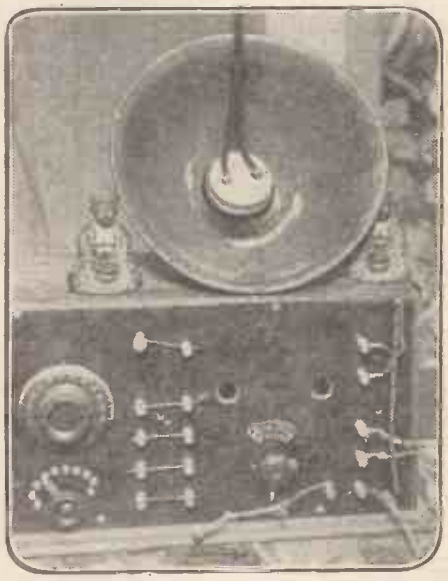
If the former is all wood, and provided there is sufficient space at each end of the coil, two thin wooden laths ½ in. apart might be screwed to the former in lieu of the cardboard tube, and would answer the same purpose.

AN IMPROVISED LOUD SPEAKER.

MANY attempts have been made to reproduce loud-speaker signals without distortion, and up to the present, although there has been considerable progress in that direction, none have been attended with complete success.

The accompanying photograph illustrates the very simple apparatus employed by an ingenious amateur in what is claimed to be a fairly successful attempt to solve the problem. A single telephone receiver earpiece is suspended in the centre of an ordinary metal saucepan lid. It will be seen that the sound emitted by the receiver is collected by this, and reflected back in the opposite direction.

It was intended merely as an improvisation but the results claimed would seem to prove that the idea possesses serious possibilities.



MAKING SMALL FLAT DRILLS.

AMATEURS constructing their own wireless sets are often in need of small drills, and they will find it quite simple to make their own "flat"-drills for a very trifling cost.

The best material to use is "silver steel" rod, which may be bought in any size from the local ironmonger or tool-factor at 1½d. or 2d. per ft. length. Steel knitting needles are excellent for the very small sizes.

The screws most used by wireless amateurs are ⅛ in., $\frac{5}{32}$ in. and $\frac{3}{16}$ in. Whit. or 2 B.A., 3 B.A., and 4 B.A., therefore the most useful sized drills to make would be "tapping" sizes and "clearance" sizes for the screws mentioned.

The following tables give the clearance and tapping sizes for drills:

B.A.

	Dia. of Screw.	Tapping Hole.
2 B.A.	·185 in. ($\frac{3}{16}$ in. bare)	$\frac{5}{32}$ in. (bare)
3 B.A.	·161 in. ($\frac{5}{32}$ in. full)	⅛ in. (full)
4 B.A.	·141 in. ($\frac{9}{64}$ in. full)	$\frac{9}{64}$ in. —

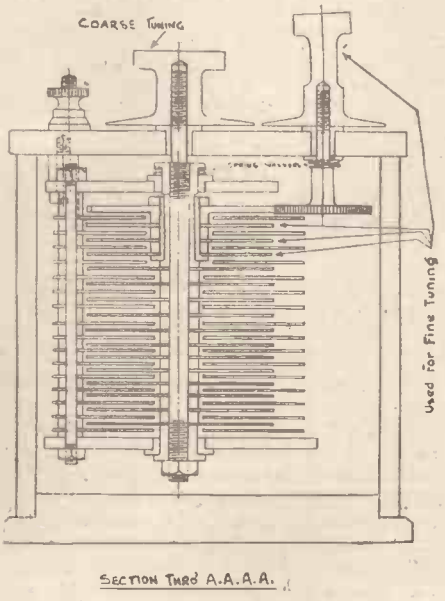
WHIT. (WHITWORTH).

Dia. of Screw (or Clearance size).	Tapping Hole.
⅛ in. Whit.	$\frac{5}{32}$ in.
$\frac{5}{32}$ in. ,,	⅛ in. (bare)
$\frac{3}{16}$ in. ,,	$\frac{5}{32}$ in. (bare)

Silver Steel.	Will Make Drills for—
⅛ in.	2 B.A., 3 B.A., and $\frac{3}{16}$ in. clearance
$\frac{9}{64}$ in.	4 B.A. and $\frac{5}{32}$ in. clearance. 2 B.A. and $\frac{3}{16}$ in. tapping.
$\frac{5}{32}$ in.	⅛ in. clearance. 3 B.A., 4 B.A., and $\frac{5}{32}$ in. tapping.
⅛ in.	⅛ in. tapping.

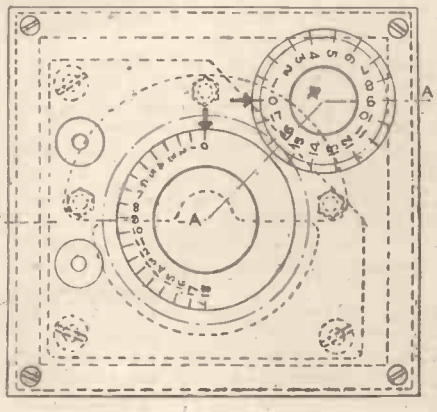
Referring to the first table, as an example, it will be seen that an ⅛ in. drill is needed for a 3 B.A. tapping hole, therefore a piece of $\frac{5}{32}$ in. silver steel will be required, as indicated in the last table.

A VERNIER CONDENSER EFFECT.



SECTION THRU A.A.A.A.

These two diagrams represent the top and section of a variable condenser of simple design, that is capable of very fine adjustments. The top three moving vanes are adjustable independently of the others by the rotation of a second knob, which is geared to a sleeved spindle.



HOW TO RE-WIND TELEPHONES.

By F. YELLAND.

This is a practical article for the amateur who wishes to tackle the task of re-winding his telephone receivers. As the author points out, care is essential when re-winding your 'phones.

THE re-winding of earpieces is, perhaps, of primary interest to users of crystal detectors, in which case a pair of 'phones must have a resistance somewhere in the vicinity of 4,000 ohms, low-resistance 'phones being useless working on a crystal, as there are insufficient ampere turns on the spools.

The instruction generally given to amateurs is "Don't meddle with your 'phones." This, taken generally, is excellent advice, especially when the 'phones are in good working order, as a deal of trouble can be caused by novices interfering with these delicately made instruments.

With this advice in their minds, it is not to be wondered at that amateurs are very wary in attempting to re-wind earpieces. But, with a little care, this is not such a dreadful job to tackle after all, and since there are at present a large number of ex-Government earpieces on the market at the very low price of about 3s. 6d. each, the re-winding process is a very remunerative one.

The Wire to Use.

One earpiece can be re-wound for the sum of 2s., the cost of a quarter ounce of No. 47 S.W.G. copper wire, silk covered. Some firms sell this wire in $\frac{1}{8}$ oz. reels, each reel being sufficient to re-wind one of the two bobbins of an ordinary watch pattern 'phone. The total resistance of the earpiece—two bobbins in series—will then be about 3,000 ohms. Thus for a complete double headset the resistance would be from six to seven thousand ohms.

After taking off the cap from the earpiece, it is an easy matter to remove the two bobbins of wire from the case, by slacking off four securing screws and removing the two connections from under the insulated terminals. Cut the short piece of wire connecting the two coils as near the centre as possible. The first layer on the bobbins is of comparatively large gauge, and can be unwound after cutting through one of the end turns with a sharp knife. This wire should be kept, as it will be useful for finishing off the coil after re-winding, as it is usual to have larger gauge wire at the ends of the coils, so as to ensure strong connections.

Preparing the Spools.

Underneath the larger gauge wire will be found a large number of turns of very fine wire. This should be carefully removed and wound on to a piece of wood or a bobbin, as it may come in handy for re-winding a faulty low-resistance 'phone at a later date. When all the fine wire has been removed, you will find it connected to a thicker gauge wire on the inside of the coils, this wire being used to connect the two bobbins in series.

This thick wire should be left on the spools after satisfying yourself that the insulation is perfect. You will find that the two iron spools are covered with insulating paper wherever the wire is likely to touch, and this should be left in place; or, if faulty, should be repaired by fixing on fresh thin paper with shellac.

Now that the spools are prepared for re-winding, it will be necessary to mount them in some way so that they can be rotated at a fair speed, as winding by hand with such a small gauge wire would be a very tedious job indeed.

Simple Winding Device.

The following method has been found to work well in practice, and it is, perhaps, better than a lathe for the amateur, for if anything happens, such as a slight tangle or a breakage of the wire, the process can be stopped immediately, whereas with a faster moving machine complications may ensue.

The material required is one piece of wood 9 in. by 2 in. by $\frac{1}{2}$ in. thick, one $\frac{3}{8}$-in. bolt and nuts $1\frac{1}{2}$ in. long, one piece of sheet brass $\frac{3}{4}$ in. by $1\frac{1}{4}$ in. by $\frac{1}{16}$ in. thick, and a short length of stiff copper wire of about 12 S.W.G.

Burn or drill a $\frac{3}{8}$-in. clear hole through the wood about $1\frac{1}{2}$ in. from the top. Drill two holes in the sheet brass large enough to let the spool securing screws pass through them, and having the same centres as the securing holes in the spool plate, and in such a position that the edge of the spool will reach within $\frac{3}{16}$ in. of the bottom of the brass sheet when mounted on it.

Solder the brass strip to the bolt head, so that the centre of the elliptical spool coincides with the centre of the bolt head. Pass the bolt through the wood and screw the nut in position just hand tight so that the bolt may turn in the hole.

Now place a thin lock nut on the bolt to prevent the first nut slacking back, or if one is not available, a touch of solder between the outside surface of the nut and the screw thread of the bolt will suffice to lock it. Make a saw-cut diametrically in the end of the bolt end, and solder the piece of wire into it.

If a hacksaw is not available, a file cut will suffice, or simply soldering the wire to the untouched end of the bolt will be sufficiently strong. This wire should now be bent, to form a handle. You are now ready to re-wind the spools.

Fix one spool in position, and leave about one inch of the thick gauge wire already on it protruding out over the flange. Bare the other end of the wire for about $\frac{1}{2}$ in. and wind about 1 in. of the 47 S.W.G. wire round it, scraping both with a knife to make joint clean, and just touch with a soldering iron, using just a little flux, which should be carefully wiped off after with an oil-covered wad.

Take a small piece of tissue paper, fold it, and place the joint between the large and small wires in the crease, and start winding on the wire by turning the handle, the wood being held in a vice, or between the knees when sitting down; one-eighth of an ounce should be wound on to each bobbin, the wire being kept in tension when winding.

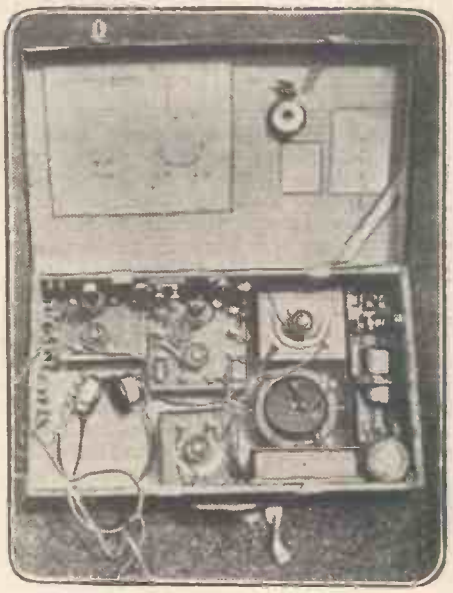
If you should accidentally break the wire at any point, simply twist the ends together, solder, and insulate with paper as before. When all the wire has been wound on the spool, solder it to the larger gauge wire that you took from the original winding, insulate the joint, and complete a layer of winding with this wire, fastening the last turn so that the winding cannot slack back. This end connection should be long enough to reach the terminal screw.

Repeat the process with the other spool, taking care that you wind it in the same direction as you have done the first coil. The connections coming from the inside of the two coils should then be twisted and soldered together, each connection being given a few turns to form a spiral so that the two coils can be pulled apart a little if necessary when mounting them inside the case of earpiece. The outside ends of the two coils should be taken to their respective terminals.

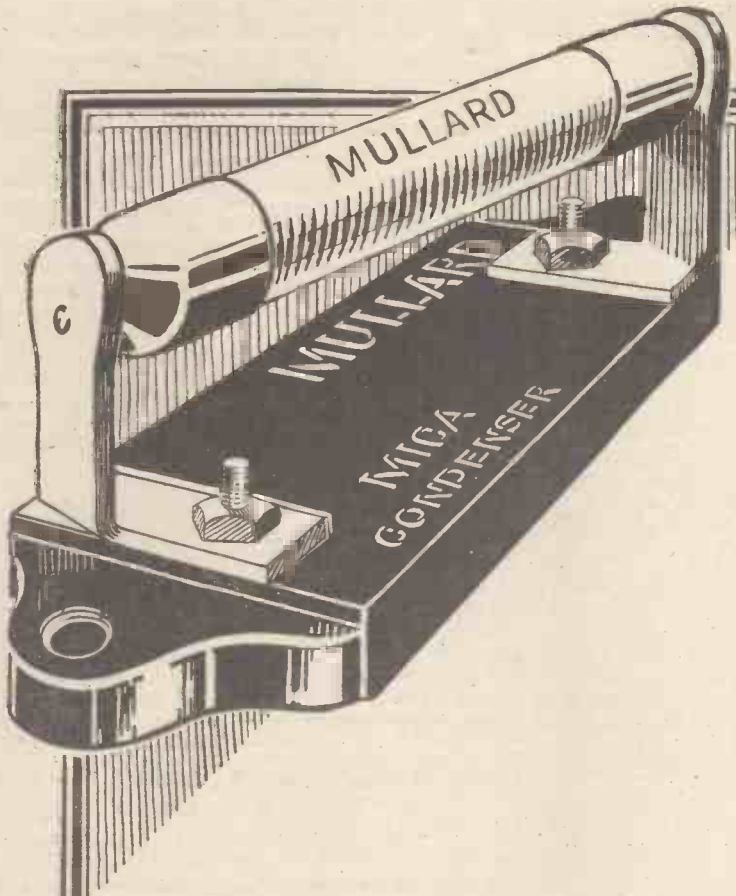
Little Patience Required

It is now only a matter of putting the earpiece together again, taking great care that the joint between the two coils is not touching anything metallic. Also, if you have had cause to remove your terminals from the case, make sure that your insulating bushes and washers have been replaced correctly.

The re-winding of an earpiece requires a little patience and careful handling, but it is quite within the scope of the amateur, and is well worth attempting if the opportunity occurs. The shape of the spool securing pieces may vary slightly in design with different makes, but it will not be difficult to adapt the arrangement described to any design.



A portable receiver in a suitcase, made by Mr. G. Smart, 73, Church Lane, Old Charlton, S.E.7.



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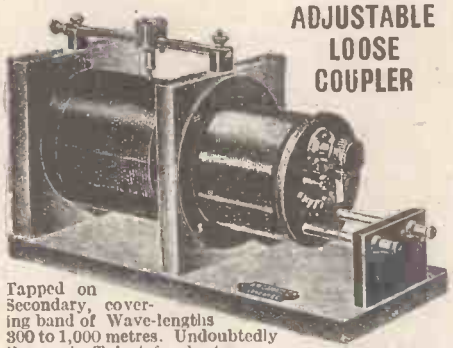

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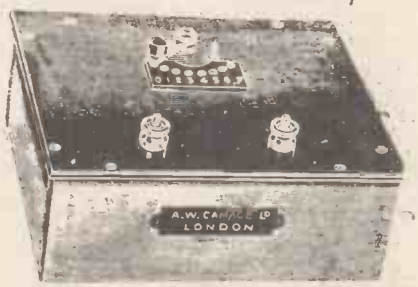

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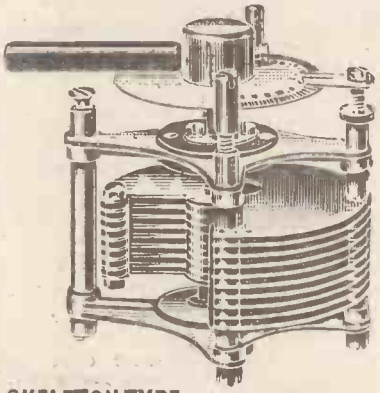

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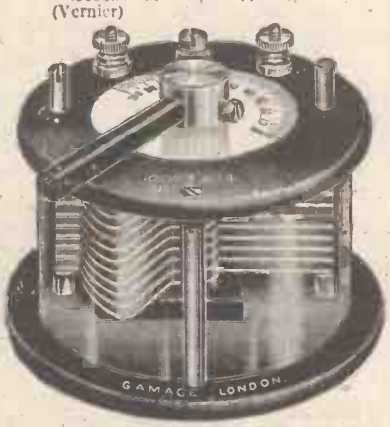
.00045	12 -	19 6
.0003	10 -	18 6
.00008 (Vernier)	5 6	8/-



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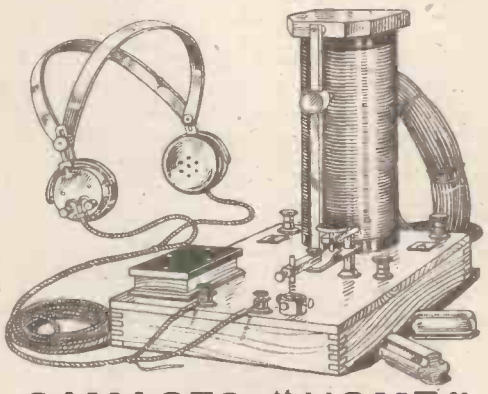
.0005	16,6	25/-
.00045	14,9	23,6
.0003	13/-	22/-
.00008	8,6	12 6



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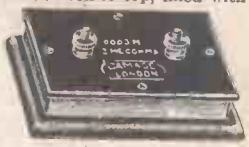

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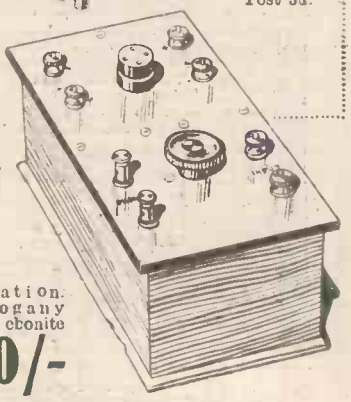

Designed to give the maximum efficiency in amplification. Polished mahogany cabinet with ebonite top. SALE PRICE **50/-**

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SIMPLE CRYSTAL DETECTORS.

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

IT is well known that certain minerals and crystals possess the peculiar property of rectifying electrical oscillations, and converting them into a pulsating direct current. Many articles have been written explaining the necessity for rectifying the electrical oscillations involved in connection with wireless telegraphy so that sounds may be produced in the telephone receivers.

In a "receiving" set fitted with a crystal detector, the adjustment of the latter is so important that very often an instrument is blamed for defects which are solely confined to the detector itself.

A Novel Holder.

The chief consideration in the design of a crystal detector is to provide a suitable means of obtaining a contact with any spot on the surface of the crystal employed. It is also desirable that the contact should be arranged in such a manner that its pressure on the crystal can be varied or adjusted as required.

In the construction of a crystal detector it is important to mount the crystal in a proper manner, as such a precaution enhances its sensitiveness. Again, too, "rough and ready" methods in connection with the adjustment of contacts do not tend to produce good results.

It will be observed that this detector is arranged to be supported by means of an ordinary flanged lamp-holder. Such a method will be found convenient for an amateur's crystal "receiving" set, as the crystal detector can be readily removed when necessary.

A Useful Formula.

When mounting crystals some careless experimenters use lead, or a metal having a high melting point instead of a fusible alloy. Such a procedure is likely to destroy the sensitiveness of a crystal, and make it unfit for long-distance work on account of the high temperature involved causing oxidation, coating the surface of the crystal and the interior of the crystal cup with a layer of non-conductive substance.

A fusible alloy, melting at about 200° F. or even lower, should be used. Such an alloy is usually composed of tin, lead, and bismuth, but the addition of a little cadmium serves to make the fusing point lower in each case.

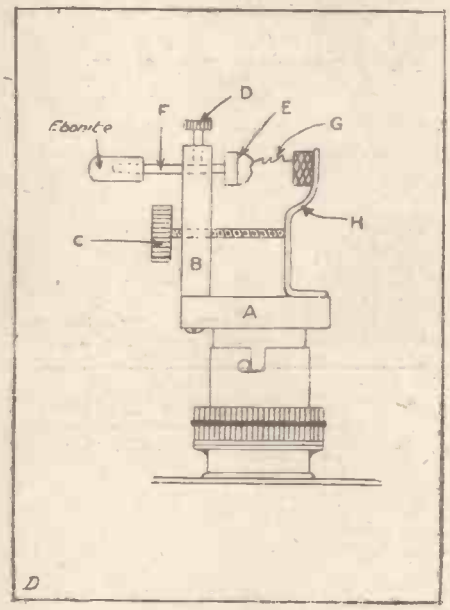
The alloys may be prepared from the following formulæ:

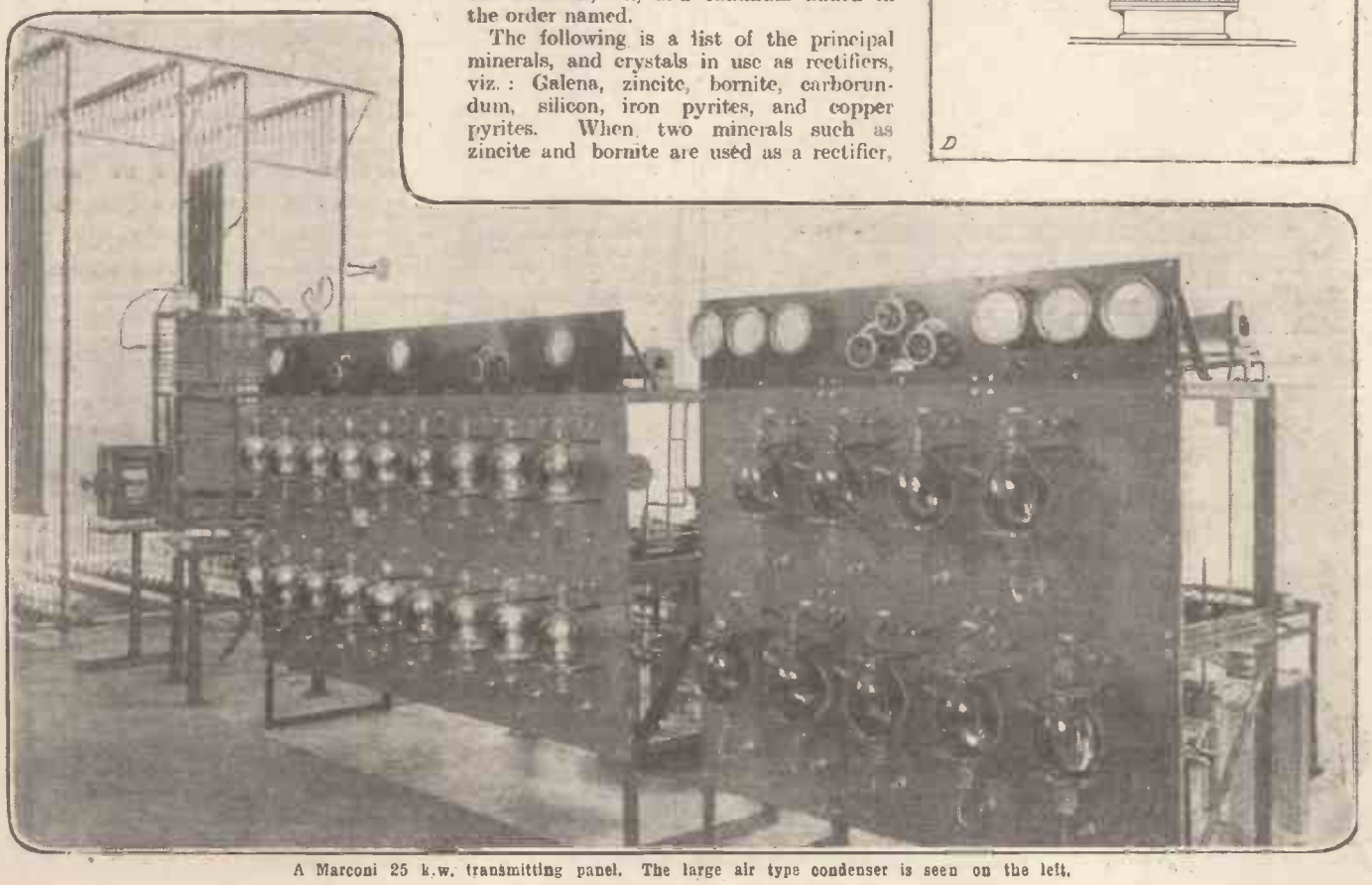
Bismuth.	Lead.	Tin.	Cadmium.	Fusing Point.
5	3	2	—	197° F.
5	3	2	1	167° F.
4	2	1	1	138° F.

The lead should be melted first, and then the bismuth, tin, and cadmium added in the order named.

The following is a list of the principal minerals, and crystals in use as rectifiers, viz.: Galena, zincite, bornite, carborundum, silicon, iron pyrites, and copper pyrites. When two minerals such as zincite and bornite are used as a rectifier, the zincite should present a rather flat surface, with the grain of the crystal parallel to the sides of the crystal cup, so that the top surface corresponds to the end of a stick of wood sawed at right angles to the grain.

From the foregoing remarks it will be apparent that the successful working of a crystal detector depends to a large extent upon its proper construction. There are, of course, numerous designs of crystal detectors, many of them quite ingenious. The one shown and described in this article will be found quite reliable.





A Marconi 25 k.w. transmitting panel. The large air type condenser is seen on the left.

POPULAR WIRELESS Beginners' Supplement

PART III—THE ETHER AND ETHER WAVES.

By MICHAEL EGAN.

ONE cannot be interested in wireless for long without hearing or reading something about the "mysterious ether." In many cases it is the first trap into which the unwary beginner falls, having been lured to his destruction by a variety of such fascinating terms as "the intangible ether," "the imponderable ether," "the all-pervading ether," etc.

Sooner or later his imagination is tickled by some such reference to this extraordinary "medium" which is supposed to carry wireless waves from place to place, and he wonders what on earth it can be. It is invisible, he is told; yet it exists everywhere. It cannot be touched, seen, heard, tasted, or smelt; yet it is absolutely essential to the transmission of wireless waves. Could anything be *more* mysterious?

Speculating in Circles.

He reads somewhere that it is "the thing inside a vacuum," and he immediately feels that he has got hold of a good clue at last. Take the air out of a glass bulb and—behold!—you have a glassful of ether left. At first he thinks that all his difficulties are solved by this enlightening discovery. Ether, he now concludes, is the thing which ignorant and dull-witted people had formerly called "nothing."

This satisfies him for a time, until he inadvertently realises that even if you put back the air into the bulb the ether will remain there all the same! In fact, if you cram the bulb full of air it will not displace the tiniest speck of ether. In other words, ether seems to exist independently of whether there is air there or not. Not only that, but ether must also exist wherever there are houses and trees, etc., because wireless waves are capable of penetrating these substances.

And so, by slow degrees, he comes back to the idea that ether exists everywhere—without being made any the wiser as to what ether *actually is*. So, lest the reader should be tempted to wander forth into similar realms of speculation, let me advise him or her at once that there is no need whatever to worry about the constitution of the ether in order to acquire a sound working knowledge of wireless.

Through Windows and Walls.

Scientists found that wireless waves are able to pass through anything, *i.e.*, not only through a vacuum (where there is no air or substance of any kind), but also through material bodies, such as tables and teapots, windows and walls, etc. In other words, wireless waves can pass through space; either empty space or occupied space. But, it may be asked here, why speak of *ether and ether waves* in that case; why not *space and space waves?*

This may be answered by saying that the word "space," as commonly used, stands for an abstract non-material notion—somewhat similar to "distance." It does not suggest any kind of *substance* or *stuff*, and it is difficult to conceive of a wave motion taking place *except* through some kind of substance or stuff. Sound waves, for instance, need air for their conveyance. If all the air were removed from a room it would be impossible to carry on a conversation, because air is the stuff through which sound waves travel.

It is also easy to send a wave along a string stretched across a room from wall to wall, or along the surface of a pond. By "plucking" the string, or by throwing a stone into the pond, a wave motion is set up in each case. Similarly, if I speak, or shout, or sing, various kinds of wave motion are set up in the surrounding atmosphere.

It will be noticed that in the above instances the *string*, the *water*, and the *air* are the mediums through which the waves act. They are the three kinds of substance, or stuff, through which the wave motion takes place. Numerous other examples might be given, in each of which the waves act through some substance or other.

Must be Something.

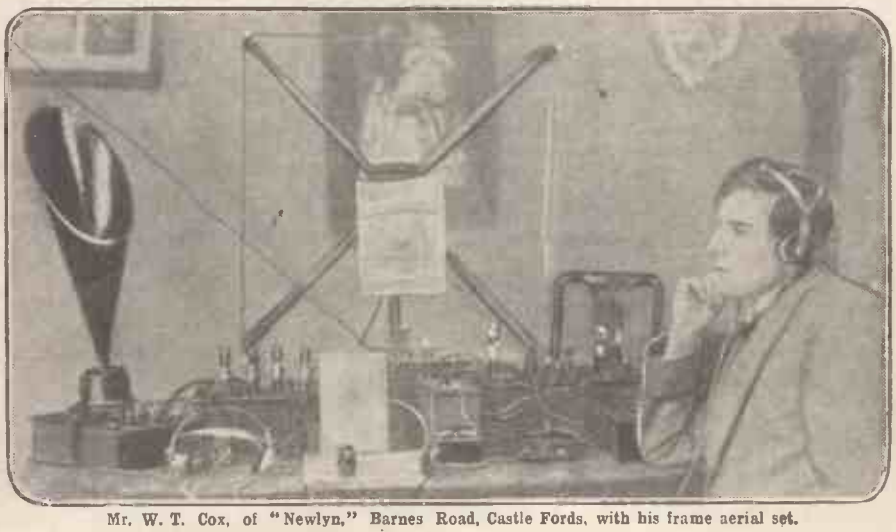
Now, when scientists first discovered that light and heat came to us in a wave-form from the sun, they immediately asked themselves the question: "Through what medium or substance do these light waves and heat waves travel?" It was obvious, of course, that air was not their medium, because the layer of atmosphere which surrounds this earth is not many miles deep; it gets thinner and rarer as the distance from the earth increases, and finally ceases altogether.

There are, therefore, millions of miles of airless space between the sun and the upper layer of our atmosphere, through which heat waves and light waves must move in their passage to our earth. Now, what is the thing that bears them up, as it were, on their journey? Scientists were, and still are, baffled by this apparently simple question. They just did not know, and they do not know to-day. The stuff through which these waves act is still an "unknown quantity" in the scientific world, and to distinguish it from the other "unknown quantities" with which the scientific world necessarily abounds it is called the "ether," and the wave motions which take place in it are called "ether waves." All waves which use the ether as their medium are called "ether waves," and to this class *wireless* waves belong. Heat waves, light waves, and wireless waves are all governed by the same general laws, and all use the ether as their medium of travel.

A Discovery "Wanted."

Of course, there *may* be no such thing as the ether. But scientists feel that it is only reasonable to expect that there is a *something* "out there in space" which acts as a medium for the conveyance of these waves, since all other known forms of wave motion act through particular mediums. What that *something* is they have as yet been unable to discover; all they know is that it is "intangible," "imponderable," "all-pervading," and "mysterious"! Perhaps it will fall to the lot of one of those thousands of enthusiasts who are commencing the study of wireless to-day to make the first really fundamental discovery about the ether.

(To Be Continued Next Week: Another Four-Page Supplement for Beginners. Tell your Friends about it.)



Mr. W. T. Cox, of "Newlyn," Barnes Road, Castle Fords, with his frame aerial set.

HOW TO ADJUST YOUR SET FOR THE WIRELESS CONCERTS.

By G. V. DOWDING, *Grad.I.E.E.*

QUITE a number of people will buy a wireless outfit, fit it up, and then wait for results, without knowing or troubling to find out anything at all about the "whys and wherefores" of the business. Perhaps their innocent knob twistings will meet with success right away and, owing to the simplicity of the apparatus now being retailed for broadcasting purposes, that is quite likely. But one day there will be a "radio tea," and flustered turnings and twistings will not bring forth the expected results. It is then that just a little knowledge will disprove the old saying and prove very useful.

Therefore I propose to outline a simple method whereby at least the first principles of wireless reception can be easily grasped without touching technicalities. To commence with, you must grasp the fact that wireless waves are ripples in what is known as the ether. Briefly, this substance is presumed to fill all space and exist between the atoms of all substances, even such as brick walls, windows, ceilings, etc. That is why wireless waves can travel through anything.

Question of Time.

Transmitting stations disturb this ether and cause ripples to radiate in every direction. When these ripples or waves come along and cut by a receiving station, one of maybe thousands, they generate a very small current of electricity in the aerial. Even in the case of quite a strong signal, this current is so small that it would take nearly a million of them to light one of those small pocket lamps. Some people seem to think that a wireless wave will stop at someone's aerial, slide down it, run through the set and disappear into the ground, but the procedure is quite different.

It will be easier to understand exactly what happens by studying something that performs a similar action in a visible manner. Supposing we fasten one end of a thin wire to the bottom of the sea and the other to something solid and immovable, say a bridge, a few yards above the surface of the water. The waves of the ocean would cut by, but the thin wire would not appreciably affect their progress, or rather, motion. That is how the ether waves cut by a receiving aerial, but with this difference, and that is that in so doing they generate those diminutive currents of electricity. However, they lose practically nothing of their initial energy and therefore have the power to pass on and perform the same act on the aerials of all the thousands of other listeners-in.

The small induced current in the aerial generated by the wireless wave will run through the set down to the earth and then back again through the set to the aerial, and will continue to run backwards and forwards like that until it wears itself out overcoming the resistance of the circuit. That, in effect, is the electrical vibration referred to in a previous article. The more correct term is oscillation.

On its way through the aerial and the set our small current of electricity has to do a certain amount of work. It must, for instance, spread out, and, as it were, fill up, large areas of metal such as the plates of condensers, etc., and must run round turns of wire wound on what are known as inductance coils, and all that takes time. The greater the area of metal, in which is included all the wire in the set as well as the condensers, and the more of those turns of wire it has to travel round, the longer it will take to get through the set to earth and back again to the aerial. If its work is decreased it will, of course, take less time to complete its double journey.

Now with this "oscillation" just like the swing of a swing in the garden, to obtain a strength increasing and sustained series of such swings it is necessary to give it a push just on the point of its return. That is why we vary the "area of spread" (capacity) and the number of turns on the tuning coil (inductance), so that we can arrange that the small current of electricity will get back to its starting-point just as the next wireless wave comes along, and by inducing another small current of electricity, provide that "push" just at the right moment.

The more quickly the waves follow each other the shorter they will be and the less work we must give that little current of electricity to do in order to allow it to get back in time. The longer the waves, the less rapidly they will come in, so we must give the current more work to do. Imagine a series of trains behind each other, all travelling on the same line at sixty miles an hour. The longer the trains are the less the number that would pass you in a certain time, and the shorter they are the greater the number. Take the analogy still further. Say each train is a mile long—it would take a minute for just one train to pass travelling at 60 miles per hour, whereas if each train was but 400 yards long, four could pass in a minute.

In a Nutshell.

Wireless waves always travel at the same speed; therefore it logically follows that the shorter they are the more quickly they will come in speaking in the sense of a number in a certain time; in technical parlance they have a greater "frequency."

Get hold of the above ideas, because they bear directly upon the adjustments of your radio set, and by them you will be able to know in which way to turn the knobs to tune-in to the wave-length of a certain station. More work for longer waves is the simple idea I want you to grasp. A larger coil or the greater the number of turns of wire on it or the greater the area of the vanes of these variable condensers that interleave, the longer will be the wave-length tuning of the set. All these things singly and collectively contribute.

One more rule, and that is always keep the condenser reading as low as possible and increase the tuning by means of the coil as far as possible.

BUYING THE "ETCETERAS."

WE will assume that the actual receiving set has been purchased; if in some cases it is proposed to purchase a set complete with all the accessories, then the reader will be well advised to make sure that he is obtaining the best of everything, or at least value for money.

In the case of the crystal set the only essential accessories are the telephone receivers, apart from, of course, the aerial wire and earth lead. Make sure that you obtain high-resistance telephone receivers not less than 4,000 ohms—that is, 2,000 ohms each earpiece. The actual figures should be marked on the back of each of the earpieces. Low-resistance telephones are useless with crystal sets. The same thing applies to valve sets not fitted with telephone transformers, and 4,000-ohm 'phones or loud speakers are required.

The Right Accumulator.

Valve sets require accumulators for lighting the filament of the valves. See that the accumulator is of good make and of good current capacity. Most are marked with the latter in figures, and those that bear no label giving that and other information such as charging rate, etc., should be avoided. Remember that 40 ampere hours *ignition* is only 20 ampere hours capacity *lighting*. The latter applies to valve sets; 4 volts 40 a.h. ignition is O.K. for a single-valve set, but if more than one valve is contemplated, then at least a 6 volts 60 a.h. accumulator should be purchased. Otherwise charging will prove a very frequent annoyance.

In the case of valves it is a good plan to take careful note of the current consumption and plate voltage required and thereby study economy in running expenses. Generally speaking, it is advisable to employ similar types or makes on a multivalve set, and a valve that will both rectify and amplify is advisable.

Of course, all valves will do both, but some types are more suitable for one certain purpose. The choice of valves is very important and will have a very great bearing on results. Moreover, they are expensive items and should be carefully chosen and handled.

High-Tension Batteries.

Then there is the high-tension battery. This should be of some well-known reliable make and of a voltage slightly above that required for the set. Too much H.T. voltage will not affect the reception unless very "soft" valves are used, while too little might prevent reception altogether—therefore observe the margin on the right side.

With one valve stated to require 30 volts on the plate, employ 36 or even more volts. When using two or three valves a greater plate voltage will be necessary. 45 to 60 volts for two, and 60 to 75 volts for three, should be provided when a single valve of the type used takes 30 volts. If you add 50 per cent. of the initial H.T. voltage to each further valve added, you won't be far out. Definite figures are impossible, as the characteristics of valves vary not only with make and type but individually.

CONNECTING UP VALVE SETS AND SELECTING TELEPHONES.

IN the first case it is possible that many people having purchased a complete set and all the accessories may be confused as to the letters employed to indicate terminal connections. Some, and in fact most, broadcasting sets have clearly marked earth and aerial terminals, and where E and A are used that will be quite clear, but F for earth and G for aerial is often to be seen on sets designed on the unit system. F stands for "filament" which is on the earthed side of the circuit, while G stands for "grid" which, of course, goes to the aerial. These letters are used to facilitate interconnections.

L.T., the initials for low tension, will be known to most, and to these terminals is connected the accumulator. H.T. or high tension denotes the connections of the large dry battery of some fair voltage used for the plate circuit. Be very careful in these connections, and do not connect the large dry battery to the L.T. terminals, otherwise another valve or valves will be required.

Several Pairs of 'Phones.

Sometimes but three terminals are supplied for the H.T. and L.T., one being a common terminal for perhaps the minus of one and the plus of the other, or for like poles of both batteries. Watch these connections carefully and see that the positive lead of one battery goes to its correct terminal and the negative also to its correct terminal. Remember, again, that the cheapest type of valve costs at least 15s.

The 'phone terminals are generally marked "'phones," although perhaps it may be but the letter "P," and sometimes "T." When connecting up two pairs of telephones take one connection from the first pair to one terminal, connect the other short lead to one of the leads of the second pair, the other lead of the latter going to the other 'phone terminal on the set. The simple rule is that the current flowing out of one of the 'phone terminals, it matters not which, must flow through all the telephones one after the other and back to the other terminal. That is called placing them in "series."

All leads should consist of a flexible wire such as is used for electric lighting; its name indicates that it is "flexible" and not so liable to break as single-strand wire. Keep all leads well separated and as short as possible. This latter is very important in respect of the earth and aerial leads.

Finally, remember that complete failure to receive signals may attend a loose or dirty connection, and therefore make a practice of regularly running over and tightening all the terminals and scraping and cleaning the ends of the leads or tab and plug connections.

What 'Phones to Use.

The telephone receivers of the adjustable reed type are both expensive and sensitive. Where weak signals are to be expected they are very useful, but for the reception of concert telephony of fair strength the more common and less expensive flat diaphragm type will prove quite satisfactory. At the present moment there are quite a number of different makes of these latter on the market at prices ranging slightly above and below 25s.

The reed type are eminently suitable for crystal sets, 8,000 ohms being the most useful value. You need not worry at this point as to what an ohm is, but when buying them make sure that the figures are marked plainly on the back of each earpiece. For valve work the flat diaphragm type will prove the most mellow and pleasing in reproduction, as owing to their sensitivity and fine adjustment the reed type are apt to render the signals "tinny" where a fair amount of energy is available.

Danger of Damp.

Four thousand ohms is the value most suitable for valve sets not fitted with telephone transformers. Higher resistance 'phones too easily burn out owing to the fine wire employed in their construction.

It need hardly be said that the 'phones should be handled with care. Dropping them will certainly cause damage. It is very advisable to keep them in a dry place and not hang them up where they are liable to collect atmospheric moisture. Walls should be avoided, as so many are liable to exude damp during the night. If traces of rust are noticeable on the diaphragms, carefully remove them with a rag slightly moistened with paraffin. It is a good plan to smear the faintest trace of vaseline over the diaphragms of 'phones to prevent them rusting.

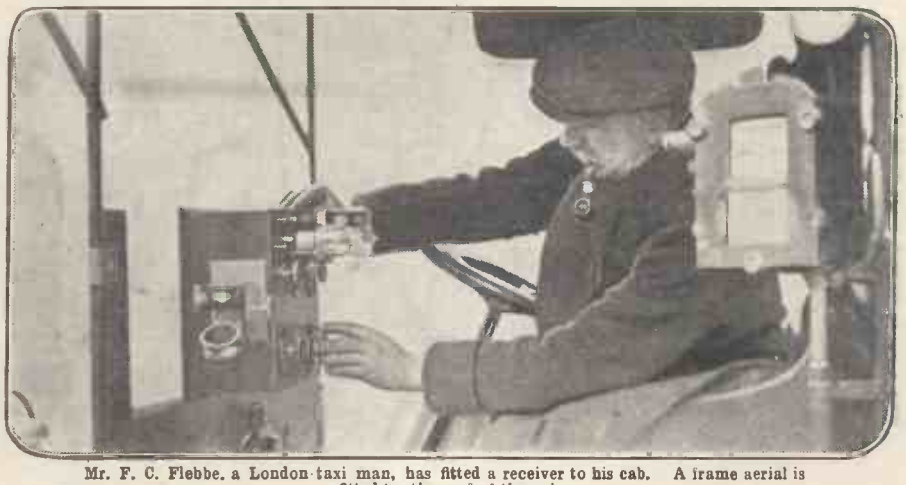
One of the most frequent causes of failure to receive signals is a loose or faulty 'phone connection. Include the examination of the connections behind the earpieces in the preliminary "run over" which should be made on the set at least once during the evening's reception.

A complete outfit for a simple crystal receiver, showing telephones, aerial wire, tuner, and crystal detector, insulators, and rope for mast. Crystal sets are cheap and reliable for a 20-mile radius.

Locating Faulty Earpieces.

If at any time a pair of telephone receivers refuse to function and no external disconnection is traceable, try connecting the two small terminals on one of the earpieces together. By shorting the faulty side in this manner, if it is but the one that has an internal disconnection, the other earpiece is brought into service and can be used *pro tem.*

Invariably but one earpiece will burn out and "save" the other in cases where greater current than the fine wire on the magnets will carry has been sent through a pair of telephone receivers.



Mr. F. C. Flebbe, a London taxi man, has fitted a receiver to his cab. A frame aerial is fitted to the roof of the cab.

QUESTIONS & ANSWERS FOR BEGINNERS.

NOTE.—On this page the beginner will find a selection of questions and answers which will concisely deal with many little problems met with in the erection of a wireless receiver. Readers are invited to send their queries to the Technical Dept., Room 138, The Fleetway House, Farringdon Street, London, E.C.4, where they will be carefully and promptly dealt with. Replies are sent by post free of any charge.

Q. Why should headphones be of high resistance ?

A. They need not be of high resistance, though in most cases high resistance 'phones are advisable. When dealing with the amount of current flowing in a receiver, everything possible must be done to make use of every bit of that tiny current. To do this, telephones are wound with very fine wire, in order to obtain a large number of turns round the magneto, and thus make the current do as much work as possible. It is the effort to increase the number of turns that necessitates the high resistance.

* * *

Q. What is an ohm ?

A. An ohm is the name given to the unit of resistance. It is the amount of resistance present in a conductor which cuts down the amount of current flowing. Thus, one volt pressure can only force one ampere of current through a wire whose resistance is one ohm. If the resistance is doubled, only half the amount of current will get through, unless the pressure is increased.

* * *

Q. What is a transformer ?

A. In wireless this is an instrument used for transferring energy from one circuit to another. In addition it is usually so constructed that it also increases the voltage in the second circuit as it transfers the energy across. A telephone transformer usually acts in the opposite way, by transferring energy into the telephone circuit and at the same time increasing the current instead of the voltage.

* * *

Q. Are wireless waves affected by wind ?

A. No. Unlike sound waves, which are air waves, these ether waves that compose wireless waves are not affected by wind any more than the light waves—also ether waves—are.

* * *

Q. Must special telephones be purchased for wireless reception ?

A. Yes, the ordinary type as are used in the ordinary land line telephony are not sensitive enough to be actuated by the very small currents flowing in wireless circuits.

* * *

Q. Will a crystal set operate a loud speaker ?

A. No, you need at least two valves, to magnify the signals in order to operate a loud speaker.

* * *

Q. How long does it take for a message sent out by a station to reach a receiving-station 20 miles away ?

A. Practically no time ; the wireless waves travel at the same speed as light ; about 186,000 miles per second.

* * *

Q. Is it better to have a single or a double aerial ?

A. For telephony reception on low wavelengths a good single aerial is best. If the aerial space is limited, a double one should be used.

* * *

Q. Will a gas pipe be suitable for an earth connection ?

A. No. Most gas pipes have joints cemented with some substance that does not conduct electricity well, and thus impedes the path to earth of the received oscillations. A water pipe is one of the best earth connections.

An aerial outfit, showing spreaders, insulators and wire.

Q. Must the earth-lead be directly under the aerial ?

A. Not necessarily, though this is supposed to be the best arrangement.

* * *

Q. What is the best wire to use for an aerial ?

A. 7/22 stranded copper or phosphor-bronze wire is the best.

* * *

Q. What is the best wire to use as an earth-lead ?

A. The same wire as is used for the aerial will be very suitable, otherwise a fairly stout gauge should be used ; No. 16 or 18 is quite good.

* * *

Q. What is the minimum height for a good aerial ?

A. An aerial which does not reach 20 ft. at either end cannot be said to be very efficient. Below this height, however, the aerial is still better than the indoor type. You should endeavour to have your aerial at least 20 ft. high at each end.

* * *

Q. Does it matter how long the earth-lead is ?

A. Yes. The earth-lead has to carry more current than any other part of the aerial system ; therefore it should contain as little resistance or impedance as possible, and to avoid this impedance the lead should be kept as short as possible.

* * *

Q. Are batteries necessary for crystal sets ?

A. The majority of crystal sets do not require a battery. It is only when such a crystal as carborundum is employed that a battery has to be added.

* * *

Q. I cannot erect an outdoor aerial ; can I use one indoors ?

A. Yes. The only difficulty that this alternative presents is that the receiving set capable of giving good results with a frame or indoor aerial will have to be much larger and expensive, and, of course, more complicated, than one that would give equally good results using an outdoor aerial.

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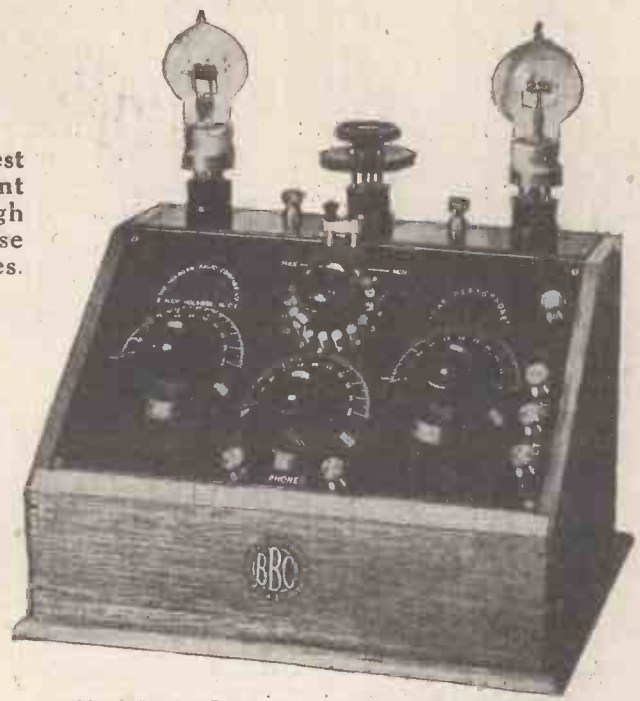

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FROM AN UNOFFICIAL LOG BOOK.

Being further uncensored Extracts from the Journal of a Sea-going Operator, between the years 1916—1919.

By N. F. E.

APRIL 20TH.—Port Said, although reputed to be the wickedest place on earth (I think Kipling says so somewhere), presents a very pretty picture from the sea. More of Port Said anon.

Last night was rather interesting from a wireless point of view. Received Press O.K. from Poldhu, Eiffel Tower, and a lot of German propaganda stuff from the station at Damascus. The latter's call sign is D A M.

At two o'clock this afternoon a large Swedish vessel, the "Pekin," caught fire, and by six was a floating fiery furnace.

As darkness fell it was a grand though terrible sight to see her, half submerged, but still blazing with undiminished fury. The cargo was sugar, I hear.

The local fire brigade at Port Said turned out and performed prodigies of valour with an antiquated fire engine that must have been drawing the old age pension when the Fire of London raged. The amount of water sprayed on the burning ship would hardly have filled a bucket.

APRIL 21ST.—We sailed from Port Said at 11.30 a.m., anchoring off Ishmalia to drop the canal pilots. All the afternoon I have been watching the land of Egypt on one side and Syria on the other. On the Egyptian side of the canal the banks are thick with shrubs and bushes; on the opposite side the great desert of Tih stretches as far as the eye can see—an arid, barren waste. Encamped on the banks were some thousands of soldiers, who shouted eagerly for home news.

Assyrian chariots and the hosts of the mighty Pharoahs have given place to military camps of a more modern kind and strings of telegraph poles. As Mr. Wells once remarked, "This 'ere progress it goes on"

Land Station "Sauce."

A curious thing about the journey through the canal is the strange fading of signals from the station at Aden. In Port Said I picked up this station quite clearly, but directly we were through the canal and the salt lakes and out into the Red Sea, the signals faded almost to inaudibility. There is some peculiar screening effect which is the cause of this, so I am told.

APRIL 26TH.—Each day the weather becomes steadily hotter. Even when perfectly still one becomes bathed in perspiration; and the "Billi" condenser on the crystal set has commenced to stick badly. The heat seems to have expanded the two cylinders considerably, and the insulation coating is peeling off.

APRIL 29TH.—On the 27th we passed Perim, well in sight of land. On the following day we were 50 miles east of Aden, and now we are about to commence our trip into the Indian Ocean and up the Persian Gulf to Basra. Have just picked up a war warning from Seychelles reporting an armed enemy cruiser knocking around somewhere. This is probably the "Woolf."

MAY 7th.—After a very warm journey through the Persian Gulf we steamed slowly up the Shaat-el-Arab to-day, anchoring at 7 p.m. off Ashar, the port of Basra.

The confluence of the Tigris and the Euphrates at Kurna is known as the Shaat-el-Arab, which flows for about 70 odd miles into the Persian Gulf, near Kowiet. We passed Abadan at midday—an awful-looking hole and the site of the Anglo-Persian Oil Company's wells. The smell reminded me of Port Arthur (Texas).

Signals were so scarce coming up the Gulf that I sent out a C Q in the hopes of getting a few test V's, but had no reply. Later on I called V T C (the Basra station), and was politely if laboriously told that my signals were as clear as pearls, and as badly sent as could be. It being against the rules to sauce a land station (especially in war time), I gave V T C a curt "R" and closed down. Land station operators are generally born with a multiple tuner round their necks, and consequently think they own the ether.

MAY 10TH.—For the last day or so we have been unloading military stores off

Mr. A. W. Owen's home-made set, 53, Warner Road, St. James Street, Walthamstow.

Magil, a small depot chiefly remarkable for its utter desolation and the excellent iced beer kept by the military officers in their mess-room.

During the last couple of days I have managed—despite the heat—to scout round and see a bit of the neighbouring country. Of Basra itself (it lies some five miles inland) I cannot say much, for fully three-quarters of the place is placed out of bounds to the naval and military. The town is infested, however, with the filthiest natives I have ever seen—and I've seen a few.

In the Bazaar at Ashar I was pointed out a youth of about 17 who was idly looking after a dirty shop. He was the richest man in Basra and Ashar—and that means anything over a quarter of a million sterling. These people can live on about a rupee a day, and when they have made that sum the majority of them shut up shop and go and see Charlie Chaplin at the local cinema show. Charles is a great favourite with the Arabs; but the effect on their morale is not good from an English point of view. They get a rather misleading impression of white men.

MAY 22ND.—The last few days have been pretty dull except for two noteworthy items of interest. The first was a visit to the Basra wireless station, V T C.

This station is a pretty hefty one—eight tall masts, 450 feet each, support the aerial system. The main station building is situated in the middle of the station grounds, and is guarded by Indian soldiers. When I stalked up, intent on exchanging Lizzie (the crystal) for one more stable, I was greeted with the guard turning out and saluting like automatons.

F L in Basra.

Gravely returning the salute "*à la* Beatty," I asked for the W.O. in charge, and soon was having a heart-to-heart talk with that pessimist. However, I managed to swap a crystal, and returned in high glee. The exchange was O.K. That night I heard F L at medium signal strength. Not so bad, I think.

The second item of interest was the execution of some rebel Arabs. I had gone swimming early one morning, my favourite creek being a mile or so outside Magil. A squad of native soldiers with white officers in command arrived as I rested on the bank. Six Arabs were blindfolded, placed in a row, and, before I quite realised what was up, were shot on the spot. It's not a pretty sight, an execution.

MAY 23RD.—Heard F L again last night, as well as D A M (Damascus) and O S M (Constantinople). Poldhu I cannot hear. Nantes (U A) is quite distinct, and plenty of Indian stations are audible when darkness falls.

THE RADIO ASSOCIATION

GREAT strides are being made in the study of wireless science in South-East London, and on January 20th the Brockley branch of the Radio Association was formally inaugurated by Mr. C. W. Bowerman, M.P. for Deptford, who was accompanied by Professor A. M. Low and Major Raymond Phillips. Since the commencement of the year a POPULAR WIRELESS representative was informed by Mr. J. V. Ballard, the chairman of the Brockley Branch, no fewer than 120 members have been enrolled. The Radio Association itself is extending by leaps and bounds, and is already on its way to a membership of 2,000.

In opening the proceedings of a most interesting wireless demonstration at the Gladstone Hall, New Cross, Mr. Bowerman asked what would their forefathers have thought of an air-wave conversation between folks in America and this country, such as had taken place a few days ago.

Professor Low, in his address, said we talked of wireless radio-activity, but we really knew very little about it, and in the future the science was bound to extend in every possible direction. In the near future we should probably be able to obtain racing and football results while travelling in a train, reports of the happenings in the law courts, and, possibly, of what members were really saying to each other in the House of Commons. (Laughter.)

CORRESPONDENCE.

AMERICA ON ONE VALVE—GOOD RESULTS IN SCOTLAND

CRYSTAL SET PHENOMENA.

To the Editor of POPULAR WIRELESS.

Sir,—Will you kindly include W G Y, Connecticut, in your list of listening-in times?

I get American stations every night on one valve.

This was the programme last night, January 15th, and this morning, January 16th, bearing in mind that as I do not write shorthand I had only time to write down a few words before the next item was upon me.

I switched on at 11.10 p.m. Monday, just in time to pick up the following:

National coal congress. . . News bad from Alexandria. . . Former President. . . Navigation Co. . . Embargo on coal. . . Bonar Law. . . . . 60 % of the aliens admitted to the United States. . . Numbered 62,130. . . departed 17,225. . . During 5 months. . Annual Banquet to-morrow night. . . Toast master . . . Annual Michigan Convention. 74,748 dollars collected for the Memorial Fund. . . also collection for museum and library

Then followed the announcement: "This is W G Y, General Electric Co., Connecticut, 7.45 standard time. Closing down. . . ."

My watch then showed 11.30 p.m., and as I have had shoals of protests against a paragraph referring to my U.S. reception on one valve in an issue of the "Southport Visitor" last week, I went straight down to the office of that paper and submitted all the foregoing items to them as proof, and returning home, received the following story from the same station:

"A boy with a bundle of newspapers under his arm. . . 'I want to study law, sir,' answered the boy. . . 'I told you I couldn't afford an office boy,' answered the lawyer. The boy seemed to be terrified."

Then followed a story about a Professor Henry, who was arrested in mistake for a spy, and referred to a flying machine at Washington.

Then followed news items, money market, and the following announcement: "That brings us to the end of our news items."

Then followed: "The next number on our programme will be a piano solo. This is W G Y, General Electric Co., Connecticut."

The piano solo was as clear as a bell, every note distinct.

Then followed the announcement: "W G Y, closing down until 9.30. Please stand by."

Then followed a lady singing. Then a dialogue between two men, one evidently a coon. Then a male and female duet. I then turned in another station on about forty metres longer wave-length announced as W J Z, giving a technical description of their apparatus. "Valve cost a thousand dollars," etc. Then followed the "Missouri Waltz," beautifully received. Then the following announcement: "The next number of the General Electric Co.'s programme will be a violin solo, one minute please." This solo was received perfectly. Then the announcement: "W G Y, General Electric Co., Connecticut." Then a long lecture on oil in the United States.

My set is wholly made and designed by myself, excepting 'phones and valve. My aerial is attached to a tree about 28 ft. in height at one end, and is a double one of 30 ft. in length composed of 18 copper wire, the lead-in end being attached to a window frame 20 ft. high. Without doubt listening-in to the American stations will be a matter of course for English amateurs within the next month or so.

Should you desire a test my set is at the disposal of any of your representatives on appointment.

Yours faithfully,

VINCENT M. CARTMEL.

45, Linanker Street, Southport.

To the Editor of POPULAR WIRELESS.

Dear Sir,—With reference to the article entitled "Notes on the Scottish Ether" in your issue of December 30th, I am one of the local amateurs referred to as having been successful in the reception of 2 M T on one valve, and wish 2 M G to understand it was not a freak. Marconi House, Birmingham, Manchester, and Newcastle can be clearly heard any evening on my single valve set, and on Friday, December 29th, 2 Z Y was so clear that the "click" of the opening and closing of the microphone switch was actually heard.

In my opinion the reception of telephony is all a question of careful tuning. My circuit is of the usual type and not a freak in any way.

It may interest 2 M G and others to know that recently I logged the following amateur stations on this home-made apparatus:

2 A W Wakefield.
2 D F New Malden, Surrey.
2 F P London, S.E.14.
2 J F Liverpool.
2 J Z Huntly, Aberdeenshire.
2 K F Merton, London, S.W.19.
2 M M Winchester, Hants.
2 N A Walsall.
2 O D Gerrard's Cross, Bucks.
5 M S Manchester Wireless Society.
5 S H Liverpool (?)
5 S W Radio Society of Great Britain.
O X M Holland (20 watts).
O Y B Holland (20 watts).
P C 1 1 Holland (20 watts).
8 D P Location unknown; thought to be French.

I have also heard a French Radio Society sending Transatlantic tests.

I have already been in correspondence with 2 K F, who kindly verified the transmission and gave his power, and if the owners of the other stations would care to write me, through the Editor, I would be pleased to listen for their transmissions on prearranged dates, preferably Saturdays, and give a report of reception, if required.

Yours faithfully,

"RADIO" (Glasgow).

Twenty thousand people buy up the first edition of MODERN WIRELESS

within a few hours!

OUR estimate of 20,000 readers for MODERN WIRELESS was very wide of the mark—the whole edition was completely sold out within twelve hours. But we were determined that no one should be disappointed—we wanted everyone to be able to buy a copy.

Therefore we put in hand an immediate reprint of a further 50,000 copies, making the huge total of **70,000** in all. This reprint is now on sale everywhere. After reading it, be sure to place your order in advance for a copy of No. 2, which is going to be an even greater success.

The Constructional Articles alone are worth the shilling.

If you are contemplating building your own Set you are given a choice of several Receivers, ranging from a simple Crystal Set for receiving the Broadcast Concerts to a super-sensitve 5-Valve Receiver with a range of 4,000 miles.

If you have got tired of carrying your accumulator to a garage to be re-charged, you will be interested in a practical article showing you how to re-charge it off your own electric light supply.

An interesting article on double reaction is sure to hold your attention. There are big possibilities for amateurs in this. Besides these, there are articles on how to make a Detector Unit, a Note Magnifying Unit, a Grid Leak, a winder for winding your own Coils, and many others.

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Monthly

MARSHALL AD.

MEMORIES.

BY A MARCONI ENGINEER.

THE wireless profession has led some of us into many lands bordering the Seven Seas, and has provided us with many sidelights on life. I shall not be far out if I venture to boast that in well-nigh every habitable part of the globe, not to mention the uninhabitable ones, the Marconi engineer has worked his works, and the Marconi operator has kept his watch.

If I may venture a joke, I would say that the Marconi man during his useful, restless existence generally keeps his watch, even if he has temporarily to "pop" his dress-suit; for that is my way of saying that, though he occasionally finds himself in a tight place, he carries on with the job.

No one could accuse me of dallying with the sweet uses of advertisement because I humanly express pride in being ever so insignificant a member of a real *service*, which though a mere quarter of a century old, has indeed a spirit animating it. There may be no traditions in soap or jam or nails, but there are in the Marconi service.

In that service men have died at the post of duty, at sea in every imaginable kind of craft. and on shore in the far-distant and dark places of the earth, where fever, sudden death, perpetual discomfort, and deadly monotony wrestled with their souls. But the work went on, and as men died or were broken others stepped into their places.

"Dinner is Ready."

Some of my memories are of those who went to Manaos, far up the Amazon, and died; who exiled themselves at the Falklands, in the arid tracts of Somaliland, and the heights of Colombia; who struggled on in the Aretic; in squalid islands in the Mediterranean, and in the South Seas. Many of those men came back only to find their end in the Great War, somewhere near a coil, a condenser, and a key. And the sea-going operators. Ah, there is not an ocean-bed on this rolling globe which is not sacred to their memory.

My first recollection of wireless would be somewhere about 1894, when I was present at a *soirée* of which one of the attractions was a magician who could cause a bell to ring at least three yards from his transmitter. I suppose Marconi was just then getting his dreams into working order, for he did not bring his invention to England until 1896.

Some years later I was being shown over a small steamer—one of the Batavier boats, I believe—and distinctly remember how the wireless operator truncated his eloquent lecture at the most interesting stage because he said, "*My dinner is ready.*" I remember that I was secretly amused by his *naiveté*, but I had still to learn that unpunctuality at mess is an offence. Still, visitors——

The Long Arm.

