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THE WORLD'S LATEST HOBBY FULLY EXPLAINED

PUBLISHED EVERY FRIDAY

ORDER IN ADVANCE

PACKED WITH PICTURES AND EXPERT ADVICE

Popular Wireless

TOPICAL NEWS AND NOTES.

Belgium and Radio.

BEFORE the war Belgium's merchant service had about ten ships fitted with wireless; she now possesses more than 120, which is a very big improvement. The wireless units are under the control of the Administration des Télégraphes.

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Central Europe Wireless.

A STATION with a range of a thousand kilometres is being erected at Kbely, near Prague, to deal with the aeroplane service between Prague, Paris, and Warsaw. Two stations are to be built in Bohemia for aerial navigation purposes also.

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Broadcasting Schemes.

THE Postmaster-General's scheme for wireless broadcasting by private enterprise has been considered by the Federation of British Industries, who suggest that only British-made apparatus should be used for receiving sets.

* * *

Help!

"PUNCH" recently published a very funny "wireless" cartoon. An aeroplane, tearing along in a cloud of smoke and flame and heading for certain destruction, brought forth the remark from a yokel that "There's another of them wireless messages caught fire!"

* * *

Amateur Concerts.

RADIO amateurs in the district of Broadstairs should note that Mr. H. Pound, a wireless amateur, transmits gramophone music and speech practically every evening at 9.30 on a wave-length of 440 metres. Mr. Pound's radio set has a transmitting radius of about nineteen miles. Good telephony has been received at Canterbury.

* * *

Pill Box Wireless.

MR. T. F. RENDALL, a young electrical engineer, of Sunderland, has constructed a wireless receiving set in a pill box. He believes it to be the smallest installation in the world. It is complete in every detail and, according to the inventor, picks up clear Morse code messages from vessels passing along the north-east coast.

* * *

A Step in the Right Direction.

THE Central Telegraph Office has now established wireless services with Berlin, Cologne, Posen, Rome, and Egypt. News that is handed in at their office is broadcasted from the Post Office Wireless Station at Leafield, near Oxford, and is easily picked up in India and Australia, except on those days when atmospheric conditions are far from favourable. They have also established a regular wireless news service with Halifax in Canada.

* * *

Marconi's Voyage.

SENATORE MARCONI recently stated in New York that he had no sensational announcement to make.

He declared that his experiments during the voyage on his yacht had shown that it was possible to flash wireless messages round the world. Previously, he stated, the maximum distance had been 12,200 miles, established between England and the Antipodes.

Senatore Marconi suggested that round-the-world wireless would doubtless greatly reduce the cost of long-distance communication.

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Wireless in Sweden.

IN the 1921 report of Mr. H. Kershaw, H.M. Commercial Secretary at Stockholm, on the economic, commercial, and industrial situation of Sweden, he states that serious consideration is being given to the possibilities of practical use of the wireless 'phone, and that during the summer exhibition in Lulea communication by wireless telephone was carried out between that city and Boden. Experiments were also carried out earlier in the year with the object of examining the possibilities of utilising high-frequency power cables.

* * *

Congested Telegraph Traffic.

JAPAN is a very progressive country, and when we hear that the telegraph service between Tokyo and Osaka is congested at certain hours of the day, we are not surprised, but when we learn that the business men have found a means of getting over this difficulty, then we cannot suppress our admiration.

The business men of the two cities have planned a wireless telephonic service between the two points, with Nagoya as the intermediate station. Their application has already been placed with the Department of Communications for the establishment of this wireless service by the representative of the Daido Electric Motor Power Company, one of the chief promoters of the scheme.

* * *

Wireless at Colombo.

WIRELESS has spread all over the world, and where it has taken root it has started to grow larger and larger by continual improvements.

The Government of Ceylon are now considering the report of a naval officer on the question of the Colombo Wireless Station. It is very nearly certain that they will improve this station in the near future, as it will prove of great service to the mercantile community of Colombo, who have been endeavouring for some little while to get this station modernised.

* * *

General Squier the man who invented the system of "wired" wireless.

Moth Radiograms.

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

* * *

A Chance for Red-haired Men.

WHEN a recruiting office starts to apply for red-haired men with large ears one starts to think that that office has gone quite mad. Well, that is what the United States have done. It appears that red-haired men have an added alertness, and that big ears are better for listening with than small ones. It sounds reasonable enough, and they have applied for 150 candidates whom they intend to send to the Naval Militia Radio School to test their alertness. They will also probably measure the size of their ears!

His Father's Voice, 1922.

NEWS AND NOTES

(Continued.)

A Reminder.

THE Editor asks me to remind readers of POPULAR WIRELESS that he will award 10s. 6d. to the owner of every amateur photograph published in this paper, and £2 2s. if the photo is used as a cover plate.

* * *

"Last Post" by Radio.

WIRELESS operators on steamships round the U.K. coast "stood by" at noon last Thursday to hear the Last Post and Reveille sounded by six bugler-boys at Marconi House on the occasion of the unveiling of a Roll of Honour, containing 348 names, 316 being those of wireless operators lost at sea.

* * *

New Paris Weather Signals.

I HEAR that in future the National Meteorological Office, Paris, will at fixed hours and twice daily send a weather forecast by wireless telephone to the French rural districts. The Communes will have a receiving station put up in the parish school or at the gendarmerie station, and they will warn the peasants of impending storms by ringing a bell. The cost of the receiving stations will only be two hundred francs (£4).

* * *

A "Wireless" Garden Party.

A WIRELESS concert at a garden party was given by Commander Sir Trevor Dawson, Bart., R.N., and Lady Dawson last Saturday.

At their country residence, Edgwarebury House, Elstree, the wireless concert was given from 5 o'clock to 5.30 through the co-operation of the Marconi Wireless Telegraph Company.

The wave-length was 360 metres, and the power 1½ kilowatts.

* * *

Henry Ford's Wireless.

HENRY FORD, who has made his millions out of his cheap car, has obtained a licence to operate a broadcasting station at Dearborn, Mich. A broadcasting station is a dangerous thing to handle and requires a lot of experience, but I understand that there is little about wireless that Mr. Ford has not learned.

Let us hope that he does not fill the ether with too much information about his cars, as it is possible to have too much of a good thing.

* * *

Some Horse Power!

I READ the other day that Mars was very near the earth, but when I saw that "near" meant 42,000,000 miles I rather changed my mind. But this huge distance is only 3,000 times greater than an intelligent wireless message has been sent on this earth.

Mr. Nikola Tesla has calculated that it would take at least a hundred million horse-power to get a message across to Mars. If the difficulty can be got over soon, it will be easier to send a message in two years' time, for the Greenwich Official has calculated that Mars will be under 35,000,000 miles away in 1924.

* * *

Radio and the Alps.

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

The Enterprising Spirit.

AT the forthcoming meeting of the British Association we shall see a novelty in scientific entertainments. Mr. Howarth, the secretary, informs us that arrangements have been made with the Air Ministry and the Meteorological Office that synoptic weather charts and forecasts shall be given.

These will be compiled from reports received hourly by wireless sent from broadcasting stations at home and throughout Europe. The whole process of receiving, decoding, and charting the messages will be clearly demonstrated by experts for the benefit of members of the Association. This spirit of enterprise is one that I like to see.

* * *

Poldhu's Successor.

ONCE a furniture warehouse, a building in Wilson Street, Finsbury Square, E.C., has just become the centre from which wireless messages to all parts of the world are sent from London.

Radio House, Finsbury Square, London, is the latest sending station of the Marconi Company, although there is not a wireless instrument in the building. From one of the many rooms operators hold communication with three European capitals—Paris, Madrid, and Berne. By automatic machines under their control they work the transmitting apparatus at the new wireless station at Ongar, in Essex, 20 miles away.

A continuous wave is sent out from Ongar, and directly the operators touch their instruments in Radio House, that wave is interrupted and transmits the message, whether it be to France, Switzerland, or Spain.

* * *

Poldhu Gives "S.K."

A MOST famous wireless station has closed down. M P D, the call of Poldhu, will no longer be heard by ships at sea, and its place has been taken by M F T, the sign of Clifden, Marconi's Irish station, which now takes up the duty of talking to ships and telling them at midnight all the news of the preceding 24 hours.

Poldhu is perched on the rocky coast of Cornwall and was the first high-power wireless station ever built, and it was from there that the first wireless message was flashed across the Atlantic on a 2,000 metres wave-length to St. John's, Newfoundland. This happened as long ago as November 12th, 1901.

At first it seemed as if the little cluster of houses that had sprung up round the wireless station would no longer shelter human beings, but it is now rumoured that the station will be used for research work, so there is no fear that this little place that has made history will fall out of existence.

It is a sad thing to relate, but Poldhu's last message was to a little town in Spain, and now the new wireless station at Ongar, in Essex, will look after the Spanish service. Amateurs and professional operators alike will feel a pang of regret at M P D's retirement.

As one of the old brigade, the station has rendered signal service (in more than one respect), and together with F L probably shares the distinction of being the best known and best appreciated station in the world.

ARIEL.

Wireless on top of a 'bus

Broadcasting Programmes

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

EVERY afternoon, excepting Saturdays and Sundays, the powerful wireless station at the Eiffel Tower, Paris, transmits speech and music on a 2,600-metre wave-length.

The transmissions commence at approximately 5 p.m. (summer time) and are followed at 6 by a weather forecast in French.

Special transmissions are fairly frequent from F L (the station's call sign), and, as a rule, notice is given of these special concerts during the regular transmission period at 5 p.m.

The 2,600-metre wave-length is not very sharply tuned, and amateurs in London should have no difficulty in "picking up" the telephony using only one valve. In Scotland it will be found necessary to use four valves if a loud speaker is used.

The Marconi Concerts from Writtle may be heard every Tuesday evening. The concerts commence at 8 o'clock (summer time) on a wave-length of 400 metres. The call sign is 2 M T.

The power used at Writtle is only ¼ kilowatt; but using valve amplifiers, good speech and music have been heard in Scotland.

The Hague Concerts, sent out every Sunday from 2.30 to 5 p.m., are great favourites with amateurs in this country. The station's call sign is P C G G, and the wave-length employed 1,070 metres. The second part of the programme is sent in English for the benefit of amateurs in Great Britain.

Apart from the regular transmissions stated above, the amateur may hear telephony from the Croydon Station (call sign G E D) at various times throughout the day on a wave-length of 900 metres. This latter station communicates with aeroplanes on the Continental air routes. About 400 amateurs now hold transmitting licences in this country, according to the latest information, and they may be heard working at various times during the day and evening.

Aviation & Wireless

By MICHAEL EGAN, Late Instructor of W/T, R.A.F.

WE are only beginning to awake to the possibilities of wireless. This is proved by the fact that there are still many people who are unaware of the actual achievements of wireless in solving some of the most important problems of modern life.

The history of the development of aircraft forms in itself a story of thrilling adventure. And when that story becomes the setting for a record of the numerous deeds of noble endeavour that led to the successful application of wireless telegraphy and telephony to the needs of aircraft, we are confronted by such a tale of heroism and romance as is unparalleled in the most imaginative flights of fiction.

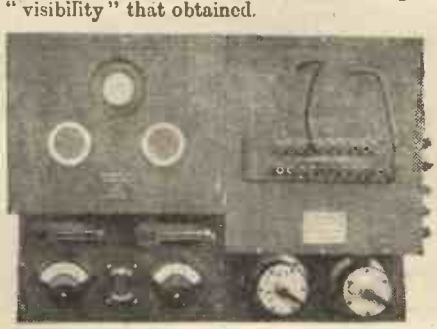
The first really serious attempts to use wireless in aircraft were made at the commencement of the late war. At first there was a good deal of opposition to it on the part of flying men. The chief argument was that it was dangerous. Wireless in those days, it must be remembered, meant "a thing that crackled and gave off sparks." And sparks and petrol tanks were by no means suitable companions to travel alongside each other on the same small craft!

Hence the early opposition to wireless. The introduction of wireless sparks into petrol-driven aircraft was regarded by many as a piece of rare imbecility on the part of a few hare-brained enthusiasts.

But time proved otherwise. Gradually it came to be realised that if wireless was dangerous, it was also very useful on occasions. So, by the end of 1915, numerous types of aircraft were carrying wireless instruments, by which they achieved very remarkable results.

This is particularly true of the smaller airships known as "Blymps," most of which carried a small transmitting and receiving apparatus. During the summer of 1916 several of these small airships were saved from destruction by wireless. I well remember my own excitement on first hearing distress signals from a sister airship on patrol.

We had both started out from a south-coast airship station to carry out a long patrol over sea. Shortly after crossing the coast we encountered fog and a heavy mist. I quickly lost sight of the sister airship as she set off on her own particular course. We kept in touch by wireless, however, and chatted to each other through miles of mist, commenting upon the "stickiness" of the weather and the poor "visibility" that obtained.



The type of transmitter used on R 38.

Suddenly the strident note of the aerodrome wireless station interrupted our gentle discourse with:

"Shut up. Get on with the job and stop jabbering," or words to that effect. I remember that we each replied meekly in turn: "Visibility bad. Nothing to report. All's well." Then silence followed for about half an hour.

Everything was so still that I began to wonder if my receiver had broken down owing to the vibration of the engine or for some other cause. Quite suddenly my fears were set at rest by the sound of our sister airship commencing to transmit. As I listened, however, the ominous significance of the message that reached me through the ether gave rise to fears of a far more serious nature. The other airship was flashing a wireless message to the base station at the aerodrome to the following effect: "Engine stopped. Unable to restart. Drifting rapidly in north-east direction."

I need not go into details of the rescue. The distressed airship was, fortunately, drifting back over the land. Motor-cars, fitted with wireless, were sent out from different stations to search for her and report developments. At last the drifting airship was sighted, and a safe landing was effected without any more serious consequences than a slight "shaking-up" for the small crew, comprising the pilot and the wireless operator!

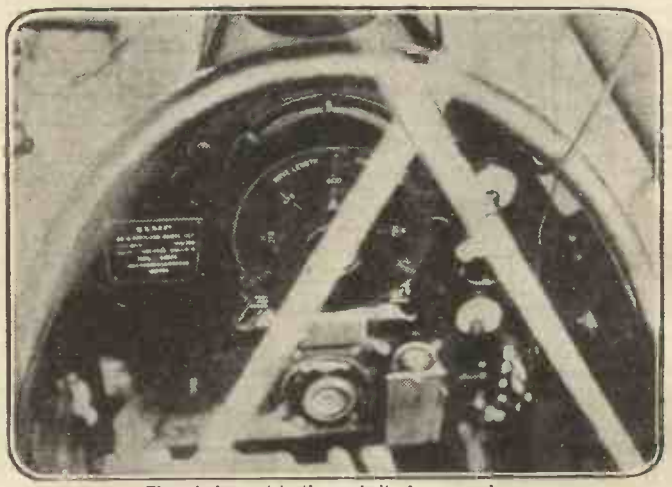
This was only one of the many instances in which wireless played a part of supreme importance in assisting the progress of aeronautical science. Over and over again it was the chief factor in saving the lives of those who were unimaginative enough to condemn its practical utility.

Of course, what has been said so far relates only to wireless *telegraphy*, in its application to the exigencies of aerial warfare. It was not until fairly late in 1917 that the first really successful attempts were made to employ wireless *telephony* in aircraft.

The progress that has been made since then may be judged from the fact that for months past the telephony equipments of British commercial aeroplanes have been rendering signal service in the operation of our Continental air route. Each machine is fitted with a telephony receiver and transmitter, by means of which it can keep in constant communication with one or other of the terminal aerodromes at Croydon (London) or Le Bourget (Paris).

The importance of this is manifold. For instance, owing to the notorious versatility of the climate in this part of the world, it is essential that a pilot should be acquainted, during flight, with the varying moods of the weather. It frequently happens that, as a machine is about to

(*Continued on page* 68.)



The wireless set in the cockpit of an aeroplane.

Our photograph shows General Salmond and his staff listening to speech sent from an aeroplane.

AVIATION & WIRELESS

(*Continued from page 67.*)

leave Paris for the homeward journey, the pilot is informed of the "bright, sunny weather and good visibility" that awaits him on the English coast.

Shortly after the flight has begun, a thick fog suddenly falls upon the English Channel which totally obscures the view of the coast-line from the air. Even the environs of the home aerodrome may disappear beneath clouds of rolling fog. Under such conditions, a pilot would have a difficult task to convey his human cargo safely to their destination without the use of a wireless telephone. In practice, the base station keeps him constantly informed with regard to the weather variations that occur on his route.

He is also warned of the presence of other craft that may be flying along his own route in the opposite direction. Likewise he is told the speed and direction of the wind at the home aerodrome and advised as to the best way of effecting a good landing.

Again, the pilot of a machine may want to report "engine trouble" whilst on his course, or inform the home aerodrome authorities that he is compelled to make a forced landing; or he may have been driven so far off his track by an unexpected high wind that he is in need of ascertaining his position by wireless. In all such cases his telephony transmitter comes into play.

In reading the foregoing notes it will have occurred to some readers to wonder how on earth a sensitive thing like a wireless instrument can withstand being "joggled to death" in a noisy aeroplane, or how, indeed, it is at all possible to hear wireless signals under such conditions? Such questions are perfectly natural and intelligent, and I propose to discuss them in my next article.

(*To be continued.*)

THE FORD CAR AS A WIRELESS TRANSMITTER.

MANY and varied are the stories at present being told regarding the Ford car. From the immaculate clubman to the humblest comedian, the name of Henry Ford is considered fair game wherever motor-car stories are broached as a topic of amusement.

But the statement that the Ford car is a transmitter of wireless waves, which are detected by sensitive valve receiving apparatus, is not given in a spirit of levity, but as a cold fact.

The magneto of the Ford is of peculiar construction, corresponding very nearly to the high-frequency dynamo employed by wireless stations for the radiation of messages.

The coils might be considered the equivalent of the high-tension transformers, and the sparking plugs as similar to the wireless spark transmitter. The sharp click of the ignition sparks are clearly audible in a wireless receiver's telephones, when a Ford car is some hundreds of yards away.

The signals thus received from the sparking plugs of a Ford car are so clearly defined that it is possible to detect a misfiring cylinder on the car by this means, without even having seen the car.

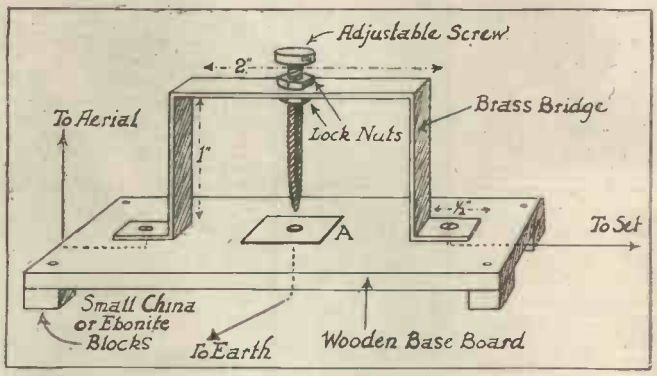
It has always been understood that the Ford car possessed certain advantages enjoyed by no other make of automobile, but that it numbers among its various accomplishments that of a wireless transmitting station, as well as a means of conveyance, certainly seems to be the strangest story of all.

A SIMPLE EARTH ARRESTER.

By fitting an earth arrester to your set you safeguard it against lightning.

OWING to numerous inquiries from readers of POPULAR WIRELESS regarding the possibility of injury to their sets through electrical charges in the atmosphere striking the aerial, the following article has been promptly published. Our contributor points out the manner in which a simple contrivance can be constructed which will carry to earth any static charges that may accumulate on the aerial without the necessity for disconnecting the aerial from the apparatus. A two-way switch could, of course, be used for earthing the aerial direct, or connecting it to the set, but it does not possess the advantages of the piece of apparatus described in this article, which ensures for the set a certain amount of protection, and enables the operator to "listen in" at the same time. It is also possible by its use to directly earth the aerial if required. It thus embraces the sole purpose for which the two-way switch is installed.—The Editor.

THE earth arrester shown in the accompanying illustration is simple and efficient, and quite easy to construct. The only materials required are a wooden base board, a few screws and terminals, some small pieces of china, ebonite, or rubber, and small brass "bridge." A strip of brass, say, five inches long and one inch wide, to conform roughly to the measurements given in the illustration, should be procured and two small holes punched through it, one at each end, about a quarter of an inch from the ends of the strip. A third hole should be punched in the exact centre of the strip,



A sketch of a home-made earth arrester.

and, if possible, a thread turned in it. The dimensions of the holes will depend upon the size of the screws which are going to be used. The strip should then be bent as indicated, and if the foregoing dimensions have been used, a small brass bridge will result, being 1 inch high and 2 inches long, with two small "feet" each ½ inch long, in which the holes are punched. Before fixing the bridge into position on the base board, screw a small piece of the brass strip to the board as shown at A, connecting a lead between the lock-nut and the under part of the board. Thus both the screw and lead are held firmly in position. This lead should be of fairly large thickness or cross-sectional area, and should be connected directly to earth. Keep it as short as possible. The brass bridge should now be clamped firmly to the wooden base board by means of two screws, which must be of a proper size to fit the holes in the brass without allowing the screw heads to pass through. Now reverse the board and connect two more leads, one to the end of each screw, by tightening up the lock-nuts and making a firm connection, while at the same time tightening the screw. One of the leads should then be taken to the aerial, and the other to the receiving set. The hole, which is now in the centre of the bridge, must receive consideration. If the brass strip used is of sufficient thickness to permit of a "thread" being turned in it, all that remains to be done is to insert the corresponding screw, and continue to screw it through the strip until it just makes contact with the small brass plate on the base board. Then give the screw a half-turn in the reverse direction, and the arrester is ready for use. In the case of heavy atmospherics or a thunderstorm, the aerial can be effectively short-circuited to earth by just twisting the screw the half-turn necessary to establish connection with the metal plate—an operation which does not take a second to perform. The strip should not be thinner than $\frac{1}{16}$ inch, or the bridge will be unstable, and probably alter in shape. Neither will it be possible to turn a thread in the top hole. In any case, if difficulty is experienced in turning such a thread, or the strip is too thin, a screw terminal with two lock-nuts can be used. Screw one of the lock-nuts on to the terminal before running it through the brass strip. Then drop the terminal through the hole and screw the remaining lock-nut on the bottom end of the terminal. It will then be found that by turning the lock-nuts in opposite directions the terminal can be clamped firmly to the bridge in the required position. The end of the terminal should be dropped as near to the small brass plate as possible without making actual connection. By loosening the lock-nuts and dropping the screw, the aerial is earthed as previously described. The board should be well insulated by china, ebonite, rubber, or other insulating supports attached to the bottom of it. If screws are used, drive them downwards from the face of the board, and be sure that they do not go right through the support. Provided a fine adjustment of the screw is made, static charges on the aerial, such as accumulate in hot and thundery weather, will be found to spark from the end of the screw to earth and danger from this source is eliminated.

The dimensions given need not necessarily be adhered to, so long as the principle of providing a short path to earth is borne in mind. An earth arrester is sometimes mounted outside of the building, away from the set, but at the same time in a position where it can easily be reached. Do not place it on a window-sill or open space where rain will reach it. Instal it in a sheltered spot, and, if possible, run a separate earth lead from it to the garden, or other suitable earth outside of the building. It is worth a little trouble to know that the receiving set is in some degree protected from electrical discharges in the atmosphere.

BROADCASTING A CONCERT.

The difficulties of transmitting music by wireless.

THE evolution of broadcasting in America has taught the managers responsible for the transmission of concert items many things about the correct way a broadcasting station should be conducted, and the difficulties that must first be overcome before "listeners in" may enjoy a wireless concert to the utmost. This article explains some of the trials experienced in America, and the troubles which managers of British stations will have to overcome.—The Editor.

PROBABLY, as, with your receiver on your ears, you listen to a concert that is being broadcasted, you give little thought to the trials and worries of the man to whose efficiency you owe your enjoyment.

And yet the manager of a concert at a broadcasting station has many difficulties to contend with. There are tones that will broadcast, and there are tones that won't. There are singers whose voices sound well after having travelled over miles of space, and there are singers who, captivating in the opera house or concert hall, lose most of their attractiveness when they try to put their voices through the microphone.

One of the first troubles encountered in endeavouring to transmit the sound of musical instruments went by the name of "blasting."

This was a confusion of most unpleasant and unharmonious noises produced when certain notes were played. Probably it was caused by excessive vibration of some part of the microphone.

To combat this numerous experiments were made. Wood, tin, fibre, parchment, and lead were some of the materials of which the microphone was made in these tests, and, after months of careful study and improvement, the fault was entirely overcome; at least, as far as the better-class broadcasting stations are concerned.

A little while ago no sane broadcasting concert manager would attempt to transmit a quartette, because the combined voices would most assuredly lead to blasting; but nowadays a chorus of voices, accompanied by a full orchestra, can be sent out without fear of causing chaotic melody.

The most difficult of all the instruments to tackle was the piano. Forming, as it does, an indispensable part of a small orchestra, the manager of the earlier concerts fretted under failure after failure.

The bass notes "blasted" badly, and all that resulted from them in a receiver's ear-pieces was a confusion of sound, more like a peculiarly unpleasant fog-horn than anything else; the middle notes were tinny, and the top notes refused to transmit at all.

Experts took the piano in hand, dealing almost note by note from the highest in the treble to the lowest in the bass. They had to construct a microphone especially for the piano's peculiarities, but, nothing daunted, this they did, and in the end they succeeded, until to-day there is little or no cause for complaint, even from the most exacting musical critic.

The biggest part of the fight, as regards musical instruments, was then over. The other string instruments, such as the violin, the 'cello, banjo, harp, and guitar, created practically no further complications. Similarly the wood instruments—the clarinet and flute; all instruments of percussion—bells, xylophone, etc.; and brass instruments—trombones, cornets, etc., are to-day transmitted by wireless with complete success.

Brass instruments may, even at the present time, cause blasting if held too near the microphone, but this can be easily remedied by withdrawing the player a little.

The human voice lends itself to wireless broadcasting, and proved easier than any of the musical instruments. Yet there are grades of excellence even in voices, and the soprano carries best by wireless, the contralto worst.

The notes of a soprano will carry to greater distances than any other sounds, and the tones will sound as beautiful in the ear-pieces of a receiver as in any opera house or concert hall. The contralto at times loses, through transmission, some of the velvety richness of tone; a great deal depends upon the person singing.

It is not entirely a question of voice. It may be that some singers owe their fame to their personality; or perhaps nervousness or some other disability prevents them giving their best into an instrument; but it is an undeniable fact that some quite excellent singers do not sound well "by wireless." Makers of gramophone records will tell you just the same.

It is one of the difficulties of the wireless concert manager to select artistes whose voices will sound well after transmission, and the only sure way is by an actual trial of the singer's suitability for wireless work.

A big point is that in a concert hall the singer is never nearer to the most forward member of the audience than fifteen or twenty feet. A gangway, and possibly the orchestral pit, will separate the stage from the front row of the stalls.

In wireless concerts the artistes are near the microphone, and the tendency is to sing or play right into it. As the microphone practically represents the listener's ear, it can quite be understood that this is not desirable.

The manager works hard and persistently to keep the artiste back, but it is most difficult to break the habit of trying to get as near as possible to the audience whom you know is miles away.

If a singer gets too near to the little recording instruments, such sounds as, for example, breathing, which are lost before they reach the audience in an ordinary concert hall, are, by wireless, caught up, and distinctly heard by "listeners in."

An instrument like the clarinet will even record the clicking of its stops unless it is placed some distance from the microphone.

Yet another problem that has to be overcome by the successful manager of a broadcasting concert is the selection of the right type of microphone for the style of concert to be broadcasted.

Also the positions around the microphones of the various singers and musical instrument players must be carefully allocated.

In the most up-to-date broadcasting stations in America, a plan of the floor is made, and on it are marked normal positions for microphones and artistes. But these will be found to vary from time to time, and ultimate perfection can only be obtained by trial.

Probably you will have noticed that, as the programme of a broadcasting concert—from the Hague, Writtle, or Eiffel Tower—is gone through, there will be a distinct improvement of one selection on the last one played. This is often due to some fault having been remedied between the playing of the two pieces.

The manager of the concert listens in from a receiver near the concert hall of the broadcasting station, and by this means can detect many defects. But he is too near to be aware of some imperfections.

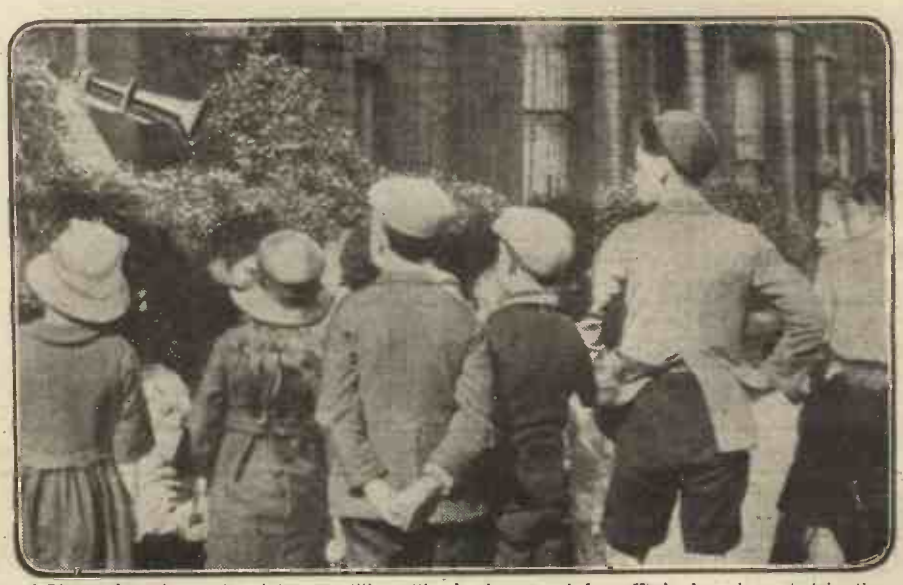
In America the manager relies on a staff of critics.

These critics listen in from their homes or offices at varying distances from the broadcasting station, and telephone to the manager any alterations they deem advisable, such as:

"The piano is drowning the singer. Tone it down a little."

"Bring the contralto forward; her voice isn't strong enough."

A difficulty that a little experience soon helps the manager to lessen, if not to overcome altogether, is to select a programme pleasing to the "listeners in." It is impossible to please everybody, but what the wise manager does is to vary the items on his programme so that anyone who does not care to listen in to one piece will find the next more to his taste



A Liverpool amateur enters into competition with a local organ-grinder. His loud speaker entertains the neighbourhood with wireless music.

CRYSTALS AS DETECTORS.

Before setting up a Valve Set, gain experience by using a Crystal Detector.

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

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

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

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

(1) ZINCITE PRESSING AGAINST CHALCOPYRITE. This combination is sometimes known as "PERIKON."

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

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

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

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

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

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

I have not yet tried this device, but it would seem to be of a more permanent nature than the usual method with galena.

A good crystal detector, in conjunction with efficient tuning coils, however simple, and good telephones, will give excellent results in reception of broadcast concerts, provided you live within about 15–20 miles from the broadcast stations. After the initial outlay for the crystal detector no expense is incurred for maintenance, as no batteries are required.

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

AVIATION WIRELESS STATIONS.

Amateurs "listening in" will often hear telephony from many of the stations given in the list below. They are in almost constant communication with aeroplanes and other land stations.

NAME	CALL SIGN	NORMAL RANGE	OPERATED BY	WAVE-LENGTHS IN METRES
Belgium: Evère, Brussels	B A V	—	Belgian Government	C.W. 900
France: Bordeaux	A B	300 km.	French Government	C.W. 1,400
Le Bourget, Paris	Z M	800 km.	French Government	C.W. and Telephony 1,400 and 900
Lyons	A L	400 km.	French Government	C.W. 1,400
Maubeuge	A V	—	French Government	C.W. 1,200
Nimes	A N	300 km.	French Government	C.W. 1,400
St. Inglevert	A M	400 km.	French Government	C.W. and Telephony 1,400 and 900
Netherlands: Soesterburg	S T B	—	Dutch Government	C.W. and Telephony 900 and 1,400
Amsterdam	K L M	—	Dutch Government	C.W. and Telephony 900 and 1,400
United Kingdom: Castle Bromwich	G E C	—	——	C.W. or Telephony 900
Croydon	G E D	—	Air Ministry	C.W. and Telephony 1,400 and 900
Didsbury	G E M	—	——	C.W. or Telephony 900
India House	G F A	—	Air Ministry	C.W. 1,400
Lympne	G E G	—	——	C.W. or Telephony 900
Renfrew	G E R	—	——	C.W. or Telephony 900

JAN MAYEN ISLAND.

An Arctic Wireless Station.

JAN MAYEN ISLAND, over which flutters the flag of Norway, is a dreary, desolate spot of land, rising forlornly from the icy waters of the North, far within the confines of the imaginary Arctic Circle.

It is an island where night reigns for nine long months of the year, and day for but a short twelve weeks. The nearest land is distant 500 miles.

It is a place of dreary desolation, intense cold, and high winds, and, in short, has nothing to recommend it to the average man in search of a solution to the housing problem. If we boarded a vessel at Land's End, Cornwall, and sailed or steamed away due north, we should eventually come to Jan Mayen Island.

It lies within the Arctic Circle, practically in the latitude of the North Pole, and the course followed by our vessel would have been along the meridian line, 10 degrees west of Greenwich. This little spot, however, has attracted the attention and interest of meteorologists. The island is situated in the path of the Great North wind, one of the factors governing European weather conditions, and the idea of erecting a station on this outpost of habitable earth has been carried out by the Norwegian Government.

The station is able to supply valuable information regarding the weather, and enable regions farther south to forecast more accurately the kind of weather likely to be experienced as far as Europe is concerned.

The severity of the bleak north is tempered by the Gulf Stream, that huge warm water artery which flows to us across the Atlantic from the Gulf of Mexico. We are thus protected to some extent from the uninviting conditions which prevail farther north in parts of Iceland, and Jan Mayen Island.

The British Government also has evinced an interest in lonely Jan Mayen Island and its new meteorological station, and has offered to contribute towards the fund required for the cost and upkeep of the station. It will undoubtedly prove of great value from the meteorological point of view, but the staff necessary to operate it will have to be simple, contented souls. Even then they will certainly not be sorry when the arrival of the relief ship is signalled across the waters of the lonely north.

Readers are invited to send photographs for publication in POPULAR WIRELESS. A fee of 10/6 for every photo used will be paid, and £2 2s. if used as a cover plate.

Wireless for the Deaf

The story of the wonderful Ossiphone.

By P. J. RISDON.

IN the midst of the present popular enthusiasm over wireless, one is apt to overlook a large and patient class who, by reason of their common infirmity, are debarred from the excitement and enjoyment of listening to concerts and speeches borne on the crests of other waves. That class is the army of the deaf.

For them, however, there is good news, for Mr. S. Brown, a London scientist, has invented an instrument, known as the "ossiphone," by means of which deaf persons are enabled *to hear through their bones*, independently of the outer ear. Since, however, even the inventor does not claim it as a panacea in all cases of deafness, we must not raise any false hope where there is room for none, but only explain in which cases the instrument is applicable.

Deafness may be due to any one or more of a number of causes. Without going into technical details, and avoiding the use of medical terms, it may be said that the causes are of two principal kinds, one being disease of the aural nerves communicating between the ear and the brain, for which no remedy is at present known. The other causes of deafness are due to defects in, damage to, or other affections of the outer or middle ear, such as a broken ear-drum, growths or wax in the ear, or a severe cold or catarrh.

It often happens that even these troubles are not met by any of the various devices, such as ear trumpets and microphones, which merely serve to augment sound vibrations with the object of forcing them through, and so influencing the aural nerves.

Sounds via Bones.

By means of the ossiphone, the sound vibrations are imparted to the bony structure of the system, and are thence communicated directly to the aural nerves leading to the brain, entirely *independently of the outer ear*, which may be quite useless. Many medical men refuse to believe this until they have witnessed a demonstration, but some wonderful results have been secured, and the writer has, personally, thoroughly tested the instrument.

The ossiphone is contained in a small, light, ebonite case, that can be slipped into the waistcoat pocket quite easily. It is a perfectly simple instrument, actuated in much the same way that certain telegraph appliances are worked. It comprises a small iron bar that vibrates under the influence of electro-magnets. It may be coupled up by "flex" and plugs to the receiver of an ordinary telephone, or to a wireless receiving set, without interfering with anybody else's use of the instrument. When the current passes through the electro-magnets, the bar of course vibrates. The end of the bar projects outside the ebonite case and terminates in a small knob. The case is held in one hand, and the knob is pressed gently but firmly against one's knuckle or skull, and, as the bar vibrates, the knob communicates the vibrations (which are imperceptible to the touch) to the bone, and thence by the aural nerves to the brain. A curious thing is that, when in use, if held loosely in the hand, sounds proceed from the instrument, although they cannot be distinguished.

How the ossiphone is used

It might reasonably be argued that the cartilage separating the different bones would prevent the vibrations from reaching the aural nerves at all, or, at least, that they would be deadened so as to become imperceptible. Yet, strange to say, that does not happen, and, in point of fact, with one of these instruments in his possession, the writer is able to carry on telephonic conversations better by placing the knob of the ossiphone against his finger knuckle than by using the ordinary telephone receiver. Not only is the sound of a voice much more distinct, but it is less interfered with by other sounds foreign to the conversation.

A Boon to Amateurs.

This is a remarkable and interesting point, and brings home more forcibly than any other experience the fact that sound is a sensation produced by power waves; for, after all, even to whisper means the exercise of force. It is a common experience that very loud sounds, such as the report of a gun, and certain sounds, such as the scratching of metal on glass, produce actual physical pain, and may break one's ear-drum.

Apart from deaf persons, the instrument should prove an asset in the hands of wireless experts and amateurs, for, instead of "listening in" for long periods with an uncomfortable and trying telephone headpiece on, one can hold the ossiphone and change its point of application as often as desired. Prolonged pressure on the head in the neighbourhood of the ear is itself liable to cause partial deafness, if only of a temporary character. An interesting example of this came within the writer's knowledge.

A friend of his wore spectacles and suffered from a considerable degree of deafness. Subsequently he went blind, and discarded his glasses, and the deafness almost immediately ceased. The pressure of the spectacle wires had caused his deafness.

The ossiphone contains no accumulator or dry cell, the current from the telephone circuit or the wireless receiving set serving to energise the electro-magnets. The case measures $2\frac{3}{4}$ inches by $1\frac{1}{2}$ inches by $1\frac{1}{8}$ inches, and, as already mentioned, can be carried in the waistcoat pocket. There is a neat little socket on one side into which the flex plug is inserted.

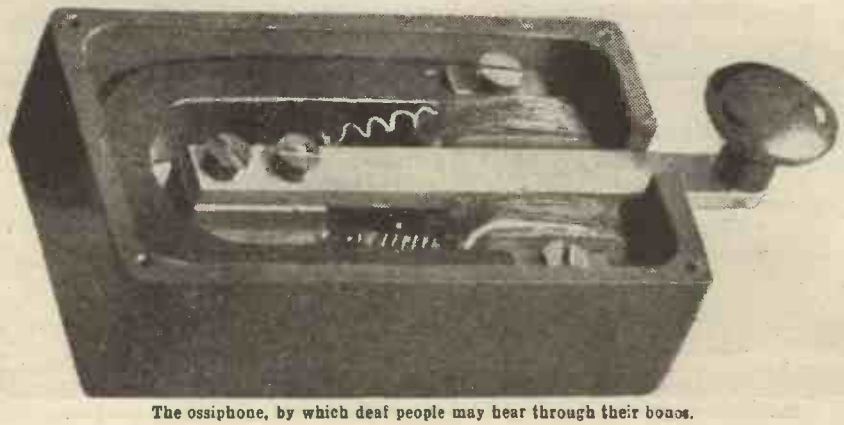
By using a relay and an aural box, sounds may be magnified enormously. Thus, I have held the ossiphone knob against my knuckle, and listened to the soft ticking of a watch that sounded like sledge-hammer blows.

Hearing without Ears.

The aural box is a separate instrument, and is used for carrying on a conversation with a deaf person in the same room. It comprises a box measuring about $8\frac{1}{2}$ inches by $4\frac{1}{2}$ inches by 7 inches high, with an opening on one side that diminishes in a scientifically proportioned curve, terminating at a microphone. Current is supplied by dry cells inside the aural box, and the aural box is connected to the ossiphone by any convenient length of "flex." The deaf person holds and uses the ossiphone as already described, and the other person faces the opening in the aural box—a good distance is about eighteen inches or two feet—and converses in the ordinary manner without any raising of the voice.

When a "loud speaker" is employed in conjunction with a wireless receiving set, the aural box and ossiphone may both be used by a deaf person, or, alternatively, the ossiphone alone may be used as already described.

Wireless has become so common that its wonders are apt to be overlooked. It is an amazing reflection that when a person speaks the power waves of his voice may be converted into electro-magnetic waves that course through the ether with the speed of light; and that with the aid of the ossiphone a deaf man may hear a man talking hundreds of miles away, independently of his very ears!



The ossiphone, by which deaf people may hear through their bones.

Wireless Voices for the Films

Our Contributor has a good imagination, but for all that there is a distinct possibility in the future he prophesies for the Cinema.

YET another wonder is about to be performed by wireless. The cinema audience of the near future will be able to watch the figures on the screen, and at the same time listen to the voices of the actors filling the hall.

Nor will the voices emanate from a gramophone, as has been tried in the past; they will be the actual voices of the performers carried direct to the cinema theatres by wireless.

After many experiments a method has been evolved by means of which the film projection machines in any number of cinematograph theatres, in no matter how scattered an area, can be synchronised with a key projection machine at the wireless broadcasting base.

At the broadcasting station the key projection machine throws the same picture on the screen as the other projectors in theatres all over the country are showing on their screens.

Working to Time.

To the very second, every cinema theatre in the scheme is showing exactly the same film. B-r-r-r-h! goes the signal to start from the wireless broadcasting station, and forty, fifty, or a hundred skilled operators in as many theatres commence projecting the film on the screen, and all the films thus started at the same moment are kept in perfect time with each other through the play, right up to the last moment.

In the meantime, at the broadcasting station, actors, supers, chorus, stage hands, orchestra, and all the other people necessary to make a play a success, have been assembled together.

The scenario writer has supplied speaking parts and sound effects just as though the production were to be given behind the footlights.

Every actor and actress, and every member of the chorus has his or her microphone, and, with their eyes on the screen, speak or sing their parts into the instrument, keeping their voices in time with their actions as portrayed by the film.

The audiences in the various picture theatres hear and see the actors in their parts in the play simultaneously.

If the play is of the musical type, the strains of the music will also be conveyed by wireless from one grand and special orchestra at the broadcasting station. An orchestra in the cinematograph theatre will not be necessary.

How it Will be Done.

Just imagine, while the screen is still dark, an invisible orchestra which seems to come from all parts of the cinematograph theatre at once—for loud-speakers will be placed all along the sides of the hall—striking up the overture, prior to the play actually commencing.

Once the actual film commences the success of the scheme depends upon the film operators at the various theatres keeping strict time with the signals sent out from the operator at the broadcasting station, and with the actors speaking or singing the parts keeping strict time with the actions of the characters on the screen.

Generally the actors will have taken part in the making of the film, and in speaking will be re-acting the play, and therefore keeping time to their own movements. This should not be difficult.

As they speak into their microphones their voices will be transferred to the wireless telephone station, where they are passed through the usual amplifiers, until the sounds are finally magnified many hundreds of times.

Every cinematograph theatre will have its receiving apparatus, and maybe six or a dozen loud-speakers distributed about the hall.

Once the actual performance begins the operator will find no difficulty in keeping time with the incoming sounds of voices or music. All he will have to do is to moderate or increase the speed of his machine as occasion demands. It will not even require highly exacting concentration, as the sounds will not be coming in with various speeds, but in regular time because both sounds and films are being synchronised at the base where they originate.

If the operator finds that he gets ahead for a second, he can readily slow up, or if he gets behind, one second speeding-up will rectify the fault, and once he has acquired the requisite speed he will probably maintain it without any further effort whatever.

At any rate, with a very little practice even the operator most distant from the broadcasting base will be able to time his machine perfectly, and the patrons of his cinema will enjoy an ideal performance.

When the Heroine Screams.

At the present time, an important part of an actor's art—the voice—is lost upon the screen. The heroine screams—at least, we surmise she screams—but the incident is robbed of more than half its realism because all we see is a soundless yawn.

We see the hero addressing sobering words of advice to a mob seething with desire to wage destruction, but we are not in the least affected by his speech, not knowing what words he is actually speaking. At times we are left to wonder how the crowd on the screen could have been prevailed upon to melt away so quietly as it does.

But when there are actors at broadcasting stations speaking, as the film is projected, the words to suit their actions as if they were performing before a crowded house, then the films will receive a very big "boost."

And the time is at hand when natural sounds will be supplied for the screen by wireless. In this direction the cinema may far outstride the theatre of the footlights. As the hero speeds to the rescue of the heroine in his powerful motor-car, the sound of the car may be the real thing and not the improvised "noises" now employed.

Pistol shots, banging of doors, can be reproduced "from life," and the quieter sounds, which even on the stage cannot be rendered so as to be audible all over the theatre, may possibly be reproduced most realistically by wireless.

The sound of a glass breaking as it rolls off a table, the laboured breathing of a struggling man, the stealthy footsteps that the hero hears as he lays awake—all these and many others may be reproduced in the future by wireless telephony.

Mary Pickford enjoys a little wireless music while resting between the filming of a new play.

All About Batteries

This is the second and concluding article describing the action and upkeep of batteries

CELLS may be connected together in various ways to form a battery. If we join the positive terminal of the first cell to one end of a wire and connect the negative terminal to the positive terminal of the second cell, and so on, connecting positive terminals to negative terminals until we have as many cells as we require, finally connecting the negative terminal of the last cell to the other end of the wire, we have a complete electrical circuit, and the cells are said to be connected together "in series." If all the cells are of the same type, and, taken individually, give the same voltage, the number of volts obtained in an electrical circuit by joining them together as described above will be the voltage of one cell, multiplied by the number of cells being used. See Fig. (1, A). Thus, if we had 4 cells so connected, and each cell supplied 2 volts, we should have a circuit containing 8 volts. A circuit of this nature contains a good amount of electrical pressure, or electro-motive force, but the strength of the current flowing in it is comparatively weak, and will not exceed the amount of current which would be given by any one cell singly. If we take the four cells and connect the four positive terminals to one end of the wire, and the four negative terminals to the other, as in Fig. (1, B), the cells are joined together "in parallel." The result of this arrangement is to give us different electrical values in the circuit. The electro-motive force or pressure is now reduced to the number of volts which would be given by any one cell singly, namely, 2, but the amount of current flowing in the circuit will now be the current given by one cell, multiplied by the number of cells we are using.

Various Combinations.

A combination of the above two methods is known as a "series-parallel" arrangement and consists of two batteries of cells connected in series, and the two batteries finally connected in parallel, as in Fig. (1, C). This style of connecting cells gives us a circuit which contains a good voltage, and a fairly good flow of electricity as well, and might therefore be supposed to be the best method of the three. In some cases, however, it is desirable to have a circuit where the strength of the current is of paramount importance, and in this case a "parallel" battery would obviously be the best to use. Likewise, a good voltage might be the only consideration necessary in a circuit, and in this instance the battery would consist of a group of cells connected together "in series." It is a battery of this nature, generally composed of dry cells, that is almost invariably used to supply the necessary voltage to the plate of the valve used on wireless receiving sets. It is then called an "anode battery," or more frequently a "high-tension battery." (Amateurs should be warned against trying to light the present type of valve with dry cells. The resistance of the filament is so great that this kind of cell will speedily become "discharged," if utilised to heat the filament to a satisfactory point.)

Faults in Cells.

One of the most prevalent faults in ordinary cells is "sulphating." When the cell is supplying a current for any purpose, lead sulphate is formed on the plates. When the cell is recharged, the lead sulphate is dispersed by the action of the charging current. If a cell is neglected or left idle, the lead sulphate will crystallise on the surface of the plate, and, being a bad conductor of electricity, affect the action of the cell. A sulphated cell should be given a good charge of long duration, the sulphate being difficult to remove. If this does not have the desired effect, it may be necessary to obtain fresh plates.

Local Action.