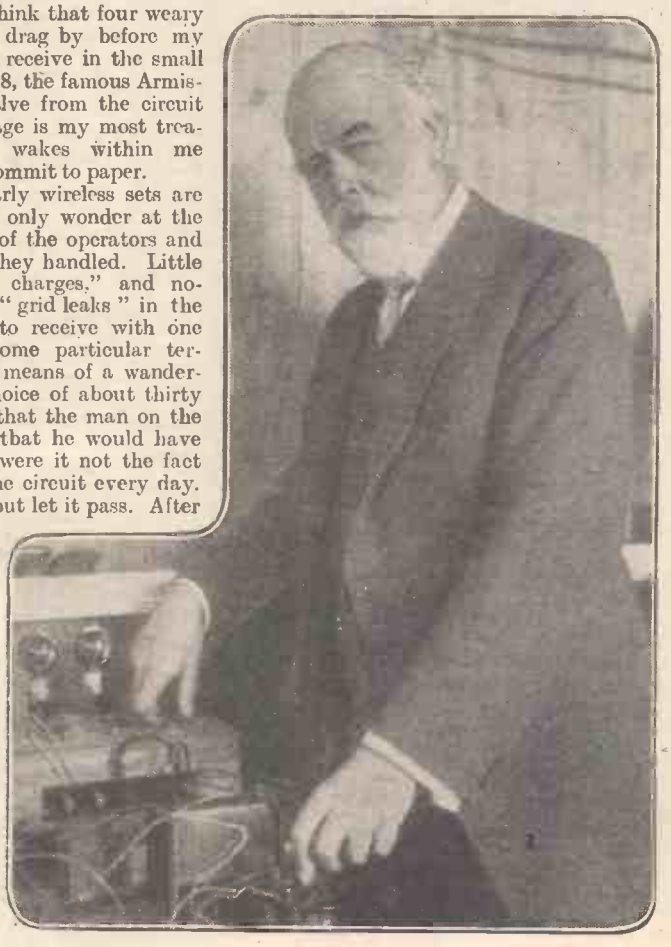
In due course Marconi's long arm shot me out to keep up my wicket for "the old firm," and I remember most vividly a sight of the breakers spouting about the Old Head of Kinsale, and my surprise that my supposedly sensitive interior economy had not by then succumbed to *mal de mer*. I also have a photographically clear remembrance of Land's End as I passed it outward-bound for an exile of three years.

Equal in vividness to the two preceding mental pictures is one of green Plymouth Sound, when I returned hungering for the grey English sea and the smell of motor-'buses on a summer afternoon. Oh, the jabber and sweat, the shrill clamour of the Eastern cities! But, oh, the sunset over the quiet Essex flats, and the hearty English voices of the dockside labourers at Tilbury! In two weeks the long arm of Marconi shot me forth again, this time to the little known Balearic Islands, where I stayed for several years. There I climbed a real man-sized mountain, wrestled with demons in the shape of half-wild mountain pigs and sheep who uprooted my earth-plates, and with Mallorquin cooks—quite wild—who laid in me the foundations of a permanent dyspepsia.

"Sparks" of Hate.

The Great War! Never shall I forget the persistent screech of Norddeich during August, 1914, as on the 5th of that ever-memorable month I sat in a stifling cupboard at —— and hear, hour after hour, the scream of the Imperial Eagle who in anticipation already saw itself and its allies gathered about the corpses: "*Krieg ist erklärt gegen England, Frankreich und Russland!*" Little did I think that four weary years and more would drag by before my station at —— should receive in the small hours of Nov. 11th, 1918, the famous Armistice message. The valve from the circuit which took that message is my most treasured souvenir, and wakes within me memories I can never commit to paper.

My experience of early wireless sets are not blessed. One can only wonder at the dogged determination of the operators and the amount of traffic they handled. Little was known of "space charges," and nothing of "plates" or "grid leaks" in the days when one used to receive with one finger (damped) on some particular terminal, or tuned-in by means of a wander-plug which had the choice of about thirty sockets. I remember that the man on the Suez Station told me that he would have gone mad with *ennui* were it not the fact that he had to alter the circuit every day. And, as for coherers—but let it pass. After all, Marconi only had a coherer when he first spanned the Atlantic.



This is the latest unpublished photograph of Sir Oliver Lodge. It was taken in his experimental laboratory at his home near Salisbury, where Sir Oliver is understood to be engaged in important experiments connected with wireless. A little while ago he informed a press reporter that he believed he might soon have some interesting wireless improvements to show before very long.

A FEW HINTS.

MANY amateurs find ebonite rather costly for use in valve panels, but slate can often be obtained easily, and is quite a fair substitute. The one difficulty to be overcome is the tendency of moisture to condense on the surface of the slate. This can be overcome by coating the slate evenly with shellac, and this will also add considerably to the appearance of the panel by giving it a glossy finish. Other polishes should not be used as they are not always good insulators.

* * *

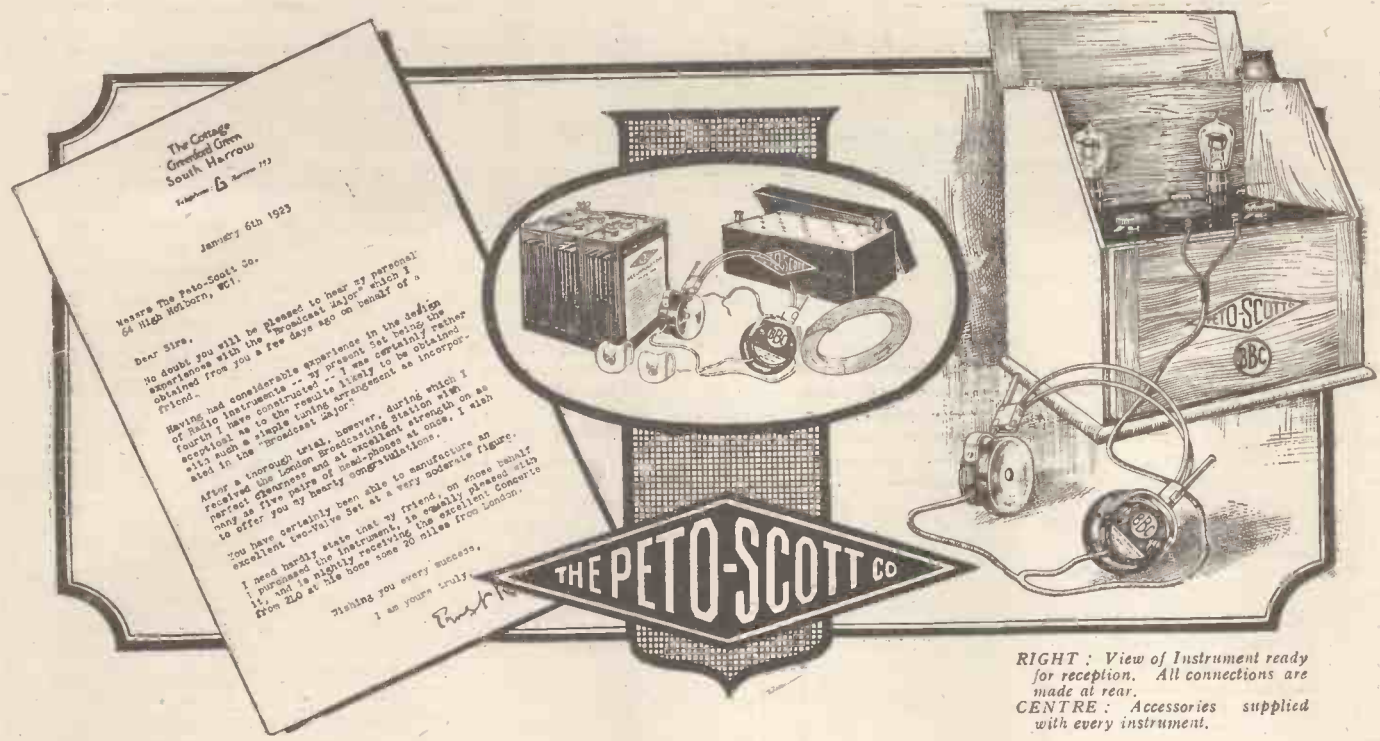
Mercury can be cleaned by shaking or stirring well in concentrated sulphuric acid. The acid is poured off after a time, and the mercury rinsed with water and soda. It is then strained through wash leather, and will be found to be quite clean.

* * *

When using primary cells making use of amalgamated zinc, a good tip is to stand the zinc in a thin layer of mercury placed at the bottom of the container or porous pot. This helps to preserve the zinc.

* * *

A piece of cane hammered at the end so as to form a sort of fibre brush is very useful for glueing purposes. In this case the "hairs" will not come out, and a piece of cane will last a long time, the brush being renewed at intervals by the simple expedient of more hammering.



RIGHT : View of Instrument ready for reception. All connections are made at rear.
CENTRE : Accessories supplied with every instrument.

Performance counts

Your Wireless Set must be something more than a handsome Cabinet—it must receive loudly and clearly the Concerts now being transmitted from the various Broadcasting Stations. Read the above letter and see how these requirements are fulfilled by the

BROADCAST MAJOR

Approved by P.M.G.

IF you are situated within 25-30 miles from any of the four Broadcasting stations—London, Manchester, Birmingham, and Newcastle—you will find that the 2-Valve *Broadcast Major* is ideal for you. Not only does it receive loudly and clearly—as many as five pairs of headphones can be in use at one time—but its tuning arrangement is simplicity itself. Merely rotate *one dial* and any wave-length from 300 metres to 500 metres —**all the Concert Wave-lengths**— is found immediately. Even a child could use this Set, since absolutely no Radio knowledge is required.

Every instrument, besides being subjected to an actual test upon our own aerial, carries our full guarantee of complete satisfaction after a *seven days' trial in your own home*, or money willingly refunded.

The Cabinet is built from solid mahogany, hand polished throughout, and is fitted with a hinged top and a drop down front. Included with the instrument is a complete equipment consisting of a pair of Western Electric Headphones, a 6 volt 40 amp. hours accumulator, and a 60 volt H.T. Battery—both made specially to our own specification for wireless work —and a complete Aerial outfit consisting of 150 feet of copper wire, and the necessary insulators.

There is absolutely nothing more to buy, with the exception of the two Valves which, owing to risk of damage in the post, should be purchased locally.

You cannot purchase a better 2-Valve Set, although you may be asked to pay very much more.

When this Set is required for use with Broadcast Licence a B.B.C. royalty of 35s. must be paid at time of purchasing. The royalty of 25s. due to the Marconi Co. is at present being paid by us.

£9-9-0

Valves 15s. each extra.

THE PETO-SCOTT Co., Ltd.,

Featherstone House,

64, HIGH HOLBORN, W.C.1.

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.

Wireless and Experimental Association.*

The meeting of the Wireless and Experimental Association, held on January 10th at the Central Hall, Peckham, was of exceptional interest.

The steps now being taken for making the association's three-valve receiving set of greater sensitiveness and utility, under the expert supervision of Mr. Joughin, were explained in detail by Mr. Knight, the chairman.

Mr. Chastney (member) described, with the help of the blackboard, a two-valve set which he had constructed; and Mr. Joughin, again coming to the rescue, pointed out one or two undoubted improvements.

The elementary members were then enlightened on the needs and use of lightning arresters.

The foreign secretary, Mr. Bird, read accounts of what some of our foreign members are doing "down under." But the crown of the evening was the design of Mr. Voigt with crystals, and of Mr. Joughin with valves, of sets to effect "full wave" rectification of signals.

The subject of balaneing capacities versus earths was treated exhaustively, and the meeting closed at 10 p.m.

Assistant sec.. Mr. G. H. Horwood, Buckland, 355, Lordship Lane, S.E. 22.

* * *

Birmingham Experimental Wireless Club.

A very enjoyable and instructive lecture was given before the above club on 15th of December by Mr. Dore, one of our vice-presidents.

The subject was primary batteries. Mr. Dore's lecture was particularly devoted to the Leclanché dry cells much used for modern wireless purposes.

The lecturer explained very fully the chemical reactions which take place in this type of cell, and gave the analysis showing the compositions of the various commercial cells on the market.

The accurate testing of such cells in the laboratory and the apparatus used for same was very interestingly explained, and careful graphs showing the behaviour of the different makes when under test were of much interest to the members present.

It was interesting to note that the behaviour of the British makes was far superior to the German when tested under equal conditions.

Hon. sec., A. Leslie Lancaster, c/o Lancaster Bros. & Co., Shadwell Street, Birmingham.

* * *

Hackney and District Radio Society.*

"High-Frequency Currents and Tesla Coils" was the title of a most interesting and instructive lecture recently given to the members of the above society at their premises at the Y.M.C.A., Mare Street, Hackney, by Mr. A. Valins. There was a large attendance, and some most interesting experiments were carried out in the darkness in order to show the best effect.

Several members have already found the benefit of joining a radio society, as by doing so they have been enabled to obtain the much-coveted experimental licence, which had been applied for several times previous to joining the society without success. All those persons living in the district of Hackney who have hitherto "ploughed the lonely furrow" should take heed and support their fellow amateurs, so that all may benefit by united action.

Hon. sec., E. R. Walker, 48, Dagmar Road, Hackney, E. 8.

* * *

Stoke-on-Trent Wireless and Experimental Society.*

At a meeting of the Stoke-on-Trent Wireless and Experimental Society on December 21st, the construction of the tuner for the society's multi-valve receiver was proceeded with. A coil-holder was constructed, a variable condenser assembled, and several inductance coils were wound.

Hon. sec., F. T. Jones, 360, Cobridge Road, Hanley.

* * *

Isle of Man Radio Society.

At a recent meeting the constitution of this society was established. The following additional officers were elected: President, Mr. F. R. Grundey, B.Sc., F.C.S., Director of Education (I.O.M.); joint sec., Mr. J. S. Craine; treasurer, Mr. A. Gore; committeeman, Mr. R. Cannell.

An excellent syllabus has been arranged by the committee, who have already shown great enthusiasm in their work.

Secretaries, J. P. Johnson, 16, Hildesley Road; J. S. Craine, 6, Belmont Terrace, Douglas.

* * *

Feltham, Ashford, and District Radio Club.

Will all persons in these districts who are interested in wireless please communicate either with Mr. Nettleton, "St. Albans," Feltham, Middlesex, or with Mr. H. G. Moss, 48, High Street, Feltham, with a view to forming the above club.

RADIOTORIAL

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

Readers of **POPULAR WIRELESS** who listened-in the last night the opera was broadcast probably heard the news that a special Dame Nellie Melba Wireless Fund had been opened.

This fund has been started to mark the appreciation felt by "listeners-in," and Dame Nellie Melba has promised to be personally responsible for the distribution of the proceeds in the cause of British opera.

I feel sure the thousands of readers of **POPULAR WIRELESS** who enjoyed the opera by wireless will help to make this fund a record one.

Contributions should be addressed to—

The Melba Fund,
c/o The British Broadcasting Co.,
Magnet House,
Kingsway, London.

* * *

The Beginners' Supplement has met with a warm and appreciative reception, and our offer to personally assist the new amateur has resulted in a record post for the last two weeks.

I feel certain I can rely on old readers to mention this Supplement to their "wireless friends." One good turn deserves another, you know.

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 138, The Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send necessary postage for reply.

A. P. Z. (Aylesbury).—I have a number of pieces of mica, about ·008 thick. I want to use these for making fixed condensers with tinfoil plates. What size, and how many plates shall I use for ·001, ·0003, ·002, ·0001 mfd. ?

You should use the following sizes: ·001, about 6 sheets of tinfoil 4 cm. by 2 cm.; ·003, 4 sheets 4 cm. by 1½ cm.; ·002, about 11 sheets of foil 4 cm. by 2 cm.; ·0001 mfd., about 2 sheets of 2 cm. by 2 cm.

* * *

J. S. (Stirling, Scotland).—I am at the following distances from the places named: London, 350 miles; Birmingham, 260; Glasgow, 20 miles. What set do I need to hear all these. (2) What would be its cost ?

You need at least a four-valve set, including 2 H.F. amplifiers. The cost of such a set complete would be somewhere between £30 and £40, or possibly a little more.

* * *

C. W. W. (Westminster).—I have made a crystal set from bought parts. Must I apply to the P.M.G. for an experimental licence, or will it be good enough if I buy a broadcast licence ?

You must write to the Secretary, G.P.O., and ask for an experimental licence form. This must be filled in and returned together with the details of your set. When returning the form state whether the parts of which the set is made are of British manufacture.

* * *

B. O'D. (Dublin).—Should I connect low-resistance telephones or telephones and a loud speaker in series across the secondary of a telephone transformer ?

No; in that case telephones or telephones and a loud speaker can be more advantageously connected up in parallel. As you know, the current that will flow in this circuit, which consists of the transformer, secondary and the telephones, will be limited by the amount of resistance present. Therefore, by placing them in parallel this is reduced. At the same time it may be argued that the current then is divided into more than one path, but it is proved very often in practice that the distinct advantage is gained by the general reduction of impedance where the figures of resistance are comparatively low.

* * *

L. M. (Walthamstow) submits for criticism the diagram of a five-valve set.

Although in the main the diagram is quite O.K., we do not approve of the plug and socket connections for "tapping" in any number of valves from one to all five. You are employing two H.F. stages of amplification and reaction, and these do not lend themselves very well to such arrangements. We are afraid that the close proximity of wiring necessitated will be liable to cause violent reaction and consequent "howling" when not required—if it can be said that such conditions ever are required. When dealing with H.F. and reaction all leads and wiring should be kept as far apart as possible, and the wiring arranged so that "cross overs" are avoided.

* * *

"AERIAL" (Windsor).—Does a bypass condenser in a valve set act as a telephone condenser or is the latter necessary also ?

The bypass condenser acts in the dual rôle of telephone condenser to smooth out the impulses of current passed through the 'phones, and also as an H.T. condenser to smooth out the impulses of current discharged by the H.T. battery. It also acts, as its name indicates, as a bypass in providing a path for the high-frequency impulses flowing in the plate circuit and thus preventing the necessity of these overcoming the impedance of the 'phones and H.T. battery.

* * *

R. L. K. (Winchester).—Do valves vary individually as well as by make ?

Yes; no two valves will be found to possess exactly the same characteristics. This is due more to the fact that it is impossible to obtain absolutely identical degrees of vacuum.

* * *

T. M. C. (Barking).—Is it a fact that some valves are better as detectors than they are as amplifiers ?

Yes. Generally speaking, a "hard" valve is more suitable for amplifying and a "soft" valve for detecting. Valves, even although they be of the same type and make, should be changed over and their position varied until the best place for them or the best arrangement is discovered. Two apparently similar valves may have a slight difference in degree of vacuum (see reply to R.L.K., Winchester), and the one that is "harder" or slightly more exhausted than the other would function better for amplifying.

* * *

T. R. (Paignton).—Will valves stand vibration, as I desire to fix up a valve set on a motor-car ?

Yes; valves will stand a fair amount of mechanical vibration as long as the filament is not taken to a white-hot temperature. Use more H.T. and cut down the filament current to its lowest possible point.

* * *

"AMATEUR" (London).—Must a variable condenser placed in series with the serial be of large capacity ?

No, because the resultant capacity of the aerial circuit with a series condenser will always be smaller than the smallest capacity placed in series. Thus the aerial may have a capacity of but ·0002 or ·0003 mfd. at the most, and therefore whatever the size of the condenser placed in series with it the resultant capacity will be smaller than that figure. However, for capacity adjustments just below that of the

(*Continued on page* 868.)

HOW WILLIAM THE CONQUEROR COMPILED THE DOMESDAY BOOK.

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page 867.*)

aerial a variable condenser of fair average value should be employed. ·001 mfd. is about the usual figure for that purpose.

* * *

"TREDLITELY." (Stratford, London).—How far round should I turn the valve resistance on a single-valve set using a 4-volt accumulator?

It will probably be necessary to turn the filament resistance control nearly all the way round. With an "Ora" or any similar valve you would not burn out the filament if you placed the accumulator straight across the filament without employing a resistance. However, in point of economy, if for no other reason, it is advisable to carefully adjust the filament control so that you are working with as much resistance in circuit as is possible conducive to comfortable signal strength.

Would too much high-tension current harm the valve?

No, but there is a point where additional H.T. does not increase signal strength, and may even decrease it, and therefore you should vary the H.T. voltage until the best point is discovered. In very many cases this is below the rated plate voltage of the valve, but in a few cases it will be found to exceed that pressure. No two valves possess similar characteristics, and therefore both the best filament temperature and plate voltage can only be discovered by experiment. Remember, though, that even if too great an anode pressure will not harm the valve it may burn out a transformer winding or high-resistance telephone receivers, and for that reason care is necessary in its application.

* * *

J. S. (Herts).—What is the use of an inter-valve transformer?

Primarily it is used as a coupling between one circuit and another. Also, as a valve is a potential operated device, the transformer is so wound that it acts as a "step up" transformer, so that the voltage applied to the second valve is as great as is consistent with efficient working.

* * *

"EDONA" (Salisbury).—I do not quite understand how the tuned anode circuit is connected. Is this an efficient method?

The tuned anode method of H.F. coupling will be found to be a very satisfactory arrangement. The plate of the first valve is connected direct to the grid of the second, a small condenser being placed in series, and a grid leak being connected from the grid of the second valve to earth. The tuned anode coil is connected between the plate of the first valve and the positive side of the H.T. battery. A small ·0002 or ·0003 variable condenser is shunted across the coil for tuning purposes.

* * *

B. R. G. (Worcester).—I have just built a one-valve set which gives quite good results, except for the fact that signals keep on fading away. How can I remedy this?

This may be due to some peculiar geographical effect, or it may be caused by a sulphated or run-down accumulator. Also, the substitution of another grid leak might have the effect of curing the trouble. If you have an unsuitable leak it might result in the effect you mention, owing to the electrons not being able to get through the leak rapidly enough.

* * *

R. P. L. (Harrow).—I am constructing a one-valve set and should like to know how large the A.T.I. and secondary coil should be for low wave-length reception.

If you wind the A.T.I. with No. 22 D.C.C., using a former of about 4 in. diameter and 4½ in. long, you should obtain quite good results. In this case, the secondary should be about the same length and about 3 in. diameter. Wind this with No. 26 D.C.C. to within about ½ in. of each end. These two coils should give you a useful loose coupler for low wave-lengths. For higher wave-lengths the loose coupler described in our issue No. 23 will give good results.

* * *

"VARIOMETER" (Hendon).—I want to construct a variometer capable of covering the wave-lengths between 300 and 3,000 metres. What should be its dimensions?

You will find that the following dimensions will give the required range. The stator should have a diameter of 5 in. and contain 96 turns of 24 S.W.G. It should be tapped at the 8th, 12th, 18th, 24th, and thence at every 10th turn. The rotor should have

(*Continued on page 870.*)

T·M·C WIRELESS

for

The "Everset" Crystal.
No adjustment necessary.
Fits any crystal receiver.
10/- each.

Enjoyable Concerts

You can hear the best singers, excellent orchestral music, or first-rate entertainers with a T.M.C. Wireless Set. Or you may be interested in football, boxing, the latest news, stock exchange quotations, the weather forecast, or an evening of dancing.

You can have all these, enjoyably and pleasurably in the comfort of your own home, with a T.M.C. Wireless Receiver.

There is no trouble to you—T.M.C. have engineers in every large town to advise you, free of cost and without obligation, as to the best apparatus to use.

Your choice having been made, T.M.C. engineers will install the apparatus and periodically inspect it.

T.M.C. Wireless is particularly simple to work and gives every satisfaction.

T.M.C. Wireless Receivers, which are fully approved by the Postmaster-General, bear the seal of the British Broadcasting Company.

The wide variety of models are entirely British made.

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London, Birmingham, Manchester and Newcastle are "broadcasting" NOW.

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GLASGOW, LEEDS, LIVERPOOL, MANCHESTER, NEWCASTLE, SHEFFIELD.

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HOLLINGSWORTH WORKS, DULWICH, LONDON, S.E.21.

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page* 868.)

about 50 turns of the same wire, and be about 3 in. diameter. This will then be tapped at turns Nos. 6, 10, 14, and thence at every four turns.

* * *

"TWO-VALVE" (Bedford).—I have been offered a two-valve B.B.C. set. Should I be able to hear Marconi House from here?

Yes, you should be able to hear London from Bedford, though you do not state whether the second valve is H.F. or L.F. If it is H.F. you will naturally be able to receive over a greater distance than if it is L.F.

* * *

"AERIAL" (Hampstead).—I have a three-valve set, and wish to use the electric light type of aerial. Will this be suitable? Should I hear Birmingham?

Yes, for reception of Marconi House it should be quite O.K. You will not be able to receive Birmingham, however, unless you use an outdoor aerial, or add one or two H.F. valves to your set.

* * *

"CRYSTAL" (Enfield).—I have one of the "Gecophone" crystal sets, No. 2 type. Can I add an amplifier to this?

Yes; the primary of the transformer in the amplifier panel must be connected to the two telephone sockets in the crystal set.

* * *

J. H. W. (Portsmouth).—I have a three-valve set, and find I can hear the Paris time-signals without either aerial or earth connected. Is there something peculiar about my set?

No, this is due to the fact that the radiation from Paris is very powerful, and the coil of your set—the A.T.I.—is acting as a frame aerial, and thus a certain amount of energy is being picked up.

* * *

R. A. J. (Croydon).—I have a former 12" by 4" wound with 24 S.W.G., and using 100 ft. galvanised steel double aerial. What condenser should I use for fine tuning? I have one slider on the coil.

In the first place, the aerial is not of a material likely to give efficient results. Steel or iron are not to be recommended for use in aerial wires. You should use copper wire. A .0005 mfd. or even .0003 mfd. should be ample for fine tuning. The less capacity you have to add to the circuit the better.

* * *

"WORRIED" (Ilfracombe).—I have a three-valve set, and have been worried recently by a "frying" sound in the telephones. All connections are clean and tight, and the accumulator is in good condition. The sound continues with the aerial and earth disconnected. How can I remedy it?

The sound is probably due to your H.T. battery. Test the cells with a voltmeter and cut out any that appear to be defective. This is not always a sure test, however; and if you cannot spot which cell or series of cells is giving the trouble, try a larger condenser across the H.T. + and − terminals. Failing this, you should try a new H.T. battery.

* * *

A. R. (Balham).—(1) Can I hear the Hague and Paris concerts on two valves? (2) Will an existing aerial, six feet directly below mine and parallel to it, be a disadvantage? (3) Will telephone wires cutting across my aerial at 45° be a nuisance? (4) If I made a set, and bought the 'phones, should the 'phones bear the B.B.C. mark?

Probably not without using reactance, which is forbidden, unless you have an experimental licence. (2) This may be a nuisance if it radiates at all. It is a very bad arrangement, and should be avoided if possible. (3) No, these should not cause any interference. (4) Yes, the telephones should certainly bear the B.B.C. mark.

* * *

X. Y. Z. (Chippenham).—(1) If I bought two fixed condensers of copper foil and waxed paper, would all additional condensers have to be of the same material? (2) How many kinds of wireless licences are there? (3) How much does each cost?

(*Continued on page* 872).

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 870.*)

No, the material will not have any effect. The capacity varies, however, with the kind of dielectric used, but providing the capacity is correct, any type of condensers could be used. (2) Primarily, there are three, if we count the transmitting licence. Otherwise, there are two—experimental reception licence and the broadcasting reception licence. (3) 10s. each for either of the receiving licences. Transmitting licences cost more.

* * *

A. H. C. (Upton Park).—(1) Should I have to pay the B.B.C. royalty if I constructed a set from bought parts? (2) Should I have to buy the licence before constructing the set. (3) Our garden is 30 ft. and the aerial will be 24 ft. high at one end and 15 ft. at the other. What type shall I use?

No. In this case, you could not pay the royalty on the complete set, but must buy the parts already stamped B.B.C. This means you are paying a small royalty on each part. (2) The licence should be obtained before the aerial is erected. (3) Use a twin aerial, the wires being not less than four feet apart.

* * *

"DETECTOR" London).—(1) Must I use a potentiometer with a carborundum crystal? (2) What wire do I use for the potentiometer?

(1) Yes, a potentiometer should be used. Except for very stong signals you will find it necessary. (2) About 20 yds. of No. 36 Eureka high-resistance wire. Wind on a former of any convenient size, separating each turn from the next.

* * *

P. K. M. (Wimbledon).—Why is it that I can hear Marconi House plainly, but never hear Croydon?

That may be due to quite a number of reasons. For instance, your tuner may be quite capable of tuning to 2 L O's 360 metres, but will not go up to Croydon's 900. Then, again, Croydon's transmissions are generally of a very brief nature, and can only be heard during "flying" hours. Possibly you would hear him loudly enough if you were listening-in on 900 metres while he was actually transmitting.

* * *

"RETAILER" (Liverpool).—Are licences granted by the P.M.G. for portable receiving sets?

Yes; licences are granted frequently in the case of wireless firms who desire to carry about a portable set for demonstration purposes. Also it is possible for bona-fide experimenters to obtain such a privilege.

* * *

F. J. (Budleigh).—Could my neighbour use my wireless mast for one end of his aerial without stopping me from receiving signals?

Yes; providing that both aerials were insulated, and neither of you employed reaction.

* * *

"WIRELESS" (Netherton).—Is it necessary that one should be able to read Morse before one can obtain an experimental licence?

In the case of a receiving experimental licence it is advisable and helpful to the success of the application to be able to do so, although it is not laid down as being absolutely essential. The latter exists, however, as a condition in respect of transmitting licences.

What is the wave-length of a coil 11 inches by 2 inches wound with 26 enamelled copper wire on an aerial 80 feet long?

Approximately 280–1,200 metres.

* * *

"TOC VIC" (Bradford).—I cannot fix an outdoor aerial, and will have to work with a frame aerial. (1) I have 75 feet of 40 strands of No. 30 S.W.G.; will this be suitable? (2) What size of frame do I require for broadcasting purposes? (3) Does one fasten an end of the aerial to an insulator?

(1) It would be better to use thicker wire, say 22 or 24 d.c.c. (2) Use a four-foot square frame. (3) No; both ends are taken to terminals, and these terminals are then connected to the A and E terminals on the set. You should use about five turns of wire, each turn spaced about ¼ in. from the next. A ·001 mfd. condenser is connected across the aerial terminals for tuning purposes.

T/Y

The Perfect Loud Speaker at last

We have acquired the sole manufacturing rights for the United Kingdom of a Wonderful New Loud Speaker, in principle entirely different to any yet placed upon the market. Instead of the unsightly horn, which causes distortion of the music and speech, this instrument comprises a handsome cabinet, the top of which is designed and manufactured from specially tested timber which is attacked by a volume of air. The principle can be incorporated into any cabinet wireless set, the lid of the cabinet forming the Loud Speaker. It can also be used as a separate instrument, as illustrated.

The "VIOLINA"

Loud Speaker de Luxe

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Price £5-5-0 Complete

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When once you have heard this instrument you will not tolerate any other make

Ask Your Wireless Dealer for a Demonstration.

IT IS NOT LIKE A TROMBONE! IT IS NOT LIKE A KLAXON!!
IT IS AS DELIGHTFUL AS A VIOLIN!!!

With this instrument you can hear the voice of the artist, the notes of any instrument, and the words of the speaker faithfully and perfectly reproduced. In addition it is an elegant piece of furniture, handsomely French polished, mahogany finish.

Before buying your Loud Speaker, make a point of hearing this instrument. Agents wanted in all parts. Inquiries from Manufacturers desirous of incorporating the "Violina" into existing Wireless Sets cordially invited.

If Early Delivery is desired place your order AT ONCE

Important Notice to all Wireless Manufacturers, Retailers, Experimenters and Amateurs

EX-GOVERNMENT WIRELESS APPARATUS.

A FEW WEEKS AGO we advertised the purchase of a complete Government Wireless Depot and offered the same for re-sale at astonishingly low prices in accordance with our invariable business rule to

SHARE OUR BARGAINS WITH OUR CUSTOMERS.

The immediate response to our advertisement resulted in our being "snowed under" with inquiries and orders from all over the country, and it was only through despatch staffs working night and day at full pressure that we were able to keep faith with our customers in respect of our promise to execute all orders

WITHIN 48 HOURS OF RECEIPT.

It was impossible to deal with the thousands of inquiries as expeditiously as we should have wished, and we again take the opportunity of tendering our apologies to all those who were, unfortunately, kept waiting.

WE have now purchased outright for spot cash the whole of the Wireless Material recently offered for sale at

WOOLWICH DOCKYARD AND KIDBROOKE, R.A.F. DEPOT.

The work entailed in compiling price-lists of the multitudinous variety is colossal, and it will be two or three weeks before these are available. You can help us considerably by **FILLING IN THE FORM AT THE FOOT OF THIS ADVERTISEMENT.**

You will then receive complete lists as soon as available.

A STARTLING OFFER

Complete 5-Valve Set, 2 H.F., 1 Detector and 2 L.F. The Famous R.A.F. 10, made by The General Electric Co., U.S.A., for the Royal Air Force.

Ideal for Broadcasting. Can be used with Loud Speaker with indoor aerial within 20 miles of the Broadcasting Station.

We guarantee this instrument to be as effective as any instrument costing up to £75.

Brand New, exactly as received from the Manufacturers.

OUR PRICE (limited quantity only) £15
Valves and Accessories extra.

—Fuller particulars on application.—

FILL UP THIS FORM NOW

and post to us immediately.

½d. stamp only required.

Messrs. THE CITY ACCUMULATOR CO.
Mail Order Department, 79, MARK LANE, LONDON, E.C.3.

Please include my name on your Mailing List. I am particularly interested in

.....

(Signed) .....

P.W. *Full Postal Address* .....

Date.....19.... .....

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R/Y

POPULAR WIRELESS WEEKLY, FEBRUARY 10, 1923. REGISTERED AT THE G.P.O. AS A NEWSPAPER

THE PERFECT BROADCASTING VOICE.

POPULAR WIRELESS Weekly

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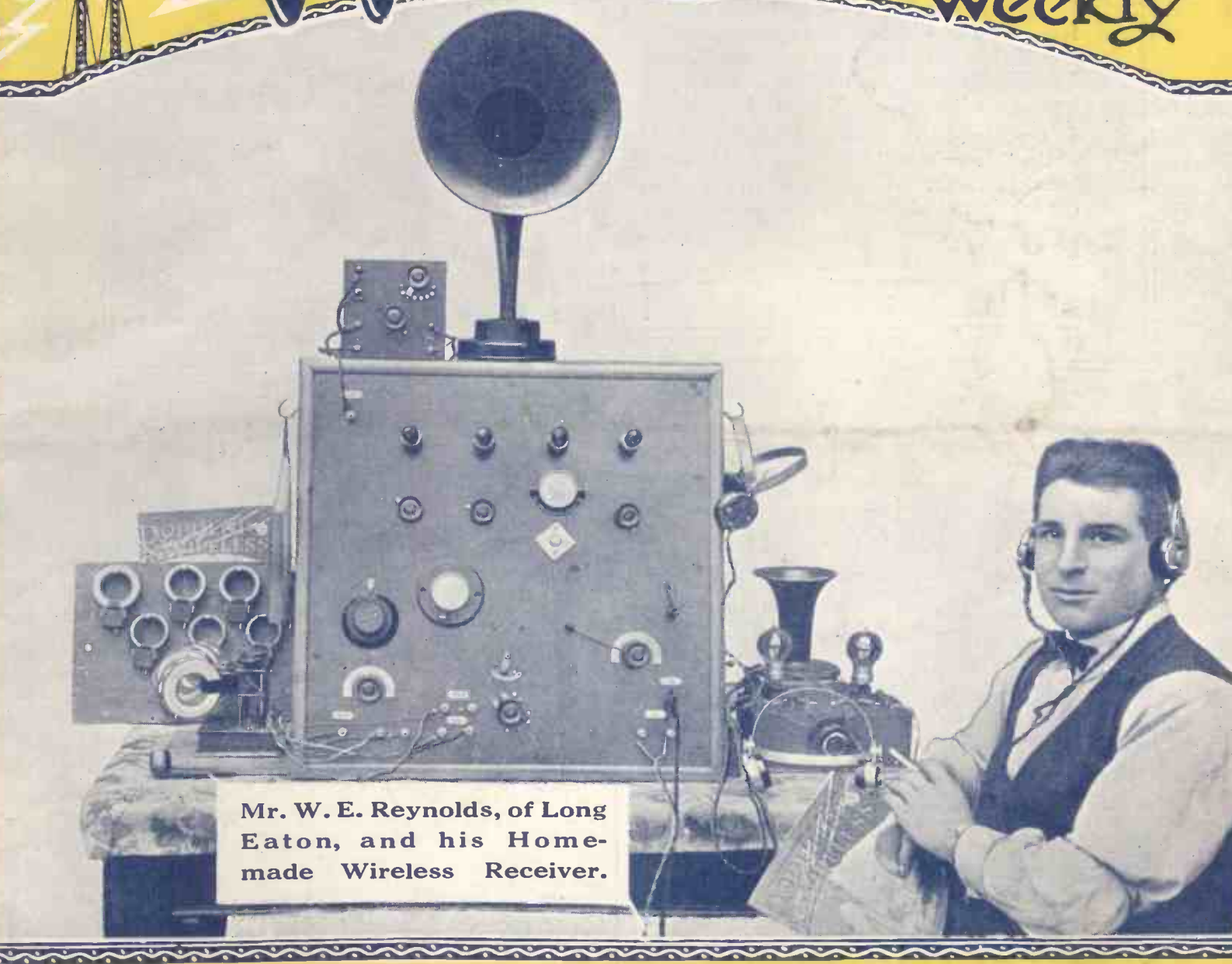


Mr. W. E. Reynolds, of Long Eaton, and his Home-made Wireless Receiver.

SPECIAL FEATURES.

Short Notes for Amateurs.

Making Honeycomb Coils.

What I Think of Broadcasting. By Sir Landon Ronald.

A Four-Page Beginners' Supplement, and many other excellent Articles.

NEXT WEEK.

Two Special Articles.

NOTES ON BROADCASTING.

By E. H. Shaughnessy, O.B.E., M.I.E.E.

(Engineer-in-chief, Wireless Department, G.P.O.)

and

WIRELESS AND TELEPATHY.

By P. J. Risdon, F.R.S.A.

Popular Wireless

TOPICAL NEWS AND NOTES.

NEXT WEEK.

THE BERNE WIRELESS STATION.

A PAGE OF IDEAS FOR AMATEURS.

THE RANGE OF RECEPTION.

Articles by E. BLAKE & SIR WILLIAM NOBLE.

Another Four-Page Beginners' Supplement.

Mind Your—Aerial.

A MAN caught cutting down the aerial of a wireless amateur at Ramsgate has been removed to an asylum.

The development of wireless telegraphy had preyed on his mind, and, obsessed by the idea that imaginary plugs in his neck enabled all his movements to be known, he determined to destroy an aerial a day.

* * *

Musical Wales.

MR. ARTHUR BURROWS, the Director of Programmes for the B.B.C., has recently been visiting Cardiff, arranging details for the transmissions from that station. Mr. Burrows told a Press man he considered the musical standard for Wales would have to be a high one, and suitable for Welsh sentiments. The report that a solo Welsh harp will figure largely in the transmissions is, I hear, unfounded.

* * *

"Bars" of Music.

A WELL-KNOWN K.C. considers that wireless is not in law a purely mechanical affair, and he does not think the police are likely to interfere at present where "loud speakers" are used in public bars and cafés.

If the police do take action, I hear the Licensed Victuallers' Association is prepared to fight a test case.

* * *

Australian Progress.

THE High Commissioner for Australia has received cabled advice to the effect that Australian manufacturers of wireless instruments, traders, and others interested have formed themselves into an association for the progress of wireless in Australia.

* * *

A Hebrides Station.

OWING to the breakage of telegraph cable between the lonely islands of Tiree and Coll, all communication by telegraph between Tiree and the mainland of Scotland was severed, and owing to the inability of the Government cable ship to proceed to the Hebrides, the cable remains broken upon the bed of the Sound of Gunna.

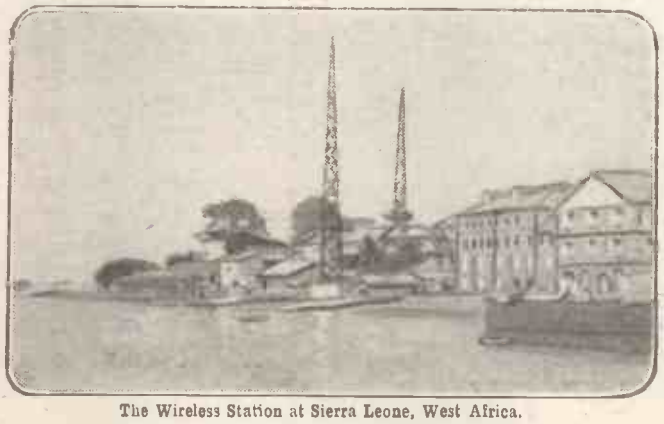
The postal authorities, therefore, have decided to erect on the island the first wireless installation.

A suitable site has been selected at Scarinish for the mast and aerials, that reach a height of 80 feet, and the station will be capable of receiving messages from Le Havre, London, and even New York broadcasting stations.

Wireless Inspectors.

IT is pointed out that wireless users will be visited by telephone inspectors, who will be armed with the proper authority, and who may possibly be in uniform. This, however, has not yet been definitely settled.

A Post Office official, however, states that no fresh officials are to be appointed, and the work of inspection will be performed by members of the telephone engineering staff in the course of their ordinary work.



The Wireless Station at Sierra Leone, West Africa.

Motor-car Sets

A SPECIAL feature is being made of the installation of wireless receiving sets in Daimler cars, and in conjunction with the Marconi Company compact and powerful apparatus has been devised to receive broadcasting while travelling by motor. One of the large Daimler models has been fitted with this gear and receives the broadcast nightly concert programmes.

* * *

Apparatus Used.

THE aerial consists of a small flat copper plate just clear of the roof, and it is hoped that shortly no visible aerial will be in use at all. It will then consist of a sheet of copper foil in between ebonite sheets. The sets are fitted without altering the body work of the car in any way, and nothing is visible inside the car itself except the head telephones.

The multi-valve panel with which the model is equipped is hidden in the flooring, and adjustments of wave-length are made by means of a single tuning condenser, very sharply tuned. The apparatus is carefully screened so that no interference is caused by the ignition, and excellent results have been obtained in recent tests.

Wireless in Schools.

HARNESSED to education, there are great possibilities for wireless. Some time ago, owing to the expense chiefly, Dudley Education Committee had to abandon its play centres, but if the necessary permission is forthcoming teachers at some schools intend to try and interest the children in the evenings and keep them off the streets.

It is to be done through wireless, and Bayliss's School in Tower Street is one of the first in the country to attempt broadcasting. The headmaster, Mr. Perry, and his staff are enthusiastic as to the possibilities of wireless educationally, and one of the senior teachers, Mr. W. McClean, has himself built a crystal set, erected his own aerial on the flag pole of the school, and with a small outlay has provided an efficient apparatus.

* * *

Various Items.

THE Holborn Radio Co., Ltd., have removed to more commodious premises at 267, High Holborn.

* * *

I HEAR from Messrs. Rogers, Foster and Howell, Radio Engineers, of Edward Road, Birmingham, that they have now perfected 2-, 3- and 4-valve receivers containing reactance, but conforming in every respect with the regulations of the ordinary broadcasting licence.

* * *

MARCONI'S Wireless Telegraph Company announce that they have introduced a Week-end Wireless Letter Service to the United States at the rate of threepence per word without minimum.

Telegrams sent by this service must reach Radio House, 2-12, Wilson Street, E.C.2, either by hand or post, before midnight on Saturdays, and will be delivered in New York City on Monday by messenger.

* * *

MR. FRED. ROBERTS has been appointed musical director for the Cardiff broadcasting station. Mr. Roberts has an intimate knowledge of musical tastes in Wales.

NOTES AND NEWS

(*Continued from previous page.*)

A New Broadcaster.

A CORRESPONDENT in Amsterdam tells me that a concert is given every Wednesday from 8.10 to 9.40 from a station belonging to Messrs. Smith and Thorogood, Amsterdam. The wave-length is 1,050 metres, but the call sign is not given.

* * *

A Paris One, Too!

THE High School of Posts and Telegraphs, Paris, broadcasts a concert every Tuesday and Thursday evening, from 7.45 to 10 p.m., and on Saturday afternoons from 4.30 to 7.30 p.m. The wave-length is 450 metres. The power is not known, nor the call sign, but the former is certainly greater than that used for the Radiola Concerts.

Mr. A. A. Swaseland's home-made set, 74, Grenard Road, Peckham.

Another Wonder Valve.

NEWS is to hand of a new valve discovery from the General Electric Co.'s laboratories, America.

The valve, it is stated, can deal with 1,000 kilowatts, the equivalent of 1,300 h.p.

By coating the filament with a layer of thorium oxide $\frac{1}{100,000,000}$th of an inch thick the electron flow is increased a hundred thousand times. Dr. Irving Langmuir—whose articles on the new type of valve appeared in POPULAR WIRELESS some time ago—may yet find his invention rendered obsolete by this new valve marvel.

* * *

Backward Britain.

OWING to the failure of the Marconi Company to obtain the necessary licences from the Government for the erection of high-power wireless stations in this country, a crisis has arisen in the consortium of wireless companies of Great Britain, France, Germany, and the United States which was formed for inter-communication with the South American Republics. The situation was under discussion at a conference which took place in London recently, at which the following representatives were present:

Great Britain, Mr. Godfrey Isaacs and Colonel A. F. H. Simpson; America, Mr. E. J. Nally; France, M. Emil Girardeau; Germany, Dr. Schapira.

Mr. Isaacs stated to a press man that Great Britain took the initiative in forming this consortium.

"In its power of communication," he said, "this country is already far behind France, Germany, America, and Japan—a serious state of affairs both in peace and in war—and that has been brought about solely by the failure of our Government or our Government departments."

* * *

Sir Oliver Lodge.

SIR OLIVER LODGE has delivered the first Silvanus Thompson Memorial Lecture at Finsbury Technical College. Sir Oliver was an intimate friend of Dr. Silvanus Thompson, who had been Principal of the College for over thirty years at the time of his death in 1916. Sir Charles Parsons presided.

Sir Oliver entitled his address "The Origin or Basis of Wireless Communication."

That Indispensable Ether.

The lecturer emphasised that we should not hesitate to speak and think of the ether of space as the continuous reality which connected everyone up, and which welded not only the world but all the planets into a coherent system.

We must not be misled by any misapprehension of the theory of relativity into supposing that that theory dispenses with the ether, merely because it succeeded in ignoring it. One could ignore a thing without putting it out of existence, and the leaders in that theory were well aware that for anything like a physical explanation of light or electricity or magnetism or cohesion or gravitation, the ether was indispensable.

* * *

Glasgow Broadcasting Station.

THE permanent broadcasting station in Glasgow, it is announced by the British Broadcasting Company, will probably be in operation at the beginning of March. The new station, which is to be situated at the Port-Dundas Power Station, is now in course of erection. It will, when completed, be equal in power and in equipment to the London broadcasting station, so that Glasgow wireless enthusiasts will be equally well served so far as the means of transmission is concerned.

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.
London Broadcasting Station, Strand ..	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 ..	As a rule from 7 to 10 p.m.
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.).
Glasgow Broadcasting Station	5SC ..	415 ..	Commencing shortly.
Cardiff Broadcasting Station	5WA ..	395 ..	Service commencing shortly.
Croydon	GED ..	900 ..	Throughout day to aeroplanes.
Writtle, Essex	2MT ..	400 ..	Service discontinued.
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 ..	1,100 ..	12 o'c. and 16.50 o'c. Telephony.
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.
School of Posts and Telegraphs, Paris ..	—— ..	450 ..	Every Tuesday and Thursday, 7.45-10 p.m. Saturdays, 4.30-7.30 p.m.

Note.—See announcements in daily Press for last minute alterations in times of Broadcasting Programmes. No Broadcasting during hours of public worship on Sundays.

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.

PROFESSOR LOW AND OUR RADIO FUTURE.

By **C. H. STEDMAN.**

HAVING been associated for several years with Prof. A. M. Low, the well-known scientist, it may be of interest to many readers of POPULAR WIRELESS to hear about some of the research work continually being carried out by this earnest worker.

Not only in the vast realms of Wireless are many experiments made in his interesting laboratory, but the internal combustion engine, more particularly as applied to pleasure and transport vehicles, has claimed, and is claiming, thoughtful and careful research, always with a view to greater simplification and improvement.

During the war, Prof. Low's laboratory was taken over by the Government, and he, as O.C., together with a selected body of skilled craftsmen, carried out many secret experiments and constructed costly apparatus. The control of aerial torpedoes by wireless was but one of the most interesting experiments, and it was successfully demonstrated that a small biplane could be manœuvred from the ground under wireless control. Again, after much labour, a very simple piece of apparatus was devised for the wireless control of sea torpedoes, with excellent results; in fact, some of this control gear is in use at the present time.

Wireless is daily becoming of more interest in the home for the entertainment of young and old alike. Receiving sets are being offered to the public in many and varied forms, making the choice of a suitable set for a particular home a matter of some little difficulty.

America on a Crystal!

With the circuits allowed for sets to receive the broadcast concerts and news, it is of great importance to ascertain the useful range of a given set. Experiments are being carried out with thiso bject in view, and the *modus operandi* is, roughly, as follows:

A car is fitted up with a number of sets, ranging from a "crystal" to the multi-valve type, and a selected spot is reached which is considered to be within the capacity of the particular set for reception. An aerial is rigged up and "listening-in" commences during the time broadcasting is "on tap." Results certainly vary, but it is possible to obtain some very good idea of the mileage range of any set, and it is marked accordingly.

Thus, with the aerial used on these occasions, which is, of necessity, rather crude, it is safe to assume that given a reasonably well-arranged aerial, the ultimate use of the set should be satisfactory, and, if anything, within its *real* range. This seems a very fair way of dealing with such a problem as range, as it is one of the leading questions asked by purchasers of sets, who, after all, are entitled to know what they are buying. It is, of course, admitted that often a crudely constructed set will receive over a very wide range, to the great joy of the owner, but to the mixed joy of the research scientist who is seeking for the explanation.

In dealing with this practical side of the use of wireless, it is perhaps advisable to point out that even in conducting such experiments as those described the research worker is continually happening on something new which sets his mind on some problem calling for a solution. Prof. Low thinks that amateurs of a scientific turn of mind, and all wireless amateurs can surely be classed as such, ought to concentrate on the investigation of unusual cases. When they receive broadcasting from America on a cheap crystal set, it is the basic reasons into which they should enquire.

During "Still Watches."

There is nothing fantastic in supposing that wireless may be used for sight, as well as for telegraphy and speech. Prof. Low is most surely of the opinion that in the near future perhaps it will be possible to obtain a clear picture at will by means of wireless. Is it fanciful to suggest that while "listening-in" one may be able to see, pictured on a mirror or screen, the actual forms of the orchestra, the singer, or the teller of bedtime stories?

Professor A. M. Low.

The scientist has much in store for us, and the quiet research work going on is teeming with vast possibilities. Experiments with regard to the reflection of sound and light and on various forms of aetheric oscillations are continually going on in our laboratory, together with other wave interference experiments, which have a direct bearing on "wireless sight."

One of the recent experiments carried out by Prof. Low will most surely be of interest to readers and more particularly to the fortunate owner of a car. Using a pocket sending set and an umbrella aerial, he has been able to call up his car which was fitted with a special receiving apparatus. This set is at present only suitable for short distances, but it illustrates a practical use for wireless. Further experiments are being carried out, and difficulties experienced have yet to be overcome, but I mention it to show that research work never ceases.

Another most interesting and useful experiment is the testing of loud speakers for sound-wave purity. This is carried out by taking a "sound photograph" of the waves emanating from a loud speaker, and comparing it with a photograph taken of the voice of a singer, or musical instrument, as the case may be.

While on the subject of sound, the reader will be interested to hear that Prof. Low makes use of the dictaphone for the reception of ideas. It is a fact that he keeps one of these machines at his bedside, and in the "still watches" pours into its uncomplaining receiver ideas which are destined for future use. For instance, one of these ideas, gathered in this way, is now being worked on, and will ultimately take the form of a dictaphone driven by clockwork small enough to be contained in a travelling case. This suggests at once the business man of the future, who when travelling is in constant touch with his office by wireless, dictating letters into his dictaphone and posting back to his secretary the flat records.

At present the business man thinks he is busy, but in reality spends about half of his time in travelling, eating, and sleeping. The business man of the future will look upon us as having a quiet and leisurely existence, just as we regard the business man of a hundred years ago as leading a soft life. If a curve be plotted between hours of thought and date, it shows that the time devoted to work is steadily rising.

Broadcasting Old Bailey.

Soon the business man will, with the help of wireless, use all his time and make appointments for odd *minutes* while at lunch. There is no reason at all to suppose that the above curve should suddenly break down; on the contrary, humanly speaking, it should go on rising. The research in which Prof. Low engages, is on broad lines, looking into the future. He is a firm believer in the extension of wireless communication, which must make for better international understanding, and consequently lessen the cause of wars.

At present public broadcasting is romantically better than the gramophone, but offers less choice. Broadcasting at its best should give us at the time of happening, descriptions of famous trials, parliamentary speeches—a mixed blessing, although home truths by our Labour members would certainly enliven us—instantaneous details of football matches with the crowd's "voice" as a sure guide to the success or otherwise of the home team!

The Radio Association, of which Prof. Low is an active member, has great hopes of wireless as a means of affording instructive entertainment to a vast public. The amateur is given every help in his pursuit of wireless knowledge by the Association.

The latest invention of Prof. Low will, it is hoped, be of assistance to the blind, enabling them to enjoy a wider choice of reading matter. He has enthused the whole laboratory with a great desire to present the finished article to such a noble cause.

HOW TO MAKE HONEYCOMB AND BASKET COILS.

A Useful Article for the Amateur making his own Receiver.

By A. W. DRANSFIELD.

IT is proposed to describe an experimental winder for the above type of coils, but it must be understood that it is possible to vary the measurements. This winder will permit of the making of the ordinary basket type of coil, or three different widths of the honeycomb type, and the sizes given will make a winder that will give the experimenter plenty of scope.

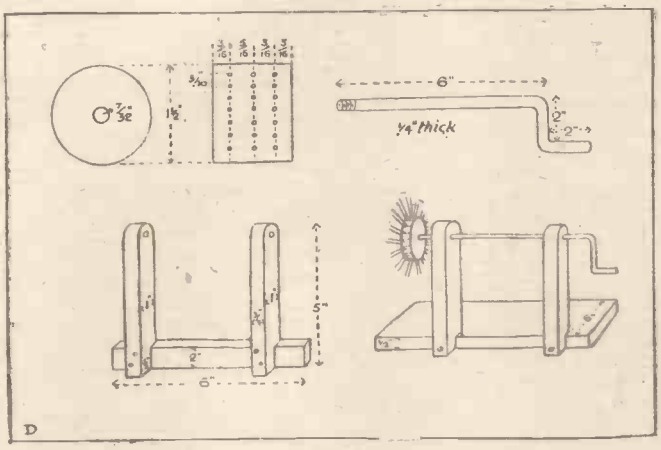


Fig. 1

This winder is well within the scope of any amateur possessing a few tools and odds and ends. In the first place, a piece of round material is required; the writer used a piece of 1½ in. ebonite, but a piece of hard wood will serve quite as well. Round this was scribed three lines parallel with the edge, which was, of course, straight; these lines are spaced as in the drawing. The first line is $\frac{3}{16}$ in. from the edge, the next $\frac{5}{16}$ in. farther in, and the last line $\frac{3}{16}$ in. still farther. It will be seen by this that quite a $\frac{7}{8}$ in. of the round material is required to get all these lines in.

In the centre of one end drill a $\frac{7}{32}$ in. hole, but not right through. This hole is to be tapped with a ¼ in. tap. Now set the dividers or compass $\frac{3}{10}$ in., and mark round the line nearest the edge in equal divisions, and, if the compass is set just right, there should be 15 equally spaced marks.

Drill small holes to take 15 gauge cycle-spokes at each of the marks, holding the drill up straight and pointing towards the centre. The other two lines will have to be marked in line with these holes, and drilled in the same manner. The finished core will now be a piece of round material that has three rows of 15 holes, spaced so that there are 15 equidistant holes in each line. The diagram (Fig. 1) shows this clearly.

Now cut off 30 pieces of 15 gauge cycle spoke, file off all the cutting burrs, and make them all quite smooth. These will form the spokes to wind the coils on, and for this experiment they should be 1½ in. long. The spindle of the winder is quite a simple matter. A piece of ¼ in. stair-rod will do quite well. It has to be cranked one end to form the handle, and on the other end is cut a ¼ in. thread for a distance of ¾ in.

The mounting is made of wood and will be, perhaps, more easily understood by referring first to the diagram. The uprights are shaped and then held together in the vice, and drilled at the same time to ensure that the holes (¼ in.) will be in line. The notches are cut in the same manner, as it will help to get the uprights more accurate and make the spindle run nicely. If it is desired to lay the winder on the table, it is as well to fasten the uprights on the edge of a flat piece of ¾ in. wood, and put a weight on the board; but, if it is to be held in the vice, then the uprights should be fastened on a narrow flat piece in the manner shown in the diagram (Fig. 1).

The whole winder may now be assembled, and the spokes put in their holes. To wind a basket coil only one row of spokes will be needed, the wire being wound in and out of the spokes until the diameter desired is reached. After having wound the coil dip it in molten wax, and allow it to set, then draw the spokes out, and the coil will come off quite easily.

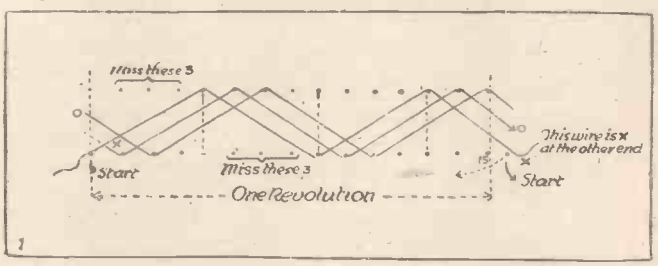


Fig. 2

Now for a honeycomb coil. This is rather a different job. It will be seen that three different sizes of widths may be made—*i.e.*, $\frac{3}{16}$ in., $\frac{5}{16}$ in., and ½ in. The following will tune from 360 to 400 metres for broadcast reception.

First set the spokes so that they are in the $\frac{3}{16}$ in. lines, and, winding a turn or two round the core outside the spokes, then pass the wire round any one spoke. Now lay the wire inside the spokes in the direction of the other row of spokes, missing three, and going outside the fourth. Passing inside again, and crossing over to the other side, missing three and going outside the fourth (see Fig. 2). One complete layer should appear as in Fig. 3.

Fig. 3

This is repeated until counting up the layers on *one* spoke there should be 16 layers. This does not mean there are only 16 turns of wire on the spool, as it will be seen that the actual number of turns will be 16 times 15 (see Fig. 3). A little patience is required to wind the first coil, but, like all jobs of this sort, one soon acquires the "knack."

Removing Completed Coils.

With a little care the complete coil can be removed at once, as these coils hold together very well, and will allow a test to see if a little wire has to be taken off. It is always as well to make the coils *larger* than required, and adjust on test by taking off a turn or two. The wire used was 26 gauge double S. If satisfied with the test the coil should be taped with empire tape, or insulating tape of the ordinary kind.

A good plan is to lay a narrow strip of waxed paper between the spokes before commencing winding, this allows the coil to slip off the former easier.

When testing first coil pass the end of the wire right through the meshing, this will keep the outside winding from becoming unravelled. Keep a fairly good tension on the wire whilst winding, this will make a nice sharp kink round the spokes, and will help to keep the coil in decent shape.

The writer tested one coil by first wrapping a piece of insulating tape right round the outside of the coil, and then took away the surplus from the inside turns.

Before removing the coil from the former, take it right off the spindle; this will save straining the uprights when drawing out the spokes.

In this article I have not given full winding details for a set of coils to cover all the wave-lengths that may be required, and, in any case, it is much a matter of experiment.

The best plan is to wind a set from, say, a small one of but 25 turns to a large one of 250 turns. One cannot wind too many different coils, remembering that an ideal tuning is where no capacity variation is required and the inductance value is correct "to a turn."

WHAT I THINK OF BROADCASTING.

In the following article, written specially for POPULAR WIRELESS, one of our great musicians, Sir Landon Ronald, gives his opinion on the present state of broadcasting. During the opera season a representative of this journal took a portable set to Sir Landon Ronald's home and demonstrated the possibilities of wireless to him. Sir Landon Ronald is the Principal of the Guildhall School of Music, a conductor of international fame, and the composer of many well-known songs.

By SIR LANDON RONALD.

LET me say at once that my first experience of "listening-in" to a broadcast wireless concert was—for me—a great revelation. Like other people who read the papers I have noticed the increasing popularity of broadcasting, and not having a set of my own, have often wondered how clear the received music really was, and whether one could enjoy a concert by wireless without a steady accompaniment of buzzings. The other evening my curiosity was satisfied,

Sitting comfortably in an armchair in my study before the fire, I listened to the British National Opera Company at Covent Garden. The opera that night was Wagner's Siegfried, and when a representative of POPULAR WIRELESS (who had kindly brought a portable set to my home) handed me a pair of telephones, I put them on my head quite unprepared for the shock I was to experience.

For I did receive a shock—not an electric one—but an emotional one; with clarity and volume of sound I heard the Covent Garden Orchestra, and rising above it, the voice of Mime. To one who knows the opera it adds to the interest to follow its course with a full score on one's knees.

Bar by bar I followed the whole of the first act—noting the little faults—the orchestral "slips," and the way in which the conductor most ingeniously "caught up" "Siegfried" when the singer missed a bar or hurried the tempo.

A Candid Opinion.

In fact, I thoroughly enjoyed myself. My candid opinion of the way in which opera is broadcast is as follows; the strings come out poorly; they seem to be unable to make themselves noticed above the other instruments in the orchestra. This may be due, I am told, to the position of the microphones at Covent Garden. On the other hand the brass instruments were superb. The singing, also, I thought excellent in many ways.

Siegfried, of course, is not an ideal opera for broadcasting. There are many long orchestral pauses and long passages for the bass instruments which do not come out well when listening-in; but, on the other hand, there are parts of this opera which come out so clearly that at times I could hardly realise I was not at Covent Garden in the flesh, instead of in the imagination.

Towards the end of the first act I thought the transmission slowly improved—but this may be due to the fact that I was getting accustomed to wearing the telephones, which are, of course, a little strange to one listening-in for the first time. If it is indeed true that the improved "loud speaking" horns reproduce the broadcast concerts loud enough to be heard all over a large room, and at the same time lose but little of the quality and "human feeling" of the telephones—then truly wireless receivers will soon be in every home.

Sir Landon Ronald.

I think it is an excellent idea of the organisers to let listeners-in hear the clapping of the audience at Covent Garden. At once you catch a feeling of the atmosphere; you know instinctively when some particular item has aroused enthusiasm; even the "encores" and the "bravo's" come out clearly. And when the mysterious person at the Broadcasting station announced that "We are now switching off from Covent Garden." I laid down the telephones with real regret.

I will not linger on the wonder of this wireless broadcasting. To me, as it is to thousands of others, it is a mystery; a wonderful achievement of human endeavour and brilliant invention. The genius of Marconi has enabled the present generation to enjoy educational and entertaining lectures and musical items by the thousand without leaving their home.

Selecting Programmes.

And what a future wireless broadcasting has before it! One's imagination almost recoils before the vista opened up—the boundless possibilities that lie ahead.

Most sincerely do I hope that those responsible for the programmes will see to it that the right stuff is selected. The problem of pleasing untold thousands is one from which many a good man might shrink, but I believe the problem can be successfully solved if studied carefully and with sincere purpose.