Great care should be taken, when the cover or lid of an accumulator is removed for any reason, to see that no foreign substance, like an iron filing or a pin, falls into the acid. If it does it will set up a process in the cell known as "local action." If we refer to the part of this article which deals with primary cells, we shall see the reason. We have introduced another tiny plate of dissimilar metal, and the acid will affect the pin or filing in the same manner as either the copper or zinc. Unequal action between the inadvertently introduced scrap of metal and one or more of the plates will take place, and a decrease in efficiency will result. It may even cause the disintegration of some of the plates, which will have to be replaced. When an accumulator or storage battery is delivering current to an external circuit, a tendency to expand is exhibited by both banks of plates. If a cell of this type is excessively discharged, the plates will begin to bend or buckle, and eventually will become so distorted in shape as to render impossible their removal from the container. This fault is known as "buckling," and is to some extent obviated by the inclusion of thin sheets of wood or glass placed between the plates.

Finally, when it is observed that the liquid in the cell is evaporating, and that the plates are beginning to show clear of the acid, do not remedy the deficiency by adding more acid. Distilled water should be used for this purpose, the plates being covered until they are at least half an inch below the level of the acid.

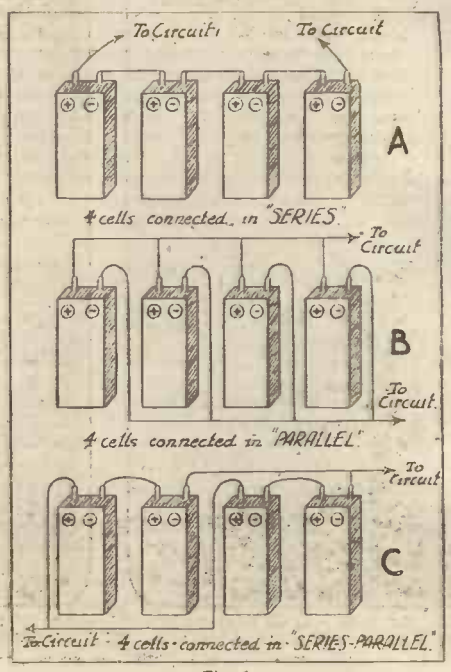


Fig. 1.

The Electrolyte or Acid.

The acid used in a storage battery is diluted by mixing it with water until it is of the right strength to give the best results. The strength of the solution varies for different types of cell, but is usually about 1 part of acid to 5 of water. The *specific gravity* or specified weight of the solution depends upon a comparison of it with the weight of pure water. As acid is heavier than water, a given quantity of the diluted acid in the cell would be heavier than a similar quantity of water. Thus, if a definite quantity of water be taken as 1, the basis for the values, the specific gravity of the solution will be approximately 1·2. The larger the proportion of acid to water in the solution, the greater will be the specific gravity of the electrolyte.

The Hydrometer.

The gravity of the solution in a cell is measured by an instrument called a "hydrometer." A simple form of hydrometer is a thin glass tube six to eight inches long, filled at one end with small shot or mercury, having various values of specific gravity calibrated upon it. If the hydrometer is dropped into a cell containing absolutely pure water, it will sink to the bottom and remain there. If, however, it is placed into a cell containing acid, it will only sink to a certain depth dependent upon the density or gravity of the acid. The specific gravity of the cell can then be read off from the calibrations marked on the hydrometer, at the surface of the liquid. We can thus easily ascertain if the cell has the correct strength of electrolyte. The terminals of a cell are usually plainly marked to prevent any error occurring when they are being connected up. The positive terminal is usually painted red in addition to the + mark, and the negative terminal black in addition to the — mark.

THE PROPER ADJUSTMENT OF AMPLIFIER AND DETECTOR.

SIGNALS can only be received when your detector is correctly adjusted, and it is therefore necessary to understand the proper methods of adjusting.

Mineral detectors depend for clarity of note upon the pressure and spot of the contact crystal. This must be varied until the clearest note is obtained through the 'phones from the test buzzer.

To adjust "soft" detector valves, connect the high-tension battery to the plate and raise the filament current gradually; then, when a slight hiss is heard in the 'phones, reduce the current until the hiss just stops.

The inductance must be set at its minimum value. Either by means of a potentiometer, which is the best way, or by variable battery taps, the plate battery voltage should at the same time be so adjusted that this hiss begins at as low a filament current as possible.

The majority of soft valves require a critical plate voltage of between 18 and 22 volts.

Many amateurs prefer a "hard" valve—*i.e.*, one possessing a high vacuum.

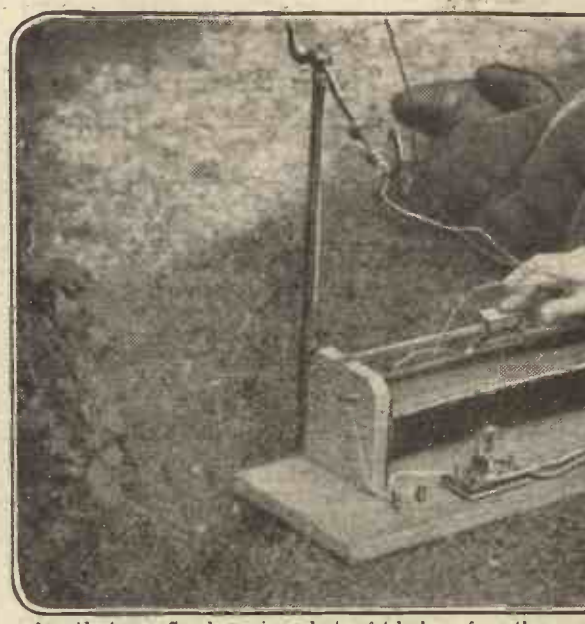
These hard valves have no "hissing" point. The best plate voltage should be found by trial, and is usually about 20 to 40 volts for a single valve.

Hard valve filaments are burned with just sufficient brilliancy to afford the highest signal strength. The amount of voltage required by the filament will depend upon the voltage applied to the plate.

Higher values of plate voltage usually give rather increased amplification of signals, though any voltage within the limits specified may be used on the plate valves.

GARDEN WIRELESS SECRETS

A little while ago the universal question was: "Do you jazz?" To-day it is "Do you wireless?" And, if you don't, why not? Wireless in the garden, as will be seen from the above photograph, is ideal in the summer.



A resident near Croydon enjoys plenty of telephony from the aero receiver, with an iron rod stuck in the grass for an "earth." Ama sin

The latest Parisian novelty is a vanity bag wireless set. The aerial is of the frame variety, and is concealed at the back of the bag. This type of set is of the freak genus, and, as such, is amusingly unique.

You can enjoy plenty of wireless "stunts" if you live near a wireless station. This Croydon resident uses a wire fence for an aerial and an accommodating dustbin for an "earth."

FROM THE ETHER

drome wireless station and from aeroplanes on the Continental air routes. He uses a crystal teurs who live close to wireless stations can amuse themselves in a variety of ways with a very ple type of crystal detector.

In this case he gets quite ingenious. The garden rake comes in handy as the aerial, but amateurs living in Scotland are not advised to try to pick up signals in this way from a station in London!

A SHIP'S WIRELESS CABIN

This photograph shows the interior of a wireless room on board a ship. The old magnetic detector, with the glass case front and the multiple tuner directly beneath, are used as an emergency receiver, the crystal detector being placed on the left of the table. The emergency 10" spark coil is also shown.

Boys will be boys—but they are out of mischief for a time. The new hobby has taken its hold, and thousands of keen amateurs are now hard at work constructing their own apparatus.

Step by Step in Wireless

No. 5.—HOW SPEECH IS SENT BY WIRELESS.

In this series of elementary articles the beginner will find the mysteries of wireless explained in simple, non-technical language.

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

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

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

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

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

A Simple Analogy.

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

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

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

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

The circuit also contains a transmitter and receiver.

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

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

Continuous Waves.

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

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

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

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

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

The variety of little marks visible on a gramophone record, each stand for a note or a word, or something which under the action of the needle is rendered intelligible to the human ear. We can see the wax and feel it; it is tangible.

But the something used in wireless telephony that corresponds to the wax in the case of the record, cannot be seen. It is a *continuous wave* such as is used in ordinary wireless telegraphy for transmission of "C.W." signals.

"Carrying" the Speech.

This wave corresponds to the father's back in one case, and to the wax of the gramophone record in the other. Continuous waves are propagated by means of a rapidly alternating or oscillating current of electricity generated in the aerial of the transmitting station.

They are uniform: in other words, they have the same amplitude, length, and velocity, and follow one another, as their name implies, continuously.

They also have a uniform frequency, which is much above the range of sensitivity possessed by the human ear, or the diaphragm of the telephones, and are therefore inaudible at the receiving station, as will be understood.

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

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

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

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

Wireless versus the Telephone.

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

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

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

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

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

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

HINTS TO AMATEURS.

IF you use pocket-lamp dry batteries for your "B" or Plate Battery, sandwich a piece of old inner tube between each section, and, above all, keep the cells away from damp.

* * *

Don't fix a galena crystal in heated metal, as the heat impairs the sensitivity of the crystal. The crystal should be held in its cup by three set-screws.

* * *

If you have a garden long enough, one line of 14-gauge copper wire is more efficient than a number of shorter wires, and is easier to erect.

Sometimes the tuning switch may grate or squeak on the contact studs. Cure this by keeping the studs clean and free from dirt.

* * *

Keep the spaces between contact studs free from dust or metallic particles. Use a small dry camel-hair brush when dusting.

* * *

A lead-covered roof will make a good "earth." This is due to a "dissipating" effect.

* * *

Aerials may not be slung across streets.

* * *

Loose connections mean bad faults.

WIRELESS CLUB REPORTS.

The Editor will be pleased to publish concise reports of the meetings of wireless clubs and associations, reserving the right to curtail the reports if necessary. An asterisk denotes affiliation with the Wireless Society of London.

The South London Wireless and Scientific Club.*

OUR meetings on Wednesday and Monday each week evidently "caught on," for our numbers have increased rapidly this last two or three weeks, and with the ever-increasing demand for expert practical and technical knowledge, we hope within a very short period to have created a new record.

The members have responded so well since our formation, in November, 1921, that demonstrations, lectures, etc., have entirely eclipsed any idea that imagination may have credited us with, and we hope that we shall be able to further our activities of being such a live organisation, solely devoted to the amateur in South London.

Recently our old friend Mr. Walsh gave us a very interesting lecture on "High Frequency," accompanied by practical demonstrations with a ten-inch spark coil, glass plate condensers, oudin coils, etc., besides furnishing us with very interesting data regarding the construction formulæ for this type of wireless transmission, and to whom we must tender our very best thanks.

This lecture was followed by Mr. Wilkinson, on "Cinematography," with special reference to kinematics, and this gentleman proved a most distinguished lecturer, as well as a very good linguist.

Forthcoming events, which include every date up to July, and full details as regards subscriptions, entrance fees, etc., may be had of the Assistant Secretary, Mr. Ansell, 69, Larcom Street, S.E. 17, or to the Headquarters, St. John's Institute, Larcom Street, S.E.17, where all meetings take place.

* * *

Bradford Wireless Society.*

A meeting was held in the clubroom at 7.45 p.m. on Friday, June 16th, with Mr. W. C. Ramshaw in the chair. The minutes of the previous meeting were read and passed, following which a few new members were elected.

The chairman then called upon Mr. J. Bever to give his lecture on "General Wireless Matters." This consisted in the main of a description of his own four-valve set, and was extremely interesting. During the course of his remarks Mr. Bever made several references to the increasing number of people using valve sets, who, not having the necessary knowledge to operate them, cause interference by allowing their apparatus to oscillate unnecessarily. Mr. Bever's set was on view, and is a very small, well-made piece of apparatus, fitting, as it does, in a moderate sized attaché case. The set was connected to the society's aerial, and excellent signals were obtained on short wave, including telephony from a local station. These signals were easily readable with the telephones lying on the table at the other end of the meeting-room.

Our next meeting on June 30th concludes the present session, but the committee have decided to continue the fortnightly meetings throughout the recess, when short elementary lectures and discussions will be given for the benefit of new members. Morse practices will also be held.

The chairman made an announcement urging all new members desirous of purchasing apparatus to consult members of the committee before deciding on what to buy, in view of the fact that there is a considerable amount of junk gear now being sold.

Hon. Sec.: Mr. J. Bever, 85, Emm Lane, Heaton, Bradford.

The Hackney and District Radio Society.

The first general meeting to discuss the formation of a Radio Society was held at 111, Chatsworth Road, Clapton, E.5, on June 8th, at 8 p.m.

It being the first meeting, the following officers were elected: Mr. D. Street, as chairman; Mr. E. R. Walker, secretary; Messrs. A. V. Morgan, D. R. Ison, A. Valins, T. Kuman, and F. Jenkins as the committee. Having agreed upon the above title, we settled down to work out a foundation. After making several resolutions, the committee stayed to a later hour, to bring them into motion at the next meeting.

Before the close of the meeting we had a general conversation, covering many working principles in wireless, together with the exhibition of some high-frequency transformers by Mr. A. Valins. It was decided to have a Morse class, also instructional help for our new members.

Considering all members being strange to each other, we got on well, the large attendance being a general surprise.

All inquiries as to membership will be gladly appreciated by the Secretary, at 48, Dagmar Road, South Hackney, E.9.

* * *

Guildford and District Wireless Society.

On Saturday, June 10th, by kind permission of H.M. Air Ministry, a party from the Guildford and District Wireless Society paid a very interesting and instructive visit to the London Terminal Aerodrome, Croydon.

The party travelled to East Croydon by train. The wonderful working and operation of the Croydon wireless station was explained at length by the chief operator. Unfortunately, "atmospherics" were very bad, and listening in was a little disappointing.

Also, for nearly an hour our keen interest was centred on the machines that ply between England and the Continent. A machine passed overhead, and someone remarked:

"That's the joy-'bus, ten shillings a trip."

On the whole, the day was thoroughly enjoyed by all, and undoubtedly all were feeling much wiser on Sunday morning. The society hope at an early date to be able to pay a visit to some other station in the neighbourhood. The secretary would be very pleased to hear from anyone who is interested in wireless, or to introduce them to the society's "set," which is open every Monday evening at 7 p.m., at 46a, High Street, Guildford.

Stoke-on-Trent Wireless and Experimental Society.*

On Thursday, June 15th, J. Gaskell, Esq. (Asst. Hon. Secretary), gave a lecture and demonstration on X-Rays. Questions were asked and answered regarding the relation of X-ray waves to wireless waves, and remarks were made concerning the similarity between the X-ray tube and the thermionic tube used in wireless communication. A vote of thanks was heartily accorded to the lecturer, the chairman expressing a wish that in the coming session we should have the pleasure of hearing Mr. Gaskell again.

We have opened a corresponding members' section for members unable to attend the ordinary meetings, and a technical committee has been formed to deal with questions put forward by them.

Those interested should communicate with the Hon. Secretary, F. T. Jones, 360, Cobridge Road, Hanley, Stoke-on-Trent.

LIST OF PRINCIPAL WIRELESS SOCIETIES IN GREAT BRITAIN.

The following list of the principal wireless clubs and associations in Great Britain has been compiled for the benefit of readers of POPULAR WIRELESS, who wish to join a wireless club. Full particulars, on mentioning this paper, may be had on application to the secretaries of the various clubs.—*EDITOR.*

WIRELESS SOCIETY OF LONDON.
Hon. Sec.: L. McMichael, 32, Quex Road, West Hampstead.

ALTRINCHAM WIRELESS SOCIETY.
Hon. Sec.: Breeze Crest, Plane Tree Road, Hale, Cheshire.

BIRMINGHAM EXPERIMENTAL WIRELESS CLUB.
Hon. Sec.: 110, Ivor Road, Sparkhill, Birmingham.

BLACKPOOL & FYLDE WIRELESS SOCIETY.
Hon. Sec.: 6, Seventh Avenue, South Shore, Blackpool.

(*Continued on page* 78.)

A demonstration at the Cardiff and South Wales Wireless Society's headquarters.

WIRELESS SOCIETIES IN GREAT BRITAIN.

(Continued from page 77.)

BRADFORD WIRELESS SOCIETY.
Hon. Sec. : 85, Emm Lane, Bradford.

BRIGHTON RADIO CLUB.
Hon. Sec. : 68, Southdown Avenue, Brighton.

BRISTOL & DISTRICT WIRELESS ASSOCIATION.
Hon. Sec. : 5, Pembroke Vale, Clifton, Bristol.

BURTON-ON-TRENT WIRELESS SOCIETY.
Hon. Sec. : 66, Edward Street, Burton-on-Trent.

CAMBRIDGE UNIVERSITY WIRELESS SOCIETY.
Hon. Sec. : D. Wade, Esq., 16, Trumpington Street, Cambridge.

CARDIFF & SOUTH WALES WIRELESS SOCIETY.
Hon. Sec. : 16, Adamsdown Square, Cardiff.

CRYSTAL PALACE & DISTRICT RADIO SOCIETY.
Hon. Sec. : 25, Beckenham Road, Penge, S.E. 20.

CITY & GUILDS WIRELESS SOCIETY.
Hon. Sec. : City & Guilds Engineering College, Exhibition Road, London, S.W. 7.

THE CORINIUM WIRELESS SOCIETY.
Hon. Sec. : The Old Vicarage, Cirencester.

COWES & DISTRICT RADIO SOCIETY.
Hon. Sec. : Pretoria, Castle Street, East Cowes, I.O.W.

CROYDON WIRELESS & PHYSICAL SOCIETY.

Hon. Sec. : Meadmoor, Brighton Road, Purley, Surrey.

DARTFORD & DISTRICT WIRELESS SOCIETY.
Hon. Sec. : 84, Hawley Road, Wilmington, Dartford.

DERBY WIRELESS CLUB.
Hon. Sec. : 1, Littleover Hill, Derby.

EAST-KENT WIRELESS SOCIETY.
Hon. Sec. : 8, Longford Terrace, Folkestone.

EDINBURGH & DISTRICT RADIO SOCIETY.
Hon. Sec. : 9, Ettrick Road, Edinburgh.

THE FOLKESTONE & DISTRICT WIRELESS SOCIETY.
Hon. Sec. : 8, Longford Terrace, Folkestone.

GLASGOW & DISTRICT RADIO CLUB.
Hon. Sec. : 7, Queen's Gardens, Glasgow.

GLEVUM RADIO & SCIENTIFIC SOCIETY.
Hon. Sec. : Burfield, St. Paul's Road, Gloucester.

GLOUCESTER WIRELESS & SCIENTIFIC SOCIETY.
Hon. Sec. : 1, Jersey Road, Gloucester.

WIRELESS SOCIETY OF GREENWICH.
Hon. Sec. : 18, Blackheath Rise, S.E.

HALIFAX WIRELESS CLUB.
Hon. Sec. : Y.M.C.A., Clare Hall, Halifax.

WIRELESS SOCIETY OF HULL & DISTRICT.
Hon. Sec. : 16, Portobello Street, Holderness Road, Hull.

LEEDS & DISTRICT WIRELESS SOCIETY.
Hon. Sec. : 37, Mexborough Avenue, Leeds.

LEICESTERSHIRE RADIO SOCIETY.
Hon. Sec. : 269, Mere Road, Leicester.

LINCOLN & DISTRICT WIRELESS SOCIETY.
Hon. Sec. : 168, West Parade, Lincoln.

LIVERPOOL WIRELESS ASSOCIATION.
Hon. Sec. : 98, Ampthill Road, Liverpool.

LUTON WIRELESS SOCIETY.
Hon. Sec. : Hitchin Road Boys' School, Luton.

RADIO SCIENTIFIC SOCIETY OF MANCHESTER.
Hon. Sec. : 16, Todd Street, Manchester.

MANCHESTER WIRELESS SOCIETY.
Hon. Sec. : 1, Parkwood, Victoria Park, Manchester.

NEWARK-ON-TRENT WIRELESS SOCIETY.
Hon. Sec. : 44, Hatton Gardens, Newark-on-Trent.

NEWCASTLE WIRELESS ASSOCIATION.
Hon. Sec. : 51, Grainger Street, Newcastle-on-Tyne.

NORTH LONDON WIRELESS ASSOCIATION.
Hon. Sec. : c/o Superintendent, Peabody Buildings, Essex Road, N.

NORTH MIDDLESEX WIRELESS CLUB.
Hon. Sec. : Nithsdale, Eversley Park Road, Winchmore Hill, N.

NORTH STAFFS RAILWAY ELECTRICAL DEPT. WIRELESS SOCIETY.
Hon. Sec. : 87, Spencer Road, Shelton, Stoke-on-Trent.

OLDHAM LYCEUM WIRELESS SOCIETY.
Hon. Sec. : Oldham Lyceum, Union Street, Oldham, Lancs.

PLYMOUTH WIRELESS & SCIENTIFIC SOCIETY.
Hon. Sec. : 9, Ryder Road, Stoke, Devonport.

PRESTON SCIENTIFIC SOCIETY.
Hon. Sec. : 119a, Fishergate, Preston.

SHEFFIELD & DISTRICT WIRELESS SOCIETY.
Hon. Sec. : 18, Linden Avenue, Woodseats, Sheffield.

SOUTHPORT WIRELESS SOCIETY.
Hon. Sec. : 26, Hartwood Road, Southport.

STOCKPORT WIRELESS SOCIETY.
Hon. Sec. : Mersey Chambers, King Street East, Stockport.

SUNDERLAND & DISTRICT AMATEUR RADIO SOCIETY.
Hon. Sec. : 15, Ridley Street, Southwick-on-Wear.

SUSSEX WIRELESS RESEARCH SOCIETY.
Hon. Sec. : Technical College, Brighton.

THREE TOWNS WIRELESS CLUB.
Hon. Sec. : 9, Ryder Road, Stoke, Devonport.

TYNEMOUTH (BOROUGH OF) Y.M.C.A. AMATEUR WIRELESS SOCIETY.
Hon. Sec. : Y.M.C.A. Buildings, Bedford Street, N. Shields.

WANDSWORTH WIRELESS SOCIETY.
Hon. Sec. : Technical Institute, High Street, Wandsworth.

WEST LONDON WIRELESS ASSOCIATION.
Hon. Sec. : 19, Bushey Road, Harlington, Middlesex.

THE WILLESDEN WIRELESS SOCIETY.
Hon. Sec. : 87, Mayo Road, N.W. 10.

WIRELESS & EXPERIMENTAL ASSOCIATION.
Hon. Sec. : 18, Melford Road, S.E. 22.

WOOLWICH RADIO SOCIETY.
Hon. Sec. : 42, Greenvale Road, Eltham, Kent.

YORK WIRELESS CLUB.
Hon. Sec. : 16, Wentworth Road, York.

QUESTIONS ABOUT THE VALVE

What is a valve?

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

* * *

What is a grid?

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

* * *

What is the plate?

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

* * *

What is the filament for?

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

* * *

What is the plate for?

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

* * *

What is the grid for?

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

* * *

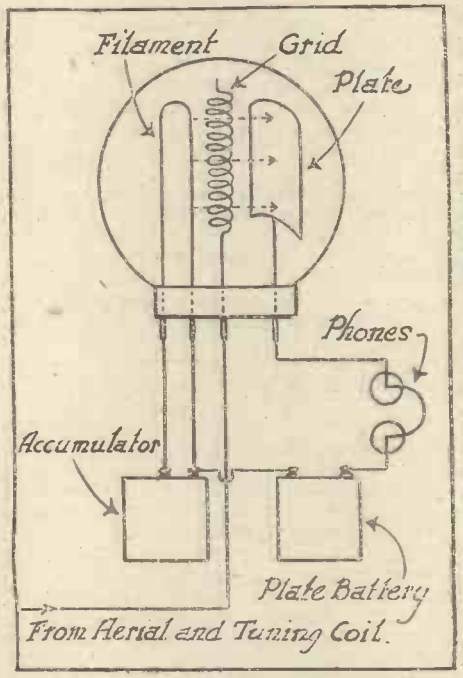
How does the valve detect?

Look at the little sketch and you will see the filament, the grid, and the plate, inside the glass globe. In an actual valve, the filament might be a vertical wire passing through the centre of the coiled wire grid. Surrounding the filament and grid would be the nickel tube which we call the plate. Directly the 4-volt accumulator is switched on, the filament becomes almost white hot, and the electrons, or small charges of negative electricity, are thrown off from the filament and fly to the plate, which, being positive, attracts negative. On the way from the filament to the plate the electrons are bound to pass through the coils of the grid, which remains positive and negative alternately.

* * *

What happens when the grid is positive?

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



Whilst the grid is negative, what happens to the electrons?

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

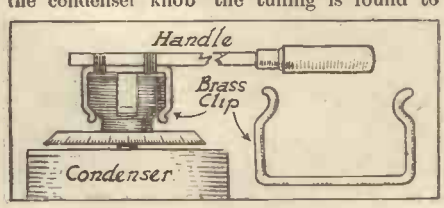
* * *

To sum up—

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

A CONDENSER HANDLE

FOR the reception of continuous wave signals, it is necessary to employ either reactance in the circuit, or a separate "heterodyne" system. When the receiving set is thus arranged, it will sometimes be noticed that when adjusting the variable condenser the capacity of the hand gives the condenser what may be termed a false value. The signals are "tuned in" apparently to the proper point, but immediately the hand is removed from the condenser knob the tuning is found to be incorrect. This can be remedied by the addition of a handle about a foot or eighteen inches long, which can be attached to the condenser knob in the following manner:



Two strips of brass are cut to fit closely over the condenser handle when bent as shown in the illustration. By bending them in this manner they will be found to act as clips, and should be placed over the condenser knob at right-angles to each other after being clamped together at the point where the two strips cross. The handle, which should be made of hardwood or ebonite, can be attached to the top strip of metal by insulating tape or waxed thread. True tuning can then easily be obtained, and it will be found that much finer adjustments of the condenser are possible when use is made of the long handle than when variation is carried out by moving the actual condenser knob with the hand.

The Warning in the Air

So quickly is the application of Wireless to the cause of justice progressing that this article tells of innovations which have been introduced since the first article of this series was written only a few weeks ago.

AS stated in last week's issue, the police of this country are keenly on the alert to the possibilities of adapting wireless to the suppression of crime.

The Chief Commissioner of Police himself is devoting a great deal of attention to the recent rapid progress of the science.

He believes that the portable wireless set has unlimited possibilities, and will be an important and useful factor in the future in the tracking down of a man endeavouring to escape the arm of the law.

Experiments have been going on at Scotland Yard for the last four months, and tests have been made to bring wireless to their aid in the difficult task of maintaining a continuous and constant communication between headquarters and officers on the track of the lawbreaker.

In one of the upper rooms of the building at New Scotland Yard the Chief Engineer of the Yard is personally supervising experiments with a powerful receiving set.

It is useless for them to try to run before they can walk, but, although the active department of the Yard is quite a young one, the men in charge are aiming at big results which they hope, in the fulness of time, to achieve.

Many problems will have to be entertained and solved before every police motor has its own portable set by means of which its occupants can report their every movement to headquarters, and in return receive later instructions, or even advice of news coming in from other quarters. Nevertheless, the London police hope to have this scheme in working order eventually.

The advantages of such a scheme are obviously apparent, and its inauguration is anxiously awaited by the members of the "Flying Squad," than whom no one can greater appreciate its utility.

This "squad" is a separate and mobile body of officers, whose base is Scotland Yard, but, with motor-cars at their disposal, hold themselves in constant readiness to go to any part of London to take up a case or pursue a fleeing fugitive.

It has proved its value on many occasions since its inauguration, but the equipping of its cars with wireless, and thereby making communications possible with H.Q. even after the cars have left the Yard, would greatly enhance the "squad's" utility and mobility.

Another great use to which portable wireless sets could be put is the equipping of the cars of the most important heads of the Yard. The "Big Four," as the area superintendents have been popularly termed, would find wireless very useful if their cars were fitted with it, to enable them to keep in close touch with their areas at all times.

If the perfecting of wireless communication proceeds at the rate it is now progressing, small portable transmitting sets may be invented to more than double the use of the wireless sets in the police cars.

But there are many more difficulties in the way here. The task of preventing interference is one. As they pursue their way at top speed on varying roads, cars must be able to talk to each other without either interfering with, or having their own messages rendered indistinct by interference of any sort from other privileged transmitting sources.

Then, again, will crop up the problem of secrecy. The messages sent out between C.I.D., H.Q. and its officers, if broadcasted, will stand every chance of being picked up by the criminal himself, for modern lawbreakers arm themselves with the very latest scientific improvements. If the police are making high endeavours to benefit themselves by the power that wireless can give them, you can rely on the fact that the modern crook is studying the subject too.

These are only a few of the problems the police of this and other countries are devoting great attention to.

In the U.S.A., the New York and Chicago Police Departments report yet another step forward in this adaptation of wireless to the causes of law and order.

Like London, both these cities have fitted their police headquarters with a very full wireless equipment, and have inaugurated special departments for experimental and research work in the possibilities of wireless in the detection of crime.

The headquarters of the police in both these towns have wireless transmitting stations, which broadcast the news of every fresh crime over an area of thousands of miles directly it is reported to them.

Both police forces, too, possess motor squads similar to our "Flying Squad," and have their cars fitted with both transmitting and receiving wireless sets. By means of these, communications have been kept between cars travelling at fifty miles an hour.

They have a miniature set, with which, as soon as they can be manufactured in sufficient numbers, every policeman in Chicago will be equipped.

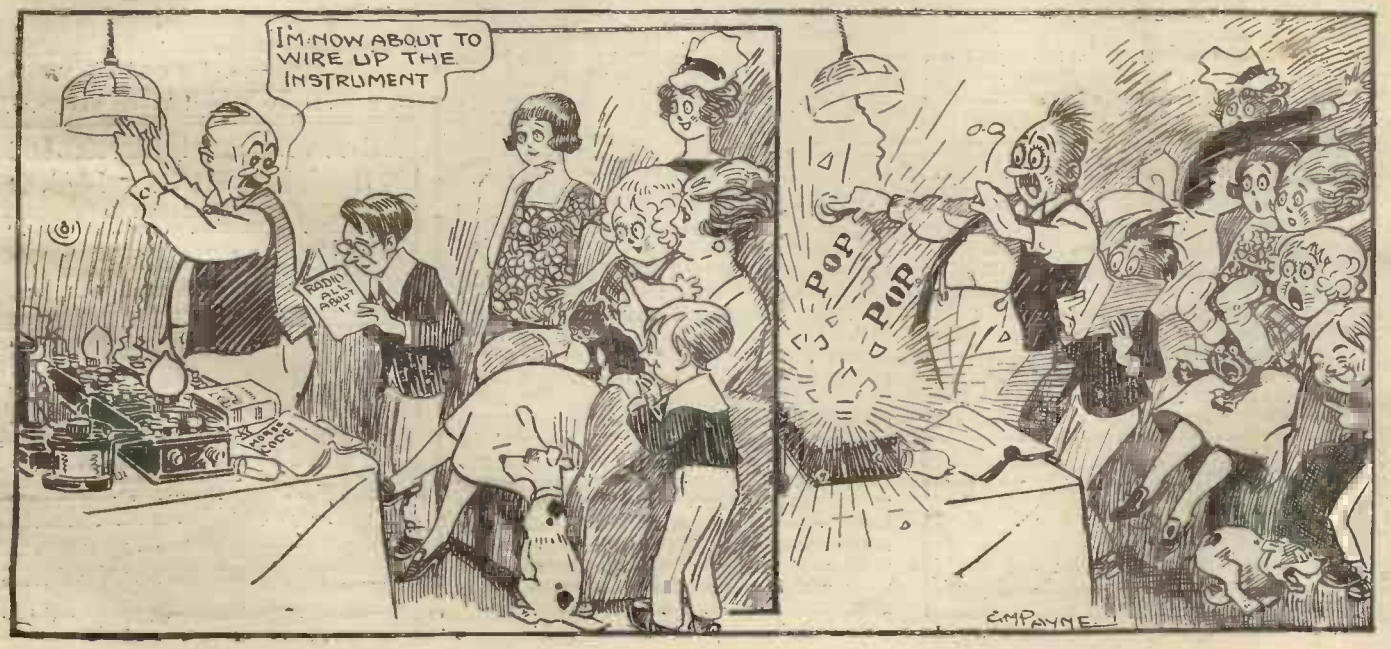
Owing to very generous, but nevertheless unwise, lack of restrictions, permissions to broadcast have been granted in America to far too many people. Interference is a bugbear over in the States through the air being overcrowded with etheric messages.

In Paris the police are calling wireless to their aid in new directions every day. Additional patrol motor-cars are being equipped with wireless apparatus as quickly as circumstances permit.

Already reports from the French capital prove that wireless has had very big effects in checking the crime wave within its walls.

It is quite possible that in the future, in this and in other countries, as soon as a big crime is reported *all* wireless communications will be suspended for a period, except police calls.

FATHER TRIES THE A.C. MAIN FOR VALVES.



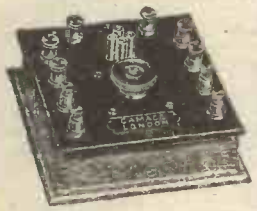
GAMAGES Still Maintain the Lead in Wireless for Amateurs

We will erect your aerial for you at a nominal cost. Advice on any wireless matter gratis.

Gamages are the Pioneers of the Wireless Industry for amateurs and willingly place their vast experience at your service. We can supply or quote for anything wireless. Our goods are the cheapest on the market, when quality and reliability are considered.

Our wireless expert will instal any apparatus supplied by us for mere out-of-pocket expenses ∴ if desired. ∴

"Sonus" Unit Valve Panel



Designed to obviate the use of several separate parts in a valve receiving set. Having the necessary inductance and condenser, all that is required is to connect them up with this panel and a valve receiving circuit is completed for the reception of all kinds of signals (C.W. Telephony and spark).

The panel comprises valve holder, filament resistance, grid condenser and leak, 'phone condenser and the necessary terminals for connections. The positions of the latter are clearly engraved on the panel. Finished in polished Mahogany and Ebonite with heavy brass terminals. Size 7 x 7 x 3 Price **37/6**

Experimental Change-over Panel

A specially-designed panel for changing over from one set of receiving apparatus to another in one operation. The continual changing of connections is entirely eliminated when using this panel. When comparing results on two receiving sets, it is essential to change from one to the other immediately, and in this the value of the panel is most pronounced. One high-tension battery, one accumulator and one pair of telephones will suffice for both sets of apparatus under test. Highly-finished in polished mahogany, ebonite (matt with polished bevelled edge) and burnished lacquered brass. Size 12 in. x 7 in. x 3¼ in. Price **30/-**

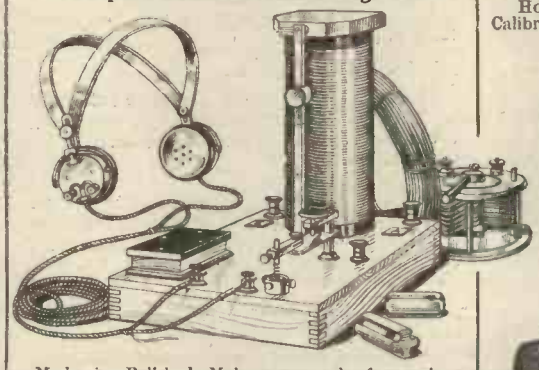
Terminal Panel

This is an extremely useful piece of apparatus for connecting 'phones and batteries in a valve circuit and many other kindred reasons where it is essential to have good connections at difficult junctions. Professionals, as well as amateurs will appreciate the advantages of this little panel. Subsurface wiring. Beautifully finished in matt ebonite ¾ in. thick. Sizes 5½ in. x 2¾ in. x 1½ in. Price **12/-**

Single Valve Amplifier

This instrument will double the value of any single valve receiver. Quiet in operation, and gives exceedingly good amplification when signals are received. Recommended for telephony. Easily connected to any one valve receiver. Handsomely finished in polished mahogany and ebonite, and fitted with heavy brass terminals. Size approx. 7 in. x 5 in. x 4 in. Price **75/-**

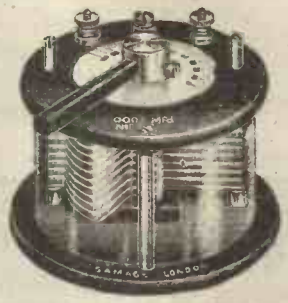
Complete Home Receiving Set



Made in Polished Mahogany, and of superior workmanship throughout. Designed to cover a range of wave lengths from 300 to 2,000 metres, and to receive telephony messages from broadcasting stations over 20 miles. Spark telegraphy up to 200 miles. Paris Time Signals, Ship and Station messages—all can be obtained. No complicated circuits to join up. A complete unit, including our No. 1 ·0003 variable condenser (as shown) ready for working. Price **£4/19/6**

Nos. 1 and 2 Air Dielectric Type Variable Condenser

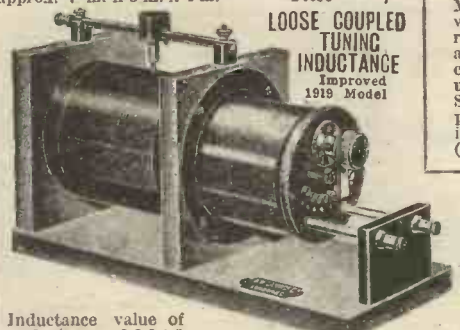
(Faraday House Calibration.)



This instrument is one of the neatest obtainable. It is of the best workmanship, electrically and mechanically perfect. It has 10 fixed and 9 moving vanes, and a maximum capacity of ·0003 mfd. Top and bottom panels of matt ebonite, with polished rounded edges. Fitted with engraved ivorine scale as shown. A handsome and efficient condenser. Price No. 1 **25/-**
No. 2, ·00045 mfd. **33/6**

LOOSE COUPLED TUNING INDUCTANCE

Improved 1919 Model



Inductance value of primary 0·0015 Henry. Do. Secondary, between terminals: o-1 0·00025 H.; 0-2 0·00050 H.; 0-3 0·00074 H.; 0-4 0·0010 H.; 0-5 0·0012 H.; 0-6 0·0015 H.; 0-7 0·0020 H. A most sensitive and selective Tuner; better results than the ordinary "Tight" type. The secondary of our Transformer is tapped off in eight sections, and brought out to studs mounted on ebonite and operated by a rotary pick off switch. The sliding contact permits of the primary being selected at every turn. If a variable condenser be used in shunt or series with the inductance, atmospherics can be partly cut out and strength of signals increased. All metal parts insulated with ebonite. **50/-**

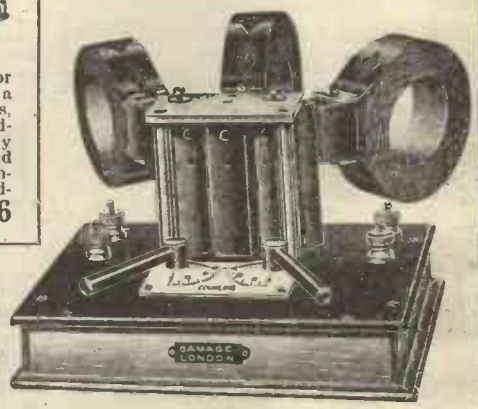
Honeycomb Inductance Coils.

The following table shows the number of the coils and the wave length they cover with the use of a ·001 mfd. variable condenser:

Approx. wave range in conjunction with ·001 MFD. Variable Condenser

Metres	Price	Metres	Price
170—375	5/-	1340—4800	9/5
200—515	5/2	1860—6300	10/3
240—730	5/2	2340—8500	10/6
330—1030	5/6	2940—12000	11/-
450—1460	7/-	3100—15000	11/10
660—2200	7/10	5700—19000	12 8
860—2850	8/8	5900—21000	14/-
1120—4000	9/-	7200—25000	15/-

The "Multi" Tuner



A specially designed stand to carry our Honeycomb coils. Very simple in construction and most practical in use. Three coils may be mounted together, either as primary, secondary and reactance, or in accordance with the ideas of the user. The central coil is stationary, whilst those at either side can each be moved through an angle of 90°, thus giving a large variation of coupling. Connections from the coils are brought out to terminals as shown. Finished in polished mahogany and ebonite, with burnished and lacquered brass fitments. A really handsome and efficient piece of apparatus. Size 8 in. x 6 in. x 5 in. Price **32/6**
Cheaper quality, price **20/-**.

Write to-day for Gamages Free Wireless Catalogue, full of good things for the Amateur.

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

RADIOTORIAL

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

I must say right away how very much I appreciate the letters sent to me by readers of POPULAR WIRELESS.

Judging by their general tone I gather that this paper supplies a long-felt want. If that is so, I am at least repaid tenfold.

It is impossible to reply to every individual reader who sends in his or her congratulations, because my staff are already overworked in answering technical queries sent in by readers.

But I want to take this opportunity of thanking all those who so kindly wrote to me and gave their frank and candid opinions of POPULAR WIRELESS. There is nothing so stimulating as criticism.

I will admit that I was a little alarmed when I saw the enormous number of letters and queries that arrived with every post; but the loyal co-operation of my staff soon dispelled those fears.

If readers who sent in queries failed to get their replies by an early date, I ask them to be patient and remember that if they had been answered in the pages of POPULAR WIRELESS, IT WOULD HAVE TAKEN MONTHS TO DEAL WITH ALL THE QUESTIONS.

The response to my invitation for readers to send in photographs has been so good that I am making a further offer. I will award 10s. 6d. to the owner of every photograph printed in POPULAR WIRELESS, and £2 2s. to the reader who sends in a photograph most suitable for publication on the cover.

Address your photographs to:

The EDITOR,
POPULAR WIRELESS,
Fleetway House,
Farringdon Street,
London, E.C.4,

and mark the envelope "Photo" on the left-hand corner.

Questions Answered

T. H. H. (Upper Tooting) says he is going to erect an aerial from a chimney stack to that of a neighbour's, a distance of about 50 feet, and about 30 feet high. By taking the aerial to another stack further away, he can get an aerial of 100 feet, one end of which will be only 25 feet high instead of 30. Which would be better; to lose height or length?

Height is very important, but in these circumstances it would not justify the loss of 50 feet in length in order to avoid the reduction in height at one end by 5 feet.

K. L. D. (East Sheen).—How can I charge my accumulator from 210-volt direct current house supply?

Unless you have considerable experience of electrical work, don't. 210 volts can give you a shock, and you might blow the fuse. The charging rate of an accumulator might coincide with or be above the usual current consumption of the lights. If so it can be placed in series with the main, but this sort of thing is very dangerous for the amateur to meddle with.

* * *

W. T. (Hartshill).—Does the wire run under the ground past the length of the aerial? If so, how can you communicate with anyone if the wire under the ground does not reach the person to whom you wish to speak?

Why is it called *Wireless*? There is no metallic connection between the transmitting and receiving stations. An earth connection is necessary only to get some good connection with the earth, which is a universal conductor. A water pipe is excellent, but an iron rod driven into the ground would do.

* * *

C. V. (Dulwich).—Must an aerial wire be level, or could one point be, say, 30 feet high, and the other 20 feet?

Horizontal aerials are to be preferred, but do not reduce height to do this; height is all-important.

* * *

M. C. G. (Essex).—What are "honeycomb" coils used for, and why?

Primary, secondary, and reactance in valve receiving circuits. By the use of these coils the self capacity of the circuit is reduced to a minimum.

* * *

L. H. (Durham).—Can ordinary telephones be used for wireless?

Not successfully.

* * *

H. A. T. (London).—If I replaced the telephones for a buzzer, would it work and repeat the Morse signals received on the aerial?

It would not.

* * *

G. M. (Croydon).—What value would an inductance have to be to bring my tune side (Mark III receiving set) up to 1,500 metres? The condenser is ·001 mfds.

630 microhenrys.

* * *

"CURIOUS" (Eltham).—How do aeroplanes make their earth connections?

An aeroplane uses its engine, to which most of the bracing wires are electrically connected, as an earth. This is known as a capacity earth. All aerials and earths can be likened to condensers, the aerial forming one plate and the earth, whatever it is, the other.

* * *

E. C. M. (London).—Up till quite recently I have been receiving excellent telephony on my Mk. II. A few days ago it commenced "howling" every time I switched the current on, completely preventing the hearing of signals.

Without doubt, a broken or faulty connection. Examine both exterior and interior connections thoroughly.

* * *

B. M. (London).—My earth lead to the water pipe is 20 feet, but to get down to the earth it will have to go down this pipe at least another 70 feet. Is this taken into account?

No; "earth" in this case is the water pipe.

* * *

S. P. (Walsall).—Would it be possible to detect Morse signals on a buzzer using a crystal receiver?

No, it would not. The received current is extremely small and the only buzzer it would actuate is the high resistance telephones that are used. In that sense these are buzzers, aren't they?

* * *

R. T. (B'ham).—Would a frame aerial be suitable for use with a crystal receiver?

No, not at all suitable. The range would be extremely small, only a mile or so.

* * *

"PUZZLED" (Glasgow).—Should not your sketch on page 17 have four wires leading to the receiver instead of one? I note that each wire has been insulated.

This sketch heading "Topical News and Notes," is not intended to be diagrammatical. In any case, the four wires would group to one common lead-in.

* * *

W. H. P. (L'pool).—Do you think the P.M.G. would object if I fixed my aerial to a telegraph pole?

Yes. And, in any case, it would not be a very sound scheme. With the three-valve set you intend to use, you would hear much more land line conversation than wireless signals.

* * *

W. F. G. (Bushey).—Are any batteries or accumulators required with the 35s. receiving set described in number one?

No.

* * *

W. S. (Farnborough).—I wish to communicate at will with a friend 75 miles away by wireless.

The P.M.G. will only issue transmitting licences for stated and definite experimental purposes. The power is limited to 10 watts, and this, in any case, would not allow of communication over this distance.

(*Continued on page 84.*)

WIRELESS QUESTIONS ANSWERED.

(Continued from page 82.)

H. R. H. (Rock Ferry).—Does light or darkness affect wireless waves ?

Yes. Signals are much stronger at night, and the range of transmission considerably increased.

* * *

Does the direction in which the aerial points in relation to that of the transmitting station affect the strength of the signals received ?

Yes. Signals will be stronger from a certain station if the instrument or lead-in end is pointing towards it. This is the principle of wireless direction finding.

* * *

P. H. (Darlaston).—Would putting two crystals "in cascade" improve reception ?

No. By doing so the received current would be greatly reduced owing to the increased resistance offered.

* * *

W. D. (Walsall).—Having seen how simple it is to erect a receiver in number one, I wish to know whether if I increased everything in proportion using same materials I could receive up to, say, 100 miles.

No. By increasing the size of the inductance, for instance, you would increase the wave-length maximum of the set. The range of reception does not depend on this, however. It is the sensitiveness of the crystal detector and the efficiency of the aerial that count.

* * *

C. J. B. (Essex) asks if a potentiometer is necessary in a crystal set.

Not every type of crystal needs a local battery circuit-and potentiometer. Carborundum does, but silicon and many other crystals do not. (See article on crystal detectors.)

* * *

"Novice" (Grantham) asks how stations working in the Morse code may be recognised, and how the origin of telephony may also be determined.

All stations are given call signs. The majority of stations have three-letter call signs, although some have two and four.

Paris, for example, has a two-letter call sign, F L, and when you hear "C Q, C Q, C Q *de* F L," the following is the explanation :

"C Q" is a call sign meaning "All stations." Paris calls C Q and separates this call by the sign "de" (— . . — . in the Morse code), and then gives her own call sign, F L, to indicate the name of the station that is calling all other stations. The station calling always gives its own call sign *after* the sign *de*.

The call sign of the station to whom another station wishes to communicate is always given first, *i.e.*, B R M *de* G L D, or, Land's-End Wireless Station calling the steamer "Hunnie."

"George Hague" (Doncaster) asks what sort of receiver he would require for signals from the Hague and Paris.

You will get Morse from Paris on a good crystal set, but for telephony reception you will require a valve receiver. Using one valve you would get only poor results from Paris and the Hague in Doncaster, but with two or three stages of amplification you should get excellent results. The Hague concert is only sent on Sundays, but Paris sends regular Morse and telephony every day. (See Broadcasting Programmes.)

* * *

M. H. (Leeds) asks how "deep down" he should bury his "earth" plate, and whether old tin cans, etc., would make a good "earth."

Two or three feet would be a good depth. Choose your ground plot where there is plenty of damp. The "tin can" type of earth you suggest would not act at all well, unless you connected each can, etc., together. By soldering them (a long job if you use small tins) together you could construct a fairly good earth, but it would be simpler to use a "one piece" earth. A sheet of copper or some good wire netting would do very well.

* * *

"Pessimist" (Lincoln) says he heard telephony last Tuesday from a station called "Two Emma Top." He expresses weary resignation at this enigma, and asks for a translation.

If you are a beginner you may well be surprised. "Two Emma Top" is not a lady amateur as you suggest, but is the Marconi station at Writtle, near Chelmsford. The call sign of this station is 2 M T, and the operator, in stating the sign, announces it as "Two Emma Top" in order that the individual letters may not be misunderstood. Army signallers started this game. They referred to A as "Ack" and B as "Beer," so that A B would be spoken over the 'phone as "Ack Beer," which often startled the novice. Letters are sometimes so distorted when spoken by 'phone or wireless (though very rarely in the latter case) that these precautions are necessary. Therefore, we cannot give you an introduction to "Miss Two Emma Top."

* * *

"New Hand" (New Cross) asks the meaning of the following mystic letters : H.F. ; L.F. ; A.T.I. ; H.T. ; L.T. ; E.M.F.

H.F. = High Frequency ; L.F. = Low Frequency ; A.T.I. = Aerial Tuning Inductance ; H.T. = High Tension ; L.T. = Low Tension ; E.M.F. = Electro-Motive Force. The unit of E.M.F. is the Volt.

* * *

E. A. W. (Manchester).—In the article "How to Make a Receiver for 35s." the diagram Fig. 3 shows no battery. Is this correct ?

Yes. No battery is required with a receiver of this type.

* * *

F. L. (Sheffield).—Can music be received on a crystal detector set ?

Yes, quite well within a range of 15-20 miles.

* * *

C. J. R. V. (Newcastle-on-Tyne).—Does the Post Office licence entitle one to erect an aerial across a street ?

No.

* * *

S. A. (Darlington).—Will our electric light supply (250-volt A.C.) interfere with reception ?

Yes. Using valves you will doubtless experience some interference. Endeavour to keep all the apparatus and leads as far away from the wiring as possible.

* * *

G. F. M. (Woodford).—Can amateurs have an official call ?

Only in the case where a licence is granted for the purpose of transmission.

* * *

G. D. (Dulverton).—The main supply is 230 volts direct current. Could I use this for my plate current ?

No. The pressure is too great. Even should you reduce this by inserting resistance it would not be suitable. It would be too "noisy."

* * *

T. T. T. T. (Birmingham).—Should I be compelled to get out a licence if I have no fixed aerial ?

You would.

D. W. D. (Strood).—I have wound my inductance with 28 d.c.c. Is there any way of testing the winding to make sure that there is no break in the wire ?

Connect one terminal of a dry battery to the one end, and the other terminal to one of the telephone receiver leads. You can then test the continuity of the winding by touching the other receiver lead to the free end of the coil. If it is O.K. a distinct click will be heard.

* * *

J. T. (Redcar).—What is galena, silicon, and carborundum, and where can they be obtained, and at what price ?

Galena and silicon are mineral crystals, and carborundum a chemical combination of carbon and silica. If required for wireless purposes they should be procured from a firm specialising in this apparatus, as all specimens are not suitable. Price is 6d. to 1s. per specimen.

* * *

"Rag Time" (Dorking).—I am constructing the "rag and bone" set. To what wave-length could I tune ?

With 100 feet aerial about 800 metres.

COMPETITION RESULTS.

The entries for the second Broadcasting Competition were even more numerous than those for number one, but I have finally decided to award prizes to :

Mr. Peter Dow,
23, Graham Avenue,
Kilbowiehill,
Clydebank.

Mr. G. Parsons,
51, Brettell Street,
Dudley, Worcester.

Mr. J. L. Wright,
8, Norbury Parade,
London, S.W. 16.

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No. 6. PACKED WITH PICTURES AND EXPERT ADVICE

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No. 6. Vol. 1.
July 8, 1922

KING'S NORTON WIRELESS CLASS

CONTENTS OF THIS :: ISSUE ::

SIR WILLIAM NOBLE ON BROADCASTING

QUESTIONS AND ANSWERS ABOUT WIRELESS, BY E. BLAKE, A.M.I.E.E.

Popular Wireless

TOPICAL NEWS AND NOTES.

Holland and Radio.

HOLLAND is building a big station at home, and another at Java, in order to communicate an overland distance of about 6,000 miles.

* * *

A New Club.

THE Faversham Catholic Wireless Society was formed on June 20th. It will have autumn sessions and lectures, and members must have a knowledge of the Morse code.

* * *

High Power Stations.

HIGH power stations at Bogota Bay, Columbia, and Cuba will be completed this year. The great Buenos Aires wireless station will be in operation by the summer of 1923

* * *

If There Only Were !

"THEORETICALLY there should be 300,000,000 different wave-lengths available," states a writer in the "New York Tribune," "but in practice there are less than 20,000."

* * *

Far-fetched.

"THE 740 state-rooms of the s.s. Leviathan will be fitted with wireless sets when the great ship is reconditioned. Communication from any set to any vessel and to any state-room, in the case of the Leviathan, will be possible," states the "Radio World." This latter sounds nice. Personally, as wireless stands to-day, I doubt its practicability.

Badly Needed Here.

I HEAR that Chicago taxi-cabs are to be signalled by wireless. People hope to get a better and quicker service by this means. The central cab garage will instal a receiver and transmitter, and receivers at taxi stands will inform drivers where they are to report for fares.

* * *

A Wireless Club for Boys.

A JUNIOR wireless association for Manchester and district is being formed. It will be open to boy amateurs between 12 and 17 years of age. Mr. James Griffin, principal of the Wireless School of Telegraphy, 335, Oxford Road, Manchester, is interested in the movement, and will be pleased to receive applications for membership.

* * *

Another Wireless Society.

WIRELESS societies are springing up all over the country and I was pleased to hear that Colchester is one of the latest recruits. The Colchester Wireless Society has been formed and will meet weekly. Mr. Alden is in the chair, with Mr. Banham vice-chairman, whilst the duties of Hon. Secretary are being filled by Mr. H. Barton. Mr. J. Radcliffe is acting as technical adviser to the Society.

* * *

Sir A. Conan Doyle and Wireless.

"I EXPECT in the next three or four years some definite messages will be received to prove the contentions of the spiritualists. I believe it will come through radio," said Sir Arthur Conan Doyle, at a reception recently given in his honour at the American Psychical Institute, New York. "I think it is along this line that we will get our evidence. They have transmitters in the line of ether and all we must have is the receiver," declared Sir Arthur.

* * *

Ireland Up-to-date.

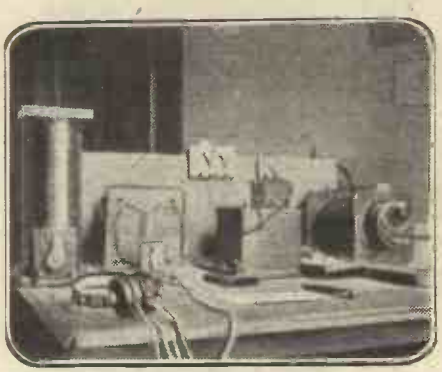
IRELAND is a distinctly unhealthy spot these days, and one never knows when a battle or a free fight is going to break out next, and naturally the police are having an exceptionally busy time.

The various stations of the police in Co. Fermanagh have just recently been connected up by wireless to the headquarters at Enniskillen, so that it is now possible to give warning of any outbreak in quick time, and enable the force to call for help if they are ever hard pressed.

* * *

Long-Distance Wireless.

THE commander of the Royal Mail Packet Company's steamer Almanzora, from South America, reports that his ship, when sixty miles north of Fernando Noronha, exchanged wireless signals with Cape Town, a distance of 3,457 miles, thus creating a wireless record for the South Atlantic. He also reports talking to Leafield, near Oxford, when the ship was off Monte Video on May 25th. The ship also received a wireless news service at a distance of 5,534 miles.



A set erected by Mr. F. D. Cross, of 30, Barnabas Road, Cambridge.

* * *

Another Step Forward.

TO Mr. W. D. Owen, of Jesmond, Newcastle, we owe another step forward in the progress of wireless, for he has successfully applied the time switch to a receiving set. The switch, made by the Venner Time Switches, Ltd., London, can be set so that it will switch on and off a set three times daily for any periods or for any scheduled signals.

At the moment he has set the apparatus to pick up the Eiffel Tower weather reports, and it automatically switches on when the signals start, and switches off when they come to an end.

* * *

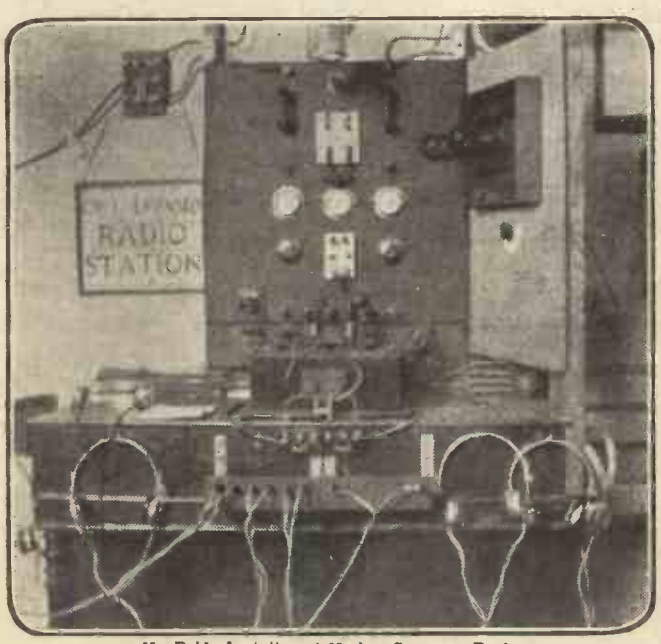
Radio Swindlers.

THE Vienna police recently discovered two Americans who had been swindling people on racecourses. Wireless played a big part in their *modus operandi*. One crook, who was also a wireless operator, backed a horse heavily about ten minutes after a race was over.

A Vienna bookmaker accepted the bet, believing that communication between Vienna and Paris was impossible excepting by telegraphy, a message by the latter taking about four hours to get delivered.

By wireless, however, the swindlers did the trick.

The bookmaker became suspicious in the long run, and the two men were roped in by the police.



Mr. Baldry's station at Marlow Common, Bucks.

NEWS AND NOTES

(Continued.)

Wireless Service to Spain.

CONSIDERABLE acceleration of the commercial wireless service between England and Spain has been secured by the recent transfer of this service from the Poldhu station to a new Marconi station at Ongar.

Under the new conditions messages to Spain, marked "via Marconi," instead of being relayed by long land line circuits to Cornwall, are transmitted direct by distant control from Radio House, Wilson Street, E.C., to the receiving station in Spain. Three Continental wireless services are now being conducted simultaneously from the Ongar - Marconi stations.

* * *

The Great Invention.

MR. JOHN HAYS HAMMOND, who recently declared he had invented a "secret wireless" device, states that he has been at work on this important problem for the past fourteen years. He promises actual secrecy in wireless work, and that it will be practically impossible for any other than the proper receiving station to hear anything but a confused jumble.

His apparatus is quite simple, according to the "Radio World." The same wave sent out from a station may be made to carry several messages at the same time, and both voice and code may be transmitted, so the inventor claims.

* * *

International Wireless Exhibition.

MR. ALEX. STEWART, the well-known wireless expert, tells me that he is busy organising the First International Wireless Exhibition and Conference, which will take place at the Central Hall, Westminster, in the autumn of this year.

Leading manufacturers of radio telephony and telegraph devices will exhibit the latest developments and receiving sets, and a general conference of representatives of the various amateur wireless societies throughout Europe is being arranged.

Lectures upon various subjects of interest to the visiting delegates will be given each morning at 11 a.m. during the period of the exhibition.

In the afternoon, demonstrations of receiving and transmitting by wireless telephony will be given, and concerts from Berlin, Paris, and the Hague will be received, loud speakers being used so that all attending visitors may enjoy them.

Endeavours are being made to use a new and perfected apparatus whereby it may be possible to receive broadcasted concerts direct from America.

Demonstrations of the control of wireless torpedo boats and wireless airships will take place during the week.

The leading manufacturers of wireless apparatus have given the exhibition their support, and it is proposed during the conferences to form a Manufacturers' Association, to advance the growing interest on the part of the general public in wireless matters.

The Army, Navy, and Aircraft Departments of the Government are being approached to instal apparatus showing the workings of the various departments during times of war and peace.

American police methods of speedy detection of criminals by wireless telephony will also be shown.

The exhibition promises to be most interesting and instructive, and there is no doubt that the general public, who are just beginning to take an interest in the general developments now proceeding in the wireless world, will gain much interesting and useful knowledge at this exhibition.

Wireless and Farmers.

THE possibility of using wireless telephony for broadcasting weather reports to farmers is under consideration, Captain Guest stated recently in the House of Commons.

* * *

A New Club.

IT is proposed to form a Durham City and District Wireless Club. Will all amateurs interested please attend a meeting in the Rose and Crown Hall on July 11th, at 7 p.m. ?

Sec. (pro tem.) : George Barnard, 3, Sowerby Street, Sacriston, Durham.

ALWAYS POPULAR!

Sent in by Mr. Jack Poole, Denlyn, Llanath, Cardiganshire.

Round the World.

THE girth of the world is now one-tenth of a second, the time required for a wireless wave to make the circuit. It may soon be possible for an operator to speak as Columbus sailed into the West, and hear his own voice from the East.

* * *

Transatlantic Telephony.

MR. E. J. Nally, president of the Radio Corporation of America, stated at a banquet recently given in Senatore Marconi's honour in New York that the Radio Central Wireless Station will, possibly this year, be in wireless telephonic communication with London and Paris.

* * *

Mr. Isaacs and Broadcasting.

VERY important developments are shortly expected in connection with the National Broadcasting Scheme. There has been considerable delay in the matter, and there has been a lot of grumbling by amateurs.

Mr. Godfrey Isaacs, who is managing director of Marconi Co., which are the organisers of the scheme, thinks that the fulfilment of a broadcasting programme can be expected any moment. There have been very important points to consider, but let us listen to Mr. Isaacs' views on the subject.

"The public," he said recently, "do not perhaps appreciate the many little difficulties which have to be overcome in organising a scheme of this magnitude. These, however, are, I believe, being smoothed away, and amateurs can rest assured that really no time is being lost. Special machinery and appliances have to be prepared, and this is being done while the difficulties are being adjusted."

It has been estimated that the cost of a broadcasting programme will cost something like £20,000 a year for each of the eight stations. Who is to pay this big item? It has been suggested that the price of the Government "listening-in" licence, which at the moment is 10s. 6d., should be increased, and that this increase should be reserved solely for the purpose of providing a broadcasting programme. I learn that a prosposal of this sort is being considered by the authorities, and as it is likely to be accepted we may have to put up with an increased licence fee.

* * *

M. Rosing.

THE Editor has asked me to state that the illustration on the front copy of our fourth issue is a photograph of M. Wladimir Rosing giving his first recital by wireless at the Westinghouse Broadcasting Station in Newark, U.S.A. The recital was given on December 31st last, and was the first wireless recital given by this distinguished Russian tenor.

ARIEL.

Broadcasting Programmes

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

QUITE a number of amateur stations have been transmitting music and speech during the past week.

The number of transmitting licences issued to amateurs now totals 400, and this big increase may account for the increased traffic on amateur wave-lengths.

Certainly much of the speech and music transmitted is as good as that sent out by professional stations, and amateurs with receiving sets will find plenty of speech to listen to every night of the week.

The amateur with valve amplifiers may also hear the telephony from the German station at Königswusterhausen.

Regular transmissions are made at 7 a.m. (G.M.T.) on 2,500 metres, and at 10.30 a.m. The station's call sign is L P.

Paris (call sign F L) sends speech and sometimes music at 5 p.m. (summer time) every afternoon of the week, excepting Saturdays and Sundays, on a wave-length of 2,660 metres.

A weather forecast follows at about 6 p.m., in French.

As a rule, notice of any special transmissions, such as concerts, etc., are given out during the 5 p.m. period of transmission.

The Marconi Concert from Writtle, near Chelmsford, commences at 8 o'clock (summer time) every Tuesday evening, on a wave-length of 400 metres. The call sign is 2 M T, usually announced by the operator as "Two Emma Top."

The Marconi House Experimental Station (call sign 2 L O) may often be heard working on a low wave-length between 3.30 and 6 o'clock of an afternoon.

Excellent speech and music may be heard from this station.

The Sunday concerts from the Hague commence at 2.30 and end at 5 p.m., and are splendidly received by many amateurs in this country, using valve amplifiers. The station's call sign is P C G G, and the wave-length is 1,070 metres.

Croydon Aerodrome (call sign G E D) may be heard at all times of the day speaking to various aeroplanes on the Continental air routes. The wave-length employed is 900 metres.

It is very unusual to listen in on this wave-length for more than ten minutes without hearing speech from Croydon or some other aerodrome wireless station.

WIRELESS QUESTIONS AND ANSWERS.

Readers of the "Daily Mail" have read Mr. Blake's fine articles on wireless subjects, and I am sure that readers of POPULAR WIRELESS will equally appreciate these questions and answers which he has compiled at my request.—Editor.

By E. BLAKE, A.M.I.E.E.

What is wireless? A method of communicating through space by means of electric waves in the ether, there being no material link, such as a wire, between sender and receiver.

* * *

Who was the discoverer of wireless? Marconi first made it possible to work wireless over long distances so that it became of real use. He based his experiments on facts discovered by Hertz and others, but absolutely transformed wireless by his new discoveries, inventions, and improvements.

* * *

What is the ether? A weightless, highly elastic medium which is believed to fill the whole of space, and to penetrate completely all material bodies.

* * *

What is a wireless wave? A change in the state of the ether which is produced and then reproduced constantly outwards from the wave-making station at a speed of 186,000 miles per second.

* * *

How are wireless waves made? By causing an electric current to flow very rapidly, in fact many thousands of times per second, to and fro in a wire.

* * *

What is an "aerial"? The wire, generally elevated to a considerable height above ground, which either is used to "pick up" wireless messages or to radiate waves.

* * *

Do the waves go direct to the receiving station? Yes, but not to one station only. They leave the aerial of the sending station in ever-widening circles, so that any receiving station at any direction from the sending station can receive the message.

* * *

How does a station know whether a message is intended for it? The authorities assign a group of three or four letters to every wireless station, and when one station wishes to send to another, it calls it by repeating the call-letters of the station it wants, followed by its own call-letters, thus "A B C de (*i.e.*, from) D E F." The reply would be "D E F de A B C — . — " The last dash dot dash means "Send your message."

* * *

What is a wave-length? If waves be represented by a wavy line, then the wave-length may be said to be that represented by the distance between the crest of one wave and that of the one immediately following (or preceding) it.

* * *

Are wireless waves very long? They vary between limits which may be roughly put at 100 metres and 25,000 metres (1 metre = 1 yard approximately). Ships commonly use waves of 600 metres. Carnarvon station uses waves of about 14,000 metres.

* * *

Do all ether waves travel at the same speed? Yes; whether they are the tiny waves of light and radiant heat, or the waves of wireless.

* * *

Can wireless waves pass through houses, mountains, etc.? Yes; but when they pass through anything which conducts electricity they are weakened, because they leave some of their electricity behind them in the conductor.

* * *

How many waves from a given station pass over a place in a second? Divide the speed by the wave-length. Example: How many waves from the s.s. Aquitania pass across your house in a second? The speed of the waves never alters and is 300,000,000 metres (186,000 miles) per second. The wave-length we will say is 2,000 metres. The number of waves per second is 300,000,000 divided by 2,000, that is, 150,000. The number of waves sent out per second is called the wave frequency.

* * *

How far do wireless waves go? Mathematically speaking, once a wave is created it never dies. Wireless waves follow the surface of the earth, and probably go right round it. Some are reflected back from a peculiar atmospheric layer; few, if any, escape from earth. In wireless a wave is considered to go only as far as it can be received, and as we can, with high-power stations, communicate between any two points on earth, we may say that wireless waves can go as far as we want them to.

* * *

How are messages sent by wireless? The waves are sent out in long and short "bursts" or series, corresponding to the longs and shorts (dashes and dots) of the Morse code. This is done by means of a telegraph key, operated by a telegraphist. Every time the operator presses the key he releases a series of streams of waves. When he lets the key up the waves stop. This explanation refers to the "spark" system.

* * *

How is the voice and music sent by wireless? A continuous stream of waves is sent out, and the action of the sound waves produced by the voice is such that by means of a device called a microphone these waves are varied (or "modulated") so that they become reproductions or models in ether of the sound waves.

* * *

How is wireless telephone speech received? When the modelled ether waves reach the receiver they are turned back into sound waves of similar shape and frequency as those which produced them, and can be heard in an ordinary telephone.

* * *

How is a wireless telegram received? The telephone or other instruments used for wireless reception cannot respond to such rapid frequencies as those of wireless waves, so special devices are employed which turn the current "picked up" by the receiving aerial from "radio frequency" to audible frequency, without interfering with the dots and dashes, which are heard in the telephones as long and short buzzes or whistles, and are mentally transcribed by the operator into the letters of the alphabet, and written down as they are heard.

* * *

How fast can Morse be received? It can be received by ear, but not transcribed in writing, at about 50-60 words a minute. It can be received by ear and written down in plain English at about 35 words a minute; a fair working speed being 30 words a minute. By automatic means Morse can be recorded reliably on paper tape at anything from the lowest working speed to 120 words a minute.

* * *

Do wireless waves get mixed up? Myriads of waves of all different lengths are continually passing through the ether. All those of the same length are apt to interfere with each other in reception. This state of affairs is called "jamming." But by tuning it is possible to cut out waves of lengths other than those it is desired to receive.

* * *

What is tuning? The act of varying the "electrical" length of the receiving circuit so that the latter responds more readily to waves of the length of those it is desired to receive than to other wave-lengths.

* * *

How is tuning done? By varying either the capacity or inductance of the receiving circuits.

* * *

What is capacity? The power of containing a quantity of something. In wireless tuning an instrument called a condenser is associated with the circuit. The capacity of the condenser, that is, its power to contain electricity, is varied by turning its handle, and thus the capacity of the whole circuit is increased or reduced.

* * *

What is inductance? The property of an electrical circuit which tends to oppose the start of a current in it, and which, when the current has begun to flow, tends to oppose its stoppage. Inductance tends also to oppose an increase or decrease in the strength of a current. This property is very marked in spirals and coils of wire, which are often loosely termed "inductances." It is generally varied in tuning by increasing or decreasing the number of turns of the coil which are in action; there are other methods.

* * *

Why is a receiver connected to earth? So that the rapidly reversing current received by the aerial may have a reservoir, as it were, into and out of which it can flow as it oscillates in the aerial circuit. An earth connection may be made to a water pipe or to a metallic plate buried in the ground. The "earth" on an aeroplane or airship is the metallic portion of the vessel itself.

(To be continued.)

Mr. T. S. Porter, of Huddersfield, and a young wireless enthusiast.

The Microphone

The Sensitive Instrument which Transmits Speech and Music

EVERYONE is familiar with the ordinary telephone mouthpiece, into which one speaks when "ringing up" a required number. A similar piece of apparatus is used when speaking into a wireless telephony transmitter, and this "mouthpiece," by which speech is broadcasted into the ether, is known technically as the microphone. A recent article in POPULAR WIRELESS dealt with the manner in which speech was radiated across space. It is the purpose of this article to describe the piece of apparatus by which the speech is superimposed upon the continuous wave. The fundamental principle upon which the action of the microphone is based is shown in Fig. 1. Three carbon blocks are used. Two of the blocks are firmly supported, and the third, which might be slightly thinner, poised loosely between them. If a battery and a galvanometer are connected to the two rigid blocks as shown, the needle of the galvanometer will register the passing of a slight current, despite the high resistance of the carbon.

If a low, staccato noise is made in the immediate vicinity of the poised piece of carbon, it will vibrate under the influence of the sound waves. The slight tremors thus produced will be conveyed to the rigid carbon blocks, and the galvanometer needle will move, thus registering the sound. Much thought and patient labour have converted the rough and ready microphone described above into the finished article used to-day upon a modern wireless telephony transmitter. The principle, however, remains the same. The ordinary mouthpiece needs no description. At the back of this are two thin carbon discs, separated from each other by a ring made of some insulating material. Felt or rubber is often used for this purpose.

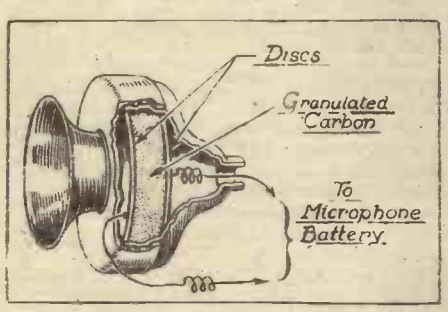


Fig. 2.

The resultant space between the two discs is then loosely filled with fine granulated carbon. Under the influence of the voice or music, especially if loud sounds are introduced into the mouthpiece, these carbon granules will sometimes be found to pack together, and in so doing will create an undesirable amount of resistance between the voice and the circuits of the transmitter. When the microphone is in this condition, much of its sensitivity will be lost. The receiving station will then probably only hear the louder sounds being transmitted. The weaker sounds will be unable to overcome the resistance of the packed granules in the microphone, and will be lost. The result in the receiving telephones will therefore be intermittent and unintelligible speech. A slight tap with the finger will usually decohere the granules.

This drawback to the reliability of the microphone has partially been overcome by cutting circular grooves into the second or back carbon disc (see Fig. 2). In this manner the granules of carbon are more or less uniformly distributed over the areas of the two discs. The speech, which is only another way of saying sound waves, will vary the resistance of the carbon granules, and therefore the microphone current. This is similar in action to the manner in which the voice varies the current flowing through the elementary microphone circuit, given in Fig. 1. As described in an article on "How speech is sent by wireless," which appeared in No. 5 of POPULAR WIRELESS, the variation causes vibrations which are of a very slow order when compared with the rapid oscillatory current in the aerial on which they are imposed.

These oscillatory currents, used originally for the propagation of continuous wave telegraphy, are generated either by a high-frequency alternator, a Poulsen arc, or the electron valve.

In a future article the action of the valve as a generator of wireless waves will be given. A common fault when speaking into the microphone is to place the instrument too close to the mouth. Keep the mouthpiece about two inches away for ordinary speech, and make the distance greater if a large volume of sound, such as a powerful baritone voice, is being transmitted. If items are read from a newspaper, or other manuscript, place the sheet in a position where it can easily be seen without necessitating movement of the head. Speak in an even voice, without too much variation of tone, but do not whisper. Clear enunciation is essential. Do not shout, and do not hurry. As in singing, breathe at regular intervals, and not in one long breath at the end of a sentence. Remember that receiving circuits are sensitive, and the registering of this sound is unpleasant.

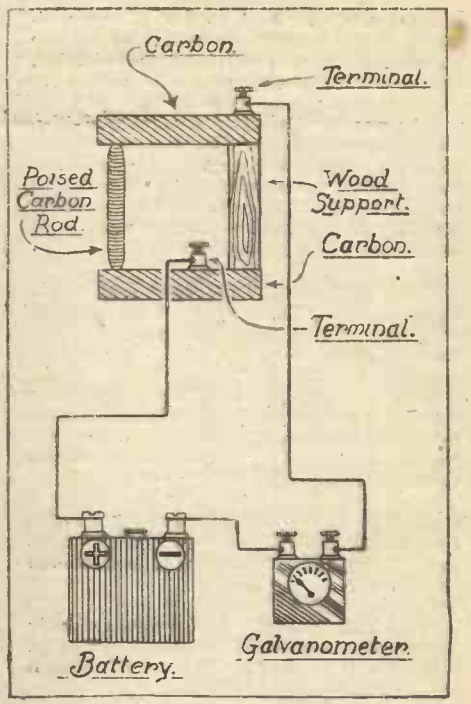


Fig. 1.

FUTURE OF WIRELESS.

As Seen by Thomas Edison.

IN fifty years' time, according to the great inventor, Thomas A. Edison, we must expect to see wonderful and startling advances in the way of communication, transportation, and living conditions. There is no limit to the possibilities of the radiophone development.

One has only to turn back to the files of an illustrated newspaper of 1872 to compare the marvellous age in which we live now with the relatively simple conditions under which people lived fifty years ago. To the present younger generation such things as telephones, motor-cars, aeroplanes, moving pictures, electric light, and wireless communication have helped to bring more pleasure, convenience, and education to all of us.

The phenomenal progress in invention shows that civilisation is on the right track, and that rapid strides will continue to be made.

Edison, writing in "Popular Science Monthly," states that the most minute sounds may be made audible by wireless across a continent. The dropping of a pin in New York may be heard as far away as San Francisco. It is difficult to imagine the practical possibilities of these developments.

Information, and entertainment, will be spread on a hitherto unparalleled scale.

Nearly every home in the land is being drawn into the wireless telephone's educational influence.

Edison is unable to foresee the wireless transmission of electric current for power purposes; neither is he able to agree with others who prophesy that power will be obtained by the liberation of atomic energy.

At the same time he is quite open-minded about such matters, and does not say that they are impossible.

He expects increasingly dramatic possibilities from the next few decades of science, owing to the numberless research specialists, some of whom may have startling surprises in store for us at any moment.

New brains will be required to push forward along these lines, to carry on the complicated processes of research, invention, and industry. The demand for brains will be sufficiently enormous to warrant a bigger proportion of young men entering the scientific and engineering professions than has ever been known before.

Great powers of imagination rightly developed must be possessed by research men.

"If you have real industry and ability, you are wanted at the top. The good ones are so rare! As the basis of all preparations for success in science and invention, take up physics. They and chemistry stand right at the bottom of everything."

Edison concludes his remarkable views by warning us that when we attempt to look into the future we must not forget that man himself has not changed for a thousand years, and although we may be happier, and more comfortable, we have the same defects and weaknesses as of old.

Aviation & Wireless

By MICHAEL EGAN, Late Instructor of W/T, R.A.F.

WHEN we discussed the early developments of aeronautical wireless last week, the question arose as to how the conditions of noise and vibration that obtain in all kinds of aircraft were to be overcome. The roar of an aero-engine is deafening, and the vibration imparted by it to the body of the machine itself is intense.

How, then, is it possible to hear wireless signals through this terrific noise, and to preserve the delicate parts of a wireless installation from being dislocated, or even broken, by the vibration?

These questions, indeed, represent two of the most important problems that impeded the early efforts of the pioneers of aircraft wireless. When the first attempts were made to use wireless in aircraft, the science of aeronautics was itself in an infant state. This meant that the severest restrictions were imposed on those who experimented with wireless gear.

There was little room, and less "carrying capacity," to spare in existing types of aircraft. Hence, wireless instruments had to be of minimum size and minimum weight. The result of this was that many of the first aircraft wireless installations were little more than miniature toys!

In the early days of the crystal detector, the aerial wireless operator frequently carried his receiver in his hands during flight. He was thus able to replace the detector needle on the "sensitive point" of the crystal, from which it became repeatedly unshipped in the course of operations.

On occasions I have had to readjust the contact of my crystal at least a dozen times in order to capture a single message bit by bit during a series of "repeats." No joke, that, on a cold day, when it means discarding clumsy flying gloves!

As regards the question of noise, this is not really so difficult a problem as it appears to be on first consideration. The roar of an aero-engine, when it first begins, is a horrible din, of course. But after a certain time one's ears tend to become insensitive to its monotonous howl.

Thus it begins to act, to some extent, as a dull rumbling background of sound through which the sharp staccato notes of a wireless message are not altogether prevented from penetrating. It did, however, constitute an important problem from the outset, and steps had to be taken to cope with it. There were two ways of doing this. One was to augment the strength of signals as much as possible by the use of automatic relays. The other was to devise a special wireless aerial helmet which should be as sound-proof as possible.

A novel type of helmet was invented with large padded ear-caps, into which the ear-pieces of the wireless telephones were inserted. By means of two straps passing over the top of the head, down over the outside of the ear-caps, and buckling underneath the chin, the receivers were kept pressed tightly against the ears.

Incidentally, after six hours' patrol, one's head usually emerged from such close confinement in a semi-baked condition. And heaven help the operator who happened to have got hold of an ill-fitting helmet on the *small* side! I remember the hilarious enthusiasm with which the announcement was first received at a certain air-station that, in future, each operator could have a special helmet "made to measure"!

It so happened that the other solution to the noise problem, namely, the increasing of signal strength, was seriously obstructed by the second main problem, *i.e.*, vibration. In order to increase the strength of received signals, automatic magnetic relays were, as I have said, introduced. But these were themselves far more sensitive and susceptible to vibration than the crystal detectors they accompanied.

It was thus essential that they should be in a part of the machine where the least vibration took place. This was, naturally, the furthest point from the engine. They were therefore slung very carefully from strands of thin elastic inside the tail of the fuselage.

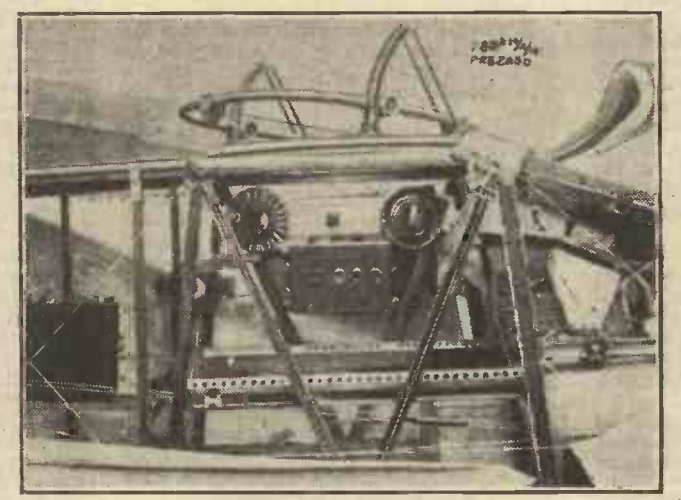
Long wires connected them, along the whole length of the aircraft, to the receiving instruments in the wireless cockpit, which was usually situated in the nose of the machine immediately behind the engine. This position of the relays was, of course, quite inaccessible during flight. Hence the whole success of the wireless operations depended upon the correct adjustment of these sensitive relays before the machine went into the air.

That is, of course, "barring accidents"! But, unfortunately, accidents were not easily barred in those days. Sometimes a machine got away without any mishap to the sensitive instruments, and after meeting one bad "bump" the relays were thrown completely out of action! When this happened an ominous click was registered in the operator's telephones, followed by a deathly silence!

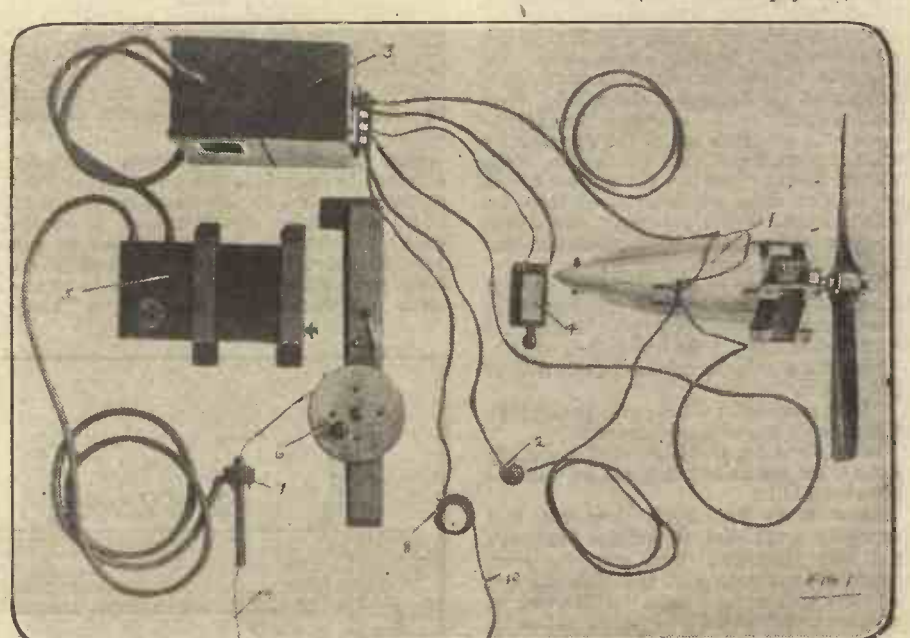
But I remember once having to come down three times in half an hour to readjust relays that had been dislocated each time in the course of "taking-off." It was rather a gusty day and the machine hit every available little lump on the aerodrome before it decided to take the air. One such hit was usually more than sufficient.

After each "take-off," I turned in my seat and waved plaintively to the pilot behind to indicate that "the thing" had happened. Then I sat tight whilst we came

(*Continued on page* 90.)



Telephony Set on Bristol Biplane.



(1) Generator; (2) L.T. switch; (3) valve transmitter; (4) Morse key; (5) variometer for short waves; (6) aerial winch; (7) lead-in tube; (8) hot wire ammeter for measuring radiated energy; (9) aerial weight; (10) earth lead.

AVIATION AND WIRELESS

(Continued from page 89.)

down again, the pilot all the time cursing me hard with soft mutterings under his breath. He seemed to think the recurrence of the accident was altogether my fault. It occurred to me forcibly that it *might* have been due to his extraordinarily bad piloting.

Relays were sometimes put out of action during flight, especially in gusty or bumpy weather. On the whole, however, they did great work and stood up to their difficult task very well. For many months, prior to the advent of the valve, they were used in almost daily service on airship patrol.

The photograph on page 89 shows the standardised method of suspending wireless instruments in modern aircraft. It comprises two aluminium frames, between which the apparatus is slung on a cord of strong elastic.

Next week I purpose to discuss some of the manifold uses of wireless in aircraft.

TWIN WIRE AERIAL SPREADERS

THE variation between the ideal and the real is rarely more strikingly shown than in many cases of double wire aerials and their spreaders. They look such trim, taut line erections when properly erected.

Theoretically, in order to subject the spreader to the minimum amount of strain, the slings by which it is hauled up to the mast should be as long as possible, and attached to the spreader at the points where the pull of the aerial is at maximum.

In practice this usually results in the spreader being considerably lower than it need be, and the double wire aerial anything up to ten feet lower than necessary.

A perfectly arranged double aerial is often more efficient than a single wire aerial of the same height, length, and material, so that if you have increased the theoretical efficiency by twenty per cent. on account of doubling your wire, and then diminished it by thirty per cent. because you cannot hoist it any higher, you gain nothing.

To revert to a single wire aerial might be considered as tantamount to an admission of failure, but it is much easier to erect nearer the top of the mast.

However, to return to the spreader trouble. A spreader is generally of ash, and sufficiently stiff to allow of its being supported at the middle, the aerial wires being light enough not to put too much bending strain on it. Do away with the sling attachments at the ends and take off the halliard at the middle. Now it will probably twist badly from the horizontal, so attach to each end of the spreader, by means of a small insulator, a thin wire. Take this wire down so that you can make it fast to the mast or elsewhere below, and keep the spreader level. If you put up your aerial with spreaders in the fine weather, remember that our climate is a changeable one.

What appears to be a firm and satisfactory connection on a calm summer afternoon may often prove to be something quite different under the buffeting of the first gale of wind.

Spreaders should be anything from five to eight feet in length.

It is no good using a twin wire aerial if the wires are only two or three feet apart.

Once the aerial is aloft it does not necessarily mean that it can be left in peace for the rest of its natural life.

Unless it is periodically inspected and thoroughly overhauled, its natural life won't be a very long one. Dust and soot from everywhere will soon coat the spreaders and insulators with a nice "short" path to earth, and a consequent lack of good signals will result.

If the aerial is hoisted on pulley blocks it is no difficult matter to lower it every month or so and give the insulators a clean up.

THE GRID LEAK

This article will tell you how to make a grid leak, a necessary piece of apparatus when using a valve receiver.

TO one newly entering the field of experimental wireless, the grid leak, though tripping lightly off the tongue as a phrase, is very much a sealed book as regards meaning.

The thing itself is so simple in construction that it is no wonder apparatus makers try to invest it with as much mystery as possible, and seal it up in their sets in a way that prohibits examination, unless you destroy it in opening to see what is inside.

But why does a grid want to leak? Is it not sealed up inside the glass of the valve so that it cannot leak by any means?

Why the Grid "Leaks."

Let us consider our valve a little in detail. The filament in the centre is glowing with the current from a 4-volt battery and emitting negative electrons. A high-tension battery of 30 to 60 volts has its positive terminal connected to the plate of the valve, or that plain cylinder of metal which surrounds the glowing filament.

The negative electrons rush across from the filament to the positively connected plate, or would do so but for the grid, a little spiral of wire placed in between the filament and the plate.

Now, if this grid started by being neutral, that is, being neither positive nor negative, the negative electrons arriving from the filament would settle on it, like swarming bees on a tree branch, and make it so negative that it would positively repel any more negative electrons that tried to settle there. It would then be in a proper dog-in-the-manger position; it would want no negative electrons itself, and bar the way to negative electrons which wanted to get past to settle on the plate.

The Grid Condenser.

If we attach to the grid terminal a high-resistance conductor which will allow the congestion of negative electrons to drain away as fast as they congregate, the grid would cease to be repellent to the stream arriving from the filament and exert less repulsion on those streaming through and past which were on their way to the positively charged plate. This high-resistance conductor is called a grid leak because it allows the accumulated negative charge which was choking the grid and spoiling the action of the valve to leak away.

Now for the grid condenser. Usually attached to the grid in the valve receiving set is the connection to the aerial, by means of which the wireless signals arrive. If we are tuned to receive a 300-metre wave we get 1,000,000 waves in one second, a rate of arrival much too rapid for the human ear to appreciate. We therefore put in the way a "hold-on-a-bit" piece of apparatus called a condenser, the grid condenser to be exact, and this has the effect of slowing up the breathless pace of 1,000,000 per second into something we are able to appreciate.

The grid condenser then becomes part and parcel of the grid system of the valve, and would get as congested as we saw the grid itself get, but that the grid leak provides for the draining away of unwanted negative electrical charges.

The Materials Required.

It will be instructive for the novice to try it experimentally. Connect up the set without a grid condenser or a grid leak, and tune in for signals. Touch the grid connection with the finger and take the finger away. Good signals coming in will quickly die away, as if being smothered, and can be restored every time the finger touches the grid circuit and acts as a grid leak.

The materials required for making a grid leak are two terminal binding posts, with long screw going right through washer, body nut, and terminal nut. Also a piece of thin wood four inches long and two inches wide—cigar-box wood will do; two pieces of smooth tinfoil, two and a half inches long and one and three-quarter inches wide; one piece of waxed paper or mica, four inches by two; Manila luggage label, four inches by one, or a piece of good drawing paper the same size.

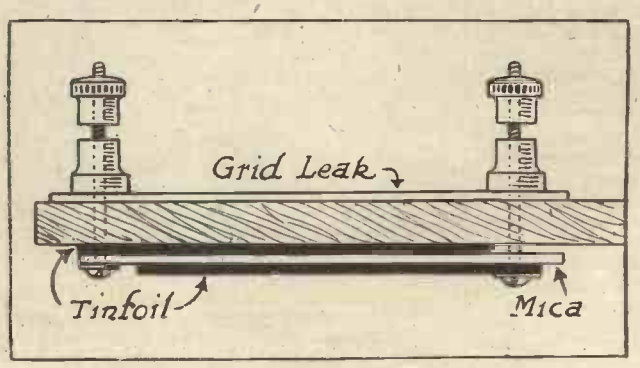
Bore two holes in the wood half an inch in from each end to take the screw of the binding post. Lay one piece of the tinfoil on the wood with $\frac{1}{8}$ of an inch margin along the sides and one end, and $1\frac{3}{8}$ inches margin the other end. Next put on the waxed paper or mica, with holes in it corresponding with those in the wood. Put on the other piece of tinfoil so that the $\frac{1}{8}$-inch margin comes at the end where the $1\frac{3}{8}$-inch margin of the other tinfoil was, the idea being that the binding-post screw makes contact each with one tinfoil strip, but the two strips must not be in metallic connection with each other.

Connecting Up.

Stick a piece of stout paper over this to protect the tinfoil. On the other side of the wood now slip the strip of Manila or drawing paper over the two screws. Blacklead pencil plentifully all round the holes on the paper and screw the body nuts down, allowing some of the blacklead pencil marks to show out from under.

A heavy blacklead pencil mark, or a number of Indian-ink marks, should be made joining the binding posts, and the grid leak is complete.

One terminal of the grid leak is connected to the slider of the aerial tuning inductance coil, described in a recent issue of POPULAR WIRELESS, and the other terminal direct to the grid terminal on the valve panel. A great difference in signal quality and strength will at once be noticeable.



If you are having trouble with your set, write to POPULAR WIRELESS. Our expert's advice is at your service.

BROADCASTING—ITS INCEPTION AND MANAGEMENT.

By SIR WILLIAM NOBLE, Ex-Engineer-in-Chief to the G.P.O.

SIR WILLIAM NOBLE.

So much of late has appeared in the Press about wireless broadcasting that there are probably few who have not some superficial idea as to what it is, although it is equally probable that there are but few who have given much thought as to its probable evolution.

The immediate future as well as the popularity of wireless telephony in its application to broadcasting must of necessity depend, in large degree, on the acumen displayed by those who at its inception are responsible for ordering and controlling the environment in which it is destined to grow.

The truth of this statement is best supported by a brief review of what has taken place in America, where broadcasting was first introduced.

With the characteristic enthusiasm which is an outstanding feature of the American nation, the door was thrown wide open. Any company that was so minded erected a station just where and how it pleased and broadcasted its programmes with but little discrimination or regard for what anyone else was doing. On the other hand, manufacturers of and agents for receiving sets sprang up like mushrooms, and, to satisfy the public demand, flooded the market with apparatus good, bad, and indifferent. The result has tended to produce serious confusion.

Development in the United States has been so phenomenally rapid that a state approaching chaos existed almost before the Government realised the situation. When the true position had been gauged, a Government committee was appointed with a view to unravelling the tangled skein.

It is obvious that for this country there is but one proper course to take, and that is to profit by the mistakes of others before anything is done to "queer our pitch." The Americans have certainly had their proverbial hustle on with broadcasting. To hustle is excellent when all is in order, but calm deliberation in the preparation of a plan of campaign is a virtue. Already there are ample signs in America of "listeners-in" becoming disgruntled with the unsatisfactory and unenjoyable attempts to receive programmes owing to the disorder prevalent in some parts of that country. We must prepare our schemes so as to avoid similar troubles, and ensure permanent satisfaction to all concerned.

Anyone who gives the problem some thought will concur in the statement that it is essential that broadcasting should be under official control, and the department best suited to exercise the necessary supervision is the Post Office.

Fortunately at present we have a keen, enlightened, and progressive Postmaster-General, supported by an able administrator as permanent head of the department. The Post Office can therefore be relied upon to handle the problem efficiently and in the public interest. It is to be hoped that the firms now in conference will formulate an agreed scheme that will be acceptable to the Postmaster-General and satisfactory to the public.

Those who have studied the art of radio telephony know that the reception of messages is sometimes seriously interfered with by "atmospherics," that is by interferences due to uncontrollable ether disturbances, the effects of which cannot be entirely eliminated. It has been found in practice, however, that such atmospheric disturbances are nothing like so serious on the short waves which the Postmaster-General has allocated for broadcasting stations.

A more serious difficulty which occurs is that known as "jamming," or interference due to the receipt of signals from stations other than the one desired, either because the interfering station is on the same, or very nearly the same, transmitting wave-length, or because the reception apparatus is not highly selective, or a combination of both. Although the short wave-lengths have distinct superiority over the longer ones in utilising selectivity and eliminating this trouble, it will be seen that in order to obtain the best results it is necessary to have the available wave-lengths distributed among the broadcasting stations throughout the country in such a manner that the difference between the wave-lengths used in adjacent areas shall be as large as possible, so that the possibility of jamming troubles shall be reduced to a minimum. "Listeners-in" in intermediate areas between two or more broadcasting stations should then be able to obtain good receptions from any of the adjacent working broadcasting stations without trouble from jamming.

At the outset, at any rate, the number of transmitting stations should be limited to, say, seven or eight widely distributed, so as to avoid mutual interference. The most suitable centres for serving appropriate areas are: London, Bristol or Cardiff, Birmingham, Manchester, Newcastle, Edinburgh, Aberdeen, and possibly Plymouth. Experience with the working of such a network of stations is essential in order to determine the possibility or necessity of extending the number and determining the power of broadcasting stations.