It occurs to me that certain programmes might be selected either for various portions of each evening, or for different nights of each week. Mondays might be devoted to classical music; Tuesdays, musical comedy; Wednesdays, operatic, and so on, reserving Saturday for dance music and Sundays for sacred concerts.

In any case, the whole thing is very interesting, and has enormous possibilities.

ADDITIONS TO POPULAR WIRELESS DIRECTORY OF AMATEUR STATIONS.

NOTE: C W=Continuous Wave. R/T=Telephony. Sp.=Spark. T.T.=Tonic Train.

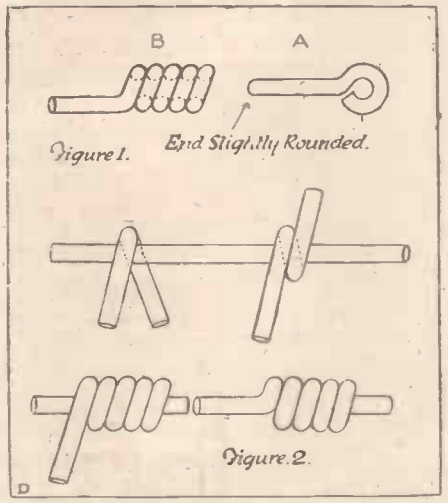
Call Sign.	System.	Name.	Address.
5 A K	C.W., R/T & Sp.	H. G. Mansell	Cleve View Harrington, Evesham.
5 A N	T.T & R/T	W. J. Joughin	21, Troughton, Charlton, S.E. 7.
5 A U	C.W. & R/T	Dubilier Condenser Co.	London, W.12
5 C V	C.W., R/T & T.T.	R. J. Harrison	"Seaton," Walton-on-Thames.
5 D M	C.W. & T.T.	A. Jackson Ley	Grove House, Albert Grove, Nottingham.
5 G B	C.W., T.T. & R/T & Sp.	L. Humphries	61, Geraint St., Princes, Park, Liverpool.
2 W T	Artificial Aerial	H. Chadwick	9, Raimond St., Halliwell.
2 X W	C.W. & R.T.	H. A. Woodyer	118, Buckingham Rd., Heaton Moor, Stockport.
2 Y N	C.W. & R/T	A. W. Thompson	32, St. Nicholas St., Scarborough.
2 Y Y	C.W. & Duplex Tel.	O. H Patterson	26, Allerton Rd., N. 16.
2 Z V	C.W. & R/T	F. T. Smith	Rutlands, Felsted, Essex.
2 A V	R/T	D. H. W. Swiney	18, Southchurch Rd., Southend-on-Sea.
2 C B	C.W. & R/T	W. E. Cooke	29, Empress Avenue, Chingford.
2 C P	Portable Set	J. C. Elmer	14, Gordon Sq., Birchington-on-Sea.
2 G T	Sp. & C.W.	G. Irvine	12, Treboth St., Liverpool.
2 O J	C.W., R/T & Sp.	E. A. Hoghton	52, First Avenue, Hove, Sussex.
2 U N	C.W. & R/T	14th Cardiff Scouts	Cardiff.
2 W L	C.W., R/T & Sp.	F. J. Cripwell	Lonkhill, Thorpe, Tamworth.

SHORT NOTES FOR AMATEURS.

SIMPLE PLUG CONNECTIONS.

NO doubt many readers are constructing a set of panels on the unit system, which is one of the best arrangements for the experimenter owing to its capability for extension. A cheap and, at the same time, an efficient connector for the various leads will therefore be appreciated, especially by the experimenter who prefers to make all he possibly can of his apparatus.

The connector consists of two parts, a plug A and a socket B, Fig. 1, both of which



can be very quickly made from a length of 15 S.W.G. bare copper wire with the aid of a small pair of round-nose pliers and a knitting-needle or another wire of slightly smaller diameter, say 16 S.W.G.

When Wiring Up.

Fig. 2 is practically self-explanatory and shows how to make the sockets. The plugs need no explanation, and it is surprising how quickly they can be made. In use, the plugs are soldered to the ends of the leads on, say, the left-hand side of each panel, and the sockets on the right-hand side. The leads should be of flexible wire, and the soldered joints should be covered with insulating tape and wrapped with cotton or silk of a distinctive colour to prevent the possibility of a wrong connection being made. It would be an advantage for a short length of indiarubber tubing to be slipped over the outside of the sockets and then bound with the coloured cotton or silk to match the corresponding plugs.

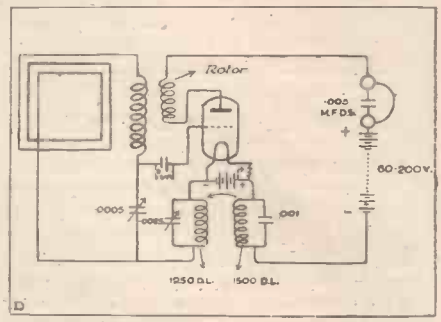
AN INVITATION TO READERS.

Short, instructive articles are welcomed from readers of POPULAR WIRELESS. Copy should be as short and concise as possible. If accepted for publication, articles will be paid for at our usual rates.

A SINGLE VALVE "SUPER."

THIS circuit is of American origin, with some additions and exceptions. The loop aerial consists of 9 turns round a 3-foot frame with 4 tappings. The value of the condenser across the A.T.I. was, in my case, ·0003 mfd, but the capacity shown in the diagram is more suitable.

A.T.I., 40 turns with 8 tappings, with rotor 60–70 turns for reaction. Grid leak can be omitted without any appreciable difference. The ·0025 condenser is really necessary, although perhaps hard to obtain. I was fortunate in possessing a De Forest of that capacity. D.L. coils are to be preferred to those which I roughly pile wound on bobbins for economy's sake, having thoughtlessly disposed of a good stock of D.L. coils when I found that I obtained such good results with a home-constructed tuner.



Coils mentioned here should be constructed to obtain a variable coupling between same.

The best results are obtained with the set just off the oscillation point. As the adjustments are very critical a certain amount of patience is needed to obtain the best results.

Ordinary valves can be used, but a power-valve is to be preferred, as it is capable of taking the necessary high-plate current without risk of damage.

THE USE OF INDOOR AERIALS.

JUDGING from the queries which are being sent to the radio papers from time to time regarding aerials, it would appear that amateurs are concentrating on outside aerials, and are neglecting the advantages of indoor aerials.

Of course, we all know that the better the aerial the more efficient will be the results, but those of us living in flats or houses not possessing back gardens are under a disadvantage when we wish to erect our outside aerial.

Some Results Obtained.

It is not always convenient or easy to obtain permission to erect a pole on another person's property, and it was owing to this that we have experimented successfully with an indoor aerial. By the words "indoor aerial" we do not mean a frame or loop aerial which is a very different thing. We mean an aerial stretched several times across a room and suspended some two or three inches below the ceiling.

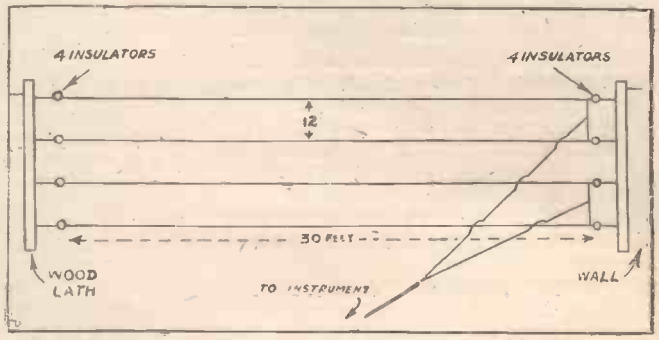
Those of us who are on upper floors of high buildings (blocks of flats, etc.), where the rooms are fairly large, will find this an excellent way of obtaining splendid results. No 20 gauge rubber-covered wire is used. In experimenting with other kinds of wire we have noticed that this wire (which, by the way is called Pertinax) to be easily the most efficient.

For those who have no large room, the same good results can be obtained with the aerial erected in a passage, preferably near the roof.

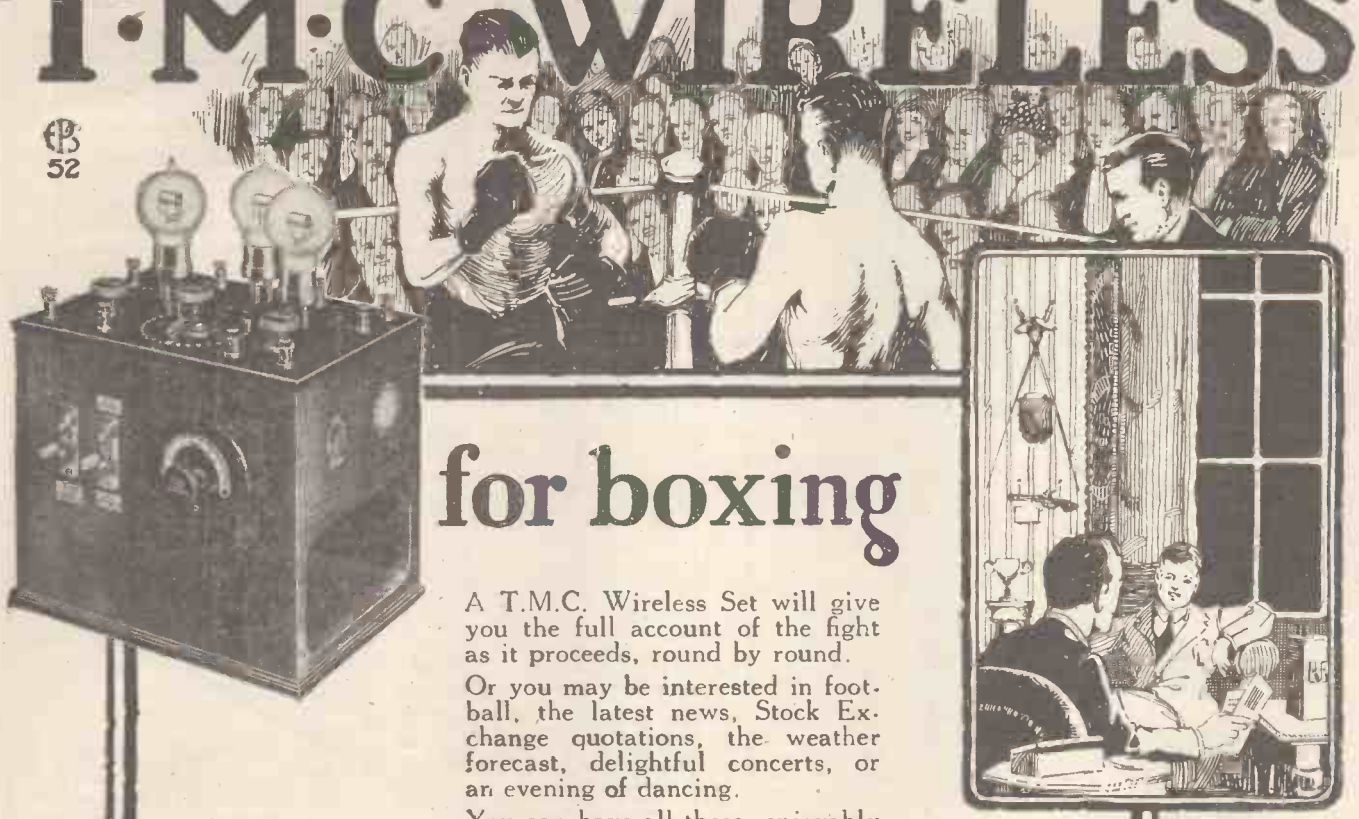
Naturally, the higher the aerial from the ground the better the result. On an aerial similar to the one described and erected in a top landing of a house in North London—at a height of about 25 ft. above the ground—excellent telephony was received from 5 C P at Ealing and 2 O M at Brentford, using two valves, with three pairs of telephones in circuit. The receiving instruments were one H.F. and one Detector Unit. When using the detector by itself, Marconi House came in quite loudly and very clearly.

Usual Earth Required.

From these experiments it will be seen that the amateur who is prohibited from using an outdoor aerial can still get splendid results by the exercise of a little ingenuity and care. The usual earth will be required—a water pipe is the most suitable.



T·M·C WIRELESS



for boxing

A T.M.C. Wireless Set will give you the full account of the fight as it proceeds, round by round.

Or you may be interested in football, the latest news, Stock Exchange quotations, the weather forecast, delightful concerts, or an evening of dancing.

You can have all these, enjoyably and pleasurably, in the comfort of your own home, with a T.M.C. Wireless Receiver.

There is no trouble to you—T.M.C. have engineers in every large town, who will install and periodically inspect the apparatus.

T.M.C. Wireless is particularly simple to work, and gives every satisfaction.

T.M.C. Wireless Receivers, which are fully approved by the Postmaster-General, bear the seal of the British Broadcasting Company.

The wide variety of models are entirely British made.

From £4 : 5 : 0 upwards, including all Royalties.

London, Birmingham, Manchester and Newcastle are broadcasting now.

Come and listen to them any evening up to 10 p.m. at our showrooms in London, Birmingham, Belfast, Bristol, Cardiff, Dublin, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Sheffield.

Write to us for our nearest address.

The "Everset" Crystal. No adjustment necessary. Fits any crystal receiver.

10/- each.

T·M·C Makes Wireless Worth While

TELEPHONE MFG., Co. LTD.

HOLLINGSWORTH WORKS, DULWICH, LONDON, S.E.21.

USEFUL ADAPTATIONS FOR YOUR SET.

By S. V. HEAP, A.C.P.

HOLDERS of experimental licences who contemplate building their own receiving sets, or modifying and improving those already built, may appreciate a few tips culled from practical experience of the beginner's difficulties and limitations.

The over-ambitious tyro is apt to select too large a former on which to wind his inductance, with the result that he cannot readily tune down to broadcasting wavelengths. Moreover, he is likely to make or buy a frail cardboard cylinder—impregnated with paraffin wax or otherwise—liable to get out of shape through pressure of the slider and hygroscopic susceptibility to weather changes.

Coil Winding Tip.

Should he try to avoid this by using an extra stout cylinder he will not find much improvement, as the continued pressure of the slider will eventually cause a pronounced furrow or depression on the surface of the tube. An ebonite tube, of course, would avoid this difficulty, but ebonite is expensive, and ebonite tubes are not always at hand when wanted by the man who does not live in one of our large towns.

A remarkably good substitute, however, is found in the shape of a stout lamp glass cylinder, or in one of the plain glass cylinders so often used with the upright incandescent gas burner. With due care no special difficulty is attached to the winding of an inductance on such a former.

A couple of corks taken from pickle jars may be selected or cut to fit the ends quite accurately, and a stout knitting needle thrust through the pair makes a serviceable spindle for supporting the cylinder during the process of winding. It is a good thing to warm the glass and brush over it a coating of paraffin wax to lessen the tendency of the wire to spring off the former if the tension is for any reason relaxed during the winding.

Cheap Variable Condenser.

The wire should be fastened at the beginning by being thrust through the cork end twice in the form of a stitch. Additional security is afforded by dipping it in shellac varnish. On completion the wire is similarly fastened off by being passed through the other cork twice, a length of six inches or more being left for making connection.

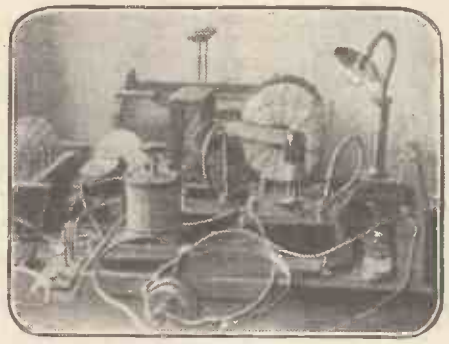
The best way of supporting such a cylindrical inductance is by cutting suitably sized holes half-way through the wooden end supports, using a centre-bit, or Clark's expansion bit. Those who do not possess these tools may mark out the position carefully with compasses, and cut out the wood with gouge and chisel.

Glass being such a good insulator adds greatly to the efficiency of the inductance, which is further increased by placing narrow strips of sheet ebonite under the wooden end supports. Wireless apparatus is usually handled with such care that the fragility of glass as compared with other materials is of little account.

A most useful, cheap, and efficient variable condenser may be constructed from two similar glass cylinders of such a size that one slides comfortably within the other. The outer surfaces of each are to be covered with tinfoil to within three-quarters of an inch of each end. The best adhesive is a strong solution of gum arabic. Means of mounting the same on a convenient base with terminals, and of enclosing it within a wooden box with open end, or glass cabinet as described in a previous article, will readily suggest themselves to the interested reader.

Handling Unit Sets.

The small glass cylinders used in certain makes of drip-feed lubricators for motor-cycles make ideal dust and damp excluders



Home-made set by Mr. W. George, Ambridge, 82, Edinburgh Road, Walthamstow, E.17.

for perikon and other types of crystal detectors at a cost of a few pence, and they can be used either in the horizontal or vertical position.

Experimenters who build or buy sets on the "unit" system with panels 7 in. by 5 in., or larger, will find a baseboard large enough to accommodate all the panels a great advantage. It is inviting trouble to have several small connected panels loose on a table or bench. An accidental tug at a connecting wire may occasion a broken valve filament if nothing worse.

Baseboard Terminals.

A cheap drawing-board of three-ply wood makes an excellent base for a set of these small units. It is desirable to have the L.T. and H.T. batteries connected to terminals conveniently fixed in the baseboard, and these in turn connected to the appropriate terminals on the panel or panels. In making connection direct from the batteries to these small panels there is risk of shaking or jarring the valve and breaking the delicate filament.

The old terminals from exhausted dry batteries, such as the "Ever Ready" and "Hellesden" type, make excellent baseboard terminals, and the addition of a suitable switch or set of jacks is a refinement which materially assists towards comfortable and safe working.

AN EMERGENCY RECEIVER

BY the aid of a crystal detector, a two-way switch and a length of ordinary connecting wire, the amateur who possesses a single-valve panel for the reception of broadcasting, can so arrange his set that he is at all times in possession of an emergency receiver.

It is, of course, well known that the range of reliable reception when using crystal detection is considerably less than when a valve is employed. On the principle, however, that half a loaf is better than no bread, the following circuit has been evolved.

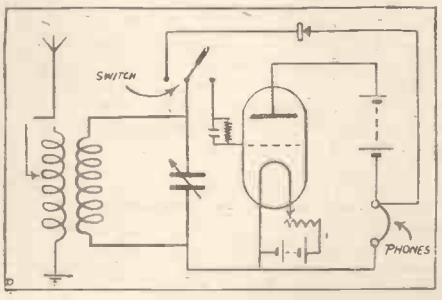
A lead is taken from one side of the crystal to a point in the plate—telephone circuit between the negative terminal of the high-tension battery and the telephones, the lead from the other side of the crystal going to one side of the two-way switch. The grid circuit of the valve-panel is then broken on the aerial side of the grid leak condenser.

Switching Over.

Of these two ends, the one attached to the tuning inductance is connected to the base of the switch-arm, the lead going to the grid leak and condenser being connected to the other side of the switch. It will be seen that by throwing the switch to the right, the set will still continue to function as a single-valve panel, the crystal being out of circuit.

By placing the switch in the left-hand position, the valve together with its attendant batteries is completely cut out, leaving the ordinary form of simple crystal receiver.

This double detector circuit should prove useful to the many amateurs who live within a few miles of a broadcasting station, as should batteries run down or the valve burn out, thus rendering the receiver as a



valve-panel inoperative, a single throw of the switch will still enable them to enjoy their usual programme albeit in a modified form.

It should be remembered, however, that when changing over from the valve to the crystal, a slight tuning adjustment will be necessary to compensate for the loss of the capacity in the circuit contributed by the valve and its connections. This will affect both the primary and the secondary to a very slight extent.

OUR SCHOOL SET.

By A **HEADMASTER.**

THE three-valve set illustrated in the enclosed photos has been erected in school from parts supplied by a local dealer. There are two high-frequency valves and one rectifying valve.

Every Part Accessible.

The set has been assembled in such a way that all connections can be clearly followed. The tuning coil is open on one side and the top, the condensers are open, and the resistances, valves, and transformer connections can be followed quite easily. To be of use from an educational standpoint it was necessary to be able to show to a class exactly what took place each time a switch was moved or a knob turned; obviously the only method was to leave all uncovered and have the connections on the top of the panel. I have 10 transformers giving wave-lengths from 180 to 4,000 metres. These were wound on the axle of a treadle grindstone. A piece of wood with a threaded peg through the centre was firmly fixed on the axle, the transformers screwed on, then one stroke of the pedal put on one turn of wire. This method was a great improvement on winding by hand, as both hands are at liberty and the wire could be fed on evenly. In the absence of a lathe this method served admirably.

The set is built on an oak base, with a cover in oak so that all can be closed in when not in use. The valves, transformers, terminals, etc., are mounted on ebonite strips.

Practice Makes Perfect.

The first messages were received on November 24th, since when we have heard Marconi House, Birmingham Broadcasting Station, and Manchester Broadcasting Station. Manchester comes in sufficiently strong to work the loud speaker.

The Boy Scouts' Evening Class, which is greatly interested in wireless, have a class in signalling, and can send or receive Morse fairly well; we hope before the end of the session to take down a good many of the messages sent. At present they find it excellent practice taking down the slower Morse.

The wiring of the set can be followed by reference to the accompanying diagram.

The School Three-valve Set.

RUB OUT THOSE LINES

A not infrequent cause of failure is through omitting to rub out pencil lines made on the underneath side of a panel during construction. These lines are really thin films of conductive substance, and are capable of causing considerable leakage.

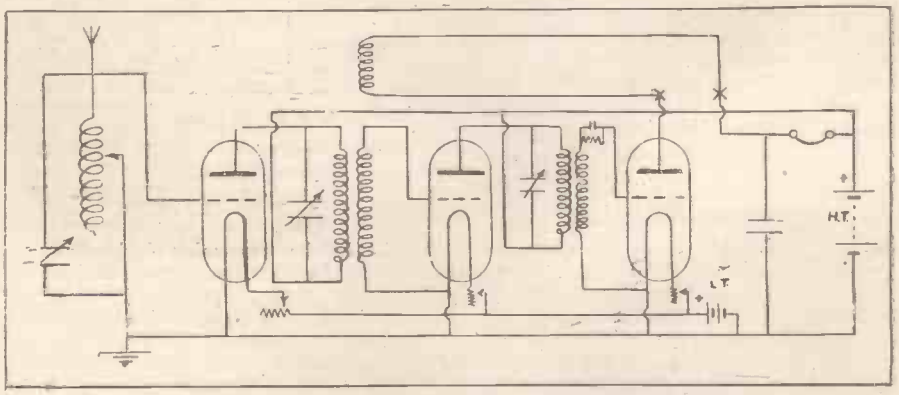


Diagram of connections for Three-valve set described in the article above.

CORRESPONDENCE.

To the Editor of POPULAR WIRELESS

Sir,—The invention of Radio-broadcasting, like that of the alphabet, may be a means of disseminating vulgarity and falsehood, as well as refinements and truth. To guard against the former possibility, I think broadcasting should be controlled by an advisory board consisting of scholars and men of science.

I am, Sir,
Yours faithfully,
AUGUSTUS E. JOHN.

To the Editor of POPULAR WIRELESS.

Dear Sir,—I wonder whether it is known by readers of POPULAR WIRELESS that it is possible to run a pair of 'phones from a receiving set to any part of the house?

I made this discovery last Sunday, when, for a special reason, I wanted my next-door neighbours to hear 2 L O without leaving the comfort of their own fireside. I conceived the idea of connecting two wires to the 'phone terminals of the set—which is a crystal one—and attaching the 'phone leads to the other end of the wires. I then fixed another pair of 'phones to the terminals on the set in the ordinary way, and awaited five o'clock. Prompt on the tick came 2 L O's chimes, and what was more, *through the 'phones* I heard a voice remark, "I say, it *is* coming through well." The voice was that of the listener in the house next door, and we then discovered that it was possible to carry on the conversation both ways by using the headphones as receivers and transmitters. In view of the fact that there was no local battery, this seems rather queer to me. We carried on through the whole programme, exchanging comments on the various items, and it came through so well at the other end that they announced their decision to wait up for the 11.50 call-up from 2 L O.

Since then, I have made several experiments in this line, and can honestly say that with a 40 ft. run of wire from the terminals to the 'phones, the clarity and loudness of the items seem unaffected.

Yours very truly,
FRED B. LIDSTONE.

To the Editor, POPULAR WIRELESS.

Sir,—It will interest you to know that, using a crystal set, I can distinctly hear 5 I T, the Birmingham B. station, transmitting telephony. This station is over 85 miles from my home where the set is installed, and the reception is no "freak," as I can hear it any evening.

The set is self-made, and consists of:

Twin aerial 60 ft. long by 8 ft. between the two wires, the wire used being 20 S.W.G. enamelled; height, average 36 ft. Two-slide tuning inductance, using 30 S.W.G. enamelled wound for 11 inches on a former 3½ in. by 12 in.

"Perikon" detector, and 8,000 ohms Sullivan 'phones purchased from the City Accumulator Co. I have also accomplished the same feat using a silicon detector with brass contact.

Yours very truly,
LEONARD SKIPP.
Buntingford, Herts.

THE PERFECT BROADCASTING VOICE.

In the following article, specially written for POPULAR WIRELESS, a Physician discusses the secrets of good voice production for Wireless Broadcasting.

By a PHYSICIAN.

THE human voice, in one sense the easiest of all the bodily mechanisms to understand, is yet, perhaps, the most mysterious of them all.

After the marvellous delicacy of the eye with its lenses and refractors, or the infinite complications of the ear, those two pale vocal cords, which, using the laryngoscope, seem like threads stretched across the windpipe, are surely the last word in simplicity. A child can learn in a few seconds that the voice is produced by their vibrations, just as a sound is produced when a tense piece of elastic is made to vibrate by the fingers.

But how little, after all, such an explanation tells!

For this device of Nature is the most wonderful of all instruments alike in its range, its tone, its powers of emotional and intellectual expression. So wonderful is it, indeed, that a beautiful voice becomes, very often, its owner's most valuable possession. By means of it he or she may, literally, bewitch the senses of all within earshot.

Not only so, but there are beautiful speaking voices, beautiful singing voices, and voices beautiful especially when large audiences are being addressed. The charming tones which, in a small room, seem so adequate are, frequently, utterly weak and ineffective when used on the public platform. The voice of the orator, again, so full of "colour" and enthusiasm, may be unbearable across a dinner-table. Finally, speaking voices which attract may, if an attempt is made to use them as singing voices, repel and distress.

Value of Breathing.

Whence this extraordinary range? Where the secret of this infinite variety?

Let us admit at once that we scarcely know. The laws of acoustics, even as applied to public buildings, are at present so little understood that great halls are often designed on mistaken theories, and found, when built, to be almost "impossible" from the point of view of speakers or singers.

Some men, as is well known, can speak in a whisper in the largest building and be heard by every other occupant of it, whereas others, shouting their loudest, are inaudible.

This is a question, primarily, of timbre, of the shape of the "voice-box," or larynx. And, in so far as it depends on physical form, it lies outside of any possibility of improvement or alteration. Just as there are pretty girls or ugly ones, so there are "carrying" voices and voices which will not carry.

But when that has been said the subject is by no means disposed of. For there is probably no faculty which can be so greatly improved or educated as the human voice. Let no one forget that the Greek orator Demosthenes, the greatest orator of the ancient world, was a halting, stammering speaker until, by sheer force of will, he trained himself.

The qualities of voice which make the effective public speaker are those which make the effective telephone speaker, the effective gramophone speaker, and the effective speaker for broadcasting purposes. One of these qualities, undoubtedly, is a voice-box of a particular shape, but there are others which do not depend solely on Nature, and which are, perhaps, of greater importance.

The first of these is correct breathing. The voice, after all, is a wind instrument. Like an Æolian harp it is stretched for the breath of life to play on it. As the breath blows so the harp plays.

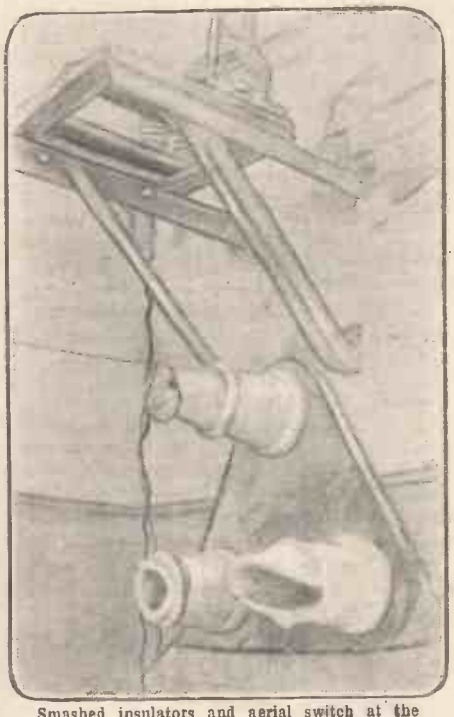
Thus, short, jerky breaths, which must be renewed continuously, and which break in on the flow of speech, are detrimental to success. The "power behind the words," as it has been called, is spasmodic, and consequently the intensity of the voice varies continually. One word may be loud, another soft. In a room we largely discount this by watching the speaker, and, as it were, making allowances for him. But over the telephone or in broadcasting that is impossible, and consequently the speaker is condemned.

Careful Enunciation Necessary.

Correct breathing, in this respect, means the use of a "full chest," from which the wind passes slowly and *steadily* out through the larynx. The incoming air is drawn through the nose, and is so regulated that the pressure in the "bellows" is not permitted to fall.

More important even than this constant flow of air is the correct breaking up of the sounds which the voice-box produces.

This operation is accomplished by the mouth, the teeth, the tongue, and the lips. Every consonant depends for its expression on one or other of these structures. If they function carelessly, the whole effect of the voice is spoiled.



Smashed insulators and aerial switch at the Turkish station, Bagdad, 1917.

Thus a voice which is quite inaudible in a public hall may often be made distinct and clear by the simple process of careful enunciation.

The greatest enemy of all is "slurring." For example, if the two syllables of the word "water" are fused into one, as is often done by bad speakers, the word becomes indistinguishable. Or, again, if the "t" sound is weakened, the identity of this word may be lost.

No Good Shouting.

It is a cardinal rule of telephone, and so of broadcasting, speech that every syllable must be sounded and every consonant given its full value. It is better to say "*can-del*" than "*candl*" when pronouncing the word candle. Close at hand that separation of syllables may sound like affectation; but to a distant listener there is no such suggestion.

One of the advantages of this clear and careful enunciation is that, at once, the necessity for shouting is got rid of. Shouting in public speaking is always bad. It means that an attempt is being made to compensate by mere noise for lack of intelligence and training. It is not far removed from the shouts of the uneducated Englishman into the Frenchman's ear. And, as a rule, it is not more effective.

This is the last rule of good speaking—*use a quiet voice, a low tone.* It is the most difficult of all rules to learn and observe, because the moment the idea of distance enters our minds the idea of loudness arises. In broadcasting loudness is a fault. The object of the broadcaster is to "punctuate a current with words," not to speed those words on their way. Punctuation in this respect is but another name for pronunciation.

Even so, however, the broadcaster has other lessons to learn. He may possess a fine voice, he may use it finely, and his word-formation may be beyond reproach and yet he may fail.

For, in truth, speaking is not alone a matter of speech.

It is a matter also of emotion and thought. The same words spoken well by a bad actor and badly by a great one are not the same words at all. The great actor has it every time, no matter what his voice may be like.

For his emotions are alive. He *feels* what he says.

This is perhaps the secret of secrets. For, while there may be little scope for tone of the emotional kind in a mere news recitation, the scope is greater than is generally supposed. Some people instantly establish a "contact" with their audiences whether seen or hidden. Their voices respond; the horrible "parrot tones" of the indifferent person are not heard.

It is not given to all men to possess the quality of responsiveness. But all may cultivate that interest in, and enthusiasm or, their work which is the essential of its success.

GEARY'S FREAK.

By HIGHAM BURLAC.

GEARY was elected President of the Clapham and Environs Electric Wave Institute, chiefly because he had a spare sitting-room and a really good Sphero-elliptical Non-skid Anti-capacitative Warranted All-wire coil winder. The "Clapham Free Advertiser" devoted ten lines to this momentous appointment, referring to Geary as "the popular wizard of Chestnut Gardens, to wit, Mr. Aloysius Geary."

The paragraph in which this gem scintillated was headed:

LOCAL SCIENTIST FOUNDS INSTITUTE.
SAYS WILL STARTLE EUROPE.

The editor must have been studying an odd copy of the "Boston Bi-Weekly Bugle-Blast" in his barber's or the dentist's, for the account of Geary's elevation was preceded by a human document entitled, "Nonagenarian Beaver Bites Patrolman."

The "beaver" was poor old Sam Cockburn, who regularly every Saturday night was collected from the steps of the Three Bells in a highly-glazed condition by Sergeant Mullins, the star of the Clapham constabulary. Again, Geary's ten lines were followed by:

MAYOR SMITH HORNSWOGGLES THE MODS.
LABS AND PROGS BEAT HIM TO IT.

This seems to refer to the Municipal Election—but no matter.

In a month the Gearys were living in three rooms. The club occupied the other seven rooms and most of the garden. The club manufactured a scraggy-looking crystal receiver and about four hundred coils, after which the coil winder had to be sent to the makers, in Upper Silesia, for re-treading and boiler overhaul. Then Geary printed the second month's syllabus, which I have great pleasure in reproducing:

Nov. 1. Lecture: How to make a Grid Leak. A. Geary (Pres.).
Nov. 4. Coil-winding and Morse practice.
Nov. 7. Lecture: Wireless in the W.A.A.C. in the next war. Miss O. Geary.
Nov. 12. Excursion to gas works.
Nov. 16. Coil-winding. Research work on a Leclanché.
Nov. 20. Lecture: The Asymmetry of Valve Legs: A Theory of Staggering. A. Geary (Pres.).
Nov. 24. Lecture: Defects of coil-winders; their causes and remedies. A. Geary (Pres.).
Nov. 27: Morse practice (or) Buzzer repairs.
Nov. 30. Demonstration to Press.

* * *

The demonstrator was the president; the demonstrated was the president's Armstrong super-regenerative receiver, improved by the president: the demonstratee was a pink-eyed youth from the "Advertiser," who, after drinking a quart of coffee, went home and dished up half a column of parodied Kipling with patches of Begbie and a general flavour of night-school "composition."

The triumph swept Geary's head from his shoulders.

"Burlac," he confided, "we are creeping into the world's Press. Give me sufficient publicity and the Government will endow the institute—p'r'aps affiliate us to the National Physical Laboratory. D'you think there's any chance of my going as a delegate to the next Radio Convention?"

"Well, you might walk there—and go as a walking delegate," I replied.

"And, of course," continued Geary, "I shall have to get a degree of some sort. Carries weight. Looks well. I've got a Second Class Society of Arts Certificate for clay modelling. Got it in '94. Any good, d'ye think? Member Royal Society of Arts? Could I be a B.Sc. now I'm married?"

"I doubt it," I said sadly. "I've known several fellows who got their Inter. and then married. They never even smelt the Final after that. Love and learning don't mix."

After that Geary appeared as the hero of a series of smudgy photographs in the "Advertiser," the "Daily Delineator," and other moulders of public opinion. Sometimes he was depicted leaning ponderously against "the largest receiver ever built"; sometimes he posed in company with "Dwarf Wireless; Radio set in a thimble." Once he paid a local photographer seven-and-sixpence to produce a picture of a Geary tea-fight. This atrocity was reproduced in the "Weekly Hobbyhorse," entitled "Clapham family goes the pace. Winkles and wireless."

One day Geary—don't think I dislike Geary—showed me a visiting card, inscribed:

A. Geary, F.R.E.A.K.

"Why say so, Geary?" I said.

"Wodger mean? That's a degree. It stands for Fellow of the Radio-Electrical Academy, Kansas."

"How much?" I asked, feeling faint.

"Twenty dollars. I've got a diploma."

"Good for you," I replied. "What are you going to do about it?"

"Oh, it will look fine in print. Send the membership up, too," he answered.

"Oh, my friend," I said, "unless a special intervention occurs, I fear for you. Go home and light the copper fire with your diploma, and study the life of plain Michael Faraday."

* * *

There's a little cherub who sits up aloft to keep an eye on us. That's a fact. For before a week had passed Geary's licence was cancelled because he intercepted Leafield and blew fourteen Government messages into the High Street so vociferously that the Boy Scouts sent out a general rally call, and disorganised the traffic. Then Geary's landlord objected to the aerial, and pulled it down at night. Lastly, young Bill Geary contracted scarlet fever, and the club left the premises hastily.

There's a highly moral story for you.

STABILITY IN CRYSTAL ADJUSTMENT.

WHEN one has the good luck to become possessed of a crystal of very high sensitivity one's satisfaction is apt to be qualified by the frequency with which it requires readjustment to keep it on its best performance. The advice has even been given that these supersensitive crystals should be avoided on account of their refractoriness in this respect and the lower efficiency accepted of those crystals which, by permitting of firmer contact, can be trusted to keep their adjustment for a considerable time.

A contributor has recently told us that the sensitive spots on some crystals are less in dimension than the point of a needle. It can therefore be seen that a degree of vibration hardly, or not at all, perceptible to our senses may be relatively a pretty considerable shaking up to these microscopic areas, and we need not be surprised that it suffices to disturb the light contact of the catwhisker with the tiny sensitive spot.

Therefore I sought to improvise some arrangement to combat this with such materials as were at hand.

A flat tobacco tin, dimensions 4½ in. by 3½ in. by 1 in. deep, and a length of discarded cycle inner tube were all the appliances used.

The rubber tubing was wound round the box as in Fig. 1, snugly but without stretching, each turn overlapping the previous one so successfully that no alteration has been made. Fig. 2 shows the complete "fit up."

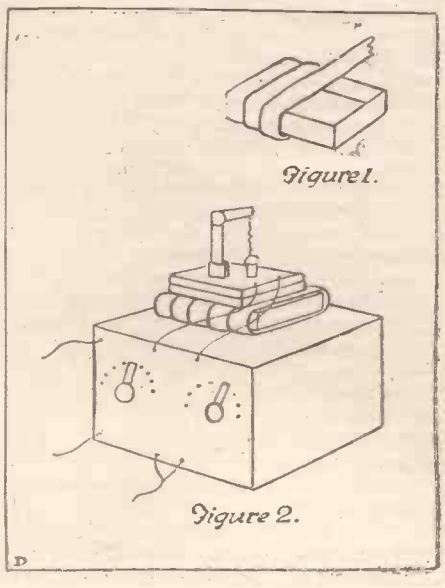


Figure 1.

Figure 2.

POPULAR WIRELESS Beginners' Supplement

PART IV—WHAT IS ELECTRICITY?

By MICHAEL EGAN.

THE question which the title of this article expresses is one which must present itself to the mind of every wireless amateur the moment he begins to get really interested in his new hobby. Electricity is the vital thing that animates all wireless instruments, both receivers and transmitters, and no one can be content to operate a wireless apparatus for long without becoming obsessed with a desire to know something of its mysterious character.

Simple enough as the question is, however, the plain fact had better be stated at once that it has never yet been satisfactorily answered. Many people, of course, have attempted to describe how it *acts*, and what it *does*, but no one has yet succeeded in explaining what it *is*. Various theories have been put forward from time to time. It was thought at one period, for instance, to be a "kind of fluid." But that has long since gone the way of all theories, and to-day we may well be as far from understanding its real nature as were the early Greeks who first "discovered" it.

An early Greek once observed that a piece of amber, when rubbed on the hand, became possessed of the power to lift small pieces of paper. This was the first electrical experiment we know of, and it is from the Greek word for amber (elektron) that our term electricity is derived. Having said which, I don't propose to waste any more time on the dear old Greeks. I might write reams on what they did, and what they didn't, without helping in the least to give the reader a clearer *general* idea of the nature of electricity.

Something Like Water.

In spite of the fact that it is, scientifically, incorrect to describe electricity as a "kind of fluid," this may serve as a very useful introductory definition for the beginner. An intangible and invisible fluid would be better. Anyhow, it behaves, in many respects, similar to a fluid. It can flow along a wire, as water flows along a pipe, and it can be made to pour out of the end of the wire, as water can be made to pour out of a pipe. When it is poured out of the end of wire, however, it becomes visible—in the form of a "spark."

Similarly, the energy which the electricity in the wire, and the water in the pipe, possess can be utilised to perform some useful work. The water can be made to fill the bath, for instance; and the electricity can be made to fill, or "charge-up," a transmitting aerial. Moreover, they can both be made to perform some special mechanical operation. A water-stream can be utilised for the purpose of turning a mill wheel; a stream of electricity can be used for turning a wheel on an electric motor.

A pipe, of course, offers a certain amount of resistance to the passage of water; the smaller the cross-section of the pipe the greater the resistance and the smaller the quantity of water that can flow per second, or per minute. It is the same with electricity. The thicker the cross-section of the carrying wire the lower the resistance and the greater the quantity of electricity that will flow in a given time.

How It Is Produced.

Again, the pressure of the water at the source that feeds the pipe has a direct effect upon the quantity of water that will flow through the pipe in a minute. Suppose the pipe is fitted to the bottom of a small tank, and that it takes one minute to collect a pint of water in a jug from the other end of the pipe. If, now, you wanted to get a much quicker supply of water you would have to do either of two things.

You could either transfer the pipe to a much larger tank, capable of holding more water and, therefore, of exerting a greater pressure; or you could achieve the same effect by employing a pipe with a larger cross-section, whilst using the same tank. You could also, of course, use a medium-sized tank in conjunction with a medium-sized pipe. The point to notice in connection with this is that the rate of supply of water at the lower end of the pipe depends upon two things: (1) the pressure at the source, and (2) the resistance of the pipe. The greater the pressure, *or* the smaller the resistance, the quicker the rate of flow from the mouth of the pipe.

In all important respects these same factors are met with in dealing with electricity. Electricity must always flow from some definite source, big or small; and the greater the pressure exerted by that source, *or* the greater the cross-section of the carrying wire, the greater will be the amount of current that will flow through the wire in a given time.

There are two ways of "making" electricity; one is chemical, the other physical. When it is produced chemically it is contained in primary batteries, "accumulators" or "dry cells;" when produced physically or mechanically, it comes from a revolving dynamo. In either case, the above rules hold good.

The First Law.

In order to simplify electrical calculations, certain "units" of electricity have been adopted, just as we have units of measure, weight, time, etc. The electrical unit of *pressure* is the "volt," the unit of *resistance* is the "ohm," and the unit of *current* is the "ampere." Since the current is *directly* proportional to the pressure and *inversely* proportional to the resistance, we may therefore formulate the first law of electricity, namely—

The current or quantity of current that will flow per second

$$= \frac{\text{pressure}}{\text{resistance}} \text{ or amperes} = \frac{\text{volts}}{\text{ohms}}$$

A little reflection will soon make the beginner familiar with the significance of this law, after which he will be to no small degree fitted for studying the application of electricity to wireless.

A GLOSSARY OF RADIO TERMS.

AERIAL.—A term used to define the wire from which electric energy is radiated into the ether and also the wire by which the radiated energy is received.

ALTERNATING CURRENT.—A current which flows first in one direction and then in the opposite. A single alternation is called a cycle. Commercial alternating currents are composed of 60 cycles a second. The number of cycles in the alternating currents used in wireless is many thousands a second.

AMPLIFIER.—A term used to define the means of amplifying the electrical effect detected. The electron valve may be used as an amplifier.

AMPLITUDE.—The crest of every wave grows from zero to maximum value. The latter value is the amplitude, and is ascertained by measuring the height of the wave crest.

AUDIO FREQUENCY.—When vibrations are audible to the human ear, they have audio frequency. Frequencies below 10,000 cycles per second are regarded as audio frequencies.

CAPACITY.—A term chiefly used in connection with condensers. A condenser stores up electrical current, the amount depending on the capacity. Capacities are measured in farads. The farad, however, is far too large for practical wireless work; the unit generally used is the microfarad (mfd.), or one millionth of a farad.

CLOSE COUPLING.—When mutual inductance is caused by mounting the primary and the secondary of a tuning coil very close to each other, this arrangement is known as "close coupling."

CONDENSER.—See "Capacity."

The condenser stores up electricity. A condenser is used in wireless for collecting energy and putting circuits into resonance so as to tune them.

CONTINUOUS WAVE.—A continuous wave is a wave in the ether which has a constant amplitude. It is an undamped wave and travels far.

CRYSTAL DETECTOR.—A detector in which a rectifying crystal is used to receive electrical effects in such a manner that they can be made audible in the 'phones.

DETECTOR.—Any contrivance which transforms the electrical vibrations set up in the receiving aerial into audible sounds.

DIRECT CURRENT.—An electric current flowing constantly in one direction.

(*To be continued next week.*)

HINTS ON AERIALS.

IT is as well to be very definite on all points connected with wireless, because so little can rest between excellent results and complete failure. For instance, a spider's web connecting the wires of an aerial to the damp branches of a tree has frequently caused complete loss of signals. Having mentioned that, doubtless you will see that none of the members of the "Arachnida" family spin their delicate curtains on your aerial, but that is not sufficient.

The point is that the actual aerial wire should not be so close to the branches of a tree, or the ivy on a wall, that it will be possible for them to do so. That is one step towards efficiency. Suspend the aerial as far away from trees, walls, etc., as possible, and rather than employ the utmost limits of length available, and in so doing bringing it to within a foot or two of such energy-absorbing obstructions, make up the length with strong cord or rope—separated, of course, from the wire by the insulators. Remember that height is *the* all-important factor—not length.

Points to Consider.

The most probable cause of "falling off" during rainy weather is that moisture is collecting on the insulators and thus forming a path over which the received current will tend to flow to earth instead of going through the set. A good tip to prevent this happening is to smear a line of vaseline around the middle of the insulator every now and then.

Now take the lead-in, the wire that connects the horizontal aerial wires to the set. This should take the straightest line possible, should be free from angles, clear of the roof and walls, and should not be run round the house like electric lighting wires. If it is desired to listen-in in a room any great distance from the point where the lead-in enters the house, the best plan is to employ long telephone leads.

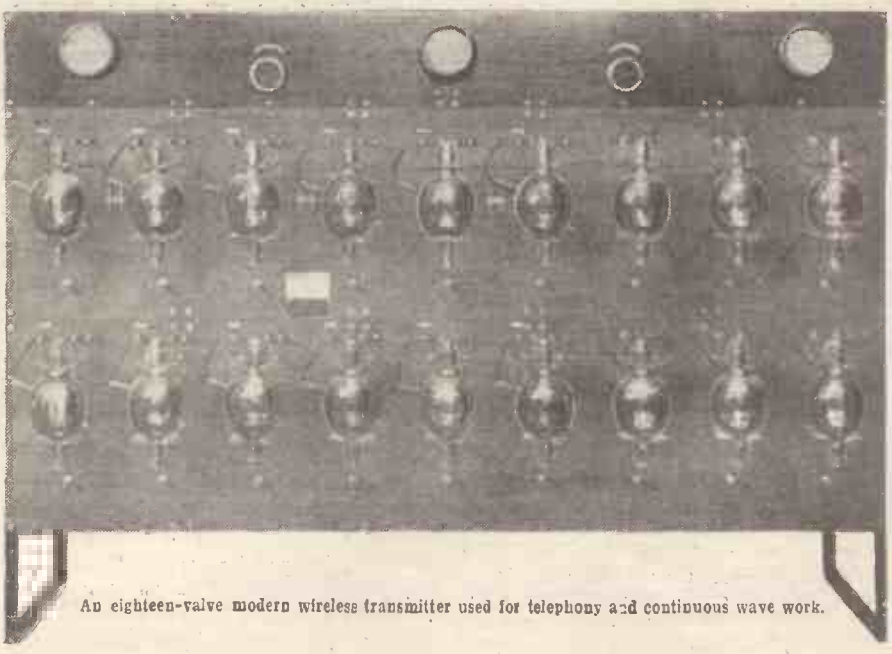
Make the Most Of It.

Because it is impossible to light lamps or make big sparks with the current received on a wireless aerial, it is quite reasonable to presume that it cannot jump away through the insulating material of, for instance, bell wire or lighting flex. Therefore such material is often employed for the lead-in, and is run through a small hole in a window frame and fastened to the wall with staples without further insulation. That is a mistake. It is not an ordinary small current of electricity that is being dealt with.

Although it is small it is what is known as a high-frequency current, and has the power of escaping to earth through paths that would be quite impossible for ordinary currents to traverse. Therefore, if you want to make the most of your wireless outfit, carefully consider that, and employ a lead-in tube of ebonite or glass. Rubber tubing can be used or even that thickly rubber-covered high-tension cable that is used on motor-cars, but if permanency is required it is not advisable to do so, because, unless vulcanised, rubber will quickly deteriorate with exposure to the elements.

Such a lot has been said about soldering the lead-in to the horizontal wires that the new amateur is liable to wonder whether in the case of a single-wire aerial he should cut the wire in order to be able to do so. He argues that the one single length can be employed by twisting it at the insulator, binding it, and running the one continuous length straight down to the set.

Theoretically there are arguments against doing so, but practically it has not been proved to cause any appreciable deterioration of signal strength. Therefore, use one continual length of wire by all means, but where necessary solder all joints, because twisted joints are very liable to cause trouble.



An eighteen-valve modern wireless transmitter used for telephony and continuous wave work.

HOW THE TELEPHONES WORK.

IT is perhaps not necessary to point out, even to the veriest novice, that the receiving telephones are used to convert the rectified signals received, into sound. The manner in which this is accomplished, however, may not be so well known. The functioning of the telephone earpiece depends primarily upon the action of an electro-magnet, and its influence upon a thin disc of soft iron known as the diaphragm.

It is an elementary fact that if a length of wire is wound in the form of a spiral, and a current of electricity passed through the wire, the coil will possess definite magnetic properties, one end becoming a South Pole and the other end a North Pole.

This is because "lines of force" are set up about the conducting wire by the current of electricity and create a magnetic field similar to that surrounding an ordinary "horseshoe" or bar magnet of the permanent type. The strength of this field can be considerably increased by winding the spiral round a soft iron core which in most telephone receivers is permanently, although weakly, magnetised.

Undesirable but Unavoidable.

One end of the permanently magnetised core is always exerting a certain amount of pull upon the diaphragm which tends to draw the centre of the diaphragm nearer to the electro-magnet and away from the position that it would normally occupy.

There is therefore a steady magnetic field existing between the magnet and the diaphragm. If a current is now passed through the winding of the electro-magnet it will either strengthen the existing polarity of the core or have the reverse effect, according to the direction in which it flows round the wire.

This means that a variation takes place in the steady magnetic field between the diaphragm and the magnet, the pull upon the diaphragm being either increased or lessened. In the case of received signals which continually vary in value, the diaphragm is alternately attracted and repulsed by the electro-magnet—in other words, it vibrates according to the variation in the magnetic field influencing it. It is a succession of these vibrations that the human ear registers as one note or buzz, commonly referred to as a "signal."

The high resistance of some earpieces, running into thousands of ohms, is due to the fact that the core of the electro-magnet, which of necessity is very small, is wound with a very thin wire, because the more turns that can be wound upon the bobbin, the greater the resultant magneto-motive force, which depends upon the amount of current flowing in the coil in addition to the number of turns of wire taken round the core. The resistance is an undesirable factor, but unfortunately is unavoidable in the case of telephone windings.

The diaphragm is usually supported by the outer case or shell of the earpiece, and a cover which keeps it firmly in position is screwed on to a threaded turn on the outer case.

HOW A CRYSTAL SET WORKS.

In this article the beginner will find a simple explanation of how the crystal set works. Next week some valuable advice on tracing "faults" on a crystal set will be given, and subsequently valve sets will be dealt with in the same way.

By G. V. DOWDING, *Grad.I.E.E.*

IN a previous article I presented an easy method of grappling with the problem of "How does it work?" in connection with a wireless receiving set, but only in respect of tuning it to receive long or short wave-lengths. I am now going to carry on just a little way further and hope that by the time you have read this second article, the whole theory of how a crystal detector receiving set receives wireless signals will be clear to you. When I say the "whole theory," I mean all that you need to worry about—leave the mathematics to the scientists.

More work, longer wave-lengths, was the essence of my previous article. The more "area of spread," which is primarily the area of the plates of what is known as the variable condenser, and the more turns of wire on the tuning coil that that little current of electricity induced by the wireless wave had to travel through, the longer it took to do so, and we had to give it just the right amount of work to do, so that it could run from the aerial through the set to the earth and back again to the aerial just in time to be pushed off again by the energy supplied by the next one of the series of waves.

Imagine yourself trying to push a swing more or less times per minute than the swing was swinging, and after you'd hurt your hands and the swing had stopped, you'd realise that you were acting in the manner of a wireless wave that was trying to "swing" a wireless set that wasn't tuned to the right wave-length.

An Electrical "Ditch."

Anyway, we will presume that the little current of electricity is finding its "push" just at the right time and is rushing backwards and forwards through the set.

In other words, by adjusting condenser knobs and inductance slides or knobs you are tuned in correctly to a certain station. The small current of electricity will, during its double journey, rush backwards and forwards through the inductance coil just like the water would rush up and down a river if the tide rose and fell very rapidly. Well, supposing we take that analogy another step further and dig a ditch by the side of our imaginary river and run each end of the ditch into the river. A certain amount of the water would divert into this ditch and flow up and down it in time with the up and down flow in the river.

Back to our coil of wire. We will connect a wire to each end of the coil, that will then divert a little of the flow of that small current of electricity which will flow backwards and forwards through this wire in time with that which flows through the coil. Right! Then we have diverted some of the current and can do what we like with it without putting that initial little current out of its step. It is quite free to carry out its journey and keep its regular appointment with the next wave.

So far so good, but its double journey and appointment takes place hundreds of thousands of times in a second, and therefore the current that we have diverted and caused to flow through an alternative path will be flowing backwards and forwards at the same huge rate.

Now, supposing we put a valve in that electrical "ditch" so that the current can flow through one way but not the other. Picture the river and the imaginary diverting ditch; if we put a valve in that latter, then, when the river was flowing in one direction, a little of the water would divert and flow through the ditch; but when the river was flowing in the opposite direction no water would be diverted and flow through the alternative channel because of the valve which would only allow the water to flow in one direction through the ditch. Therefore, we have water flowing through the ditch, but only in one direction.

Introducing the Detector.

Splendid! We will then put a valve in our wire that is diverting some of the current from the inductance. Now what is known as a crystal detector, which is a small piece of mineral crystal pressing against a piece of metal wire or another crystal, will act as a valve, as it only allows a current of electricity to pass through it in one direction, the reason why need not concern us.

Having put a valve in the diverting electrical "ditch," we have a current passing through it in one direction only while the main "river," or current, is still rapidly and comfortably rushing backwards and forwards through the coil of wire known as the inductance coil.

Through the 'Phones.

What happens if the wireless waves increase or decrease in size but not length? In other words, if they increase to the corresponding size of an Atlantic 40 ft. high wave, or decrease to the proportional height of an ornamental pond ripple, or stop altogether every now and then? Why, simply that the main current flowing backwards and forwards through the coil will increase or decrease in size and keep stopping and starting. So will our smaller diverted current which is flowing in one direction only through that other little channel which contains that valve the crystal detector.

Supposing we make the diverted current flow through not only a detector, but also a pair of telephone receivers, surely I haven't taken you along so fast that you cannot turn now to the article about telephone receivers on another page and say you know how a crystal detector receiving set works?

In simple reasoning you have a current of electricity flowing in one direction through a pair of telephone receivers which increases and decreases in strength, and at certain intervals stops and starts, so there I will leave you to connect up the two stories yourself.

The Lavender Hill "Pavilion" at which Cinema Theatre this station is installed, is run in conjunction with the well-known "Pavilion" at Marble Arch, where is situated the very fine and completely equipped installation belonging to and constructed by the Chief Engineer, Mr. Basil Davis. Both these stations are Test Stations for Messrs. The Wireless Equipment Ltd., Radio Engineers, No, 90, Charing Cross Rd., London, W.C.2. This station 2 X L, may often be heard working to 2 B Z and to 2 O M at Brentford, both too well known to need any further comment. The station at 2 X L has been built more or less with the definite object in view of being, when finished, a complete and essentially up-to-date looking low power transmitting and receiving station.

QUESTIONS & ANSWERS FOR BEGINNERS.

NOTE.—On this page the beginner will find a selection of questions and answers which will concisely deal with many little problems met with in the erection of a wireless receiver. Readers are invited to send their queries to the Technical Dept., Room 138, The Fleetway House, Farringdon Street, London, E.C.4, where they will be carefully and promptly dealt with. Replies are sent by post free of any charge.

Q. Will a bell battery work a valve set?

A. No. This type of battery does not give enough current to light a valve for any length of time.

* * *

Q. If wireless waves are ether waves, why is it that we do not feel them?

A. This is rather a deep question to answer here. The ether is a peculiar undefined substance which is said to permeate everything. It exists and fills the space between all the tiny atoms of which various substances are composed. A wireless wave sets the ether in a state of vibration, each particle of ether bumping into the next. This forms a wave. Thus it is the wave that travels along, not the ether itself. Also, as it exists between the particles of which we are made, it is not likely that we should feel its motion, as we do that of the wind, for instance.

* * *

Q. What is meant by an oscillation?

A. The term used to denote rapid surging backwards and forwards. In the case of an electric current, the current rushes up and down the conductor at a very rapid rate.

* * *

Q. Why is it that some stations can be heard farther away than others?

A. Because they use more power, and thus cause more energy to be put into the ether waves. This naturally causes them to travel farther.

* * *

Q. Why are crystal receivers not suitable for ranges over 20 miles?

A. The crystal is not such a sensitive detector as the valve, and needs a comparatively large amount of energy to operate it. This means that it must be fairly near the transmitting station in order that it may give satisfactory results. This especially applies to the reception of telephony.

* * *

Q. Can a crystal be used as an amplifier?

A. No. It is merely useful as a detector.

* * *

Q. What are hertzite, permanite, silicon, and galena?

A. These are different forms of crystals. Hertzite and permanite are specially prepared forms of the mineral galena. Silicon also is another mineral used for the detection of wireless signals.

* * *

Q. What is a loud speaker?

A. An adaptation of the telephone which enables the received signals or music to be heard all over a room or hall. It takes the place of the head telephone receivers.

* * *

Q. What is a frame aerial?

A. An aerial which is used indoors or where a portable aerial is required. It consists of a number of turns of wire wound round a wooden frame, and these wires take the place of the usual outdoor aerial and collect the incoming wireless waves.

Q. Should an aerial be cleaned periodically?

A. This is not absolutely necessary, but it will tend to keep the aerial working at its maximum efficiency. In any case, the insulators should be periodically overhauled and cleaned, as accumulations of soot and dirt cause leakage and therefore weakened signals.

* * *

Q. Must the aerial be of any particular size or shape?

A. No; it should be as long and as high as possible, taking into account the Government regulations. These, of course, limit the size to 100 feet combined height and length. Thus an aerial 25 feet high at its highest point above ground can only be 75 feet long. This length also includes the length of wire used for the lead-in.

* * *

Q. What is the best earth to use?

A. Either a large metal plate buried about three feet in the ground, or a water-pipe; both make very good earth connections. Gas-pipes are not to be advised.

* * *

Q. Does it matter how long the earth lead is?

A. This should always be as short as possible. If it has to be rather long—more than 12 feet—several wires of thick gauge should be employed.

* * *

Q. What size accumulator is needed for a three-valve set?

A. To ensure that the battery will not need charging too frequently, a 6-volt 60 or 80 ampere-hour accumulator should be employed.

* * *

Q. What is the L.T. valve that is advertised?

A. It is a fairly new type of valve which requires a very small current to work it. The letters stand for Low Temperature, and the valve is designed so that a dry cell can be used to light it, thus doing away with accumulators. Unfortunately, it is rather costly, each valve costing about £2 10s.

* * *

Q. What is meant by the "sensitive point" of a crystal?

A. The sensitive point on a crystal is that point where the contact must be made in order that the received signals may be best heard. Owing to the structure of crystals, it is found that they conduct and rectify better when contact is made at certain spots than when it is made at others. These spots are called "sensitive points."

* * *

Q. What are the best crystals to use?

A. Probably the most sensitive is galena, but this crystal requires careful adjustment very frequently. Permanite, a "prepared" crystal, or silicon are both very good detectors. Hertzite is also a reliable crystal.

* * *

Q. What is meant by saying an aerial is "directional"?

A. This means that the aerial is so placed that it will receive from one direction better than from any other. To attain this property, the lead-in end of the aerial should point towards the particular station for which the aerial is desired to be directional.

* * *

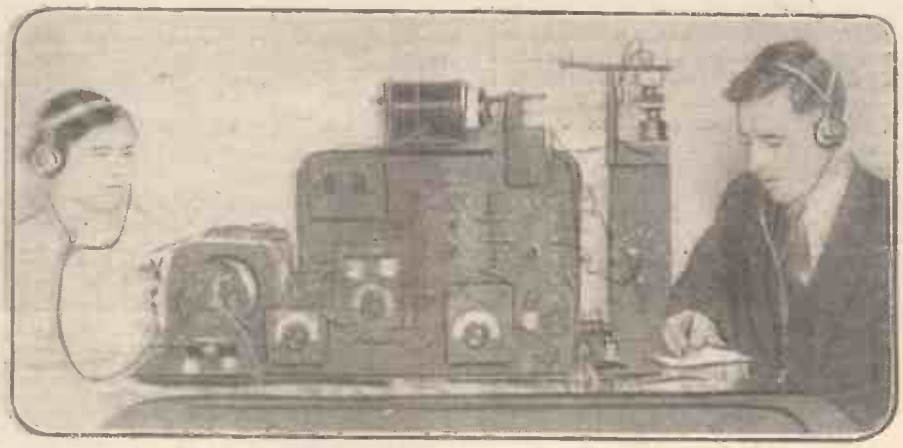
Q. What is meant by the "unit" system?

A. This is an arrangement in the construction of wireless sets whereby various circuits can be added at will by simply connecting up a few terminals, instead of having to re-build the whole set. It is very useful in the case of the amateur who wishes to begin in a small way and then add gradually to his set without having to re-design his apparatus.

* * *

Q. What are atmospherics?

A. This is the name given to stray charges of electricity in the atmosphere which when collected by the aerial cause a peculiar crackle in the receiving telephones.



Mr. I. Polley's home-made receiver, Corporation Huts, Eastbourne.

The constructional Articles alone are worth the shilling!

SOONER or later, every Wireless enthusiast wants to try his hand at building his own Set, or, at least, some components for one. Even if he is not generally "handy" with tools he will find no difficulty in following out the constructional articles contained in *MODERN WIRELESS* because they are so clearly explained and so well illustrated.

In No. 1, for instance, now on sale, several designs are given for Broadcast Receivers which may be built up at home from the simplest of materials and at ridiculously low cost. For those who want a more elaborate Set, full working instructions are given for the construction of a super-sensitive 5-Valve Receiver with a radius of 4,000 miles.

Besides these, other constructional articles show how to build up a Valve Panel, an Amplifying Panel, a Winder for making your own Coils, a Telephone Transformer, a Vernier Condenser, and many others.

It is the excellence of such dependable Articles as these which has created such a huge demand for *Modern Wireless*. Reprints of No. 1 to date already amount to the amazing total of **100,000 copies**—surely a record for any Magazine.

You may be sure that every Article—either theoretical, practical or constructional, appearing in *MODERN WIRELESS* is thoroughly dependable. The Editor, John Scott-Taggart F. Inst. P.,—the well known authority on the Thermionic Valve—is assisted by Paul D. Tyers and E. Redpath and a fully qualified staff.

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PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
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1/-

MODERN WIRELESS
THE GREAT NEW WIRELESS MONTHLY MAGAZINE

THE VIBRATION.