Another important restriction that should be imposed is that only experienced and substantial firms should be entrusted with the erection of the stations. It is due to the public that the service should be good, and also that as the expense of the installation and maintenance of the plant, as well as the provision of attractive programmes, will be very heavy, only companies which are financially strong should be allowed to shoulder the responsibility.

The wireless sets sold to the public should be of a type approved by the Postmaster-General, or the sets themselves should be so approved. If the broadcasting scheme is launched under Government auspices, and licences to receive are obtained against a monetary payment, then the public have some claim to the protection of the State against the sale of sets which may not ensure satisfactory results.

Further, since the manufacturers responsible for the cost of the installation and maintenance of the stations, and the provision of programmes, must depend mainly upon the sales of sets for a return on this heavy expenditure, the dumping of foreign-made sets on the British market would cripple the new industry, if indeed it did not altgether render the broadcasting scheme an utter fiasco.

It has been wisely decided that the programmes of broadcasting stations should be limited to music, lectures, speeches, and interesting news, and shall not include anything in the nature of advertising.

The management of the broadcasting stations should be in the hands of a syndicate or company representative of all the manufacturers concerned in the industry. The cost of providing high-grade programmes—and these are essential to permanent success—will be considerable, and unity of control will be advantageous in providing and maintaining uniformly good quality of performances.

: HINTS : TO AMATEURS.

Wires which connect various parts of your wireless apparatus should be kept short. Always scrape bright the ends of wires before fastening to terminals. Also see that the terminals are clean where the wires join.

* * *

If your variable condenser "scrapes" during operation, two or more of the metal plates may be touching, and they should be carefully separated by a thin table knife. The trouble may be caused by particles of dust or filings, which can be removed by brushing with a feather pipe-cleaner.

* * *

The slider on a crystal receiver may make poor contact. This may be remedied by soldering a short length of flexible covered wire to the metal part of the slider, and fixing the other end of the wire to the slide rod terminal.

* * *

Don't let clothes lines rub against your aerial wires.

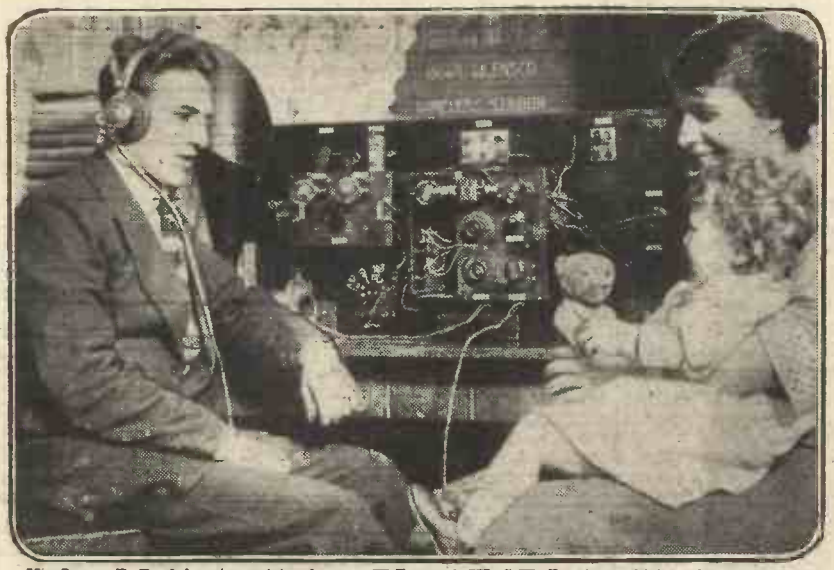
* * *

An indoor frame aerial is not for use with a crystal detector receiver. Fair results may be obtained with a frame if you use one valve, but three valves are necessary for the best results.

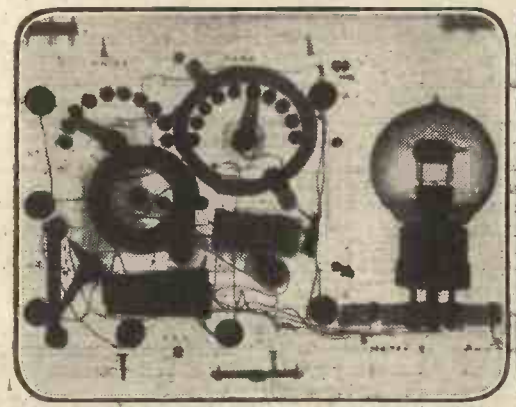
* * *

When you add metal fittings such as terminals and switches to your set, always mount them on ebonite, which insulates the fittings from any "earthing" effect.

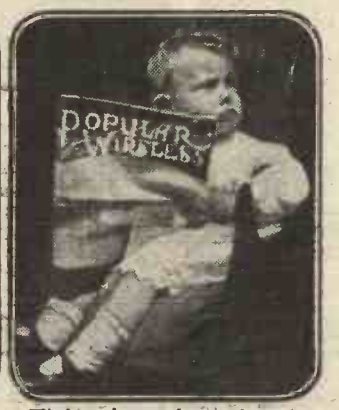
LISTENING TO 2 M T.



Mr. James F. Doyle's set consists of an ex-W.D. Mark III. C.W. Receiver which he has converted to his liking. Mr. Doyle gets music and speech which can be heard all over the house when using a loud speaker. His station is situated at Finsbury Park.

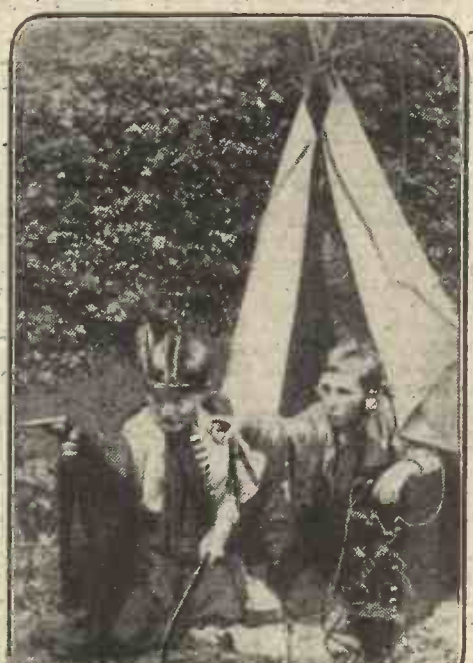


This shows an X-ray impression of a small wireless receiver. Sent in by Mr. H. Pickering, Twickenham Park, Middlesex.



Wireless is popular, and so is POPULAR WIRELESS.

Many amateurs will feel envious when they look at this fine aerial erected by Mr. F. T. Thesworth, Stone House, Endon, Staffs.



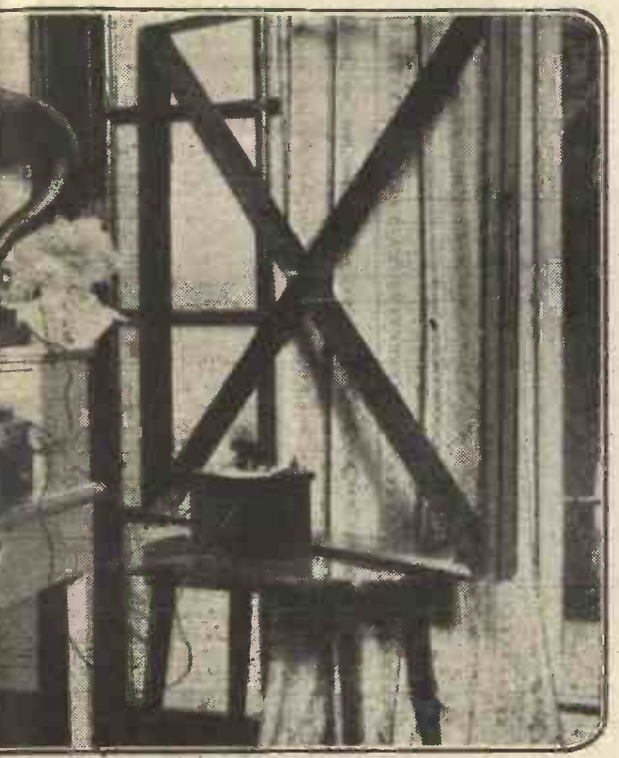
Mr. P. R. Hawton, Chester Road, Erdington, Birmingham, finds wireless useful when out camping, and especially when attacked by hostile Indians and "bad men" from Texas.

WIRELESS IN MY

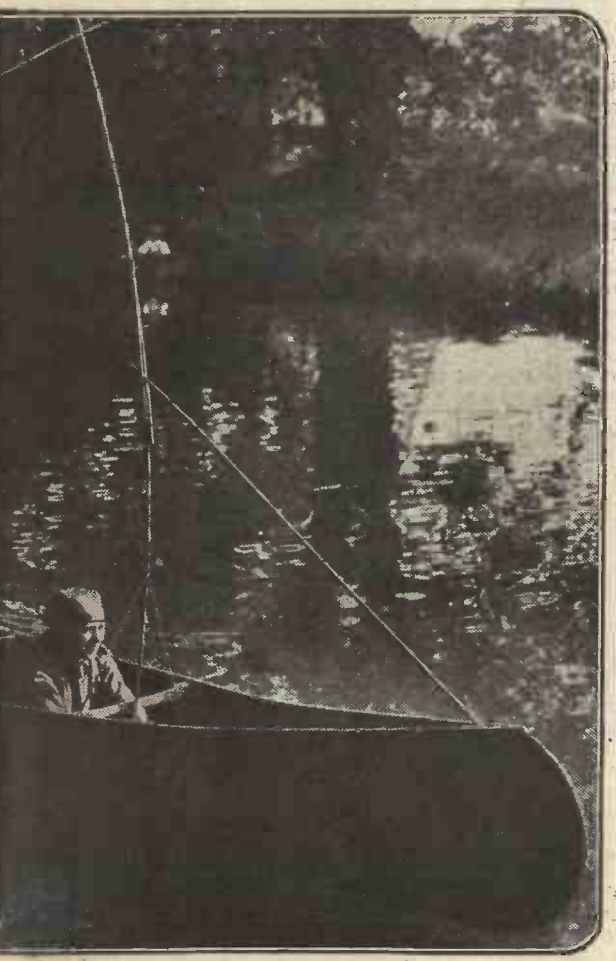
Miss Cecily Debenham, who played so successfully in that amusing comedy, "
She is so keen on the wireless 'phone that she has a special receiver fitted up i
extreme right of the photograph, and a loud speaker. 2 M T and 2 L

The 1st S.W. Herts troop of Boy Scouts have fitted up a wireless set in a ca
Other Scouts please note, and remembe

LADY'S BOUDOIR.

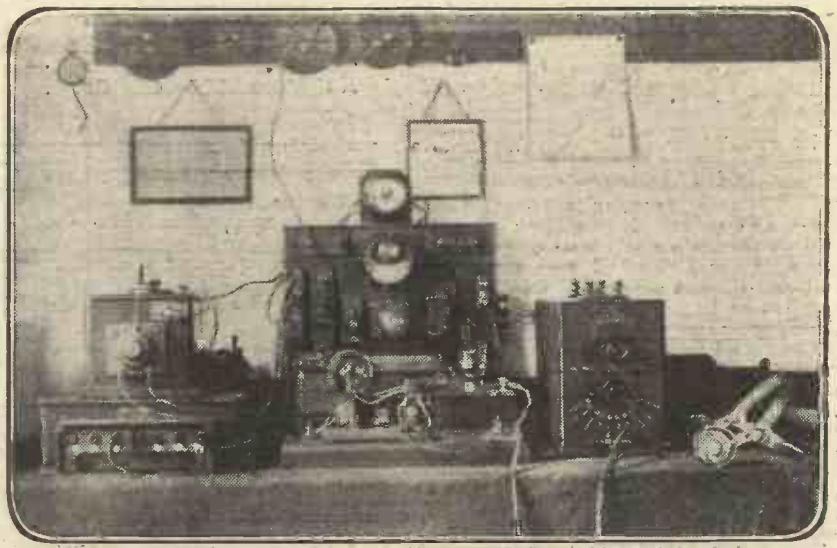


His Girl," at the Gaiety Theatre, London, finds listening-in a new hobby. n her dressing-room. Miss Debenham uses a frame aerial, seen on the O (Writtle and Marconi House) " come in " quite loud and clear.



e, and " pick up " good telephony on the aerial shown in the photograph. the watchwords, " Be prepared ! "

A FINE AMATEUR SET.



Mr. C. Drummond, 5, Market Place, Ulverton, is the owner of this splendid set, which he practically constructed himself. The ingenuity shown by amateurs in this country who have made their own apparatus is a good indication of the interest taken in wireless. Mr. Drummond's set does him infinite credit.

Here is another fine home-made set. The owner and creator is Mr. Stanley J. Smith, 39, Randolph Road, Glasgow. He is only fifteen years old—but he knows how to erect a good set.

This photograph was sent in by Mr. David C. M. Evans, 33, Whitecross Street, Hereford. By using a simple type of receiver the fair amateur in the picture can enjoy telephony and music by wireless while sitting in the garden.

THE TRAINING OF AN AERIAL SIGNALLER.

The Early Experiences of an Ex-Fleet Observer.

IN a recent issue of POPULAR WIRELESS a reader asked if he could learn the Morse code at 15 words a minute over a week-end. The query, touching in its candid innocence, and of optimistic outlook on a big subject, started a whole train of reminiscent memories, for I, too, had been through the mill, and climbed slowly and wearily up the long ladder leading to proficiency in Morse signalling by many and various systems.

Although I worked at it every day, it was more a matter of months than of a week-end, and hard, grinding months at that, before the training began to show tangible results.

For the benefit and interest of some beginner, let me give an outline of the methods adopted by the R.A.F. in the training of their observers, as far as matters connected with signalling were concerned.

Instruction commenced at a preliminary training school, in my own case, at Reading. Classes were formed of about 20 attached officers or flight cadets, and were grouped according to any knowledge of the code they already possessed.

The lowest, or commencing, class was that working at a speed of from 0 to 2 words per minute, and the highest from 8 to 10.

Having attained these giddy heights, the pupil earned exemption from further classes, and, incidentally, an extra hour in bed of a morning, as "buzzing" instruction commenced with the lark under war-time conditions.

In the classes the pupils sat at long school benches, and were each provided with the usual double telephone headgear and a signal pad. The instructor had charge of the buzzer transmitting key, and commenced operations by sending the whole alphabet through slowly, so that the symbols, dots and dashes, might be taken down.

Two Words a Minute!

The next stage was to send letters in irregular order, and to give time for the pupils to pick them out from the written copy of the code which they already possessed.

By dint of forty-five minutes, morning and afternoon, most of the class were able to dispense with the "crib," and take the buzzed letters down direct at the maximum speed of the elementary class by the end of the third day. An examination followed, and all who passed proceeded to the 2 to 4 w.p.m. class, usually moving to the next higher stage after the examination on every third day.

On moving up, the first lesson or so was always a trifle confusing, and the signals sounded more like a disordered medley of noise than the straightforward code, but this state of mental discomfort always passed in due course.

Gradually, as a knowledge of the code became absorbed into the system; the faculty of recognising a letter by its sound *as a whole*, and apart from its structure of dots and dashes, became acquired, and until this phenomenon is observed no real progress has been made.

For practice in sending, use was made of Morse inkers giving a record on a paper tape, so that the instructors could form an opinion of one's style and regularity of spacing.

The minimum standard for the pass-out examination at Reading was 6 w.p.m., and all, even those who had obtained exemption from classes, had to qualify. This speed was the one at which the artillery observation machines working with the Army used to transmit.

In view of later experience in a harder school, Reading can only be regarded as having given a slight groundwork of Morse, on which to work up to a higher standard by more intensive study afterwards.

20 Words a Minute!

As the result of my pass-out, I found myself posted to the Fleet Observers' School at Eastchurch, with a view to becoming an observer in a seaplane coast patrol squadron, always provided that I emerged unscathed from an exacting course, compared to which Reading was child's play.

On arrival in the mess, I ventured to ask an old hand what speeds we were expected to attain.

"Oh, about 20 w.p.m. if you are going to a coastal squadron," he replied airily, "but if you try for the fleet they want about 25."

When I regained consciousness, they were squirting the mess soda-water over me!

My heart sank, even at the thought of their lower estimate. 20 w.p.m.! What a hope! And the Army people thought themselves regular dogs at 8!

A kindly L.T.O., an instructor in the buzzing class, endeavoured to revive my drooping spirits.

"You'll get the 'ang of it! We've had some precious thick 'uns 'ere, sir, and even they done it!" With which small crumb of comfort I set to work grimly.

So much concentration did we bring to bear on the subject that we were literally physically fatigued when "Stand easy" came, and we hung up our headgear in front of us.

The instructors always sent at a speed just a little quicker than we could comfortably take, for therein lies the whole secret of progress. While learning the noble art, a speed that one can take without exertion does but little good.

From 8 w.p.m. we climbed with surprising ease to 16, but from there onwards we began to feel the pull. Every additional 2 w.p.m. thereafter required an inordinate amount of effort, but at the end of four months we had reached the twenties, and were still going strong.

It must not be thought that W/T alone occupied our days, or four months might be considered an extravagant length of time for the progress actually attained. Five other comprehensive subjects were being pumped into us simultaneously, and some members of the party were experiencing acute mental indigestion in consequence.

Practice in the Air.

Instruction in wireless was by no means confined to terra firma. As soon as a reasonable proficiency had been attained, and the enormity of jamming somebody else's signals duly impressed upon us, we were sent into the air, at first with a variety of spark transmitters, and crystal-cum-amplifier receivers, and later on promoted to the last word in C.W. sets.

Once in the air, the "make-learn" observer lowered some 200 feet of aerial from a reel, tuned in, and proceeded to get in touch with the ground station. He was then sent a coded message, which had to be decoded from the signal book, and an appropriate coded answer transmitted. A signal of cypher groups was then sent twice and repeated back from the aeroplane. The aerial would then be reeled in, and the balance of the half-hour allotted to W/T flights would be spent in stunting or joy-riding.

The above operations may sound simple, but what is easy on spacious land becomes less so in the cramped quarters of the observer's cockpit, where, if he be long-legged, his knees are jammed up against the instruments, and his feet in the accumulators.

Add to this the jugglery required to deal with a lead-bound signal book, signal pad, and pencil, sending key and change-over switch, also the roar of the motor, hurricane blast of wind, and "buckshee" oil floating round, and it can be understood that some of the shining lights of the instruction shed showed to less advantage when aloft.

The Intricacies of Procedure.

When we were quite *au fait* with Morse at regulation speeds, more and more time was devoted to the intricacies of procedure, absolute exactitude in which was regarded as essential. Manœuvre procedure, too, was a subject that came in for much attention as our knowledge of the rudiments of fleet formations and dispositions improved.

By this time Morse had lost all its terrors, and on thinking of the (comparatively) far-off days at Reading one was permitted a whimsical smile. One also realised the great gulf, as far as technical attainments were concerned, between the fleet observer and his less highly-trained brethren of the Army.

Wireless societies that aim at instructing the young idea might do worse than adopt some such system, modified, of course, according to their individual needs, and those who take the trouble to reach even a moderate proficiency in the code will find that there is much in the ether to interest them over and above broadcasted telephony.

Step by Step in Wireless

No. 6.—CONTINUOUS WAVE RECEPTION.

THE problem to be solved when considering the reception of continuous wave signals, commonly known as "C.W.," is one which has for its solution the satisfactory detection in the receiver of the radiated waves.

Waves which are created by the "spark" method of transmission occur in groups or trains of waves which gradually decrease in amplitude. Such a wave train was shown in diagram form in No. 2 of POPULAR WIRELESS. Each train of waves, when it arrives at the detector of the receiving set, is rectified into a unidirectional impulse of current, which is carried to the receiving telephones. This results in a click being heard in the earpieces every time a fresh wave train arrives at the receiving station. If therefore the operator at the transmitting station uses, say, 50 such wave trains to make a "dot," and 150 to make a "dash," the receiving telephones would click 50 times for each dot received and 150 times for each dash. These clicks follow each other so rapidly that to the human ear they do not sound like sharp individual noises, but are merged into a buzzing sound.

As there are many more clicks in the dash than in the dot, the buzz will naturally be of longer duration, and we therefore get the essentials necessary for communication by means of the Morse code; namely, long and short buzzes, or dots and dashes. This will not apply to continuous waves, however. As the name implies, the waves are continuous, and are not radiated in groups or wave trains. A continuous wave is just one long train without variation, and the only sound which will be heard in the telephones is one click when the first wave of the train passes through the receiver circuit, and another click when the "train" ceases.

If we can manage, however, to break or "chop" up the wave into several groups, we shall have similar conditions to those which govern the reception of spark signals. One of the commonest methods adopted to accomplish this end is known as the "Heterodyne System," or "beat reception."

The action of the heterodyne system for receiving continuous waves is based upon the interaction of two alternating currents of different frequencies, generated in the receiving circuits of the wireless set. In this system the rapidly alternating current set up in the receiver circuits is combined with a second alternating current generated locally at the receiving station.

Let us suppose that the oscillations set up by the received signals are alternating in the receiver circuits at 51,000 alternations, or cycles, per second (see Fig. 1, A). If another alternating current of 50,000 cycles per second (Fig. 1, B) is superimposed on it, a beat current will result. The frequency of the resulting beat current, however, will be the numerical difference between the frequencies of the two currents creating it, namely, 1,000 cycles or alternations per second.

This is due to the two alternating currents, which are of different frequencies, and therefore constantly changing their relationship one to the other. This can be seen in Fig. 2. The waves when "in phase" are helping each other, and a maximum current will result. When the two waves are "out of phase" they are opposing each other, with a corresponding decrease in current value.

The result of this interaction is shown graphically in Fig. 3. A subsequent article in POPULAR WIRELESS will show readers how they can draw out these two wave trains, and the manner in which the resultant wave representing the beat current is arrived at. We thus have a wave which varies in a manner similar to that of the spark signals previously referred to. The number of beats that take place in one second is known as the "beat frequency," and must not be confused with the oscillating frequency of the two superimposed waves.

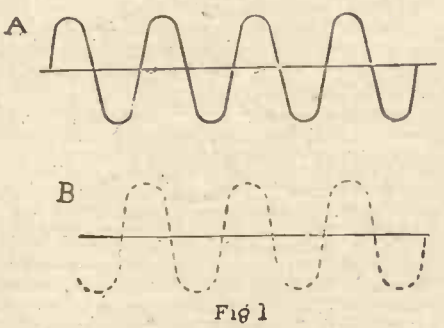


Fig 1

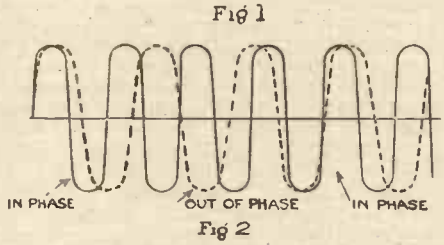


Fig 2

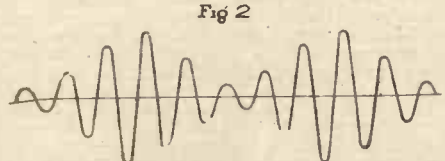


Fig 3

The "beat" frequency, as explained, is always equal to the difference between the frequencies of the two rapidly alternating currents.

The pitch of the note actually heard in the telephones will depend on the frequency of the "beats" which go to form it. If the difference between the oscillating currents was 2,000 instead of 1,000 as quoted, a higher note would result in the telephones, because of the higher frequency of the beat current. If the two wave trains were brought nearer to the same frequency, so that the beat current only possessed a frequency of 500, the note would be lower.

It can now be seen why the note of the continuous wave signals can be altered in the receiving telephones while still retaining the Morse signals. If the frequency of the waves generated locally is altered, the note in the telephones will become either higher or lower, as explained. The same reasoning will show that if the local wave train is allowed to remain constant, and the frequency of the incoming oscillation is varied, similar results will be obtained. The piece of apparatus used to create the local wave train is known as an oscillation generator, and sometimes as a "local oscillator." It may be included directly in the receiver circuit, or erected in close proximity to the receiving apparatus as an independent circuit.

Originally the local oscillations were generated by means of an arc set, but to-day the three-electrode valve is more generally used for the purpose of "heterodyning."

DUST COVERS FOR CRYSTAL DETECTORS.

WHEN a crystal is purchased, it is usually soldered into a metal cup which is about a quarter of an inch in diameter. Connection from this side of the crystal to the circuit is therefore easy of accomplishment. The lead taken to the other side of the crystal, however, requires delicate adjustment, and this is sometimes obtained by means of a fine wire spring joined to the end of the lead.

The area on the crystal covered by the end of the wire is therefore very minute, and the presence of a speck of dust or dirt between the crystal and the wire will render the crystal inoperative. The possibility of trouble in this respect can be greatly minimised by providing the crystal detector with a dust-proof cover.

One of the easiest methods is to procure, from a chemist's or draper's shop, an empty celluloid powder box, large enough to cover the mounted crystal. It costs about 1s. 6d. Remove the lid, and place the box, inverted, over the detector. Small holes can be pierced in the celluloid in positions convenient for the admission of the necessary wires connecting the crystal to the set.

If a carborundum crystal is used, or any type to which a small voltage is applied, the leads from the crystal to the outer circuit should be well insulated. This method of supplying the crystal with a cover has the advantage of mobility.

The crystal will require constant adjustments if it is very sensitive, and unless the cover can be removed and replaced quickly, the process becomes irksome.

Another, and perhaps better way, is to place the entire detector in the bottom of the box, taking the leads through notches in the edge of the lid and the box. It will then only be necessary to remove the lid of the box to adjust the crystal.

Readers are invited to send photographs for publication in POPULAR WIRELESS. A fee of 10/6 for every photo used will be paid, and £2 2s. if used as a cover plate.

WIRELESS CLUB REPORTS.

The Editor will be pleased to publish concise reports of the meetings of wireless clubs and associations, reserving the right to curtail the reports if necessary. An asterisk denotes affiliation with the Wireless Society of London.

Tuxford and District Wireless Society.

The above society has been formed under the above title to serve the rural area surrounded by the towns of Retford, Gainsboro', Mansfield, Newark, and Worksop.

Owing to the courtesy and kindness of Mr. B. Clark, a recreation-room capable of seating 300 people, and smaller rooms have been placed at the disposal of the society free of all cost, hence, when the apparatus is installed, the society can be run at small expense.

It is proposed that a twin aerial be erected, and a three-valve set with loud speaker be installed as a beginning.

The provisional rules provide for full members aged 16 years and upward at a minimum subscription of 5s. per annum and one student member at 2s. 6d. per annum. Subscribers of 10s. 6d. per annum will be eligible for vice-presidentships, with all the privileges of ordinary members.

The subscription will admit to all classes and lectures, etc., on wireless subjects, and to all "Wireless Entertainments" provided by the society.

It is hoped that a well-known scientist will accept the presidentship.

Hon. Secretary, H. N. Watson, Post Office, Tuxford, Notts.

* * *

Cardiff Wireless Society.*

The initiation of the first lady member into the enthusiastic brotherhood of the Cardiff and South Wales Wireless Society was carried out at Market Buildings, Cardiff, on June 15th. Special reference was made to Mr. H. Russell Jones, hon. treasurer, who is leaving South Wales, the society giving him a warm farewell. Mr. Jones was thanked for his work.

Mr. Alex Lawrence gave a lecture upon the elements of electricity. Mr. N. M. Drysdale was in the chair.

* * *

Forming a New Club.

Mr. Horace E. Hobbs, of 15, Rydon Crescent, London, E.C. 1, will be glad if wireless amateurs in Holborn, Bloomsbury, Islington, and Finsbury would get in touch with him with a view to forming a wireless club.

* * *

Wireless Society of Hull and District.*

At a well-attended meeting of the above society, presided over by Mr. G. H. Strong, and held on June 12th, Mr. W. J. Featherstone read a most interesting paper on "Miscellaneous Subjects Appertaining to Wireless."

He carefully explained the various detectors which have been used in the past and others which are still in use, such as the coherer, magnetic, crystal, and valve. A relay was exhibited and the lecturer gave a brief account of the many uses to which this piece of apparatus could be put. Incidentally, he related several incidents which had occurred since he began to dabble in wireless many years before the war.

In fact, he is one of Hull's pioneers in wireless, and an ex-Post Office telegraphist.

The chairman issued a few words of warning to the newcomers not to expect too much from the crystal as a detector for wireless telephony in connection with the broadcasting scheme, and then proposed a vote of thanks to the lecturer, which was ably seconded by Mr. C. Dyson (another pioneer in wireless).

Fourteen new members were elected. Will all members please note that their attendance is *specially desired* at the annual meeting of the society, which will be held on Monday, July 10th, at the Signal Corps Headquarters, Park Street, at 7.30 p.m. ?

After the business has been transacted, the remainder of the evening will be devoted to questions and answers, and should prove very helpful to the new members. Meetings are held on the second Monday in each month.

Intending members should get into touch with the Hon. Secretary, H. Nightscales, 16, Portobello Street, Holderness Road, Hull.

Radio Club Formed.

A wireless club for Hereford and district was formed at a public meeting held at the Y.M.C.A., St. Owen Street, on June 19th, Dr. Herbert Jones in the chair. There was a good attendance of local amateurs and others who are interested in the fascinating hobby of wireless telephony and telegraphy. Those present were: Mr. A. J. Rowbery, Mr. A. Cope (Y.M.C.A. general secretary), Mr. S. Cholerton, jnr., Mr. Blackmore, Mr. T. Connell, Mr. G. C. Davies, Mr. S. D. Best, Mr. Geo. P. Jones, Mr. L. F. Miles, Mr. MacAdam, Mr. C. Edwards, Mr. E. Last, Mr. A. T. Howard, Mr. G. Reese (Credenhill), Mr. H. J. Auber, Mr. K. L. Goodall, and Mr. J. E. Thompson (Brinsop).

Dr. Jones said he saw from a wireless journal in front of him that there were a great number of wireless clubs all over the country which seemed to be doing most excellent and interesting work. One outcome of that meeting to-night might be that they would start a wireless club for Hereford. He thought it might be better for them to consider the best course to take. The meeting that evening, although held at the Y.M.C.A., was quite disconnected with the Y.M.C.A. It showed them how very catholic the Y.M.C.A. was, and how it encouraged things which came its way. He invited opinions as to the forming of a club.

Mr. Blackmore proposed that Mr. Rowbery should write to Mr. Mayall inviting him to address the club, and Mr. Best seconding, this was carried.

Mr. G. C. Davies, of Eign Street, was elected acting secretary upon the proposition of Mr. A. Cope, seconded by Mr. MacAdam.

The secretary was instructed to write to other societies asking for books of rules, etc. The question of details and subscriptions was left until a later date.

Dr. Herbert Jones, Mr. A. Cope, Mr. A. J. Rowbery, Mr. Percy Pritchard, Mr. F. Ladmore, Mr. S. Cholerton, jnr., and the secretary were elected as a temporary sub-committee.

It was stated that the following gentlemen had sets in Hereford: Mr. Percy Pritchard (transmitting and receiving), Blenheim House, Broad Street; Mr. F. Ladmore, Mr. Miller, Oswin and Co., Broad Street; Mr. S. Cholerton, jnr., Nelson Street; Mr. A. J. Rowbery, St. Owen Street; Mr. Kenneth Simpson, Eign Street; Mr. Wallis, King Street; Colonel Wilkes, Aylestone Hill; Mr. Reece, Credenhill; Mr. A. R. Kirby, Fawley; Mr. G. Thompson, Brinsop; and Mr. Yeo, Lugwardine. Some of these, however, are not in actual use.

After the meeting several members visited Mr. Rowbery, where his set was seen in operation, quite good signals being received.

* * *

The Leicestershire Radio and Scientific Society.*

The monthly meeting of the Leicestershire Radio and Scientific Society took place on Monday, June 19th, at headquarters.

The balance-sheet of a recent dance was read and accepted, it showing a substantial profit.

Three new members were accepted, bringing the total to 43 members.

The lecturer for the evening was the society's president, Mr. Cyril T. Atkinson, and the subject "Short Wave Reception." Mr. Atkinson first of all pointed out the reasons for the special measures necessary for short wave receiving the short ether waves of below 300 metres, and then described step by step the various classes of gear and methods of construction. The lecture was illustrated by a number of pieces of apparatus of the lecturer's own construction, and an extremely interesting evening was spent.

At the conclusion a very hearty vote of thanks was accorded to the lecturer, proposed by Mr. Pallett, seconded by Mr. Yates, and heartily acclaimed by the whole assembly.

The meeting closed at 9.30.

The next general meeting of the society will be held on July 17th at headquarters, the lecture being "Continuous-Wave Transmitters," by Mr. J. W. Pallett. Hon. Secretary, Mr. J. R. Crawley, 269, Mere Road, Leicester.

LAND STATIONS IN GREAT BRITAIN.

D F—Direction Finding stations. C W—Continuous Wave system of transmission. T—Telephony.

NOTE.—The Admiralty stations, the call signs of which generally begin with B, do not make public their wave-lengths or power used.
* Service temporarily suspended.

Amateurs desiring a complete and detailed list of all the wireless stations in the world should purchase the International List of Radio-telegraph Signals, published at Berne, price 18 francs.

Call Sign.	Name of Station.	Approx. Normal Range.	Wave-lengths in Metres.
B Y D	Aberdeen	—	—
B Y A	Admiralty	—	—
G F A	Air Ministry	500	1,400 1,680
G F I	Andover, Hants	—	—
G F B	Baldonnel	—	—
Y X Q	Ballybunion	—	—
G S L	Ballycastle (Ireland)	15	250
B V G	Berwick (D F)	—	450
M A X	Broomfield	—	—
B Y R	Bunbeg*	200	220 300 600 1,000 1,200
G C S	Caistor-on-Sea	—	1,000
G F L	Calshot	—	—
M U U	Carnarvon	—	14,500
B V Z	Carnsore (D F)	—	450
G E C	Castle Bromwich (T)	400	(CW) 900
M Z X	Chelmsford	—	—
B Y B	Cleethorpes	—	3,000
M F T	Clifden	—	6,500
B Y Q	Corkbeg	—	600 800
G F C	Cranwell	—	(C W)
B Y P	Cromarty	—	—
G X O	Crookhaven	250	300
G V A	Cross Sand Lightship	15	230
G E D	Croydon (T)	400	(CW) 900
G C C	Cullercoats	250	300 600
B Y M	Culver Cliff	200	600 800 1,000
G K U	Devizes	1,000	1,800 2,100 3,000 (C W)
G E M	Didsbury (T)	400	(CW) 900
G F K	Donibristle	250	(CW) 1,300
B Y L	Dover	—	—
G V B	East Goodwin Lightship	15	230
G N J	Fastnet	100	300
B Y J	Felixstowe	—	—
G F E	„	—	(C W)
G R L	Fishguard	200	300 600
B V N	Flamborough (D F)	—	450
G U R	Folkestone Harbour	45	300 600
G F G	Grain	100	1,300 (C W)
B Y V	Grimsby	100	300 600
G K A	Guernsey	—	—
G V C	Gull Lightship	15	230
B V H	Harwich	—	—
B W H	„	—	—
M H H	The Haven	—	—
G K G	Heysham Harbour	150	400
B Y C	Horsea	—	3,000 4,500
G F Z	Howden	—	(C W)
B Z U	Immingham	—	—
B Z A	Inchkeith (D F)	—	600
G E G	India House (T)	—	1,400
B Y E	Ipswich	—	—
G D X	Isle of Man	—	—
B Z S	Kingsnorth	—	—
B W K	Kingstown	—	—
G L D	Land's End*	250	300 600
G B L	Leafield	—	—
G E L	Lerwick	250	600 900 1,400
B V Y	Lizard (D F)	—	—
G C B	Lochboisdale	150	300 (C W)
G E G	Lympne (T)	400	900
G M H	Malin Head	250	300 600
2 L O	Marconi House Experimental Broadcast Station	—	—
G N V	Newhaven	120	400
G N I	Niton	150	300 600
G N F	North Foreland	150	300 600
B X H	Orfordness (D F)	—	—
G P Q	Parkstone Quay (Harwich)	130	450 600
B Y F	Pembroke	—	—
M P D	Poldhu*	1,500	2,800
B Y N	Portland Bill	—	600 800
B Y S	Portpatrick	—	—
B Z C	Portsmouth Signal School	—	—
G E P	Pulham (T)	400	900 R.3d airship
B W Q	Queenstown	200	300 600 1,000
B Y O	Rame Head	—	600 800
G R N	Rathlin Island	15	250
G E R	Renfrew (T)	400	900 (C W)
B Y H	Rosyth	—	—
G L V	Scaforth	150	300 600
B Y K	Sheerness	—	—
G F O	Shotwick	—	(C W)
G V D	S. Goodwin Lightship	15	230
G S W	Stonehaven	900	300 600 1,800 3,000 5,000
G V E	Sunk Lightship	30	230
G C A	Tobermory	150	300
G V F	Tongue Lightship	15	230
M U V	Towyn	—	—
B Z T	Tynemouth	—	—
G C K	Valentia	250	300 600
G K R	Wick	—	300 600

FROM OUR NEW YORK CORRESPONDENT.

THE enormous growth of radio in the United States has had the effect of raising some extremely interesting questions which were never dreamed of when the great game was in its infancy.

To begin with, there is its effect on the study of music by young people. The gramophone and the player-piano, both of which are far more popular in the United States than in England, have had a marked result in lessening the number of pupils received by music teachers. Music is now so easily obtained by mechanical means that boys and girls in increasing numbers are unwilling to undergo the drudgery of learning an instrument. Is it not reasonable to suppose that radio will add to the effect already produced by the growth of the player-piano and the gramophone ?

Mechanical Melody.

This question leads to others. It has been found that the sale of sheet music has decreased very considerably with the growth of these mechanical means of producing music. It was at first thought that the hearing of new songs sung by "radio-artists" would stimulate the demand for them, but this has not been the case. Now, what becomes of the poor song-writer under these circumstances ? That his plight and that of the music publisher is a serious one is seen from the fact that the Music Publishers' Protective Association is taking up the question of obtaining a royalty for each performance of a song or other piece of music which is transmitted by radio.

It is pointed out that were it not for the free broadcasting of music the radio industry would never have grown to anything like its present size. This means that performances of music for radio broadcasting are performances for gain, and the authors and publishers are morally and legally entitled to a royalty.

Now there is the further question of how the concerns giving concerts are to recoup themselves, not only for the payment of royalties, but of artists. The stage has not yet been reached where artists are no longer willing to give their services for the sake of the advertisement, but it will certainly come before long. It is impossible to collect admission to a radio concert, so that the only solution seems to be for the radio manufacturers to treat the cost of concerts as selling cost, and add it to the price of the instruments.

Press Broadcasting.

The "Detroit News" claims the credit of being the first newspaper in the world to equip itself with a radio broadcasting apparatus for the regular transmission of news. Every weekday since Sept. 30, 1920, this newspaper has broadcasted a programme of news and other features. It includes speeches by prominent men and a regular nightly programme of dance music of which private parties avail themselves for hundreds of miles round. The present transmitting apparatus consists of a 500 watt, 300 to 600 metre broadcasting set with a range of 1,500 miles. Actually, however, it has been heard in Bordeaux, Hawaii, and Cuba. It has a special Western Electric amplifier in the speech input section which amplifies the voice a hundred thousand times without any distortion.

Railway Radio.

The Lackawanna Railroad Company, one of the principal Eastern lines of the United States, has conducted some experiments in receiving on moving trains which have been so successful that the company has now decided to equip all its long-distance expresses with receiving sets. The apparatus finally evolved was a 15-watt set, for both transmitting and receiving, with a detector and two-step amplifier, and a regenerative set. The antennæ consisted of three 4½-in. wire cages, six wires to each cage, one cage on each side of the coach roof and one on top.

Perhaps the most striking experience of the experimenters was that they were able to transmit and receive while the train was rushing through a long tunnel. Several other theories regarding the effect of location on signals were upset. It was found, for instance, that it made little difference whether the train was running through a cutting forty feet deep, or on the level. Rock, and steel bridges similarly had little effect. Woods had the effect of causing long-distance signals to fade out entirely. When the train was running by a large lake or by a river, signals immediately increased in strength to a marked extent. The position of the antennæ in relation to the sending station was another important factor, because it was found that often, going round a curve, one set of stations would fade out and another set come in !

Going One Better.

The equipment of hotels with radio sets is proceeding apace in the U.S. The McAlpin in New York is the latest to instal a set. When the fitting up of steamships with duplex sets, which enable speech and telegraphist signals to be sent and received simultaneously, has proceeded far enough, we shall see passengers booking their rooms and settling all details of location, price, and so on, from a telephone receiver in the lounge of their vessel, on even from their state-rooms !

COMPETITION RESULT.

The number of entries for the competition given in No. 3 of POPULAR WIRELESS proves that thousands of readers are keenly interested in the policy of this paper.

It is impossible to print the many useful and ingenious criticisms given by readers, but some of the chief points of interest are as follows :

Readers are obviously divided on the question of printing fiction. Many say "cut it out," and others say "leave it in"; therefore I intend publishing a short story dealing with wireless every few weeks and not regularly. This, I hope, will satisfy both parties.

One reader suggests leaving all humour out of POPULAR WIRELESS. This, I feel sure, would be a mistake.

Constructional articles seem in great demand, and to meet this I have ordered a special series from a well-known expert. They will appear very shortly in subsequent issues of POPULAR WIRELESS.

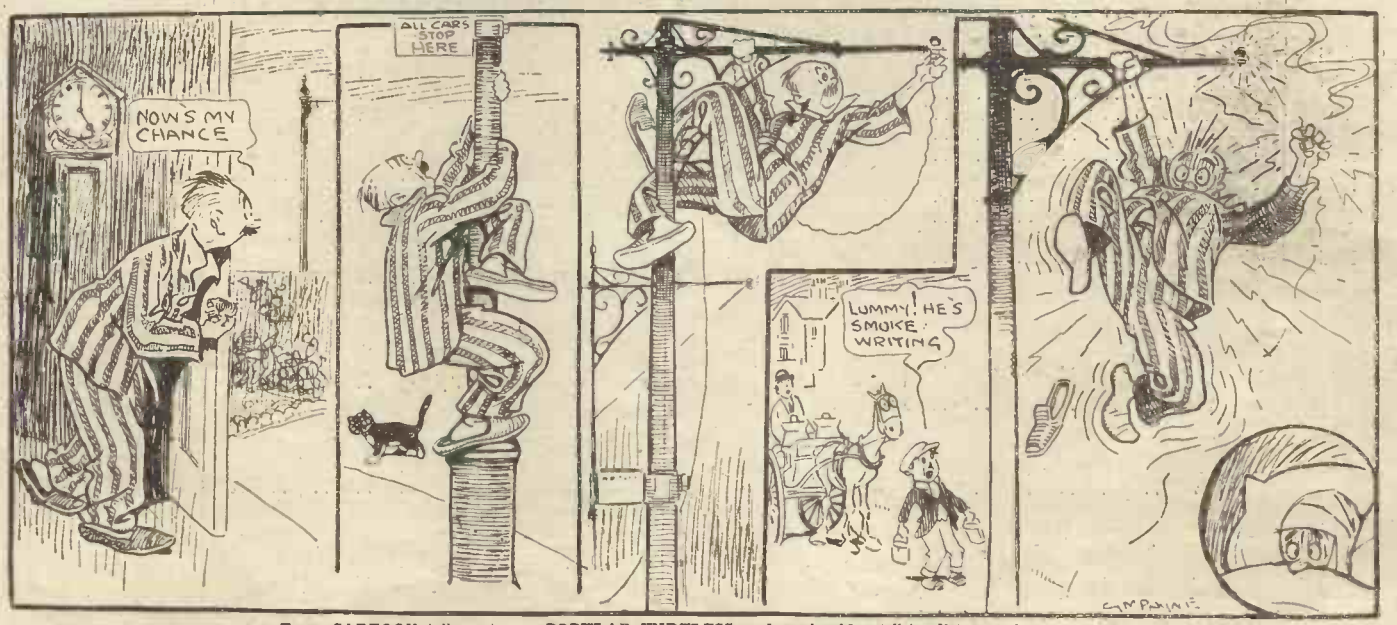
On the whole, readers appear to have found a long-felt want in POPULAR WIRELESS. I only hope they will continue to do so ! The prize-winners are :

Mr. E. J. W. GUNNER, 19, Prince's Avenue, Chester.

Mr. H. E. MIDDLETON, 120, Golden Hillock Road, Small Heath, Birmingham.

Mr. E. LOWDEN, Boxgrove, near Chichester.

FATHER'S EARLY MORNING TRAGEDY !



Every CARTOON tells a story. POPULAR WIRELESS readers should not "tap" tram wires

RADIOTORIAL

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

Many prominent wireless amateurs in the country have written to me just lately asking me to point out the annoyance and confusion caused by amateurs experimenting with "stunt" valve circuits.

The novice may not be aware of the fact that the electron valve, if connected up on an unsuitable circuit, will radiate energy and cause considerable "jamming" in the telephone receivers of other amateurs.

This is generally what happens when the novice begins experimenting before he has acquired a sufficient working knowledge of valves.

If the novice will bear this in mind and refrain from experimenting until he quite understands what he is about, this confusion and jamming will not interfere with other amateurs.

If any beginner is in doubt about his valve circuit, and thinks he may be causing interference, I shall be pleased to give him the advantage of the opinion of the Technical Staff of POPULAR WIRELESS, if a diagram of the circuit is sent in.

The valve sets sold by manufacturers will not cause this undesirable radiation, providing the novice does not experiment with the circuit until he is fully aware of what he is doing.

I hope this advice will be taken to heart, for after all, "Live and let live" applies equally to wireless.

EDITOR.

Questions Answered

P. S. (Chiswick).—I have difficulty in using shellac. It seems too thick, and will not lay on evenly. Can you tell me how to handle it?

You should thin it down with methylated spirits. By adding this slowly and stirring gently with a thin piece of wood, you should have no difficulty in reducing it to a consistency suitable for equal distribution.

* * *

F. E. S. (London).—Will I be able to receive anything with a twin aerial 12 feet long?

Yes, but only the nearer and more powerful stations. Endeavour to extend the length to at least 30 feet.

* * *

W. A. (Tayport).—Could I increase the loudness of signals by putting a microphone button beside the 'phone, and leading two wires from it to another 'phone with a trumpet attached?

No. The button would have to be attached to the reed or diaphragm of the receiver, and a small transformer used for the microphone circuit. It is not advisable to attempt to do this unless you have some considerable experience and skill in the handling of fine instruments, or the result will be but the damaging of the telephone receiver.

* * *

S. A. (Birmingham).—I have purchased a Mark 3 ex-Government crystal set, having been told that it could be very easily converted to a valve set. I have no knowledge of wireless, and find that I cannot convert. What shall I do?

These sets are very suitable for conversion or adaptation to valve circuits. Unfortunately it cannot be accomplished with any success by anyone who is not well up in valve work. In any case, one must have a very good grounding in theory to handle valves at all. You should commence reading the subject up. The wave-length range of the set in question is limited to 700 metres, so eventually the better course will be to dismantle it and use the parts separately. There are two good variable condensers, two inductance switches, a potentiometer, and a buzzer circuit that could be very usefully employed in any receiving set. Carefully follow the articles dealing with valves that are appearing, and it will not be long before you will be able to apply your knowledge gained.

* * *

H. L. (Marlborough).—My aerial passes right over the house, being affixed to two trees each 50 feet high. This necessitates bringing the lead in through the back of the house to a front room where I have my set, a distance of 35 feet. The aerial is 90 feet long. Will this prove effective?

No. You can erect a very efficient "T" aerial, however, by taking the down lead from the centre of the aerial. This should be directly above the room in which you will have your set, judging by the sketch.

* * *

D. K. M. (Enfield).—My aerial inductance coil will not tune down below about 500 metres. There are 12 tappings, the first embracing more turns than any of the others. How would you suggest that I could reduce my wave-length? I understand that putting a condenser in series with the aerial proves detrimental to reception.

Take the underneath connection of the first contact stud of the inductance, and wind a small piece of wire round it. Connect this fine wire to the most convenient point at the commencement of the inductance winding—it may be either the earth or aerial terminal of the set—in the same manner. This will have the effect of shortening the first and larger number of turns of the inductance, adjustments being from the second stud and not from the first.

* * *

J. K. M. (Glasgow).—What would be the fundamental wave-length of an aerial (twin) 150 feet in length?

190 metres.

* * *

J. M. (Newcastle-on-Tyne).—Since the frame aerial gives best results when the frame is edge on to the sending-station, would it not give best all-round results if placed in a horizontal and not vertical position?

No, the frame aerial must be vertical.

* * *

W. H. P. (Warminster).—I have two variable condensers of ·00005 and ·00015 mfds. capacity. How could I use these to their best advantage on a loose coupled crystal receiving set?

Put the ·00005 condenser in parallel across the primary inductance, and the other parallel across the secondary.

* * *

A. H. H. (Boston).—Will it be possible to have a radius that will enable me to hear the Queen's Hall and other good concerts in London?

No, broadcasting by wireless has not yet reached these desirable heights.

* * *

"Rex" (Newport, Mon.).—Would a piece of lead piping do for a leading-in tube?

No, the leading-in tube must be a good insulator made of ebonite, glass, porcelain, etc.

* * *

"Valve" (London).—Is it possible to attach more than one pair of telephones (high resistance) to a single valve set?

Yes, place them in series; you will weaken the received signals somewhat, of course.

* * *

F. A. (Willesden).—From what distance can I receive messages with two crystal detectors with a 4-volt high-tension battery running through them?

About a quarter the distance that you would receive the same signals, using but one crystal and dispensing with the "H.T." battery.

F. C. (Bristol).—How many and of what size zinc and glass plates shall I need to make a condenser ·0003 mfds. capacity?

You would require 40 square inches of ordinary glass one-tenth of an inch in thickness between suitable zinc plates. The glass must be covered each side by the zinc plates, but the number of plates you could arrange to suit your most convenient size. Thus you could have but one sheet of this glass measuring 4 by 10 inches between two suitable zinc sheets, or two plates of this glass each 4 by 5 inches between three suitable zinc sheets, etc.

* * *

A. B. (Grimsby).—How can a crystal be soldered into a brass cup?

An extremely soft solder should be used, such as "Wood's" metal. A piece of this can be broken off and placed in the cup. A second or two in the flame of a spirit-lamp will suffice to melt it, and the piece of crystal can be pressed firmly in. The interior of the cup should be well scraped, but no flux should be used.

* * *

J. A. (London).—What wave-length can be got using a coil 3 inches in diameter wound with 200 turns of 30 S.W.G. with a 100 feet single aerial, and what would be the wave-length using two such coils in series?

1,200 and 1,700 metres.

* * *

L. W. C. (Harrow).—Is an insulated "lead-out" required for the earth wire?

No.

* * *

C. J. H. (Luton).—Can you tell me the capacity of a condenser with 20 fixed vanes, 19 moving vanes, 9 square inches of overlap of vanes, ·057 inch separating fixed and moving vanes?

·0075 mfds.

* * *

F. C. (Birmingham.)—Is a licence required for a crystal receiving set?

Yes.

* * *

B. J. (Caterham).—About how many feet are there to a pound of No. 20 S.W.G. wire?

262 feet.

Would an aerial 70 feet long and 18 feet high receive messages on crystal set?

Yes, but 10 feet or so higher would be more efficient.

What is the best way of taking the insulation off the wire to be used for the aerial?

You should buy bare wire for the aerial.

Should I be able to receive messages from the wireless station at Frankly Beeches, Birmingham, living 4 miles away, using the aforementioned crystal set?

Yes, quite easily.

* * *

"Beginner" (Highgate).—What should be the dimensions of a tubular variable condenser using air as a dielectric to have a maximum capacity of ·001 mfds.?

This would be too large for practical purposes. You would require two tubes about 18 inches long, the larger being 6½ inches diameter, with a spacing between the two of one-tenth of an inch.

* * *

C. V. (Leeds).—Why should the earth lead be short?

Because a maximum of current flows at the earthed end of the aerial. This current must flow through the earth connection from the aerial to the earth, and, by virtue of its being an oscillating current, from the earth to the aerial. Therefore, if the earth connection is long, its resistance will cause loss of current.

* * *

F. G. D. (Liverpool).—Does it matter if the sliding contact of an inductance coil rests on more than one wire?

No.

* * *

"Rex" (Clapham).—My condenser has 18 moving and 19 fixed vanes. The diameter of the fixed vanes is 3¼ inches, and the space between tenth inch. Can you tell me the capacity?

·003 mfds.

* * *

S. W. (Bradford).—Is it essential to have a primary and secondary winding when making a good inductance?

No, not at all. The introduction of a secondary circuit for the cutting out of unwanted stations, however, proves very useful in the case of "jamming."

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POPULAR WIRELESS WEEKLY, July 15, 1922. REGISTERED AT THE G.P.O. AS A NEWSPAPER

No. 7.—WIRELESS QUESTIONS ANSWERED FREE BY POST

POPULAR WIRELESS

3d.

Weekly

No. 7. Vol. I.
July 15, 1922.

Mr. T. Russell, of Leominster, "Listens In" on his set.

THE WORLD'S LATEST HOBBY FULLY EXPLAINED

PUBLISHED EVERY FRIDAY

ORDER IN ADVANCE

PACKED WITH PICTURES AND EXPERT ADVICE

Popular Wireless

TOPICAL NEWS AND NOTES.

India Takes Up Wireless.

IN a recent memorandum issued by the Government of India a scheme is outlined for the establishment of a system of low-speed wireless stations in the interior.

The idea is not for communication to England, but for the various states, plantations, etc., to be better able to keep in touch with each other. Whether this scheme will develop to anything depends a great deal on the support accorded it by the local governments and by the Indian States.

* * *

An International Meeting.

AN important international meeting of marine wireless operators was recently held at Brussels. There was hardly a nation that was not represented.

The formation of an International Federation of Wireless Operators, whose headquarters should be in London, was one of the chief resolutions that the society decided upon. Many technical and professional questions were also dealt with.

* * *

A Wireless Greeting.

A FEW days ago the school children of Wales sent through the Leafield Wireless Station in Oxfordshire a message of greeting to children in other countries on the occasion of the third anniversary of the signing of the Covenant of the League of Nations.

This idea was promoted by the Welsh League of Social Service, and the response from the Welsh schools was remarkable, and as this is the first time that children of one country have greeted another by wireless the records of the communications are being sent for safe-keeping to the Welsh National Library.

* * *

Aerial Surgery.

WHEN the steamship President Adams arrived at New York recently, Dr. W. S. Irwin was able to inform the officials of his treatment by wireless of a sailor suffering from pneumonia.

Apparently the President Adams was in mid-ocean when Dr. Irwin was aroused by the wireless operator with a message from the captain of the steamer Hickman, stating that there was a sailor on board seriously ill with pneumonia.

The doctor wirelessed a prescription and instructions, and in reply was informed that some of the drugs mentioned were not on board. This necessitated Dr. Irwin calling for a list of all the drugs on board the Hickman, and when he had obtained same working out a prescription from the little material that was given him.

During the next two or three days the doctor received and sent messages every hour, and was greatly relieved when he received the glad tidings that the sailor was very much better.

It is interesting to note that Dr. Irwin is the first to amputate by wireless. This happened ten years ago when on board a vessel in the Caribbean, and some time later, when he arrived in New York, he was met by a one-legged man, who greeted him with:

"You don't know me, doctor, but I am the man whose leg you cut off by wireless!"

* * *

Indo-China and Radio.

A NEW wireless station is being built at Phuto, near Sargon in Indo-China, and the necessary energy will be supplied by the Énergie Électrique de L'Indo-Chine. It will help to connect up many ports in the East, and greatly increase their trade.

* * *

The Scilly Islands.

FOR some while communication was interrupted with the Scilly Islands, but communication has been restored by messages being transmitted by wireless from Land's End.

* * *

Wireless Weather Reports.

THE Air Ministry have announced the following alterations in the distribution of meteorological information by wireless, which took effect from July 1st:—

(1) The Synoptic Weather Reports and General Inferences hitherto issued daily on 1,400 metres C.W. at 6 a.m., 8 a.m., 2 p.m., 7 p.m., and also at 9.15 a.m. and 8 p.m. (all hours are Greenwich mean time), will be transmitted on 4,100 metres C.W. The Synoptic Report at 2 a.m. will continue on 1,400 metres. The 8.30 a.m. report will cease.

(2) In cases of breakdown or other delay, should transmission on 4,100 metres not have begun within ten minutes of the scheduled time, the message will immediately be issued on 1,400 metres.

* * *

Demonstration at Chichester.

AT the Red Triangle Club, Chichester, an interesting lecture and demonstration took place in connection with wireless telephony. The demonstrators were Messrs. H. A. Dossett and J. Horgan, of the Marconi Co. The transmitting operations were conducted from Chichester Barracks by Mr. Horgan, whilst Mr. Dossett explained things to the audience, who were greatly interested, especially in the concert that they listened to, which was being played at the barracks.

Outside the club was a scaffolding, and this came in very convenient as an aerial. Mr. Dossett picked up Morse messages from Norddeich (Germany), Boulogne, Niton (Isle of Wight), and from several ships at sea. He also received a message from a Croydon operator, who had heard their concert and wanted to know who had sent it out. Many questions were asked and satisfactorily solved, and at the close of the evening the chairman expressed a hearty vote of thanks for so interesting an evening to Mr. Dossett and his assistant, and to Mr. S. E. Payne, the secretary of the Red Triangle Club, for arranging the demonstration.

* * *

Guernsey and Wireless.

THERE is a possibility that the Fort George Wireless Station in Guernsey will be reopened, as there is every chance of a seaplane service being started with the Channel Islands. Naturally, if this comes about the air companies would wish for facilities for wireless communication in connection with their service in the islands.

* * *

A Delay in British Broadcasting.

ONE of the chief reasons for the delay in the British broadcasting scheme is the difference that has arisen between the manufacturers re the construction of the broadcasting stations. The more important manufacturers want to construct all the stations, and naturally the smaller firms are opposed to this proposal, which they rightly consider monopolistic.

A Post Office representative stated that the firms had been asked to submit a scheme, but even now there is still much wrangling.

Fixing the Lead-In.

NEWS AND NOTES

(Continued.)

Dancing by Wireless.

ON Saturday, July 15th, a wireless concert will be received at the King's Hall, London Road, S.E., between seven and eight o'clock in the evening. Mr. W. F. Hurndall, the proprietor of the hall, hopes that dancing by wireless music will be possible.

* * *

New French Service.

A NEW wireless service between France and the United States was opened yesterday, when the powerful Sante Assise station (Seine and Marne Department) was tested with satisfactory results.

* * *

Broadcasting Licences.

REPLYING to questions in the Commons last week, Mr. Pike Pease, Assistant P.M.G., said that the number of licences granted for receiving wireless messages by June 3 was approximately 11,000, and of those granted for transmission approximately 450.

* * *

The Reason Why.

IT is understood that proposals made to the Postmaster-General by a number of firms desiring licences for wireless broadcasting include a stipulation that only British-made apparatus shall be permitted.

This is now the chief reason why broadcasting is being held up. Manufacturers of wireless apparatus want a clear field and no foreign competition for at least two years.

* * *

Toronto and Wireless.

ONE of the leading evening newspapers in Toronto sends out a concert programme each evening at 7 o'clock, and also a children's bedtime story. Special musical programmes, which are broadcast on Wednesday evenings, are not only available to individuals who have receiving sets, but are also available to the public in two of the largest Methodist churches in the city.

* * *

No Ether?

DR. CHARLES P. STEINMETZ, the chief consulting engineer of the General Electric Company, America, has declared in an article in "Popular Radio": "There is no such thing as the ether. Light and wireless waves are not wave motions of the ether."

The beam of light and the wireless wave, says Dr. Steinmetz, are merely due to changes in a field of electrical force, occurring at fixed intervals and known electrically as a periodic alternation. A wireless station sends out a signal. In doing so it throws out a field of force which extends to the receiving station hundreds of miles away.

What is it that carries this field of energy from one spot to another? Dr. Steinmetz argues that no carrier is required, and that Einstein has squashed the ether theory.

The Editor tells me he will shortly print an interesting article on Dr. Steinmetz's theory.

* * *

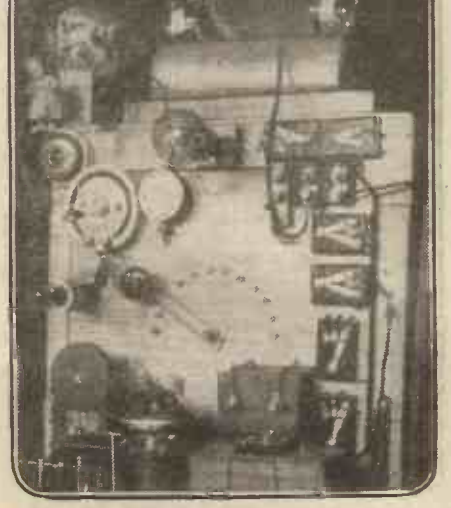
Some members of the Leicestershire Radio Society. Standing: Mr. L. Pratt, Mr. D. Norton. Sitting: Mr. J. Rudkin, Mr. C. T. Atkinson, Mr. J. R. Crawley.

Very Important.

MESSRS. MITCHELLS, LTD., of Rye Lane, Peckham, ask me to say that, through a clerical error in their advertisement in No. 5 of POPULAR WIRELESS, it was announced that by using their Symoplion instrument seven valve amplification could be obtained using only three valves. This should read *five* valve amplification, using three valves only.

Messrs. Mitchell also inform me they have been inundated with queries and orders, many people sending money orders, *without their address*. Therefore, will readers please note the importance of forwarding *full particulars* when giving an order to a wireless manufacturing firm?

ARIEL.



Mr. J. Percy Johnson's set, at 16, Hildesly Rd., Douglas, Isle of Man.

Broadcasting Programmes

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

IT is worth while listening in of an afternoon, about 5 o'clock (British summer time), on the lower wave-length ranges, for Marconi House Experimental Station (call sign 2 L O), as special concerts are sometimes sent out.

A new aerial has been erected at Marconi House, stretching across to the new Bush Terminal Building, and it is understood that this new aerial is intended for broadcasting purposes.

In any case, amateurs may console themselves that things are moving apace in the broadcasting world, and the special transmitting apparatus necessary for the service is nearly ready.

The Writtle concerts still carry on every Tuesday evening at 8 o'clock, B.S.T., on a wave-length of 400 metres. The call sign is 2 M T.

The Hague concerts are sent out Sunday afternoons from 2.30 to 5 p.m., and are still the most looked for event of the week in the broadcasting line. The call sign is P C G G, and the wave-length 1,070 metres.

Königswusterhausen transmits telephony usually at 7 and 10.30 a.m., G.M.T., on a wave-length of 2,500 metres. The station is situated near Berlin. Call sign, L O.

Possibly, in the near future, Nauen will commence a regular telephony service, in which case amateurs will probably find the ether full of German and excerpts from Wagner.

The Eiffel Tower Radio Station (call sign F L) may usually be relied on for a telephony transmission (and sometimes a concert) at 5 o'clock, B.S.T. A weather forecast is sent in French at 6 o'clock. The wave-length is 2,600 metres.

Croydon Aerodrome (call sign G.E D) may be heard on 900 metres at all times of the day in radio-telephonic communication with various aeroplanes on the Continental air routes.

Other aviation stations which transmit telephony include Castle Bromwich (G E C); Didsbury (G E M); Hinton-Admiral (sign not allotted yet); Lympne (G E G); Renfrew (G E R); Pulham (G E P).

In all cases the 900-metre wave-length is chiefly used.

Some of the most enjoyable telephony and musical transmissions to be received emanate from amateur stations. On any evening the listener-in may hear plenty of speech, and often some excellent music.

A few days ago one amateur transmitted a gramophone record of Schubert's Unfinished Symphony, and for clarity of tone and general perfection it was received by the writer without a flaw.

The well-known station at Poldhu, in Cornwall, is shortly to be used for experiments in Transatlantic telephony.

It is now being partly dismantled by Mr. Montague, the resident engineer, and much taller masts are about to be erected in different positions.

It is now expected that the research department of the Marconi Company, including Senatore Marconi, Captain Round, and Mr. W. T. Ditcham, will carry out some very interesting experiments upon new lines, to which the amateur will, no doubt, be able to listen.

So look out for telephony from Poldhu.

CHARGING ACCUMULATORS.

By P. J. RISDON.

THE storage of electrical energy by means of an accumulator involves chemical action and reaction. It is unnecessary and would be confusing to give the chemical formulae of this action and reaction—indeed, it is extremely few persons who understand them.

As you are probably aware, there are several different types of accumulator, but the ordinary type consists of a case, constructed of a suitable insulating material, containing a solution of sulphuric acid and distilled water, in which are immersed two sets of lead plates, or rather grids, the interstices of which are filled with paste, made with red lead and sulphuric acid for positive plates, and litharge for negative plates, which is reduced by a preliminary charging current to peroxide of lead on the positive and to a soft, porous mass of lead on the negative plates. All the positive plates of one set are connected at the top, those of the negative set being similarly connected, a terminal screw for the attachment of a wire conductor being provided for each set. The plates of the two sets alternate with each other, being separated by the acid solution.

Action of Cells.

Supposing such an accumulator to have nearly run down—a condition, by the way, that it should never be allowed to reach—during discharge, the electrolytic action of the current frees oxygen that collects at the negative plates, which tend to become converted at the surface into sulphate of lead. Hydrogen is also freed and collects at the positive plates, where it is oxidised by the peroxide, and the resultant oxide, attacked by the acid, tends to produce sulphating of the positive plates also, a small portion of the acid being taken up from the solution in the process. It is this temporary loss of acid that causes the specific gravity of the solution to fall to about 1·18 in an almost discharged cell. When the cell is discharged again, the chemical action above described is reversed, the lead plates being restored to their original condition, and, in the process, the acid is freed and returned to the solution, the specific gravity of which rises nearly to 1·2 when the cell is fully charged.

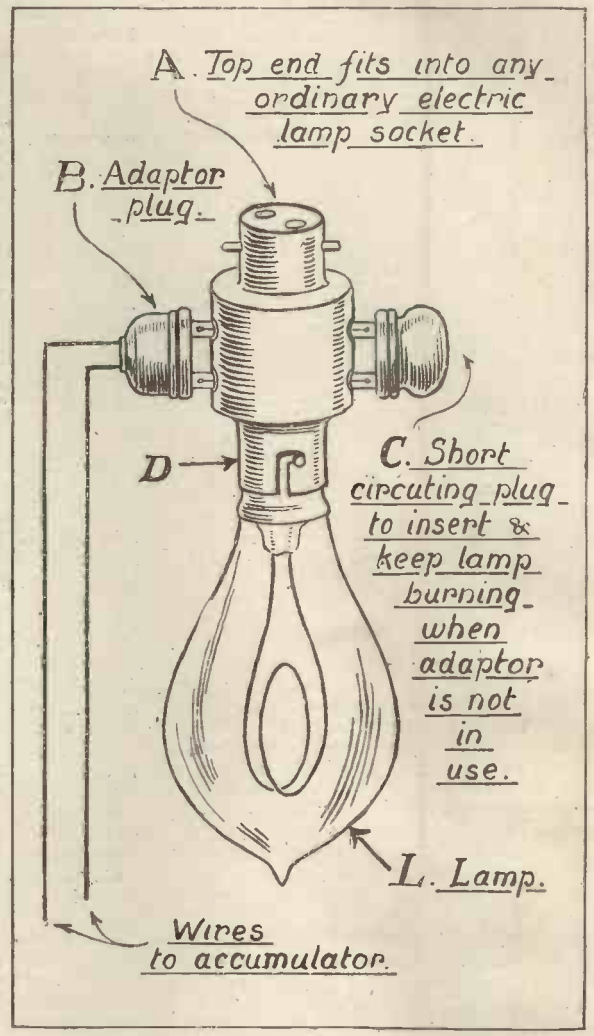
Each cell in an accumulator is nominally of 2 volts, ranging from 2·2 when fully charged to 1·8 volts when discharged. Thus two cells in series give 4 volts, or 4.4 volts when fully charged. It follows, then, that to charge a 4-volt accumulator the charging current must be something over 4·4 volts. For instance, a charging current of 4 volts would not half-charge a 4-volt accumulator. Now a curious feature is that a current of 200 volts or more can be employed to charge a 4-volt accumulator, providing that amperage of the charging current is not in excess of that for which the accumulator is rated, the rating being given in the instructions issued with the accumulator.

Methods of Changing.

Accumulators can only be charged by direct current, although, as will be seen, alternating current can be employed by converting it to direct current first. There are several different ways in which they may be charged. (1) From a larger battery of accumulators; (2) from a small direct current dynamo such as one in the lighting equipment of a motor-car; (3) they may be taken to an electric lighting station and charged; (4) they may be charged from a direct-current house supply; and (5) from an alternating-current house supply, by first converting it to direct or continuous current. It is the two last-mentioned methods that we shall describe.

D.C. Supply.

For direct current supply we shall require a charging adaptor, such as the one illustrated, the cost of which is about four shillings. Such an adaptor enables one to avoid meddling with the wiring. A lamp is removed from an ordinary lamp-holder, the upper end A of the adaptor is inserted in its place, and a carbon filament lamp inserted in socket D. A two-stem plug B is inserted in a pair of corresponding holes in the adaptor. Another plug C, known as the short-circuiting plug, is withdrawn, the ordinary wall switch is turned on, and the ends of the wires from the plug B are attached to the terminals of the accumulator, care being taken to couple positive to positive and negative to negative. The adaptor is so wired that, with plug C removed and plug B inserted, the current to and from the accumulator is bound to pass through the lamp, the resistance of which is so great as only to permit of a sufficient quantity of current passing through the accumulator to charge it properly without damage. Thus an accumulator may be charged whilst the lamp is still burning. When plug B is removed, plug C is inserted so as to complete the circuit again independently of the accumulator and so enable the lamp to continue burning. Carbon filament lamps being expensive to burn, it is better to keep one specially for charging only and not for use in the ordinary way.



Final Hints.

A pocket voltmeter, that can be purchased for a few shillings, is necessary for testing the voltage of the accumulator cells. When fully charged they should register 2·2 volts each, or, 4·4 for a 4-volt accumulator. There are, however, two other visible signs of its being fully charged: one is that the solution turns a milky colour, and begins to froth or bubble on the surface; and another is that the lead plates should present a clean, metallic surface, in contrast to a dull or even drab colour, when the cells are run down or sulphated. As already stated, the specific gravity of the acid, with the cells fully charged, should be 1·2, or, more exactly, 1·195. This may be tested occasionally with the hydrometer.

Evaporation inevitably occurs, and should be made good with distilled water only, a well-corked bottle of which should be kept in the house. If any acid is spilt it must be made good with fresh solution. It is best to get a chemist to prepare this, but those who do so themselves should remember that the solution should be mixed in another receptacle, and by adding sulphuric acid to distilled water (not water to acid), and allowing it to cool before placing it in the accumulator. It is also necessary to obtain the correct specific gravity of the fresh solution. Be careful never to short circuit between the terminals.

In order to ascertain the direction of current in the house mains, prepared paper may be obtained from any electric supplies firm. If this paper be damped and touched by the two wires, it will turn red at the negative terminal.

When the positive terminal has thus been found, in order to avoid having to repeat the operation, a small tag, marked with a conspicuous red cross, should be attached to the positive wire near where it is coupled to the positive terminal of the accumulator. Alternatively the insulation of the positive wire may be painted bright red or bound with red tape.

To avoid having to take off the terminal nut every time the accumulator is charged, the ends of the wires should be attached to copper or brass clips with the ends slotted, so that the nuts need only be slackened, the clips pushed into place, and the nuts screwed up tight again.

The resistance of the lamp naturally varies. For charging a 6-volt accumulator from a 100-volt current supply, a carbon filament lamp of 32-candle-power should be employed. For a 200-volt circuit a 60-c.p. lamp would be required. A metal filament lamp could be employed, but, as it only passes about a quarter to a third of the number of watts as a carbon filament does, it would take about three or four times as long to charge. On a 100-volt circuit, a 32-c.p. carbon filament lamp allows about one ampere, so that for a small 6-volt accumulator a charge of about 12 hours duration would be required, according to the capacity.

(To be continued).

By MICHAEL EGAN, Late Instructor of W/T, R.A.F.

THE immense value of wireless in solving the problems of modern commercial aviation is gaining wider and wider appreciation every day. So far, in the machines that fly to and fro across the Channel, the privilege of using wireless telephony for the purpose of speaking to their friends on the ground has not yet been extended to passengers.

But that is only a matter of time. Air liners of the future will no doubt be equipped with a small wireless telephone bureau for the convenience of passengers, who will be able to get into communication with their own homes via the land system of telephonic communication.

The passenger will first call up the ground wireless station and state the desired number, *e.g.*, Victoria 2761. The ground operator will then, through the Victoria Exchange, get a clear line to this number, to which he will connect up his own apparatus. The aeroplane passenger will thus be able to carry on direct conversation with the members of his own home.

Although this stage has not yet been reached, however, the great importance of wireless in numerous other directions is being demonstrated daily. On practically every flight there is occasion to use the telephony installation with which each cross-Channel aeroplane is fitted.

These installations are, of course, operated by the pilot, as, for commercial reasons, it is not desirable to carry a "non-paying" wireless operator on such comparatively small machines. And since the pilot has many other important things to attend to during flight, it is necessary that the wireless gear should be simplified as much as possible.

In practice, the only instrument that needs manipulation on the part of the pilot is a "control" switch, by means of which he can change over from "send" to "receive" and vice versa. He can, if he wishes, alter the tuning of his receiver, but this is rarely necessary since he works on the same short wave-length all the time.

This control switch can be seen in the accompanying illustration of a pilot's cockpit. It is fitted on the left-hand side of the fuselage. Next to it is an aerial ammeter, by the reading of which he can tell if his transmitter is working efficiently.

Next to the ammeter is the winch from which the aerial is released as soon as the machine has attained the necessary height after leaving the aerodrome. To the right of the photo, just behind the pilot wheel, the transmitter microphone can be seen.

From the winch the aerial wire is conducted through an insulated tube to a position that brings it clear of the under-carriage of the machine. In order to keep it in place during flight a lead weight is attached to the suspended end.

From the very earliest days of aircraft wireless it was always necessary to pay particular care to the winding and unwinding of the aerial. In letting it out, if your hand slipped from the handle of the winch, thus allowing it to run by itself, the momentum acquired by the weight at the end invariably resulted in the aerial snapping and being carried away *from the machine end.*

Also, when winding it in, if care wasn't taken to slow up during the last few turns, the lead weight jammed against the bottom of the aerial tube with a force that was quite sufficient, after a few repetitions, to sever it from the wire. It would scarcely be an exaggeration to say that hundreds of lead weights and aerials were lost in this manner during the war.

Numerous methods for supplying power to the wireless transmitter have been tried. Attempts were first made with accumulators, which were used in conjunction with induction coil transmitters. Later, when more efficient transmitters were designed, small petrol-driven motors were carried on larger craft for generating power.

The most efficient method of all was arrived at when the wind-driven generator was developed. This took the form of a very small electrical generator which was fixed on the under-carriage of the machine. This is the method that is employed universally to-day.

One end of the generator shaft carries a small fan, which is rotated by the air pressure from the "slip stream" of the machine's propeller during flight. Thus the power developed is affected by the speed of the machine. As the speed of the machine increases, so does the speed—and hence the power—of the generator.

Unlimited power is not required, however In fact, it is especially desirable that the power should be maintained at a constant value during transmission. Precautions are taken to effect this by arranging for any excessive development of current to be automatically cut off from the transmitter.

It sometimes happened that, during a fast nose-dive, the windings of the generator were fused by the excessive rise of current that accompanied the increased speed. It will be remembered that something of this nature occurred to the generator on one of the first aeroplanes which attempted to fly the Atlantic.

There is no more interesting development of aircraft wireless than that of direction-finding. Two methods have been used extensively. In one, the direction-finding is done by ground stations. In the other, the aircraft carries its own direction-finding gear and finds its own position from fixed transmitting stations on the earth.

The former method is employed daily in connection with the cross-Channel air routes. Of the direction-finding stations concerned, there is one "control" station whose function it is (besides direction-finding) to acquaint the pilot of a machine with his position when desired.

A system is in course of development which will eventually enable the pilot to automatically direct his machine when he has arrived too close to a D.F. station to make use of the ordinary direction-finding apparatus with any degree of accuracy.

The system is known as the Rudder Bar method of direction-finding.

The "searching" coil of the D.F. gear is coupled to the rudder bar in such a way that the slightest movement of the rudder control in an anti-clockwise direction will move the "searching" coil through a large arc, in a clockwise direction, and vice versa.

Therefore, if a station is transmitting, and if the ordinary method of direction-finding is being employed, no signals will be heard if the 'plane is flying directly towards the aerodrome.

But if the machine gets off its course, or the rudder is so moved that the 'plane begins to veer off its course, the "searching" coil will also move, and as it does so, over a large arc, signals will be heard in the pilot's receivers, and thus warn him that he is off his course.

To correct this he has but to adjust his rudder until the signals cease. Automatically he can then steer in the correct direction of the aerodrome.

The Marconi Type 14 D.F. apparatus has been specially designed for aeroplane work, and the simplicity of its operation and compactness have made it of particular value to aerial navigation.

(*Continued on opposite page*)

Calling up Croydon from a 'plane. Croydon station is shown in heading.

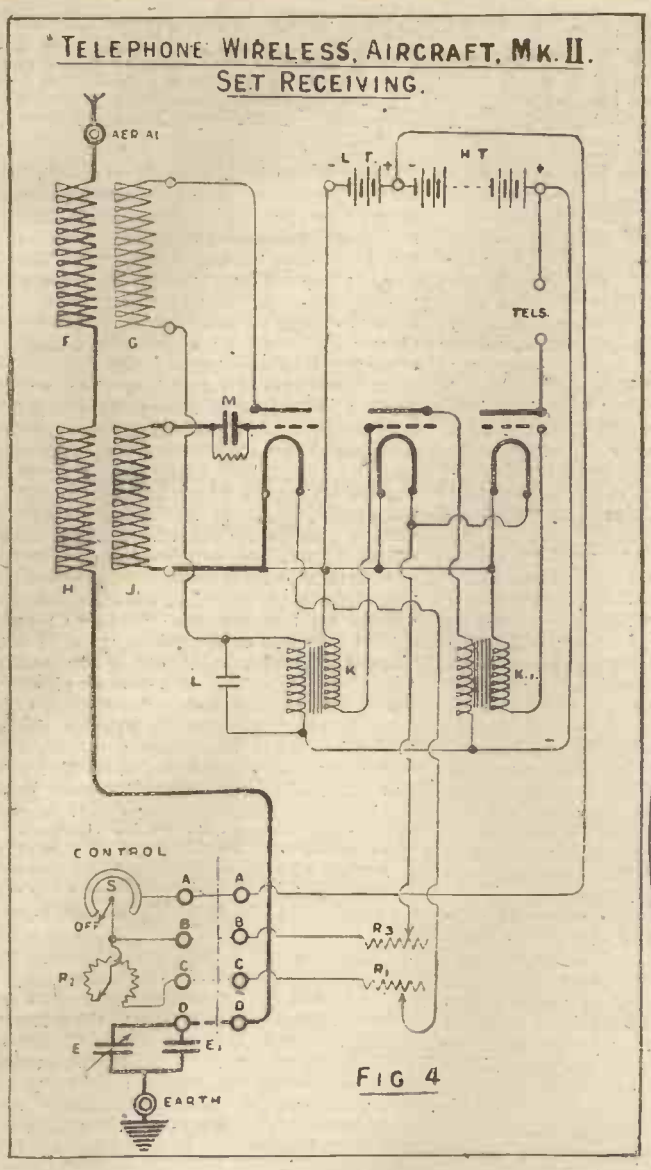


FIG 4

The call signals of aircraft fitted with wireless telephony apparatus are represented by capital letters in the Roman characters.

An example is the Handley Page machine G.E.A.P.J.

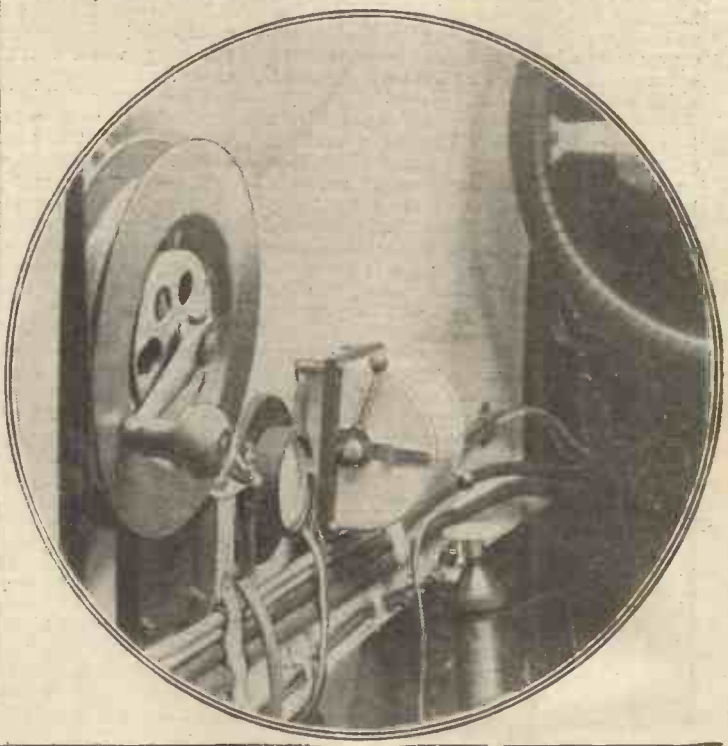
The wave-lengths employed by aircraft are 600 and 900 metres. Telephony on 900 metres may often be heard between 'planes and aeroplane stations, the most familiar of the latter probably being Croydon Aerodrome Wireless Station, call sign G E D, which transmits telephony at all times of the day to aeroplanes on the Continental air routes.

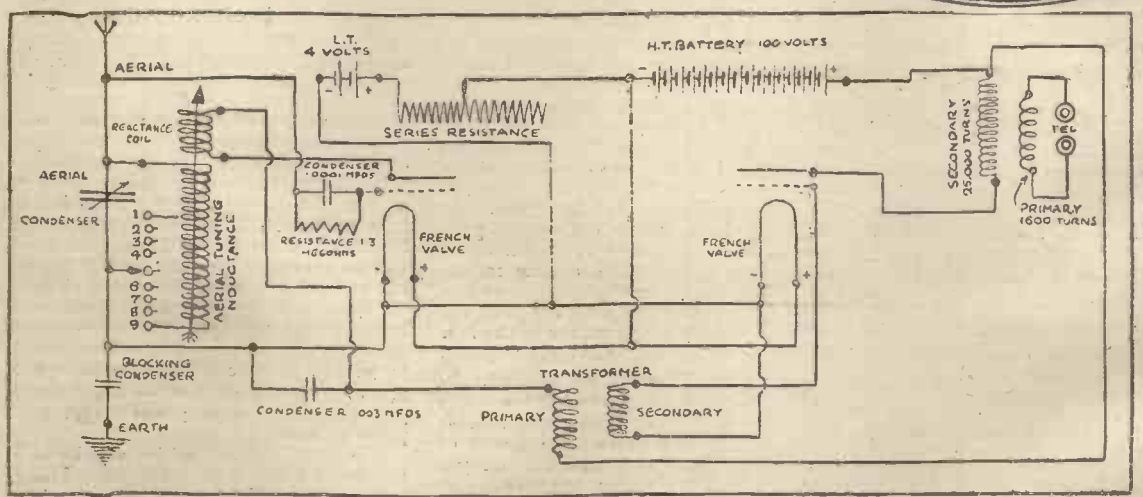
On many occasions machines have been directed to Croydon by means of the D.F. facilities provided at that station, despite thick fog and adverse weather conditions in general.

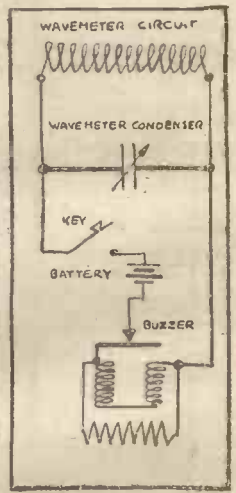
The knowledge that a 'plane can "nose" its way home is a great comfort to the passengers, who, naturally, feel a little nervous when a thick blanket of fog suddenly blots out the face of the earth and all aerodrome markings included.

Without D.F. apparatus it is certain that crashes would be more frequent and that the Continental passenger service by 'plane would be negligible.

The ranges obtained from the 'planes to the aerodrome station are something over 100 miles, and in numerous instances speech has been heard from a 'plane ascending from the Paris aerodrome at the Wireless Station at Croydon—a distance of about 240 miles.







The diagram marked Fig. 4 (the number was inadvertently left in, and has no reference to the text of the article) shows the circuit used in an aircraft three-valve telephony receiver: F G, reactance; H J, aerial tuning inductance (note the control with fuses are separate); L T, resistances for the detecting and amplifying valves; E, condenser in series for short waves; K and K 1, L.F. transformers; L, fixed condenser; M, grid leak and condenser.

The bottom diagram shows an aircraft two-valve C.W. receiver, with wave-meter combined. To operate this set, switch on buzzer of wave-meter, and adjust its condenser to wave-length to be received. Adjust the A.T.I. and aerial condenser to tune with the wave-meter. If the PURE musical note of the buzzer is heard, the set is ready to receive SPARK signals of that wave-length, but not C.W. The filament resistance and reaction coil must be adjusted so that the ordinary MUSICAL QUALITY of the buzzer is lost, and the steady note changes to a peculiar warbling sound. The buzzer signals can now be decreased in intensity, and the above adjustments made to make the set as sensitive as possible, still keeping the valve oscillating. A good test of the latter condition is to move the A.T. condenser to its extreme position, when two sharp clicks will be heard. For "searching," proceed as above to get the valve oscillating, setting wave-meter to any convenient wave-length. Then place A.T.I. on stud 9, and search through whole range of condenser. Repeat on studs 8, 7, and so on. When signals are heard, adjust reactance coil to most sensitive position. L.R. 'phones not to be used with this set.

The photo in circle shows pilot's cockpit. The control switch is shown, and the aerial winch.

Controlling a Ship by Wireless

RECENTLY the American battleship Iowa was controlled and manœuvred by wireless from a distance of twenty miles with not a single soul aboard.

To enter into technical details is out of the question, but it is quite possible to give the layman some idea of the principles underlying distant control by wireless.

We will suppose that a ship out at sea is being controlled from a wireless station on land. The first thing the controlling operator wishes to do is to start the ship's engine. On his right hand is a Morse tapping key similar to that found in any telegraph office. He gives this key one sharp tap, and immediately a definite amount of electrical energy from a battery travels through various instruments, and at length along an aerial which is about fifty feet high.

From the aerial the energy is flung broadcast into space, and travels through a medium called ether in the form of waves which, if it were possible to see them, would resemble in formation the waves of the sea. What ether is, nobody has yet found out. Einstein, with his natural aptitude for dispelling illusions, has proved that there is no possibility of detecting its existence, and this has caused many scientists to doubt its presence altogether.

Anyway, the point is that electrical energy, when propagated with the proper instruments into space, travels on something and arrives at its destination, where it can be utilised in the same way as the electrical energy which travels comfortably along the common or garden copper wire.

Almost m- on leaving the land wire- some of these energy—their official name is electro-magnetic waves, and they travel at the rate of 186,000 miles a second—strike the aerial wires stretched between the masts of the ship, and, entering the wireless cabin, flow through various instruments collectively called the receiver.

stantaneously the aerial of less station, waves of

Now the amount of energy, when it arrives in the receiver, is very small, for more than 99·9 per cent. has been lost in space.

But attached to the receiver is an instrument called an amplifier, and this magnifies the energy which does arrive to an enormous extent.

The energy, owing to its powerful magnification, brings an instrument called the selector into play, which in turn works an automatic switch.

The definite amount of energy which the operator has sent causes the selector to move the automatic switch in such a way that it completes an electric circuit, and causes a new supply of energy from a local electric battery to flow through a coil of wire. Running through the centre of this coil of wire is a bar of iron, and the fact of the energy flowing through this coil of wire turns the iron bar into a magnet. The magnet, by the force of its attraction, pulls in a switch which sets the ship's engine going; for everything has been prepared beforehand.

The operator on land now wishes to steer the ship to the left. He again taps the Morse key, but this time gives it two taps instead of one, thus sending into the ether twice as much energy as he sent for starting the engine. The two bursts of energy travel in the same way as before, and are also magnified on arriving at the ship. This time, however, the selector is actuated by two bursts of energy instead of one, and therefore causes the automatic switch to move in such a way that it brings into action an entirely new electrical circuit which works another coil of wire and iron-bar magnet. As before, the magnet pulls in a switch which starts a small electric motor, constructed in such a fashion that it pulls the ship's rudder to the left.

If the operator wishes to put the rudder to the right, he gives the Morse key three taps, which releases three bursts of energy and acts on yet another magnet and electric motor.

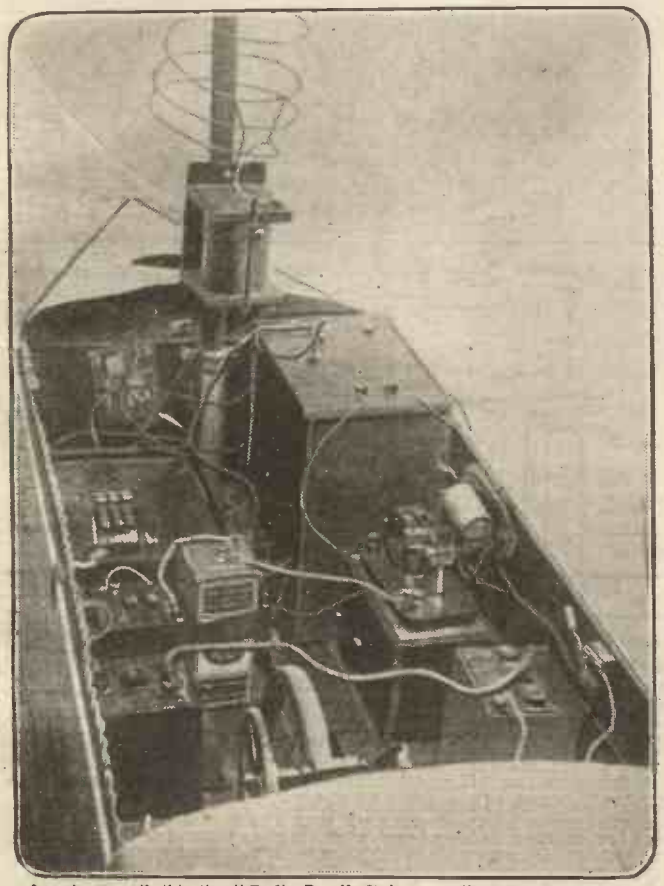
In this way, any number of things can be done on the ship, such as firing guns and torpedoes, or even reversing the engines.

* * *

A wireless operator, when receiving by wireless, hears all stations that happen to be sending wireless messages at the time, provided they are within range and that his receiving apparatus is correctly tuned to their sending instruments. Therefore, in the ordinary way, a ship being controlled from a distance by wireless waves is liable to be accidentally controlled by any other wireless station which is also sending out waves into the ether.

In order to make this impossible, an ingenious instrument called a wireless lock has been invented. It works somewhat on the principle of the combination lock of a safe. Such a safe can only be opened by a person cognisant with the letters which have locked the combination. It is the same with the wireless lock, for a certain letter of the Morse code has to be sent in a certain way by the operator who is doing the controlling before the rest of the apparatus will function at all. No outsider can therefore butt in and create chaos.

This lock will be of greatest value in wartime, for previously, if one party sent a wireless-controlled ship into an enemy harbour with a load of explosives, it was quite possible for the enemy to return the ship by wireless with its present unexploded; and this, of course, took away a great deal of the usefulness of wireless control as a weapon of war.



Americans call this the "Radio Pup." It is a small model of a ship on wheels, and can be controlled by wireless. You press a key and say "Come here"—and it comes!

SHALL WE HAVE MUNICIPAL BROADCASTING STATIONS?

TEN thousand pounds has just been voted by New York authorities for the preparation of one of the most up-to-date and powerful broadcasting stations in America.

Plans for the completion of the station are rapidly going ahead, and before this summer is over citizens will have a daily service of news, information, and entertainment from their own broadcast station, situated at the top of the Municipal Building in City Hall Park, New York.

Its range will be about 1,250 miles, and the programmes will include concerts, educational lectures on health, fire and crime prevention, municipal government, and any other matters of interest. The mayor and other influential public gentlemen, some of whom are wireless enthusiasts, have looked ahead, and seen the present and future possibilities and advantages of a state-owned broadcasting station.

To the police, the radio will render a valuable service. They will be able to enlist the help of thousands almost instantly in any important crime hunt. Thus, if a crew of bandits are escaping by motor-car, a broadcast call will put numberless interested citizens on the track, in every portion of the community, however remote from the scene of the crime.

People will be informed by broadcast how to guard against criminals: lectures will be given by police officials to aid citizens in guarding their property and supplementing police efforts.

The municipal authorities will be able to talk to the public at large, and convey the rules of personal health and sanitation, so that broadcasting will be a powerful force for better citizenship. Only music and entertainment of the best quality will be transmitted.

Will London follow suit?

At present the broadcasting arrangements are being left in the hands of business firms—and the result has not been encouraging.

A nationalised station might therefore seem to solve the problem.

How to Make a Fixed Condenser

THERE are certain materials essential for the construction of wireless apparatus with which the ordinary non-wireless man is unfamiliar.

One of these is paraffin wax; and before going on to describe how to make fixed condensers with paraffin wax, tinfoil, and paper, it is better to say a word or two about the wax.

Paraffin wax is a tough, translucent substance, much like camphor in appearance, greasy to the touch, and almost odourless. There is no need to go to the chemist's shop to buy it. Find a good drysalter or oilman who will sell it to you at a lower price.

Paraffin wax melts at a fairly low temperature—below that of boiling water—but it takes a long time, over gentle heat, for any considerable amount of it to melt. After being melted it cools again very slowly. It is advisable not to hurry the melting too much, as you may "burn" part of the wax while the other part is still solid and unmelted. Burnt paraffin wax gives off a disagreeable smell, and loses its most valuable property, that of insulation.

Though it melts at a fairly low temperature it must be made considerably hotter if it is to turn into steam and expel the moisture contained in cardboard, wood, paper, or other material whose electrical insulation it is desired to improve. Consider what is likely to happen if a piece of damp wood is immersed in cool, melted paraffin wax.

The moisture in the wood, which provides the path for the current to leak away to earth, would remain there, and the colder wood would cause a skin of chilled paraffin wax to form on the outside surface and prevent the moisture from being expelled.

If the temperature of the wax is raised well above the boiling point of water the heat of the wax permeates the wood and turns the moisture into steam, which, by its expansion, readily escapes out of the fibres and is replaced by the liquid wax. The wax, when it cools and solidifies, prevents the return of the violently expelled wet, and the wood has its insulation permanently improved.

This can be seen in operation if two small pieces of wood, one dried for a long time in a good oven, and the other piece just "ordinarily" dry, are immersed in good hot wax. The specially dried piece will bubble just a little and then cease, while the other piece will continue to boil and froth for quite a long time as the steam escapes.

A good deep iron saucepan over a slow-burning gas-ring is best for melting the wax. Let the lumps of wax dissolve gradually in the liquid, like chips of ice in a tumbler of water, and then, without increasing the rate of heat supplied, allow it to go on getting gradually hotter until it gently simmers. Let it cool just a little before using.

While the wax is being melted prepare three similar strips of paper, thin and tough like good foreign letter paper, about 12 inches long and 4 inches wide. Foolscap paper will do, but a thinner paper is better if it is a good tough specimen.

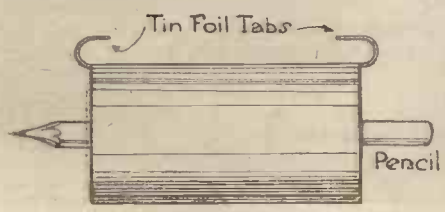


Fig. 2.

Procure two strips of tinfoil 11½ inches long and 3 inches wide. Lay one piece of the paper down flat on the table. On top of that, and half an inch from one end of it—we will call it the "A" end—take one of the strips of tinfoil and place it on top of the paper exactly in the middle, with a half-inch margin all round. (See Fig. 1.)