Another brilliant article from the pen of Mr. John Hill. These articles are primarily intended for the experimenter and serious student, but the general reader will find much food for thought in the various problems connected with Radio which Mr. Hill discusses in this journal from time to time.

By JOHN HILL

HOW would the theory of wireless stand in the absence of any idea of the vibration ?

There could hardly be a theory. We are told that the atoms everywhere are constantly vibrating and generating waves in the ether, by means of which wireless messages are carried. The theory of wireless, then, has its definite beginning with the vibration as the primary unit. Properly speaking, the theory does not begin with the ether. The ether is the assumed intermediary between the vibration and the wave. As Sir Oliver Lodge has pointed out in these pages, there is no theory of the ether ; it is pure, although necessary, assumption. Hence the vibration is little understood, and is also called "oscillation" and "alternation," according to taste.

Indeed, interpretation "according to taste" is not unknown these days ; much explanation of facts, wireless and otherwise, is of a surface character and liable to considerable modification. If we begin with an assumption—the ether—we end more or less with assumption. As a result, practice advances beyond theory, but at the cost of a deal of needless labour in experiments. After all, theory is the interpretation of that invisible world which is the other side of our world of sensible experience. Still, it may be argued that since the practical operation of wireless is advancing we need not worry about the lack of a truly theoretical basis. But if Clerk Maxwell's philosophic inquiry led to the actual discovery of free electric waves, how much may the practice of wireless be further extended by rescuing the vibration from the intermediation of the unknowable ether in establishing vibratory motion as constitutional of an omnipresent and scientifically *familiar* medium in the absence of which wireless would be impossible ?

Eluding Our Grasp.

Some years have passed since I worked out, on philosophic grounds, that there is no difference in kind between planetary process and the process of consciousness or any other. Now comes the discovery of the constitution of the atom being in the nature of a planetary system built up of electrons. But there is no unanimity with regard to details, presumably because of a leaning on the part of the physicists toward the old notion of space and motion as having separate existence. One opinion is that the electronic system is like our own planetary system ; another that it is more like Saturn. Is it possible to come to closer grips with the problem ? Yes, if we supplement physical research with philosophic inquiry. In doing so we may find a substitute for the ether, one within the bounds of experience, and therefore capable of providing a truly theoretical basis of wireless.

Crookes said, "When we come to hunt matter down to its ultimate it eludes our grasp, and floats away in a sea of vortices." It should be put, "floats away and eludes the grasp of our senses." For Crookes did not, and could not, reach the ultimate in an absolute sense. We cannot transcend experience. We can only affirm that since scientific knowledge is a co-ordination of the facts of experience and is nothing more, the physicists reached a point where matter passes beyond the grasp of the physical senses ; yet not, unless we indulge in futile guessing, beyond the elements of which the senses are built.

Mark this, too : Crookes' dictum, while the outcome of laboratory experiment, applies to matter as it exists apart from experimental conditions.

When Matter is Space.

Consider light, heat, sound, colour, solidity, anything you like within the range of the senses ; analyse the process in which these receive final shaping in the act of perceiving them ; the conclusion is irresistible. We see that which appears to us under various forms, and in degrees of tangibility, floating away into the invisible ; and—this is what Crookes did not say—*back again*. We cannot conceive of any gap between any of the stages from the most perceptible to the utmost ethereal or invisible, in either direction.

Indeed, we become aware, on due reflection, that in a universe in which it is radically impossible for space to exist in the absence of motion, or for motion to exist in the absence of space, nothing can have being in the absence of an alternation between an apparently purely material and an apparently purely motional state.

When what we call matter "eludes our grasp," it is not that it can be changed fundamentally. It is that matter could not be matter w i t h o u t the alternation. Perceptible matter is space and motion ; it remains space and motion under whatever conditions it eludes our senses. And if, at a comparative ultimate, we perceive vibrations only, we can but say that sun, earth, moon, and stars vibrate wholly and in every atom because they are sun, earth, moon, and stars.

Could we look into the intangible side of things and retain our perception of the solid world, we would view a ceaseless passing and repassing from one condition to the other. We would be viewing the universal process.

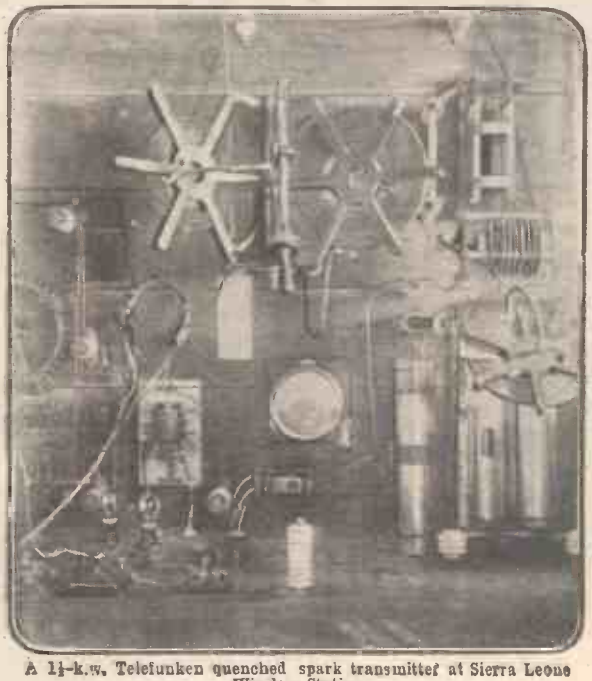
Further back we may not go. Process is our ultimate, but not an absolute ultimate, since our whole body of experience rests in it. It should be realised that our visible world and the invisible world of vibration are one and the same viewed from different standpoints : the one of space and the other of motion. It is not so realised because we are in the habit of accepting only the special seat of observation. Yet if it had not been for Clerk Maxwell, who, from the motional standpoint, asserted the existence of free electric waves, Hertz would not have sought for and brought them within the realm of experiment.

It is not difficult now to identify Crookes' "sea of vortices" with the electronic stage of matter as seen in the constitution of the minutest portion conceivable—the atom. How can we arrive at unanimity regarding the constitutional details ? By granting the obvious—that in a unified existence, a conception of fundamental diversity in process is unthinkable, by understanding that a centre of force without extension is likewise unthinkable, and that the extension must be in every direction. Consider here that sound waves and light waves are spherical in their space-motion constitution. On these grounds I predict that the atom will be described eventually as spherical, with the further view that the system of electrons it embodies is the motional aspect arrived at when matter "eludes our grasp."

Independently of Ether.

In other words, the constitution is based on a ceaseless alternation between an apparently purely spacial and an apparently purely motional condition. Thus it provides that which is fundamentally necessary to wireless—the vibration.

The latest view of energy is that it is "a substance endowed in itself with existence." The above confirms this, *and amplifies it*. Amplification follows on a space-motion consideration that the atom has its existence not more in itself than in everything else. Hence, without reference to the ether, we have a continuous medium making electromagnetic "events" possible.



A 1½-k.w. Telefunken quenched spark transmitter at Sierra Leone Wireless Station.

THE RADIO ASSOCIATION

THE Executive Committee of the Radio Association is able to report considerable progress in the organisation and consolidation of licence holders and amateur experimenters of the United Kingdom, and set out below, in tabular form, is a report of some of the work which has been carried out by the Radio Association.

ELECTION OF OFFICERS.

(a) *Vice Presidents:* Professor A. M. Low, D.Sc., A.C.G.I., F.C.S., F.I.P.; Col. C. L'Estrange Malone; A. W. Sharman, Esq.; Col. Moore Brabazon, M.P.; Lieut.-Commander Hon. J. M. B. Kenworthy, M.P.; Neville Maskelyn, Esq.

(b) *Hon Treasurer:* Professor P. M. Baker, B.Sc., A.M.I.M.E., A.M.I.E.E.

FORMATION OF BRANCHES.

The following branches have been formed:

(a) London and Suburbs.

BROCKLEY: Hon. sec., Mr. C. R. Rice, 111, Upper Brockley Road, S.E. 4.
BRIXTON: Hon. sec., Mr. D. G. Fowler, 31, Josephine Avenue, S.W.
SOUTH NORWOOD: Hon. sec., Mr. C. H. P. Nutter, 243, Selhurst Road, S.E. 25.
WANDSWORTH: Hon. sec., Mr. O. C. Lay, 43, The Grove, S.W.
WOOLWICH: Hon. sec., Mr. H. W., Atkinson, 226, Plumstead Common Road.
CENTRAL: Hon. sec., Mr. J. Treadwell, 4, Shipton Street, S.E.
BLACKFRIARS: Hon. sec., A. E. Norris, c.o. Smith's, Stamford Street, S.E.
SHEPHERD'S BUSH: Hon. sec., Mr. F. Gain, 8, Clematis Street, W. 12.
MERTON: Hon. sec., Mr. J. A. Partridge, 22, Park Road, Colliers Wood, Merton.

(b) Provinces.

EDINBURGH: Hon. sec., Mr. H. A. Herdson, 103, Corniston Road.
BRISTOL: Hon. sec., Mr. V. W. Russell, 14, Park Row.
CARLISLE: Hon. sec., Mr. Charles Crompton, 107, Warwick Road.
BIRMINGHAM: Hon. sec., 32, Coventry Road
ALTRINCHAM: Hon. sec., Mr. Frank Kenyon, Gaskell Road.
SOUTHSEA: Hon. sec., Mr. John H. Harold, 11, Albert Grove.
LEEDS: Hon. sec., Mr. A. Bull, 40, Bently Lane, Meanwood.
WHITLY: Mr. R. G. Oliver, 12, Waverley Avenue, Monkseaton.
LIVERPOOL: Mr. S. Frith, 6, Cambridge Road, Gt. Crossby.

Manchester, Glasgow, Cardiff, Brighton, Plymouth, Hull and Ireland will be announced shortly.

London branches have club rooms for the members, where there are facilities for learning Morse, testing apparatus, receiving technical information. Furthermore, lectures are being organised for those anxious to acquire a knowledge of radio science, and the weekly debates are of great assistance in stimulating interest.

BROADCASTING.

The Executive Committee of the Radio Association has taken up with the Broadcasting Co. and the Postmaster General, on behalf of members, the question of broadcasting during other hours than from five until eleven. One of the greatest difficulties which beset the would-be licence holder is the fact that he is unable to hear a demonstration of his instrument before he buys it. The executive committee are glad to be able to report that the Postmaster General has replied stating that the matter is under careful consideration.

ERECTION OF AERIALS.

The Postmaster General has given permission to the Radio Association to grant certificates to individuals who are competent to erect aerials for amateurs. Many licence holders who have no technical knowledge, experience considerable difficulty in fixing their aerials in accordance with the regulations.

FELLOWSHIP.

The standards of the Degree of Fellowship have been drawn up and those members desirous of becoming Fellows of the Radio Association can have full particulars on application. This degree of Fellowship should be of great value to the genuine wireless experimenter, and in course of time anyone holding the degree will be recognised as an expert in wireless.

BADGE.

The Badge of the Association is now obtainable from the head office or from local branches by members on application. The executive committee are glad to note that the badge is much appreciated by members, and a very large number have already been applied for.

INSURANCE.

A special R.A. Policy underwritten at Lloyds, has been drawn up for members of the Radio Association. The policy is on extremely advantageous terms and protects the receiving sets of members up to the value of £50 for 5s. per annum. The holder of such a policy is also protected up to the amount of £500 in third party risks.

MEMBERSHIP.

The executive committee announce that members of the Association are to be found in South Africa, Uganda, Chile, Gibraltar, Nova Scotia, Canada, Sweden, Belgium, and Egypt, and these members will form the foundation of the Colonial and Foreign branches.

CO-OPERATION AMONG MEMBERS.

The executive committee urge all members of the Radio Association to co-operate together and join the branch nearest their homes. Application forms and literature will be forwarded to anyone interested, and those members willing to help, on application to the organising secretary, Capt. G. Drury Coleman, 44, Great Russell Street, W.C. 1

KING CANUTE AND THE "UNTUNED WAVES."

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.

The Brynmawr and District Radio and Experimental Society.

At a recent meeting of the above society, Mr. E. H. Williams took the chair, and the following vice-presidents were unanimously elected: T. L. Williams, B.A.; A. Jenkins, Esq., M.P.; W. D. Lewis Evans, Esq., M.A.; and H. Harris, Esq., J.P.; also Mr. J. D. Calloway, M.I.E.E., was unanimously elected as assistant secretary. It was resolved that the secretary should give full particulars to the ironmongers in the district with a view to obtaining a wireless agent for the society. A very pleasant evening was spent in experimenting with a Morse buzzer and headphones, in order that this could be fixed permanently to give Morse practice to the members.

The secretary will be pleased to give full information to anyone in the district who wishes to join the society.

Hon. sec., 206, King Street, Brynmawr.

* * *

Glasgow and District Radio Club.*

The above club is having a highly successful season, the membership being now well over 200, and new applications are being received every week. A number of interesting lectures have been held.

As the matter of fading in connection with transmissions of telephony from the broadcast stations has been causing club members a considerable amount of trouble, six members had arranged to listen-in specially to the full programme of Manchester Broadcasting Station on a particular night. These reports had just come to hand at the last meeting, and are being tabulated by Mr. Pick, one of the members of the committee, who has kindly consented to open a discussion on this subject, and it is hoped that we may during the evening find some suitable ground for further experiments later. There is only one thing necessary now in Glasgow to make wireless practically complete—that is the starting up of the local broadcast station, after which there will no doubt be a few more hundred members coming along.

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

* * *

Wolverhampton and District Wireless Society.*

The annual general meeting of the above society was held on December 29th, at which officers and committee were elected for the ensuing year, Mr. D. P. Baker in the chair. Minor alterations in the rules were effected, and the financial statement was presented by the treasurer (Mr. F. G. Redhead). Improvements where necessary were suggested, and an individual expression of opinion was given by most of the members present. The business conducted was most satisfactory.

Hon. sec., J. A. H. Devey, 232, Great Brickkiln Street, Wolverhampton.

* * *

Ashton-under-Lyne and District Radio Society.

A most enthusiastic meeting of wireless workers was recently held at Livesey's Café, and it was decided to form a radio society, every person present giving in his name for membership, so that, with the names of persons who notified their intention of taking up membership but were unable to be present at the meeting, it is expected that the first membership will total forty.

All particulars of membership can be obtained from the hon. sec., Mr. James Hy. Marshall, 22, Warrington Street, Ashton-under-Lyne.

* * *

The Bishop's Stortford College Wireless Society.

At a meeting of the society to elect officers for the coming term, the following were elected: President, J. K. Gale, instead of A. A. Lockhart; secretary, A. A. Lockhart, instead of J. K. Gale; treasurer, Mr. A. D. Hayward; committee members, D. B. Collett and H. C. Golder. The term's work was then discussed, and it was found that Hertzite crystals had yielded very good results. The society has been gradually increasing in numbers, and now has twenty-five members.

* * *

Stratford-on-Avon and District Radio Society.

Captain H. C. G. A. R. West, R.N., has graciously accepted an invitation to act as president of the society, also Mr. P. C. Foley as vice-president.

A buzzer class has been held for the last three meetings, and the members show a keen interest in learning the code. Mr. S. Nicholls recently gave a demonstration with a fine Wimshurst machine, and quite splendid results were obtained in charging and discharging condensers, lighting vacuum tubes, etc. The secretary will welcome all applications for membership to the society.

Hon. sec., Mr. E. W. Knight, 17, Park Road, Stratford-on-Avon.

* * *

Redditch and District Radio Society.

At a recent meeting of the above society at the Temperance Hall, Redditch, details of the proposed installation of a two-valve receiver were again discussed, and members anticipate the reception of concerts, etc., in the course of a week or so. The outside equipment has already been erected, and is expected to give very satisfactory results.

The society is at present composed of about twenty-five members, and some valuable work has already been carried out. With the aid of receiving apparatus, which will be improved upon in the near future, it is hoped to strengthen the membership and attract the interest of the many enthusiasts in the district. Amateurs especially will no doubt welcome an opportunity to discuss their experiences with others similarly engaged.

Lectures are being arranged for future meetings, and Morse practice will prove a useful feature to many.

Particulars may be obtained from the secretary regarding membership, and all interested in the science are cordially invited to the weekly meetings of the society held in the Temperance Hall each Friday at 7.30 p.m.

Hon. sec., Mr. A. W. Reeves, The Elms, Alvechurch, nr. Redditch.

* * *

The Chorleywood and District Wireless Society.

A very successful inaugural meeting of the society was held recently. Mr. W. Blake was elected chairman and Mr. A. G. S. Richards was elected secretary.

A committee has been formed, consisting of the chairman and secretary, together with Messrs. Craske and Watkins, for the purpose of drawing up a programme.

The society meets every Monday evening at the secretary's residence, Hillbrow, Haddon Road, Chorleywood, and all interested are invited to communicate with him as above.

TO READERS OF "P.W."

Some valuable and interesting notes on Broadcasting and the position of the amateur experimenter, made by Captain Round, Chief Research Engineer of the Marconi Co., will shortly appear in this paper.

* * *

THE BEGINNERS' SUPPLEMENT

The articles appearing in the Beginners' Supplement will, week by week, deal in a comprehensive way with the fundamental principles of Wireless. Three special articles on the Valve will shortly appear.

TELL YOUR FRIENDS ABOUT THE BEGINNERS' SUPPLEMENT.

RADIOTORIAL

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

I have received many letters from new readers suggesting themes for articles for the Beginners' Supplement, and I wish to thank them very cordially for the many useful hints and very nice remarks concerning POPULAR WIRELESS. Perhaps my new readers will be interested to know that the Beginners' Supplement will continue for several weeks. It will contain each week articles of general information for the beginner which will eventually cover a very large ground, and will enable the novice to gradually acquire a sound working knowledge of radio.

Beginners will notice that very little mention of valves has so far been made in the Supplement. This very important subject will be dealt with later on in three special articles, and in such a manner that—I hope—the veriest tyro will not fail to clearly grasp the working principles of the wonderful valve.

In the meantime, I feel sure my new readers are finding much useful information in the weekly instalments by Mr. Egan, who has quite a reputation for "simple explanations." Succeeding instalments will continue to lead the novice gently by the hand along the intricate paths of wireless, and any suggestions from my readers will be most welcome.

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 138, The Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send necessary postage for reply.

"AERIAL" (Manchester).—(1) Which end should I take my lead-in from, the high or the low end of my aerial? (2) Should bornite and zincite crystals be soldered?

(1) The lead-in is better taken from the higher end of the aerial. (2) If these are soldered, you should use a low temperature solder, such as Wood's metal, in order not to damage the crystals by the application of too much heat.

E. A. (Southall).—(1) What is the wave-length of a coil 3½ in. by 5½ in. wound with 26 S.W.G. enamelled? (2) Would a 4-volt 10-amp. accumulator be suitable for a one-valve amplifier? (3) Would this amplifier—L.F.—work a loud speaker in conjunction with a crystal set?

(1) The wave-length will be about 250 metres to 1,000 metres. (2) No; you would have to recharge it very frequently. Use a 4-volt 40-amp. (3) Not unless you were very near a broadcasting station. In your case another L.F. amplifier will be necessary.

* * *

A. B. C. (Birmingham).—I recently purchased a B.B.C. licence, and find this does not cover my home-made crystal set. Can I change the licence for an experimental one?

Your best plan will be to write to the Secretary, G.P.O., London, and explain that you have built a crystal set and have already bought a licence (broadcast type) in error. Ask for permission to use the set with the licence. Explain clearly the details of your set, and state whether it is all home-made, and whether the materials used are of British manufacture.

* * *

"ANXIOUS" (No address).—I bought a crystal set from a friend *before* the B.B.C. was formed, and applied for a licence. I was told, after some weeks, that I could get it at a post office. I find this licence does not cover my set. What shall I do?

Your best plan is to write to the Secretary, G.P.O., and explain the circumstances, also pointing out that the set is of British manufacture, and give the details of the set, when it was purchased, etc. Ask for permission to use the set under the broadcast licence you possess.

* * *

R. W. (Cirencester).—What length of time should a valve last?

The length of life of a valve is the length of life of its filament, generally speaking, and this should with the average valve approximate to 1,000 hours or more light. The golden rule with valves is to operate them at their lowest possible filament temperature, and keep them free from mechanical shocks or vibration.

* * *

T. P. O. (Liverpool).—Could an accumulator high-tension battery be constructed with the mouths of the cells sealed with paraffin wax like the dry H.T. batteries?

Not unless a small opening is left for the gas to escape and through which distilled water could be inserted to compensate for dielectric evaporation.

* * *

I. D. (Okehampton).—Why cannot A.C. current be used for valve H.T. work direct, because I understand that every valve will permit of the passage of current in but the one direction? It would seem to me that it would be only possible to make use of the A.C. current in the one direction.

A.C. current can be used in the manner that you suggest for transmission. Moreover, there are circuits that are arranged with two valves in opposition, so that each direction of the alternating current can be used. If a sinusoidal A.C. is applied directly to the plate, however, the anode current and therefore the radiated energy will undergo such variations that the signals will be inaudible in an ordinary receiver. Therefore telephony is very difficult with such supply, but for C.W. work it is quite O.K. Of course, the note will be accompanied with the well-known A.C. hum. This latter, if there was no other reason, would prevent its useful adaptation to reception.

* * *

D. N. (Leith).—Why are such long wave-length coils used in the super-regenerative Armstrong circuit when it is said that the circuit is essentially for short-wave reception?

In the first place amplification of low wave-lengths and high frequencies is considerably poorer than that of the longer wave-lengths and lower frequencies with cascaded valve amplifications. It is upon that fact that Major Armstrong based his experiments and endeavoured to change the frequency of these low wave-lengths to one more suitable for cascade amplification. Therefore he introduced an applied heterodyne to the received signal in order that the resultant beat should be of low frequency. This gives a new wave-length which may be of the order of 6,000 metres or so. To deal with this the coils of high inductive value are necessary.

* * *

"AMATEUR" (Reading).—Why is it that when a valve set is oscillating there is a click when a damp finger is touched on to the aerial terminal?

Because in doing that the oscillations are quenched and the cessation of current flow through the anode circuit due to the self-heterodyning will in the same way as the commencement of current flow cause a click in the telephone receivers.

* * *

L. B. C. (Wolverhampton).—Would it be possible to employ a reaction coil with a crystal set in such a way that there was a current induced into the detector circuit in the direction likely to render the crystal more sensitive by the resultant applied potential?

Various methods of doing this have been attempted without the success obtained by the introduction of applied potential by means of a potentiometer and a battery. The great difficulty lies in the varying characteristics of various crystals and the fact that at the most there is no great initial energy available.

(*Continued on page* 900.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page* 898.)

"AERIAL" (London, E.).—What is the efficiency of a frame aerial compared to that of a good outdoor aerial?

A frame aerial will have but from 5 to 10 per cent. the efficiency of the ordinary elevated type, and for that reason some considerable amplification is desired to obtain good results on the former.

How many turns on a three-foot frame aerial should I wind for the receiving of broadcasting?

Seven turns of 24 S.W.G. spaced ¼ inch with a ·0005 mfd. variable condenser across its ends for tuning purposes.

* * *

T. M. (Willesden).—I am constructing a four-valve set, and have only room on the panel for two filament resistances. It is a 1 H.F. and 2 L.F. circuit. Should I have one resistance for the H.F. and detecting valves, and one for the L.F. valves, or what would you advise?

We should, in the first place, advise you to endeavour to rearrange your apparatus so that such a congestion of apparatus and consequent restriction of space does not occur, otherwise we are afraid that you will have trouble with interaction and its attendant "howling." Anyway, whatever else you do, always allow the detector valve a separate filament control, as this is the most critical of the three stages. If you employ "hard" valves for amplification, one filament control for the amplifying stages will suffice, although, in point of both economy and general efficiency in reception, separate filament controls are extremely advisable.

* * *

"NOVICE" (Newcastle-on-Tyne).—What is an average value of inductance and capacity for an amateur aerial?

·0002 to ·0003 mfd. capacity and about 15 mhs. inductance.

Is it necessary to obtain these exactly in order to work out with a coil the wave-length of a set?

Take the average values as given above, a slight error either way in these will not affect the result to any great extent, as the whole scheme of finding wave-length by mathematics is liable to a 10 per cent. error, at least.

* * *

K. B. T. (Stepney).—Would you advise me to employ an outdoor aerial of only 20 ft. in height and 20 ft. in length with a crystal set, or an indoor aerial and a valve set? I only desire to hear Marconi House on telephones.

With careful adjustments and obtaining every available inch of height, you should obtain quite good results from Marconi House on a crystal set, employing the outdoor aerial you mention.

* * *

W. A. R. (Stratford-on-Avon).—Why cannot I receive messages from stations on my crystal when I am within their stated range of transmission?

Probably because your receiver is not sufficiently sensitive. A stated range, nowadays, is generally made where it is presumed that the receiving stations possess a fairly sensitive valve set.

* * *

"NO NAME" (Whitstable).—I have a crystal set with a coil of 2½ in. diameter and 16½ in. long, wound with 26 S.W.G. (1) What is its wave-length? (2) My aerial is 18 ft. high and 80 ft. long, including the lead-in. Is this O.K.? (3) Could I hear Writtle on this set? (4) What 'phones should I use?

(1) About 250 to 1,800 metres. You should use a larger diameter—say, 4½ in. and about 9 in. long—which would give more efficient results. (2) This should act fairly well, but the aerial is on the low side. Try and raise it four or five feet, taking off a corresponding number of feet from the length. This is necessary in order to keep within the regulations. (3) This is not likely, as it is out of range for a crystal set. (4) 4,000 ohms.

(*Continued on page* 902.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 900.)

"FRAME AERIAL" (Kentish Town).—What size frame should I use for 2 L O? Could I use wires slung up across the room near the ceiling?

A four-foot frame wound with five turns of 22 d.c.c., each turn being ¼ in. from the next. The aerial, slung across the room, would give you fair results; but in this case you need the usual earth connection, and these aerials make it very difficult to tune in successfully, as the slightest movement of any person upsets the capacity of the aerial, and thus the tuning.

* * *

M. P. D. (Highgate).—I am using a tapped tuning coil on my crystal set, but find that best tuning is obtained for 2 L O when the switch arm rests on two studs instead of on one, as is usual, I believe. Why is this?

This should not be so. You have probably taken the tappings so that the natural wave-lengths of the sections of the coil do not quite coincide with that of the station at any one tapping. Thus, when using two, you are short-circuiting a section of the coil, thus putting it in shunt across the switch arm and studs. This shunt possesses a certain amount of capacity and inductance, and these are added to the total effect of the section of the coil used, and thus bring the tuning somewhere near the correct value for the reception of the required station. A small variable condenser connected across the coil would stop this trouble and give you finer tuning.

* * *

J. A. M. (Brighton).—I am repeatedly jammed by ships and coast stations when listening to the broadcasting from London. Is there any cure?

Without going to the trouble of adding numerous and complicated rejector circuits to your set, which would make it very difficult to tune in, your best plan is to use a frame aerial. This will, unfortunately, necessitate the addition of one or more high-frequency valve amplifiers to make up for the change in aerials. You would, however, obtain the directional effect that all frame aerials possess, and this would aid greatly in cutting out the interference.

* * *

"ANODE" (Sheffield).—I want to use the tuned anode type of coupling. Can I use reaction with this, instead of reacting on the aerial?

Yes; the reaction coil may take the form of a smaller coil to slide inside the anode coil, or it may be hinged and the coupling varied by swinging it nearer or farther away from the anode coil. A useful method is to make both coils of the basket type and use a small coil-holder, mounting the coils in the same way as the aerial tuning and secondary coils are mounted.

* * *

T. P. D. H. (Forfar).—Is there any way by which old H.T. batteries can be used again?

There is no very successful way of repairing them. They can be rejuvenated to a certain extent by piercing each cell through the top with a small hole, and then pouring a few drops of sulphuric acid into them. This will give life to old cells, and they will sometimes last for several weeks after this treatment.

* * *

A. S. D. (Hartlepool).—Is there a right and a wrong way to connect telephone receivers to a set?

There is a correct way, but it is not often that amateurs take the trouble to find which it is. The proper way is to connect the 'phones so that the current flowing through them will increase the strength of the magnets at each impulse. To find which way this is, it is necessary to test the strength of the magnets, first with the current flowing one way and then the other. A small weight (of iron) should be attached to the diaphragm of either earpiece; then, with the current passing through the coils, the magnets will be strengthened or weakened, as the case may be. If the 'phones are hung with the diaphragms downwards, the weight will pull the diaphragms off, if the current weakens the magnets, and if it strengthens them, they will be fixed more firmly. A little trouble will enable you to find a weight of suitable size.

* * *

R. E. A. C. (Bedford).—How do I know when my set is oscillating?

It is very difficult to tell sometimes if the set is only radiating slightly, but if the oscillation is at

(*Continued on page* 903).

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page 902.*)

all violent there will be a decided rushing sound in the 'phones. Very likely you will notice a click when the set begins to oscillate. In any case, as soon as you near the oscillation point the signals will become rather "smudgy," and will eventually be very distorted.

* * *

X. Y. Z. (Reading).—I have often read in your columns references to harmonics. What are harmonics ?

When a station is sending out wireless waves, these waves are not always pure, especially in the case of high-power continuous wave stations. Smaller waves whose wave-lengths are less than that of the main or fundamental wave are very often transmitted. These waves are called "harmonics," and bear a direct ratio to one another and to the fundamental wave. They are usually of wave-lengths of ½, ⅓, or ¼ that of the fundamental. So that it does not infrequently happen when you are listening-in on 400 metres or thereabouts that you hear the signals or speech of a station operating on about 800 metres. This is very often noticeable with Croydon, whose signals can often be heard quite distinctly and loudly on about 600 metres, whereas the proper wave-length is 900 metres.

* * *

G. A. P. (Southampton).—How does "beat" reception function ?

It is a method whereby a high frequency oscillation is generated in the aerial of a different frequency to that of continuous wave-signals coming in. These two oscillations come first into step and then out of step with one another. When they come into step they assist one another, and when they are out of step they oppose each other, thus producing periodical fluctuations causing signals in the telephones.

* * *

"QUERY" (Dover).—I noticed that on charging my 6-volt accumulator, one of the cells, the middle one, showed no sign of gassing even though the other two had been doing so for some time. Should this be so ?

No ; in all probability there is some dirt causing a short circuit internally. The cell should be carefully examined, and, if the bottom appears dirty, it should be emptied and washed out. Acid of 1.2 specific gravity should be poured in and the charging of that cell resumed until it gasses freely. You may find a piece of the positive plate has crumbled away and has lodged between the positive and negative plates, causing an internal circuit. This should be removed, when the cell can be charged again until it gasses.

* * *

T. D. (Reading).—Can I take it that in the wave-length formula both capacity and inductance play the same part, and therefore I can increase the wave-length range of my set by the addition of either ?

Yes, that is so, but in point of efficiency it is advisable to obtain the range by the addition or reduction in inductance, keeping the capacity as low as possible and using it only for the fine variations of tuning.

* * *

M. C. (Upper Tooting).—I am thinking of buying a crystal set, but am rather doubtful as to result. I have never listened-in and have heard such a lot about the "nasty twang of a cheap gramophone," that I would like an unprejudiced opinion on the point.

With a crystal set and telephone receivers you will be surprised at the faithfulness of the reproduction. "Might as well be in the room" is the type of comment more often heard when telephone receivers are used. It is the loud speaker that has caused so many people to base their ideas of wireless music on distorted results. In any case loud speakers cannot be used with crystal sets.

* * *

"CISSIE" (Rugby).—(1) I read in a book that the length of an aerial is limited by regulations to 120 ft. of wire if used in one piece. Is this correct ? (2) Can I get a set, made at home from parts, stamped by the B.B.C. ?

(1) No, this is certainly not correct. The regulations state that the height (at highest point) of an aerial plus its total length from the set to the farther insulator or spreader must not exceed 100 ft. This length includes the length of the lead-in. In the case of a double aerial the length becomes the span from insulator to insulator plus the length of the lead-in. (2) No, the only course for you to adopt in this case is to apply for an experimental licence. If all your bought parts are stamped by the B.B.C. you may be given permission by the G.P.O. to use the set under a broadcasting licence. In any case, the experimental licence form must be filled in.

(*Continued on page 904.*)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 903.)

J. C. B. (Glasgow).—(1) Would a 2-megohm grid leak be better than a 4-megohm leak? (2) When reaction is used, is touching the aerial terminal and listening for a click a reliable method of knowing if the set is radiating?

(1) Probably 2 megohms would be a more suitable value for most valves than 4. You should experiment with different values of leaks until you find the one that most suits the particular valve you are using. (2) No; we should not like to say it was an infallible test. It will certainly give you a guide as to whether the set is oscillating violently or not, but an aerial may be radiating gently without your having the click on touching the aerial terminal. There is no absolutely safe way of telling if your aerial is radiating unless you have a milliammeter in the aerial circuit.

* * *

A. P. D. (Ilkley).—Can my set radiate at all without causing distortion of speech and music?

It is not likely to be radiating badly enough to cause serious interference without causing a certain amount of "smudgy" reception and distorting speech somewhat. We would not like to say, however, that the aerial is not radiating at all except when distortion of reception occurs.

* * *

A. T. (Welwyn).—Is there any connection between electrical units of power and the ordinary mechanical units of horse power? I often hear people talking about a ½-h.p. electric motor.

Yes; it has been found that about 746 watts equal 1-horse power.

* * *

I. M. J. (Manchester).—What is meant by heterodyne reception?

Heterodyne reception is a method used for the reception of continuous waves. A special generator—usually a valve circuit—is coupled to the detector circuits so that it causes high-frequency oscillations to flow in the aerial. (In the case of a valve and reaction, the reaction does this.) These oscillations have a certain frequency, and also those of the C.W. station which are coming in have a certain frequency. When these frequencies are different they form a beat every now and then, and this beat is audible in the 'phones. The beat-note is dependent on the difference between the two frequencies.

* * *

D. T. M. (Hendon).—Why do some loud speakers distort more than others?

The distortion that takes place in loud speakers is mainly due to the fact that a small diaphragm is vibrating and sending out sound waves. These waves are then expanded as much as possible by the horn of the loud speaker. Unless the waves expand regularly they become ragged and tend to be jumbled up. This causes distortion, and is mainly due to the acoustic properties of the horn used. If the horn also vibrates and has a metallic ring, it will cause distortion by providing more waves due to its own vibrations.

* * *

"JAMMED" (Newhaven).—What is a rejector circuit? Is it of any use for the elimination of jamming?

The rejector circuit is a tuned circuit composed of an inductance and a variable condenser, which is shunted across a portion of the receiving circuit. The rejector circuit is so tuned that it will not respond to the desired signal, but will form a by-pass to all other signals of near wave-length which would be likely to cause interference. Usually several rejector circuits are included in the receiving circuit so as to cut out interference as completely as possible.

* * *

L. T. C. (York).—Can I use wood for a valve panel, or slate?

Neither of these materials is really as safe for use as an insulator as ebonite, but both can be used if treated well first. In the case of the wood you should dry well in a warm oven for some days, and then soak in melted paraffin wax for about 24 hours. After this the wood should be cooled in a dry place. The slate should also be well dried in a warm place, and its surfaces covered with a thin coat of shellac. This will help to prevent moisture from condensing on the surface of the slate.

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R/Y

POPULAR WIRELESS WEEKLY, FEBRUARY 17, 1923.

REGISTERED AT THE G.P.O. AS A NEWSPAPER.

MAKING A SUPER-CRYSTAL SET.

POPULAR WIRELESS

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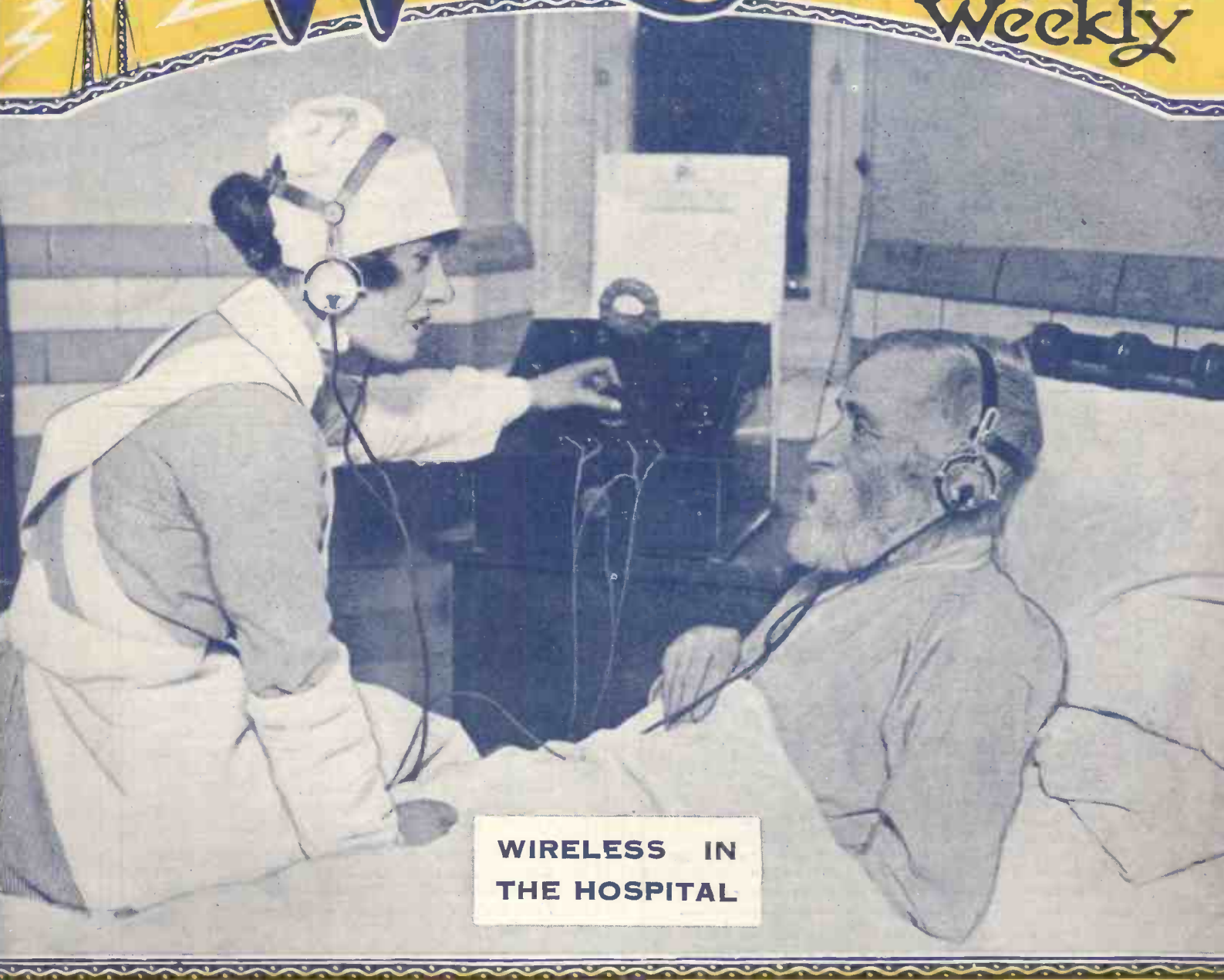
Weekly



WIRELESS IN THE HOSPITAL

FEATURES IN THIS ISSUE.

Constructional Notes for Amateurs.

Wireless and Telepathy.

A Few Notes on Broadcasting.

The Berne Wireless Station.

The Range of Reception.

By E. H. Shaughnessy, O.B.E., M.I.E.E.

Another Four-Page Beginners' Supplement.

NEXT WEEK.

WIRELESS FOR THE AMATEUR.

A special exclusive article written for "Popular Wireless" by

CAPTAIN H. J. ROUND,

(Chief Research Engineer to the Marconi Co.)

No Amateur should miss this long and intensely interesting article.

Popular Wireless

TOPICAL NEWS AND NOTES.

NEXT WEEK.

THE CONSTRUCTION OF COIL HOLDERS

MAKING A POTENTIOMETER

THE RECEPTION OF AMERICAN AMATEUR STATIONS.

A PAGE OF IDEAS FOR AMATEURS, Etc.

And a Another Four-Page Beginners' Supplement.

The ex-Premier's Set.

MR. LLOYD GEORGE, on his return from Spain, found his four-valve cabinet set installed in his new home. The other evening he listened to the results of the Lausanne Conference, and was deeply impressed with the usefulness of the B.B.C's news service. From what I can hear of it, the ex-Premier is on the high road to becoming what our American friends call a "Radio Fan."

* * *

Newcastle's Record.

5 N O is to be congratulated on its transmission. The station is clearly audible in London on one valve and comes in nearly as well as Birmingham.

* * *

Writtle's Announcer.

CAPTAIN PETER PENDLETON ECKERSLEY'S much-loved humour and always cheerful voice will no longer tickle the ether from Writtle. That enterprising little station has followed its more staid companion, Poldhu, into temporary retirement—at least, as far as amateur transmissions go.

"Toc Emma Toc" has retired full of honours. The first British concerts were started there, thanks to the efforts made by the Radio Society of Great Britain. Captain Eckersley has now been appointed engineer-in-chief to the B.B.C. Congratulations and good luck to him!

* * *

Cafe Wireless.

HOPING to enjoy a brief respite from the eternal wireless, I treated myself to a solo supper the other evening at a well-known café in the West End.

I had just made a few judicious selections from the menu, and had almost forgotten that such a thing as broadcasting existed, when suddenly a horrible growling broke out just behind me.

With a sinking heart I turned in my seat. That growling seemed strangely familiar!

Sure enough, there was a great, big, black "back chatter"—commonly known as a "loud speaker"—surrounded by a perspiring high priest armed with a four-inch spanner.

The speech was horrible.

* * *

Bad Effect.

SERIOUSLY, though, this sort of thing is going to do a lot of harm to wireless. The people in the café were disgusted with the results—and well they might be. The man in charge of the set hadn't the faintest idea of what he was doing, and, though 2 L O could hardly have been a couple of miles away, the results were atrocious.

A Deal in Valves.

I HEAR that the Grafton Electric Co. have bought up a store of Siemens-Halske and A.E.G. valves. These will be very useful to many amateurs, as they only take 3 volts on the filament and ·5 amp. With 60-80 volts on the plate, they make very good amplifiers, though if a soft one is obtained it serves well as a detector also.

* * *

Opera For Glasgow.

GLASGOW listeners-in will be delighted to learn that they are to share the delights of opera and other such broadcast transmissions locally. I hear on very good authority that a "landline" will be laid between the Glasgow Coliseum and the Glasgow Broadcasting Station, and that when the British Opera Company reaches that city, preliminary experiments will be carried out. However, it is not expected that permanent arrangements will be made for extended transmissions of that nature until October in this year. In Manchester and Birmingham it is hoped to transfer the actual broadcasting stations nearer to the centres of those cities in order that similar transmissions will be possible from these points.

* * *

Wireless at the Ideal Home Exhibition.

I HEAR that the wireless section of the "Daily Mail" Ideal Home Exhibition, which opens at Olympia on March 1st, is going to be a first-class representative gathering. Some forty well-known firms have booked stalls.

POPULAR WIRELESS will also have a stall, and experts will be in attendance to answer questions.

* * *

"Uncle Arthur Speaking."

THAT the "Uncles" and "Aunties," that delight the kiddies during the transmissions devoted to "juvenility"—and enjoyed by thousands of grown ups, it must be added—are ordinary and kindly people has now been proved to the satisfaction of everybody. When a little girl lying in hospital very dangerously ill was allowed to listen-in, and heard Uncle Arthur of the London Broadcasting Station actually speaking to her, calling her by her pet name, and telling her to hurry up and get well, she was so delighted that—she very quickly did get well.

* * *

An American operator and the latest type of Telefunken Wireless Set.

Broadcasting "Cinderella."

NOW that a permanent cable has been laid down connecting the London Hippodrome to the London Broadcasting Station, listeners-in will be able to look forward to the pleasing prospect of being able to bring the country's leading musical variety "turns" right to the fireside. I am told by one who should know that the present transmissions from the Hippodrome will continue until Easter. After that it is expected that from time to time selections from the programmes of that hall will be broadcast in turn with other such interesting items yet to be arranged.

The manager of the London Hippodrome is of the opinion that by enabling all the thousands of listeners-in to hear the choicest items from his programmes, an incentive to greater attendance at the actual "show" will be provided. I am sure his optimism will be very ably supported.

* * *

A Change of Name.

Uncle Fred, of 2 L O, is to change his name. I believe he has certain objections to that name, and prefers to be called by his correct nomenclature. He will in future be Uncle Rex.

NOTES AND NEWS.

(Continued from previous page.)

A New Invention.

AN instrument known as the cathode oscillograph has been made by M. Dufour, a professor of physics at the Faculty of Sciences, Paris, which is capable of recording the millionth part of a second. It is possible, with this wonderful appliance, to register minute currents of high-frequency electricity, and it is proposed to apply the invention to the reception of high-speed wireless messages.

* * *

2 L O's Orchestra.

I WAS thinking the other evening that 2 L O is rather too fond of its orchestra. Less band and more lectures and talks seem to be the general desire of listeners-in. Further, the items chosen by the band are not inspiring; they are not classical nor are they frankly "popular." They hit a medium which is only third rate. There is room for improvement here.

Mr. George Robey and Miss Alma Adair in 2 L O's studio.

Radio for Railways.

A NUMBER of railway experts recently studied the experiment of receiving wireless messages during the journey of an express from Liverpool to London. On arriving at Euston Mr. Billington, a leading official of the London, Midland, and Scottish Railway, said that the tests had been so surprisingly satisfactory that they were justified in going further into the question of train control by wireless.

He added that probably very soon loud-speaking wireless sets would be fitted to dining-cars so that passengers could enjoy the entertainments during their journey.

* * *

Cardiff a Broadcaster.

THE Cardiff broadcasting station was opened last Tuesday by the Lord Mayor of the city (Dr. J. J. E. Biggs). Lord Gainford, chairman of the B.B.C., and Mr. J. C. W. Reith, the general manager of the company, were present.

It is too early in the day to give an opinion on the Cardiff transmissions; but as the gear installed is similar to that at the Newcastle station, and as the aerial is suspended in a particularly happy fashion, there is no reason why 5 W A (the Cardiff station) should not prove quite O.K.

For the Hospitals.

FREE wireless demonstrations in aid of a local hospital are being given in Kettering Market Place by a local enthusiast. The aerial is suspended between the tops of two of the market stalls.

* * *

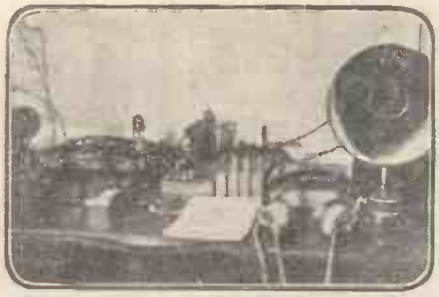
To Be or Not To Be?

IT is expected that the question as to whether music licences are necessary for the use of loud speakers in public-houses will soon be settled in a test case. Recently the justices at Hartlepool granted a licence to a public-house, but one was refused by the justices at West Hartlepool.

* * *

The Exhibition.

DON'T forget that on March 1st the Ideal Home Exhibition opens at Olympia, and that there will be a first-class representative wireless section. Experts will be in attendance at the "Popular Wireless" stall, so roll up and propound your questions. I am told that this wireless section will have some very interesting novelties to show, so don't forget to pay a visit to Olympia.



Mr. W. Morrison's set, 103, Loughborough Park, Stockwell, S.W.9.

An Original View.

I SAW a letter in the Press the other day from an amateur who had rather original views about the B.B.C.

He stated, rightly enough, that an Englishman's home was his castle, and that even the air above and about his house was, by law, his. And he wanted to know whether the B.B.C. should not pay *him*, for, by using a home-made set, he can hear their concerts in his house, and consequently accuses the B.B.C. of trespassing! Rather original!

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.
London Broadcasting Station, Strand ..	2 L O ..	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	5 N O ..	400 ..	As a rule from 7 to 10 p.m.
Manchester Broadcasting Station	2 Z Y ..	385 ..	Every evening, usually from 4.30 to 10 p.m.
Birmingham (Witton) Broadcasting Station	5 I T ..	425 ..	Every evening, usually from 6.30 to 10 p.m. (News, Concerts, etc.).
Glasgow Broadcasting Station	5 S C ..	415 ..	Commencing shortly.
Cardiff Broadcasting Station	5 W A ..	395 ..	6.30 to 10 p.m.
Croydon	G E D ..	900 ..	Throughout day to aeroplanes.
Paris	F L ..	2,600 ..	11.15 a.m. Weather report; 6.20-7 p.m. Weather report and Concert; 10.10 Weather report.
Königswusterhausen ..	L P ..	2,800 ..	Between 6 and 7 a.m., between 11 and 12.30, and between 4 and 5.30 p.m.
The Hague	P C G G ..	1,085 ..	Sundays, 3 to 5 p.m. (Concert.)
Haren	O P V H ..	1,100 ..	12 o'c. and 16.50 o'c. Telephony.
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.
School of Posts and Telegraphs, Paris ..	—— ..	450 ..	Every Tuesday and Thursday, 7.45–10 p.m. Saturdays, 4.30–7.30 p.m.

Note.—See announcements in daily Press for last minute alterations in times of Broadcasting Programmes. No Broadcasting during hours of public worship on Sundays.

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.

A FEW NOTES ON BROADCASTING.

Readers of POPULAR WIRELESS will find much to interest them in the article given below. Mr. Shaughnessy has always been sympathetic to the cause of the amateur, and the suggestions he makes below are helpful and valuable.

By E. H. SHAUGHNESSY, O.B.E., M.I.E.E., Engineer-in-Chief, Wireless Dept., G.P.O.*

THE rapid progress made by broadcasting in this country is, in my opinion, most remarkable. It is all the more wonderful to anyone acquainted with the technical difficulties that must be overcome to render such a feat of scientific engineering possible, and the greatest credit is due to all who have contributed towards its successful accomplishment.

If there has been one "fly in the ointment," it is in the continual misuse of reaction. It should be realised by all possessors of experimental valve sets that the introduction of reaction within, say, 10 miles of a broadcasting station, is quite unnecessary. Further, in order to obtain sufficient coupling to cause self-oscillation it is quite a common practice to employ coils of greater value than is required for efficient short wave reception. This means that what is gained by the use of reaction is lost in general inefficiency.

Examination of Sets.

I have wondered why a greater number of reports of interference are not received from more distant areas. It may be due to the fact that a trunk telephone call is necessary in order to get through to the transmitting station. Anyway, heterodyning becomes a very serious matter indeed where the strength of such interference becomes as strong, or even stronger, than the signals of the broadcasting station. Where this latter is but a few miles away, its signals would be sufficiently powerful to drown most heterodyning by valve receivers, but for more distant reception every stage of amplification introduced, whether it be of high or low frequency, will tend to magnify the interference to the same degree that it would the signals of the station from which it is desired to receive.

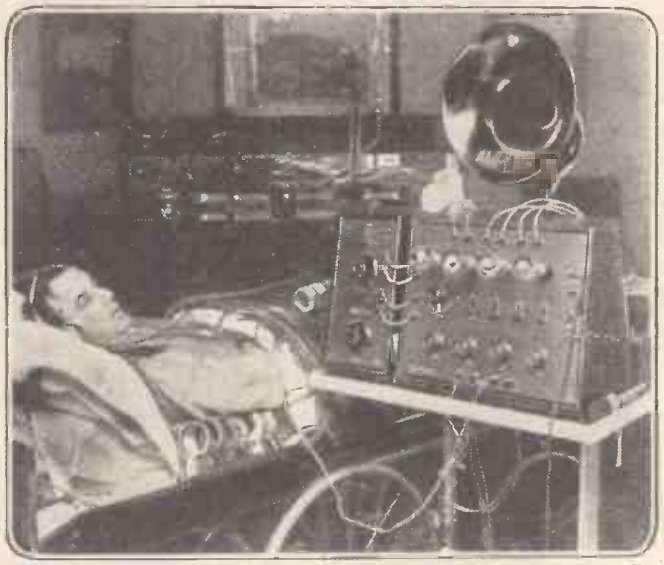
Needless to say, the strictest examination of the sets submitted to the department to be passed for B.B.C. stamping is necessary to provide that this nuisance will not extend. The test for reaction and aerial oscillation is carried out very carefully on a 100 ft. aerial with a sensitive receiver connected to a similar aerial running parallel with about 100 ft. separating them.

It does not seem to be generally realised that a set may be capable of self-oscillation, even although it is not provided with a reaction coil. The principle is similar to the original Armstrong regenerative effect, and is caused by an anode capacity due to the capacity that exists between the plate and the grid. About 1,000 different pieces of apparatus, submitted by some 300 different wireless firms, have been carefully tested for this, or any other tendency to oscillate the aerial, and emit interfering waves.

Also, a wave-length range test is carried out on both the 100 ft. and a 30 ft. aerial. The object of this is not to confine the adjustments of a set to a certain limited range of wave-lengths, but to see that the set is capable of tuning between 300 and 500 metres, and is therefore quite suitable for the reception of the broadcasting stations.

Issue of Licences.

A significant fact in connection with licences is that before the inception of broadcasting there were roughly thirty experimental licences issued per week; now the number could be multiplied many times. Surely all these people do not intend to devote themselves to the purely experimental side of wireless. For a short time subsequent to the commencement of broadcasting there were no broadcasting licences available, and to a certain extent the issue of experimental licences was generously extended in the favour of the increasing number of applicants. Now, however, that broadcast licences are fully available for all who desire to join the ranks of listeners-in with the one point in view, that of receiving the programmes broadcast by the B.B.C., the department intend to exercise care in respect of the issue of experimental licences.



Mr. C. Tye, of 10, Evrilley Road, Sevenoaks, Kent, an invalid who finds Radio a boon.

I have been asked whether permission is granted for the use of the Armstrong super-regenerative circuit by *bona fide* experimenters, and the answer is "Yes." There are, however, certain restrictions, and it will be agreed by all who are acquainted with the "super" and its potentialities as a "reaction jammer" that they are absolutely necessary.

In the first case permission to use this circuit is only extended to applicants of proved experience in valve regenerative work, and even then the antenna must not exceed in value that of a frame of one square foot in size. The necessity for these restrictions will be realised when it is remembered that the "super" will oscillate even when being tuned in by an expert. As a matter of fact, it is necessary to the efficient tuning of this circuit that it should do so.

Broadcasting Music-halls.

In connection with the broadcasting of opera by wireless I am asked to give my views regarding the possibility of microphonically reproduced transmission from the Queen's Hall. This would be quite possible, and presents no technical difficulties whatever, but, on the other hand, the laying of the special cable is a very expensive undertaking, and it depends upon the resources of the B.B.C., and whether that enterprising company consider that such a step would meet with the approval of their clientele, as to whether it will be attempted. As a matter of fact, to link up all the places of entertainment in London for broadcasting purposes would be quite possible. But in order to do this the Company must obtain a good income from the sale of broadcast sets.

It would not, in my opinion, affect the attendance of the actual halls themselves any more than it would encroach on the ground of the Electrophone system (whereby a possessor of a private telephone line can be switched through to a theatre or music hall), simply for the reason that in the one case you must accept what is offered, but in the other you are able to choose for yourself.

Then, in connection with such a wireless Broadcasting scheme, there has been expressed the idea that the more distant halls would suffer in reproduction from the effects of inductive interference, but by employing the special cables previously mentioned, and introducing devices well known to radio and "land-line" experts, there need be no fear of trouble from that source. Of course, there would always be heard that slight rushing noise well known to all who have enjoyed the recent Covent Garden transmissions, but that is due to the general noises of the building and vibration caused by traffic.

The whole future of broadcasting lies in the hands of the great British Public; if the innovation is well supported, then much may be expected; but on the other hand, if insufficient support is forthcoming, then it will not survive. The best way to support it is to buy a broadcast receiving licence and a B.B.C. broadcast receiver.

* In an interview.

AN ADJUSTABLE 'PHONE RECEIVER.

THERE are at present on the market many ex-Government 'phones of a type similar to that shown in the diagram, which may be purchased for about 2s. 6d. each. With a little trouble these may readily be converted into very sensitive, adjustable wireless 'phones.

Unless they are intended for use with a transformer, they should first be re-wound

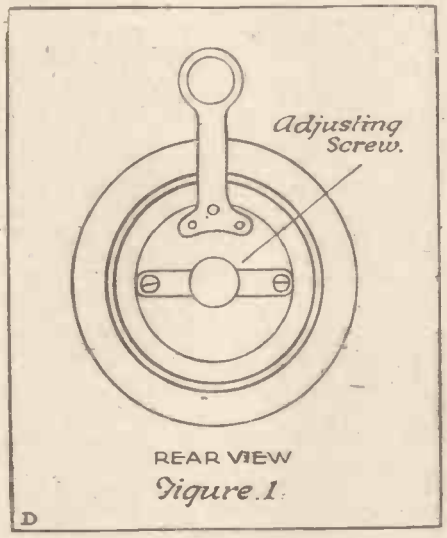


Figure 1.

to about two or three thousand ohms each. For instructions on re-winding I would refer the reader to the excellent article on the subject which appeared in No. 36 of "P.W."

The Adjusting Screw.

Before the magnet and coils are replaced in the case, a piece of thin sheet rubber, say about ⅛ in. thick, should be cut and fitted in the bottom of the case, so as to make a cushion for the magnet to rest upon.

It will be found that the magnet is held in position by two screws projecting through the back of the case. These should be replaced by two more, ⅜ in. or so longer. Next obtain a piece of ⅛-in. brass plate about ⅜ in. wide.

Cut off a piece which is ⅜ in. longer than the distance between the centres of the two screws holding the magnet in position. This will be about the diameter of the back of the case.

Two holes should now be drilled and tapped in the ends to take these two screws, the distance between these two holes coinciding with those in the back of the case. Now drill and tap a hole in the centre of this bar to take a milled head adjusting screw. This should preferably have a micrometer thread. I used a screw from an old camera.

The next thing to be done is—cut a piece of brass ⅝ in. square by ⅛ in. thick. Fasten this to centre of back of case with shellac, gum, glue, or any available adhesive. This takes the pressure from the adjusting screw and prevents it from breaking the back of the case.

Cost Practically Nil.

The whole should now be assembled according to the illustration. A washer or two of paper should be gummed to the edge of the diaphragm, to raise it just clear of the tops of the pole-pieces if it is necessary. It depends, naturally, upon the thickness of the piece of rubber inside the case.

By turning the adjusting screw the magnet and coils can be adjusted until the tips of the pole-pieces are just clear of the diaphragm—this is the most sensitive position.

The measurements given may vary with different receivers and the materials available. That is the reason why only approximate measurements are given. The cost is practically nil, and the results well repay the time expended.

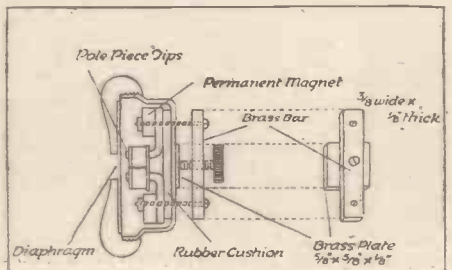
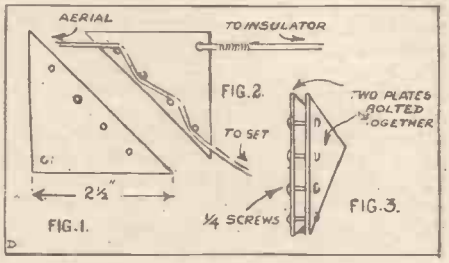


Figure 2. Figure 3.

AN AERIAL WRINKLE.

A DEVICE is shown in the accompanying diagram which eliminates any necessity to solder or splice the down lead of the aerial to the horizontal span. It also possesses an added advantage in so far that the length of the aerial may be easily adjusted before it is finally fixed into position.

The down lead is connected to the horizontal span by means of two pieces of sheet brass which are cut to the dimensions shown in the diagram (Fig. 1), four small equidistant holes are drilled as indicated to take ¼ in. screws, a fifth hole being drilled in the remaining corner as shown. The plates are then loosely clamped together as in Fig. 3, and are then ready for use.



A length of aerial wire is then cut, depending upon the type and position of the aerial which is to be erected, one end of the wire being fixed to the insulator of the mast or other support, and the other permanently connected to the brass clamp as illustrated (Fig. 2). The remainder of the aerial wire is then connected to the second mast and threaded through the screws between the two plates in the manner shown in the diagram, until the correct clamping position has been ascertained.

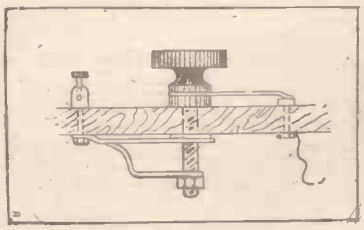
The screws are then tightened up until the wire is firmly gripped in the desired position.

If the aerial is not controlled by a pulley, and is, therefore, difficult to hoist or lower, the plate must be fixed before elevating the wire.

It is, of course, easier to place the wire in position before affixing the second plate

A SWITCH CONTACT DEVICE.

IN connecting a lead to the base of any of the variable knobs used on valve-receiving apparatus, such as that employed for the filament rheostat, or in some cases for the variable inductance, trouble is often experienced in maintaining a good connection, owing to the nature of the pivot which is apt to loosen or break the wire connection with the action of adjustment.



The need for a wire between the actual base of the pivot and the connecting terminal can be eliminated by making use of a metal strip of any good conducting material, preferably of copper, bent as shown in the illustration, so that the spring thus formed ensures a good connection being maintained.

The strip is held in place by lock nuts, and the device is a practical method of overcoming a difficulty often experienced by amateurs when constructing their own sets.

REVIEW

"Diagrams of Non-radiating Circuits" is a booklet that has long been needed, and should find a home on every serious amateur's bookshelf. Published by the Halifax Wireless Club and Radio Scientific Society, it contains a very useful set of diagrams setting forth very clearly how various valve and valve-crystal sets can be efficiently operated without the risk of causing interference. The book is prefaced by a few concise paragraphs dealing with the oscillation trouble and its solution.

All amateurs should get this book as it is, besides being very useful in itself, the effort of one of the largest wireless clubs in the country to finally put a stop to the interference that occurs so frequently through the careless and selfish use, or rather misuse, of reaction.

THE RANGE OF RECEPTION.

By SEXTON O'CONNOR.

THERE are so many varying factors in the problem of estimating the range over which a given strength of radiated signals can be successfully received that the average amateur is tempted to cut out all idea of purely theoretical considerations.

He is satisfied to know in actual practice, that he can get 2 L O with varying degrees of loudness upon a simple crystal set if he is within 20 miles of Charing Cross, or that by using a combination of two or three valves he can increase his range so as to include Birmingham, Manchester, Paris or the Hague, as the case may be.

At the same time, apart from directional effects, fading, and other "freak" phenomena, and independently of whether a crystal or one or more valves are employed, there is a definite relationship between the power emitted from a transmitting station, the height of the two aerials concerned, the resistance of the receiving aerial, and the wave-length employed, which fixes the amount of current that should be picked up at the receiving end under ideal conditions over any given range.

This relation can be written:

Cr is proportional to $\frac{Cs \times Hs \times Hr}{R \times L \times D}$ where

Cr is the current in the receiving aerial, Cs the current in the transmitting aerial, Hs and Hr the heights of the sending and receiving aerials respectively, R the resistance of the receiving aerial, L the wave-length of the signal energy, and D the distance or range.

Points Worth Noting.

Set out in this manner, the expression emphasises several points of practical importance, which it is well to bear in mind.

In the first place, it is clear that the higher the two aerials are, the greater will be the received current. Obviously the same is true if the value of Cs is increased.

On the other hand, the received energy diminishes as the resistance of the receiving aerial is increased. Hence the advantage in using as short an earth-lead as possible. Incidentally, it shows the undesirability of using very fine and therefore high-resistance wire in winding inductances and variometers included directly in the aerial circuit.

It will be observed that the signal strength also diminishes as the wave-length is increased. This appears somewhat paradoxical at first sight, as all long-range work is at present carried out with wave-lengths of 10,000 metres and over.

It must, however, be remembered that the huge wave-lengths employed in trans-Continental transmission are determined by other considerations. In the first place, in order to take up the tremendous power supplied to them, the transmitting aerials must have large capacity and inductance. This to a large extent fixes the physical dimensions, length, etc., which in turn affects the tuning and hence the wave-length. Also, it is found that long wave-lengths suffer less absorption losses in their passage over the surface of the earth than do the shorter wave-lengths.

Leaving aside such special considerations, it may safely be taken for granted that the maximum range for a given energy input is attained by using the shortest possible wave-length consistent with the given dimensions of the aerial system. In the case of a "plain" aerial, this would correspond to a wave-length of four and a half times the length of the aerial.

The Ultimate Factor.

If such an aerial is "loaded" to increase its wave-length, the energy input must also be increased in order to maintain a given range. The point is perhaps simplified by realising that the shorter wave-length corresponds to a higher frequency, and in consequence there are a greater number of oscillations impacting per second upon the receiving aerial.

The ultimate factor of range is determined by the minimum amount of current which must be induced in the receiving aerial before audible signals can be heard in the 'phones. This quantity (Cr) will obviously vary inversely with the distance D.

Its absolute value will also clearly depend upon the nature of the detecting device employed, *i.e.*, whether high-frequency amplifiers are used or not.

For an ordinary crystal detector, a current of about 60 microamps. in the receiving aerial is sufficient to give good audible telephony signals. This, of course, is the mean square value or the direct-current equivalent, of the actual oscillations received.

Assuming that the resistance of the receiving aerial is, say, 5 ohms, such a current represents an energy input of C^2R or approximately $\frac{1 \cdot 5}{10^9}$ watts.

The transmitter at 2 L O is a 1½ kilowatt set, *i.e.*, it is supplied with 1·500 or $1 \cdot 5 \times 10^3$ watts.

It will therefore be seen that in order to obtain good reception of the ordinary broadcast programme upon a simple crystal set, it is sufficient if only the one-billionth part of the total radiated energy is caught up on the receiving aerial.

TIPS FOR AMATEURS.

By "MODULATOR."

ALL apparatus and the operating table itself should be kept spotlessly clean.

Do not allow dust to accumulate, or the terminals or switch contacts to become corroded or dirty. Accumulator terminals in particular become quickly corroded if neglected. A thin coat of ordinary vaseline helps to keep them from corroding.

Arrange the circuits as far as possible so that the coupling between circuits is confined to the coils designed for this purpose.

Very often poor results are obtained as a result of a system of wiring which resembles the goods yard of a railway station. Especially in circuits designed for undamped reception, cleanliness and arrangement of wires plays an important rôle. A little resistance may make the whole difference between success and failure.

Make soldered connections wherever possible. See that all terminals are kept clean and tight. Keep switches clean and making good contact, and a great many troubles will disappear.

For reception of undamped waves, the condenser valves should be relatively small compared with those which would ordinarily be used for spark reception.

Some Accumulator Hints.

Correct polarity of both batteries is necessary also, as well as the proper amount of voltage. Don't by mistake connect the H.T. battery to the filament, and repeat the action after one lot of valves have been burnt out.

A good plan, after you have decided on a particular circuit, is to work out on a piece of paper the exact dimensions you have determined for your ebonite panel and draw to scale all parts that are to be assembled, with the best wiring, etc. You will find that when the real assembling is done it is quite a simple matter.

Much may be said about accumulators and their care, but the main points are: Keep the battery clean; watch for acid creeping and corrosion; keep the plates covered with solution. Many amateurs have discovered that it is easier and quicker to bring the solution up to the proper specific gravity by adding acid than by charging. This is a tremendously clever idea and a great saver of time, but such is the perversity of accumulators that they persistently refuse to accept this innovation. Wise men prefer the old-established methods and keep off this method of raising the specific gravity.

Blaming the Detector.

Do not discharge beyond the point given by the maker, and do not allow the battery to stand idle when low.

Place it on charge as soon as possible. Contrary to opinion in some quarters, 100 A.H. stamped on a cell does not mean that it may be left on short circuit for one hundred actual hours!

No one has ever yet succeeded in making the ground lead too short. Keep the aerial resistance as low as possible.

Due to the slow rate of progress made by our inventors and manufacturers, the elastic telephone cord has not yet arrived, and it is better to remove the headphones when wandering from the set. Such cords as we are offered have a disagreeable habit of breaking when we attempt to stretch them more than a yard, and this causes the receiver to function poorly, due, of course, to the unmentionable detector.

MAKING A SUPER-CRYSTAL SET.

The following article describes in detail the construction of a very efficient crystal receiver for broadcasting wave-lengths. Using a standard G.P.O. aerial, good telephony can be picked up on this set from a distance of 100 miles, and even more.

THE crystal receiver described below was designed specially for the reception of "broadcasting" on a wave-length of 360 metres, and should therefore prove of great interest to those readers of POPULAR WIRELESS who are fortunate enough to be so situated that they can receive good signals from one or other of the Broadcasting Stations, without needing to use valve apparatus.

Particulars relating to the construction of a similar receiver were given in the December issue of the "Wireless Age," and we are indebted to Mr. Carl Dreher for a most exhaustive description of the instrument.

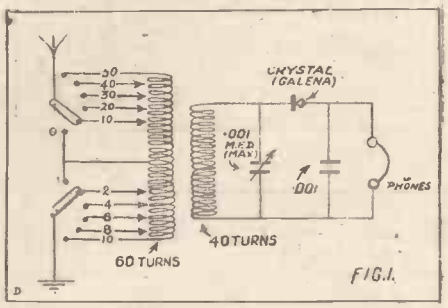


FIG.1.

Good reception on this set is claimed over a distance of 100 to 140 miles, and in one instance 400 miles, although the latter was admittedly a case of freak reception.

These instances are of course exceptional, but a receiver capable of picking up signals over such a distance should undoubtedly give results above the average when used to receive telegraphy or telephony over a distance of 10 to 15 miles — the usually accepted range for this type of detector.

Fig. 1 shows a theoretical diagram of the set, which it will be seen consists of an open aerial tuning circuit, and a closed detector circuit, arranged in the usual manner. The two-circuit design was adopted so that full use could be made of the greater selectivity obtainable by this method.

The Tuning Coils.

Fig. 2 illustrates the front of the panel. The three control knobs on the left hand side of the panel are: A, primary inductance control, in steps of two turns: B, primary inductance control, in steps of ten turns; and C, the control knob for varying the amount of coupling between the primary and secondary coils.

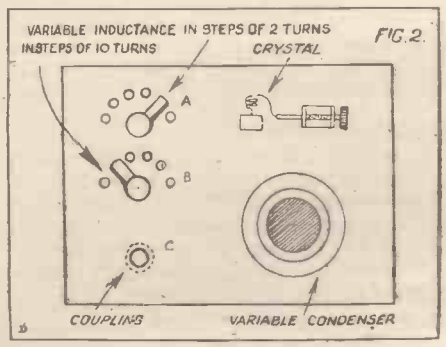


FIG.2.

The variable condenser, shown in the wiring diagram in the closed detector circuit, is shown on the right of the panel, and the variation of this condenser is the only means by which the closed circuit may be tuned. In the right hand top corner is shown the detector, the crystal being of galena.

The primary coil, which is wound with No. 24 D.C.C., has a maximum inductance value of 450 microhenries and is designed to cover a wave-length range of from 200 to 700 metres approximately, if used with the ordinary type of amateur aerial having a capacity of about ·0003 microfarads. A certain amount of margin is allowed, however, as reception on 800 metres is stated to be within the compass of the receiver.

The secondary coil, which consists of 40 turns of No. 24 D.C.C. has an inductance value of 200 microhenries, and if used in conjunction with a condenser having capacity value of 0·0005 microfarads will tune the circuit up to a maximum wave-length of 600 metres.

Wave-length Range Covered.

The use of a larger capacity condenser—0·001 microfarads, will increase the wave-length range over which the receiver will operate to 800 metres, or alternatively the addition of ten turns to the inductance,

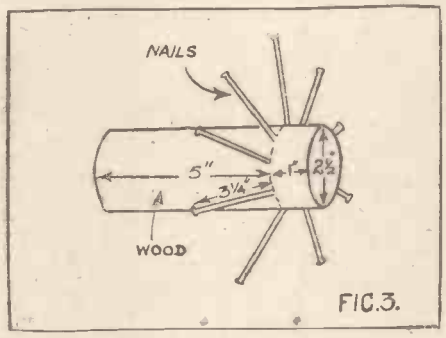


FIG.3.

making 50 turns in all, will give an inductance value of 310 microhenries, which if used with a variable condenser of 0·0005 microfarads capacity, will allow of signals on 740 metres being received.

It will be noted that the wave-length range given includes 600 metres, which is the wave-length on which ships at sea work "traffic" to each other and to the shore, and there should therefore be no lack of signals either for "tuning" purposes, or for obtaining the critical point on the crystal.

In constructing the receiver, it is presumed that the condenser will be purchased ready made and calibrated and therefore need not be discussed.

The inductances are of the spider-web spiral type and are wound as shown in Figs. 3 and 3A, over nine nails driven into a cylindrical piece of wood 2½ in. in diameter, such as a portion of a curtain pole. To construct the primary winding, a small nail

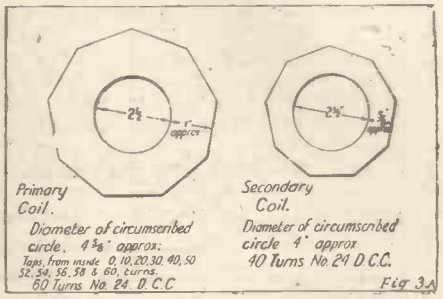


FIG 3A.

should be driven into the wooden cylinder, firmly fastening one end of the wire. Fifty turns of wire are then wound round the nails in the usual manner, a tap being taken at every ten turns. The "tapping" point is formed by giving a single twist to the wire, thus forming a small loop about ⅛ in. in diameter.

The insulation is later cleaned off of this loop and a wire attached which is taken to one of the studs controlled by the inductance switch. It is advisable to use the same gauge wire for this connection as that employed for winding the coil, namely 24 D.C.C. After 50 turns have been completed a tap is taken from every second turn, to permit of finer adjustments when tuning the instrument to any desired wave-length.

Having completed the winding, fix the end firmly with a thin strip of insulating tape, and give the complete coil a thorough coat of shellac, mixed to a medium consistency.

The Panel "Lay-out."

Allow the shellac 24 hours to dry when it will be found that with care the nails may be drawn out, and the coil removed from the wooden former. During the latter operation do not disturb the inner turns of the coil, which are liable to unwind if not handled carefully. When the coil has been removed from the former it should be wound with insulating tape as an added precaution against any tendency to unravel.

The secondary coil, as can be seen from Fig. 1, has no taps, but is wound in a similar manner to the primary coil already described.

Fig. 4 shows the "lay-out" of the panel, which can be of ebonite, bakelite, or any other suitable material. Particular care should be paid to two points in the mechanical design: The spacing distance shown as $\frac{1}{32}$ in. between the switch studs is for studs of ¼ in. diameter, and if larger studs are used the distance between them must be correspondingly increased. Fig. 5, which shows the connection block, will not satisfactorily hold the six terminals indicated if their diameter is over ⅜ in.

The construction of the supports for the two coils is shown in detail in Fig. 4. Two thin wooden uprights of the dimensions given are let into a wooden base and glued together. To ensure a good firm joint clamp the whole arrangement in a vice and leave it for 24 hours, giving the glue time to set.

(*Continued on next page.*)

MAKING A SUPER CRYSTAL SET

(Continued from previous page.)

The support for the secondary coil and for the coupling control device makes use of the same principle excepting that the horizontal piece is not screwed to the base of the set, but is fixed to a flat rotating arm between two collars.

This design might be modified if other metal pieces of suitable construction are available. In the model instrument above described, the flat rotating portion was constructed from copper "bus bar" $\frac{3}{8}$ in. by $\frac{1}{8}$ in. and approximately $3\frac{1}{2}$ in. long. The ends were set into brass collars to a depth of $\frac{1}{4}$ in., and soldered. The same material was employed in constructing the rear bearing piece for the shaft.

The horizontal wooden piece is used to separate the flat metal bar from the coil in order that any eddy current losses in the winding which would occur if the metal were placed in close proximity to the outside turns of the coil, may be avoided. The coils are fastened to their respective supports by drilling small holes in the wood and attaching the coils with strong twine or heavy thread.

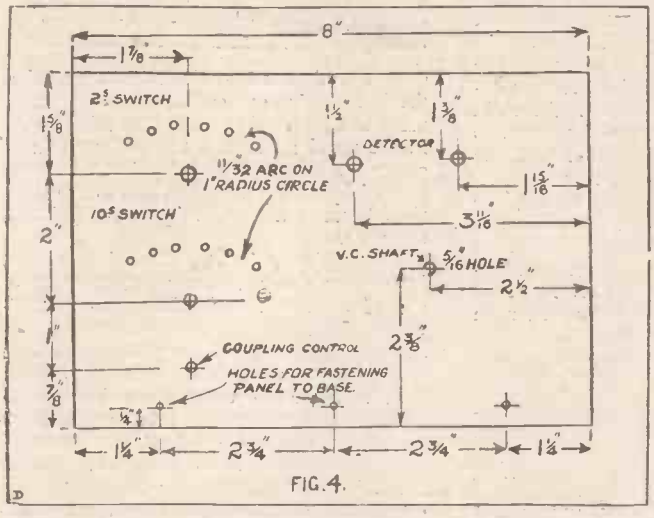


FIG. 4.

If the thread is then shellacked, it will, when drying, contract and hold the coil tightly to the support. The position at which the holes should be bored will of course vary with the size of the coils.

Variation of Coupling

After the panel has been drilled, the next step is to assemble the receiver, fixing the panel to the base with suitable brass wood screws. The coupling device should then be put together, the rear bearing mounted and the primary coil so placed that it is flush against the secondary winding in its upright position. It should then be fastened down.

The contact of the two coils acts as the close coupling stop. A stiff copper wire about an inch long beaten flat at one end and fastened under the nearest of the three nuts compressing the stator plates of the variable condenser forms an easily made loose coupling stop. The free end of the wire should be so bent that the wooden support of the secondary winding will touch it when the two coils form an angle of about 50°. Ample variation of the coupling is thus obtained.

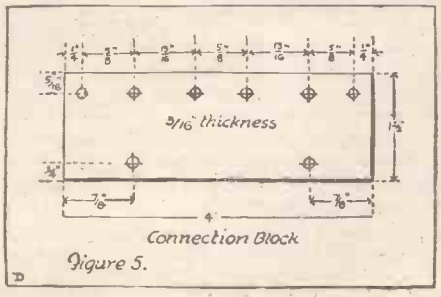


Figure 5.

Ready for Use.

Fig. 4 shows the assembly of the set, together with the necessary connections. It must be mentioned that in the diagram showing the lay-out of the panel the holes for fastening the variable condenser are not indicated, as ready-made condensers usually have holes already tapped, and the correct position of the condenser is a matter for individual discretion. A fixed condenser having a capacity value of 0·001 microfarads is connected across the telephones. When all the connections have been made, including the taps from the primary coil, the set is ready for use.

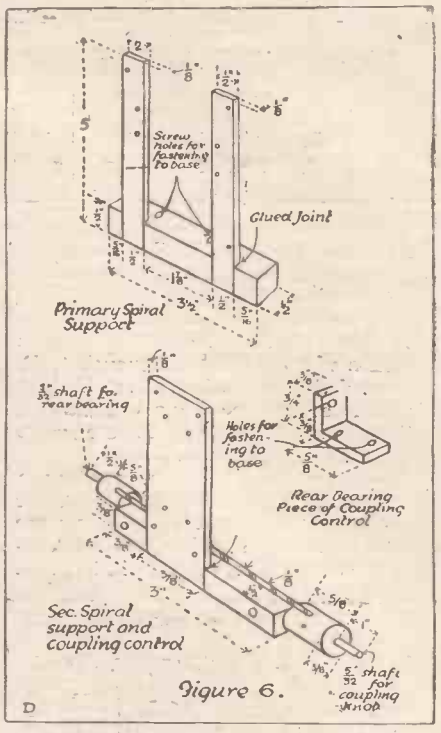


Figure 6.

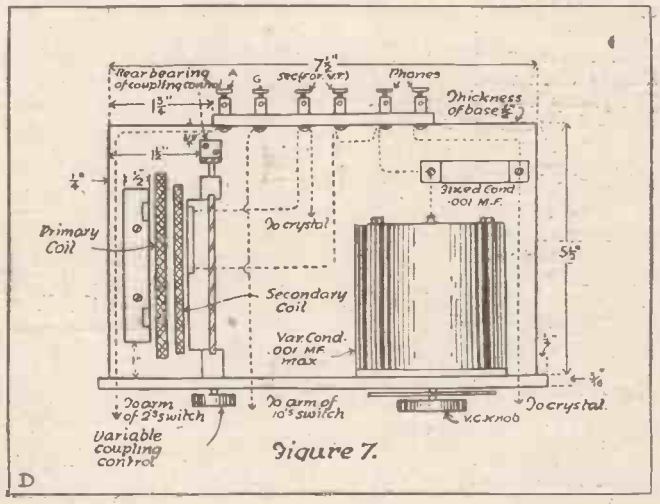


Figure 7.

BROADCASTING v. THEATRES.

CONSTERNATION among the theatre managers has been brought about by the recent success of opera broadcasting. According to the "Star" there is a divided opinion among them as to whether or not broadcasting will eventually have the result of emptying the theatres altogether.

Among those who believe that wireless will have a bad effect on the stage world is Mr. C. B. Cochran, who says that it will do more harm than good in this respect.

"I think," he said, "that anything that keeps people at home in the evening prevents them from going to the theatre. I don't believe in the wireless. No person fond of the theatre could possibly enjoy hearing a great artiste by wireless."

In this connection it is as well to reflect on the thousands who enjoyed the Covent Garden season by this means, most of whom would have found it absolutely impossible to have been present at the Opera House.

But many of the theatre managers are not so pessimistic about broadcasting, and though they do not welcome the idea of whole plays being broadcasted, they have no objection to parts being transmitted.

Mr. Cecil Barth takes a far more cheerful view.

"We need to be liberal-minded," he said; "it's no good saying broadcasting is going to ruin us. Let us see how it will help us. I do not think it will cut the ground from under the feet of the producers."

Free Advertisement.

But why should there be all this unrest and consternation? Broadcasting is never likely to empty the theatres, and however good the transmission and the play, it cannot be the same to listeners-in as it is to those present in the theatre. Surely those who hear a play by wireless and like it, will want to go and see it.

More Good Things for Our Readers from
GAMAGES of HOLBORN

In Wireless equipment, the all-important thing to-day is reliability. Wireless is over-run with goods of irresponsible makers. Your only protection is the standard brand of an established manufacturer. GAMAGES were making and selling Amateur Wireless Apparatus in 1908 : to-day their goods are unrivalled for reliability, design, and value for money.

VALUE IN WIRELESS SUNDRIES

Single-Valve Amplifiers for increasing the volume of sound	42/-
Improved "Sonus" type, Model A.1	50/-
Single-Valve High-Frequency Amplifier for increasing the range	70/-
Intervalve Transformers (low frequency), maximum efficiency	25/-
"Ora" Valves	15/-
"Ediswan" Valves	15/-
"Marconi Osram" Valves	17/6
Valve Holders	1/6
Filament Resistances	3/-
Fixed Condensers, .002, .0003, .0004, Best Quality	3/-
Contact Studs .. Per dozen	1/6
On-Off Switches, high class	3/9
Earthing Switches on porcelain	4/6
"Permanite" Crystal per piece	1/6
Silicon " " "	1/-
Zincite " " "	2/6
Bornite " " "	1/-
Copper Pyrites " " "	1/-
Woods' Metal ..1/- and	2/-
Ebonite Panels, cut to size, per lb.	5/-
Shellac Varnish, per tin ..1/- and	1/6
High-class Dust-proof Crystal Detectors, complete with Crystal,	7/-
Aluminium Pulleys, 2 in.	1/4
Aerial Insulators, Reel Type	3d.
" " Barrel "	6d.
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" " Superior types	1/9 & 1/6
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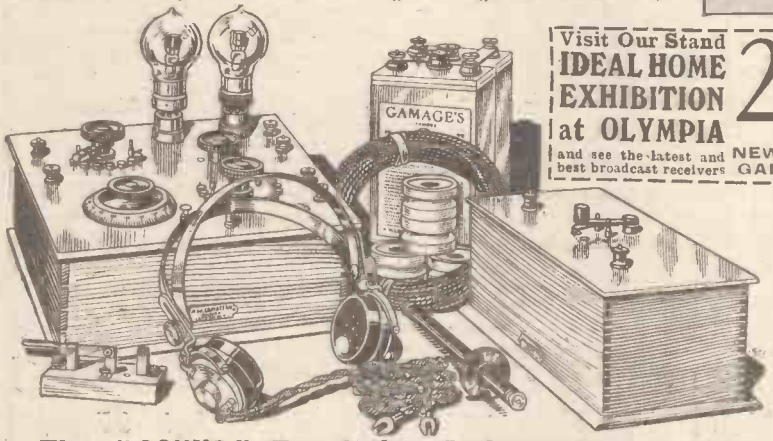

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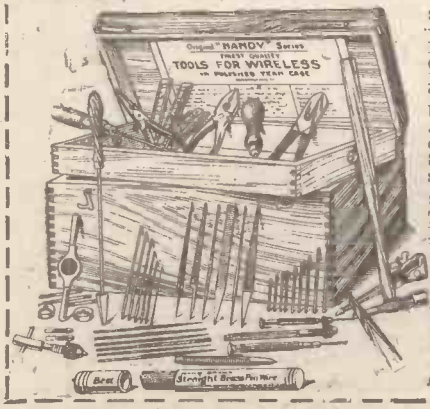

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A VISIT TO THE BERNE WIRELESS STATION.

By DAVID MASTERS.

WHILE engaged on a special mission to Switzerland quite recently, I seized the opportunity to visit Berne on behalf of POPULAR WIRELESS for the express purpose of going over the new Marconi wireless station which was opened a few months ago. The transmitting station is some distance from the city, and I journeyed through the snow-clad countryside for about twenty minutes before alighting at Munchenbuchsee, where the wireless station is situated.

I trudged through the snow up the village street, guided by the mighty wireless masts that towered in the distance, until I came out into the open and saw the red-roofed Marconi station set in the snowy expanse a quarter of a mile ahead. In a little while I was being welcomed by Mr. Anselmi, the chief engineer, who most courteously showed me over the station and pointed out its wonders.

Working to London.

The station is beautifully situated on a little plateau overlooking the village, with a road to Berne passing the front gate. In the distance the snow-clad Alps loom up to delight the eye. The self-supporting towers carrying the aerials reach up in a delicate tracery of metal for 300 feet into the heavens, and at regular intervals around are some twenty other towers. These seem insignificant beside the two central towers, yet they are thirty feet high.

The station does not earth its wires in the ordinary way. Instead, it is using an earth screen, formed of wires stretched between the twenty towers. This arrangement has the advantage of reducing the resistance in the aerial and increasing the radiation for a given input of power.

The entrance to the station leads into the office, where were blue prints and tracings and various small pieces of electrical apparatus. Through the glass screen of the office I could see the power-house, and I stepped inside to examine the switchboard by the door. The switchboard is of white marble, dotted with the dials of the instruments for measuring the current, and mounted with the various switches for controlling the machinery.

There was comparative quiet as I glanced at the switchboard, but suddenly transmission began, and as the transmitting keys came into action it was like a battery of machine guns wakening to life.

"It's working with Spain," shouted Mr. Anselmi. I queried the speed. "Forty words a minute," he explained.

Five minutes later the noise ceased for a moment, then it broke out with redoubled fury. The engineer cupped a hand to his mouth and shouted in my ear:

"They're on high speed now, talking to London at ninety words a minute." The transmitting contacts emitted a roar of sound as they sped to and fro, every ordered series of movements indicating some letter or word. The current actuates the valve which controls the compressed air, and this in turn works the piston which operates the keys.

When Steel "Tires."

I watched the needle of the inker oscillating along the tape on the side table, every movement perfectly synchronised with the sound of the transmitter. As I watched the needle inking the tape, a similar needle in London was making an identical mark simultaneously—not an appreciable fraction of a second later!

High speed work for a period of three months sometimes renders the steel arm of the transmitting key so brittle that it breaks and needs replacing. The metal gets "tired" and loses its elasticity.

My gaze wandered from the giant leading-in tubes in the side of the station to the huge condenser a dozen feet away. The condenser is 16 feet high, and it is composed of 42 plates of zinc, each 10 feet high, each armature consisting of 21 plates. This air condenser is remarkably efficient and its loss is considerably less than that of most other types.

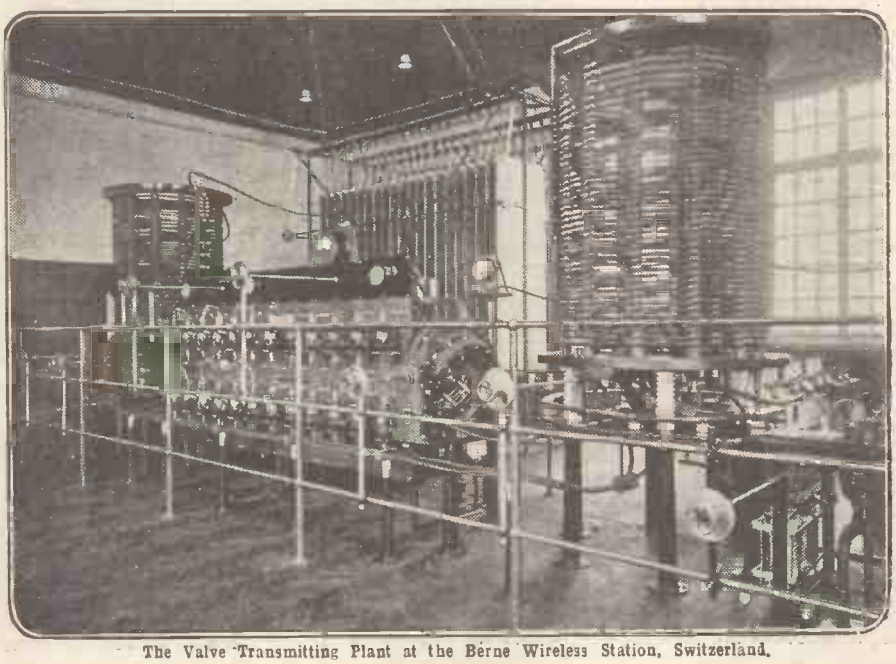
Just inside the rails which guard the unwary from danger is a bank of 24 thermionic valves for generating the necessary high-frequency current required by the transmitter. The valves are almost the size of footballs, and, although compressed air plays about the necks of them in order to cool those parts liable to deterioration through excessive temperature, they give out enough heat to keep the place cosily warm. Standing in the doorway twenty feet away, I felt the heat from the valves just as though I stood in front of the fire.

Melted Like Wax.

Normally the electrical energy for working the station is carried across the countryside on overhead cables from the Berne Power Supply Company. Sudden storms have a habit of interfering with most means of communication, including wireless, and if lightning should strike the overhead cables it would not only stop the supply, but do considerable damage. On one occasion the power line from Berne was struck in this way, and the heavy current burned out the integrating meter on the switchboard. The stout steel walls of the meter, an eighth of an inch thick, just melted away like wax under the terrific heat and left the walls honeycombed with holes.

Such things, however, are carefully guarded against, and they do not interfere in any way with the transmission. If the power from Berne fails, a reserve power plant worked by a 60-h.p. Diesel engine is brought into use. It is started up by compressed air, with a pressure of 840 pounds to the square inch, and in 2½ minutes it is in full operation. The engine is tested out once a week to see that it is in proper working order. Practically everything else on the station is duplicated in order to ensure the continuity of the service.

There is a fine, well-equipped workshop, to enable the engineer to cope successfully with all emergencies, and as I bade goodbye to Mr. Anselmi and trudged through the snow to the train I was much impressed by the efficiency of this latest Marconi station, the controlling interest in which is owned by the Swiss Government.



The Valve Transmitting Plant at the Berne Wireless Station, Switzerland.

WEATHER REPORTS BY WIRELESS.

MANY of those who have recently joined the ranks of wireless amateurs had their interest aroused, in the first instance, by the idea of hearing music, speeches, news, etc., by wireless. But the fascination of wireless does not rest with these things alone, as is evidenced by the thousands of enthusiasts who have begun to learn the Morse code during the last few months.

The telephony broadcasting programmes will, no doubt, constitute a feature of special interest to the amateur at all times. As those who are "old hands" at the game know, however, once the spirit of wireless has cast its subtle spell over the imagination there are few who can remain content with broadcasting programmes however attractive these may be. The mind of the amateur is lured ever farther and farther afield, until, eventually, he finds he can only satisfy his enthusiasm by trying to keep an eye on the whole domain of ether.

Perhaps his first temptation comes when he reads some reference to aircraft wireless in his morning's paper. He wonders to himself what these aircraft chaps can have to talk about. It *should* be rather good fun to hear an aeroplane yapping to a ground station! On investigation he finds that he can easily tune in the aircraft wave on his receiver, and so—next day he intercepts his first aircraft message.

Then, one day, about a month later perhaps, he hears an aeroplane report that there is a ship in trouble in the Channel. Immediately his imagination is fired. Ship! Wonder if there are any S O S calls flying about? Probably that's the chap who has been doing such an extraordinary amount of croaking for the last half hour! Wonder what he's saying? Jingo, *must* learn the Morse code!

How to Decode.

It may happen that way, or it may happen in a hundred other ways. The important thing is that it *does* happen somehow or other, some day or other. Inevitably, the novice is induced, sooner or later, to learn the Morse code. Once he has taken that step there is scarcely any limit to the variety of sources of wireless entertainment at his command: new worlds of ethereal warblings are revealed to him for the first time.

It is to be regretted that amateurs are inclined to be "frightened off" weather reports. The argument is that they are usually sent on rather long waves, and, moreover, there is the difficulty of decoding them. For those who are not deterred by these considerations, however, the following information will be of interest.

Most weather reports are sent from the Air Ministry, some being in code and some in plain language. Transmission is sometimes carried out on 4,100 metres continuous wave. "Synoptic Reports" are sent on this wave-length at 0200, 0600, 0800, 1400, 1900 G.M.T. The special code used in connection with these messages can be found in M.O. Publication 252, which is obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2. With a little practice, decoding weather reports becomes as easy as A B C. These synoptic messages, moreover, contain data necessary for the preparation of weather charts. Instructions in this very interesting subject of preparing weather charts are also contained in M.O. Publication 255.

At 0915 and 2000 G.M.T., "General Inference Reports" are sent out from the Air Ministry on the same wave-length, but in plain language. These reports are based on data collected by the meteorological stations about two hours earlier. They summarise the main characteristics of the weather in this part of the world and give a general inference with regard to its behaviour in the immediate future.

"Aviation Reports" and forecasts for the London-Continental Aerial Route are sent out at one-hour intervals from 0335 to 1635 G.M.T. These messages contain forecasts of weather over the Channel and along the stretch of south-east coast over which the Continental air traffic passes. At the times 0835, 1135, 1435 the forecasts are sent in a special code, which will be found in M.O. Publication 244. These reports are sent on a 1680 metre continuous wave.

Very Latest Information.

The most interesting of all are the "Coded Forecasts for various districts in the British Isles," which are sent out on a 1,300 metres continuous wave. The times of transmission are liable to vary slightly, but they are usually 0900, 1500 and 2000 G.M.T. The forecasts are sent in groups, each group representing the weather for a particular area of England or Scotland.

With regard to these latter forecasts, the Meteorological Office report states that the "reception and decoding would probably only take a quarter of an hour, and the result would be a forecast in plain language drawn up a few minutes earlier by a professional forecaster with full information at his disposal." The code can be obtained from the Meteorological Office for one shilling: postage three-halfpence.

A plain language weather report is also sent from Clifden at 0950 and 2150 G.M.T. on a 5,750 "spark" wave. The forecast begins with the word "Western," and gives an estimate of the weather that may be expected during the next 24 hours on the western and south-western seaboard of the British Isles.

Many amateurs in this country have heard the concerts from this American station—W G Y, at Schenectady, New York. The photo shows the G.E.C. Broadcasting Studio

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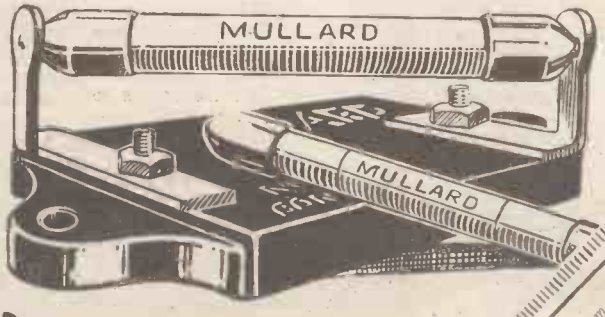

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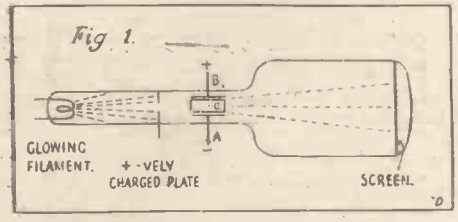
MARSHALL AD.

AN AUTOMATIC DIRECTION FINDER.

By A. HARLEY REEVES, A.C.G.I., D.I.C

PROBABLY a good many readers of this journal have read the story by H. G. Wells in which a transatlantic air-ship of the future is described; those who have done so will have been interested by the chart on which the air-liner's position was automatically and continuously registered. Could not this be done in practice?



I shall describe below the outline of a scheme by which this result could almost certainly be accomplished, with the aid of wireless telegraphy. The apparatus needed is comparatively simple, although some of the principles involved are not very widely known at the present time.

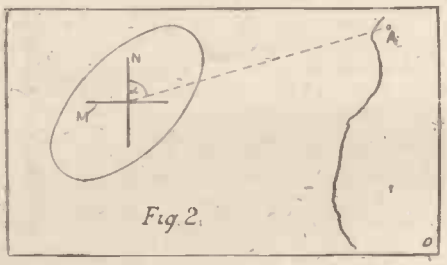
Wireless position finding is now used to quite a considerable extent, employing, almost entirely, one of two methods. Both these systems depend on a wireless receiver which will indicate the direction of the received signals. Consider a ship approaching a coast in a fog; if the ship does not possess a direction-finding apparatus, it can call up two or more coastal wireless stations, which will observe the directions of the ship's signals, and give these directions to the ship by the Morse code. If the ship has a directive receiver, the operator can find these "bearings" by merely listening-in to the coast stations.

In either case, the navigator can then find his position by "plotting" these bearings on his chart (on which the coastal stations will have been marked); the point of intersection will show him his ship's position.

The Principles Involved.

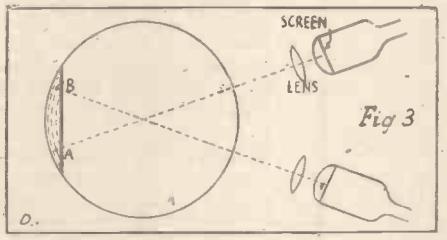
Before describing an automatic system (which would have certain obvious advantages over the above method), the principles of ordinary modern wireless direction finding will be explained.

Wireless waves seem to consist of vibrations in a medium called the "ether," taking place at right angles to the direction in which the waves are travelling. These vibrations appear to be of two kinds, which cannot exist separately, producing electric and magnetic forces respectively in the directions of the vibrations. The electric forces produced by an ordinary transmitting aerial are vertical, and the magnetic forces horizontal. It is well known that an electric current is set up in any closed coil of wire when the magnetic "field" through the coil is altered; it is obvious, then, that the rapidly changing, horizontal magnetic forces contained in a beam of wireless waves should also be able to produce electric currents in the coil.



How can this be done? By placing the coil so that these horizontal forces can go through it; *i.e.*, the plane of the coil must be vertical, and in line with the transmitting station. If the coil is now turned round through 90°, no wireless signals can be received by it; the direction of the transmitter can be determined by finding this position.

Now consider two coils, exactly similar, fixed on one spindle with their planes at right angles to each other. If one coil does not exactly face the transmitting station, this station will produce currents in both coils. Let each of these currents then be magnified by exactly the same amount, with the aid of valve amplifiers, and magnified sufficiently to work the apparatus



next to be described. The action of the ordinary wireless valve depends on a stream of minute negatively charged particles, called "electrons," emitted by the incandescent filament. A positively electrified disc of metal, with a small central hole, is placed in a vacuum tube containing such a filament (see Fig. 1); this plate will attract the electrons to it, giving them such a high speed that the particles entering the central hole will continue in a straight line, forming a beam of rays, and producing a glowing spot when they strike a screen coated with calcium tungstate.

Compass Bearing Coil.

Suppose now that two metal plates, A and B, are inserted inside such a vacuum tube; and another pair inserted at C, at right angles to the first pair. Let the plates at C be connected to the amplifier of one of the receiving coils previously considered, while A and B are joined to the amplifier of the other coil. The currents due to the received wireless waves, magnified by the valves, will produce rapidly changing electric charges on the plates A, B, and C. When A is positive, it will attract the stream of electrons towards it; B, being then negative, will assist this movement by repelling the particles. When A is negative and B positive, a reverse deflection takes place.

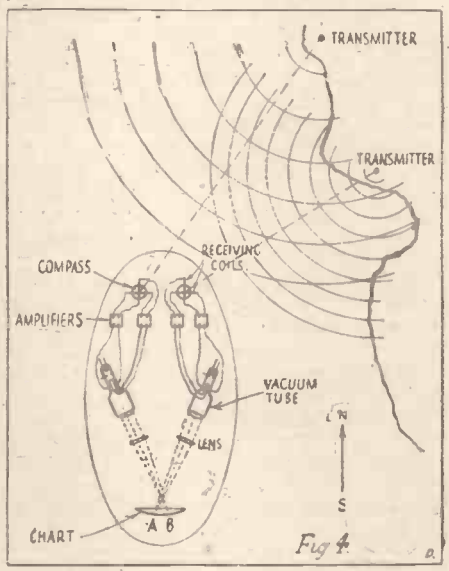
The result, as seen by the eye, is a vertical band of light on the screen, when A and B are acting alone; with the C pair alone, a horizontal band is seen. If both pairs of plates act together, the band will be neither vertical nor horizontal, but oblique, but will remain a straight line as long as the charges on A and B, and C, are "in step"—*i.e.*, as long as these charges are simultaneously at zero. (*As long as the phase difference is zero—or* 180°.) The amount by which the band is tilted away from the vertical depends on the relative strengths of the electric charges on the two pairs of plates—and therefore on the relative current strengths in the two receiving coils. (*Let θ be the "angle of tilt" away from the vertical; then ten θ = ratio of current strengths.*)

Now consider Fig. 2. M and N represent the two receiving coils of a ship picking up signals from the coastal station A; these coils, which may be quite small, must be carried by a compass (preferably a gyroscopic type), so that one coil always points north (coil N in this case). The relative current strength in the coils then depends on the compass bearing of the station. It can be shown by a little geometry that the angle of tilt of the band of light on the screen away from the vertical is now always the same as this compass bearing; this takes place quite automatically wherever the ship may be. (*Current strength in coil M (Fig. 2) = $I_M = I \sin \alpha$, where I is the current through any coil when in line with A. Current in coil N = $I_N = I \cos \alpha$. Hence ten $\alpha = \frac{I_M}{I_N}$. But $\frac{I_M}{I_N}$ = ten θ (see above). Hence $\alpha = \theta$.*

Registering Positions

The next step is to automatically transfer this bearing to the ship's chart. If a lens is placed behind the partly transparent screen (Fig. 1), an image of the band of light can be projected on to the back of the ship's chart in such a way that the centre point of this image coincides on the map with the position on the map of the wireless station that is producing this light band; and also so that a vertical band on the screen represents a

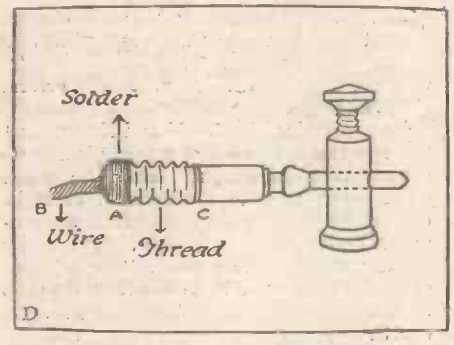
(*Continued on next page.*)



A NEW USE FOR CYCLE VALVES.

MOST who use the limp, stranded rubber-covered copper wire and flex for the wiring of a set find some difficulty in making a connection with that kind of terminal that has a hole through the side with a vertical clamping screw. This difficulty can be eliminated by the following.

Take a bicycle valve (the part over which the tyre valve rubber goes) and cut it off about ¼ in. from where the thread begins



(at A in the diagram). Polish it up and after baring the rubber-covered wire for ¼ in., solder it to the point A.

The whole thing can then be bound round from B to C with silk to hide the solder and the thread. If the wire represents positive bind with red silk, or if negative with black or some other colour. This gives a neat and smart finish to the job.

AN AUTOMATIC DIRECTION FINDER.

(*Continued from previous page.*)

north-south line on the map. This band of light on the map will then always represent a "ray" from the station to the ship, in direction and position. The receiving unit (not including the map, or necessarily the coils and compass) must then be duplicated, and the apparatus "tuned" to a second station working on a different wave-length. A band of light corresponding to a ray from this second station to the ship is then projected on to the chart in exactly the same way as before. The bright spot where the resulting pair of bright lines cut each other is the ship's position on the chart.

A Source of Error.

The problem thus seems to be solved, in outline. There is, however, one important source of error not yet considered; this is due to the fact that no flat map can be drawn of the earth's curved surface which will give the ship's true position in this way, when long distances are dealt with. This difficulty can be got over by using a map drawn on a spherical surface instead of on a flat one, and suitably placing the screens and lenses (see Fig. 3). (*So that the projection of the light bands shall be parts of "great circles."*)

Fig. 4 is intended to give an idea of the scheme as a whole; the deck of a ship is represented, with the apparatus installed on it.

THE SUCCESS OF BROADCASTING.

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

SIX months ago the subject of wireless broadcasting had only just begun to attract public interest in this country. To-day, there are four big broadcasting stations in regular operation, and the number of listeners-in throughout the country is rapidly increasing by thousands.

In spite of the rapidity with which these stations have been installed, their efficiency has already been fully demonstrated by the results achieved. Not only have the northern stations been heard satisfactorily throughout the areas, which they were primarily intended to cover, but they have been received clearly at various points on the south coast, while the London station has been heard as far north as the Shetland Islands. These are not mere "freak" occurrences. The Shetlands are a long way off, of course, and it is not probable that regular reception from the London station could be maintained over such a distance in the ordinary course. Nevertheless, excellent reports have been received from various parts of the British Isles on the quality of the signals picked up from the existing stations.

Matter of Taste.

Apart from the technical efficiency of the stations themselves, the broadcasted programmes have gained a wide public appreciation. Needless to say, the task of arranging these programmes is far from being an easy one. In the first place, the taste of every class in the community has to be considered. There would be little advantage in wireless being within the financial reach of all if the broadcasted programmes were intended to cater for certain tastes only. This is a problem which is not encountered to the same extent in connection with any other form of entertainment. In the dramatic world, for instance, there is never any attempt made to cater for all tastes in a single performance. Light comedy may be enjoyed at one theatre, melodrama at another, variety turns at a third, and so on.

Arrangement of Programmes.

One's tastes may vary, of course, making one want to see a serious drama this week and a good farce next week. But that is a matter for the individual. It does not concern the theatrical manager, who just chooses one special play in the hope that it will appeal to a great number of people. Similarly in the musical world, no one would dream of attempting to appeal to all tastes in the same concert hall. People who want to hear opera go to Covent Garden, and people who want to hear light music go to a musical comedy.

These facts serve to indicate the main difficulty that is met with in trying to arrange broadcast programmes. It would, obviously, be quite impossible to provide facilities which would enable one to choose one's wireless programme as one would choose a play or concert. Apart from the technical difficulties involved in such an undertaking, the cost of erecting and maintaining a sufficiently large number of stations would have the effect of making broadcasting one of the most expensive forms of entertainment.

The solution, therefore, must lie in arranging the times of daily transmission, and the character of the various broadcasted items, in such a manner that every section of the community shall have an opportunity of enjoying this new development of science in its own way. It will take some time, of course, to achieve this. The British Broadcasting Company has only been in existence for a few weeks, and no one could expect such an ambition to be realised in so short a time.

Only the Beginning.

Up to the present broadcasting has been confined mainly to the evening hours, the programmes being varied as much as possible by the introduction of vocal and instrumental music, children's bed-time stories, weather reports, news bulletins, short addresses on subjects of general interest, etc. The choice of these items, of course, represents a purely tentative effort to provide the greatest variety of entertainment in the course of a single programme.

Neither the times of transmission nor the character of the programmes are to be regarded as permanent. As time goes on, and more and more experience is gained, new features will be introduced, and fresh enterprises will be embarked upon. The conditions under which the transmission of some of these programmes is carried out are also, in many respects, of a temporary nature, the studios in particular being unsatisfactory for efficient transmission. The new studios will be specially designed and equipped for broadcasting purposes.

Quite recently a novel and daring innovation has been effected at the London station. The operas of the British National Opera Company, at Covent Garden, have been broadcasted from the London Broadcasting Station. This involved the laying of a special underground cable from Covent Garden Theatre to the station, in addition to which numerous minor technical difficulties had to be overcome before the project was rendered practicable.

This experiment was an instantaneous success. People were thrilled by the experience of listening to grand opera by wireless, and hundreds of letters have been received testifying to the wonderful clarity with which the smallest detail was reproduced. The preliminary "tuning up" of the orchestra, and the low buzz of conversation among the audience could be heard distinctly; then came the sharp rapping of the conductor's baton, a moment of silence, and the opening strains of the overture. The solos, duets, and chorusses "carried over" splendidly, whilst such incidental sounds as the clash of swords in the dual scene in "Faust" were reproduced with startling vividness.

The undoubted success of this first big broadcasting experiment augurs well for the future. If grand opera can be broadcasted so successfully, so can public speeches, plays, musical recitals, debates, etc. We are only at the beginning of things. Co-operation and perseverance will achieve wonders.

POPULAR WIRELESS Beginners' Supplement

PART V.—HOW WIRELESS WAVES ARE SENT AND RECEIVED.

By MICHAEL EGAN.

HOW is a wireless wave sent out from a transmitting aerial? The answer to this question is: the aerial is vibrated. A current of electricity is made to flow up and down the aerial at a terrific rate, the result being that the aerial vibrates electrically. The process is in many respects similar to that which occurs when a violin string is vibrated. There is one important difference, however. The vibrating violin string sends out an audible note, which can be heard distinctly by anyone in the vicinity, whereas the vibrating aerial produces no sound whatever.

The audible note which results from the vibrations of the violin string is due to the fact that the latter sends out waves through the surrounding air. You cannot see these waves, but you can hear them. The vibrating aerial also sends out waves, but these are of a variety which can neither be seen nor heard. They can, nevertheless, produce another effect. They can travel through space and set up electrical vibrations in a distant aerial, and these vibrations can then be converted into sound.

The whole theory of wireless arises from one simple fact, namely: when a varying current of electricity flows in a wire it produces a disturbance in the space surrounding that wire. The actual nature of that disturbance is something that the beginner need not worry about. Let it suffice that some kind of "force" is exerted on the surrounding space when a varying current of electricity is passed through a wire.

Producing Wireless Waves.

Moreover, this force is also a varying thing. It varies with the current that produces it, growing stronger or weaker as the latter is increased or decreased, and even changing its direction as the direction of the current is changed.

Now a wireless transmitter really constitutes an elaborate mechanism for passing a varying current through a wire. A special apparatus is used for producing a current which varies in strength at a uniform rate, and reverses its direction at regular intervals. This current is made to flow into the transmitting aerial, with the result that it produces in the surrounding space a "force" which changes its strength and direction in sympathy with the current which causes it.

When the current first begins to flow in the aerial, the force is small, and, as the current increases, the force gets stronger and stronger—all the time acting in a certain direction. Then, when the current has reached a definite strength, it suddenly begins to die down again, and the force does likewise.

When the zero point is reached (*i.e.*, when the current has died down to zero), the whole process is repeated—in the opposite direction. The current now flows along the wire in the direction opposite to that in which it was previously travelling, and the force likewise begins to act in the opposite direction.

Crystal and Valves.

This process is repeated at an extremely high speed, the effect being that *waves* of force are sent out through the space surrounding the aerial. The stronger the current used, of course, the stronger the resulting force and the greater the distance over which the waves will travel. The same effect is experienced with a violin string. The greater the force with which it is struck, the greater the distance over which the resulting note can be heard.

I have said that these variations in current take place at an extremely rapid rate. Their "frequency" (to use a technical term) is, in fact, so high, that one is quite powerless to grasp its significance in any practical sense. An average frequency for wireless waves is 1,000,000 per second!

A ship's operator in his cabin. Mr. M. Robson, of the s.s. Pelton.

This means, literally, that the current changes its direction and strength in the aerial 1,000,000 times every second. Or, in other words, 1,000,000 waves of force roll away from the aerial every second.

When these multitudes of waves strike a receiving aerial, they set up an electric current similar to the one which produced them. The problem now arises: How is this received current to be converted into sound? Or, put in another form: How are these electrical vibrations to be converted into sound vibrations? Obviously, it would be quite impossible to make a mechanical instrument capable of vibrating a million times per second. And even if such an instrument could be evolved, the human ear is incapable of sensing waves of such frequency.

It is therefore necessary to reduce this frequency considerably, before sound-waves can be produced. A number of instruments have been devised for this purpose, two of which are in constant use among amateurs to-day—the crystal and the valve.

Crystals are obtained in the earth, and are so constituted by nature that they are able to convert "high frequency" electric currents into currents that are suitable for producing sound. Crystals vary somewhat in quality, though, on the whole, they exhibit about the same degree of efficiency.

The valve, on the other hand, is a specially constructed device for carrying out the same operation. In addition to this, however, the valve can also *strengthen* received signals, and the more valves employed the louder will be the resulting signals. This is a characteristic which the crystal does not possess, its sole function being to reduce the high-frequency currents set up in a receiving aerial to a frequency that will permit of their conversion into sound waves.

Transmitting Music.

If, therefore, the transmitting and receiving stations are at a great distance apart, the signals resulting from an ordinary crystal receiver will be proportionately weak, since the transmitted wave decreases in strength as it moves away from its source of origin. By using valves, however, these same signals could be increased to any desired degree of loudness. This will be more easily understood from a practical example.

Using a crystal at a distance of, say, 20 miles from a broadcasting station, signals would probably be just intelligibly loud in a pair of head telephones. It might even be necessary to press the telephones tightly over one's ears in order to catch the message. Three valves, on the other hand (connected to the same receiving aerial at the same distance from the transmitter), would produce signals which could be heard throughout a small room on a loud speaker.

When wireless waves are received and converted into sound in the way we have just been considering, they produce a note of a definite pitch in the receiving telephones, or loud speaker. This is exactly analagous to what takes place when a violin string is "tuned." The greater the tension of the string the more rapidly will it vibrate and the higher will be the resulting note that it emits.

By varying the quality of the wave that is sent out from a transmitting station, the quality of the received note will be varied accordingly. In effect, this is what is done in practice. By means of a special mechanism the character of the transmitted wave varies in response to the variations that occur in the speech or song or instrumental selection that is being broadcasted. These variations are reproduced identically at the receiving station.

GENERAL ADVICE FOR THE BEGINNER.

By E. BLAKE, A.M.I.E.E.

WHILST the installation of an amateur wireless receiver is fairly simple, and not what McTodd would call "regular engineerin'," some small difficulties may spring up in the path of the novice. Let us smooth them away.

The first matter requiring attention is the all-important aerial. Though I blush to think of the aerial which, as I write, is assisting to squirt "Aida" into my room, I know how an aerial should be put up, and, for my sins (and my bread and butter), have erected more than one. But as I cannot divine the various circumstances under which my numerous readers must hoist their antennae, I can deal only in generalities. It is known, however, that the best kind of aerial for general purposes is an "open circuit": this means a wire as long and high as possible (within G.P.O. limits), extended as much as possible.

It's a poor heart that never rejoices. Similarly, it's a queer dwelling-place that cannot accommodate some sort of an aerial. If you cannot stretch 30 ft. of wire at a height of 20 ft. or so from a top back bedroom window to a tree, pole, house, chimney-stack, or clothes-prop in the garden—well, you must investigate elsewhere.

Dodging the "Bill."

Suppose you live in a block of flats. Try the effect of a wire stretched vertically, and parallel with the outside wall, between two horizontal projections, say, a couple of broomsticks. Again, if you live within 10 miles of a broadcasting station, an insulated wire led from the receiver on the ground floor, upstairs, as vertically as possible, to the ceiling of the topmost landing, will give you good results. But you will need two valves, at least. Captain Round, of the Marconi Company, got Schenectady, U.S.A., working his "loud speaker" at Muswell Hill, *on a two-foot frame aerial.* You might try a frame aerial and a four-valve set at a distance of 20 miles, with reasonable hopes, if you cannot stretch 30 ft. of wire in the back-yard.

If your house or flat has electric light, you can try the neat contrivance known as the "Ducon" aerial. A flexible wire from the aerial terminal of your receiver leads, through a condenser, to a plug which fits into an electric light socket and makes connection, therefore, with the electric light wiring of the building. This is a good substitute, under certain conditions, for an aerial.

From the aerial we will proceed to the earth. If you cannot arrange for a wire from the "earth" terminal of your receiver to a discarded tin bath or some other metallic "junk" buried in the earth, try a soldered connection to a water pipe.

Next there is the difficulty of the accumulators for lighting valve filaments. Brothers, I also have suffered here. Accumulators are unduly heavy and expensive insects. They give up the ghost in the very middle of one's choicest concerts. "Bill" at the local bicycle shop does them no good and infinite harm, because he attends to them by rule of (dirty) thumb. Therefore, brothers, since "Bill" and our accumulators do not agree, we must flee from "Bill"—or it may be "Alf" down your way. As a rule, "Alf" is more disastrous than "Bill."

Eliminating the Accumulator.

Flight from "Bill" means that we must ourselves charge our accumulators, and if our house is unconnected with a power station this is unthinkable. Hence, we must necessarily eliminate the accumulator. Can this be done, and valves still be used? Yes! If we can find a valve whose filament is not greedy of current, and requires only a fraction of an ampere we are delivered. Such a valve is available and is vulgarly called a "dull emitter." This kind of valve is made after the well-known and popular "R" type; it works with less than half an ampere and may be run off two dry cells; plate voltage, 30 to 50.

This valve has solved the accumulator problem for me, and will do the same for you. If, however, you insist upon accumulators, you may acquire one of these cunning motors which run by water power supplied by your domestic tap. Such a one coupled to a dynamo will charge your accumulators—in time. But you will need patience and watchfulness.

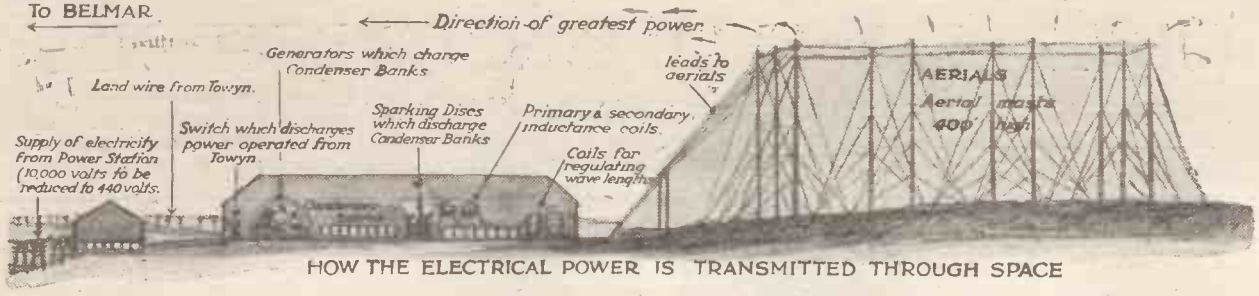
Some people believe that a receiver—being a receiver—will receive everything. The usual "broadcasting" receiver is designed to receive signals from British broadcasting stations and perhaps the Eiffel Tower time signals; this means that they cover a wave-length band (or range) of from 300 metres to 2,600 metres. Therefore it is waste of time for the amateur to listen for the big transatlantic stations. He will, however, be able to listen to Morse signals from ships and the coast stations serving them. A knowledge of the wave-lengths for which his receiver is designed, plus an examination of a list of wave-lengths of the world's wireless stations, will save many a man hours of time. If you wish to roam at large through the ether, you must purchase or make a receiver capable of dealing with wave-lengths ranging from 200 metres to 25,000 metres—and learn to use a wave-meter.

Cause of "Crackling."

Another difficulty is the choice of a set or a circuit. For telephony at moderate distances, a crystal detector plus one or more "note magnifiers" (low-frequency or audio-frequency amplifiers) is a very good combination, especially for short wave-lengths. For very short ranges, say two to five miles, a simple crystal detector used with a good aerial gives clear signals free from distortion due to the receiver. High-frequency amplification is useful, followed by crystal rectification and a "note magnifier." This is a good all-round combination. If you don't like crystals—and they are apt to be a nuisance—then a two-valve set employing reaction is excellent; but be sure the Post Office has approved it. It should bear the trade mark of the British Broadcasting Company and the G.P.O. Registered Number.

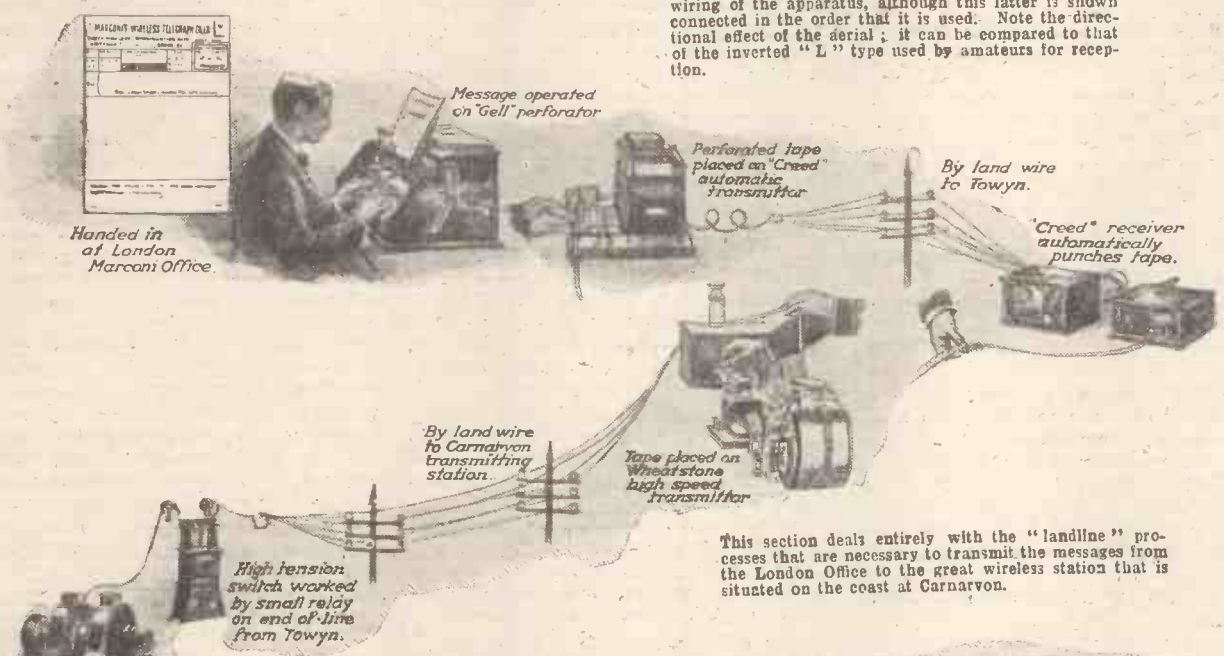
High-tension batteries, sometimes called "plate" or "anode" batteries, are prolific sources of annoyance. More often than otherwise that crackling noise in the telephones, or those squeaks like a pussy-cat *in extremis*, are due to the high-tension battery. I recommend the installation of a set of large dry cells, connected in series by soldered metal strips, insulated from each other by air, and from the earth by a layer of paraffin wax. The battery can be covered by a sheet of brown paper soaked in wax. This arrangement is somewhat ponderous but it should last for a year or more under favourable circumstances. I have tried it.

Two famous French artistes—Mlle. Sorel and M. Lamber, of the Comédie Française, broadcasting from a Canadian station.

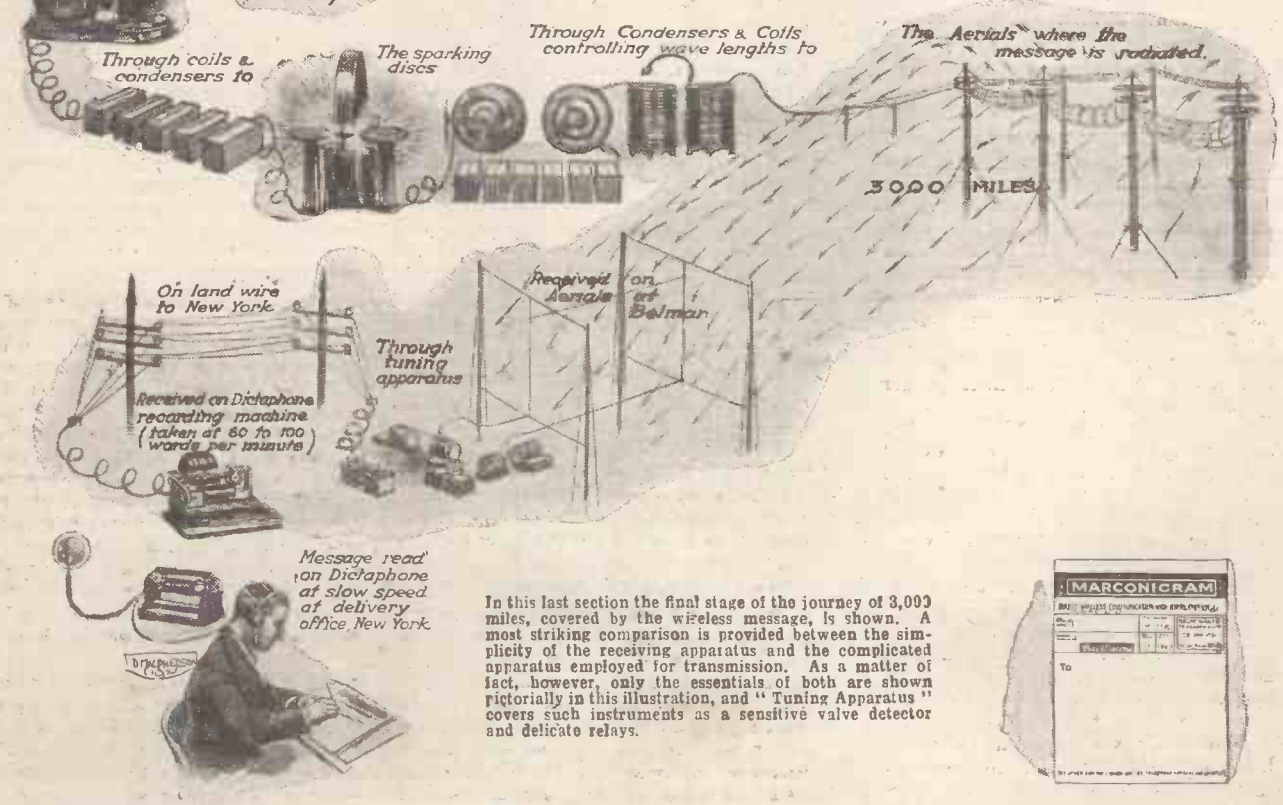


HOW THE ELECTRICAL POWER IS TRANSMITTED THROUGH SPACE

The illustrations depict the various processes involved in high speed transatlantic wireless communication. Of course, no attempt is made to show the actual wiring of the apparatus, although this latter is shown connected in the order that it is used. Note the directional effect of the aerial; it can be compared to that of the inverted "L" type used by amateurs for reception.