Double back the last quarter-inch of the tinfoil, snip it with the scissors two-thirds off, and double over the side. (See Fig. 2.)

Lay on top of the foil the second strip of paper, exactly coinciding with the first strip of paper. Then take the second strip of tinfoil and treat it exactly as the first strip, only that the snip must be made on the *other* end of the tinfoil so that it will fold over the reverse end of the paper.

Now lay the third strip of paper on top of the foil exactly coinciding with the other two paper strips. Take an ordinary round lead pencil and, beginning at the "A" end of the pile, which now consists of three strips of paper and two strips of tinfoil alternately placed, roll it all up together like a cigarette, the pencil occupying the place of the tobacco.

Tie up the roll with a piece of thread at the middle, then turn over the projecting tab of tinfoil at each end, and tie that down also, and your condenser is complete. The two pieces of tinfoil *must not touch each other anywhere, not even at the ends where the tabs are.*

Carefully draw out the pencil and let the condenser soak in the hot paraffin wax until any bubbles rising from it to the surface have ceased to appear. Take it out and let it cool. Two pieces of thin tinned copper wire bound round each end of the cylinder and making good contact with the tinfoil tabs, will give you your connections.

This will make quite a good blocking condenser for your telephones on a crystal set.

The purpose of this condenser is to allow high-frequency currents a path past the impedance of the receivers, and to provide a reservoir in which to accumulate charges which the condenser will ultimately discharge through the receiving telephones. The same type of condenser may be used to bridge the high-tension battery if you are using a valve, and for many other purposes in connection with a wireless set which increased knowledge and experience will indicate.

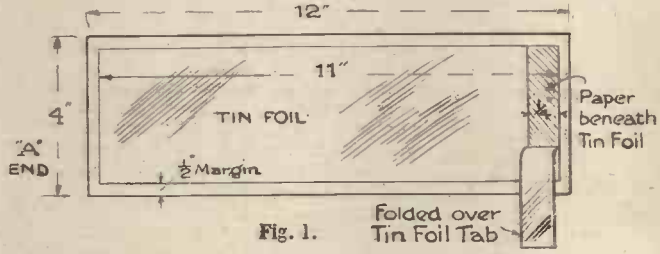


Fig. 1.

ETHER AND WIRELESS

ETHER is the mysterious "something" which is believed by many to be present in space as well as in solid substances. To ourselves, on this earth, ether conveys luminous vibrations to our eyes, and wireless waves to our receiving sets. Light waves travel at the rate of 186,000 miles per second, and wireless waves at the same speed. Ordinary sound travels much more slowly—in fact, a paltry 1,083 feet per second.

If you had the opportunity of radio-telephoning from San Francisco to a place as far distant as New York, your voice would be heard almost simultaneously with your delivery. But supposing your voice was not carried by wireless, and was merely conveyed as ordinary sound waves, it would take over four hours to reach the same distance.

Wireless amateurs in America have formed a Relay League for the purpose of reaching great distances by co-operation. At prearranged times, amateur number one sends his message to number two, who lives perhaps thirty or forty miles distant. The second amateur, upon receiving the message, immediately transmits to another member, and so it goes forward until picked up a thousand miles away, when a reply is relayed back to the original transmitter.

The American Relay League has commenced a regular two-way message system right across the continent from one coast to the other. They propose to follow this up by getting across the Atlantic Ocean to reach Great Britain, France, and Holland, and hope later that we British amateurs will be able to acknowledge receipt and reply by our own relay system. As soon as arrangements are completed, they will send a relay from America to Paris, and expect to receive a reply in ten minutes.

These go-ahead Americans are not content with bridging the Atlantic, but already have plans for an international system of abbreviations which will enable amateurs the world over to participate in making the ether carry their thoughts, views, and wishes.

Ether pervades all space—the earth, suns, stars, planets are all "floating" in it. Fast as wireless waves are, it would take about four years for a radio message to travel from the earth to the nearest fixed star, Alpha Centauri. Ordinary sound to reach the same distance would take four million years. Supposing one of us happened to pick up a wireless signal from one of the planets which move round the sun, it would probably not be of much use to reply, as the sender lived and died some twenty-five thousand years ago. The wave-lengths of ether vibrations pass through our space as though it were vacuous, therefore we are not conscious of their presence.

The earth, by the power of gravitation, is harnessed to our sun by the ether. If we wanted to be connected to the sun by a material which we could make and see, a solid rod of metal, some four thousand miles in diameter, stretching from earth to sun, would be necessary.

Some valuable discoveries in regard to gravitation have been made by Dr. Charles F. Brush. He believes that gravitation is a push, instead of a pull, and that infringing ether vibrations tend to push all masses of matter towards one another.

The use of the ether for conveying waves suitable for wireless signals was first practically demonstrated by Dr. Hertz in 1887.

Dancing by Wireless Music

A Forthcoming Attraction for a Summer Holiday will be Dancing on the Pier by Wireless, with Weather Reports telling you when to go Home to Avoid the Rain.

"I FEEL like dancing to-night, but I don't feel inclined to turn out," the young wife of to-morrow will say; and her husband will be able to answer:

"Well, I'll tune in the loud speaker to one of the stations broadcasting dance music by wireless, and we'll dance at home. I'll ring a few friends up on the telephone, and get them to come in and make a jolly evening of it."

Or as you stroll along the front at your favourite seaside resort, you will see the following advertisement:

"Come on the pier to-night and dance to Wireless Music. Special Programme by the White-Nosed Nigger Band of London will be broadcasted from their London headquarters. The Premier Band in the Land!"

And this is how it will be done.

Several loud speakers will be placed along the pier, and the wires from each instrument will be connected by means of a plug into a socket in the floor.

These sockets will be wired to a common circuit connecting all of them, and the wires will lead to a wireless room.

In other words, without the aid of a band on the pier itself, visitors will be able to enjoy dancing, thanks to a wireless operator, or operators, whose duties it will be to pick up the broadcasting wave and keep it tuned and steady throughout the evening's entertainment.

Not a Dream.

By utilising valve amplifiers, any number of loud speakers can be supplied with current for the wireless set.

This is not a beautiful dream of what may happen in the far-away future; it has already happened. The picture herewith printed depicts a scene that recently took place on board a passenger ship plying between New York and Havana.

Dancing was enjoyed on board ship, thanks to wireless music picked up out of the air from the distant broadcasting station at Newark, N.J., just outside New York.

The illustration shows a loud speaker placed on the deck, and the wires connecting it with the wireless cabin. When the vessel was in Havana Harbour, the wireless waves travelled a distance of 1,200 miles before the music was heard on the deck.

This marks a phenomenal and wonderful step in the application of wireless music and concerts. Perhaps the ocean traveller of to-morrow even will be supplied by wireless with music whenever he feels inclined for it. It can be supplied right into his cabin simply by turning a switch mounted on the base of a small horn device fitted on to the wall.

Questions have been asked whether, in such cases as are here illustrated and described, it will be possible to receive other wireless messages of a more regular nature from ships, news broadcasting centres, etc.

Morse and Music.

In the case of most wireless receiving sets this will not be possible, and either one or the other can only be received at the same time without seriously interfering with the clearness and strength of the wireless music.

Nevertheless, where it is imperative to pick up a wireless code message at the same time as wireless music or concert is being received, an expert operator can tune the wireless wave sufficiently to be able to pick up simultaneously the dot and dash signals of wireless telegraphy.

The dots and dashes will be heard through the loud speakers throwing out the dancing music or concert, but frequently, when the dot and dash signals are quite clear enough to be read without difficulty, they will still be weak in the loud speaker, so as not to interfere to any detrimental extent with the music.

Perhaps the dots and dashes may be heard by those dancing past the horns, which will give the chance to the ex-service signal officer to "swank," and tell the latest news being received to his pretty partner.

Time signals and weather reports will be picked up at all times, and relayed through the loud speakers for the benefit of dancers.

The weather reports are being found to be wonderfully accurate in their prophecies, so a warning of "rain coming" may enable you to get home to your hotel without getting your flannels soaked through.

Dancing in the Air!

Recently a well-known dancer said that she could have given a dancing lesson in the air, whilst crossing in one of the cross-Channel aeroplanes, if she had been able to move a chair or two aside.

What she would have done for music was not made quite clear, but it seems but a small step to introduce in the near future, by the aid of wireless and loud speakers, real facilities for dancing in the air.

Perhaps one of the additional attractions of the airway to Paris will be proclaimed in advertisements as follows:

"Spend your tea time travelling to Paris. Enjoy a Thé Dansant in the air, and at the same time travel from the British capital to the gay Continental capital. Book your passage in the 'Palais de Danse,' the latest and most luxuriously built aeroplane in the service."

The music being, of course, provided by wireless received from land, and thrown into the giant aeroplane's rooms by loud speakers.

Wireless Dances are a regular feature on some American ships.

WIRELESS QUESTIONS AND ANSWERS.

This is the second article by Mr. Blake in which he has compiled a series of questions and answers about wireless for the beginner.

By E. BLAKE, A.M.I.E.E.

Is there any danger from lightning in connection with an aerial? No; as the aerial is connected through the receiver to earth, the system actually forms a lightning protector. The receiver, especially if a crystal is used, may suffer because of lightning, and therefore it is advisable during a bad thunderstorm to take the aerial and earth wires off the receiver and join them together. Twist them together, making sure that there is *metallic* contact between them.

* * *

What are "atmospherics"? Either natural electric waves formed by lightning discharges or atmospheric electricity collected by the aerial and discharged to earth. "Atmospherics" are generally troublesome in summer, as they make bad noises in the 'phones.

* * *

How does a crystal receiver work? Certain crystals allow electricity to pass through them only in one direction, and thus act as valves. As wireless waves cause in the aerial a current which flows first in one direction and then in the other, the crystal cuts the current up so that it only makes the telephones work when the current flows in one direction. This makes the signals audible. Current which changes its direction with great frequency cannot be detected by a telephone.

* * *

What is a wireless valve? An instrument like an electric light bulb. It is a glass vessel pumped free from air and containing a filament, like a lamp, surrounded by a "grid," which is a spiral or meshwork of wire, these in turn being surrounded by a metallic plate.

* * *

How does a valve work? The glowing filament gives off electricity, which is controlled by the "grid" in such a way that a local battery is caused to make a click in the telephones every time a wave strikes the aerial. These clicks, being exceedingly rapidly repeated, sound like buzzes, and so the result in the telephones are long and short buzzes, which can be understood by persons who know the Morse code.

* * *

Can a valve be used for other purposes than reception? Yes; for magnifying the strength of signals and also for sending out wireless messages. The Marconi Company has sent messages to Australia from Carnarvon by means of a valve transmitter.

* * *

Is it possible to send wireless waves in one direction? Yes; the Marconi Company has recently demonstrated from the wireless lighthouse at Inchkeith Island (Firth of Forth) how wireless can be sent out in the form of a beam, somewhat like that of a searchlight.

* * *

What is a "frame" aerial? One of which the wire is wound in the form of a spiral. It is generally of portable size, and can be used inside the house.

* * *

Is a frame aerial used for sending? No; it is a very poor radiator of waves, and is used chiefly in reception.

* * *

What is a direction-finder? A receiver by means of which we can ascertain the direction from the receiving station of the sending station. By making observations from two D.F. stations, we can ascertain the *position* of the sending station—obviously a useful process in connection with sea and air navigation.

Is modern direction-finding accurate? Yes, to within half a geographical degree.

* * *

How far can a wireless station send? This depends on its power and the sensitiveness of the receiver. Modern high-power apparatus can span the globe.

* * *

What is the power of a sending station? Actually it is the number of kilowatts of electrical power delivered by the generator to the aerial system, which is the radiator of energy. Sometimes it is rated at the power of the generator.

* * *

How can music be sent by wireless? Music makes sound waves in the air. These are directed into an instrument called a microphone, which is connected in the sending apparatus in such a way that under the influence of sound waves it can vary the wireless waves exactly in accordance with the variations of the sounds. Roughly, the sound wave-forms are *reproduced* in the ether as ether wave-forms. These are turned back again into sound by the receiving telephones.

* * *

Is wireless telephony clear and distinct? Yes. The advantage of wireless telephony over the ordinary line telephony is that there is no distortion of the waves, no matter what the distance may be.

* * *

What is the difference between sound waves and ether waves? There are a number of differences, chief of which is that sound is produced by a vibrating body, and sound waves are therefore vibrations of some material body, whereas ether waves are not. Further, sound waves are pressure waves, whereas the ether is not compressible. In ether the vibrations take place at right angles to the direction in which the wave-effect is propagated, but in sound the particles of material vibrate in the same direction as the wave-effect travels.

* * *

What are "damped" waves? Wireless waves of the kind emitted by transmitters employing the "spark" system. Their characteristics are that they appear in groups or "trains," in which each wave is by a definite and constant degree weaker than the one preceding it. The constant quantity by which each succeeding wave is weaker than its predecessor is called the "logarithmic decrement."

* * *

What are "undamped" waves? Waves sent out by a valve or "arc" transmitter. They have no logarithmic decrement, each being of the same power, and they form an unbroken series. Hence their common description as "continuous waves" or "C.W."

* * *

Can a crystal receiver receive messages sent by C.W.? Only if the message is by wireless telephony. It cannot receive telegraphy by the C.W. system.

* * *

What can a valve receiver receive? It can be designed to receive "spark" and "C.W." telegraphy and also wireless telephony.

* * *

Can a receiver pick up messages on any wave-length? Yes, on any wave-length used for wireless; but it is better to have one to receive over a more limited range of wave-lengths. For example, one designed to receive on waves varying in length from 200 metres to 2,600 metres would suffice to receive amateur telegraphy and telephony, ships, broadcast telephony, Eiffel Tower time signals and telephony, telephony from the Hague and from Nauen (Germany), etc.

* * *

What is a kilowatt? One thousand watts. A watt is the unit of electrical power, and means "one ampère of current at a pressure of one volt." (Volts × ampères = watts.)

* * *

Can wireless signals be recorded in permanent form? Yes. They may be taken down on a dictaphone and transcribed at leisure. They may be recorded on paper tape at high speeds, in ink or photographically.

* * *

How can one find out the wave-length of a station? Turn to the signals of the station and measure the wave with a wave-meter; look in the list of stations issued by the International Bureau of Berne.

* * *

How do ships get their daily news? From the Marconi station at Clifden, Ireland. This service, over twenty years old, was until recently performed by the famous station at Poldhu, Cornwall. Leafield also sends news.

* * *

Does the weather affect wireless? Wet or fine, clear or foggy, hot or cold, there is no appreciable difference to wireless. Certain kinds of weather, generally in summer, breed "atmospherics" which tend to interfere with signals. It is the electrical state of the atmosphere which affects wireless.

* * *

Can wireless work better by night than day? Yes. By night the range of a transmitting station is greater than by day, though, of course, a commercial service does not rely upon this phenomenon, but can send messages at all times. Night ranges are uncertain.

* * *

Why is night better than day for signalling? Because in daylight the atmosphere absorbs more of the electricity carried by the waves than during darkness.

* * *

What are "freaks"? Abnormal ranges of transmission or reception. During a freak period a receiving station will, for a limited period, get signals from some station far out of its range.

* * *

Can signals be received best from a certain direction? General experience shows that, as a rule, signalling is easier in a north to south or S. to N. direction than between E. and W.

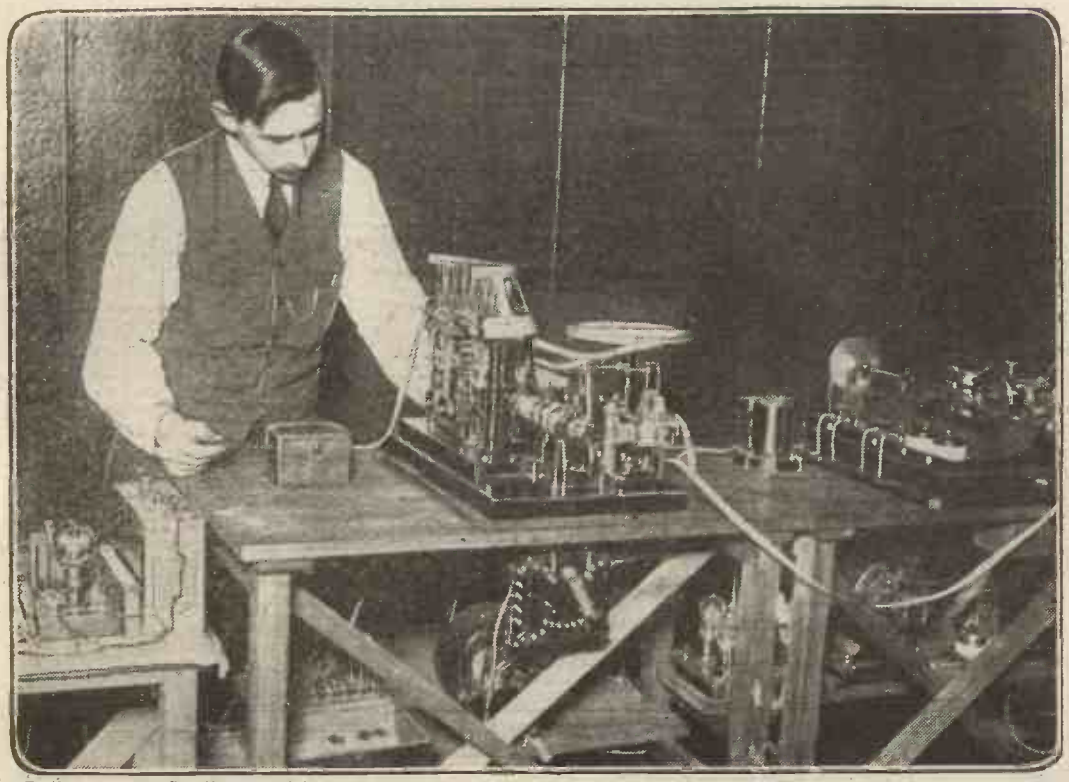
* * *

Can wireless be made "directional"? Yes. Apart from the Franklin-Marconi wireless beam, which is the most perfect example of true directional signalling, there is the method discovered by Senatore Marconi, and now employed at Clifden, whereby signalling is better in one direction than another.

* * *

How is directional signalling done? It was found by Senatore Marconi that if the sending aerial was pointed *away* from the west, for example, the waves going towards the west are the strongest. Therefore the aerial at Clifden is so constructed, because Clifden communicates westwards with the station at Glace Bay, Nova Scotia.

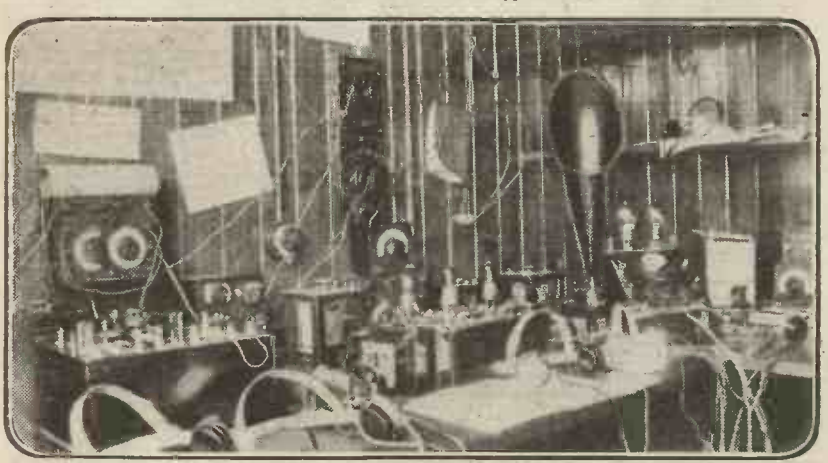
A WIRELESS TYPEWRITER



By the use of Mr. Creed's wonderful invention, wireless messages can be received and automatically typed at 100 words a minute. Mr. Creed demonstrated the utility of his invention before the Royal Society, and the apparatus recorded signals in the Roman type at *over* 100 words a minute.

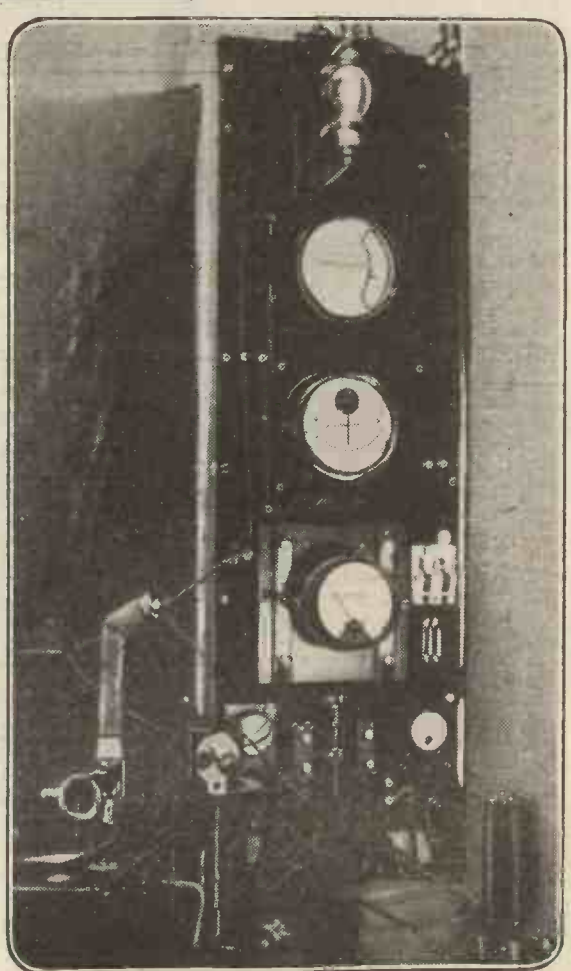
AMATEUR

This photograph was sent in by Mr. W. home-made dir



A very fine experimental set erected by Mr. S. M. Douthwaite, at 9, Rectory Road, Loughborough.

The 7th Holborn Scout "Cubs" are rightly proud of their receiving set. They may sometimes be found on Hampstead Heath, deeply engrossed with their apparatus, and getting excellent results with a small aerial.



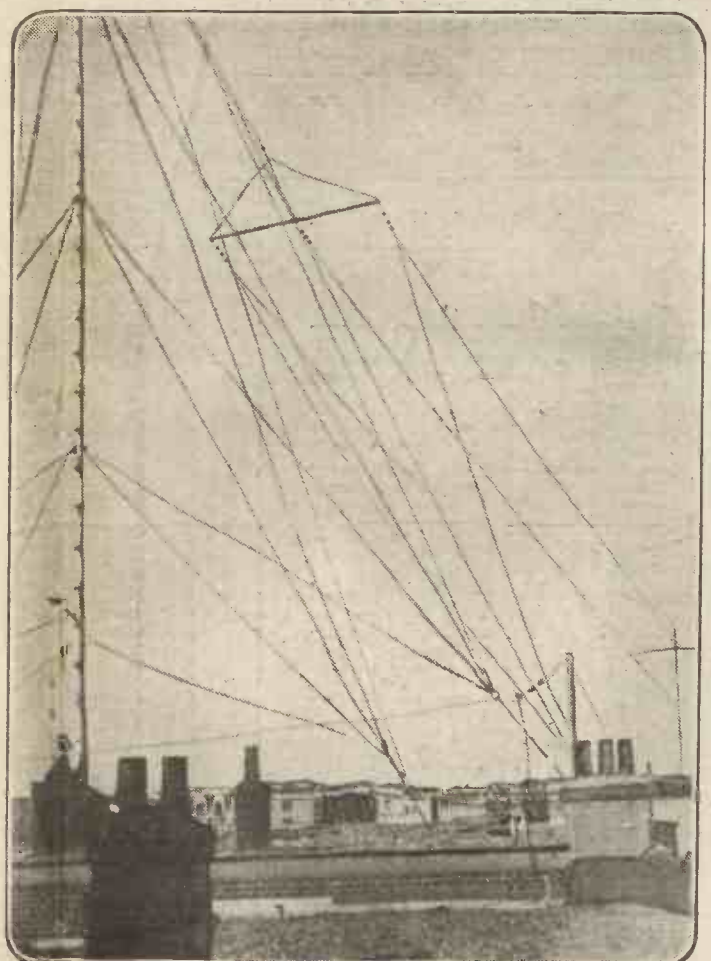
The majority of amateurs are familiar with the musical concerts sent out by P C G G, the Hague wireless station. This photograph shows the control panel of the transmitting apparatus, with a gramophone "broadcasting."

R D.F. STATION

T. Appenbeck, of the Ritz Hotel, London, and shows his ection-finding frame aerial set.

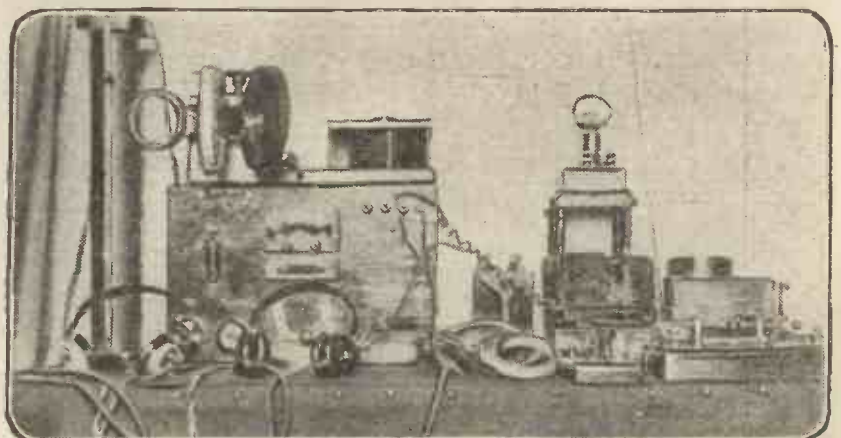
ILLUSTRATED WIRELESS LECTURES

Illustrated lectures by wireless are now possible. Hand-coloured pictures were recently projected on a screen in an American broadcasting station, and duplicates sent to various other halls in the U.S.A. The lecture was broadcasted by wireless, and the pictures were arranged in order, so that the duplicates could be altered as the lecturer proceeded.



This shows the aerial system employed at the Hague, from which are radiated the concerts we all look forward to on Sunday afternoons.

The Boy Scouts of Westminster City School, under the direction of Mr. E. Haslack, their scoutmaster, are being well grounded in the principles of wireless and the Morse code. They are seen here receiving messages on the school set.



This amateur wireless set, which is of the single-valve type, is all home-made by Mr. S. Rudeforth, 54, Worthing Street, Hull. Mr. Rudeforth states that he has heard American stations with this set, and that he receives the Dutch concerts quite clearly.

Step by Step in Wireless

No. 7. CALCULATING THE WAVE-LENGTH OF AN AERIAL.

THE calculation of any required wave-length is generally accomplished by means of a piece of apparatus known as a "wave-meter." This instrument, while measuring more accurately the fundamental wave-length of any given aerial than the following methods, usually has no place among the apparatus of the amateur. It is fairly expensive to purchase, and its utility is confined to special occasions. Simple arithmetic can be utilised instead of the wave-meter for finding the natural wave-lengths of either vertical or horizontal aerials.

The natural or fundamental wave-length of an aerial is the wave-length of the actual aerial wire itself, as distinct from any wave-length it might have, if either capacity in the form of a condenser, or inductance in the form of a tuning coil, were connected to it. Let us consider first the fundamental wave-length of a vertical aerial. A simple vertical aerial, such as a suspended copper wire, or even a high mast with an insulated wire running the whole length of it, will possess a fundamental wave-length of four times its own length. If the wire is fifty feet long, for instance, it will have a natural wave-length of 200 feet. A metre is equal to 3¼ feet or 3·25 feet. Let us suppose that we wish to erect an aerial of the type just described, with a fundamental wave-length of 360 metres, which is the wave-length at present contemplated for "broadcasting." By multiplying the 360, which represents metres, by 3·25 we shall get a certain number of feet—namely, 1,170. If this number is now divided by four we shall get 292 feet 6 inches, or 292·5 feet. This is the length of aerial which would be required to have a natural wave-length of 360 metres.

The process can be reversed. If we have an aerial 292·5 feet long, its fundamental wave-length, as we have seen, will be four times that length, which is 1,170 feet. To bring the feet to metres we must divide 1,170 by 3·25, the result being 360 metres. The erection of such a vertical aerial 292 feet presents obvious difficulties, even supposing permission were obtained to erect one of this height. The figures given, however, serve to show what a long aerial would be required to receive even a low wave-length like 360 metres, and the value of the aerial tuning inductance for lengthening the natural wave-length of the aerial becomes apparent. It is not often that a vertical aerial as described is used for either transmission or reception. The aerial almost exclusively employed by the amateur is the horizontal wire type. The fundamental wave-length of this kind of aerial can also be approximated by using the factors given below. The natural wave-length of any horizontal aerial measured in feet or yards is 4·7 times its overall length. If, however, we multiply the length of the aerial, calculated *in feet*, by 1·44, our answer will give us the fundamental wave-length of the aerial *in metres*. The proof that this is so can be seen from the following example: Let us suppose that our aerial is to be 120 feet long, and we require to know approximately what fundamental wave-length it possesses. In accordance with the figures previously given for determining the wave-length of a horizontal aerial, we shall first have to multiply 120 by 4·7 to find the fundamental wave-length in feet. The answer is 564 feet. The next step is to convert the feet into metres, which we can do by dividing 564 by 3·25. We shall then have the fundamental wave-length of the horizontal aerial wire, which is approximately 173 metres. If the length of our aerial now be again considered, we can see that 120 multiplied by 1·44 will give us 172·8 metres, which is much the same as the answer obtained by the longer method of working. This method could not, of course, be applied if any exterior value of capacity or inductance is connected to the aerial.

Finally, do not confuse the factor used for approximating the wave-length of the vertical aerial with that used for the horizontal one. You multiply the length of the former by 4 to obtain its fundamental wave-length. You multiply the length of the latter, measured in feet or yards, by 4·7 if an answer in feet or yards is required. If you desire to measure your aerial in feet, and obtain its fundamental wave-length in metres, take the measurement of its length in feet, and multiply by 1·44 as described. The result will not, of course, give a strictly accurate computation, but it is a quick and easy method of determining roughly the natural wave-length of your aerial.

WIRELESS CLUB REPORTS.

The Editor will be pleased to publish concise reports of the meetings of wireless clubs and associations, reserving the right to curtail the reports if necessary. An asterisk denotes affiliation with the Wireless Society of London.

Wireless Society of London.

THE last meeting of the session of the above society was held at the Institution of Electrical Engineers on June 14th, when an address was delivered by Sir Oliver Lodge, F.R.S., D.Sc. There was a very large attendance, and the lecture was of intense interest.

The session has been one of great success, and a large number of new members have been enrolled. Those wishing to make application for membership or associate membership should write to the Honorary Secretary: Mr. L. McMichael, 32, Quex Road, Hampstead, N.W.6.

* * *

Wireless Society of Highgate.*

On Friday, June 30th, Mr. F. L. Hogg gave the first of his series of lectures on "The Construction of Wireless Apparatus," at a meeting of the society at their headquarters at the Highgate Literary and Scientific Institution.

Mr. Hogg dealt very carefully and lucidly with the construction of tuning coils and contrasted the relative merits of cylindrical, basket, and honeycomb coils for various wavelengths. He showed how a simple one-valve circuit should be connected up and then dealt in detail with the assembling of the various components which go to make up such a set.

Mr. Hogg's lecture was followed with great interest by those present, and after a few questions had been put and answered, a hearty vote of thanks was proposed and carried with acclamation.

The lectures on the theory of wireless and the construction of apparatus are being continued each Friday until the middle of August, and the Hon. Secretary will be pleased to receive inquiries from anyone interested and to furnish full particulars of the society.

Hon. Sec.: Mr. D. H. Eade, "Gatra," 13a, Sedgemere Avenue, East Finchley, N.2.

* * *

New Association formed at Newport.

What may prove a step in the development of wireless telegraphy in Newport was taken at a meeting held at the Technical College, Newport, on Thursday, June 26th, for the purpose of forming a Newport and District Wireless Society. Mr. J. H. M. Wakefield, sectional engineer, Post Office, Newport, presided, and was supported by Alderman Dr. J. McGinn and Mr. W. B. Edwards, engineering dept., Post Office, Newport.

It was resolved to form a Newport and District Radio Association, and to ask Lord Tredegar to become president.

The other officers elected were: Vice-presidents, Sir Garrod Thomas, M.D., D.L., J.P.; Sir Frederick Mills, Bart.; Capt. C. H. Bailey; Mr. Graham Roberts; Alderman Dr. J. McGinn.

A general committee was formed, and the number of applicationsal ready received exceeds three figures.

Hon. Secretary: Edward R. Brown, M.S.A., A.T.P.I., 92, Corporation Road, Newport, Mon.

* * *

Wireless Society in Ystrad.

A Rhondda Wireless Enthusiasts' Club has been formed in Ystrad, and Mr. H. J. Griffiths is chairman. Mr. R. Evans, 69, William Street, Ystrad, is secretary, and Mr. G. Hiscocks has been appointed treasurer of the club. Since the holding of the meeting 50 members have been enrolled, and great interest is taken in the movement. The club is already in possession of a valve receiving set, and lectures will be delivered by a competent wireless expert. The society is negotiating for additional instruments, and it is the intention of the club to invite the public to the headquarters to listen to lectures and concerts sent from various broadcasting stations, one of which will be established at Cardiff in the near future.

Leeds and District Amateur Wireless Society.*

A general meeting was held on Friday, June 23rd, at the Leeds University, Mr. A. M. Bage (vice-pres.) taking the chair at 8 p.m. The chairman informed the meeting that it had been found impossible to arrange a discussion on "Direction Finding," as scheduled in the syllabus, but Mr. G. P. Kendall, B.Sc. (vice-pres.), had very kindly come forward, and the chairman had great pleasure in calling upon Mr. Kendall to describe "A Four-Valve Receiver."

This set, as Mr. Kendall explained, was still in the experimental stage, being assembled in the well-known 50-watt trench set cabinet, and utilising some of this set's components. The first valve functions at radio frequency having potentiometer grid control, and is directly coupled by means of reactance-capacity or resistance-capacity methods to the grid of the rectifier, which functions on the grid condenser system. The set is provided with magnetic regeneration taken from the plate side of the rectifier to the aerial circuit, which will provide for the reception of continuous waves if the coupling be tight enough to set up self-oscillation or autodyning. Two stages of low-frequency magnification follow, and by means of a plug and jack combination the telephones or loud-speaker may be placed in the plate circuit of either the rectifier, the first L.F., or the second L.F. valves. The receiver uses "R" valves and will function on all wave-lengths, being very useful for telephony reception. Theoretical and practical diagrams of the scheme of connections were explained briefly, but clearly, by the lecturer.

A short discussion followed, at the close of which Mr. Kendall was heartily thanked for his very interesting and instructive lecture. The meeting then broke up and adjourned at 10 p.m., after the apparatus on view had been closely examined by all present.

Hon. Secretary: Mr. D. E. Pottigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

* * *

Stockton-on-Tees and District Amateur Wireless Society.

A general meeting of this Society was held in the Jubilee Hall, Stockton-on-Tees, on Thursday, June 22nd, which was attended by a large number of members. This Society, which is only a month old, is one of the largest in the district, having close upon eighty members.

Permanent rooms have been taken in the Malleable Workmen's Institute, Norton Road, together with the monthly use of the large concert hall in which it is proposed to hold lectures, etc. An aerial is being arranged for and considerable apparatus has been placed at the disposal of the members.

The Committee have arranged that some official shall be in attendance in the rooms every evening to cater as much as possible for the wants of the members and also their comforts. The fees have been fixed as low as possible and can easily be met by any working man.

The membership is open to persons of any age, and ladies are also admitted.

The general meetings of the Society are fixed for the second Thursday in every month.

Hon. Secretary, Mr. W. F. Wood, 4, Birkley Square, Norton, Stockton-on-Tees.

* * *

Cannock and District Wireless Society.

The above society has been formed and affiliation applied for to the Wireless Society of London. At a meeting held recently Mr. Geo. Milton Whitehouse was elected chairman and Mr. T. Ball secretary.

Considerable interest is being shown in the district and a large membership is expected.

Wireless and Experimental Association.*

A delightful little entertainment took place at the Central Hall, High Street, Peckham, a few days ago, having for its subject "Wireless and what it is." A paper was read explaining in simple language the nature and properties of wireless waves.

A receiving set and two loud speakers were employed, and a practical demonstration of the reception of music given to the audience by its aid. The music was transmitted by the courtesy of Messrs. Marconi, and tuned in by Mr. Voigt, the installing engineer of the Wireless and Experimental Association, under whose auspices the demonstration had been arranged.

Another excellent item was a short address by a lady on "Wireless in the Home from a Woman's Point of View." The general public were then invited to ask any questions on the subject of wireless they cared to, which invitation led to a hearty response. After this, a lecture on "Wireless Waves," with diagrammatic representations on the blackboard, was given by Mr. Voigt, and proved highly interesting. The lecturer was loudly applauded at the conclusion of his discourse.

Votes of thanks were accorded the chairman and his assistants, and to the organisers for their efforts in arranging the demonstration.

A popular feature was the exhibition of wireless apparatus manufactured, for the most part, by the members of the Association. The exhibits on view were many and varied, and represented hours of patient work on the part of the makers.

Altogether, it was a very successful evening, and, if possible, similar demonstrations will be organised from time to time.

Hon. Secretary, 18, Meeford Road, Dulwich.

* * *

Middlesbrough and District Wireless Society.

At the 32nd meeting of the above society, held at its Meeting Room, in Borough Road East, on Monday, June 26th, at 7.30, Mr. W. H. Ward gave a very interesting lecture on "High Frequency Currents."

He fully explained some elaborate experiments which he had recently carried out, and pointed out some curious phenomena which he had found when working his apparatus. One very extraordinary effect which he pointed out was that the frequency of alternation produced by his apparatus was such that he was able to pass sparks 18 inches in length from the apparatus to his bare hand without pain, the only sensation being that of warmth to the hand. Another of the curious effects which Mr. Ward explained was that in a reasonably shaded room the top of his apparatus gives off a magnificent display in the form of an extensive blue glow, known technically as the "silent discharge," which is seen on rare occasions on ships' masts and at the points of lightning conductors during a storm.

Mr. Ward further explained the principal theories with regard to high-frequency currents, and the instruments now in use for producing them, many of which instruments are in regular use for the purpose of wireless telegraphy and telephony. At the conclusion of the lecture Mr. Ward was accorded a very hearty vote of thanks.

A meeting of the Wireless Committee was then held, whilst the other members listened-in on the wireless set of Mr. C. E. Thewlis, connections being made to the aerial, which was raised to a new mast 55 ft. high. This new mast is to form part of the society's permanent aerial, on which it is hoped to receive the broadcasting messages at a high standard of perfection.

Hon. Secretary: Mr. Cleveland Hood, Nunthorpe S.O., Yorks.

THE EARLY DAYS OF WIRELESS.

IF you read the newspapers you are led to imagine that wireless telegraphy and telephony are entirely the creation of the twentieth century, and that our fathers and grandfathers did not even know the meaning of luminiferous ether, let alone the delights and value of splashing about in it.

As a matter of honest fact, the idea of this *new* method of conveying messages is nearly a century old, for it was in the year 1831, before the great Queen came to the throne, and only sixteen years after the battle of Waterloo, that James Bowman Lindsay, of Dundee, conceived the idea of sending electric signals without wires.

This wonderful man, who was born a century too soon for his amazing genius to be properly appreciated, actually recorded his opinion that signals might in this way be sent across the Atlantic.

It was he who really discovered the electric light, and in the year 1834 publicly exhibited an electric lamp in Dundee.

Looking Ahead.

He was the son of a weaver, educated himself, and became a teacher of science. He opened classes in Dundee in the year 1834, and here is an extract from his advertisement in "The Dundee Advertiser" of April 11th in that year:

"Houses and towns will in a short time be lighted by electricity instead of gas, and heated by it instead of coals. And machinery will be wrought with it instead of steam, all at a trifling expense."

In the printed Proceedings of the British Association for 1859 can be found an account of Lindsay's method by which he actually did transfer wireless signals across the River Tay.

On the other side of the Atlantic, Morse, whose name will always be remembered through the Morse code, was also busy with wireless ideas at a very early date. He made experiments in passing signals across the Susquehanna River, a mile or more in width. But he came to the conclusion that the base line must be three times as long as the distance to be crossed, and this mistake caused him to abandon his experiments.

It was half a century before another man arose capable of mastering the problem. In the year 1882 Mr. Preece (afterwards Sir William Preece), electrician to the English Post Office, began to work on wireless. Six years later, in 1888, Professor Hertz demonstrated that an electro-magnetic discharge caused electro-magnetic waves to radiate through the ether, and propelled them forward at something like a thousand million feet a second.

Success in Sight.

Then Mr. Preece showed that it was practical to send signals by the new means, and Sir Oliver Lodge, another great pioneer, gave public demonstration of utilising these Hertzian waves.

All these experiments sent a thrill through the scientific world, but the man in the street cared nothing for these things. He did not read the scientific papers, as he does to-day, and he had not the remotest notion of the miracles that were happening under his very nose.

Mr. Preece continued his experiments. At first he worked between the Isle of Wight and the Hampshire coast. His base lines were respectively 16 and 20 miles long. You see, he was still hampered with the old idea of Morse.

Large metal plates to serve as electrodes were immersed in the sea at the terminals of the base lines, and with this arrangement "dot and dash" signals were easily sent across the straits. Telephonic speech was tried, but found impossible.

In the winter of 1893-94 Mr. Preece made fresh experiments between the Isle of Arran and Kintyre, a distance of four miles, and in 1894 came the first great triumph, for he managed to speak without wires across Loch Ness, a distance of a mile and a quarter.

In the Arran-Kintyre experiments the base lines were shortened and parallel wires each three miles long were used with success.

Still another series of experiments by Mr. Preece were those conducted between Lavernock Point on the Welsh coast, and the Islands of Flat Holm and Steep Holm. Here, for the first time, the base line wires were raised to a considerable height above the sea.

A "Stray" Idea.

Hitherto it had been supposed that the signals could only be sent across water. Now came Professor Thompson pointing out that undoubtedly they could travel through the earth itself. He showed that the instruments in Greenwich Observatory were affected by stray currents escaping into the earth from a faulty circuit in the City and South London Electric Railway, nearly five miles away. He also put it on record that the railway telegraphs of all the South London railways were put out of work by one of the dynamos at the Deptford electric power station becoming connected to earth. These currents were actually perceived as far north as Leicester and as far south as Paris! His conclusion was that with proper apparatus signals could be sent to any part of the world by conduction through earth or water.

By 1897 Mr. Preece had succeeded in transmitting wireless signals between two parallel telegraph lines forty miles apart.

"Too Visionary."

It was in 1896 that the wonderful young Italian whose name will be connected with wireless as long as mankind endures, arrived in England with his new receiver, and it is to the everlasting credit of the British Post Office that Marconi was afforded facilities for experiment. First on Salisbury Plain, and afterwards across the Bristol Channel, this boy succeeded in sending signals to a greater distance than any previous inventor.

But we must not forget our debt to Sir William Preece and to Professor Thompson. So sanguine was the latter that so long ago as 1890 he offered a financial magnate in the City to establish wireless communication with the Cape, provided that £10,000 was provided for the work.

His offer was deemed "too visionary" and was turned down!

SUPER-REGENERATION.

MAJOR E. H. ARMSTRONG, the inventor of one of the most valuable improvements in wireless, namely, the Regenerative or Reactance Circuit, has just described a marvellous improvement, which he calls super-regeneration.

With an ordinary reactance coil, a wireless signal, after detection and rectification in the plate circuit, is fed back and reacts upon the grid circuit, which greatly magnifies the original signal. This magnification may be increased by using extra valves.

By the new system of regeneration, signals can be heard all over a room with one valve, whereas the same signals are quite faint if the simple regenerative circuit is used.

For some time it has been known that the limit of amplification is reached when the negative charge in the valve approaches the positive. Major Armstrong's experiments prove that it is possible to increase the negative charge temporarily for about a 20,000th part of a second, far above the positive charge, yet the average between the two charges is still kept down. Such increase causes enormous amplification, and enables one valve to do the work of three.

THE

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EVERYTHING FOR WIRELESS

Instruments, Parts, and Materials.

Aluminium Condenser Vanes, 3½ in., 2½d. pair.
Spacing Washers, 8d. dozen pairs.
Brass Rod, threaded, 3-16th Whitworth, 6d. foot; ¼ in. square. 4d. foot.
Ebonite Panels, 9 x 6 x ¼ in., 3/- each. Sheet Ebonite, ¼ in. thick, 4/6 lb.; 1-8th and 3-16th, 5/6 lb.
Ebonite Knobs, 1½ in. diameter, 7d. each.
Ebonite Lead in Tube, 9d. foot.
Resistances for Panel Mounting, 3/3 each.
Grid Condenser and Leak, 2/6 each.
Telephone Condensers, 2/6 each.
Terminals, 1½d., 2d., 3d.; and Lacquered Panel Terminals, 3½d. each.
Aerial Insulators, 6d. each.
Aerial Spreaders, 2/- a pair (6 ft.).
Valve Legs, 2½d. each.
Engraved Ivorine Scales, 8d., 1/6, and 2/-.
Valve Holders, 1/6 and 2/3.
Crystals, Tested, 6d. each.
Mica, Best Ruby, Condenser size, 2 x 1½ x ·003 in., 2d. each.
Paraffin Wax, 1/- lb.
Enamelled H.C. Wires, 24g., 2/6 lb.; D.C.C., 3/6. All gauges stocked.
Single-Valve Panel with ·00075 Variable fitted, £4 10s.
Two-Valve Amplifier, £5.
Variable Condenser in case (·00075), 19/6.
Aerial Wires, 18g, enamelled on reel, 2/1 120 ft.
7/22 Stranded, 6/- 100 ft.
7/22 Stranded and Enamelled, 6/9 100 ft.
J. B. S. Accumulator, 4 v. 20 a., 15/6; 4 v. 40 a., 21/-; 6 v. 40 a., 33/-; 6 v. 60 a., 45/-.
All accumulators fitted with non-corroding terminals.

POST FREE ON ORDERS VALUE £2.

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300, London Road, Westcliff-on-Sea; and Nelson Street Works, Southend-on-Sea.

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Set of parts to construct above, minus phones and aerial, **£1 5s.**
Superadio No. 2 single valve receiver, £3 5s. (Valves, phones, aerial batteries extra.)

VALVE SETS EMPLOYING 1, 2, 3, and 4 VALVES SUPPLIED COMPLETE AND READY TO FIX UP.

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Ebonite Filament switches, Panel type	3/9 and 4/-
Aerial Insulators	3,9 doz., each 6d.
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Condenser spindles, with knob	1/-
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Basket Coils, set of four	2/6
1½-volt Inert cells	9d.
All. Condenser Plates	per doz. 1/6
Crystals	each 6d.
Valve pins, with nut	per doz. 1/9
Tapping Keys	2/-
Ebonite knobs	6d.
4-way Telephone leads	6d.

Carriage Free over £1.

New & Ex-Government Wireless Apparatus in Stock

WIRELESS DISTRESS SIGNALS

By P. J. RISDON.