This section deals entirely with the "landline" processes that are necessary to transmit the messages from the London Office to the great wireless station that is situated on the coast at Carnarvon.



In this last section the final stage of the journey of 3,000 miles, covered by the wireless message, is shown. A most striking comparison is provided between the simplicity of the receiving apparatus and the complicated apparatus employed for transmission. As a matter of fact, however, only the essentials of both are shown pictorially in this illustration, and "Tuning Apparatus" covers such instruments as a sensitive valve detector and delicate relays.

QUESTIONS & ANSWERS FOR BEGINNERS.

NOTE.—On this page the beginner will find a selection of questions and answers which will concisely deal with many little problems met with in the erection of a wireless receiver. Readers are invited to send their queries to the Technical Dept., Room 138, The Fleetway House, Farringdon Street, London, E.C.4, where they will be carefully and promptly dealt with. Replies are sent by post free of any charge.

Q. Are telephone wires detrimental in any way to reception if they are near the aerial?

A. Provided they are not parallel to, or nearly so, the aerial, they should have no effect on reception. If they are parallel to the receiving aerial, and are very close, the current flowing through the telephone wires will induce a similar current into the aerial, and thus cause noise in the receiving set. Keep your aerial as far away from the parallel to telephone or telegraph wires as possible.

* * *

Q. What is the use of having wireless waves of different lengths?

A. If all wireless waves were of the same length, you would not be able to listen-in without hearing all the stations within range transmitting at once. This would render the required message quite unreadable, just in the same way that conversations are impossible when everybody is talking at the same time. The difference in wave-length of various transmitting stations enables us to so tune our apparatus so that only the station we require is received.

* * *

Q. What is jamming?

A. This is the name given to the interference caused by two or more stations transmitting at the same time and using the same wave-length. The various messages become muddled up, and are sometimes quite undecipherable one from the other.

* * *

Q. Why must a telephone transformer be used with low-resistance 'phones?

A. Low-resistance 'phones are wound with a comparatively few number of turns of wire capable of carrying a fair amount of current. When dealing with wireless, however, there is very little current available, though there is considerable voltage sometimes. This voltage and small current is transformed into smaller voltage and more current by the telephone transformer. Thus sufficient current is obtained to operate the low-resistance 'phones. In the case of high-resistance telephones there are so many turns of wire round the magnets that the tiny currents flowing in the circuit are capable of operating them without further change being necessary.

* * *

Q. What is meant by "interference"?

A. With regard to reception, the word interference is used when one receiving station is jammed by another—also receiving. This is only possible when valve sets are used, and when certain circuits are handled carelessly. If this is the case, the aerial is set into a state of oscillation and a weak wireless wave is transmitted continuously. This wave produces a howl in the 'phones of receiving sets for some distance round.

* * *

Q. Does not a condenser in the aerial break the connection and thus make reception impossible?

A. No. When dealing with wireless currents—high-frequency currents—you come across quite a different state of affairs than is the case with ordinary electric currents. The currents in the aerial are rushing up and down thousands of times per second. If a condenser is inserted in their path, as soon as the voltage or pressure in one direction reaches the condenser it causes an electric pressure on the opposite side of the condenser. Then, as the first pressure changes, as it does thousands of times per second, the second pressure on the opposite side of the condenser air gap also changes. These rapid changes on the both sides give rise to the voltages and currents that operate the receiving gear, and thus form signals audible in the telephones.

* * *

Q. What causes a wireless wave to be sent out?

A. To understand this you must understand the action of a condenser. If two plates are separated by air or other insulator, and an electric pressure is applied to one plate, then an opposite pressure is produced, by an electric strain, on the other plate. In a transmitting station the aerial and earth provide two plates of a condenser with air in between.

High-frequency currents of electricity are made to rush up and down the aerial and thus cause an ever-varying pressure on the two plates—aerial and earth. This varying pressure causes a varying strain across the intervening air, and ether, between the aerial and earth, and it is this strain that causes the ether to be set into vibration. These vibrations cause wireless waves, radiating from the space around the transmitting aerial.

* * *

Q. What causes an electric spark?

A. When you have an accumulation of electricity—or, to be more correct, electrons—on a small space such as one ball of a spark coil, and the other ball is so connected that there is a great lack of electrons, eventually, if the pressure due to the accumulation of electrons on one side of the gap is increased, there is such a strain exerted on the air that it no longer acts as an insulator. The electrons on the one side rush across to the other, at the same time heating the particles of air and other matter and causing a luminous spark.

* * *

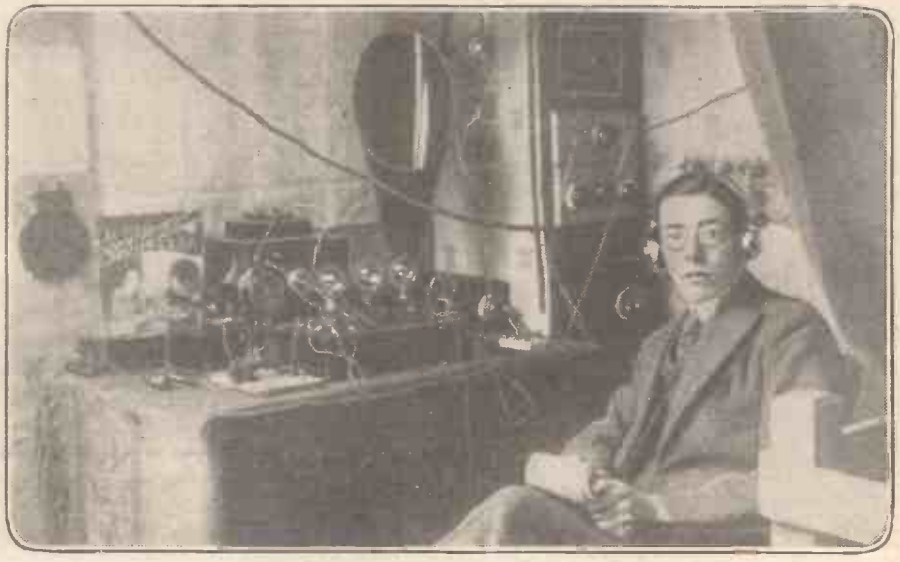
Q. Why do I only hear a click when I connect a battery to my 'phones?

A. Because to operate telephones the magnetic attraction between the diaphragm and the magnets must be always changing, in order to make the diaphragm vibrate and give out sounds. To cause the change in the magnetic field between the magnets and the diaphragm a varying current is passed through wire round the magneto. This has the property of either increasing or decreasing the strength of the magnets, according to the current flowing and its direction. Thus a varying current will vary the magnetic field and cause the diaphragm to vibrate. When you connect a battery to the 'phones the first flow of current changes the magnetism and thus causes a click, but after this the current flows steadily, and thus no change in the magnetic field, and no vibration of the diaphragm, occurs, and you hear nothing.

* * *

Q. Why cannot the telephones be placed in the aerial without a detector?

A. Because the high-frequency currents are flowing so fast up and down that the telephone magnets and diaphragm could not operate at that speed. After the detector or rectifier has been employed the variation in the current is much slower, and the telephones are able to operate under its influence.



Mr. Cecil B. Bulloss, of 27, Withins Avenue, Hillsboro', Sheffield, and his home-made set

WIRELESS AND TELEPATHY.

The following article is not to be regarded as a forecast of the manner in which problems connected with thought transmission will be solved, but should be taken rather as an indication of a possible basis upon which wireless experimenters and others might work.

By P. J. RISDON, F.R.S.A.

STRICTLY speaking, an article on such a subject as this should be prefaced by a somewhat lengthy explanation of what is meant by telepathy, and a description of certain definite results that have been secured by means of systematic investigation and experiment, many of which there is not the slightest occasion to doubt, especially because they are really not much more surprising than involuntary thought transmission, which probably the majority of persons have experienced. Lack of space, however, renders this impracticable, and we must assume, either that the reader possesses elementary knowledge of the subject or that he will be sufficiently interested to seek such explanation in an authentic work of reference.

There are some who believe that telepathic phenomena can only be explained as the result of activity of the sub-conscious mind—as distinct from the waking or conscious mind that governs our reasoning powers and acts. There is quite good grounds for this belief, since practically all telepathic communications, whether deliberately undertaken or whether involuntary, appear to be dependent upon the suppression of the conscious mind to a condition, more or less, of subservience. It is possible, however, that ultimately the waking or conscious mind will be found capable of deliberately controlling the transmission and reception of thought-waves.

Recording Emotion.

It is believed by others that the ether is the medium for such waves, although, curiously enough, some authenticated instances indicate time periods apparently at variance with the notion of a uniform speed of ether waves.

It is conceivable that there may be some other and far more delicate medium—an ether within an ether, as it were—which serves the purpose of telepathy. However that may be, it is a *sine quâ non* that the minds of two persons between whom telepathic communication is to be established must be attuned to vibrate in unison, in much the same way that wireless receivers are tuned to respond to transmitting apparatus, or that a tuning fork, when struck, will cause another tuning fork having the same period of vibration to vibrate in sympathy.

In the present state of knowledge it is imperative that the minds of two persons seeking to effect telepathic communication be kept free from extraneous thoughts and distractions, which appear to have much the same effect that atmospherics and other disturbing factors have upon the reception of wireless messages.

Another important point is that, since Nature abhors exact duplication in any shape or form, it is improbable in the extreme that any two minds vibrate always in unison. It is far more likely that the human mind possesses the power of varying its period of vibration, both as regards transmission and reception of thought, and that only practice is required in order to develop the ability to effect this at will. Many persons who have lived in the East, and especially in India, firmly believe that certain of the natives possess this power of thought-communication.

In endeavouring to fathom the secret of telepathy it is essential to remember the important fact that the mind and body react on one another, and that the well-being of one is largely dependent upon the condition of the other. Thus prolonged anxiety, such as financial worry, or sudden grief or anger, will produce in many a most serious state of health; whilst, on the other hand, physical pain or a grievous disease or other infirmity may prey upon the mind of a person to the extent of producing insanity.

It is conceivable that this interdependence of mind and body may constitute a means of detecting thought-waves and enabling them to be transmitted and received.

This suggestion is made partly in consequence of a series of tests made by the writer in conjunction with the late Dr. Waller, by means of a special apparatus devised by him for recording emotional changes. It is unnecessary to describe here the technical details of the apparatus in question; it is sufficient for our present purpose to mention that, in a somewhat complicated electrical circuit, are included batteries and a galvanometer, to the needle of which a tiny mirror is secured.

A pair of small electrodes is attached to the hand by an elastic band, so that one electrode is against the palm and the other against the back of the hand, damp blotting-paper being inserted between the electrodes and the skin in order to ensure proper contact. In this way the hand of the subject closes the electrical circuit. A light concentrated on the galvanometer mirror is reflected by it on to a graduated scale, so that any movement of the needle and mirror causes a bead of light to move up or down the scale. A means is provided for calibrating the apparatus, so that, although the resistance in the circuit may vary, the bead of light can always be brought to zero.

Effect of Pain.

Now, besides the effects, already mentioned, which an emotional condition produces upon a person, *the electrical resistance of the body varies with one's emotional condition.*

Seated in a chair with the electrodes in contact with his hand, as described, the subject is told to compose himself and, if possible, to think of nothing. Then a sudden pain or threat of pain, a loud and unexpected noise, or an unpleasant smell affects his electrical resistance so as to cause the bead of light to travel up the scale.

Even a condition of suspense has the same effect.—if, for instance, he is told that something is going to be done of which he knows nothing. But, most surprising of all, *if he is told to think of something that has been causing him worry, the bead of light will travel a long way up the scale, thus recording the effects of thought.*

It may be asked: "What has this to do with thought-waves and wireless?" But a little reflection will supply the answer.

Clearly, there should be no difficulty in magnifying the electrically indicated extent of emotion produced by thought or excited by different incidents, in much the same way that, by means of relays and valves, telegraphed and wireless messages are amplified. It has been shown that *thoughts* are capable of indicating, visibly, that they do produce effects upon the body through the nervous system, and these effects could be magnified, transmitted by wireless, received, and recorded at any desired distance.

Transmitting Thought.

It goes almost without saying that Dr. Waller's apparatus, in so far as telepathy is concerned, is a primitive and crude appliance. Nevertheless, although it does not discriminate between *different* emotions, it indicates the extent or depth of emotion excited by sensation or thought, and, what is also of importance, the temperamental differences between different subjects both in states of mental composure and excitement. In these respects it should prove of value to research workers in telepathy, for it would afford a useful means of comparing the mental attributes of different persons.

The problem that remains is, of course, a difficult one—to distinguish one emotion from another. I suggested this to Dr. Waller, but unfortunately his death, soon afterwards, put an end to his investigations, and it remains for others to pursue the subject on the lines on which he started.

When this problem has been solved the rest should be plain sailing. At present there is no technical reason why the extent of one's varying emotions should not be wirelessed to the ends of the earth, received, converted, and indicated by a bead of light on a scale such as the subject himself may witness before him.

And, if one's emotions and thoughts are thus capable of expressing themselves—or of being expressed—in a material sense, why should it be impossible for such indications, wirelessed to a distance, to reverse the procedure, and, through the body, to re-convert messages back to the realms of thought?

NEXT WEEK.

A Special article by Captain Round, Chief Research Engineer of the Marconi Co.

ADDITIONS TO "POPULAR WIRELESS" DIRECTORY.

Call Sign	Remarks	Name	Address.
5 A A	C.W. & R/T	"Leicester Daily Mercury"	Leicester.
5 A F	R/T	J. A. H. Devey	232, Great Brickkiln St., Wolverhampton.
5 A G	C.W., R/T, & Spark	A. G. Gregory	77, Khedive Rd., Forest Gate, E.7.
5 A O	C.W. & R/T	H. H. Elson	142, Birchfield Road, Birmingham.
5 A V	Various systems	R. W. J. Harvey	25, Shakespeare Avenue, Portswood, Southampton.
5 A W	C.W. & R/T	F. Hough (Southport) Ltd.	60, Sussex Road, Southport.
5 B B	—	Vickers, Ltd.	Vickers House, Broadway, S.W.1.
5 B B	—	Sir Trevor Dawson, Bart., R.N.	Elstree, Herts.
5 B M	C.W. & R/T	J. T. Quick	164, Portland Road, Egbaston, Birmingham.
5 B W	C.W. & R/T	Wireless-controlled airship; 10 w. portable telephony set and fixed 10 w. stn. (Capt. A. de Villiers).	79, St. George's Road, S.E.
5 C D	—	—	Wisbech.
5 C F	—	F. G. S. Wise	7, Vernon Road, Hornsey, N. 8.
5 C U	C.W. & R/T	J. A. Walshaw	Garnett Villa, Otley, Leeds.
5 C X	C.W., R/T, & Spark	A. Higson	161, Cotton Tree Lane, Colne, Lancs.
5 D A	C.W., R/T, & Spark 10 w.	G. Gore	24, Brucegate, Berwick-on-Tweed.
5 D B	C.W., R/T, Tonic Train, and Spark	C. H. P. Nutter	243a, Selhurst Road, South Norwood, S.E.25.
5 D P	Spark	F. L. Stollery	Fairmead, Vista Rd., Cl'ct'n-on-Sea.
2 W S	C.W., R/T, & Tonic	H. E. A. Squelch	35, Crown Lane, Bromley Common, Kent.
2 X A	C.W., R/T, Spark & Tonic Train	Rev. C. H. Townson	Wilts Farm School, Warminster.
2 X C	C.W. & R/T.	H. Johnson	Chestnut Walk, Worcester.
2 X L	—	—	Chalk Farm, N.4.
2 X L	—	Capt. S. Davis	222, Lavender Hill, Clapham Junction, S.W.11.
2 X M	C.W., R/T, & Spark	Downside Wireless Soc.	Downside School, Stratton-on-Fosse, Bath.
2 X P	C.W., R/T, & Spark	—	22, Shakespeare Cres., Manor Park, E.12.
2 X X	C.W. & R/T	D. F. Young	23, Holcombe Road, Ilford.
2 Y F	C.W. & R/T	J. R. Clay	Upper Longbottom, Luddendenfoot, Yorks.
2 Y I	C.W. & R/T	W. J. Hewitt	83, Riddings Road, Moseley.
2 Y K	C.W. & R/T	T. M. Ovenden	12a, Elgin Court, W.9.
2 Y M	C.W., R/T, & Spark	R. W. Piper	Elmhurst. Chiltern View Road, Uxbridge, Middlesex.
2 Y U	C.W., R/T, & Tonic train	G. W. Hale & R. Lyle	36, Dagnall Park St., Norwood, S.E.5.
2 Z L	Spark only	H. W. Gee	44, Gordon St., Gainsboro', Lincs.
2 Z M	Duplex Telephony	T. H. Isted	Terling, Witham, Essex.
2 Z P	C.W. only	G. F. Forwood	West Chart, Limpsfield.
2 Z T	C.W. & R/T	Benham	Woodbury Road, New Malden.
2 B N	—	—	Orchardleigh, Golder's Green, N.W.11
2 C A	C.W. & R/T	—	69, Station Road, Chingford.
2 C M	C.W. & Spark	N. D. B. Hyde	92, Littledale Rd., Egremont, Ches.
2 D Y	—	F. H. Haynes	5, Regent Square, W.C.1.
2 G A	Spark only	Rev. J. A. Gibson	18, Daniel Street, Bath.
2 G I	—	— Johnston	Hind House., La., Sheffield.
2 J B	C.W., R/T, & Spark	Downside School	Stratton-on-Fosse, Bath.
2 J C	—	I. H. Storey	Escowbeck, Caton, Lancs.
2 J D	—	—	—
2 J N	C.W. & R/T	H. B. Burdekin	Bilton, Rugby.
2 J Q	—	M. C. Ellison	Hutton's Ambo. Hall, York. (Portable).
2 K R	C.W. & R/T	F. Edmonds junr.	2, Yew Tree Rd., Birmingham
B L J	—	Worc. Cadets Sig. Co.	Sansome Walk, Worcester.
2 L T	C.W & R/T	A. F. Bartle	5, Ulundi Rd., Blackheath, S.E. 3
2 M C	C.W. & R/T	H. B. Dent	Albion, Fleetwood Avenue, Westcliff-on-Sea.
2 N J	—	—	S.E.12.
2 O H	—	G. S. Goode	Abbotsford, Hinckley.
2 O Q	C.W. & R/T	D. P. Baker	Cleveland Road, Wolverhampton.
2 O U	C.W., R/T, & Spark	Ilford and Dis. Radio Soc. (Portable)	—
2 O Z	C.W. & R/T	Worc. Cadets Sig. Co.	Worcester.
2 P D	C.W. & R/T	W. Harvey-Marston	The Manor, Willenhall.
2 P L	C.W., R/T, & Tonic	Major Stephens	Haddon House, Bridport.
2 P Q	C.W. & R/T	G. E. Mortley	23, Forest Road, Tunbridge Wells.

MARKING EBONITE AND HARDWOOD.

ALL that is required is a set of metal punches of letters and figures, and a small amount of red lead, putty, or white lead. These latter can be purchased at any oil or colour shop, and two pennyworth will be more than sufficient for the purpose.

In order to mark ebonite, warm it in front of a fire—no hotter than can be comfortably borne on the back of the hand—place it on a table or bench, and immediately place the punch in position and press hard; this will make a good impression. If the reader prefers the letters or figures made in white, red or bronze, scratch the impression carefully with a hat pin, needle, or the like to give a key to the filling to be put in. But before the scratching, which needs to be carefully done, it should be ascertained that the work is good and up to expectations. If it is not, all that need be done is to place the ebonite once more in front of the fire and it will resume its original surface. Also in marking, say, a valve panel, the completed marking should be covered over so that the fire does not draw it out again.

Applying the Colour

To colour the marks made, fill in with red lead or white lead by using an old knife or chisel, wiping off the superfluous with a clean piece of rag, leaving the impression clean and showing up well. A coat of shellac may now be applied to protect the marking.

In the case of hardwood, apply the metal punch to the required position, and tap smartly with a hammer, then, using a knife or chisel, work a little of the red or white lead into the mark, and wipe off superfluous, and, as before, varnish to protect and prevent filling, drying, and falling out. Red lead marking shellacked shows up extremely well on hardwood.

The red or white lead when purchased should be of the consistency of ordinary glazier's putty or dough. The red lead is as used by gasfitters, and white lead is the ordinary white lead paint.

In marking either ebonite or hardwood, the steel punches are used cold, it being unwise to heat *them* for fear of destroying their temper.

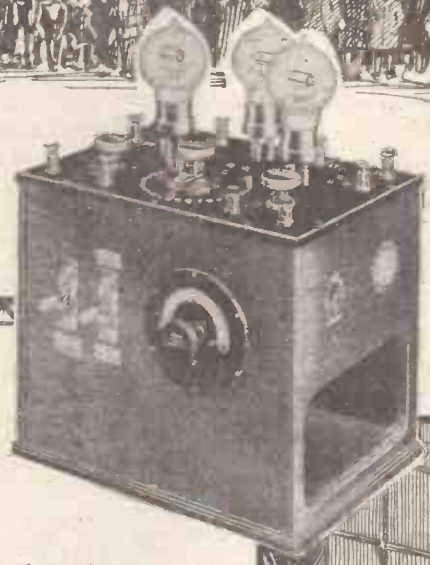
The writer tried punching ebonite with a punch and hammer, but without success, as the ebonite breaks. Red sealing wax was tried on hardwood marks, but it is not to be recommended on account of its liability to become smoky or dirty during the process of being melted. The writer also tried heating the steel punches in boiling water, but this also was not a success.

BOOK REVIEW.

"Pitman's Radio Year Book, 1923" (Sir Isaac Pitman & Sons, Ltd.).—This is a very compact and useful little volume. It is full of information, containing sections on all the most important branches of wireless telephony. The book has one failing, however: it does not provide a full list of amateur transmitting stations. We feel that a more complete list would be greatly appreciated.

T·M·C WIRELESS

for football results



A T.M.C. Wireless Set will enable you to follow your favourite team and hear the results of each match practically as soon as the game is over.

Or, you may be interested in boxing, the latest news, stock exchange quotations, the weather forecast, delightful concerts or an evening of dancing.

You can have all these, enjoyably and pleasurably, in the comfort of your own home with a T.M.C. Wireless Receiver.

There is no trouble to you. T.M.C. have engineers in every large town to advise you, free of cost and without obligation, as to the best apparatus to use.

Your choice having been made, T.M.C. engineers will install the apparatus and periodically inspect it.

T.M.C. Wireless Receivers, which are fully approved by the Postmaster-General, bear the seal of the British Broadcasting Company.

The wide variety of models are entirely British Made.

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London, Birmingham, Manchester, Newcastle and Cardiff are broadcasting now:

Come and listen to them any evening up to 10 p.m. at our showrooms in London, Birmingham, Belfast, Bristol, Cardiff, Dublin, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Sheffield.

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The "Everset" Crystal.
No adjustment necessary.
Fits any crystal receiver.
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EPS
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TELEPHONE MFG., Co. LTD.
HOLLINGSWORTH WORKS, DULWICH, LONDON, S.E.21.

A USEFUL BUZZER WAVE-METER.

THIS wave-meter will operate efficiently between 280 and 3,850 metres if the measurements given below are complied with. With a view to economy, it is as well to make up most of the components from the raw materials, in which case the following details will be necessary.

The inductance consists of a "former" of wood, or ebonite tube having a diameter of 2½ in. and length 2 in., on which is closely wound 53 turns of No. 22 S.W.G. single silk-covered copper wire. A tapping is taken in the usual way, from the 33rd turn.

The condenser has a maximum capacity of ·003 microfarads, 59 plates, $\frac{1}{32}$ in. thick by 3½ in. diameter (moving plates), using ⅛ in. spacing washers will give this value approximately. An old electric bell movement with the knob removed will do quite well for the buzzer.

Action of Circuits.

It is important to note that there must be a non-inductively wound shunt connected across the *windings* and not across the contacts as is usually the case in small shunted buzzers. Ten feet of insulated German silver wire No. 36 S.W.G. wound back on itself will be sufficient for the shunt. Two pocket lamp batteries connected in parallel will be found enough to last for several months, with daily use.

The cabinet is of mahogany, satin walnut, or any other wood that looks well, ¼ in. thick throughout. One side is fitted with hinges and fastener to allow access to the interior for buzzer adjustments, replacement of batteries, etc. A small battery switch of some kind and two terminals provided with a brass strap—drilled at one end and slotted at the other—completes the list.

Suitable dimensions for the cabinet and te arrangement of the various parts therein, are shown in Fig. 1. The inductance is secured from the outside by three ½ in. screws, and the battery is held firmly in place by constructing a small compartment into which it exactly fits. A diagram of connections is given in Fig. 2. When wiring up care must be taken that the two short circuiting terminals are connected across the smaller part of the coil that is, the part—consisting of 20 turns.

Referring to Fig. 2, the action of such a circuit is as follows: When the switch is closed, current flows from the positive of the battery, through the buzzer windings, through the inductance (L) and back to the negative. When current is flowing through the buzzer windings, the iron core is magnetised, the armature attracted, and the circuit broken.

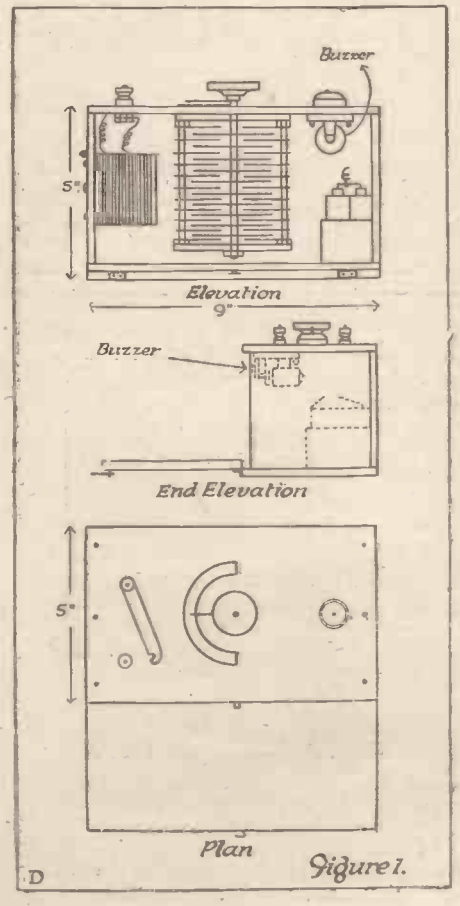


Figure 1.

Calibration.

Therefore the magnetic field set up round L by the current flowing through it, collapses, and the lines of force cutting its own turns, induce an E.M.F. tending to keep the current flowing (Lenz's law), but this is impossible because the circuit is broken. The E.M.F. induced is therefore utilised to charge the variable condenser (C) which discharges itself through L in the form of oscillations, at a frequency depending upon the values of C and L.

Thus several cycles of radio-frequency current will take place during the time the circuit remains broken by the buzzer armature.

The wave-meter is really a short distance transmitter, and if placed near a receiver that is tuned to the same frequency, will induce oscillations in that receiver, which, when rectified, will be audible in the telephones as the note-frequency of the buzzer.

When the strap is in place, the parallel circuit thus formed has negligible inductance, therefore the coil of 53 turns is virtually reduced to 33 turns and—tuning by condenser—has an approximate range of 280–1,860 metres. With the strap disconnected and the whole coil in use, the range is approximately 500–3,850 metres. Rather than calibrate the condenser scale in wave-lengths, it is preferable to have it in degrees, and plot two curves on a piece of squared paper, marking wave-length in metres from 280–3,850 along one axis and condenser readings in degrees along the other.

To do this, the instrument is calibrated against a standard wave-meter, or alternatively known signals are tuned in to maximum strength on the receiver, the wave-meter then placed near and the condenser adjusted until a maximum buzz is heard in the telephones.

The position on the condenser scale is noted, and the point plotted on the curve. As many of these readings should be taken as possible; the more there are, the greater the accuracy of the curves.

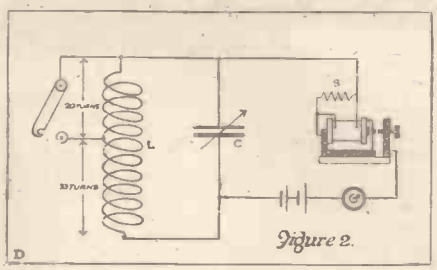


Figure 2.

The results obtained can be roughly checked by using the formula for wave-length—1,885 $\sqrt{C.L.}$—where C is in microfarads, and L in microhenries. The approximate values of capacity can be judged from the condenser scale.

For example, at positions of 45°, 90°, 135°, and 180°, the values of capacity are about ·00075 mfd., ·0015 mfd., ·00225 mfd., and ·003 mfd. respectively.

For the first range, L = 325 microhenries approx.), and for the second range L = 1,390 microhenries (approx.). Although perhaps not up to the standard of a professionally made instrument, if carefully constructed this wave- meter should prove a very useful piece of apparatus to the amateur.

A DEMONSTRATION AT "THE TIMES."

By ARIEL.

THE other evening I had the pleasure of demonstrating a six-valve portable Marconi Receiver to the Editor and staff of "The Times."

The set used has already been described in POPULAR WIRELESS. It is completely self-contained in a suit-case, with a fixed frame aerial wound to 2 L O's wave-length round the inside of the lid. The Editor of "The Times," Mr. Geoffrey Dawson, listened-in to part of the opera being broadcast from Covent Garden, via Marconi House, and confessed himself highly pleased with the clarity and general excellence of the transmission.

And as I adjusted the set for Mr. Dawson, I could not help glancing round the famous news room (where the demonstration took place) and wondering what Delane would have thought of this modern miracle—wireless: and whether George Meredith, when he conceived the dramatic scene in the room of the Editor of "The Thunderer" ("The Times") would have made Diana sell her information by wireless, had that famous lady lived to-day.

Several other members of the editorial staff of "The Times" listened-in, and were greatly struck by the fact that the set required no aerial, and that the ubiquitous wireless waves managed to penetrate walls and windows, and even the bodies of the listeners-in themselves.

In fact, many of them, I feel sure, were so interested that before long they will be keen amateurs themselves.

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.

Sutton and District Wireless Society.*

Meetings are now held on the second and fourth Wednesdays in the month at the usual time and place, namely 8.0-10.0 p.m., at the Adult School, Renhill Avenue, Sutton. All interested should write to the hon. sec. E. A. Pywell, Stanley Lodge, Rosebery Road, Cheam.

Wireless and Experimental Association.

The meeting of the Wireless and Experimental Association, at the Central Hall, Peckham, on Wednesday, January 17th, was mostly occupied with the consideration of the forthcoming meeting of the Radio Society of Great Britain, and the election of delegates to attend that meeting to represent the association. As in past years, the difficulty in agenda matters was less what questions to raise than what, of all the matters which require immediate attention, we might leave for the present.

Messrs. Knight, Jouglin, Voigt, and Webb were unanimously elected to attend the meeting, and the other members felt that their interests and the interests of other amateurs in the vicinity were safe in their keeping.

It was hoped that some means would be devised for making use of the amateur radio associations in eliminating some of the ignorant or selfishly caused valve noises which militate against the more complete enjoyment of the freedom of the ether.

Hon. assistant sec., G. H. Horwood, 557, Lordship Lane, S.E.22.

Bath Radio Club.

The above club, although only a few months old, already possesses over seventy members, and is beginning to show signs of becoming one of the leading radio clubs in the West.

At the first meeting of the year, held at the Old Red House, New Bond Street, Bath, on Wednesday, January 17th, members spent a very interesting and instructive two hours.

Following the election of new members, a discussion ensued as to the advisability of adopting the committee's proposal to hold a special social night in the near future to which ladies would be welcomed. The chairman felt that the atmosphere of happy informality which would necessarily attend such a function would do much towards promoting that spirit of fellowship which the committee are so anxious shall prevail at club meetings. After a certain amount of opposition, the proposal was carried.

Business over, the meeting settled down to enjoy an unusually capable lecture by Mr. L. E. R. Boxwell, of Bradford-on-Avon (Wilts). This lecture was the first of a series of six lectures which Mr. Boxwell will give to the club, and which are intended to tell enthusiasts all they wish to know about their pet hobby in such a manner as to be perfectly comprehensible to the merest beginners. The ground covered in Wednesday's lecture dealt with electrons, oscillations and waves in ether, and the simple, yet convincing way in which Mr. Boxwell dealt with these subjects met with the warm appreciation of all present. Questions testifying to the interest taken in the lecture showered upon the lecturer when he concluded, and he was given a hearty vote of thanks.

A question-box was installed during the evening, by means of which the committee guarantee to deal with any questions relating to radio which members may wish to be enlightened upon.

Messrs. Taylor, the proprietors of the Old Red House (the venue of the meeting), having placed their set at the disposal of the club for the evening, broadcasting from Birmingham was also enjoyed, the reception being remarkably clear and strong.

The meeting terminated with every promise of an interesting session.

Hon. sec., Geo. J. Barron Curtis, 6, Pierrepont Street, Bath.

St. Barnabas' Wireless Club.

The above club gave a wireless demonstration at the St. Barnabas' Parish Room, Epsom, on Wednesday, January 10th, at 8 p.m., in aid of the proposed new parish hall.

Reception from 2 L O (including the opera "Pagliacci") was particularly loud and clear, and special thanks are due to one of the members, Mr. H. Penfold, whose four-valve receiving set (1 H.F. 2 L.F.) was used on this occasion.

The hall was filled to overflowing, and a collection at the door yielded a generous sum for the object mentioned. The demonstration was so successful that another was given on January 31st, at the same time and place.

There are vacancies for a few keen members, ladies or gentlemen, whether they possess any technical knowledge or not.

The entrance fee, returnable, is 5s., and the subscription 1s. per month.

The club meets on Thursdays, at 8 p.m., in the St. Barnabas' Parish Room, Hook Road, Epsom, Surrey.

Hon. sec., B. H. Hardy.

Hackney and District Radio Society.*

The weekly meeting of the above society took place on Thursday, January 18th, at the headquarters, Y.M.C.A., Mare Street, Hackney, E.8, when a good number of members were present. A most interesting lecture on the Morse Code was given by Mr. J. Wilson, an expert in telegraphy.

Although the society has a good membership, there are many Hackney residents with receiving sets who have hitherto remained outside the fold, and these are cordially invited to visit the society. The new subscription came into force at the beginning of the year, an appreciable reduction on the previous subscription. Full details will be supplied by the secretary.

The society is greatly in need of outside lecturers on any subject directly or indirectly concerned with radio; up to now they have relied on members of the society for this purpose. Any person who is able and willing to give a lecture is requested to be so good as to communicate with the secretary. Exposes will be willingly paid.

Hon. sec., C. Phillips, 247, Evering Road, N.16.

The Ilford and District Radio Society.*

On Thursday, January 18th, a very successful concert and demonstration of wireless telephony was held.

Both portions of the programme were very well appreciated. Mr. L. L. Vizard operated his five-valve receiving set, and signals were made audible to the whole of the audience by means of a loud speaker, kindly loaned by Messrs. Radio Instruments Ltd.

The Stoke-on-Trent Wireless and Experimental Society.*

At a meeting of the Stoke-on-Trent Wireless and Experimental Society, held at the Y.M.C.A., Hanley, on Thursday, January 18th, when Mr. L. F. Fogarty, A.M.I.E.E. (treasurer of the Radio Society of Great Britain), gave a lecture on "Rectifiers."

Mr. Fogarty described the principles of rectification, and illustrated various types of rectifiers. The Nodon valve, the Ferranti commutator rectifier, the "Aedic" rectifier, the "Tungar" rectifier, and several other rectifiers, were explained at length, and comparisons drawn between them.

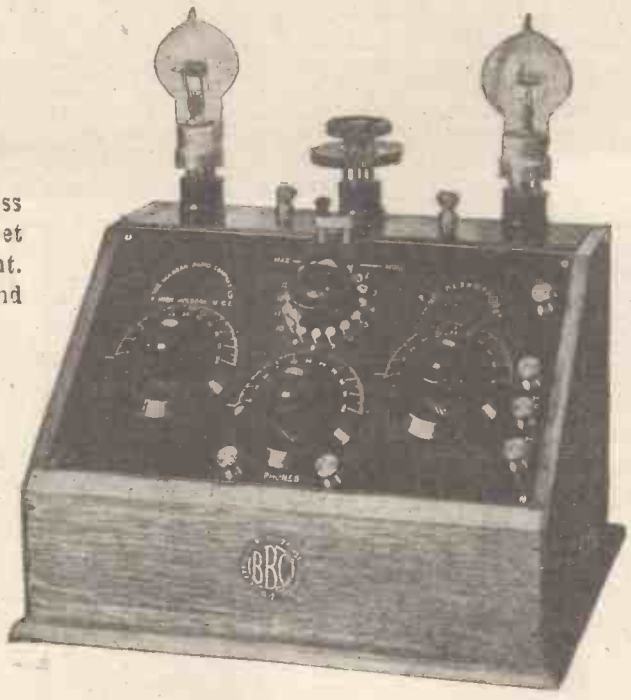
A "Tungar" rectifier and an "Aedic" rectifier were demonstrated with under working conditions, while a rectifier of the vibrating type was on view.

Hon. sec., F. T. Jones, 360, Cobridge Road, Hanley.

Don't buy a "White Elephant"!

The "Deskophone" is all that can be desired in a Wireless Set. It is handsome in appearance, and is a fitting asset to the finest room. Added to this, it is guaranteed efficient. It gives the finest results every time and everywhere. And —the price is beyond reproach.

The fact of being a "Deskophone" user entitles you to our expert advice and assistance at all times free of charge. This ensures the best results, and will avoid the disappointments that come to so many amateurs through either insufficient knowledge or the use of accessories of indifferent capabilities.



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Two-Valve Set, Tuner, High Frequency Amplifier and Detector, complete with accessories, including Headphones, H.T. Battery, Accumulator, Aerial, Lead-in-Wire, Insulators and Coil.

PRICE COMPLETE

£12 - 17 - 6

PRICE without ACCESSORIES: £9 - 17 - 6

Royalties, £3 - 0 - 0. R Type Valves, 17/6 each Extra.

Reg. Design No. 594025

THE DESKOPHONE SINGLE-VALVE SET

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AMPLIFIER

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Low Frequency Amplifier for use with Single or Two-Valve Set. Considerably increases the volume of sound. This amplifying unit is of the utmost value for use with any of our instruments.

PRICE

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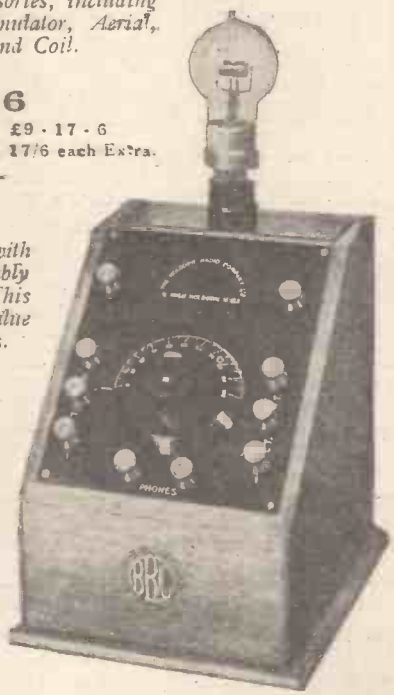
R Type Valve, 17/6 Extra



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RADIOTORIAL

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

Questions Answered

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be exercised in answering queries. Until further notice three questions from one reader will be the limit for one letter. All questions should be addressed to POPULAR WIRELESS, Queries Department, Room 138, Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send the necessary postage for reply..

F. M. (Newcastle).—I intend to employ an indoor aerial, and am not sure whether a frame aerial will be better than winding a few turns of wire round the frame of a window ?

We presume in the former case you would employ a movable frame aerial, and this, providing that a suitable set is employed, would prove the more efficient owing to the fact that it would be possible to take advantage of the very marked directional qualities of a frame aerial.

* * *

N. H. (Chorlton-c.-Hardy).—I applied for an experimental licence some few weeks ago but have not heard anything since. In the meantime, can I erect my aerial ?

No, you must wait until you receive the formal licence before proceeding with the erection of your station.

* * *

C. R. C. (No address).—(1) I live 7 miles from 2 L O, and should like to get that station on a loud speaker, and would like to hear the Hague on 'phones. What set should I want ? (2) What stations (broadcasting) should I hear ? (3) Do you advise a unit set ? (4) Are valves interchangeable from holder to holder ? (5) Ought I to have a stamped set ?

Three valves would be sufficient. You should have 1 H.F. valve, 1 detector, and 1 L.F. If possible get a set stamped by the B.B.C., and also using reaction on the H.F. transformer. This will then give you all the British broadcasting stations now working, and The Hague and Paris telephony as well. A unit set would be useful, as then you could add to it. In any case, if possible buy such a set, then you can have either H.F. or L.F. valves added to it, without necessitating rewiring the panels. Yes ; valves are interchangeable.

* * *

"QUERIE" (Eastbourne) asks if two sets can be attached to one aerial, one set at each end ?

We do not advise the practice, as very unsatisfactory results would be obtained. You thus give the aerial two earths, and every time one set was used the other would have its adjustments upset owing to the first changing its wave-length and so on.

* * *

"IGNORANT AT PRESENT" (Preston).—I am troubled by the dynamo of a nearby picture-theatre. Can I cut out the noise ? I am 19 miles from Manchester; should I hear it—my set being a crystal set ?

You will probably find a capacity earth will reduce the trouble. This is a wire stretched under the aerial for its whole length and about 2 feet above ground. It must be well insulated all the way, and is used as the earth instead of the usual type employed. You should hear Manchester, but it will be rather faint. By the way, you will find that your variable condenser will probably give better results in parallel when dealing with spark stations and higher wave-lengths. For a crystal set it may also be better connected that way for telephony if you can get down to 360 metres easily.

* * *

"NO NAME" (Bishop Auckland).—What is the difference between a B.B.C. licence and experimental licence, and one for which you will have to apply to the P.M.G?

You are getting a little mixed up. There are two kinds of receiving licences, not three. The B.B.C. licence (so called) is one which can be obtained at the post office for 10s., and which allows the use of sets stamped B.B.C. and no others. The experimental licence is one which allows of the use of almost any type of sets, home-made or otherwise, and for which application must be made to the Secretary, G.P.O. This licence also costs 10s.

* * *

A. B. C. (Nottingham).—Can I so arrange my aerial and earth that I could plug in the set in different rooms ?

We do not advise this, as it would be a very unsatisfactory arrangement. Your earth lead should be as short as possible, and the lead taken from the aerial should come as directly to the set as you can manage it.

* * *

T. N. (Petersfield).—I was listening on a 3-valve set on Tuesday and I heard a French station on about 440 metres. Is this a harmonic of some station working on a higher wave-length ?

This is possible, but most likely it is the transmission of a new French station that you heard. See Page 2 of POPULAR WIRELESS each week. There is a new station working on 450 metres and this is probably what you heard.

* * *

Z. Y. (Liverpool).—If I increase the size of my inductance coil, will it help me to increase the distance from which I can receive ?

Not directly ; it will increase the wave-length range over which you can receive, and by doing this you will be able to hear the stations that work on longer wave-lengths. These stations usually employ more power than those that are to be heard on low wave-lengths, and thus you will be able to hear stations working at a greater distance than those you now hear.

* * *

M. J. (Plymouth).—I have a 2-valve set, and I wish to increase my wave-length range. What size former must I use to cover a range of 150 to 20,000 metres ?

One coil will not be able to cope with this range. The dead-end turns not in use will prevent the coil from tuning down to anywhere near 150 metres. For such a range a set of honeycomb or basket coils will be far more efficient, as you can then insert separate coils to suit the wave-length required.

* * *

"BEGINNER" (Southend).—I am putting up a double aerial. How long should the spreaders be ? (2) What should they be made of ? (3) How many insulators should I have ?

There is no fixed length for the spreaders, but to obtain satisfactory results you should not have the two wires nearer to one another than four feet. This means that the spreaders will have to be about four to five feet long, at least. (2) Use bamboo, as the spreaders should be as light as possible. Ash will do quite well, but avoid heavier wood if you can. (3) You need an insulator at the end of each wire. That will be four altogether, and, also, you should have the ropes supporting the spreaders insulated. Two at each end should be sufficient. This brings the total to eight. Remember that a double aerial has more chance to leak than a single one, and also that no aerial can be too highly insulated.

BRUCE AND THE "SPIDER WEB" COIL.

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 937.)

A. T. N. (Cambridge).—With regard to the Dual-Amplification Circuit recently published in POPULAR WIRELESS, are the variable condensers of any special value? What size coils should be used?

(1) The condensers are of the usual size, .0001 for reaction if that form is used, and .001 for secondary circuit.

(2) The coils can be of any size, provided they are suitable for the wave-length required. You will find basket or honeycombs quite O.K. The transformer is naturally either aperiodic—when it has not to be tuned to the wave-length required—or of the tuned primary type. This latter is more efficient. A plug-in transformer is quite suitable.

* * *

J. P. T. (Reading).—Can you tell me if basket coils can be used as H.F. transformers?

Yes; they are quite suitable for this purpose. A useful way is to wind them on thin cardboard formers with about 9 slots and an inch diameter centre. The primary and secondary can be fixed together by means of a bolt, the two coils being separated by a thin sheet of waxed paper. Using 38 d.s.c. wire you will find that about 95 to 100 turns on each former will give a good transformer for broadcasting wave-lengths. This forms an easy transformer for use with a reaction coil. The reactance can be another basket coil of about 120 turns, which can be loosely coupled to the secondary of the transformer.

* * *

"MICROPHONE" (Tulse Hill).—I have a crystal set and would like to use a loud speaker. Could I use one of those microphone buttons?

This is possible, but you will find it rather difficult to arrange matters correctly. The button will have to be fixed to the telephone diaphragm and then leads taken from it to a battery and to a low-resistance telephone on which is the loud-speaking trumpet. You will probably find it easier to use a couple of amplifying valves. The microphone arrangement is inclined to be noisy, "frying" noises being often emitted from the loud speaker.

* * *

Q. P. T. (Swanage).—Can I use bichromate cells for lighting valve filaments?

No; these cells would light the valve for a very short time, but owing to the fact that the potential drops very rapidly they would be useless for serious use. I am afraid you will have to stick to the accumulator, unless you use the L.T.3 valve, which works from a dry cell. This valve is very costly, however.

* * *

"HOME-MADE" (Penrith).—What size coils should I use for A.T.I. and secondary for short wave-lengths? I do not want to use basket or honeycomb coils.

Use an A.T.I. of about 80 turns of 22 d.c.c. on a 4-inch diameter former. This will be about 5 inches long. The secondary should be about 100 to 110 turns of 26 d.c.c., wound on a 3-inch by 5-inch former. These should be tapped two or three times and the fine tuning done by means of two variable condensers. The primary condenser should be in series and of about .0005 mfd. The secondary should have a .001 mfd. condenser across it for tuning purposes.

(Continued on page 940.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 938.)

L. N. P. (Walton-on-Thames).—Is S.W.G. the same as A.W.G. or B.W.G.?

No; there is a very slight difference between them. A.W.G. or American Wire Gauge is more frequently referred to as B. and S. (Brown and Sharpe's).

* * *

B. B. (Deal).—I have a four-valve set, 2 H.F., one detecting, and one L.F. I am experiencing considerable trouble with howling and am told that a potentiometer control on the grid will assist matters. Would it be advisable to have this on the detecting valve grid, and if so, do I retain the grid leak and condenser?

It would be advisable first of all to experiment with a grid potentiometer control on the grid of the H.F. valves. If a grid control is employed on the grid of the detector valve, the grid leak and condenser should be cut out.

* * *

Is a grid leak more useful when it is connected in parallel with the grid condenser, or when it is connected to the L.T. negative or earth direct?

That is much a matter of opinion and circumstances. Where the detector valve is preceded by stages of H.F. amplification it is in most cases advantageous to connect the grid leak straight to the earthed L.T. circuit.

* * *

K. R. (St. Albans).—Would it be possible to work a crystal set without a crystal detector, but just using a rapid make-and-break to cut up the waves? Such a scheme would seem to me to allow the full energy of the received current to flow through the telephone receivers, as I believe a crystal detector has an enormous resistance.

At first glance your scheme would appear to the unwary amateur as being perfectly feasible, but the point that is overlooked is that although the received current can be "chopped" up to the correct number of impulses per second to provide a series of impulses of audible frequency, each impulse will still consist of some considerable number of cycles of alternating current of high frequency. That means to say that the current will oscillate backwards and forwards many times during each impulse, and thus will not actuate the telephone receivers, for which unidirectional impulses are required.

* * *

"BEGINNER" (Perthshire).—Some advertisements guarantee crystal sets to receive telegraphy at 600 miles. Is this possible?

This is possible when the power of the transmitting station is very great and the aerial of the receiving station is very efficient.

(Continued on page 942.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 940.)

W. D. M. (Rochester).—Having bent and put out of commission the diaphragm of one of my Brown's Reed Type 'Phones, I was wondering whether it was any good attaching the reed by means of a small brass pillar to the centre of an ordinary flat diaphragm, which could be slipped in quite easily.

Such an adaptation is not likely to prove very successful. However, the makers, S. G. Brown, Ltd., would doubtless be able to supply you with a new diaphragm should you care to write to them.

* * *

P. A. N. (Colchester).—When I am tuning in on my loose coupler I have no difficulty in hearing stations on the primary, but cannot tune them in at all on the secondary when I change over. Why is this?

That is hard to say. If you are sure that the secondary circuit is not broken by a faulty circuit and is of suitable value to tune in the desired wavelengths, then we can only suggest that it is a question of adjustment. Possibly you overlook the fact that when you vary the coupling between the two coils by varying the distance between them, or even when you change over the detector circuit from the primary coil, you are altering the tuning of this latter to a slight extent. Therefore, should the signals be fairly weak and the tuning critical, this slight alteration in values might be quite sufficient to lose the signal in the primary and therefore render tuning it in on the secondary an impossibility. Try a slight adjustment of the primary circuit after you have changed over and are adjusting the secondary.

* * *

"FED-UP" (Brockley).—Is it any good trying to make a crystal set work when no signals are heard at all? I've tried and failed.

A little patience will prove the most satisfactory remedy. That, careful adjustments, and only a fair outdoor aerial should suffice to bring in signals from the London broadcasting station.

* * *

A. K. H. (Willesden).—I am thinking of making a high tension battery of small accumulator cells. What is the paste on the positive plates composed of?

We do not advise you to attempt the formation of accumulator plates as it is a very difficult business to get the paste to stay in the holes for any length of time owing to the tendency of the materials to crumble away. The paste is made of oxide of lead, usually red lead or litharge, and some extra substance such as potassium silicate and sulphuric acid. The plates are filled carefully with this paste and then dried. They are then placed in a bath of dilute sulphuric acid with some pure lead plates as negative electrodes and a very slow current of about one half ampere is passed through. After several days the paste in the positive plates should have undergone a change, the lead oxide having been still further oxidised to lead peroxide. They will then have a dark brown or chocolate colour.

(Continued on page 944).

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 942.)

I. M. F. (Doncaster).—What is the best substance to use for sticking celluloid? Could celluloid be used as a former for basket coils?

You will find that a substance called celluloid putty will be very good as a cement for that material. It is formed by dissolving pieces of celluloid in a solution of ether and denaturated alcohol. After a day or so the "glue" is ready for use. (2) Celluloid can be used as a former for coils, but you will probably find that two sheets stuck together will be necessary in order to make the former stiff enough.

* * *

A. P. D. C. (Hertford).—I have a Gecophone crystal set and I want to add a L.F. amplifier. Can this be done easily?

This addition can be made very simply. You need a complete valve amplifier panel. The input or line terminals are then connected to the phone plug sockets on the crystal set. The phones now go on the amplifier and H.T. and L.T. are connected to their respective terminals. No alteration of the crystal set is necessary and the amplifier can be removed at any time. The same method applies to all such additions to crystal sets. The input terminals on the amplifier go to the primary of the L.F. transformer of course.

* * *

R. T. K. (Southampton).—Is there any advantage in having a variable grid leak?

Yes, for long distance work it is decidedly useful and also if you wish to change your valve. You will find that different valves require different leaks.

* * *

C. M. B. (London).—I have been offered a three-valve wireless set, but it is not stamped by the B.B.C. Could I pay the royalty and have it stamped?

No, unfortunately there is no such arrangement at present. If you wish to buy an unstamped set you must obtain an experimental licence before you use it.

* * *

"INDOOR AERIAL" (Manchester).—Could an indoor aerial be used with a crystal set, using two basket tuning coils? I am three miles from the broadcasting station. What size aerial should I use? (2) Is it possible to hear Birmingham with a crystal set? (3) Which is best, a single 40 ft. aerial or a double 80 ft. aerial?

We do not advise you to use an indoor aerial for a crystal set if you are three miles from the transmitting station. If you do use one, the frame should be 4 in. square, with 5 turns of 22 D.C.C. spaced ¼ in., tuning being accomplished by a .001 variable condenser. (2) No, Birmingham is rather out of range, and we don't think it likely that you will hear that station on a plain crystal set. (3) The double aerial.

* * *

"IGNORANT" (Leicester).—Do I need low resistance telephones on a low resistance amplifier and high on a high resistance amplifier?

We are afraid you are getting rather mixed up between resistance and frequency. The two stages of amplification before and after the signals are rectified on a detecting panel are known as high and low frequency respectively. This, however, has no bearing on the value of the telephone receivers, which should be of high resistance, otherwise it is necessary in the case of low resistance telephone receivers to employ a telephone transformer.

* * *

"VALVE" (London, N.).—Can a variable condenser be used to any advantage instead of a small fixed condenser for the grid?

Yes, when a fair amount of experimenting is contemplated both a variable grid condenser and leak will prove very useful.

The Perfect Loud Speaker at last

We have acquired the sole manufacturing rights for the United Kingdom of a Wonderful New Loud Speaker, in principle entirely different to any yet placed upon the market. Instead of the unsightly horn, which causes distortion of the music and speech, this instrument comprises a handsome cabinet, the top of which is designed and manufactured from specially tested timber which is attacked by a volume of air. The principle can be incorporated into any cabinet wireless set, the lid of the cabinet forming the Loud Speaker. It can also be used as a separate instrument, as illustrated.

The "VIOLINA"

Loud Speaker de Luxe

(Patented in all Countries throughout the World)

Price £5 - 5 - 0 Complete

(Packing and Carriage in U.K., 5/- extra.)

When once you have heard this instrument you will not tolerate any other make

Ask Your Wireless Dealer for a Demonstration.

IT IS NOT LIKE A TROMBONE! IT IS NOT LIKE A KLAXON!!
IT IS AS DELIGHTFUL AS A VIOLIN!!!

With this instrument you can hear the voice of the artist, the notes of any instrument, and the words of the speaker faithfully and perfectly reproduced. In addition it is an elegant piece of furniture, handsomely French polished, mahogany finish.

Before buying your Loud Speaker, make a point of hearing this instrument. Agents wanted in all parts. Inquiries from Manufacturers desirous of incorporating the "Violina" into existing Wireless Sets cordially invited.

If Early Delivery is desired place your order AT ONCE

Important Notice to all Wireless Manufacturers, Retailers, Experimenters and Amateurs

EX-GOVERNMENT WIRELESS APPARATUS.

A FEW WEEKS AGO we advertised the purchase of a complete Government Wireless Depot and offered the same for re-sale at astonishingly low prices in accordance with our invariable business rule to

SHARE OUR BARGAINS WITH OUR CUSTOMERS.

The immediate response to our advertisement resulted in our being "snowed under" with inquiries and orders from all over the country, and it was only through despatch staffs working night and day at full pressure that we were able to keep faith with our customers in respect of our promise to execute all orders

WITHIN 48 HOURS OF RECEIPT.

It was impossible to deal with the thousands of inquiries as expeditiously as we should have wished, and we again take the opportunity of tendering our apologies to all those who were, unfortunately, kept waiting.

WE have now purchased outright for spot cash the whole of the Wireless Material recently offered for sale at

WOOLWICH DOCKYARD AND KIDBROOKE, R.A.F. DEPOT.

The work entailed in compiling price-lists of the multitudinous variety is colossal, and it will be two or three weeks before these are available. You can help us considerably by **FILLING IN THE FORM AT THE FOOT OF THIS ADVERTISEMENT.**

You will then receive comple e lists as soon as available.

A STARTLING OFFER

Complete 5-Valve Set, 2 H.F., 1 Detector and 2 L.F. The Famous R.A.F. 10, made by The General Electric Co., U.S.A., for the Royal Air Force.

Ideal for Broadcasting. Can be used with Loud Speaker with indoor aerial within 20 miles of the Broadcasting Station.

We guarantee this instrument to be as effective as any instrument costing up to £75.

Brand New, exactly as received from the Manufacturers.

OUR PRICE (limited quantity only) £15
Valves and Accessories extra.

——Fuller particulars on application.——

FILL UP THIS FORM NOW

and post to us immediately.

½d. stamp only required.

Messrs. THE CITY ACCUMULATOR CO.
Mail Order Department, 79, MARK LANE, LONDON, E.C.3.

Please include my name on your Mailing List. I am particularly interested in

.....

(*Signed*) .....

P.W. *Full Postal Address* .....

Date.....19.... .....

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R/Y

OPULAR WIRELESS WEEKLY, FEBRUARY 24, 1923.

REGISTERED AT THE G.P.O. AS A NEWSPAPER.

AN ARTICLE BY CAPTAIN ROUND.

POPULAR WIRELESS

3d.

No. 39. Vol. 2.
Feb. 24, 1923.

Weekly

Mr. W. N. Lambert and his home-made experimental station, Hale, Cheshire.

FEATURES IN THIS ISSUE.

The Construction of Coil Holders.
The Reception of Transatlantic Amateurs.
A Page of Ideas for Amateurs.
The Newcastle Station.
Making a Potentiometer.
A Novel Earth Arrester.

Very Random Thoughts. By E. Blake, A.M.I.E.E.

Another Four-Page Supplement: The Valve for Beginners.

NEXT WEEK.

A New Cover Scheme will commence with next week's "Popular Wireless." Look out for the New Cover.

A Special Review of the Wireless Section of the Ideal Home Exhibition at Olympia. Invaluable to all Amateurs.

The Cardiff Broadcasting Station.
An interesting illustrated article.

Popular Wireless

TOPICAL NEWS AND NOTES.

NEXT WEEK.

"Some Wireless Observations" is the title of a series of articles specially written for "Popular Wireless" by Sir Oliver Lodge.
Experimenters should on no account miss Sir Oliver Lodges first article which appears in Next Week's "Popular Wireless."

ORDER A COPY NOW.

A Broadcasting Conference.

BROADCASTING in all its details was recently discussed at a conference, which included the Postmaster-General, Mr. Neville Chamberlain, and Mr. Reith, manager of the British Broadcasting Company, at the General Post Office.

Future policy in regard to the regulation and development of broadcasting was considered, and helpful suggestions were put forward by both sides, but no definite decisions have so far been arrived at.

Admiral of the Fleet Sir Henry B. Jackson, who recently broadcast a lecture from 2 L O.

A matter which is being specially dealt with is the official attitude towards those wireless amateurs who make their own apparatus.

At the present moment that is not clearly defined. It is probable that special broadcasting licences will be issued to the owners of "home-made" apparatus.

* * *

Air Ministry and Wireless.

AT the first session of the Air Ministry conference, at which Sir Samuel Hoare recently presided in the Guildhall, London, Sir Sefton Brancker, Director of Civil Aviation, gave an interesting and optimistic forecast of the future of aircraft.

It was stated that General Brancker was considering in detail the question of various cross-Channel services, but that the final decision rested with the Cabinet and also with the Dominions.

As traffic increased the wireless control system would have to be developed, and it should be very useful for night flying.

Then as this wireless organisation improved they should be able to find their way through fog.

He anticipated that we should abandon the fixed routes marked on the ground, and fly entirely by compass and wireless navigation, certain zones in height and area being allotted for each stream of traffic.

* * *

Radio for Convicts.

MR. T. A. ROBINS, manager of Wireless Telephones, Ltd., of Leicester, recently gave a lecture and practical demonstration at the Leicester prison. There were about 180 prisoners present, and they all thoroughly enjoyed the demonstration.

The lecturer explained the principles of wireless telegraphy and telephony, and the prisoners "listened-in" to a concert broadcast from Birmingham and made audible to the entire audience by a loud speaker.

* * *

B. S. T. Lectures.

TWO lectures on Rectification of Alternating Currents will be given by Mr. Jones, B.Sc., A.M.I.E.E., at the British School of Telegraphy, 179, Clapham Road, on February 28th and March 7th.

* * *

Lord Riddell on Broadcasting.

I HAD a talk with Lord Riddell the other day. He has just had a set fitted up, and is very interested in broadcasting.

"The other night I listened to one of the wireless entertainments," he said. "The singing and instrumental music were very good—clear and distinct. Of course, the selections might not have appealed to some people. It is a question of taste. Some prefer classical music, and others comic songs. I suppose that in the course of time the Broadcasting Company will devise some method of catering for all tastes. I listened also to a lecture by some gentleman. It struck me as long-winded, and that he would have done better to have written out beforehand what he had to say. Without a lot of practice, it must be difficult to speak *extempore* into a microphone.

"Furthermore, I think that people who are listening to wireless do not want anything very long-winded. If the matter is written out beforehand it can be delivered more concisely, but my experience is meagre. No doubt the Americans have worked out these things in practice. Obviously, the invention has marvellous possibilities."

* * *

2 L O's Microphones.

2 L O is not satisfied yet, and "Coué-ism" has firmly got hold of all that appertains to the station. Especially the microphone, which is "getting bigger and bigger." In fact, the "Heath Robinson" contraption now commands a large portion of the centre of the room. I hear this is shortly to be put into a box, where from the microphone cylinders will project like guns from a series of portholes. At present it is a picturesque tangle of wires and boxes and switches.

* * *

The New Studio.

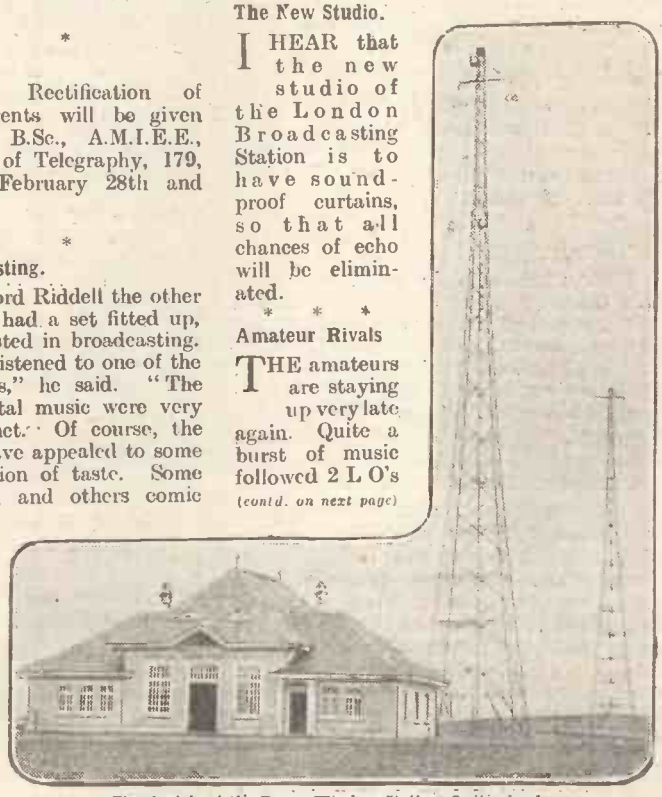
I HEAR that the new studio of the London Broadcasting Station is to have sound-proof curtains, so that all chances of echo will be eliminated.

* * *

Amateur Rivals

THE amateurs are staying up very late again. Quite a burst of music followed 2 L O's

(contd. on next page)



The Aerials at the Berne Wireless Station, Switzerland.
(*Photo by Marconi's.*)

NOTES AND NEWS.

(*Continued from previous page.*)

"close down" the other evening. I eventually traced it to 5 C P singing the "Floral Dance" and playing ragtime; but at first I was startled into believing that another broadcasting station had commenced. 2 L O will have to look to its laurels.

* * *

"Tea-time" Music.

JUST on the edge of the Epping Forest there are some tea-rooms lavishly decorated both inside and out with large posters proclaiming that wireless music is "on tap." Attracted by this, I have several times visited the place in order to observe the effects, both audible and psychological, evinced by the patrons of this up-to-date "rendezvous." So far I have been unfortunate. I cannot help thinking that if the B.B.C. were to arrange for short transmissions, say on Thursday and Saturday afternoons, the advent of broadcast "tea-time" music from such establishments would prove a considerable incentive to the erection of private installations, and thus further the interests of the British Broadcasting Company.

* * *

The B.B.C's. Programme.

IT was announced from 2 L O the other night that the Newspaper Proprietors' Association had decided that papers could not continue to insert the B.B.C. programmes free of charge.

As the B.B.C. cannot afford the very heavy advertisement cost necessary if the programmes are to be daily published in the papers, they are now busy working out an alternative scheme. Meanwhile, the programmes for the following concert are announced each evening by the B.B.C. stations.

* * *

Lectures by Wireless.

I QUITE enjoyed Mr. J. C. Squire's talk on Charles Dickens, which he broadcast from 2 L O the other evening. Lectures are wanted badly from 2 L O, and the more the better.

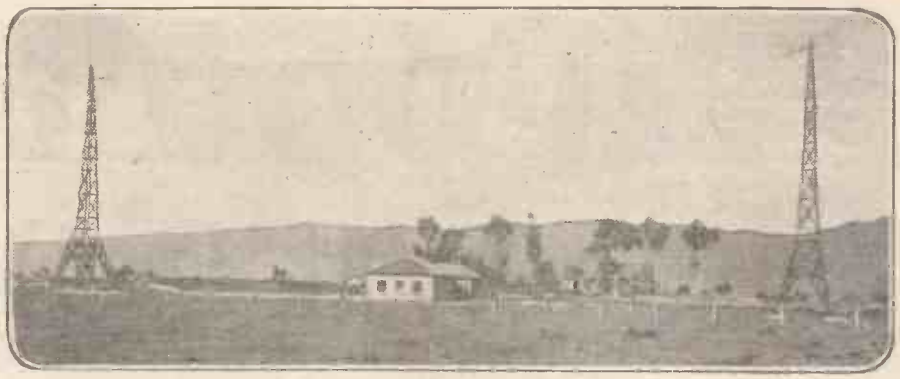
* * *

A New Encyclopedia.

THAT wireless is in rapid process of becoming a household word is shown by nothing more clearly than the long and carefully detailed description of how to fit and make a home receiving set, which is given in the first part of "Harmsworth's Household Encyclopedia."

Part 2 of this very successful publication is now on sale. Part 1 has been reprinted, and copies of this also are available.

Quite apart from its interest to wireless enthusiasts, "Harmsworth's Household Encyclopedia" is a work which should be in every home. Arranged in alphabetical form for easy reference, it gives the clearest and fullest instructions on how to perform every variety of home repair and renovation. The work is superbly illustrated, and when complete will contain no fewer than 10,000 pictures, many in colour and photogravure. It is being issued in fortnightly parts at 1s. 3d. per part, and when completed will form not more than 6 handy and invaluable volumes.



The Bogota Wireless Station, Colombia.

Honeycomb Coils.

READERS of POPULAR WIRELESS are informed that before constructing the honeycomb coils described in a recent issue of POPULAR WIRELESS by Mr. Dransfield, they must first obtain the permission of the licencees of the patent—the Western Electric Co. and the Igranic Electric Co., Ltd.

Sir Oliver Lodge.

SIR OLIVER LODGE'S broadcast lecture last Tuesday must have keenly interested thousands of listeners-in. Next week Sir Oliver commences a series of special articles in POPULAR WIRELESS—and the Editor will also have a very important announcement to make concerning Sir Oliver. **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.
London Broadcasting Station, Strand ..	2 L O ..	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	5 N O ..	400 ..	As a rule from 7 to 10 p.m.
Manchester Broadcasting Station	2 Z Y ..	385 ..	Every evening, usually from 4.30 to 10 p.m.
Birmingham (Witton) Broadcasting Station	5 I T ..	425 ..	Every evening, usually from 6.30 to 10 p.m. (News, Concerts, etc.).
Glasgow Broadcasting Station	5 S C ..	415 ..	Commencing shortly.
Cardiff Broadcasting Station	5 W A ..	395 ..	6.30 to 10 p.m.
Croydon	G E D ..	900 ..	Throughout day to aeroplanes.
Paris	F L ..	2,600 ..	11.15 a.m. Weather report; 6.20-7 p.m. Weather report and Concert; 10.10 Weather report.
Königswusterhausen ..	L P ..	2,800 ..	Between 6 and 7 a.m., between 11 and 12.30, and between 4 and 5.30 p.m.
The Hague	P C G G ..	1,085 ..	Sundays, 3 to 5 p.m. (Concert.)
Haren	O P V H ..	1,100 ..	12 o'c. and 16.50 o'c. Telephony.
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.
School of Posts and Telegraphs, Paris ..	—— ..	450 ..	Every Tuesday and Thursday, 7.45–10 p.m. Saturdays, 4.30–7.30 p.m.

Note.—See announcements in daily Press for last minute alterations in times of Broadcasting Programmes. No Broadcasting during hours of public worship on Sundays.

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.

WIRELESS FOR THE AMATEUR.

By CAPTAIN H. J. ROUND
(Chief Research Engineer of Marconi's Wireless Telegraph Co.)

The following article has been specially written for "POPULAR WIRELESS" by Captain Round, who, as Chief Research Engineer of the Marconi Co., is one of the best-known scientific research workers in the Radio world. Captain Round is one of the pioneers of valve work, the "Round valve" patent being well known to every wireless amateur. The advice and suggestions he offers will prove of great interest to readers of "POPULAR WIRELESS."

MANY thousands of people are beginning to take a real interest in wireless to-day for the first time. Previously, they knew in a vague way that, by using a quaint confusion of dots and dashes, it was possible to send wireless messages from place to place, even from ship to ship, over quite long distances. They now know that, for some reason or other, the dots and dashes are no longer essential, and that one can sit in one's own drawing-room and listen to a speech, or a song, or a violin solo by wireless.

There is one curious aspect of this new interest which the public has begun to evince towards wireless. A few years ago, when practically all wireless communication was carried out on the telegraphic system—that is, by means of these dots and dashes—people were wont to regard this branch of science with a feeling akin to reverence. It was something mysterious and incomprehensible, and they had a real respect for the progress it symbolised of man's gradual triumph over the physical conditions of his existence. Other developments of science had also accomplished marvellous things, of course. The steamship, the motor car, the electric train—even the aeroplane—had all been regarded as belonging to the familiar paraphernalia of civilisation for some little time.

Losing the "Gilt."

But these inventions, wonderful as they were, exhibited no outstanding characteristic which really baffled the alert imagination of ordinary people. They were commonly regarded, even by those who were most appreciative of their worth, more or less as clever—astoundingly clever—mechanical contrivances. There was nothing about them which appealed to the popular mind as being actually phenomenal. They were just difficult problems solved; brilliant ideas put into practice.

But with wireless it was different. From the outset, wireless was something which completely baulked the unscientific mind, at once fascinating and defying the imagination. It was all very well to send a message along a wire; that could be understood quite easily once the idea of an electric current had been grasped. When it came to sending a message from place to place without using any material substance whatever for its conveyance, it seemed almost as if some occult power, capable of transcending nature, must be involved. And to this was added the minor mystery of the Morse code, the combined effect of both being to inspire the uninitiated with a vague feeling of awe.

To-day this feeling of genuine respect for wireless is not so apparent. Wireless is no longer shrouded in the mystery of the Morse code; broadcasting stations are dispensing all kind of good things to the community each evening; enthusiasts are "running up aerials" all over the country; and hundreds of thousands of people are becoming quite accustomed to the joys of "listening-in."

After serving for a number of years as a very valuable asset in the modern industrial and commercial world, wireless has at last been adapted to serve the social requirements of our age. This is as it should be, of course. Nothing could add greater glory to science than its ever-increasing power to ameliorate the conditions of human existence. There is a tendency, however, to treat this new development of science as a toy rather than as a valuable gift of science. There are signs to-day which suggest that the modern wireless telephone, so highly efficient and yet so comparatively simple to operate, is regarded as a much less wonderful thing than the clumsy and rather complex apparatus of former days.

A view of the receiving room at the Radio Station at Chatham, U.S.A. This station sends special news bulletins to ships at sea.

Not a Toy.

This, to say the least, is a pity. The wireless telephone is not a toy. It is an instrument that is capable of affording the keenest intellectual and æsthetic enjoyment to those who are prepared to bestow upon it at least as much serious care and attention as they would bestow upon a good piano or a really first-rate gramophone. No one would think of regarding these instruments as toys, and the wireless telephone possesses far more scope for enjoyment than either of them. Pianoforte music, for instance, is reproduced perfectly by a good wireless telephone, which is something that could scarcely be claimed for the best gramophone.

The wireless telephone receiver also possesses the distinct advantage that it has associated with it adjustments which enable one to modify strength and tone in a way which is not possible with any kind of gramophone.

Moreover, no other instrument can compare with the wireless telephone in the variety of free entertainment that it affords.

An Unlimited Scope.

Once you have installed a good instrument, there is no limit to the variety of excellent musical and intellectual fare to which you have free access. It is not necessary to go on spending pound after pound on the purchase of new records when you are tired to death with hearing the old ones over and over again. This is a factor which every sensible person will bear in mind when considering what outlay he, or she, can afford for a wireless telephone receiver.

To get good results you must have a good instrument, and you must, moreover, always continue to treat it as such—seriously, carefully, and with due respect for its wonderful powers. This does not mean that you need allow it to become a source of worry or labour, devoid of all enjoyment. It just means that you should treat it as you would treat any other instrument that yielded you really deep pleasure, and not merely a little superficial "fun."

Apart from its entertainment value during leisure hours, thousands of amateurs have already been attracted to the purely mechanical side of wireless, and have made and erected their own apparatus. For the practical mechanic it would be difficult to

(*Continued on next page.*

WIRELESS FOR THE AMATEUR.

(*Continued from previous page.*)

find a more interesting hobby than wireless. Even the simplest form of receiver calls for a high degree of mechanical skill in its construction if it is to give the best results, whilst there is scarcely any limit to the variety of designs that can be embodied in the construction of multi-valve receivers.

All the high-power transmitting stations in the world are at the disposal of the amateur, as it were. There are always signals to be heard from some part of the globe at every moment of the day and night—a circumstance which gives the wireless amateur a unique opportunity to indulge his hobby.

Unfortunately, however, there is another aspect of the matter. The experimenting amateur who does not exercise the strictest control in the operation of valve sets is liable to cause a great deal of inconvenience to the many thousands of people who are solely interested in the reception of broadcast programmes. Since broadcasting began, numerous complaints have been made concerning the interference caused by amateurs using reaction directly coupled to the aerial circuit.

America on Two Valves.

In many cases, no doubt, the interference is unintentional and may be attributed to carelessness on the part of the amateur responsible, though this does not alter the fact that one offender may be the cause of spoiling the evening's entertainment for a hundred people.

The keen experimenter, of course, will never be content to forego the pleasure of using reaction, but, remembering that the broadcast programmes are intended primarily for people who are not allowed to build their own sets, he should make it a point of honour to abide strictly by the terms of his licence and refrain from using reaction directly coupled to the aerial on the band of wave-lengths ranging from 300 to 500 metres. As a matter of fact, the experimenting amateur could employ his energies much more effectively in a direction which involves no risk of interfering with the pleasure of others.

Instead of merely aiming at satisfying his own personal ambitions—by striving after "freak" results with "freak" circuits, for instance—he should regard his work as something which could, one day, prove of considerable value to science. By merely noting down the call signs of the various stations which he hears working in the course of the day or night, the wireless amateur could compile a mass of useful information.

As I have said, there are always signals to be heard, and though normally his results would contain no feature of outstanding significance, he might at some unexpected moment find himself listening to signals from the other side of the earth.

Quite recently, using two valves with non-radiating reaction, I received good, clear signals from a number of United States broadcasting stations. These same stations, moreover, have been heard in different parts of the British Isles. It would seem almost as if their energy was focused into a beam which widened only just sufficiently at this end to include the whole length of the British Isles.

At any rate, considering that the distance involved is in the neighbourhood of 3,000 miles, and that the transmitting power is only one or two kilowatts, it is obvious that there is some influence at work which has the effect of giving these signals an easy path across the Atlantic. This, of course, is only an example. There are other instances on record of phenomenal reception from different parts of the globe, and it is in the collation of information bearing upon this subject that the wireless amateur could be of real use.

Limit Your Ambitions.

There must be some general law underlying the variations that occur in reception, but it is only by accumulating all the evidence possible, and subjecting it to the closest scrutiny, that we can ever hope to formulate it. It is not necessary that the amateur should possess an elaborate and costly apparatus in order to render useful assistance in this connection.

The simplest receiving equipment, in conjunction with a keen observation and a capacity for patient application, will suffice. He should note and record as many characteristics as possible of received signals, making a particular point of getting the correct call-sign. Whatever information can be gleaned with respect to the nature of signals is always of interest, and sometimes of great importance, to science—besides affording useful practice in observation to the experimenter.

Perhaps a few notes on the choice of broadcasting receivers would be of interest to those who are now turning their attention to wireless for the first time. The first words of advice I would give to the beginner are: *Don't be too ambitious.* In the first rush of enthusiasm you will probably be tempted by the possibility of being able to receive from a number of broadcasting stations.

There is something very fascinating in the idea of switching off from a song in Manchester to a violin solo in London, for instance. If you are wise, however, you will control your early enthusiasm and concentrate on getting good results from the nearest broadcasting station. By doing so you will, on the average, afford far more pleasure to yourself and to your family than if you follow the more ambitious course of trying to receive from a number of distant stations. It is very nice, of course, to be able to listen to Paris, and even New York, but this is an achievement which may well be postponed until you have gained a little experience in the manipulation of instruments.

On Purchasing Sets.

The first thing to do, of course, is to erect a good aerial. Whatever results you may ultimately get will depend to a very large extent on the quality of your aerial. As this, moreover, is one of the cheapest items in a receiving equipment, you should take special care to erect the best aerial that the space at your disposal allows.

If you are within 10 or 15 miles of a broadcasting station, a crystal set, in conjunction with a good aerial, will give very nice signals in telephone receivers, and the same set will, of course, give signals of decreasing strength up to a distance of about 30 miles. But in order to get really satisfactory results you will need a valve set outside a radius of 10 miles from a broadcasting station.

For ranges over 10 or 15 miles one or two valves are necessary, and, as the cost of a two-valve set is not very much more than that of a one-valve set, it would seem advisable to procure one of the many two-valve sets at present on the market. This will give ample satisfaction up to ranges of 50 or 60 miles, besides enabling you to carry out a little experimental reception from more distant stations. Still greater ranges, up to a distance of 80–100 miles, can be obtained if a two-valve set with variable reaction be purchased.

This type of receiver is not much more expensive than the former, though it is slightly more difficult to operate in a way that will ensure best results. Beyond these ranges wireless telephony on the broadcast waves is too variable to make it more than an experiment—though a very interesting experiment, provided one's family is not invited to listen to a concert and then regaled with a variety of nasty squeaks and howls through which faint, distant music penetrates at rare intervals.

Question of Loud Speakers.

A two-valve set with reaction, if you can erect a good aerial and exercise a little patience in adjusting the reaction, is all that you really require for use with telephones. I possess a set of this type myself, and I have received several United States broadcasting stations on it, together with London, Birmingham, Manchester, Newcastle, Paris, The Hague, etc. After a time you will want to go a step farther, of course, and your ambition will probably run in the direction of giving loud-speaker exhibitions.

It behoves you to go very carefully here; make your dealer give you a good show, and don't allow yourself to be inveigled into purchasing a loud speaker which yields no better results than a bad gramophone. In order to get satisfactory results with a loud speaker, you will need an amplifier containing two or more valves. The amplifier, moreover, should be specially designed for use in connection with a loud speaker. This is of great importance, because a great deal of the distortion associated with loud speakers arises from the unsuitability of the amplifiers with which they are used.

Without recommending or condemning any particular instruments, I would like to emphasise this point: Do not purchase any instrument until its efficiency has been satisfactorily demonstrated to you.

As to more expensive apparatus still, there are, of course, all the cabinet and other models—which are really combinations of the above receiver and amplifier. But there is also a general line of instruments called multi-valve high-frequency amplifiers. These latter will enable you to (1) reach out to greater distances (though this will not be of much value in itself, owing to the determining factor being interference); (2) get stations up to 100 miles with much simpler adjustments; or (3) get these larger distances with an indoor aerial or a frame.

Don't be too ambitious; it will be far more satisfactory in the long run to get good signals from a neighbouring station than bad ones from the other side of the earth.

THE RECEPTION OF TRANSATLANTIC AMATEURS.

By A. G. WOOD.

If you want to pick up the American Broadcasting and Amateur Stations, the general advice given in this article will prove very useful.

FOR those who have never listened-in to the American amateurs it is very hard to understand the fascination of receiving these stations and to hear them talking amongst themselves when they are more than three thousand miles away. It is the intention of the writer to give the uninitiated a few practical hints on long-distance reception and on the best circuits to employ, etc.

First, turn to the aerial and earth and their local circuits. The aerial, needless to say, should be as high and unsheltered as possible, but it should not be, as some people think, "the longer the better," as one must remember that the wave-length upon which we are going to do all the work will be in the neighbourhood of 200 metres—more or less—and with a long aerial one would have to bring the fundamental wave-length down—this causing a loss in efficiency.

See that the lead-in does not approach any earthed body, and make it as short as possible. The operating room should be as near the ground as possible, and the earth lead as short and thick as existing conditions allow. Main water-pipes make a good earth, but it is better to use two or three earths all wired in parallel. The writer used, during the recent American tests, no less than four earths—two water pipes, one gas pipe, and one buried plate.

Two-coil tuning should be effected—that is—aerial and secondary coils. A variable condenser of about ·0005 mfd. should be connected in the earth lead and will stop any tendency of the aerial coil to become aperiodic.

What Valves to Use.

Now for the set to use. The writer advises the use of two high-frequency valves followed by a rectifier and one note magnifier together with a separate hetrodyne, if possible, the latter, not only for the sake of other amateurs, but for the elimination of jamming.

Tuning the H.F. circuits may be effected by using tuned anodes, and two small sliding coils wound with about 26 S.W.G. enamelled and about 4 in. long will suit admirably. A single plate variable condenser across each coil is essential for good results. Three moving plates across the secondary aerial coil with a vernier in parallel will do for this circuit. Extension handles to all the condensers are necessary.

All the wiring should be carefully spaced to minimise the effect of interaction. Probably no reaction coil will be necessary as the tendency is for the set to oscillate when the anodes are in tune with the aerial circuit. This reaction can be controlled by the use of a potentiometer which is connected across the filament, the tapping going to the lower end of the secondary tuning coil.

If the tendency to oscillate is still very pronounced it can be reduced somewhat by using separate high tension batteries for the H.F. and L.F. units; also, the valves may be shielded by covering them up with earthed metal plates.

The valves to use is really a matter of taste, and the experimenter's resources, but the writer used French R valves on the H.F. side, a very hard transmitting "B" valve as the rectifier, and a V24 on the L.F. side.

Having assembled the set and got it to articulate, a good test for sensitivity is to allow it to oscillate, tune in the C.W. note of the wave-meter, and then get a friend to carry the meter away with him and find the distance where it is still audible. The writer, using a "Woolwich type ex-Government wave-meter" which is placed in a metal-covered box, was able to pick up the C.W. note at no less than 190 ft. away from the set!

How to "Tune-in."

When the experimenter has satisfied himself that the set is fairly sensitive he should arrange for a preliminary test one night—Saturday, if he has to go up to business every day! Incidentally a friend of the writer lost over half a stone in weight through listening for the Americans and going to business as usual the next day! Choose, for the test, a night which gives every prospect of rain, as experience shows that the signals are stronger on a stormy and wet night. Arm yourself with food supplies and facilities for making tea (tea is a splendid beverage to keep one awake in the early hours of the morning!).

Start listening-in about midnight, or possibly a little later. Carefully tune in the set with the aid of the wave-meter to about 200 metres and then get off the oscillation point by making the first H.F. grid more positive with the potentiometer. Vary the filament current supply on the H.F. and rectifying valves and find the best position for them. Vary the coupling between the aerial and secondary coils—the strongest signals are not always obtained with the maximum coupling—and vary the aerial series condenser.

Final Advice.

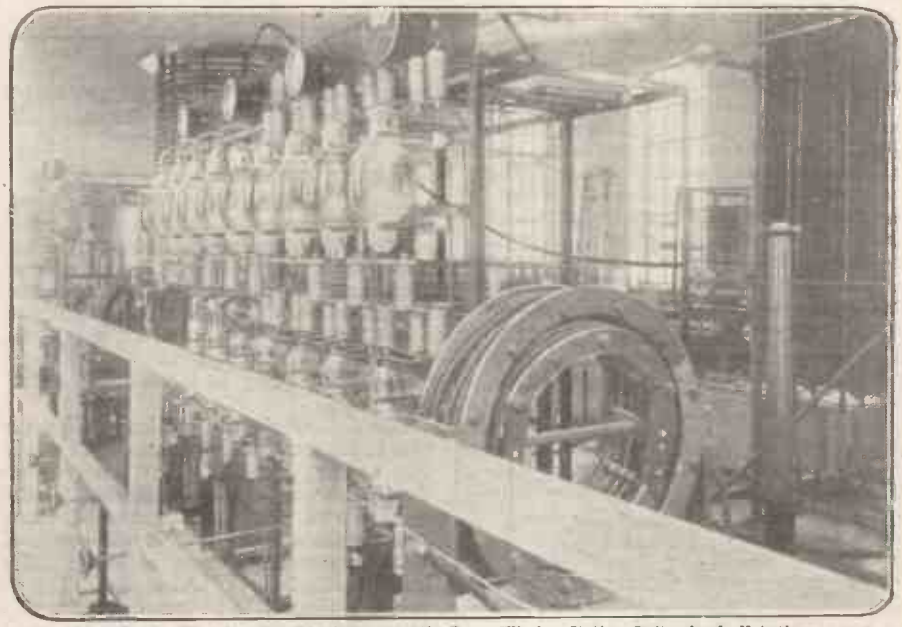
Listen carefully and tune slowly as many stations of great faintness may be missed if the above instructions are not adhered to. Also, get accustomed to the "mush" from Leafield and Northolt, as you will have to put up with this the whole time. (The latter remarks only apply to those living in the neighbourhood of London.)

Many amateurs find the best time for reception is between three o'clock and five o'clock G.M.T., and the writer is inclined to agree with them.

When at last you get the desired signals, log them, together with the time, wave-length, strength, and general weather conditions together with any other points of interest which may occur.

Finally, control your language when an amateur who is not using a separate hetrodyne (you would be surprised how many there are at that time) crosses your wave-length, otherwise you may wake the household.

If the above advice is adhered to there is no reason why the enthusiast should not get the required results, and remember that the Americans are always on at that time as it is only between 10 o'clock and 12 o'clock their time.



The Valve Transmitting Panel and tuning gear at the Berne Wireless Station, Switzerland. Note the new open type of valve panel. This station was recently described in POPULAR WIRELESS. (Photo by Marconi's.)

THE CONSTRUCTION OF COIL HOLDERS.

By A. W. DRANSFIELD.

IT is proposed to describe two units, one that will serve the purposes of test and be simple in construction, whilst the other will be a rather more elaborate piece of apparatus.

In the first place it will be necessary to

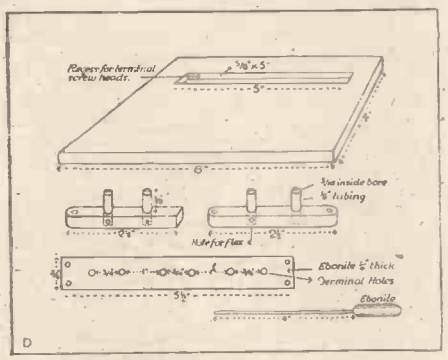


Fig. 1.

have a base-board 6 in. by 4 in. As shown in the diagram, Fig. 1, a small recess is cut to take the heads of the terminal screws so that they do not touch the board. These terminals are mounted on a strip of ebonite 4½ in. by ⅝-in., although this measurement is liable to vary with the size of the terminals used, remembering that it is proposed to mount six with a little space between each and a space left at each end for the fastening down screws.

Connecting Without Solder.

The carrier blocks will be the next parts to construct. These are made out of small pieces of ebonite ½ in. square. Two pieces will be 2¼ in. long, and one piece 2½ in. These require to be drilled as shown in the diagram. The holes for the short pieces of tube, which will be cut from ¼-in. brass or copper tube ¾-in. long, will be made ⅝-in. deep, and into these holes through the sides a small hole to take the leads that will go to the terminals.

All that is required to join the leads on, will be to clean the ends of short pieces of rubber-covered flex, passing the end of this through the small holes, and then pressing the tubing in. This pinches the wire inside and should make quite a good contact, and hold the wire very securely. The two moving carrier pieces will require a small hole in the end that will take a piece of brass wire on which a small ebonite knob has been

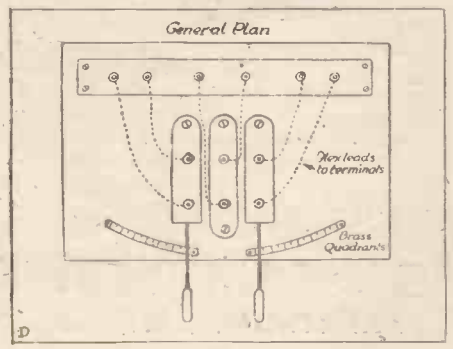


Fig. 2.

fitted for controlling purposes. If these wires are allowed to pass over a small brass quadrant each side, it will add to its appearance. (See Fig. 2.)

The Coil Holders.

The diagrams show all the other details for mounting. It is necessary to mount the coils on blocks that will fit the carriers; it is really advisable to make a small "jig," or pattern, for drilling these holes, as they have all to have exactly the same centres to ensure that all the coils will be interchangeable.

The coil holders are made out of ebonite, which will need to be 1 in. square and quite ½-in. thick. One end is filed out to take the curve of the coil snugly, and at the other end two $\frac{3}{16}$-in. holes are drilled ¾-in. deep. Two short pieces of $\frac{3}{16}$-in. copper or brass tube or rod should be cut to form the two pins that will fit into the ¼-in. tubes in the carrier. (See Fig. 3.)

All these holes should provide a close fit

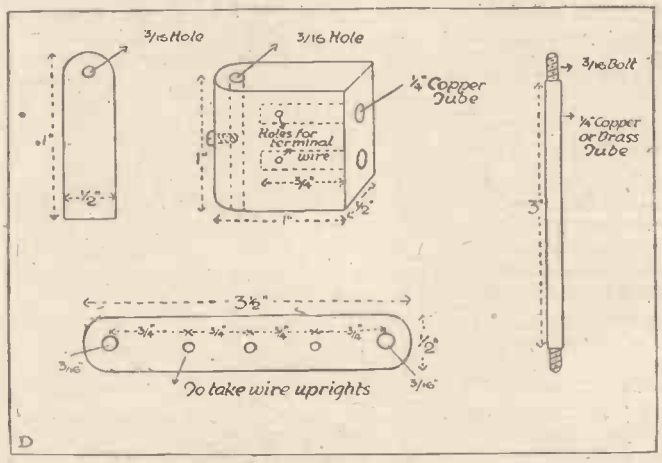


Fig. 4.

for their plugs. If the pins are made with a small saw cut down their length, it will help to make a nice springy fit.

A Superior Instrument.

The strip holding the coil to the block may be made from strips cut from an old celluloid cycle pump. This should first be heated and then bent round to shape. A piece of well-waxed cardboard would answer the purpose. The holes in the ends should be so punched that when the holding screws are well home, there will be a slight pinch on the coil. The screws for this may be the ordinary round-head type.

The ends of the coil are fastened to the pins in the same manner as the flex leads in the carrier portion. They simply pass through the small holes in the side of the ebonite, and the pins are pressed in so jamming the wire tightly. It will be noticed that two pins are arranged for instead of the usual method of pin and socket. This is to enable the coils to be turned round whilst experimenting, and allow for receiving full or retarded inductance at will, but it is advisable to mark the side of the ebonite

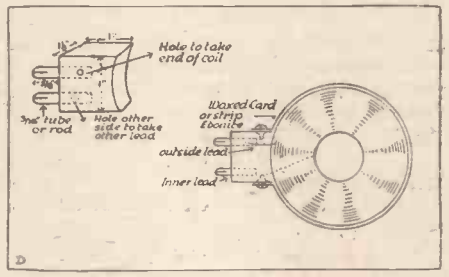


Fig. 3.

denoting the inner and outer winding of the coil.

The superior carrier unit shown in Fig. 5 is not at all difficult to construct. As will be seen, it consists of upright pillars carrying the necessary pieces of ebonite to carry the coils. These blocks are made out of ebonite 1 in. by 1 in. by ½-in., and the ends are drilled so that the pins will enter the pieces of tube. As the ebonite is 1 in. wide it will allow of the tubes being let in quite flush, but before pressing the tubes in finally, there should be drilled a small hole to take the flex lead to the terminals in the same manner as in the other carrier described.

The carrying uprights should be made of $\frac{3}{16}$-in. brass wire or rod. The blocks are held in place on the rod by means of a small set screw. The controlling wires, to which are attached the ebonite knobs, are just the same, but are soldered to the upright rods. Small holes can be drilled in the rods and the wires riveted through.

The pillars that carry the piece of ebonite or wood for the uprights to turn in are made of ¼-in. copper or brass tube. In the ends are soldered short pieces of $\frac{3}{16}$-in. bolts. Before fastening down to the board, slip on a brass washer, as this will help to stiffen the contact to the block, and make it more rigid.

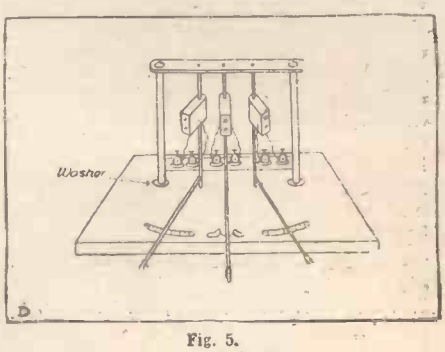


Fig. 5.

VERY RANDOM THOUGHTS.

By E. BLAKE, A.M.I.E.E.

The first of two special articles which should interest all readers.

TO the human mind physical existence appears to comprise matter, energy and ether controlled by a number of fundamental laws applied, as regards matter, impartially to planets, to electrons, and all intermediate-sized masses; as to energy, impartially to that of the bullet which takes the life of saint or other less fortunate sinner, and that of the nucleolus of the living cell from which is derived a Newton, a Shakespeare or a Napoleon, or any of their cheap imitators; as to the ether, that universal gesture of the Creator, impartially to the acceleration of an electron in the mud at your feet and the emanations from the mighty power station, called the sun, without which you would be sightless, lifeless, would not exist.

Chaos applied to nature is entirely a misnomer, for chaos can occur only in artificial systems. The search for truth is everywhere the search for law, and as truth is one so we may divine that there is but one law in the universe. If creation is not one idea expressed as one "stuff" controlled by one law, it ought to be. That is, of course, my own personal, and possibly presumptuous, idea. But I can conceive no nobler plan, and I am led to think it *was* conceived, because of the hints we have received of the existence of the ether and of the unity of nature.

What is an Electron?

What is gold? Electrons! What is dross? Electrons! Where two or three electrons are gathered together there is the law, holding them in congregation. We may call that law "positive electricity," and make of it a *thing*. That is scientific anthropomorphism. It is convenient—and altogether human—to wallow in symbolism and to make images of the "righteousness not ourselves," as Matthew Arnold defined the Ruler of the Universe, to touch the fringe of the Garment, and to call it complacently "the hem," and having cleverly given it a name to imagine we have glimpsed the Face and recognised It.

What is the electron? Is it matter? Or is matter but a diversity of malformations of the ether? Dimly, very dimly, this idea begins to loom up through the mists. The Veil would seem to be semi-transparent in places, but as the mind approaches the boundary regions—I purposely do not say boundary *line*—so it finds expression in language which is more metaphysical than one would expect from physicists.

Physics touches on the one side Chemistry, and on the other, Metaphysics, and this merging partially illustrates the great idea towards which I believe thinkers are working their painful way, that the universe is one Idea expressed as one Stuff—ether. Evolution, according to this notion, is the evolution of one Idea, which for us is Ether. Physically, mentally, psychically, evolution is evolution of the Ether. From the highest vertebrate we can trace its evolution back to the primordial ether, which seems to be the very substratum of existence. The ether is *omnipresent*; out of it comes this apparition, the visible universe; the ether is not revealed to the world of flesh. If anything *was* "in the beginning" it may well have been Ether.

Turning aside from guesses at ultimates, let us follow up the thought that the one Stuff is under the ruling of one Law. Now there are numerous natural laws, but many of them are only by-laws; they are like the little cog-wheels of a mechanism which functions only by virtue of one master prime mover, the main-spring.

"One Stuff—One Idea."

What the one great physical law is I do not pretend to think; when I am eighty and have pondered for several more decades in the light of several more decades of scientific progress, I may hazard a valedictory shot. Yet I would like to invite passing attention to the striking fact that, so far as we can at present ascertain, nothing in the universe is at rest. Part of the great Idea seems to be eternal movement. To stand still is to fall back. There is no equilibrium possible in the evolutionary process.

Creation moves, so Tennyson wrote, towards "one far-off, divine event," and ceaseless unrest is the travail of the created thing on the upward path. Organic types appear, and either disappear, devolute or develop; races and dynasties are ephemera, events of a day; planets, maybe, are temporarily embellished with living matter, and then life perishes from the surfaces of them, leaving them like glaring, dead eyes in the countenance of the heavens. Yet motion persists. The particles of dead Pharaohs and dead worlds move on in untiring phalanxes to new combinations and ever-changing appearances—one Stuff, one Idea.

THE LICENCE DODGER.

By The EDITOR.

READERS who have the interests of progress in Broadcasting at heart will be annoyed to hear that "Licence Dodgers" are increasing in such numbers that the B.B.C. are now seriously concerned.

The effect of this form of cheating—for cheating it is—will be to seriously delay the B.B.C.'s policy of steady progress and the rapid improvement of the concerts.

Surely it is not too much to expect of listeners-in to pay 10s. 6d. a year, half of which goes towards the B.B.C.'s expenses for the payment of the entertainments given nightly.

But the fact remains that hundreds of people are "dodging" the licence fee; some are fitting up hidden aerials; some are making their own sets—with reaction and otherwise—without even applying for an experimental licence.

Now, this is not playing the game.

The very life blood of the B.B.C. depends on the revenue obtained by the sale of sets and issue of licences, and it is only fair that the listener-in, who has no intention of becoming an experimenter should pay a little towards the expenses of the Broadcasting Co.

The art of philanthropy has not yet reached such a state of perfection that the B.B.C. can afford to spend £20,000 per year on every Broadcasting station and get no return on its outlay.

On the other hand, the question of home-made sets is admittedly far from satisfactory. I can see no reason why amateurs should not be allowed to make crystal sets providing they pay the crystal set tax in addition to the yearly licence fee.

And no doubt, if the whole question was carefully gone into, the same might apply to home-made valve sets of the no-reaction variety.

Another class of licence is needed—the home-made set licence; for there is no doubt that thousands of my readers find an absorbing hobby in the making of their own apparatus.

And quite naturally too. No keen amateur can be expected to be satisfied with a ready-made set—unless he be only sufficiently interested in wireless to the extent of spraying Broadcasting music all over his house to the wondering plaudits of his female relations.

That the potential amateur makers of sets have a real grievance, I do not doubt, and I think I am safe in assuring them that this particular grievance will shortly be fully investigated, and to their advantage.

But meanwhile, I urge readers of POPULAR WIRELESS to realise the position of the B.B.C. Without revenue their activities are doomed—and the only way they can obtain revenue is by counting on their clients to give them a fair deal.

The listener-in gets years of entertainment every night for an original outlay of a few pounds—part of which, a very small part—is a legitimate tax taken by the B.B.C., and by an annual fee of 10s. 6d., 5s. of which also accrues to the B.B.C.

That the listener-in has the better of it, few can dispute, and therefore, I want my readers to do their best to lay by the heels the "licence dodger." If you know of anyone with an aerial up his chimney and a guilty secret up his sleeve—warn him.

Talk to him nicely, and point out the unfairness of his position. And if that does not work, drop a line to the B.B.C.

You—who have done the square thing—will benefit in the end.

THE CONSTRUCTION OF A POTENTIOMETER.

A USEFUL accessory to the crystal set is a potentiometer. A very serviceable instrument can be made in the following manner: First procure a piece of ebonite 7 in. long, 1½ in. broad by ⅜ in. in thickness, and carefully round off all corners. This should be wound within an inch at both ends with No. 32 gauge resistance wire, and the free ends brought to two terminals placed ¾ in. from the former ends (see Fig. 1).

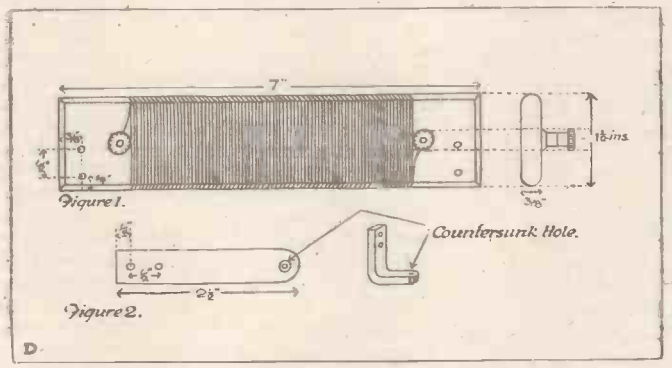


Figure 1.

Figure 2.

D

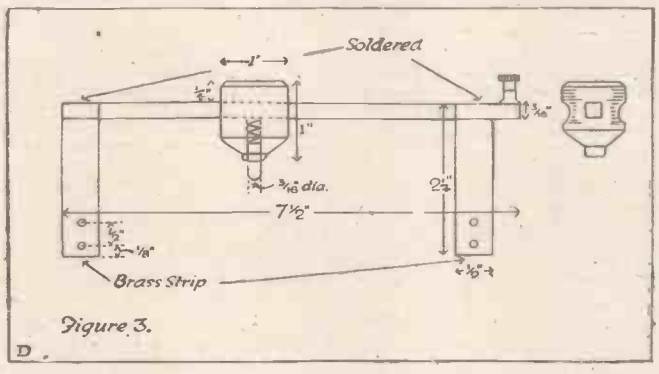


Figure 3.

D

The Sliding Contact.

Four pieces of ebonite of the following dimensions can now be cut, the length of each being 2¼ in., the breadth ½ in., and the thickness ¼ or 5/16 in., and bent to the shape as in Fig. 2. Ebonite can be rendered pliable by immersion in hot water or by gently warming in a gas flame. These ebonite brackets, or feet, are now drilled as shown in Fig. 2.

The slider and rod is the next consideration. The rod should be 7½ in. long by 1/16 or ¼ in. square, and the slider made to the dimensions given in Fig. 3, the hole being drifted in by heating the brass rod and passing it through the ebonite, which has been previously drilled out with a 1/16-in. drill.

The contact and spring can now be constructed as shown in the diagram, and after the brass rod has been cleaned and polished, two lugs of strip brass can be soldered to it (see Fig. 3). All holes must be carefully drilled with a twist drill, and small brass nuts and bolts, each 1 in. long, may be used to bolt the instrument together in the manner shown in Fig. 4.

When using a carborundum crystal detector, two small dry batteries, or one of those 4½-volt flash-lamp batteries can be used. The connections are as follows: In the first place, connect the battery directly across the two ends of the potentiometer winding, taking care not to leave it so connected when the detector is not in use, otherwise it will run down the battery. Take one lead from the phones to one end of the winding (find the best end by changing it over on test), and one lead from the detector to the slide terminal. The remaining leads from the detector and phones should be connected across the inductance in the usual manner.

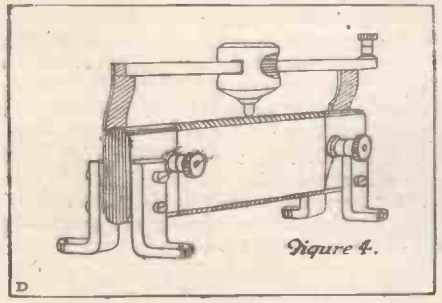


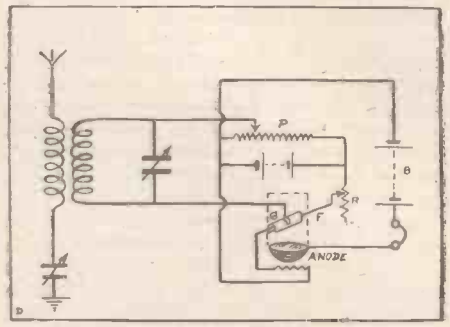
Figure 4.

D

SOMETHING NEW IN VALVES.

THE invention of a new valve which it is claimed will give results without regeneration equal to those obtained by employing a reactance circuit is the outcome of experiments conducted by Mr. H. P. Donle.

The new valve is known as an intensifying detector. It contains no grid, but is made up of a short straight filament partially surrounded by a trough-shaped electrode which collects the electron stream.

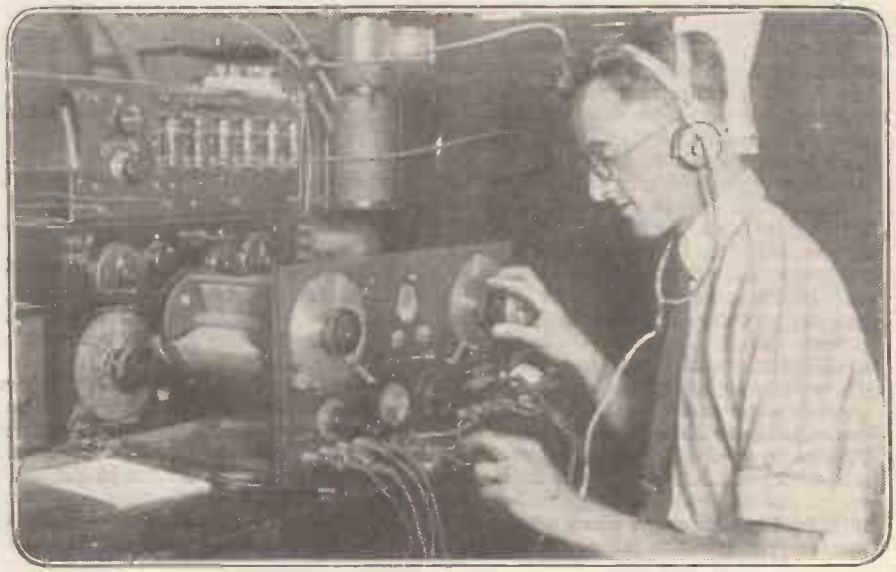


The plate or anode consists of a piece of metallic sodium. A wiring diagram for use in conjunction with the valve in question is shown in the illustration.

Cannot Cause Interference.

When functioning, the action of the tube controls ionisation, and it is claimed that while the valve is extremely sensitive it lacks nothing in stability of adjustment. The outstanding feature of this model form of detector, and one which should recommend itself very largely to those amateurs who confine their activities to the reception of broadcasting, is that the valve is incapable of energising the aerial, and cannot therefore cause annoyance to others also listening-in.

The valve is as yet in a more or less experimental stage, and there is no doubt that further interesting developments will arise. When placed on the market there is nothing in its construction to render its price prohibitive.


A Long-wave Transatlantic Receiver, fitted up at the college of the city of New York.

THE ADMIRAL AND THE "SIEGE GUN."

Admiral of the Fleet Sir Henry Jackson recently broadcast a lecture from 2 L O. He declared it the most terrifying experience of his life!

I PAID another visit to the studio of the London broadcasting station last week, and was surprised at the alterations that had taken place since the new year. Gone were the old microphones that used to hang from the ceiling and bang against your head if you wanted to cross the room. In their place, proudly occupying the centre of the studio, was a weird and wonderful arrangement that would have turned Mr. Heath Robinson green with envy.

This latest contraption to facilitate broadcasting (or, at least, I assumed it was for that purpose, for it might just as likely have been a relic of the Stone Age), took the apparent form of three shell-cases, or ginger-beer bottles without necks, proudly perched upon a pedestal of soap boxes. The whole edifice was "mounted" upon wheels. On advancing nearer I saw that the upper structure was profusely decorated and entwined with wire and string.

Opening Fire.

Someone spotted me gazing mystified at this erection, and hastened to explain. It was 2 L O's latest microphone, or, rather, combination of three microphones which have been giving the much improved results that have been noticed lately. It consists of three microphones of different peculiarities—one for the high notes, one for the middle, and the third to reproduce the low ones. Thus the whole range of the human voice is catered for, and the hard "tapping" that had always accompanied the playing of the top notes on the piano has been done away with. I was also informed that the characteristic lisp of the London station had also been cured by this new invention of the Marconi Company.

I was further assured that the Heath-Robinson effect was purely temporary, as the instrument was only in its experimental form.

A few minutes after my arrival I had the pleasure of hearing and seeing Admiral of the Fleet Sir Henry Jackson, G.C.B., K.C.V.O., F.R.S., D.Sc., M.I.E.E., late president of the Radio Society of Great Britain, speak to listeners-in on the subject of the wireless telephone as applied to broadcasting.

Broadcast Advertisements.

The miniature Nelson's Column was wheeled across the studio to where the admiral was going to stand during his speech, and it looked for a moment as if fire was to be opened upon him by a new and deadly form of siege gun. He never flinched. But the matter was quickly explained, and Sir Henry was given his "bearings" as to how and where to speak into this terrible looking instrument.

After his speech was over, Admiral Jackson told me that he had never been so afraid in his life.

"It is a most terrifying experience," he said. "To have to speak into a small cylinder, knowing all the while that every word is being heard by perhaps thousands of listeners all over the land. I don't mind speaking to an audience from a platform, for then I know whether they are being bored or not by their faces, but by this means you have not the slightest idea of how your words are being received."

"What is your opinion on broadcasting?" I asked.

"I think it is one of the most wonderful inventions of modern times," said Sir Henry. "I certainly think it has come to stay, and I believe that shortly it will rival the cinematograph for popularity. In fact, there is a great resemblance between the two, though wireless has the advantage that it can be broadcast while the cinema is confined to comparatively small audiences. They are both wonderful and useful inventions.

"There is one thing," he went on, "that I think might be developed, and that is some method of allowing firms to advertise by wireless. I don't mean that they should fill the ether with strange and awful slogans, but to speak, say, for a few minutes during the broadcasting hours, giving an interesting little lecture in which they should advertise the particular goods they have to sell.

"Again, I think that the Press might give fuller assistance with regard to the late news bulletins. It would not detract in the slightest from the sale of the morning papers if *all* the news had been briefly broadcasted the evening before. Personally, I should buy my paper just the same."

Landmark.

"I shall always remember to-night," Sir Henry concluded. "It has been quite a new experience, and will stand out as a landmark in my life."

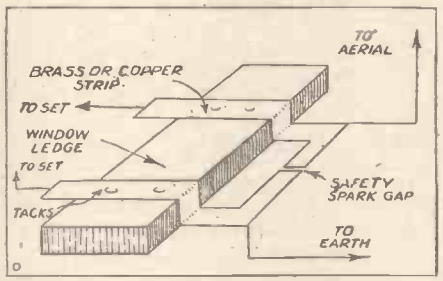
I stayed a few moments longer while a song was sung, and then I left, leaving the "siege gun" still commanding the room, with the Wireless Orchestra clustered round it, preparing to give the nightly "dance programme."

KDR

A NEW EARTH ARRESTER.

By H. A. D.

THE accompanying illustration shows a home-made earth arrester or safety spark gap which for sheer simplicity both in construction and design would be hard to beat. The only components necessary are two "L" shape strips of brass and four small screws or tacks. The over-all length of each strip should be about 1 ft. to 18 in., according to the thickness of the window frame.



Providing Insulation.

The device is fashioned by placing the two strips of brass over the window ledge with two ends touching in the shape of the letter "U." By closing the window the brass strip will be bent into the shape shown in the diagram. Attention should next be given to that part of the window ledge to which the strips are to be screwed or tacked.

While the wood in itself may be a very poor conductor, certain losses would be likely to occur, especially in wet or foggy weather. That part of the window ledge, therefore, on which it is proposed to place the strips might be prepared with a thin coat of shellac or other waterproof insulating substance. A good idea would be to use rubber solution similar to that used for mending punctures in pneumatic tyres.

When the set is being dismantled or when, for any other reason, it is necessary to remove the strips no unsightly disfigurement of the window ledge will result, and this is a great advantage over most of the methods employed to bring the lead in from the aerial or earth to the apparatus.

The four leads shown in the sketch are self-explanatory, and denote the manner in which the stripes are connected to the aerial, the earth plate, and the set. While the connections could be soldered as indicated, an elaboration of the idea might be carried out by sinking terminals through the ends of the strip and connecting the four wires in the ordinary way.

FROM PROFESSOR LOW.

Sir,—I am very interested to read in POPULAR WIRELESS of experiments on the subject of so-called "water divining."

As you will have noticed, I have mentioned this already in POPULAR WIRELESS, and it might interest you to know that some years before the war I conducted experiments on water finding by radio in Richmond. Some of the results were published in the Australian Press, where the subject is of great commercial importance.

I am, Sir,

Your obedient servant,

A. M. Low.

SHIELDING THE SET.

A WELL-KNOWN method of shielding a set is to use tinfoil for the purpose, and the manner in which this may be carried out is detailed in the following paragraph. First of all, the panel which is to be shielded should be drilled as required and carefully cleaned of any oil or dust that may be adhering to it. The back of the panel should then be coated with a good shellac, a second coat being applied after the first painting has been allowed a few hours in which to dry. A coat of shellac should also be given to the tinfoil at the same time as the second coat is applied to the rear of the panel.

When the shellac has partially dried, and is in a more or less sticky state, the tinfoil should be pressed firmly on to the panel. Any wrinkles or "bubbles" appearing on the foil should be immediately remedied and, if possible, avoided altogether.

After the foil and panel are quite dry, the foil covering the holes in the panel should be cut away, and another coat of shellac applied to the foil.

When Dry.

A thick piece of brown paper should then be obtained and one side prepared with the shellac. After the shellac has dried sufficiently to bring it to the sticky state referred to above, it should be pressed against the back of the panel.

Once it is dry, that part of the paper which is covering the holes in the panel, can be removed by burning the paper away with the aid of a thin piece of red-hot iron. A useful implement for use in this connection is the metal type of skewer used by certain butchers for "dressing meat."

The layer of brown paper is an added precaution against short circuiting, and will be found to be well worth the small amount of additional trouble entailed by adding it to the panel.

AN EMERGENCY H.T. BATTERY

AT 2.30 on a recent Sunday afternoon we discovered that our H.T. battery had "shorted" and was quite useless. No shops were open, and our only hope lay in the local chemist and the "scrap box."

The chemist supplied us with copper sulphate and zinc sulphate, the "scrap box" with the following items: 50 strips of copper, ¼ in. wide and 5 in. long, and the same number of zinc strips of a like measurement. To these were added a piece of pitch, about two pounds in weight, and some paraffin wax.

The battery was constructed as follows:

Twenty-five sheets of typewriting paper were pasted and rolled round a former 1¼ in. in diameter. These were cut in half and placed in the oven to dry out quickly. They were then dipped in melted paraffin wax.

A cardboard box lid was procured sufficiently large to take the 50 cell cases, and into this was poured melted pitch about ½ in. in thickness. The waxed cell cases were stood upright in the molten mass, and the whole allowed to cool.

The result was a perfectly rigid battery case.

A piece of the strip zinc was bent "L" shape at one end, and soldered to a strip of copper. When the 50 pieces were so joined they were placed in the battery, the zinc in one cell and the copper in the next, and so on.

The zinc being bent at the top consequently prevented it from touching the bottom of the cell, and this served the purpose of allowing copper sulphate crystals being placed in the cell without touching the zinc plate. The copper sulphate and zinc sulphate solutions were then added, and the battery was complete.

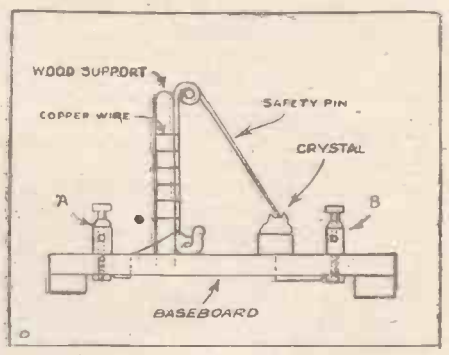
This battery was constructed with the help of a friend, and it occupied a period of two hours in the construction. It was perfectly successful.

A "SAFETY PIN" DETECTOR.

AMONG the various novel crystal detectors at present being made by amateurs it is probable that the simplest and most easily constructed of them all is that shown in the accompanying diagram. A small piece of curtain rod or, better still, a wooden skewer and a safety pin form the principal components necessary for the construction of this useful little device.

Quite Efficient.

The wooden support is sunk into the base of the board in the manner shown and the safety pin firmly bound to it by means of



a thin copper wire, one end of which is taken to the terminal A. The crystal, if purchased already soldered into a cup, is then attached to the second terminal B, the contact between the pin and the crystal being obtained by means of the pin's point.

The crystal should be mounted sufficiently far away from the support to which the pin is bound to ensure a firm connection being obtained between the pin point and the crystal.

COPPER WIRE HINTS.

THE copper from which the wireless man draws his supplies, comes to this country from the United States and Australia in ingots very like cast-iron "pigs," weighing about 140lb., measuring about 3 ft. 6 in. long and 3½ in. square.

This is how it is turned out from the cast-iron pouring moulds into which it is run from the smelting furnace. The metal as it is received is of a high standard of purity, being about 99·96 per cent. pure, according to an empirical commercial standard of purity, not necessarily that it contains only ·04 per cent. of material which is not pure copper.

Copper is very easily poisoned. A very slight amount of arsenic puts it out. As little as ·1 per cent. of arsenic reduces the conductivity of the copper to 76·2 per cent.

The above described ingots are made red hot in a "muffle furnace," and rolled down again and again till the resulting round rod is about ¼ in. thick. It is then drawn through successively smaller holes made in chilled cast-iron dies.

Anything smaller than 16 to 20 S.W.G. is drawn down through holes drilled in diamonds and polished. Most of these diamond dies commence their useful lives with a very small hole, and when the soft copper has succeeded in wearing the hole at all irregular, the hole is again polished out and used to draw a larger size of wire. At the end of these diamonds is dust, used for polishing their newer successors.

Silk Insulation.

Copper, when cold drawn through iron or diamond dies, becomes very brittle and has to be annealed in a furnace. If you made a piece of bright copper wire red hot in a flame it would become black and dirty looking, but the annealing furnace is charged with water vapour, which keeps the wire from blackening, and it is as bright when it comes out as when it goes into the furnace.

The machines for drawing copper wire sometimes have as many as nine holes all in a row, with "tractor" drums in between each, and ingenious contrivances for taking up the slack, as the wire being smaller, travels much faster out of the machine than it goes in.

Wire being enamelled, passes through several baths of enamel and is stoved after each bath, from four to six coats being the usual coverings, each complete in itself.

Machines for covering with cotton and silk are very largely automatic, and stop when the thread breaks or the spool runs out.

The silk for using on the higher gauge wires is too fine to tie into a knot with the fingers, and so a small tool, which looks like the old-fashioned candle snuffers, ties the two ends of the silk together and snips off the waste ends in one "snick."

NOTES ON THE EAST ANGLIAN ETHER.

By 2 T O.

ALTHOUGH not a lot is heard of the radio-activity of the Eastern Counties it must not be imagined that this vast area is by any means a "dead spot." Ipswich, which is considered to be the W/T capital of East Anglia, is quite a hotbed of listeners-in, for a rough estimate places the number of these gentlemen at 150, of whom the majority it must be explained are possessors of experimental licences.

So far only one full transmitting permit has been issued in the district, and that is 2 T O. The next nearest transmitters are 5 D P Clacton-on-Sea, and 2 M D and 2 O F Lowestoft.

Being only twelve miles from the seaboard of the most busy sea in the world, and in close proximity to the Channel, where the many coast stations create such a din, it can be understood that scarcely a quiet moment can be found. Indeed, great difficulty is experienced in intercepting short-wave transmissions because of the persistence of coast and ship station working.

To get really clear of this encumbrance it is necessary to descend to the vicinity of 300 metres, and even then occasional interference is experienced as a result of spark jamming from the few stations working on that and adjoining wave-lengths. By far the greatest offender in this respect is Parkeston Quay (G P Q) whose normal wave-length is 450 metres.

Fifteen Readable Harmonies.

It is usually stated that this station is a Post Office station, but in point of fact it is controlled by the Great Eastern Railway Co., or rather, to give it its new name, the London and North Eastern Railway. Parkeston is equipped with a set for transmission which is identically the same as that used by the North Foreland Radio. It can well be imagined, then, that when G P Q starts up on 450 or sometimes 600 metres all else is blotted out for the time being.

The local station B Y E, at present chartered by the Admiralty, causes very little disturbance, and can be eliminated fairly easily. No small amount of disturbance has been traced to the local electric tramway system. The interference usually takes the form of a double "click," which is especially noticeable at night and during frosty weather. It has been found that when a spark occurs, due to the trolley making a bad contact with the overhead wire, one of these "clicks" eventuates.

We are also subjected to that type of blight which seems to affect all districts where a number of receivers are in operation, namely "howling." It is really heart-breaking to hear these ether-searchers sometimes, and yet upon confronting a suspect with the question no one could be more astonished or hurt!

The heart of the whole trouble seems to be that the conditions prodncing "howling" are not really appreciated by a large number of reaction users. It is not necessary to "howl" audibly to oneself to produce "howling" in other people's phones, for a mere oscillation of a set with certain commonly used circuits—for example, the autodyne—using two coils only, will create a fearful noise at a mile range if a loud speaker is in use.

However, this district has an ether which is probably no less heterodyned than most others. By the way, the ether around this part seems to be full of harmonics of the big stations working on longer wave-lengths, for which Leafield and Northolt are responsible.

No less than fifteen readable harmonics have been heard between 300 and 600 metres, all emanating from the first-named station. Northolt has a particularly obnoxious set of harmonics, and especially on Sundays, when he appears to carry out experiments with a different set of apparatus.

The harmonics are very loud indeed, and there are several in the region of the broadcasting wave-lengths. No doubt this harmonic trouble will increase as reaction trouble did, and then the authorities will take steps to prohibit the use of sets radiating harmonics, for which we shall be thankful indeed.

2 L O is our nearest broadcasting neighbour, and his emissions come through very well. Birmingham runs him very close for strength, but the articulation is not so good in this case. The latest problem in radio: How would you take steps to localise a re-radiating receiver who uses an attachment to the electric mains in place of an aerial?

THE NEWCASTLE BROADCASTING STATION.

THE Newcastle-upon-Tyne station of the British Broadcasting Company commenced activities just over a month ago, and has proved itself quite capable of the demands imposed upon it. The quality of the concerts leaves nothing to be desired, while the transmitting is excellent in every way. The concert-room is centrally situated in Eldon Square, and it was this direction that our representative took one night, with the object of seeing the actual transmitting take place.

Only One Complaint.

Inside the building everything was bustle and activity for the approaching concert, but Mr. Tom Payne, the musical director, had a few minutes to spare for a short talk. He was called away for some time and the opportunity was taken for a look round the concert-room itself. It was a spacious apartment, the entire walls and ceiling being muslin-covered to deaden all sounds but the actual music. Four adjustable microphones were situated at different parts of the room.

Seven o'clock. All ready for the children's story.

"Hello, hello!" calls out Mr. Payne. "This is 5 N O speaking, the Newcastle-upon-Tyne station of the British Broadcasting Company. Are you there, children? This is Uncle Tom speaking. I will now proceed to tell you the story of King Killjoy." And with a "Now, are you ready?" the "Hello Man" proceeds to recount a thrilling tale of the wicked doings of this monster. One could almost imagine the chuckles of delight with which the story was greeted by the thousands of tiny tots listening-in. "Uncle Tom" is indeed a great favourite with the children, and has received numerous letters from grateful "nephews and nieces."

Then followed the actual musical programme of vocal soloists, orchestral music, violin solos; while at two intervals during the evening news bulletins were read. Dead silence prevails in the room during transmission, and one can observe on the faces of the singers—all of them experienced platform vocalists—the strange sensations they feel when singing for the first time to a huge, invisible audience which cannot show its appreciation by applauding in the usual manner. The silence is felt more at the end of each item, for no applause is allowed by the other occupants of the room. The vocalists whose voices have previously been broadcasted become used to this atmosphere, and can be picked out at once as they step forward towards the microphone. Mr. Payne is a very clear announcer, and generally repeats the items twice, sometimes with humorous additions of his own. The musical director is an expert violinist, and is quite in demand every night. He receives numerous requests to play certain pieces, and if it can be arranged these items figure in the programme "by request."

About the only complaint that has been received is that the piano sounds rather "tinny," but by careful adjustment of the microphones the sound of the piano has been greatly improved.

The actual transmitting of the concerts takes place from West Blandford Street, a land line being laid down over the distance of about half a mile.

Many letters of congratulation have been received at the station praising the high standard of the programmes sent out. A gentleman in Aarhus, Denmark, writes: "I receive your concerts very good," and commends the violin music. Reports of reception have been received from Guernsey, the New Forest, Cardiff, Poole, Antwerp, and Aberdeen.

POPULAR WIRELESS Beginners' Supplement

PART VI.—MICROPHONES, TELEPHONES, AND LOUD SPEAKERS.

By MICHAEL EGAN.

WHEN listening to a broadcast concert for the first time, one can scarcely help wondering about what is happening at the transmitting station all the while. What are the various artistes doing? Are they surrounded by a lot of intricate machinery, and does each artist have to perform some complicated technical operation which calls for a high degree of skill? Or do the artists merely give their selections in the ordinary way, whilst someone else—a mechanic or engineer—"turns the handle," so to speak?