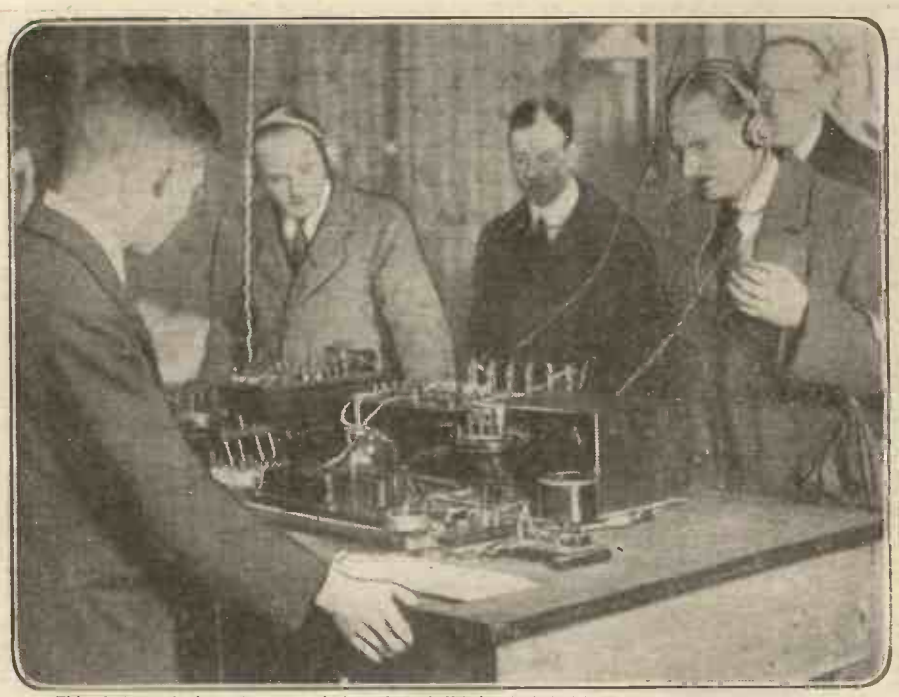
WHEN a vessel in distress sends out the S.O.S., that signal is only received by other vessels provided the operators are listening in. In the case of big boats on which more than one skilled operator is carried, the message is certain enough to be picked up because there is always a skilled operator on duty; but the majority of tramp steamers only carry one skilled operator, an ordinary member of the crew, termed a watcher, being given a brief training in wireless sufficient for him to recognise the S.O.S. Months or even years may pass without his receiving the message at all, with the result that when it does arrive he may not recognise it or may confuse it with others. In fact, this happened recently, and 17 lives were lost in consequence.

The Marconi Company have recently fitted a considerable number of vessels with an auxiliary wireless apparatus by means of which listening in for the S.O.S. only is rendered unnecessary. A new distress signal has been devised and, by means of this new auxiliary apparatus, when it is received bells are automatically rung on the bridge of the receiving ship and in the operator's cabin, and these bells are kept ringing until the operator gets to his instruments, adjusts his head-piece, and is ready to receive the direction signals giving the position of the vessel in distress.

The new signal is different from all others and consists of four dashes of one second each repeated three times at regular intervals. When received by any other ship within range, the signals are intensified by valves and relays sufficiently to work the receiving mechanism, which is so regulated by ratchet wheels as to work only when the right signal is received, with an allowance of half a second margin of error either way. It is so tuned that, in the event of such a coincidence as several stations sending signals that correspond to the four-second alarm, it would not work. Jamming is also impossible.

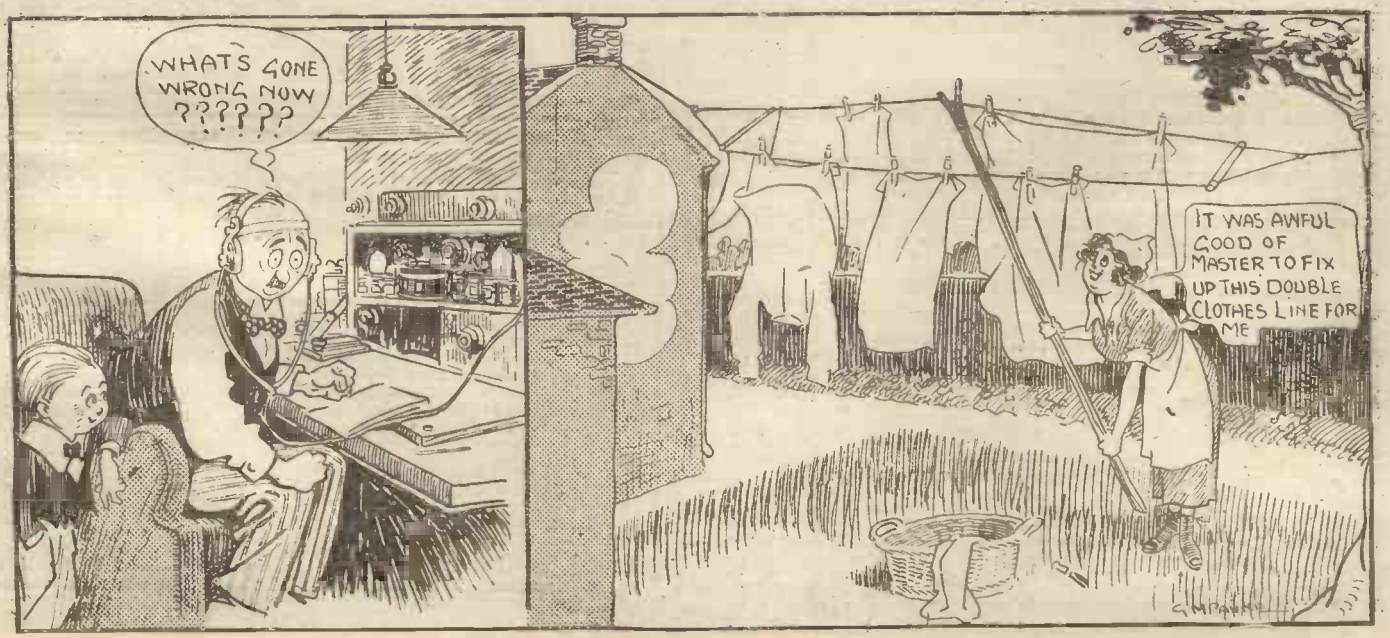
The signal is sent out in the ordinary way by a ship in distress and, when received by another vessel, passes through a tuner to 4 electrode valve amplifiers and relays by which it is enormously magnified. Thence it passes through an electrically operated mechanism fitted with ratchet wheels and with lever arms, the ends of which operate air dash pots designed for the correct intervals between the signals, the ratchet wheels acting something like the striking mechanism of a clock for regulating the timing. An electric bell in the cabin and one on the bridge are introduced in the circuit.

Let us suppose that the operator is about to go off duty. By means of switches he changes over from the ordinary receiving apparatus to the four-second alarm, and from the ship's current to an independent battery of accumulators, in case of failure of the ship's supply. He is then free to retire to rest or to leave his cabin in charge of any member of the crew possessing no wireless knowledge whatever. Should the bell ring it wakes him, or alternatively gives the watcher warning, and the operator then switches over to his ordinary apparatus and picks up whatever messages are being dispatched by the ship in distress in the usual manner.



This photograph shows the new wireless alarm bell being tested at the Marconi works at Chelmsford.

WILL FATHER WRITE TO "POPULAR WIRELESS" ABOUT IT?



FROM OUR NEW YORK : CORRESPONDENT. :

EVERY man his own aerial! This sounds an impossible idea, but it has in fact been successfully accomplished by an American army officer, Captain Donald Muse. According to Chicago technical journals, Captain Muse was amusing himself and some brother officers in his quarters one evening by listening to various radio concerts.

The host, a man of an inventive turn of mind, was seized with a whim to experiment a little, and then, quite by accident, stumbled upon a remarkable discovery. He had disconnected the ground-lead to show his friends that the set would continue to function without it, and proceeding to another "stunt," disconnected the wire leading to his antenna. He had the bare end of the wire between his fingers, which were moist from perspiration, and to his surprise heard the music which was being sent out from a near-by station, and to which he and his friends had been listening. It was very faint, but still it was coming in.

Body Aerials.

Captain Muse then stripped off the insulation from about eighteen inches of the wire, and then tuned his set to its most delicate adjustment. Taking up the wire again, he told his friends to listen. To their utter astonishment the set functioned excellently, without a ground connection and with their host's body as an aerial. The experimenter then clamped his head-receivers to the horn of his gramophone, and the room was filled with the music. He gripped the wire between his teeth, and the sound was intensified still further. It then occurred to him to have one of the other men hold the wire with him, and the music was stronger still. Eventually all four men held the wire, when the music became so powerful that the doors of the gramophone had to be closed. When all the men let go the wire, the music ceased abruptly.

This is only one indication of the possibilities which lie ahead in the development of radio. The tin roof of a shed, the springs of a bed, the rain-pipes at the side of a house, the metal rail of a motor-omnibus, have all been used with success as aerials. An American inventor is perfecting a super-regenerating device which will dispense altogether with the necessity for an aerial. Most striking of all, perhaps, is the use of the wires of an ordinary house-lighting circuit for conveying radio signals. As yet, this is only for people with considerable technical knowledge, and amateurs should not attempt to use lighting circuits for this purpose; but more than one firm in this country is working on a device which will make it possible to "listen in" on radio broadcasting by merely putting a plug in the electric light fixture.

Wireless in Churches.

It can only be a matter of time before the congregations of the smallest churches in most out-of-the-way villages will be able to listen every week to the inspiring messages of great preachers. The First Baptist Church at Shreveport, Louisiana, a new building, and one of the largest Baptist churches in the world, has been equipped with a broadcasting set with a normal radius of 1,500 miles. Not only dozens of little churches scattered all over the South-Western States will hear the sermons delivered by the well-known preachers who will occupy the pulpit of the Shreveport church, but thousands of farmhouses will become places of worship by the magic of wireless.

A Social Asset.

What this will mean to people whose means of diversion are so limited that a sermon by a visiting preacher is a great event, may be easily imagined. But when you add the lectures, concerts, and news services which such broadcasting sets will dispense daily to thousands of village halls, besides lonely farmhouses, radio begins to emerge as one of the greatest agencies for brightening country life and checking rural depopulation that has yet appeared. In the United States this is, in fact, coming to be regarded as its greatest social value.

One tip that the American radioist can give to his British brother relates to protecting himself against lightning. The National Board of Fire Underwriters has investigated the question of the fire risk arising from a radio set, and has made a series of recommendations which will certainly before long become hard and fast regulations. Lead-in wires, for instance, must be kept a minimum of four inches from electric-light circuits, and then only when they are separated by continuous non-conductors. Approved lightning arresters must be installed, together with provision for grounding the aerial. Thunderstorms are more frequent and more severe even in the Northern and Eastern States than in England, but still the question of protection from lightning and electrical storm is important. Most radio sets on the market in the U.S.A. come equipped with lightning arresters. They are simple, of course, and inexpensive. When the American amateur hears a thunderstorm approaching he switches his aerial to ground, and sits back until it is past.

Cinema Wireless.

The Radio Kinema is one of the very latest devices in the field of wireless. It enables any number of projectors to be controlled by a master projector, or, in other words, to be synchronised with it. In the broadcasting station, with the master projector, are the actors and actresses who made the film which is being shown. As it goes on they speak the words which they actually spoke while they were acting before the camera. These are broadcasted to the theatres in which the film is being shown, and the result is a "talking movie."

WIRELESS IN THE DESERT.

A CHAIN of air stations has just been made across the Syrian Desert to enable a Cairo-Bagdad air route to be inaugurated. The work has been done by the Royal Air Force, who sent their first party across the desert in a car convoy.

There were no maps of the districts traversed and this first crossing was guided by the stars at night. But to fix exact positions a knowledge of the absolutely correct time at which the observations on the stars were made was necessary.

Consequently every night at about half-past ten the chief surveyor erected his portable wireless set and "listened in" for the time signal from the Eiffel Tower.

In that way an officer, sitting in his lorry in the middle of the trackless desert, hundreds of miles from civilisation, could by strapping receivers to his ears set his watch to the correct time sent to him over two thousand miles of space by an operator working in the heart of a great city.

I wonder if the man at the Eiffel Tower realised in what a lonely and desolate spot his broadcasted message was being strictly noted?

RADIOTORIAL

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

Letters from readers in many parts of the world indicate that the interest in wireless has attained universal dimensions with the announcement that public broadcasting stations are to be erected.

Wireless telephony will not be a "passing craze" with the majority, because the scope it offers to the experimenter, and the general fascination it has for the layman, who has, perhaps, no wish to make a serious study of the science, will always grow.

Wireless is not an invention that has achieved perfection and now proposes to rest on its laurels. It must go on and on, continually opening up new fields of research for the professional scientist and experimental amateur alike.

Senatore Marconi's recent discoveries in the propagation of short waves opens up a fascinating field of research.

He himself declared, at a New York meeting of electrical engineers, that the study of short wave transmission had been neglected—that its possibilities were as yet unrealised.

For the experimental amateur there is plenty of material to work on. His work is not ended with the erection of his set; his work—if he is seriously inclined—has, indeed, hardly begun.

The success of the Transatlantic amateur tests made the world realise the utility of amateur experimental work, and therefore I urge readers of POPULAR WIRELESS who are recruits to the ranks of wireless enthusiasts to take more than a superficial interest in their hobby.

They may do great things if they apply themselves to the study of wireless. It is not always the Olympians who win the laurels, and even the humblest experimenter may hit on some epoch-making discovery.

Who knows?

EDITOR.

Questions Answered

C. A. T. (Talke).—The building is wood roofed, and about 40 feet in height. Could I use a frame aerial 6-inch sides with 6 turns of wire mounted on the top of the building?

You could, but we are not going to advise you to. In the circumstance you mention, you would be able to erect a 50-foot double aerial that would prove five to ten times as efficient as a frame aerial.

* * *

C. H. L. (Wimbledon).—I wish to construct a condenser of the air dielectric type. (*a*) Of what metal should the plates be? (*b*) What size to make the capacity .003 mfds.?

(*a*) Sheet aluminium. (*b*) Eight fixed and seven moving plates with a minimum of 3-inch radius, and a spacing between fixed and moving plates of .15 inch.

* * *

A. N. (Chorlton-cum-Hardy).—I have constructed a frame aerial two feet square, wound with 8 turns of No. 26 S.W.G. cotton-covered wire. Please say if this will work, and, if so, best wave-lengths.

The size of the frame and the gauge of the wire are not large enough to prove efficient. The wire should not be thinner than 24 S.W.G. and the frame not under four feet square. Your best wave-length would be but 250—275 metres. Endeavour to erect an outdoor aerial. Situated where you are, you must not expect any very noteworthy results using an indoor frame aerial.

* * *

H. F. (Ramsgate).—(*a*) Shall I need an accumulator or battery for the "35s." set? (*b*) Must an aerial be 40 feet?

(*a*) No. (*b*) Height is very important, but 40 feet is not essential.

* * *

J. R. (Newcastle-on-Tyne).—What are the units of measurement in wireless telegraphy, and to what do they apply?

The practical units are: Microfarad-capacity, represented by the condensers; Microhenry-inductance, the coils; and wave-length, the length in metres of the ether waves transmitted and received.

C. E. (London).—Is a fixed condenser across the telephones essential?

No, but the addition will greatly improve the quality and tone of the received signals.

* * *

"WAVELETS" (Aldershot).—What is the meaning of exhausted bulb?

A bulb from which the air has been exhausted. In other words, a vacuum.

* * *

G. L. M. (London).—In the instructions given in the article "How to Make a Receiver for 35s.," do I have to wind one layer of wire or use the whole pound?

One layer closely wound.

* * *

T. A. J. (London).—Have I wired up my set to its greatest advantage?

No; the telephones and crystals must be across the whole of the inductance that lies between the moving slide and the earth.

* * *

G. F. S. (Enfield Wash).—Can a frame aerial be used out of doors with a crystal set?

Yes, but the range would be very small compared to that of a good suspended aerial.

* * *

J. L. O. (Dublin).—Need an earth wire be insulated?

Not necessarily, but it is wiser to use insulated wire to avoid shorting any other lead that might have faulty insulation.

* * *

"RADIO T." (London).—Would a frame aerial placed outside prove as good as an aerial 30 feet high and 75 feet long?

Not by a long way.

* * *

L. H. I. (Leicester).—Is a former 1⅞ in. diameter wound for 5 ins. with No. 36, suitable for use with a crystal set?

Yes, but larger gauge wire, such as 22 S.W.G., and a larger former, say about 5 ins. diameter, would be more efficient.

* * *

"BEGINNER" (Edinburgh) suggests building a set with a range of 180 to 11,000 metres, and asks if it is possible to obtain such a range using one tuner.

It is possible, but for most purposes hardly worth the trouble. A set ranging from 300–3,000 will cover everything of interest for anyone with such a nom-de-plume.

* * *

"JAMMED" (Bradford).—My neighbour has his aerial very near to mine, and when I am receiving telephony he will keep on oscillation point, with the result that he throws me off altogether.

Two-valve receiving stations so close together are sure to cause a certain amount of mutual interference. It is not improbable but that your neighbour says something much the same about you. You should get hold of him and amicably talk the matter over.

* * *

"VALGRID" (Glasgow).—It is interesting to note that by using a frame aerial one can dispense with the usual tuning inductance. Why is this?

Because within limits one can alter the length of one's (frame) aerial. To increase the wave-length of an ordinary aerial one could increase the length, but as this would obviously be an inconvenient method of "searching" for a station, to rush out and alter the length of the aerial by joining bits of wire on a "metre" at a time, an inductance coil is used instead. Even in the case of a frame aerial, for efficient reception the usual inductance is necessary.

* * *

S. N. S. (Purley).—Can you tell me why for the last five weeks it is impossible to get the broadcasting from Writtle? I understand from other amateurs that their experience is the same.

Days were getting longer. With a fairly low-powered station, such as Writtle, signals may be very strong towards nightfall and at night, but unreadable by day. That, if your set is O.K., is a possible explanation.

"AERIAL". (New Barnet).—Can a three-valve amplifier be used with a single valve, or must I have a three-valve set?

It can be used with a single-valve set.

* * *

F. A. R. (Southam).—What wave-length can be got using a coil 5½ ins. diameter wound with 320 turns of 28 W.G. D.C.C., and an aerial 35 ft. long, 35 ft. high one end, and 30 the other?

2,200 metres.

* * *

"FLIP" (London).—What is the best way to learn to read Morse signals?

The best way to learn to read Morse is to learn to send Morse. Memorise the combinations, and practise sending with a key and a buzzer. If possible, you should get hold of a friend who is interested and send to each other. Most wireless clubs and societies have Morse practice intervals.

* * *

"GINGER" (Hednesford).—Sixty yards from my aerial, running parallel, is a 60-volt main and two telephone wires. Will these be disadvantageous?

Not with the crystal set you intend to use. Should you employ valves, there will doubtless be slight interference.

* * *

A. R. O. (Chester).—Will a 4-volt 30-ampère hour accumulator do for the filament of a valve without using a resistance?

No; a resistance is necessary to adjust the filament current. Upon the correct temperature of the filament depends the sensitiveness of the valve.

* * *

E. E. K. (Acton).—Is the length of the earth lead included in the maximum length of aerial allowed by the P.M.G.?

No. The P.M.G. knows that the longer the earth lead the less efficient the set, and can afford to leave that point outside the reckoning.

* * *

R. S. (Battersea).—Can the earth switch for protection against lightning be connected to the same earth wire as the tuner?

Yes.

* * *

J. W. C. (Streatham).—Can a microphone button be used to make a loud speaker? If so, what are the connections?

You would have to fix the button to the reed or diaphragm of the telephone receiver. This is a very difficult and tricky little operation, and unless you are well up in small instrument work it will result in nothing but the irretrievable damaging of the telephone receiver. A small transformer is necessary, and a 4-volt battery. The circuit is the primary of the transformer to the battery, and battery to the microphone. The microphone is then connected to the remaining terminal of the primary of the transformer. The secondary of the transformer is connected to a low-resistance receiver.

* * *

"CARGEEN" (Liverpool).—By having my set on the top floor of the house, my aerial lead in will be only 10 ft., but my earth lead will have to be 35 ft. long. If I have the set in a lower room, my aerial lead will be over 30 ft., and my earth only about 8 ft. long. Which will be the better?

The arrangement giving the shortest earth lead is always to be preferred. Keep the down lead of the aerial well away from the building, and run it the straightest line possible to your set.

* * *

W. W. B. (London).—I have a Mark 3 short wave tuner. Can I use a valve amplifier without alterations?

Yes. The amplifier is merely connected to the telephone terminals of the tuner.

* * *

R. W. H. (Bowes Park).—My aerial that I propose to erect will run parallel to the tram cables in the main road 100 yards away. Will the efficiency of the aerial be in any way impaired by this close proximity of overhead tram cables?

Not in the slightest.

* * *

F. G. L. B. (Bournemouth).—What town is the nearest broadcasting station to Bournemouth?

London. Marconi House.

* * *

G. D. P. (Neasden).—What wave-length will an inductance of 4 ins. diameter by 7½ ins. long wound with 24 S.W.G. tune to?

With a 100-ft. single aerial, 2,300 metres.

T/Y

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The Sterling No. 1 Crystal Receiver has been specially designed for use in connection with the Wireless Telephony Broadcasting Scheme, and comprises :—

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2. DETECTOR.—This is of the crystal type, specially selected, requiring no battery, and is designed to give universal adjustment over all parts of the crystal.

The apparatus is mounted on ebonite panel and fitted in polished walnut case.

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No. 8.—NEW SERIES OF ELEMENTARY ARTICLES

POPULAR WIRELESS

3d.

Weekly

No. 8. Vol. 1.
July 22, 1922.

BROADCASTING AT THE EIFFEL TOWER

A special two-page article and a message of encouragement from General Ferrié.

SPECIAL ARTICLES BY

JOHN SCOTT-TAGGART - - - E. BLAKE

WILLIAM LE QUEUX - LESLIE McMICHAEL

Popular Wireless

TOPICAL NEWS AND NOTES.

Jewellers' Sound Move.

MESSRS. T. BRAYBROOKE, well-known jewellers in High East Street, have installed a splendid wireless receiving set, by means of which they can daily get Greenwich time. Their customers are cordially invited to step inside and check their watches.

* * *

Hotel and Cinema Wireless.

THE Hotel Cecil, London, will shortly entertain guests with wireless demonstrations and music, etc., on a set to be fitted up in the hotel. The Marble Arch Cinema has had a receiving set installed for some time, and will also shortly hold a wireless concert for the benefit of patrons.

* * *

Eiffel Tower Reports.

DATA from America is now added to the European wireless weather report which is sent daily at 11.30 a.m. (Greenwich mean time) from the Eiffel Tower. The observations transmitted consist of the reading of the barometer and the direction and force of the wind at 1 a.m. (G.M.T.) on the day of issue at about thirty places scattered over the Continent, including Bermuda, Chicago, Cleveland, Denver, Cape Hatteras, Salt Lake City, San Francisco, Washington, and Winnipeg. Approximate positions of the centres of cyclones and anti-cyclones are also indicated.

* * *

Working Not a "Fag."

THE proprietors of State Express Cigarettes have installed on one of the floors of their factory a fully equipped "listening-in" installation of the most powerful nature. An experienced operator is in charge so that the workers may have a chance of hearing everything that is broadcasted during the day. In time, music and other features will be added, so that work will no longer be labour but pleasure.

The State Express Co. erected a wireless installation on their factory before the war and endeavoured to get direct communication from factory to traveller, in order to expedite business and delivery. Unfortunately the intervention of the war prevented them carrying out this idea successfully.

* * *

The Ossiphone and Mr. Edison.

THE other day, in the pages of POPULAR WIRELESS, you learnt of a wonderful little invention by which it was possible for deaf people to hear without using the drums of the ear—the message being conveyed by the bones to the nerves of the brain.

Now, I suppose Mr. Edison himself doesn't know how many things he has invented in his time, though curiously enough he was one of the first people to instal a wireless telegraph scheme for railway trains. The transmission was effected by metal strips installed on the roofs of the train and a parallel wire carried on poles that ran alongside the track.

To-day Mr. Edison isn't as young as he used to be, and it is not remarkable to learn that he is very deaf. Let us hope that the ossiphone will be able to benefit this wonderful inventor, who has done so much for the world in so many different ways.

* * *

The Doctor and His Car.

WIRELESS telegraphy is a wonderful thing for getting people out of difficulties. Just listen to the story of a doctor and his car.

The doctor had driven to Boston with his wife to see her off on a steamer bound for New York. He performed the seeing-off so well that he saw himself off as well as his wife, for when he bade the last tender farewell he came on deck to find the gang-plank raised and the dock a hundred yards away.

He had no other choice but to continue the voyage, as the captain refused to turn back; but, not seeing why he should lose his car, he got the wireless operator to send a message to the Boston police. It was luckily picked up by an amateur, who promptly notified the police, who proceeded to carry out instructions in a satisfactory manner. The car was berthed in a garage, where the doctor recovered it some considerable time later.

Improved Microphones.

"UNDER the auspices of the National Institute of Inventors, of Sackville Street, a new type of microphone transmitter has been developed which is free from the disturbing elements associated with carbon transmitters," says "The Daily Telegraph." "The variations in resistance accompanying the usual vibration of a thin diaphragm are accomplished by the movements of an electrode in glowing neon gas, which gives both an invariable value of the resistance when the vibration amplitude is zero, and a large proportional change in resistance when vibration takes place. It appears that owing to the nature of the conductor—an electron stream—there are no inertia effects, and the speech is transmitted with great clearness. The microphone should prove of service in radio-telephony circuits, for a more perfect modulating device is badly needed for this purpose. Meanwhile it has already been applied to the production of sounds produced and synchronised with films. A photographic record of light variations, produced by the use of the microphone and a vacuum tube, is printed by the side of the cinema picture, and reproduction of the accompanying sounds obtained by selenium and a system of amplifiers."

A prominent West End store has introduced a wireless set into the mysteries of "bobbing." Permanent waves are now, for the first time, in close touch with wireless waves of the C.W. ilk.

NEWS AND NOTES

(Continued.)

A Paris Exhibition.

AN exhibition of wireless telegraph installations is to be held from August 25th to October 5th in the Champ de Mars, Paris.

* * *

Wireless "Lessons."

SCHOOL children will receive lessons in wireless at the new radio station erected at Southport's "Pleasureland." There are sixty telephones attached to the set, as well as a number of "loud speakers," according to "The Liverpool Post."

* * *

In the Next War.

THE Earl of Cavan, Chief of the Imperial General Staff, addressing cadets of the Royal Military Academy, Woolwich, recently, said the Army Council has decided that from "division" to the front line there would be no telephone wires in future wars. Therefore he looked to all young officers to obtain a knowledge of wireless.

* * *

Wireless in Austria.

THE British Marconi Company has been granted a charter by the Austrian Government for the establishment of a central wireless station in Vienna, in co-operation with an Austrian company.

This is a great triumph for a British firm. The Berlin Telefunken Company have always been strong competitors, but this time they take a back seat.

* * *

"Music from the Sky!"

THE above is a heading to a German trade leaflet now circulating in this country. The text runs:

"We are ready to complete your orders for all forms, equipments, and parts. The low cost of manufacture, together with the best German ingenuity, which we have been able to obtain, allows us to offer you wireless apparatus at considerably lower prices than any part of the world."

* * *

The Wonder Tube.

AMERICA is very much excited just at present over the new super-regeneration circuit invented by Major Armstrong, and the latest invention of Dr. Irving Langmuir.

Dr. Langmuir, according to the "Radio World," has constructed a new device—a tiny tube—which will revolutionise long-distance wireless communication.

"By this apparatus," says the "Radio World," "direct current flows into the tube through a complicated wire system, and high-frequency current is generated which flashes signals through the ether in electric waves that travel with the speed of light to distant stations.

"The tube is an advancement over the Anderson alternator, just as that was an advancement over the old Goldsmith alternator.

"Dr. Langmuir's tube is 50 kilowatts and develops 12 horse-power within its narrow walls of glass. He has been working on the tube for several months.

"It is predicted that it will take the place of the massive alternators of the Anderson type."

* * *

Broadcasting in Paris.

"BROADCASTING is making great strides in Paris. Even the toyshops are now offering for sale 'listening-in' apparatus for picking up messages," states the Paris correspondent of "The Times."

"A well-made little instrument can be purchased for 50f. (about £1) which is capable of receiving the time and other messages from the Eiffel Tower installation. With a more powerful outfit, which is sold at about 200f. (£4), it is possible to receive messages from nearly all the wireless stations in France. But for 'listening-in' during concerts it is not satisfactory. For 800f. (£16) an instrument can be obtained with which concerts given at The Hague can be heard.

"Many Parisians, and even sailors on board the boats on the Seine, possess 'listening-in' sets, which enable them to enjoy selections by well-known artists 'broadcast' from the Eiffel Tower."

* * *

The Empire Chain.

MR. KELLAWAY, the Postmaster-General, stated recently that:

"The Government have decided to erect in England a station of the ultimate power (240 kilowatts) contemplated by the Expert Commission, instead of the smaller power (120 kilowatts) which they proposed should be used in the first instance. The Government are advised that this station will provide, especially, direct commercial communication with India, South Africa, and Australia.

"In India the Imperial Government will erect and the Indian Government will work a station also capable of direct communication with England, South Africa, and Australia. As a corollary of this decision, the proposed second station in Egypt and the station in East Africa will be deferred; and the question of erecting stations at Singapore and Hong-kong will be reconsidered.

"Communication is proceeding with the Union Government as to the station in South Africa, and the experts of the Canadian Government are expected to reach England very shortly in order to discuss the participation of Canada in the scheme."

The Commission, whose report was issued last December, recommended that the installation should be capable of being tuned to wave-lengths of between 3,000 and 16,000 metres.

* * *

Will it Come to This Here?

THIS "programme" is reprinted from the "Radio World." Comment is superfluous.

7.01—Cradle stories for grandparents.

7.14—"How to Have Your Thumbs Manicured," by William Pinkerton. What every payroll bandit should know.

7.22—Song: "Gasoline, My Gasoline!" Words and music by the Standard Oil Company.

7.25—Trombone solos and how to cure them.

7.50—Drinking Song from "The Eighteenth Amendment."

8.02—Jack Dempsey posing for a photograph of himself.

8.16—Violin solo by the one-armed paperhanger.

8.27—What Babe Ruth said when Urban Shocker struck him out.

8.27½—Board of Aldermen distributing to permits to eminent citizens to wear white socks.

9.30—Anti-Saloon League Quartette: (a) "Have One More With Me," Brewer; (b) "The Land Where the Wurtzburger Glows," Beer.

9.46—Smile on face of Mr. Average Citizen while reading this headline: "Your Winter Suit Will Soar in Price!"

10.00—"When I Threw Coconuts at Darwin," by William Jennings Bryan.

10.14—"How to Play Tiddlewinks," by Thomas A. Edison.

10.30—Beauty Talks to Deep Sea Stokers' League.

The call sign of the station which perpetrated the above is "O U C H." That is what I say!

ARIEL.

Broadcasting Programmes

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

THE experimental station at Marconi House, call sign 2 L O, often gives a concert Friday and Saturday evenings on a wave-length of 360 metres.

The concert usually commences at 5 p.m. One given recently lasted three hours—with three 20-minute intervals. The power used is 1½ kw., and using valves the range is wide.

The Writtle concerts still carry on every Tuesday evening at 8 o'clock, B.S.T., on a wave-length of 400 metres. The call sign is 2 M T.

The Hague concerts are sent out Sunday afternoons from 2.30 to 5 p.m., and are still the most looked for event of the week in the broadcasting line. The call sign is P C G G, and the wave-length 1,070 metres.

Königswusterhausen transmits telephony usually at 7 and 10.30 a.m., G.M.T., on a wave-length of 2,500 metres. The station is situated near Berlin. Call sign, L O.

The Eiffel Tower Radio Station (call sign F L) may usually be relied on for a telephony transmission (and sometimes a concert) at 5 o'clock, B.S.T. A weather forecast is sent in French at 6 o'clock. The wave-length is 2,600 metres.

Croydon Aerodrome (call sign G E D) may be heard on 900 metres at all times of the day in radio-telephonic communication with various aeroplanes on the Continental air routes.

Other aviation stations which transmit telephony include Castle Bromwich (G E C); Didsbury (G E M); Hinton-Admiral (sign not allotted yet); Lympne (G E G); Renfrew (G E R); Pulham (G E P).

In all cases the 900-metre wave-length is chiefly used.

The more one listens in of an evening, the more one realises that some of the best telephony and music transmissions emanate from amateur stations.

There is only one big fault to find, and that is very few amateurs give enough care to the announcing of their call signs.

When closing down, the majority gabble out their call signs in such a casual way that nine times out of ten the interested listener in quite fails to catch the sign, and consequently cannot tell where the transmitter is located.

The broadcasting horizon looks much clearer now. The manufacturers of wireless gear in this country have been granted protection from foreign competition for two years. This point finally settled, the prospects of a speedy commencement of a regular broadcasting service are practically certain.

NEW SERIES FOR THE BEGINNER

By E. BLAKE, A.M.I.E.E.

NOTE.—Mr. Blake's articles in the "Daily Mail" have aroused such considerable interest among laymen that I have invited him to write a series of articles on wireless for readers of this magazine. Mr. Blake will deal with a scientific subject that will be easily understood and appreciated by the novice in wireless study.—EDITOR.

PART 1.

THIS series of articles is designed to provide the beginner with a course of instruction in the general principles of radio communication. It is being assumed that the reader knows little or nothing of the subject, or of electricity and magnetism, and therefore the first few articles must needs be in the nature of an introduction. Just as the engineer, the builder, and the carpenter have to begin by learning about the tools and materials they use, so the would-be wireless man must first make acquaintance with the theory and phenomena of electricity and magnetism, and arm himself with knowledge of electrical apparatus and its uses.

My readers need not fear, however, that I am asking them to undertake a dull course of studies the like of which can be found, alas! in so many school text-books. On the contrary, we shall keep as close to the subject of wireless as is possible right from the start. After all, the practice of wireless is largely the application of phenomena which electricians have known about for a long time. As Sir William Preece said, "We all knew about the egg, but Marconi showed us how to stand it on end."

The Essence of Radio.

First and foremost, let us consider what wireless is from the fundamental point of view of physics. When we communicate by means of a letter, we convey a piece of paper from one house to another. But that is a very superficial statement, and by no means capable of being considered as fundamental; for the same object could be achieved by sending our friends an elephant's tusk, appropriately scratched. No doubt people used that method of communication in past ages. The essence of the process is *the communication of intelligence from one point in space to another.*

The definition just given applies very well to wireless, but not wholly. Music is transmitted by wireless, but it does not properly fall within the definition; it is only symbolic language, and is not directly translatable. The same may be said of wireless time signals.

The essence of radio communication is *the transference of energy across space.*

That word "energy" calls for explanation at once, because it is one we shall constantly be meeting. What is energy?

Energy and Matter.

So far as the physical contents of the universe are concerned, we are aware of two fundamental phenomena only, matter and energy. Every other phenomenon is the effect of these or their interaction. We are, through our senses, *directly* aware of matter. We are aware of the existence of energy only by its effects upon matter.

Energy is the capacity to perform work, work being the overcoming of some force—gravitation, for example. Experiments show that energy is indestructible and constant in quantity. It changes its form whenever work is done, but never disappears, although it often escapes from man's control. Some of the electrical energy in a lighting circuit is conveyed away in the forms of heat and light, and thereafter is lost to that particular system. Energy is considered by scientists to be quite as real, quite as worthy the term "thing," as matter. It always exists; it is not a mere transient "appearance," such as a sound, or a state of mind, such as hate or love.

Energy either moves matter or imparts to matter the potentiality of movement. In other words, the energy of moving matter is *kinetic*, and the energy of matter which (as a mass, but not molecularly) is not moving is *potential*. For instance, a stone flung into the air receives energy from the man's muscles. The kinetic energy of the moving stone is transformed into potential energy in proportion as the stone's velocity upwards decreases. When the stone reaches the limit of its upward movement there is a moment of time in which it is absolutely stationary, and at that moment all the energy is potential. Directly the stone begins to drop that energy begins to change back again into its kinetic form, and when the stone is finally on the ground all the energy originally given to it by the thrower has been dissipated, mostly in the form of heat.

Electro-Magnetic Energy.

Energy assumes several forms—light energy, heat energy, mechanical energy, chemical energy, electrical energy, and so forth—but though it slips from one disguise to another, as it does the work of the Creator and of creation, it never dies or diminishes. Wireless is one means man has devised of transferring energy from one place to another; in this particular instance the energy is in the form known as "electro-magnetic," and it is transferred at the speed of 186,000 miles a second. When it arrives at the receiver it does work on the diaphragm of a telephone, and is changed into the energy of sound, in which form it reaches the ear of the operator and conveys the message to his brain by the co-operation of his nerves.

The most important disguises assumed by energy in the operation of wireless are electrostatic and electro-magnetic, and so we must now proceed to the study of electricity and magnetism; but the reader should try to regard the whole process of radio transmission and reception as a matter involving only energy, its various transformations, its transference across space and through wires, and its action on matter.

Atoms and Electrons.

Electricity is now known to be the stuff of which matter is composed; in fact, we may regard electricity as matter, or vice versa. Before this fact was established the smallest particles into which matter was known to be divisible were called atoms, but these exceedingly tiny portions have been resolved into still smaller portions which are called electrons. A typical atom is thought to consist of a core or nucleus, the composition of which is unknown, around which are arranged the electrons. The number of electrons composing an atom depends upon the kind of atom—that is, whether it is an atom of oxygen, of iron, of gold, or other element.

Electrons repel each other. Hence, as the world is so largely made up of electrons, there must obviously be some compensating influence holding them in their places in the atomic systems. If there were not such an influence there would be no atoms, and therefore no world, because every electron would move as far away from every other electron as possible. Therefore, we have to conceive the existence of what, on the face of things, is a physical necessity, and so the core or nucleus of the atom is regarded as the seat of the attractive influence which balances the repelling force of the electrons. For the sake of convenience, electrons are referred to as *negative* electricity, and the core as *positive* electricity.

If we consider an atom in its normal state—that is, with its proper number of electrons—as neutral, then we may regard an atom *minus* one of its electrons as *positive*, because the positive electricity in the atom predominates. Similarly, we may regard an atom which has one or more extra electrons as *negative*, because the negative electricity predominates. The following imaginary examples illustrate this. The symbol — means "negative," and + means "positive."

Neutral atom. Negatively charged atom.

6 plus 6 6 plus 7

\+ — + —

Positively charged atom.

6 plus 5

\+ —

It will be noticed that it is only the — quantities which vary; apparently the core remains always the same.

Conductors and Insulators.

In a mass of any substance which "conducts electricity"—copper, for instance—there are at a given moment a large number of free electrons. It is supposed that all atoms are perpetually in violent motion, carrying their attendant electrons with them, these also pursuing complex movements on their own account. Therefore it is not surprising that under these conditions, producing as they must numerous collisions, some of the electrons are detached from their atoms. Such an occurrence would leave a free electron and a positively-charged atom. The latter would draw to it the nearest free electron, and the former would find some other atom minus an electron, and would combine with it. Imagine this ceaseless turmoil going on within the interior of a copper wire, and you will see that at every instant there must be a certain number of free electrons. The wire, as a whole, would exhibit neither positive nor negative electrification; it would be neutral, because even if some of its constituent atoms were positively charged, by reason of their each having lost an electron, those electrons would still be present in the wire, so that it still would contain equal amounts of each kind of electricity.

Substances in which there are free electrons are called "conductors" of electricity, and those in which there are few free are called "insulators."

It is these free electrons which make possible electric currents, and all the wonderful things which can be done with them. Accordingly, in the next article, we shall learn about the electric current.

Another of Mr. Blake's articles will appear in next week's issue.

Under the heading "Step by Step in Wireless," future articles will be of a more advanced nature.—EDITOR.

GENERAL GUSTAVE FERRIÉ.

TO the ordinary lay mind, Eiffel Tower is probably associated more with a particular brand of lemonade than with wireless telegraphy and telephony. Yet the Eiffel Tower, Paris, is the premier wireless telephony station of France.

Early experiments in wireless telephony were carried out from the Eiffel Tower by means of a high-frequency alternator, and were attended by a good deal of success. With the advent of vacuum tubes or valves, however, the alternator method of transmitting wireless speech was discontinued.

Better voice modulation, and clearer speech generally, was obtained by using valves for the purpose of radiating speech by wireless. Some little time ago General Ferrié, chief of the French Army Signal Corps, decided to arrange for a broadcast programme of speech and music to be sent out from the Eiffel Tower.

This service was for the benefit of the public, and anyone possessed of a suitable receiving set within a radius of 1,500 miles from Paris can now listen to a wireless "concert" from the French capital.

The telephony transmitter is now composed of a number of transmitting valves, connected together in parallel, the voice being "imposed" upon the grids by means of a microphone. The electromotive force supplied to the plate circuit of the valves is 2,500 volts D.C.

The initial strength of the speech and music is greatly magnified by the inclusion in the circuit of six amplifying valves. The actual transmitting-room, containing the microphones, is about 50 or 60 feet distant from the set proper, and this adds greatly to the efficiency of the transmitted speech, as many undesirable noises, unavoidably created by the transmitting apparatus, are thus eliminated from the radiated signals.

The set at present in use is stated to be more of an experimental character than a permanent fixture, it being the intention of the French Army Signal Corps to erect a more powerful station, which will eventually be able to communicate with all parts of France.

But the inference must not be drawn that the set at present in use is not efficient.

A station situated in Northern Africa recently received a Parisian concert from Eiffel Tower on a loop aerial over a distance of 1,450 miles, and so good were the received signals that by means of a loud speaker 35 people were able to enjoy the music from distant France.

It is expected also that the wireless telephony set at the Eiffel Tower will be used for direct communication between Paris and London, and, upon completion of negotiations with the Post Office authorities, it is hoped that a subscriber to the telephone service in Paris will be able to speak directly to a subscriber to the London telephone service.

Experiments are now being carried out with a view to perfecting this duplex system, and the time is not far distant when a regular wireless telephony service will be in operation.

Communication between aeroplanes flying on the Continental route between London and Paris has also been established by the installation of sets at the respective aerodromes.

The small amount of power used by the aerodrome sets, however, does not always enable continuous communication between the aeroplane and its aerodromes to be established, and the erection of another set at the Eiffel Tower of sufficient power to overcome this drawback is contemplated.

Weather reports are also broadcasted from Eiffel Tower by telephony, and are of great value to ships at sea.

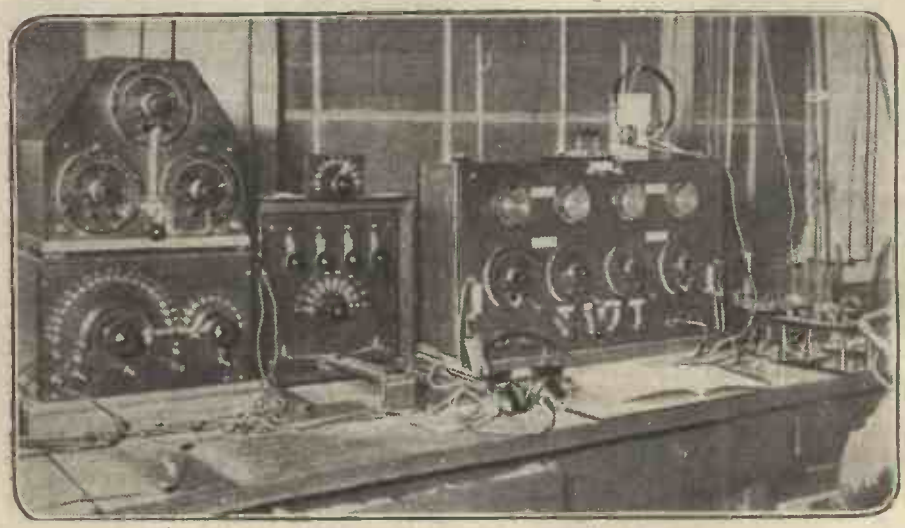
Eiffel Tower can certainly be numbered among the pioneer stations broadcasting wireless telephony. In the development of the science, and the application of "speech by air" to commercial needs and private requirements, the powerful station at Paris is certain to play a big part in the future.

The Eiffel Tower wireless station was planned and erected by General Gustave Ferrié. In 1899 he was present during Senatore Marconi's experiments carried out between Wimereaux and Dover, and in 1900 he founded the French Radio-telegraphic Service, and, although throughout his brilliant career he has been associated with the construction of many other French stations, his name will always be best remembered by amateurs in this country in connection with his work at the Eiffel Tower.

General Ferrié has always shown the keenest interest in the amateur cause, as his letter to the Editor of POPULAR WIRELESS shows, and time and again he has arranged special concert transmissions from Paris for the benefit of amateurs. Of all the land-station call signs in the world it is safe to say that the two best known are M P D and F L, Poldhu and Paris respectively.

The former recently "retired" after long and honourable service, but amateurs will be glad to hear that F L intends to carry on.

And, although the Lafayette station, near Bordeaux, may now possibly claim to be the most powerful station in France, and the new station at Sainte Assise, near Paris, even more powerful still when finally completed, the



Part of the receiving apparatus at the Eiffel Tower wireless station, Paris.

Eiffel Tower will always be reckoned one of the most important stations in the world.

The Editor has received the following letter from General Gustave Ferrié, Technical Director of French Military Radio-telegraphy, and the creator of the Eiffel Tower Wireless Station, Paris.

To the Editor,
"Popular Wireless."

Sir,—I have had great pleasure in receiving your kind letter of the 29th of May, and I beg you to excuse me for having delayed my reply to you. I have been away from Paris for the last two months, and I have to continue my journeys until the month of August, making only rare and short visits to Paris.

I am very glad and very honoured to know that the Eiffel Tower transmissions are so well appreciated by all the British amateurs. The voice which is sent forth by the Hertzian waves, under the different forms of radio-telegraphy and radio-telephony, is always that of a sincere friend of your great country, and particularly of the British Radio amateurs.

When, in 1903, I made the first experiments of Wireless Telegraphy at the Eiffel Tower, I did not think that this station which I created, and which I have unceasingly improved since that date, would become important for our two countries. During the war, it announced each day the good and the bad news, and it was by it, very often, that the magnificent fighting-men of our two nations, both on land and sea, learned the successive stages of our common victory.

At the present time it plays a more modest part, but it is still useful. It helps in particular to develop the liking for radio-technics, and to increase the number and the importance of the amateur societies, both in France and in Great Britain.

Soon, I hope, numerous communications will be established directly between the private stations of British and French amateurs. Personal relationships will be created between the operators, which will help to draw closer together the ties which already exist between our two countries.

I desire with all my heart that our closer relationships may be without limits, and I would be very proud to have been able to contribute, even in small measure, to their furtherance.

Yours, etc., etc.,

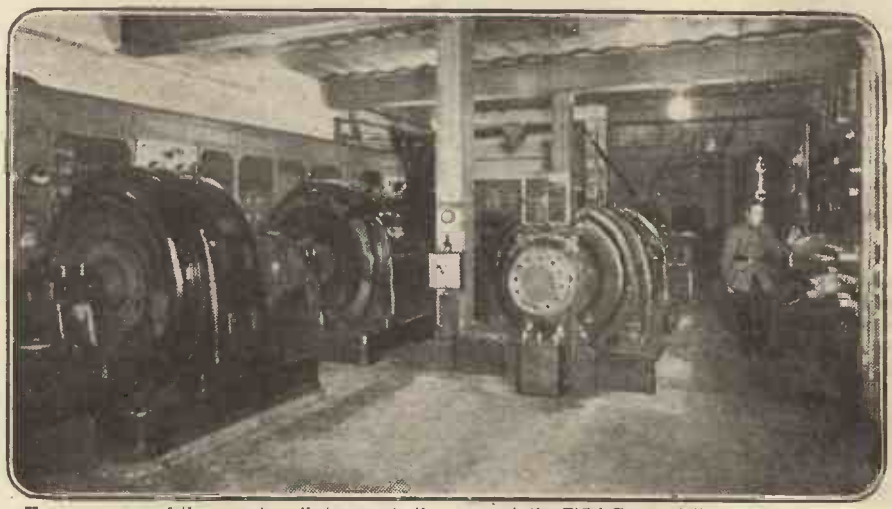
FERRIÉ.

DAILY TRANSMISSIONS FROM F L.

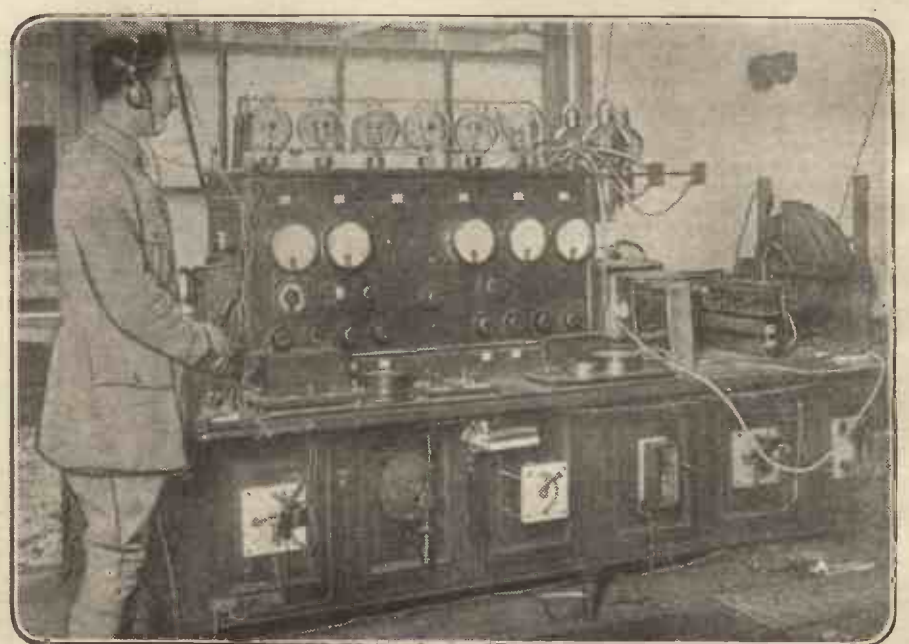
(Compiled by "Popular Wireless" Technical Staff.)