These are questions which may or may not have occurred to the present reader. They are, nevertheless, not infrequently expressed by the beginner at wireless who takes an intelligent interest in the subject from the start, and who wishes to clear up such points for himself as he goes along. I have met quite a number of people who had always tacitly assumed that wireless music is transmitted in exactly the same way as gramophone music is transmitted. They explained to me quite airily that "a record is put on a machine at the other end," and music comes out at "this" end.

This explanation has the great merit of simplicity, of course; but, unfortunately, it lacks the more important merit of correctness. This does not mean that wireless concerts could not be sent by this method. They certainly could, as many amateurs have effectively demonstrated, but this would probably be as inefficient a method of broadcasting concerts as could be devised.

In practice, the broadcast concerts are held in a "studio," in which is installed a number of *microphones*. The transmitting apparatus is situated in a distant room, and is connected to the microphones by wires. The microphones themselves are just small black discs, similar to the microphones used for conveying speech by the ordinary land line telephony. Moreover, the broadcasting artistes deliver their selections "into" the studio microphones in much the same way as we deliver our conversations into the well-known Post Office microphones—the main difference being that they stand a little farther back from the instrument and take a good deal more care with their pronunciation.

Ether and Air Waves.

The microphone may be regarded as "collecting the sound." This, however, does not correctly describe its real function. Sound waves strike upon it, and, in doing so, produce a change in its electrical qualities. This change affects the current flowing in the wire that connects it to the transmitting apparatus, which, in turn, produces corresponding variations in the waves radiated by that apparatus. In this way the variations in the air waves set up in the vicinity of the microphone are reproduced as variations in the ether waves sent out by the wireless transmitter.

In this respect, therefore, the artist's voice controls the transmitting apparatus, without involving any technical skill on the part of the artist. In order to broadcast any item, all that is necessary is that there should be a microphone close to the person who is producing the sound (or noise!) and that this microphone should be connected up to the broadcasting instruments in a certain manner. The next question is: How are broadcasted items reproduced audibly at the receiving station since they cannot be heard in transit?

In an "Air-less" Room.

I have mentioned above that the variations in sound produced in the broadcasting studio are reproduced as variations in the ether waves sent out from the transmitting apparatus. This calls for attention to the difference between *sound* waves and *ether* (or wireless) waves. The former occur in *air*, whereas the latter occur in *space*. If you were to exhaust all the air from the room in which you are at present sitting, you would be unable to "hear yourself speak," nor could anyone else hear you. In fact, you could *not* speak, because to speak means to produce air waves, and no amount of ingenuity would enable you to produce air waves in a room which contained no air!

You could, on the other hand, send ether waves across this hypothetical airless room, because ether waves do *not* depend upon air for their conveyance. They can move through *space*. They are therefore quite unaffected by the absence or presence of air. Even if there is air in the space through which they move, they will not disturb it. That is, they will not cause any air waves, and consequently cannot be heard.

The human ear can detect air waves very efficiently. It is, in fact, one of the most sensitive detectors of air waves. There are other ways of doing this, however. Instead of vibrating the diaphragm of your ear, sound waves could be made to vibrate a paper diaphragm. Or, again, to take a cruder example, the sound waves set up by the discharge of a gun are capable of vibrating the windows of an adjacent house. In the latter case, the windows may be regarded as *detecting* the sound waves.

Just as there are different ways of detecting sound waves, there are different ways of detecting ether waves. An ordinary wire mattress is capable of detecting ether waves. In other words, when a wireless wave strikes it, it tends to vibrate electrically. A more effective method of detecting wireless waves, however, is by means of a high wire or group of wires—usually referred to as an "aerial" or "antenna."

Producing Audible Notes.

When a wireless wave strikes an aerial, the latter at once vibrates electrically. That is to say, small electrical impulses surge up and down the wire at a very great speed. As previously explained, these have to be "rectified" by means of a crystal or valve, or some similar apparatus, before they can be rendered audible. This is what happens:

The high frequency impulses are first converted into impulses of current in one direction only. The latter are now capable of producing mechanical vibrations at a frequency which will give rise to an audible note. Each surge of current is passed through a coil of wire which is wound on an iron core. (Without going into the theory of electro-magnetism, it may be stated that when a current of electricity passes through a coil of wire which has an iron core the latter becomes magnetic.) Close to one end of this iron core a metal disc, or dia phragm is fitted.

When an electric impulse flows through the coil, the core becomes momentarily magnetised, and "attracts" the diaphragm. As the impulse dies down, the magnetism in the coil dies down with it, and the diaphragm springs back into its original position.

The following impulse produces a similar result, which is repeated in the case of all the succeeding impulses. A succession of impulses thus causes the diaphragm to *vibrate* and produce an audible note. The greater the number of impulses that are made to flow through the coil per second, the more rapid will be the vibration of the diaphragm, and the higher will be the resulting note.

Similar to Telephones.

This is the principle on which the head telephones work. The little black cap which fits over the ear contains a coil of wire with an iron core, and a diaphragm. After the electrical impulses have been reduced to a suitable frequency, they are passed through the telephone coils, where they give rise to the vibration of the diaphragm in the manner described above.

Loud speakers work on a similar principle. They vary a good deal, of course, in the details of their construction, and even in the application of the principle. They are all devoted to the same purpose, however. They aim at utilising the low frequency impulses to produce vibrations in some kind of diaphragm. They are also designed with the express object of throwing the sound over as large an area as possible.

THE VALVE FOR BEGINNERS

By SEXTON O'CONNOR.

The first of a series of three articles on the Thermionic Valve, specially written for "Popular Wireless" Beginners' Supplement.

PART I.

AT first sight, a wireless "valve" looks very much like an ordinary electric lamp, and as a matter of fact, one is a direct descendant of the other.

Edison, who first invented the glow lamp, found out, in the course of some later experiments, that it had certain strange properties quite apart from that of giving out light. He was actually on the brink of a further great discovery, when he apparently grew tired and put the whole thing on one side.

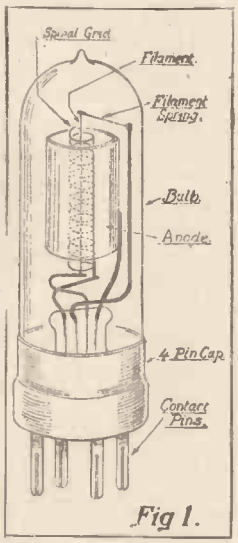


Fig 1.

Many years afterwards, Dr. Fleming took the matter up again at the point where Edison had left it. The result of Flemings' work was the invention of the "thermionic valve," the most marvellous little piece of "mechanism" to be found in the whole of wireless science.

Partly because of its outward appearances and partly because there seems to be practically no limit to its "magic," the valve has been aptly christened "The Aladdin's Lamp of Wireless."

There are, however, many points of difference between the electric lamp and the valve. The first is brought home at an early stage of acquaintance, and concerns the cash transfer necessary to persuade the valve merchant to "part" with one.

Recovering from this somewhat painful distinction and looking more closely—and carefully—in view of the cost involved in dropping the creature, other differences in detail will quickly appear.

The structure of the various parts of a standard valve is shown in Fig. 1.

"It's an Ill-Wind——"

Instead of being looped into one or more turns, as in a lamp, the "filament," or glow wire, is stretched between two arms or supports mounted in the glass "stub" or stem at the bottom of the bulb. A small spring at the top of the upper arm allows the filament to expand or contract slightly, according as it is red hot or cold.

Coiled around the filament, and lying fairly close to, but not touching it, is a spiral of thin wire, also supported by an arm mounted in the glass stub. This is called the "grid." It was first inserted in the bulb by an American named Lee de Forest.

The addition of the grid greatly increased the efficiency (and complexity) of the valve as a wireless instrument, besides causing an extensive and prolonged outbreak of litigation in the American and English Courts, which is still gratefully remembered by patent lawyers.

Surrounding both the grid and the filament will be seen a thin cylinder of metal, similarly carried by an arm from the glass stub. This is the "plate" or "anode," the latter being a particularly useful term for use in casual conversation with the ignorant.

Incidentally, the filament, the grid, or the anode (or plate), may each be called an "electrode"—without distinction. This is frequently done, and creates a decided impression of diffused technique.

Apart from the "electrodes" the glass vessel of the valve contains literally "nothing": the inside has been exhausted to the highest possible degree of vacuum by a powerful air-pump.

On the outside of the valve it will be noticed that the usual plug fitting of the lamp is replaced by four metal prongs or contact pins. Each of these is connected to one of the inside electrodes, so that when the prongs are inserted into the socket piece on the valve "panel" or box, the different parts inside the valve are automatically joined or connected up to the various outside "gadgets," such as the accumulator, high-tension battery, phones, etc.

The precise manner in which the connections are made is shown in Fig. 2.

A Point to Watch.

Here perhaps a word of warning may not be amiss. On looking closely at the contact pins it will be seen that they are "spaced" or arranged in a certain irregular fashion. One pin (connected to the inside "plate") stands somewhat apart from the others. The holes in the socket on the panel are similarly formed.

The object of this is to ensure that the instrument can only be inserted into the socket in one particular way, i.e., so as to join up the inside electrodes to the outside phones, battery, etc., in the correct manner.

There is a considerable danger of damage being done if these connections are wrongly made, and therefore, if the valve does not slip easily into the socket at the first attempt, do not take a coal-hammer to it, or use other violent measures, for they will probably cost you the price of a new valve, and these are hard times.

Instead, it will be sufficient to observe carefully the relative "spacing" of the holes in the socket, turn the valve round so that the prongs correspond, and then press them gently home.

A glance at Fig. 2 makes it clear that one prong is connected to each of the plate and grid electrodes. The filament accounts for the other two pins.

It should be mentioned that the inside electrodes are shown in diagrammatic or symbolic form in Fig. 2. The actual shape and position of the parts, for one well-known type of valve, are as shown in Fig. 1. Actually the relative shape and position of the various electrodes vary somewhat in different types of valve (*e.g.*, Marconi R, Ediswan, Mullard, "Ora," etc.), but the method of drawing them shown in Fig. 2 is generally used to cover all the different makes.

The filament, then, is connected across the terminals or "poles" of the accumulator, and when the "filament resistance" switch or handle on the panel is turned, current will flow through the wire and will render it "incandescent," or white hot.

Here a few remarks must be inserted regarding the "electron theory."

Explaining Electric Currents.

The electron is, in one sense, so small as to be utterly insignificant; but, at the same time, it is undoubtedly responsible for a tremendous volume of wireless literature and speculative argument.

It should be given a wide berth if possible, but unfortunately a nodding acquaintance with it is necessary before the ways of a valve can be fully understood.

For a long time scientists were really ignorant as to the precise nature of an electric current, although they were perfectly familiar with many visible and invisible effects which accompanied the movement of electricity. For instance, they knew that "something" appeared to flow from one pole of an accumulator to the opposite pole, and that this "flow" was always in the same direction. They therefore said that the "electric current" moved *from* the "positive" pole *towards* the "negative" pole.

Also, they observed, amongst other things, that when the current passed through a metal wire of high resistance (such as the tungsten filament of the valve)

(*Continued on next page.*)

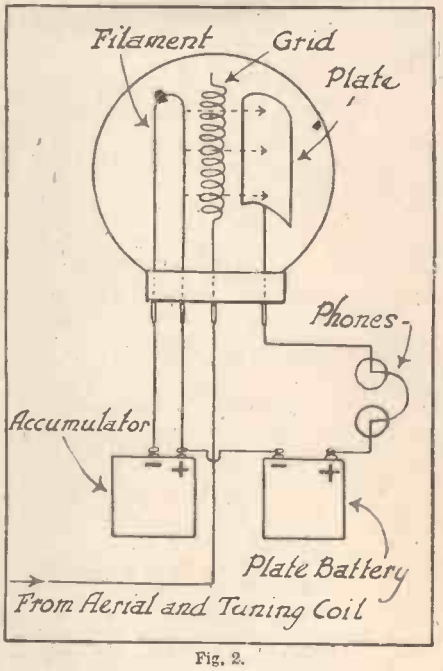


Fig. 2.

THE VALVE FOR BEGINNERS.

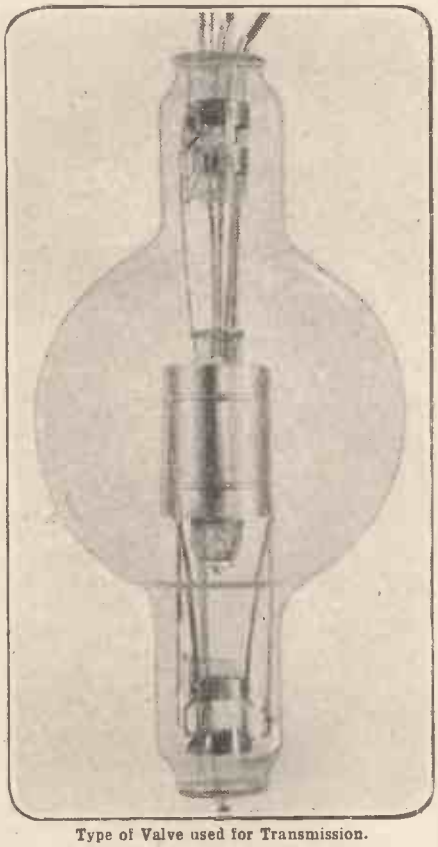
(*Continued from previous page.*)

this rapidly became red hot owing to its "resistance" to the passage or movement of the electricity.

The discovery of the valve, and the careful study of what actually happens inside it, have resulted in throwing a much clearer light upon many of these matters.

It is now definitely known that electricity is not so much a mysterious "fluid" as a substance very akin to ordinary matter. It is, in fact, composed of electric "atoms" which have been christened "electrons."

An electric current (as now understood) consists of the passage of countless millions of electrons, which flow with almost inconceivable quickness through the substance of the wire or other conductor, under the urge of the "electromotive" force which exists between the poles of an accumulator or battery.



Type of Valve used for Transmission.

In their passage, they push and jolt against the minute particles of matter forming the wire with such fury that these, in turn, are set into rapid vibration—a state of affairs which makes the wire red hot.

Why it Flows.

Incidentally, the electrons consist wholly of "negative" electricity, so that, in fact, the electron flow takes place *from* the negative towards the positive pole of a battery, but the old idea of current flow can still hold good. This will be explained in full later on.

There is no such thing nowadays as "positive" electricity. When a body is said to be "positively charged," we know that it has been, in some way or other, deprived of its proper equipment or share of electrons. Consequently it is "hungry" for more and will eagerly attract any electrons in its neighbourhood.

Similarly, a body which carries an excess number of electrons is "negatively charged," and is only too anxious to get rid of its excess load at the first opportunity. Hence the old electrical text-book saying that "likes repel but unlikes attract each other" still holds good.

Bearing these things in mind, it is not difficult to accept the statement that when the filament is heated up to incandescence it is carrying a "cargo" of many millions of electrons, which come in from the negative pole of the accumulator, push their way onwards through the filament, and complete the circuit to the positive pole. They then pass through the accumulator back to the negative pole again, and so the current through the filament is kept going.

(*To be continued.*)

A FEW VALVE DON'TS.

Don't handle valves in any other way than very gently.

Don't place a valve into its socket until all the wires and leads are safely connected to the set.

Don't turn on the filament current a single degree above that required for good signals.

Don't leave yalves in position on the set if the latter is to be out of use for any considerable period of time.

Don't forget to carefully clean the valve pins or "legs" from time to time.

Don't forget that some valves function better as detectors than amplifiers, even although they may be of the same type and make.

Don't forget to have the accumulator switched off, or all of the filament resistance *in* before the valve is inserted into its socket.

A GLOSSARY OF RADIO TERMS.

ELECTRON.—The basic form of electricity. Electrons are always negative.

E.M.F.—Abbreviated form for electromotive force. The unit of E.M.F. is the volt.

ETHER.—A universal medium which serves as a means of transmitting wave motions of radiant energy.

FREQUENCY.—The number of oscillations per second.

GRID LEAK.—A high resistance connected across the grid condenser or between the grid and the filament of a valve to allow excessive electrical charges to leak off to an external source.

HENRY.—The unit of inductance.

HERTZIAN WAVES.—Electro-magnetic waves in the ether, named after their discoverer.

INDUCTANCE.—The name given to the phenomenon of transferring a current from an electrified body to a non-electrified body.

KILOWATT.—1,000 watts.

LOUD SPEAKER.—A device for magnifying received signals so that they can be heard without the aid of earpieces.

RECTIFIER.—A contrivance which eliminates one of the beats of alternating current, so that the resultant current consists of a series of impulses in one direction only.

RESISTANCE.—Opposition to the flow of current.

RESONANCE.—Resonance exists in a given circuit when its natural frequency has the same value as the frequency of the current introduced in it.

SELECTIVITY.—The ability of selecting any wave-length to the exclusion of other wave-lengths.

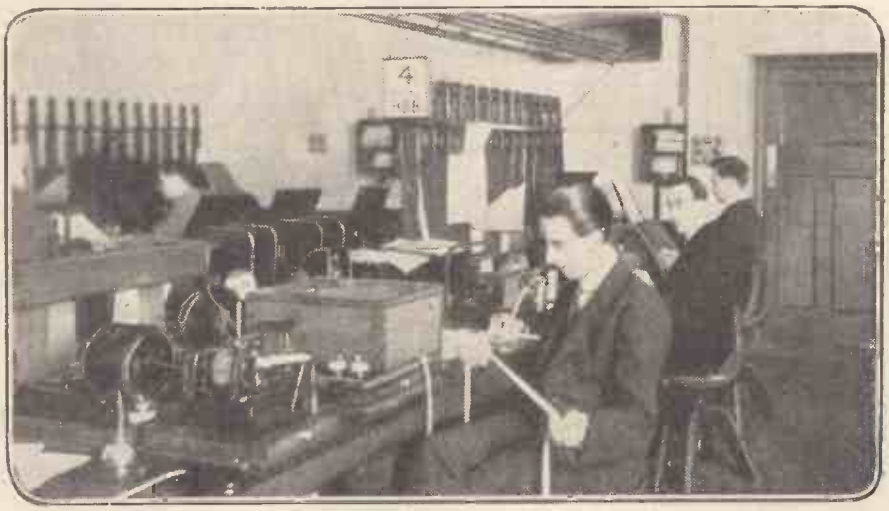
STATIC.—Atmospheric electrical disturbances heard in the receiving phones.

TRANSFORMER.—Any device for transforming electric energy from one state to another.

TUNING.—The selection of a particular wave-length.

VALVE OR THERMIONIC TUBE.—Can act as a generator, amplifier, or detector of wireless waves.

WAVE-LENGTH.—The distance from crest to crest of two waves.



One of the Receiving Rooms at Radio House. Messages come through in perforated tape form.

QUESTIONS & ANSWERS FOR BEGINNERS.

NOTE.—On this page the beginner will find a selection of questions and answers which will concisely deal with many little problems met with in the erection of a wireless receiver. Readers are invited to send their queries to the Technical Dept., Room 138, The Fleetway House, Farringdon Street, London, E.C.4, where they will be carefully and promptly dealt with. Replies are sent by post free of any charge.

Q. Is there any rule by which I may know what size accumulator to buy ?

A. For all valves it is best to have a 6-volt accumulator, so as to have a certain amount of adjustment in hand so that you can vary the amount of current flowing through the filament by means of the rheostat. As regards capacity, assuming each valve to take three-quarters of an amp., your accumulator should have ten times the total amperage taken by the valves. This capacity is the "actual" capacity, and is about half that stated on the accumulator as "ignition" capacity. For instance, if the set is a 4-valve one, the valves will take out 3 amps. altogether, so the accumulator should not have less than a 30 actual, or 60 ignition ampere-hour capacity.

* * *

Q. Is there any rule as to the size of the H.T. battery ?

A. No. This depends upon the valves you are using. Some valves require more voltage than others. For one valve, have up to 60 volts in hand. Above that, add about 10 volts per additional valve. This does not mean that all this voltage must be used, but it should be available if it is found that the valve will operate better at a higher voltage.

* * *

Q. Can H.T. batteries be recharged ?

A. The most common kinds—dry batteries—cannot be recharged. It is possible, however, to buy H.T. batteries in the form of small accumulators, these can be recharged in the same way as the low tension battery, but are rather costly to buy.

* * *

Q. How often should the L.T. battery be charged ?

A. This depends upon its size, upon the number of valves you are using, and upon the number of hours for which you use it. In order to test when it is running down, and requires charging, you should use a voltmeter or a hydrometer. The former is momentarily connected across the terminals of the battery while it is in use. If the reading is above 1·8 volts for each cell (in a 6-volt battery there are three cells, in a 4-volt there are two), your battery is O.K. Do not allow the battery to discharge after the voltage has dropped to 1.8 per cell. Have it charged then as soon as possible. The hydrometer registers the gravity of the acid in the cells, which should not be allowed to drop below 1·18. The gravity when the battery is fully charged should be 1·2.

* * *

Q. What is a hydrometer ?

A. There are several kinds of hydrometers, but the most useful for wireless purposes is the Hicks suction type. This is a small tube like a fountain-pen filled with a rubber bulb at the end. Inside are three glass beads, yellow, blue and purple, reading downwards. The instrument is dipped into the acid of the accumulator, and a little is sucked up by means of the rubber bulb. If the acid has a gravity of 1·2 (fully charged) all three beads float. If the gravity is only 1·18 (safety limit for discharge), the purple bead sinks, and the blue and yellow float. If the acid is lower than this, only the yellow floats, and if the gravity drops below 1·17 (when the cells will be in a very bad state, and liable to be ruined) no beads float.

* * *

Q. When is the danger of discharging too long ?

A. If accumulators are allowed to discharge below their safety limits a white substance is formed on the plates. This substance (lead sulphate) causes very high internal resistance, and owing to the fact that it covers the plates in patches, action takes place in patches, and the plates are liable to become warped or buckled; when they may touch each other and ruin the whole cell. The process of forming the white substance, which is very difficult to remove, being insoluble in water or acid, is called "sulphating."

* * *

Q. Can sulphating be cured ?

A. Sometimes it is remedied by giving the cells a long charge of about 7 days at a very slow rate. If this does not cure them, sometimes the sulphate may be scraped off, but if the positive plates are badly covered there is no cure, and new plates will have to be obtained.

* * *

Q. I have been told I need a fuse on my set. Is that right ? What is a fuse ?

A. A fuse is a piece of wire which is connected with one of the circuits through which a current is to flow. If it is desired to allow so much current and no more—as a safeguard to prevent burning out a valve, for instance—a piece of wire which will melt or "fuse" before too much current has passed is used. In the case of the H.T. battery, if those of 40 or 60 volts happened to be connected wrongly, and got on to the filament of the valve, such a large current would be produced that the valve would burn out. To obviate this, a fuse is placed between the high tension battery and where it connects to the set. The fuse consists of fine wire which will melt and break before any damage is done, and thus stop the current flowing by breaking the circuit. For this purpose a "quarter" or "$\frac{1}{2}$ amp." fuse is used. This will "blow" when $\frac{1}{4}$ or $\frac{1}{2}$ an amp. of current begins to flow through it, whereas it would take about $\frac{3}{4}$ or more to hurt the valve. So you see that the fuse safeguards the valve filament.

* * *

Q. What is a lightning switch ?

A. A switch used to connect the aerial straight to earth when the set is not in use. This means that if lightning should happen to strike your aerial, the current would flow straight to earth, without doing any damage. If it was allowed to go through the set on its way to the earth it would probably burn the coils of the set and cause considerable damage.

* * *

Q. What is Wood's metal ?

A. A soft solder which melts at a very low temperature and can thus be used for soldering metals—such as tin foil—that cannot stand much heat. It is used for soldering crystals into their holders, as heat is liable to damage the crystals. A match will usually be sufficient to melt Wood's metal.

* * *

Q. Some people use those flashlamp batteries for the high tension battery of valve sets. It seems to work out cheaper, so is there any objection to joining up 6 or 7 of them and using them for the H.T. instead of the 15-volt units ?

A. The batteries you mention can be employed for valve H.T. work, but the brass connecting strips should be soldered together and not merely fastened together by binding them with wire, otherwise objectionable "noises" may result.

The special 15-volt units are to be preferred owing to the high insulation provided in their construction. This is, of course, very desirable when dealing with H.T., and further will prevent that shorting which is so apt to occur where a number of uninsulated connections are exposed.

* * *

Q. With four valves how many different arrangements or circuits are possible ?

A. The number would run into at least three figures apart from the lesser known and "freak" circuits. Firstly, the order of Low Frequency and High Frequency amplifying valves, which number three, with the one detecting valve, would provide four classes of circuit, as it were. That is, you could have one H.F. valve, one detecting, and two L.F., or just one detecting and three H. or L.F., and so on. After that there are quite a few methods of arranging the coupling between High Frequency valves, and finally there are again a number of different arrangements for tuning with single coils, variometers, loose couplers, etc. You will therefore see that endless combinations of the above are possible, each of which will have its advantages and disadvantages as the articles in the Supplement will show you.

* * *

Q. What is the meaning of "in shunt" ?

A. This means that one piece of apparatus is connected to another piece so that instead of all the current *having* to flow through one or other of the two or through both, it has an alternative path and will split up, *part* going through one piece of apparatus, and *part* going through the other. In other words, instead of the ordinary path, a parallel path is provided, and hence the second piece of apparatus is often said to be in "parallel" with the other.

SIMPLE TUNERS FOR CRYSTAL CIRCUITS.

By O. J. R.

ON the next page is shown six crystal circuits, with the particular type of tuner most suitable for each. Tuners for crystal circuits may be roughly classed in the following groups: Tuning coils (under which will come one-slide, two-slide, three-slide tuners and tapped coils), loose couplers, and variometers. Honeycomb coils, basket coils, and vario-couplers are sometimes included, but generally these are better employed in valve circuits.

In all crystal circuits a small fixed condenser with a capacity of about ·002 mfd. is advantageous when shunted across the phones, and this is shown in each diagram. The designs of the crystal detectors have been varied, but it should be clearly understood that there is no hard-and-fast rule concerning the use of any particular type, the most suitable usually being determined by experiment or prejudice. The earth leads are shown soldered to waterpipes, but wherever it is convenient a natural earth is always preferable.

The Loose Coupler.

In the first diagram, A, a single-slide inductance coil is connected to a crystal detector in a very simple manner, which is termed "direct coupling." This could be aptly named "the beginners' circuit," being a hot favourite amongst those amateur mechanics who believe there is nothing like the "home-made" article.

Diagram B shows a circuit employing a two-slide inductance coil and a variable condenser connected in parallel across the "secondary." A transformer step-up effect between primary and secondary is thus effected, which gives selective tuning and very efficient results.

Diagram C illustrates a very effective means of wiring up a tapped coil. Two switch arms are employed, the one on the left for coarse tuning, and the one on the right for fine tuning.

If a sufficient number of tappings and studs are provided, very fine tuning can be obtained, and a variable condenser will not be necessary.

In Diagram D a loose coupler and variable condenser are used for tuning, and this circuit has been found very satisfactory for all-round reception, especially on the higher wave-lengths. The variable condenser is connected across the secondary, and facilitates very sharp tuning. Amongst "old timers" there exists a sort of sentiment for the loose coupler, which did such good work before the war, when a "C.Q." would cheerfully sit all night and listen to spark signals, which the modern listener-in would call nuisances. During the war, too, the loose coupler was at work in the field, in the air, and on the sea, and, having a reputation for reliability, it is only natural to regard this trusted friend as a "die-hard."

Fixed Inductance Circuit.

A variometer is the tuning device employed in Diagram E. There is only one general type of variometer, and this is the well-known form with two coils connected in series, and one placed rotatably within the other. If it is to be home-made it should be wound with an equal number of turns on both coils, and it would be advisable to purchase the moulded stator and rotor.

Diagram F shows what is probably the most simple form of inductance used in a crystal receiving set. This is of the fixed type, and its design may be modified *ad lib.*

The cartridge type shown in the diagram should be so mounted as to be readily interchangeable, so as to permit reception over a wide range of wave-lengths. For instance, at each end of the coil a suitable contact could be made to engage two brass clips permanently connected to the circuit, so that it would resemble a giant grid leak. The method of manipulating the receiver is to insert a coil having an inductance to correspond with the wave-length on which it is desired to receive, and slowly vary the condenser until maximum signals are heard.

A Few "Tips."

Experiments will determine the amount of winding required to just cover the wave-length of any particular station, and the coils can then be marked 2 L O, 2 M T, and so on. This method entirely eliminates any trouble with "dead-end effects." The small arrows in Diagrams E and F indicate the output to phones.

It will be as well to conclude this brief description of the various circuits illustrated in the accompanying diagrams with a few general remarks on crystal detectors, which will no doubt prove useful to both the "real amateur" and the "want to know" B.B.C. licence-holders.

In the first place, where the full 20 or so mile crystal range for telephony is desired, employ a sensitive crystal, such as galena. For smaller ranges a more stable crystal, such as silicon, should be used.

Do not use a wire of thick gauge for the "feeler," or "catswhisker," as it is called sometimes. A wire of very fine gauge, such as that known as 32 or 34 S.W.G., is necessary if good results are to be expected.

Do not leave the "catswhisker" pressing on the crystal when the set is not in use, and also see that the detector is covered up. Dust is a great enemy to crystal efficiency.

A 4-valve receiving set built into a small writing bureau by Mr. R. C. Common, 74, Murray Place, Stirling.

SIMPLE TUNERS FOR CRYSTAL CIRCUITS

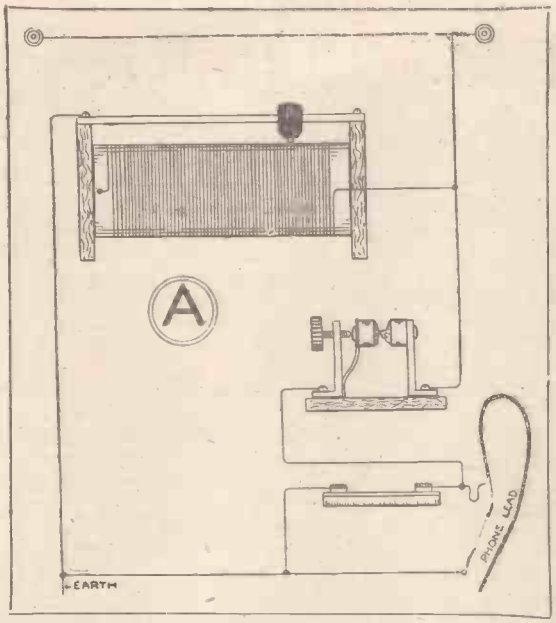


Diagram A depicts the simplest possible type of receiver that is capable of being tuned-in over a fair range of wave-lengths. Its actual capacity in this respect will depend upon the size of the single slide coil. 7 in. x 3 in., wound with 22-gauge wire, would be efficient for the broadcast wave-lengths.

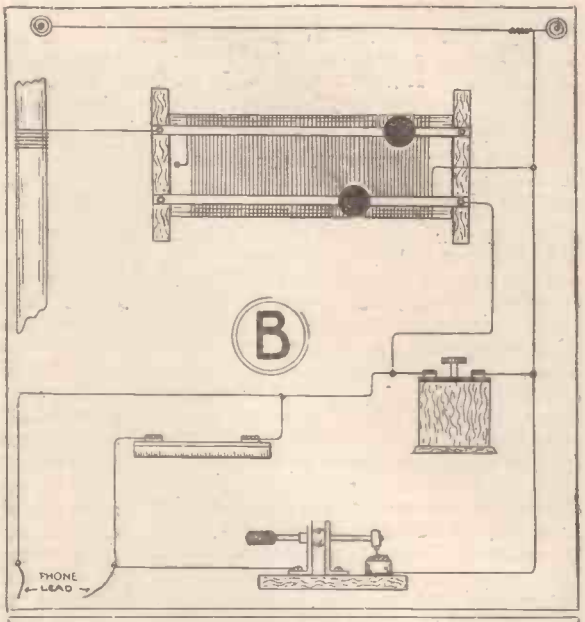


Diagram B is a decided improvement on A, owing to the fact that a closed circuit tuning is provided by the addition of another slider and a variable condenser. The Aerial-Coil-Earth forms one circuit, while the Coil and variable condenser form another, both of which should be adjusted to the same tuning by means of the sliders and condenser.

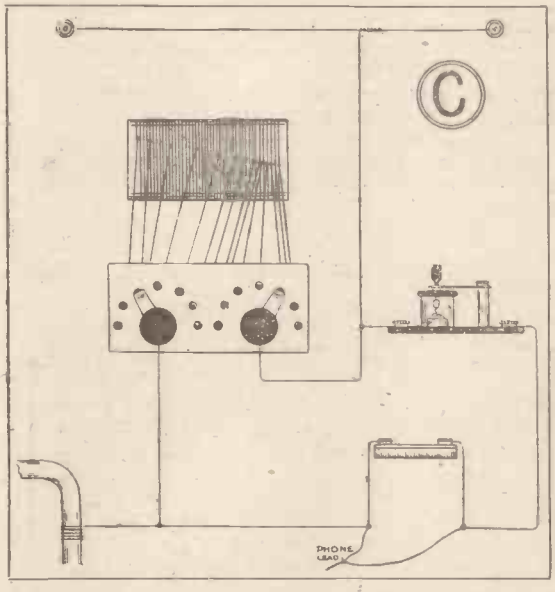


Diagram C shows the very popular tapped coil circuit. Two inductance switches are provided, one of which taps at single turns up to 7, and the other at intervals of 8, thus allowing tuning "to a turn." 60 turns of 22-gauge wire on a/ 3½-in. former would be O.K. for broadcast reception.

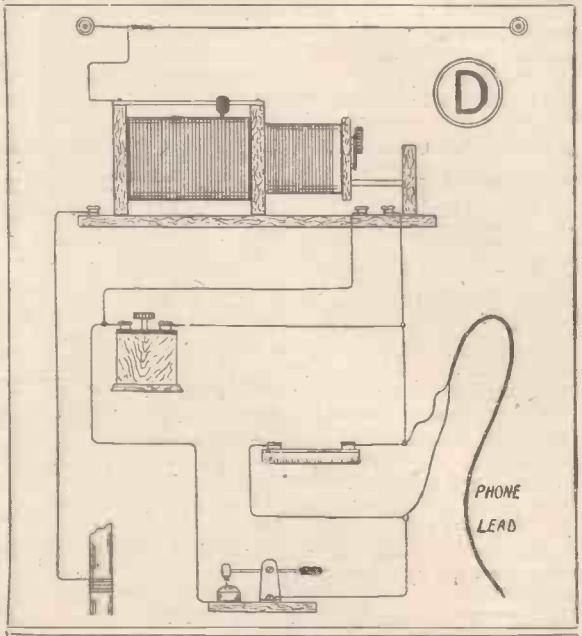


Diagram D is the very popular "loose coupler" circuit. Two separate circuits are provided as in "B," but they are inductively coupled and employ two coils, one for each circuit. 5 x 3 wound with 22-gauge wire and 5 x 2½ wound with 28 "tapped" eight times with a '0003 mfd. variable condenser would be suitable for broadcast reception.

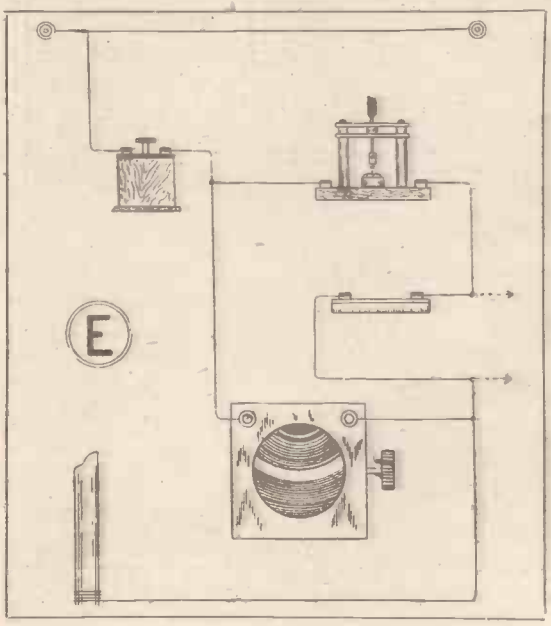


Diagram E provides an inductance tuning by means of a variometer. This consists of two coils connected in series, one of which revolves within the other. By varying the position of the movable coil a variation of inductance is obtained to a considerable degree, and a fair range of wave-lengths covered by that alone.

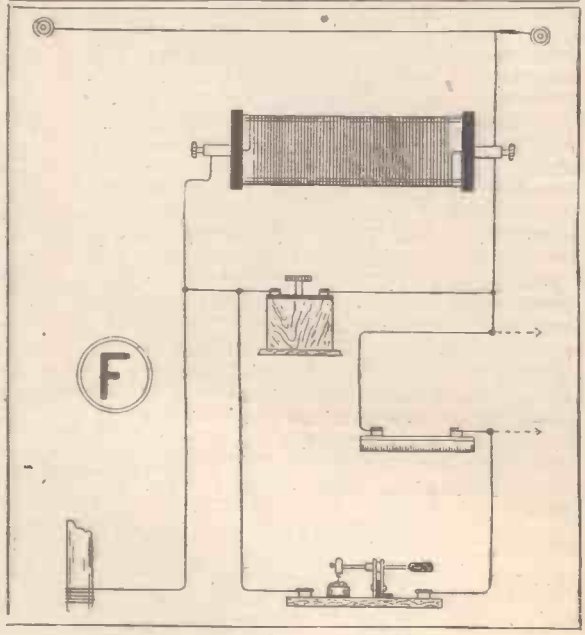


Diagram F shows a circuit that includes a fixed inductance with a variable condenser provided for tuning purposes. This arrangement simplifies tuning and is very efficient, but only over a limited range of wave-lengths. Larger or smaller coils are required for various ranges. A telephone condenser is shown in this as in all the other diagrams. Dotted lines indicate the phone leads. The most suitable condenser for all the preceding circuits would be of '0003 mfd. capacity.

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.

Birmingham Experimental Wireless Club.

An instructive and enjoyable lecture was given before the above club on January 12th by Mr. B. A. Matthews, the subject being: "On the Construction of Three-Valve Receivers."

Mr. Matthews gave an interesting account of his experiments with various circuits, and the means by which the apparatus had been evolved from the original single-valve set by slow stages was of special interest to the new members present who are busily engaged on building new sets of their own.

Hon. sec., A. Leslie Lancaster, c/o Lancaster Bros. and Co., Shadwell Street, Birmingham.

The Cricklewood Radio Club.

The above society is in progress of formation. Would anyone feeling interested in the furtherance of radio or wireless telegraphy, or would become a member, kindly communicate with:

Hon. sec., P. G. Percy, 185, Broadway, Cricklewood, N.W.2.

The Warrington Radio Association.

A meeting of the Warrington Radio Association was held recently, Mr. F. V. L. Mathias presiding. A very interesting address was given by Mr. W. Whittaker, on "Morse Reception," following which Mr. B. Nadin gave a very interesting address on "Hints on Set Making." Both speakers were accorded a hearty vote of thanks at the conclusion of their address.

Hon. sec., Mr. W. Whittaker, 68, School Brow, Warrington.

Eastern Enfield Wireless and Experimental Society.

On Thursday, January 11th, an extraordinary general meeting of the above society was held at the headquarters, to discuss the programme for the present year.

After considerable discussion it was decided to have a programme of lectures and demonstrations of members' apparatus.

Wireless enthusiasts will be heartily welcomed at the society headquarters any Thursday evening at eight o'clock.

Hon. sec., Arthur I. Dabbs, 315, High Road, Ponders End.

The Leicestershire Radio and Scientific Society.*

The first meeting of the elementary section of the Leicestershire Radio and Scientific Society, was held on Monday, January 15th, at the headquarters, the Leicester Mercury Office. The president, Mr. C. T. Atkinson, followed with a lecture on "Elementary Wireless."

A hearty vote of thanks was accorded to the speaker by the chairman, this being endorsed by the whole assembly.

All communications regarding the society should be addressed to the

Hon. sec., Mr. J. R. Crawley, 269, Mere Road, Leicester.

Streatham Radio Society*

The big meeting of the month was held on Wednesday, January 10th, at 35, Streatham Hill, Mr. H. Bevan-Swift in the chair. After the minutes of the last meeting had been read and business concluded, Mr. Gibbon gave a very interesting lecture, ably illustrated with a lantern by Mr. F. O. Read and Mr. King. Then Mr. Read, with the help of Mrs. Read, gave a concert from Marconi House on a Burndept Ultra iv, kindly lent for the occasion by Messrs. Burndept, Ltd. Mrs. Read had the honour of being the first lady to attend one of the society's meetings. The meeting closed at 10 p.m., with a hearty vote of thanks to the lecturer and demonstrators.

Members wishing to join the society should make a written application to the hon. secretary, S. C. Newton, "Compton," Pendennis Road, Streatham, S.W.

Winsford (Cheshire) Proposed Wireless Society.

Arrangements are in progress to form a local "wireless society." Some thirty names of persons interested have already been received, but many more are required to guarantee success to the proposed society; so send in your name at once, please, to Mr. S. Oakes, 188, Weaver Street, Winsford, Cheshire.

Hackney and District Radio Society*

The annual meeting of the above society was held at its headquarters, Y.M.C.A., Mare Street, Hackney, E.8., on Thursday, 4th January. The chairman, Mr. H. A. Epton, presided over an attendance of some fifty members.

The secretary presented a report of the society's activities during the past year, and stated that the progress made had been very encouraging. The treasurer presented the first balance sheet of the society, which showed a cash balance of over £7, after having paid for the society's set, which had been made by the technical committee.

The election of officers and committee for the coming year then took place, the Mayor of Hackney being re-elected unanimously as president, and Messrs. Epton, Cunningham, Jenkins, and Kiernan as chairman, vice-chairman, treasurer, and librarian respectively. The secretary, Mr. E. R. Walker, preferring to assist the society in a technical capacity in future, retired from the position of secretary, and in his place was elected Mr. C. Phillips. Mr. Bell was elected assistant librarian. A new committee was also elected, consisting of Messrs. Walker, Morgan, Wall, Valins, and Sandford.

During the evening a competition was held of the best crystal set made by the Y.M.C.A. boy members of the society, and the prize—a pair of R. I. telephones presented by the vice-chairman—was won by Mr. Haynes.

In view of the very valuable work which had been done by the retiring secretary, who was also the founder of the society, it was unanimously decided to make him a small presentation.

The chairman announced that it was hoped shortly to arrange a social evening and public demonstration.

Hon. sec., Mr. Charles Phillips, 247, Evering Road, N.16. (Letters only).

The Hornsey and District Wireless Society.

A general meeting of the above society was held on Monday, the 8th inst., at 8 p.m. The present accommodation of the society not being considered suitable, it was decided to transfer the headquarters to the Queen's Hotel, Broadway Parade, Crouch End, where comfortable accommodation has been arranged. In future, meetings will be held at the Queen's Hotel every Monday, at 8 p.m. Mr. W. L. Carter was elected chairman, and Mr. H. Hyams elected hon. secretary.

Applications for membership will be welcomed and full particulars supplied by the hon. sec., Mr. H. Hyams, 188, Nelson Road, Hornsey, N.8.

Members of Amateur Wireless Clubs are invited to send short articles to Popular Wireless. If accepted for publication they will be paid for at our usual rates.

RADIOTORIAL

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

With the next issue of POPULAR WIRELESS, week ending March 3rd, the cover will be permanently changed, so I advise my readers to be prepared for a rather altered and certainly much improved cover when they visit a bookstall to purchase next week's copy.

I am altering the cover for many reasons, chief among them being that the present cover does not give an adequate idea of the general quality of the articles appearing in POPULAR WIRELESS. I feel sure the majority of my readers will agree here, and that they will welcome the change.

Next week's POPULAR WIRELESS will be greatly enlarged. A special review of the wireless exhibits at Olympia—the Ideal Home Exhibition—will be included in the contents, as well as the first of a series of articles by Sir Oliver Lodge, written primarily for the experimenter. The Four-Page Supplement will again offer useful instruction to the amateur, and the rest of the paper will contain many constructional and general articles of interest.

Take my advice and order your copy now.

THE EDITOR.

Questions Answered

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be exercised in answering queries. Until further notice three questions from one reader will be the limit for one letter. All questions should be addressed to POPULAR WIRELESS, Queries Department, Room 138, Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send the necessary postage for reply.

"AERIAL" (no address) gives details of an indoor aerial in which he has wound the wire in the form of a helix round the room, so that the length of sides in consecutive turns gradually diminishes, and asks if it will be O.K.

No; this type is not to be recommended. As you cannot use an outdoor aerial, an indoor aerial must be used. This should either be a straight aerial stretched across the room—two or three parallel wires will be O.K.—or a frame type aerial. This latter will be found to give good results, but each consecutive turn should have the same length of wire in it as the last. That is, it should not be wound in a spiral form, so that consecutive turns gradually become smaller towards the centre. Use a four-foot frame and five turns of 22 D.C.C., spaced ¼"; each turn will, therefore, have 16 feet of wire.

* * *

A. B. (Croydon).—Can I hear Croydon without an interrupter on a crystal set? Where do the two ends of a slider inductance coil go?

Yes, the interrupter is only necessary for the reception of C.W. signals. For telephony you do not need any extra addition to your crystal set. (2) One end is left free inside the coil; the other is taken to the earth terminal. The slider is connected to the aerial terminal, and if only one slider is used, this terminal acts as connection for the detector also.

* * *

W. J. C. (N. 19).—(1) Would it be possible to work a loud speaker off a crystal set with two L.F. amplifiers? (2) Should I use a proper loud speaker or clip my phones on to a gramophone trumpet?

Yes, this can be done quite well. A loud speaker will usually work fairly well if the sound in the telephones is uncomfortably loud. (2) You will find a proper loud speaker will give better results, but your method could be tried first.

* * *

"RADIO" (Fordingbridge).—Does not the process of lacquering or shellacking terminals tend to prevent them making good contact?

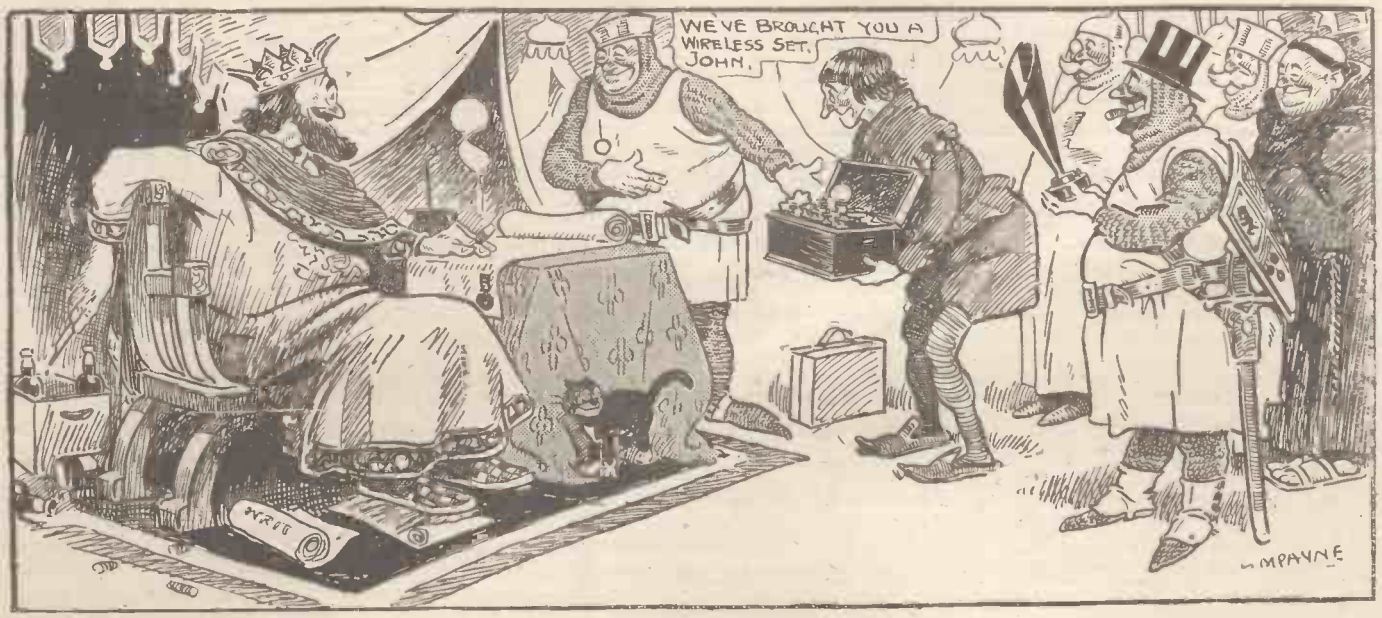
It would do so if the terminals were so treated between the points that grip the wires, but these points are omitted

* * *

"TELERAD" (Sandsend).—What coil and what wire would be the most efficient to use for short wave reception—just for the broad-

(*Continued on page* 974.)

THE BARONS GIVE KING JOHN A BIRTHDAY PRESENT.



RADIOTORIAL QUESTIONS & ANSWERS.

(*Continued from page* 973.)

casting stations ? How many turns of the wire used would there be ?

The best type of coil to employ would be the ordinary single layer cylindrical type. Use 20 or 22 double-silk-covered wire, and wind a former 6 by 3 inches full.

* * *

S. B. (Cheltenham).—The size of a single slide inductance coil 4 inches in diameter, wound with 22 S.W.G. enamelled to tune to all broadcasting wave-lengths up to 500 metres ?

Five inches in length of winding.

The wave-length of an inductance coil 4¾ inches by 9 inches long wound with 22 S.W.G. enamelled with a standard aerial ?

300—1,300 metres approx.

* * *

J. P. (Plumstead).—I am contemplating the purchase of a pair of Brown's Reed type telephone receivers. In the catalogue it says that these can be wound to 24,000 ohms if desired Would it be worth while for me to have them wound to this figure, instead of 8,000 ohms as I originally intended ?

No ; we would advise you not to go above 8,000 ohms. Even although you may have only a crystal set at the moment, some day you may come into the possession of a valve set, and 'phones of such high resistance would be liable to burn out very easily if inserted directly into the plate circuit of a valve set. If weak crystal set signals only are contemplated, then the very high resistance 'phones are useful ; but since the inception of broadcasting nobody is satisfied with *weak* signals.

The catalogue also states that the 'phones must be connected up with correct polarity in order to avoid demagnetisation of the permanent magnets, and for this reason the positive terminals on the 'phones are marked. How can I determine the polarity of my set, and to which terminals on the panel to connect the 'phones to ?

Unless the panel is marked, and lamentably few are, with plus and minus telephone terminals, it is impossible to do so without examining the interior wiring. The 'phones may come between the high-tension battery and the plate of the valve, in which case the terminal connected to the high-tension battery will be the positive one. On the other hand, the 'phones may be connected between the high-tension battery and the earthed low-tension terminal. In this latter case the terminal connected to the high-tension battery will be the negative one.

* * *

G. H. W. (Paddington).—I have a three-coil holder and crystal detector. I use a variable condenser ·0005 mfd., but my telephony is very weak. A blocking condenser makes no difference at all when placed across the telephones. Are not duolateral coils suitable for a crystal set ?

No, not at all suitable. You should employ the single layer cylindrical type. See reply to "Telerad"

(*Continued on page* 976.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page 974.*)

(Sandsend). The blocking condenser will not appreciably affect signal strength, but should improve the tone of the signals.

* * *

B. M. B. (Barnet).—Our house is lit by a 23-30 volt 25-35 ampere D.C. Would it be possible to work three valves off this supply ?

No, afraid not. For one thing generator H.T. is too "noisy" for reception, while considerably over 30 volts will be required for three valves of average degree of "hardness."

Does a valve use more current than an ordinary bulb of the same voltage ?

Yes, considerably.

* * *

J. H. K. (Saltley).—Would it be wise to make my set first and then send a drawing with full dimensions to the P.M.G., or shall I first send for the form of application ? If so, what reason shall I give to get one ?

It would be far wiser to have the circuit approved and the licence granted before commencing the actual construction of the set. No reason is necessary in the case of applying for the form, apart from expressing your desire to apply for an experimental licence.

* * *

T. D. (Clacton-on-Sea).—Am I correct in presuming that an aerial of the inverted L type when directional for receiving from a certain station will also be directional for transmitting to that same station ?

Yes, that is correct. Two stations are directional to each other for working in both directions when the lead-in ends of both aerials are pointing to each other.

* * *

T. P. L. (Greenwich).—Is wireless direction finding absolutely free from error and accurate to a point ?

We are afraid not. Errors in wireless direction finding exist in both controllable and uncontrollable forms. Under the former category would be included apparatus and the position of the stations carrying out the work. Trees in various stages of increased and decreased foliage, telegraph wires, buildings, etc., can all cause error, but of course following upon a series of experimental bearings made upon known positions, this can be allowed for, and corrections made. What are known as night effects are a considerable source of "uncontrollable" error. Not much is known about these, and no practical system has been put forward that will successfully avoid them. As errors between 20 and 40 degrees variation of correct bearing occur in the cases of the majority of stations during the hours between sunset and sunrise, direction finding is restricted to the daytime, except over very short distances. In the case of ships, the compass-line of the hull can cause errors amounting to 20 degrees and more, but it is possible to "control" this error by "swinging" the ship round and noting the errors due to each position.

* * *

A. G. K. (Blackheath).—Is there any advantage to be gained by having a single aerial instead of a double one ?

Yes, you will find that a single aerial will give much better results on short wave-lengths than will a double aerial. A single aerial of about 60 ft. long is to be recommended in the place of a double of about the same length. For long wave-lengths above 600 metres you will find the double type quite efficient.

* * *

W. O. T. (Liverpool).—With regard to the dual amplification circuit that you published in POPULAR WIRELESS a few weeks ago, how large should the high-frequency transformer be ? What type should I use ?

You will probably find that a little experiment will be necessary before you obtain a transformer that gives really satisfactory results. For broadcasting wave-lengths small basket-coil transformers of about 70 to 90 turns of No. 38 D.S.C. wire will be somewhere near the mark. These coils can be wound on well-waxed cardboard formers with nine or eleven slots, and a centre of about one inch. The same number of turns or thereabouts should be used on both the primary and secondary coils. Do not make the secondary coil with many more turns than the primary.

(*Continued on page 978.*)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 976.)

"BEGINNER" (Walton-on-the-Naze).—Is there any advantage in having a stand-by and tune switch in connection with a valve set?

Yes, though this switch is not by any means necessary if your circuit is a simple one. The idea in having such an arrangement is that the aerial circuit can be tuned to the incoming signals, and then the secondary circuit can be switched in, and the final tuning accomplished. All that happens is that the switch when on the one side, switches in the A.T.I., so that it is connected to the grid of the first valve, and then when the switch is moved over to its tune side, the secondary of the tuning circuit is connected to the grid and filament of the valve, and this circuit is tuned to a wave-length of the already adjusted primary. A double throw double-pole switch is quite suitable.

* * *

F. F. F. (Combemartin).—I am thinking of taking up wireless, and should like to be able to hear the Cardiff broadcasting on a loud speaker. What set should I purchase, as I am about 50 miles away?

In all probability you will find that a four-valve set will meet your requirements. Do not forget that the set must bear the B.B.C. stamp unless you are able to obtain an experimental licence. If possible, buy a set that has what is termed "reaction," for this will add greatly to its efficiency. The set you require should have one high-frequency valve amplifier, one detector, and two low frequency or note magnifying valves. This set will give a far greater range if you use telephones instead of a loud speaker of course.

* * *

"ANODE" (St. Albans).—If I use my reaction coupled to the tuned anode or to a H. F. transformer, will I have to vary it all when I change the wave-length?

Yes. In order to get the best out of the set, you should have some method of adding inductance to the reaction coil for use on the high wave-lengths. For this purpose a little experimenting may be necessary before you find suitable values for the reaction coil and the added inductance. About 70 to 100 turns of 38 on a basket-former will be a fairly approximate value for the reaction coil itself. This value must not be taken as exact, however, as it will vary considerably according to the set used. The anode or transformer will be found to be most suitable if wound basket fashion, and the two or three coils are mounted in a three-coil holder so that you can vary the coupling at will.

* * *

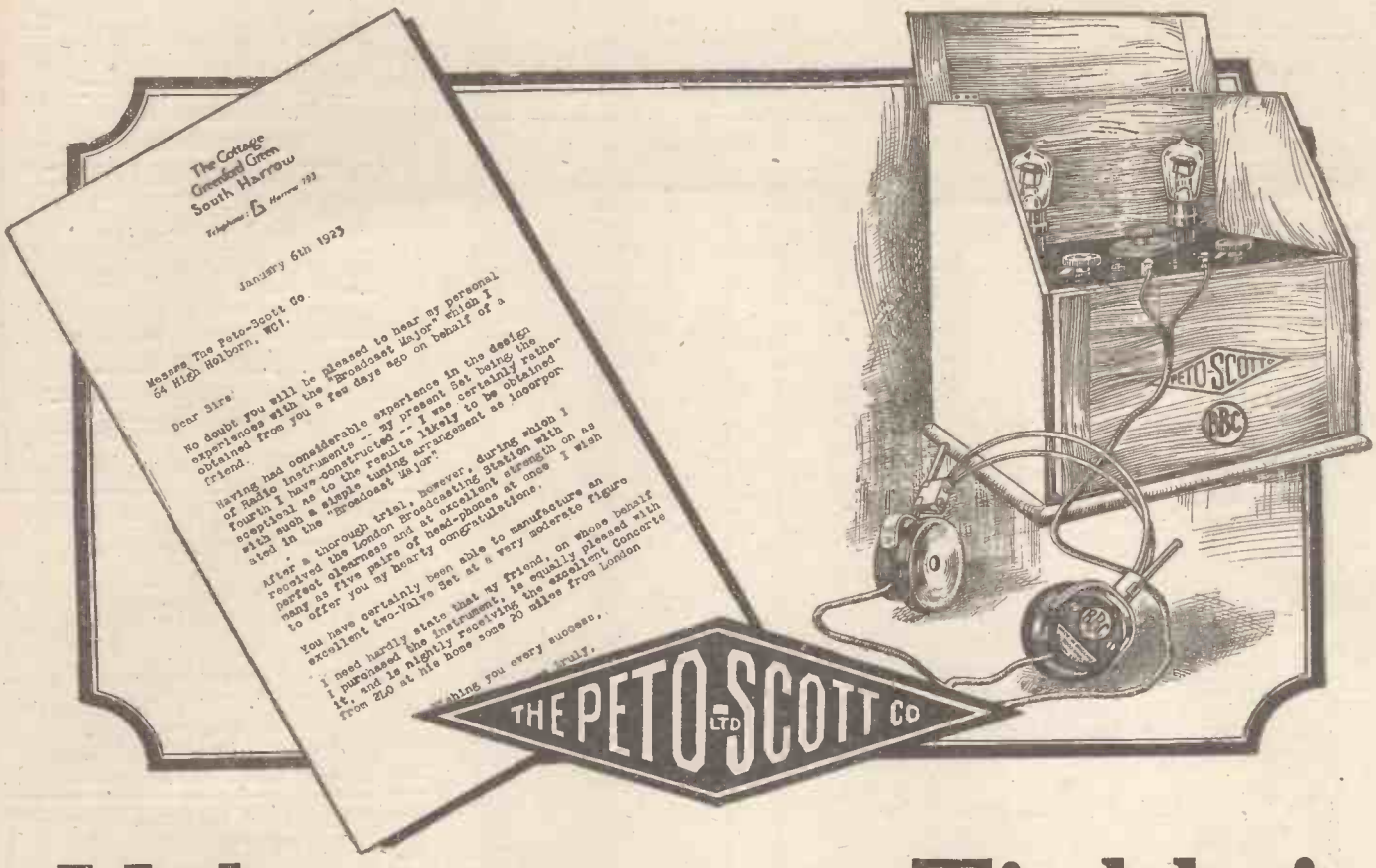
P. O'D. (Dublin).—Would the insertion of "dead end" switches in the primary and secondary coil of my loose coupler increase my wave-length?

No: but it would increase your wave-length range by allowing you to more efficiently bring in the lower wave-lengths.

* * *

E. B. (Northampton).—If I arrange my aerial in one way it is 40 ft. high at one end and 20 ft. at the other, with the lead-in at the higher end, which, I believe, is correct. However, it is not directional for the station I desire to receive from most, 2 L O. If I have a lead in at the end nearest to 2 L O to make it

(Continued on page 980.)



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Valves 15/- each extra.

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RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page 978.*)

directional it means that this end will be but 20 ft. high, and the other end 25 ft. By having a directional aerial, would it give better results than a higher aerial with the lead-in from the higher end ?

Although height is an extremely important point, we would consider that by studying the directional properties of the aerial in this instance both results would obtain.

* * *

D. V. (Glasgow).—I bought a single valve set some time ago and have broken the valve which was of Dutch origin. I have tried various valves since but can get no results. Why is this ?

Probably your grid leak is unsuitable for these other valves. Try a different one, or, better still, use a variable leak. You will also find that a little more H.T. will be needed with most valves than with the Dutch type.

* * *

G. D. P. (Plymouth).—I have a four-valve set and while I can hear F.L. telephony very well, the British telephony keeps on fading away. Why is this ?

This fading is at present unexplained. It is thought to be due to some peculiar conditions of the ground over which it passes. It is not experienced everywhere. For instance, Aberdeen is said to be well-situated and all the British stations are easily heard there on three or four valves. Cheshire is supposed to be a bad or " blind " spot for London, large sets often failing to detect a sound from 2 L O.

* * *

E. D. (Plymouth).—I have heard of a jumping effect whereby stations can be heard working at places, although intervening places in a direct line cannot hear them at all. Is this quite right, or should you think it a question of the receivers employed ?

The effect you mention is very frequently noticeable. Aberdeen and districts in the North of Scotland seem to benefit from this, as it is sometimes called " Giraffing." Some authorities credit a reflection from the " Heaviside " layer with the cause of the phenomenon, whilst others are inclined to put it down to regenerative effects caused by near-by and intervening C.W. stations. As with the better known " blind spot " effect, there is also no doubt but that the natural conformation of mineral deposits of the district plays not a small part.

* * *

H. T. (Deptford).—What exactly is a " turn " in connection with a honeycomb coil ? Is it the number of wires passing round any one peg on the former ?

No, turns in the case of that type of coil, as in the case of basket or even single-layer coils, are counted by the numbers of complete revolutions made by the wire round the former, or when using a winder, the number of complete revolutions made by the former.

* * *

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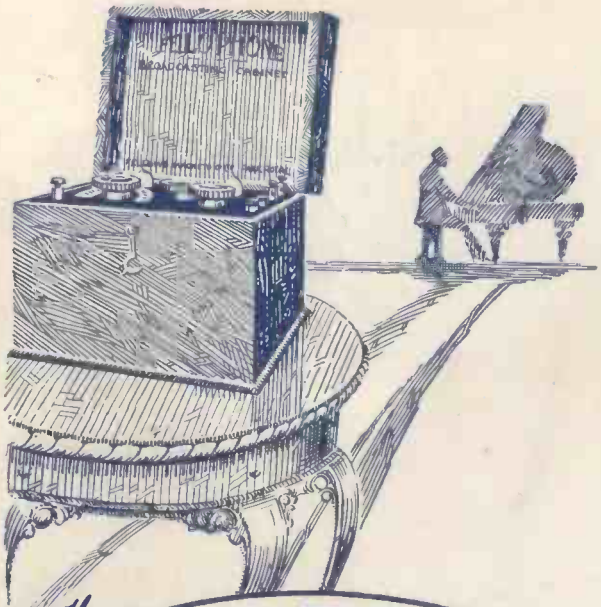

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Ewell. *J. L. S.*
2/1/23.

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