Time, G.M.T.	Wave-Length	Remarks
2.20 a.m.	2,600 spark	Weather Report
3 „	6,500 arc	Works, Bucharest (B U C)
4.15 „	3,200 „	„ Naval Stns.
4.20 „	6,500 „	„ B U C
7 „	3,200 „	„ Naval Stns.
8.20 „	2,600 spark	Weather Report
8.35 „	3,200 arc	Works, Prague (P R G)
9.23 „	2,600 spark	Time Signals
9.58 „	„ „	"Beat" Signals
10.33 „	„ „	Time Signals
11 „	8,000 arc	Works, N T T
11.30 „	2,600 spark	Weather Report
12.5	3,200 „	Press
1 p.m.	6,500 arc	Works, B U C
2.20 „	2,600 spark	Weather Report
3 „	6,500 arc	Works, B U C
5.5 „	3,200 „	Naval Stations
5.10 „	2,600 valve	Telephony
5.45 „	6,500 arc	Works, B U C
7.20 „	2,600 spark	Weather Report
9.30 „	6,500 arc	Works, B U C
9.58 „	2,600 spark	Time Signals
10.5 „	6,500 arc	Works, B U C
10.36 „	2,600 spark	Time Signals
10.50 „	6,500 arc	Works, B U C
11.15 „	8,000 „	Works, Beyrout (U A B)
11.25 „	6,500 „	Works, B U C

Every amateur is familiar with the signals from Eiffel Tower. This photograph shows the interior of one of the power rooms and the arc generator.



Here are some of the monsters that generate the power at the Eiffel Tower station. A rotary spark gap can be seen on one of the alternator shafts. "Spark" transmissions on 2,600 metres from F L are quite frequent.



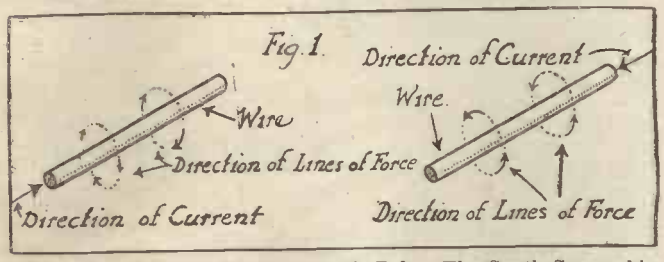
This telephony-transmitting set has been temporarily installed at the Eiffel Tower, and amateurs are familiar with the speech and music sent out by it every evening. A larger and more powerful telephony transmitter will shortly be installed

Step by Step in Wireless

No. 8. MAGNETISM AND ITS RELATIONSHIP TO ELECTRICITY.

NEARLY everyone is familiar with the "horseshoe" magnet. Most of us during our childhood were delighted by the peculiar power it possessed of lifting from the table pins and needles and other small fragments of metal. Then the majority of us passed on to the next new toy without troubling our childish minds as to the reason why the magnet behaved in the manner it did. But the adult who wishes to study wireless telegraphy will find that he or she must first acquire some knowledge of electricity, and the elementary lessons are certain to embrace magnetism. The earth itself exhibits all the characteristics of a huge magnet. It possesses a North Magnetic Pole and a South Magnetic Pole, just as did the horseshoe magnet of our childhood days. But it is not essential for the magnet to be bent. There are straight or bar magnets having a north pole at one end and a south pole at the other. We might imagine the earth as having such a bar magnet of enormous size thrust through it, terminating at one end in the North Magnetic Pole and at the other in the South Magnetic Pole.

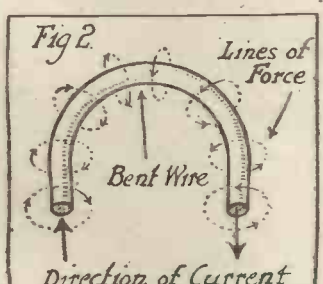
Many intrepid explorers have devoted years of their lives in endeavouring to reach the North Pole. This pole, however, is the north geographical pole, and it is situated at quite a different point on the



earth's surface from the North Magnetic Pole. The South Geographical Pole and the South Magnetic Pole are likewise distinct one from the other.

Lines of Force.

If a powerful magnet is placed a short distance away from a metal filing it will be found that the filing is attracted to the magnet, and will attach itself to one of the two poles. There is obviously, then, some power of attraction possessed by the magnet which metals in a normal condition do not evince. If the magnet is now placed some distance from the filing, no such attraction is evident. The influence of the magnet is therefore only effective within a certain radius. This radius is known as the magnetic field, which is made up of "lines of force." These imaginary "lines of force" pass out of the magnet at its north pole and return to it by way of the south pole. The area which they cover when on their journey outside of the magnet depends upon the strength of the magnet, and it is the space thus coming under their influence which is known as the "magnetic field." When the filing previously referred to was attracted to the magnet, it lay within the area covered by the lines of force. When it was unaffected, it was outside of this area. Let us now take two of the horseshoe magnets and endeavour to suspend one from the other, so that it is only connected magnetically. It will be found that this is only possible by having the north pole of one magnet against the south pole of the other. If the two north poles, and therefore the two south poles, are brought together, not only is no sense of attraction exhibited, but a force of repulsion between the two magnets will become evident. This shows us that while *unlike poles attract each other, like poles repel or repulse each other* if brought together.



A Simple Principle.

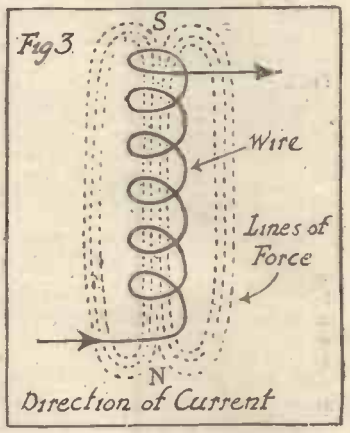
Lines of force which are leaving the two north poles are travelling in opposite directions, and when the two forces or "fields" meet the repulsion is evident. On the other hand, lines of force are *entering* the south pole, and if the north pole of a second magnet is brought into proximity with this south pole, the lines of force which are leaving the north pole will obviously join with the lines entering the south pole.

If a piece of wire is bent into a circle and the two ends are connected to a galvanometer, we shall have a completed circuit of wire. If a bar magnet is now thrust through the coil thus formed a deflection of the needle will show that a current of electricity has passed through the wire. This current, however, only flows as long as the magnet is moving—in other words, as long as the wire is cutting through a varying number of lines of force. Once the magnet ceases to move, the galvo will register no flow of current. When the magnet is withdrawn, a second "kick" of the needle shows that another temporary current has been generated in the wire, but in the opposite direction.

We thus see that the introduction of a piece of wire into a magnetic field will induce a current of electricity to flow in the wire so long as the number of lines of force cut by the wire is constantly varying. On this simple principle is based the construction of the dynamos, generators, and converters, which play such an enormous, if unappreciated, part in our daily lives.

Types of Magnets.

So far we have only considered the permanent magnet and the manner in which we can generate a current of electricity in a wire. A permanent magnet, which is usually a piece of hard steel, may be magnetised by rubbing it in one direction with another permanent magnet. It can also be magnetised by enclosing it in a coil of wire through which an electrical current is passing. When the steel has been sufficiently "influenced" it will be found to have become a magnet, and it will retain its magnetic properties for a considerable time. Hence the name "permanent magnet." There is another type of magnet, however, known as an "electro-magnet," and it is in this kind of magnet that the wireless amateur will be most interested.



Magnetic Fields.

It has been stated that if a piece of steel be included in a coil of wire in which an electric current is flowing it will become a magnet. The coil of wire is therefore a magnet, possessing "polarity." It will magnetise other metals, too, the degree of magnetism obtained varying for different kinds. Soft iron, for instance, becomes a powerful magnet when included in such a coil, but, unlike the steel, it loses almost all of its magnetic qualities immediately the current is removed. It is soft iron that is used in the construction of an electro-magnet. The iron is called the "core," and may be either of the "horseshoe" or "bar" type.

An insulated wire is wound round the "core" in the form of a coil, and a source of electrical supply is passed through it. Immediately the circuit is completed, the two poles of the magnet will evince strong magnetic tendencies, which shows that a magnetic field has been created by the passing current. This means that lines of force have been created, and as we know that lines of force act in a definite direction, it will be as well to see the path which they take under the influence of electricity.

Fig. 1 shows a straight wire with a current passing through it in a given direction. It will be seen that the lines of force which result, thereby forming the magnetic field, act in a "clockwise" direction according to the direction of current "input," if looking at the end of the wire into which the current is passed.

An Analogy.

This may be better explained by a simple analogy. Let the reader imagine that he is looking at the end of a receding wire in which electricity is flowing away from him. If it were now possible to take an ordinary screw and screw it into the end of the wire, the screw head would follow the direction taken by the lines of force. If the current now be reversed in the wire, so that it is flowing in the opposite direction, *i.e.*, towards the experimenter, the action of withdrawing the screw will correspond to the direction now being taken by the lines of force. (See Fig. 1.) We thus see that a reversal of current in the wire means a reversal in the direction of the lines of force radiating from it.

In Fig. 2, which is a bent wire, it will be seen that the lines of force are all acting in an "inward or downward" direction inside of the bend, and in an "upward" direction on the outside. Such a bent wire, if bent or wound into a spiral as in Fig. 3, will possess polarity as shown, the north and south poles being determined by the direction of the current.

When the soft iron "core" is introduced into the centre of the coil it has the effect of considerably increasing the "density" of the magnetic field created by the current and, therefore, the strength of the "electro-magnet."

CRYSTAL OR VALVE DETECTOR?

By GEORGE SUTTON, A.M.I.E.E.

THE earnest seeker after truth in wireless matters may well be sympathised with if he is in a quandary regarding the means he should adopt for detecting signals.

We will suppose, as a concrete case, that he is a clock or chronometer maker who desires to obtain the Paris time signals for the purposes of his business.

He makes inquiries of friends who are experts and friends who are not, and may even take the trouble to write to a technical or a lay paper, and he is invariably told that a £5 set which he can buy, or a 35s. set which he could make, with a crystal detector and headgear telephones, is useless for the purpose, as it will only receive over a range of twenty to twenty-five miles.

Whatever his geographical position in England may be, the Eiffel Tower is a greater distance away than twenty-five miles.

He is thus forced by circumstances, as he thinks, to spend £25 to £30 and set up a valve receiver, and the difference in cost may easily make the difference between setting up a receiving station and not being able to afford it.

Time Signals from F L.

It is a great pity that those who know better have not anticipated the difficulty that was bound to arise in the uninitiated mind by a statement of distance over which the crystal set would receive, irrespective of the strength of the transmitted signals.

Not only is it possible to receive the Paris time signal with a crystal and ordinarily sensitive headgear telephones, but the writer, both before the war and since, has regularly achieved it on quite an ordinary single solid wire aerial and without an earth connection, the latter condition being compulsory, as a connection to earth was so noisy as to be prohibitive.

If the possessor of a cheap set can get signals at all there is no reason why he should be unable to get the time signals. The principal difficulty will be that of the wave-length, for the set has probably been designed for receiving the broadcasted service on 400 metres and ship stations on 600 metres. Paris, however, sends out on 2,600 metres, and it is this wave-length, and not the distance, which keeps Paris out of the reach of his instrument.

Increasing Wave-length.

In the old days we used what we were pleased to call "loading coils," that is, separate inductances which were put between the aerial lead-in and the aerial terminal of our "aerial tuning inductance," as it was then known, and so tuned our circuit that it responded to the desired wave-length. The same thing can still be done by adding inductance. This need only be of modest dimensions, and can easily be contained within the scope of a basket-wound or a honeycomb coil, either of which can be procured for a shilling or two. The inclusion of such a coil will enable tuning of a wave-length up to the order of 2,000 metres.

If you put this in circuit in series with the aerial and well insulate it by placing it on an ordinary plate or tea saucer, you will be able to use the slider of your tuner for the final tuning. You will get better results if you actually incorporate the added coil into the set by connecting the aerial lead to one end of the coil below the point where the lead to the crystal detector is taken from the aerial. Connect the other side of the coil to your tuning inductance.

It will thus be seen that a receiver stated to have a range of twenty to twenty-five miles can receive Paris on a crystal.

The crystal is much disparaged as a detector, but it can do really good work if it is properly handled.

The main limitation of a good deal of crystal reception is that it depends entirely upon the energy arriving from the distant station and cannot, like the valve, amplify up while it receives. The crystal should be set in a metal cup with Wood's metal, that is, a kind of solder which has a very low melting point which does not split or spoil the crystal by too much heat. It can also be packed into the cup with tinfoil, if the latter is packed tightly all round the crystal so as to make good contact between the cup and the crystal. Holding the crystal in a clip is not recommended, as the grip would only be between two or three points, and might act adversely upon its sensitivity as a detector. One point of the crystal is selected to press on one side of the receiver circuit, and the rest of the crystal should, therefore, be as solidly connected to the other side of the circuit as possible.

Choosing a Crystal.

Carborundum and steel are a good combination and very sensitive when properly adjusted; also this detector is more reliable than most other crystals. It may need a potentiometer and small battery across it to obtain the best results. The carborundum may be set in a cup with Wood's metal or may be clipped between two flat steel springs. Galena will work with any metal, but needs a very light contact. A short spiral of No. 34 copper wire with its end resting lightly on the surface of the galena is often very good. A good crystal of fused silicon set in a metal cup with a steel, brass, copper, or gold point in an adjustable springy contact makes quite a good detector.

The point of a zincite crystal pressing on to a surface of bornite or copper pyrites makes the celebrated perikon detector used in a great many army sets.

Tellurium cast into the form of a pointed cone with the point pressing lightly on a surface of zincite makes a detector which gives a peculiar note quality of its own. It suggests the hearing of a note from a harp string after listening to a pianoforte. All of these detectors need good superlative telephones and faultless construction of apparatus to get the best effects, but effects are there if sufficient trouble is taken to obtain them.

Another point, which cannot be made too much of in crystal detection, is the way it renders audible speech and music. By its inability to maintain oscillations, as a valve does, the "carrier wave" effect of badly modulated speech and music is not heard at all, and while the valve receiver may be oscillating the man with a crystal is enjoying the concert without anything more disturbing than the occasional jamming of a spark station.

Inexpensive to Instal.

There are no batteries to run down with their attendant cost for recharging. The price of the high-tension battery is saved. You can also go away and leave your set, and come back again and find it instantly ready for further use.

It is inexpensive to instal and costs nothing to maintain, though you must put your best into it to get the best that it will give out of it.

But if you want to use a loud speaker, valves must be used.

NATURE'S WIRELESS BROADCAST.

WHEN listening in during the hot summer weather, have you heard those occasional crackles and other noises like two pieces of glass-paper being rubbed? At times they become so frequent as to seriously interfere with reception. Such noises, which are known as "atmospherics," "strays," "X's," or "static," are caused by lightning discharges, perhaps thousands of miles away. These natural wireless waves reach your receiving set in a similar way to humanly caused waves, but there is a great difference—static comes in on all wave-lengths, and cannot be tuned out. Some of the greatest scientists of the day have studied the matter, and although certain points of interest have been discovered, there is still no effective method of entirely getting rid of the objectionable noises.

Wireless operators have told me that when in the tropical seas, at certain times of the year, the crackling and "sissling" is so acute that it becomes painful to listen in for long. In fact, messages often cannot be understood at all, owing to the constant interruption. It is a curious and well-known fact that static comes in much stronger when listening on the higher wave-lengths than they do on short wave-lengths.

In the old "spark-coil" days of wireless transmission, static made reception of Morse code very difficult. Often the effect of the lightning discharges would cut out some of the dots or dashes of the letters, causing much confusion—and also delay, because of the necessity of repetition.

A lightning discharge may be compared to the strip of flame which is flashed between the points of an electric spark coil. In the early days of wireless the sparking of an induction coil was the method of propagating wireless waves. A short spark was a dot, and a sustained spark was a dash. One of the two sparking points was connected with the aerial, and the other to the ground. In the case of Nature's wireless, the "spark," or flash of lightning, also takes place between two points, one being clouds and the other earth.

The two methods differ in an important respect, however, and that is that we can "tune" the wave-lengths given out by the spark coil, but static is at the moment quite uncontrollable. During the summer months static is more prevalent than in winter, although it is often heard during the latter time of the year. Exceptionally strong static noises in your 'phones means that a thunderstorm is approaching, and in such circumstances it is advisable to discontinue reception, and to ground your aerial until after the storm has passed over.

In Great Britain we are not troubled with static as violent as that which affects other parts of the world, so we must be thankful for small mercies.

Doubtless, in these days of wonderful discoveries, some brainy person will suddenly hit upon a method for filtering out the hindering noise. There are some who prophesy that the sky will one day be tapped for natural electricity. Perhaps, when that time comes, the riddle of controlling static may be solved.

MY FAILURES AND SUCCESSES.

LONG-DISTANCE TELEPHONY FOR AMATEURS.

By WILLIAM LE QUEUX (Member of the Institute of Radio Engineers).

IN response to a request from the Editor of POPULAR WIRELESS, I here venture to give some details of my experimental telephony and c.w. transmitting set, upon which, in 1921, I broadcasted speech and music almost every evening during seven months. Many amateurs, I believe, know my call and my voice, 2 A Z, for fully a hundred in all parts of the country were good enough to write and report upon the strength and quality of my signals.

The set in question I started to establish in Guildford at the end of 1919, and was fortunate enough to have the advice and assistance of Mr. Duncan Sinclair, now of the Wireless Section of the Air Ministry, and Mr. E. P. Brown and Mr. F. A. Love, both land-telephone experts and well known in the wireless world. With the exception of the small radio-telephone sets used on aeroplanes and then being "scrapped" by the Disposals Board, very little was known at the time concerning long-distance radio-telephony. It could be accomplished, we knew. But how? That was the problem we set ourselves to solve.

For six months we worked daily with various apparatus and circuits, burning out expensive transmitting-valves, piercing condensers, ruining microphones, and other almost daily misfortunes, until at last, just as we thought ourselves within an ace of success, our generator broke down, and we could get no firm in London to undertake its rewinding, not even the makers themselves! It had to be scrapped, and after considerable delay a new one was installed in its place.

Still no result! A second single-line aerial had been erected at right angles to the transmitting aerial—a twin one—in order to be able to listen to our own telephony and gauge the strength and modulation of what was being sent out.

From listeners in London and in various towns reports came in that mumblings could be heard, but no word was distinguishable beyond "Hulloa! 2 A Z calling!" Weeks went on, valve after valve was tried, condenser after condenser, choke after choke, till I confess that more than once I stood in my wireless-room in despair. Indeed, so many disappointments did I have that one night I declared to my friend, Mr. Brown, that I felt like smashing up the whole bag of tricks with a hammer.

He counselled patience, so we continued. Morse could be read by Mr. L. Meyer in Amsterdam, and was also reported from Paris and the south coast of Ireland, but telephony seemed as far off as ever. Then I resolved to alter the wave-length to a thousand metres. This meant a new inductance, in the testing of which I was assisted by Mr. Frank Phillips, who is associated with the "Burndept" Company.

The Marconi Company, who were taking great interest in my experiments, kindly lent me certain apparatus, while from the research department at Chelmsford some highly valuable suggestions were made, based upon their own experience.

A further month of costly failure passed, until one day I received a letter from an amateur in Manchester, whom I did not know, telling me that my speech on the previous night—the weather forecast from the evening paper—was perfectly clear! Imagine my joy! Next day came letters from Mr. T. W. Higgs at Bristol, Mr. G. Woods of Liverpool, and Mr. F. T. Townsend, secretary of the Ipswich Wireless Club, all congratulating me upon both speech and music. These were followed quickly by reports from Mr. W. A. Ward at Sheffield, Mr. L. C. Willcox at Warminster, Captain E. J. Hobbs at Wareham, Mr. W. W. Burnham at Blackheath, Mr. W. J. Crampton at Weybridge, Mr. H. H. T. Burbury at Wakefield, and a number of others.

Naturally, on meeting with such sudden success, we persevered enthusiastically, in order to get the set to function more perfectly and to attain greater distances, until one day we received a report from the operator at Inchkeith, on the Firth of Forth, four hundred and twenty miles from Guildford, and lastly from the well-known amateur, Mr. G. W. G. Benzie, of Peterculter, Aberdeen, five hundred and fifty miles distant.

This distance, I believe, has not yet been exceeded upon the power we were using.

Just at that time Mr. T. Finucane was, under the auspices of the Marconi Company, giving popular demonstrations of wireless in various towns all over the country, and I was asked to transmit speech and music to his audiences. This I did, and by means of a relay and loud speaker those attending the lectures were able to listen to me in all parts of the kingdom. Several times I also spoke to charity concerts at Birmingham, Plymouth, Newcastle, and other places equally distant.

Now, as regards the apparatus used for transmission of the human voice over these distances, I will endeavour to describe it and its functions in language as non-technical as possible.

Out of the many circuit arrangements tried, the one given in the diagram gave best results. It operates on the "constant current" or "choke control" method of modulation.

The power-valve, or oscillation generator, maintains the aerial-circuit in a state of electric oscillation—that is, radiating the electromagnetic or wireless waves.

The waves produced by this valve (operating by itself with the control valve switched off) will be waves of constant amplitude—that is, the preceding waves will be of the same amplitude as the following waves, providing other things remain constant.

The method of transmitting speech by wireless is to vary the amplitude of this train of waves at sound or speech frequency. This is effected by the control, or modulation valve. The efficient operation of this set depends upon the iron-core choke-coils. These should be of high inductive resistance (about ·5 Henry each). The object of these coils is to limit, or keep constant, the current supplied to the valves. If two resistances in parallel A and B are joined to a source of supply of low resistance, by varying the resistance of A we do not alter the value of current in B. If now the two resistances are fed through a high resistance C and the resistance of A is made low, the current in B will also be low. If now A be made high, the current in B will increase.

This is the principle of the constant current system of modulation. It will be noticed that the plates of control and power valves are joined in parallel, and are both fed through the high resistance iron-core choke-coils. The air-core choke-coil is of low ohmic and inductive resistance to low-frequency currents, and its function will be explained later.

If the resistance of the control-valve is made high the current supplied to the power-valve will increase, and consequently the amplitude of the carrier-wave. When the resistance of the control-valve is lowered the current available at the power-valve will be reduced, and also the amplitude of carrier-wave. If the carrier-wave is made to vary at the frequency or rate of sound-waves, sound will be heard in a suitable distant wireless receiver tuned to the carrier-wave.

The resistance of the control-valve is made to vary with the sound-waves impressed upon an ordinary telephone microphone by connecting the secondary coil of a modulation transformer, or induction coil, to the grid of control-valve. Sound-waves striking the microphone cause its resistance to vary, and also the current passing through it and the primary coil. This variation of the coil induces currents in the secondary winding which are made to vary the resistance of the control-valve by impressing plus or minus currents upon the grid.

The object of the air-core choke-coil is to choke out or hold back the high-frequency current produced by the power-valve from being absorbed by the control-valve.

The aerial condenser of ·01 M F is to provide a ready path for the H.F. current and to prevent the direct-current dynamo from being short-circuited.

(*Continued on opposite page.*)

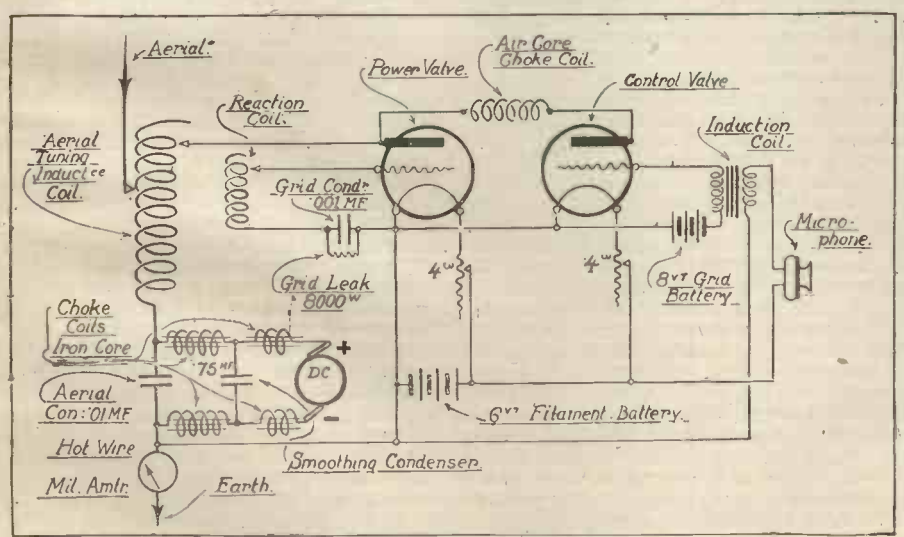


Diagram of Mr. Le Queux's Transmitting Set.

THE MYSTERY OF SOUND.

By a DOCTOR.

CAN we hear with our skins?

That, for a medical man, is the supreme question raised by the very interesting article of Mr. Risdon on "Wireless for the Deaf," published recently in POPULAR WIRELESS.

Mr. Risdon does not discuss that aspect of his subject, because he believes the vibrations set up by the ossiphone are carried in the bones to the ears. He makes, however, a very curious statement in the course of his description. He says:

"A curious thing is that, when in use, if held loosely in the hand, sounds proceed from the instrument, although they cannot be distinguished."

Now the vibrations of the ossiphone are imperceptible to the touch. That is to say, you cannot "feel" them. But even when the instrument is held lightly you can hear them. When it is held firmly you can not only hear, but also distinguish.

Bone is, of course, capable of transmitting vibrations; so are nerves and blood-vessels. But all these vibrations coming from the outside world must first pass through the skin. And there is at least a possibility that it may be this structure and not the bones which is the chief agent in the matter.

How fascinating and important the subject is, only, perhaps, a doctor can realise. Because only a doctor has opportunities of knowing the way in which our senses are built up and the enormous influence they exert not only on our happiness, but also on our health.

Let me put it in this way. There is a stage in the evolution of living things at which all the senses are mixed together. In certain lowly animals, seeing and hearing and feeling and smelling and tasting are not distinct from one another. These creatures, as it were, do them all together.

Further up the scale we find one sense after another becoming independent. Thus, the skin over the eye gets clear, and the nerves running to that piece of skin change their character and carry only "light" messages. In the same way the skin over the drum of the ear becomes a "receiver" of only sound messages.

But this need not mean that the skin of the rest of the body entirely loses its power of transmitting light and sound. It cannot, it is true, do this as efficiently as eye or ear, where ordinary light and ordinary sounds are concerned.

Yet there is some evidence that it does not entirely fail to do it. Just lately the whole medical world has been following with immense interest the sunlight treatment of tuberculosis. The essence of that treatment is to leave the sickly child naked in bright sunlight. Soon the skin grows dusky with colouring matter, not unlike that found in the eye, and the whole standard of health is raised.

The child's body, as it were, becomes "full of light."

Only the strong Alpine sunlight will give this complete effect. In the same way, perhaps, only the power waves of a telephone or wireless set transmitted through the ossiphone will produce the effect of hearing which Mr. Risdon describes.

In any case, there are strong objections to the theory of vibration in the bones. For one thing, the bones of the arm have only one direct connection with the head; and a very roundabout one it is. Vibrations to reach the skull from the wrist, going only by bones, would require to pass along the collar-bone, down the breast-bone, and thence by one or other of the ribs to the back-bone.

The ribs, however, are not all bone. The portion of each rib which is attached to the breast-bone is made of cartilage, not bone.

From the skin, on the other hand, the vibrations could pass swiftly and easily by nerves direct to the brain. Pressing the skin against a bone must necessarily tend to accentuate this effect, just as it tends to make the skin more sensitive.

This would mean that the vibrations would pass through the brain along the "auditory" or hearing nerve to the inner ear, and there be interpreted.

In other words, hearing would take place backwards, from within outwards instead of from without inwards.

There is nothing inherently impossible in this. It is well known that hearing is not lost when the drums of the ear are broken. Even when suppuration has greatly thickened the connection between the outer and inner ear, deafness is not always complete.

The ossiphone enables sound to come in by the back door instead of the front. My point is that it probably does this in virtue of the hearing power inherent in the skin.

Think what a prospect is thus opened up! For, what is possible in the case of the ear may conceivably become possible also in the case of the eye.

In any case, many of our ideas of the manner in which the human body works must be revised. And especially is this true in regard to the brain and its systems of building up pictures and images out of the stream of vibrations which flows to it from skin and eyes and ears and nose and mouth.

"Wireless," indeed, seems in actual fact to bring with it a new world and a new relationship between man and his environment. Who can say to what developments this power may lead us.

MY FAILURES AND SUCCESSES.

(Continued from previous page.)

The microphone, of course, plays a very important part. I experimented with many types—both English and American. Some of the latter were guaranteed as perfect, but I found that the best results for speech were obtained by using what is known as a G.P.O. "solid-back" transmitter, as being the most sensitive. The carbon granules in nearly all the others had a bad habit of "packing," with the result that speech became jumbled and incoherent. With the transmission of gramophone music, I found that when holding the microphone against the gramophone-horn the music always became distorted. I therefore used a special microphone, operating directly upon 8 volts attached straight upon the gramophone sound-box, so that all the sound was kept in the microphone and transmitted.

Another point was that I was at length able to do away with the second aerial for listening-in, for by placing a Townshend wave-meter near the inductance I found that the tiny bulb became illuminated, and the modulation of my voice was shown by the dimness and brilliancy of the little lamp, which responded to every syllable uttered. Thus I could at once gauge the quality of my telephony by the sensitiveness of the lamp. Indeed, by blowing into the microphone I could extinguish the lamp, but it would light again as soon as the pressure of the breath was removed, so sensitive was the transmitter. The clock ticking in my wireless-room could be heard distinctly two hundred miles distant, and, of course, the voices of anyone in the room were also transmitted.

A curious incident occurred one evening while transmitting a selection of jazz music. My second aerial was switched on to my receiving set—Marconi 7 valve, with the new double note-magnifier—when by some means the Morse "inker" was switched on, whereupon the printing machine began to respond to the music, and recorded all the higher notes on the tape! It ticked and printed, keeping time with the music, greatly to our amusement.

Another laughable incident happened one night when I called by telephony 2 H X, and mentioned my friend Mr. Love by name, whereupon some unknown amateur in Rotterdam called me by Morse, and asked in French: "What is that about love? Please repeat." And next moment another message was flashed out to me, I believe by a professional operator, saying: "Love to the girls also!" This created quite a disturbance in the ether concerning love, one man tapping out "Love to 2 A Z!" This continued until a Government station—I believe it was Aldershot—grew angry, and told the delinquents to "shut up."

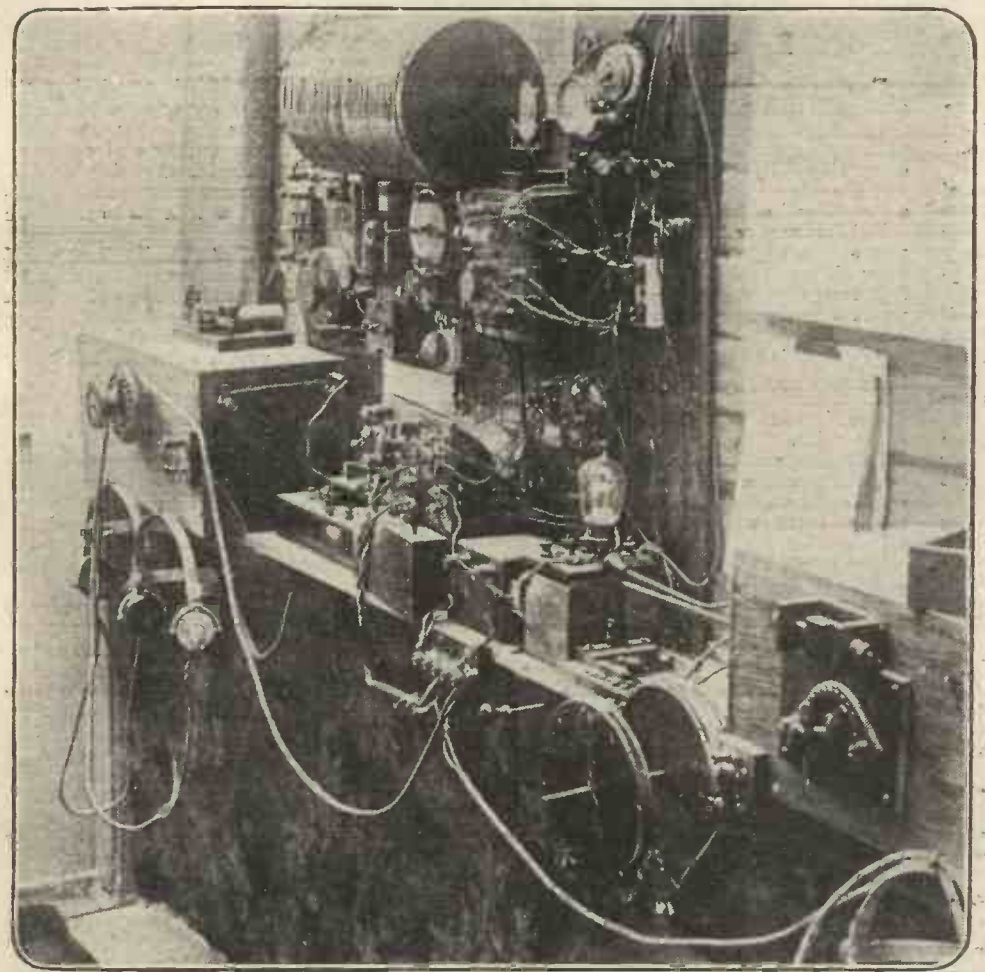
Genuine research in radio work is intensely interesting, for an almost virgin field presents itself to the experimenter. Many of the most important discoveries in wireless have been made by sheer accident, and many improvements in apparatus have been made by enthusiastic amateurs. But to those who intend research work I would give a few words of advice. First, the greatest patience, perseverance, and pertinacity are necessary. In my years of radio research, which started in the very early days of the coherer and continued at a time when nobody knew much of wireless, and cared less, I was often dubbed a fool for my pains, and regarded by my intimate friends as a dreamer. But, as one who writes mystery stories, I am interested in mysteries of every kind. The mystery of wireless first attracted me when in Leghorn, where Senatore Marconi was making his first experiments, and I have taken a keen interest in the science ever since.

The set I have described above I have just recently dismantled. It has served its purpose and proved certain facts which were hitherto mere conjectures. The diagram—after all a very simple one, though one "gadget," for which a patent is pending, is not shown—still remains. Its only claim is that it was the first amateur telephone transmitter over long distances, but probably with the quick march of discovery it will soon be relegated to the archives of perhaps the wireless museum at Marconi House.

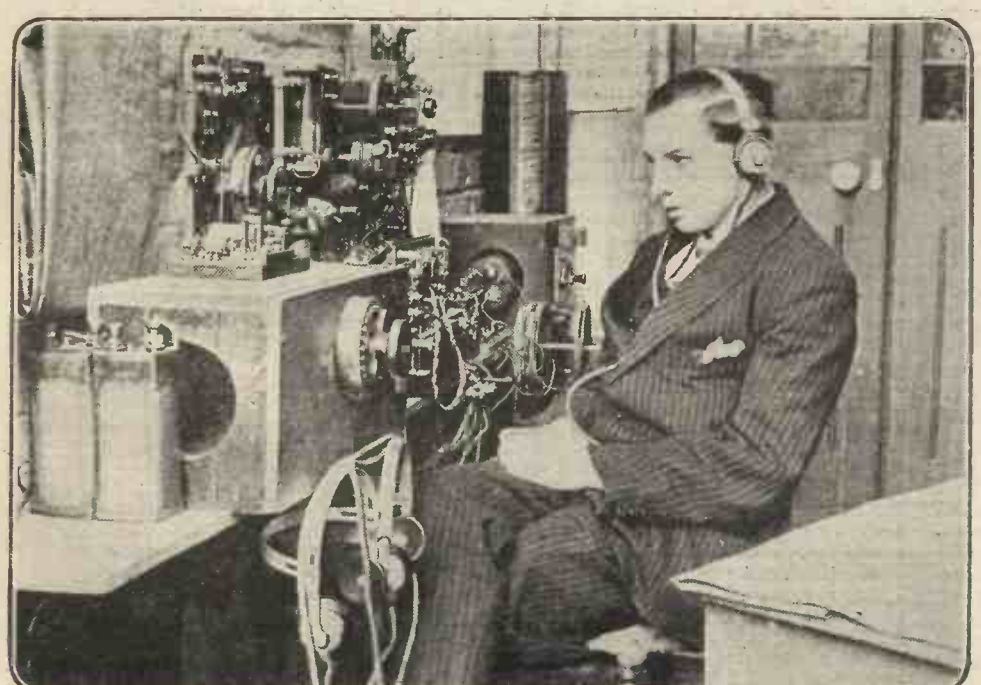
If the reader commences research work on transmission, let him ever recollect the danger of interfering with the public services, and obey the official regulations to the very letter. Let him always listen-in before transmission, lest he may disturb the signals from an aeroplane for which the constant ear of Croydon may be carefully listening. Do not let your enthusiasm outstep your care and discretion. The authorities keep a very watchful ear upon amateur transmission, as they certainly need to. But personally I have found that, by never exceeding the limits of my experimental licence, I have received nothing but consideration and encouragement at their hands.

I have been asked to assist in the new official broadcasting scheme; therefore, it is within the bounds of possibility that my friends the amateurs will once again hear my voice at a no distant date.

AN AMATEUR'S STATION



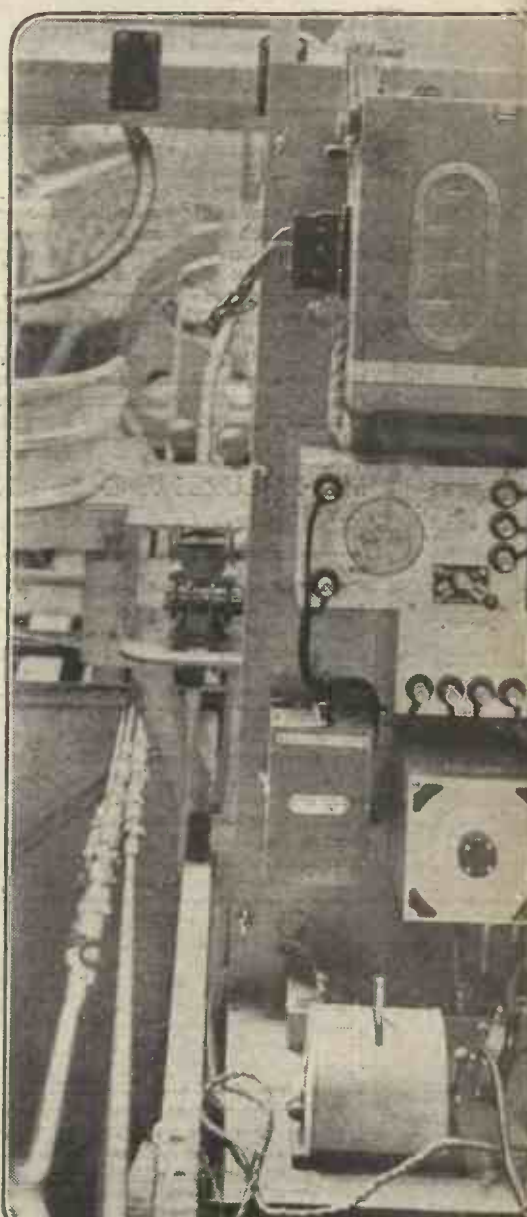
This very fine set was nearly all home-made by Mr. C. J. Dimond, of 52, Griffin Road, Plumstead. Mr. Dimond has fixed up his apparatus in a conservatory at the back of his house. He is an enthusiastic experimentalist. Judging by the above photograph of his set, and the one immediately below, he has spent no little time and patience in erecting for himself a really efficient station.



This is another view of Mr. Dimond's set, with the owner himself listening-in. It will easily be seen that Mr. Dimond has a set which any amateur might feel proud of.

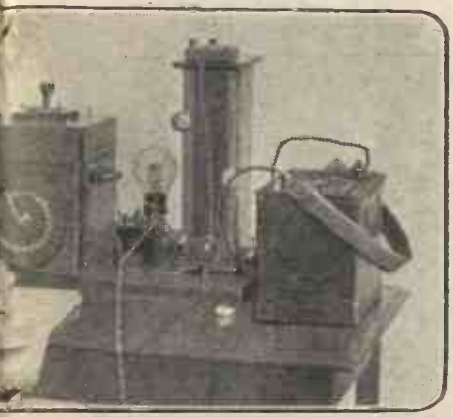
ONE OF

This young lady enjoys listening-in on a compact little set ere
Glasgow. Using one valve and a two-slide inductance coil,
from various stations. Many parts of a set of this desc
comparatively new to



It took a couple of hours' exposure to get this photograph of
erected by Short Bros., Rochester. The photographer had g
lack of space ; and not being allowed to use a magnesium flare, h
The result is one of the clearest photographs ever ta

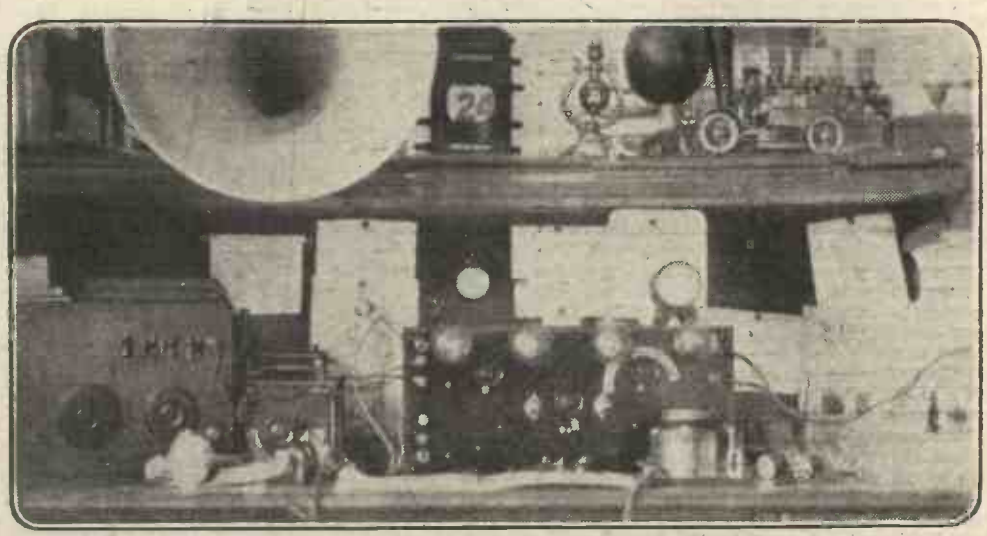
12,000



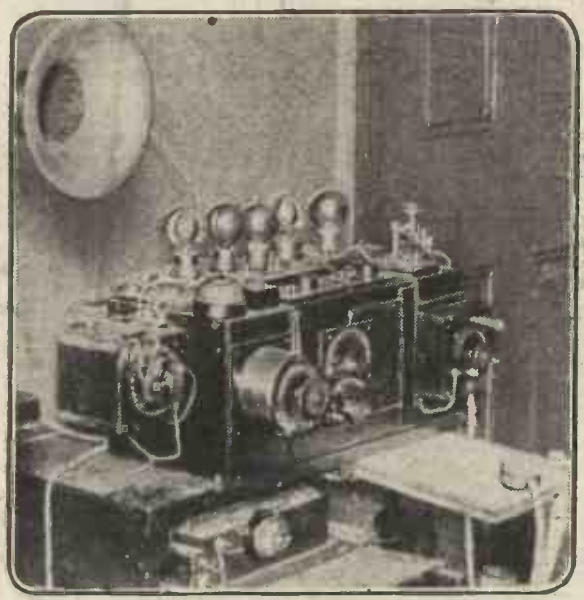
ted by Mr. R. Carlisle, 40, Watson Street, Shawlands. Mr. Carlisle receives excellent telephony and music ription may easily be made by amateurs who are wireless work.

Marconi A D 2 wireless set fitted up in a seaplane at difficulty in getting the correct focus, owing to ad to take a long exposure in a very cramped position. en of an aeroplane wireless telephony set.

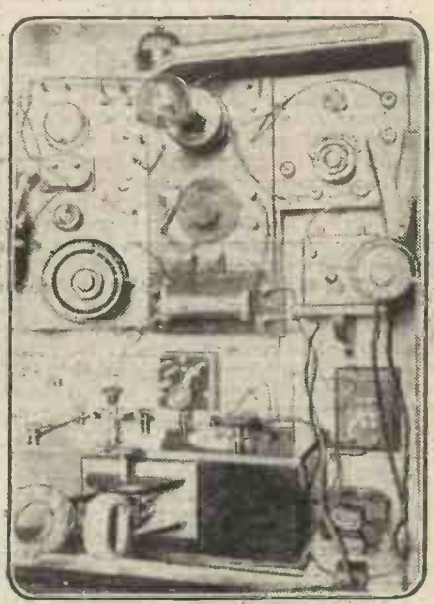
A FOUR-VALVE SET



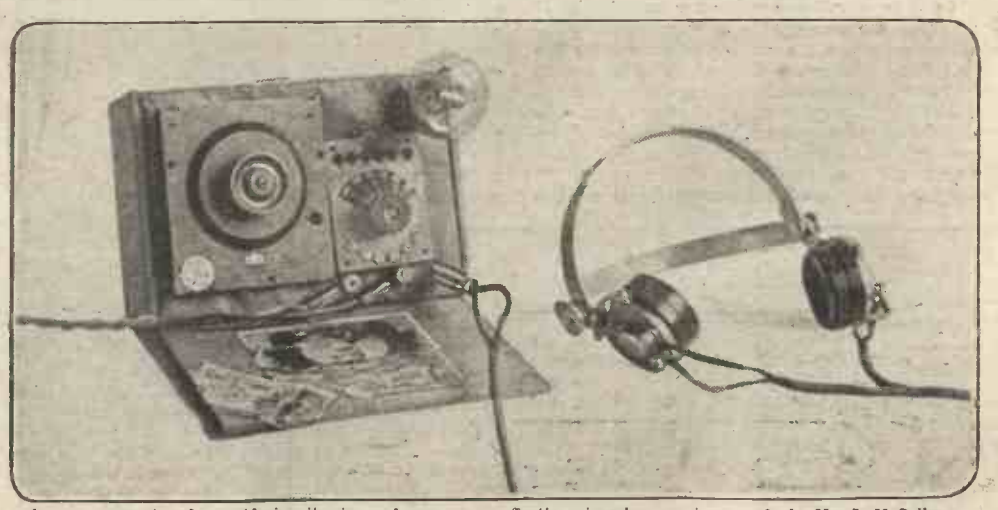
A four-valve receiver, erected by Mr. Anthony Hordern, of the College, Malvern. Mr. Hordern has arranged his valve circuit so that two, three, or all four valves may be used. He has heard telephony from the Hague, Paris, Croydon, Lympne, Pulham, Renfrew, Writtle, and other amateur stations.



This is a very neat and compact receiver belonging to Mr. Samuel Lowery, 6, Birstall Road, Liverpool. Using five valves, Mr. Lowery receives music via his loud speaker sufficiently loud to compete with a small brass band.



Mr. Ralph Collumbine's set at Roughead Place, Stenhousemuir, Lobert, Stirlingshire. He made nearly all the set himself.



A very compact and, considering its size and genus, very effective cigar-box receiver, made by Mr. J. McCallum, 11, Avenue Mansions, North Side, Clapham Common. The set will receive clear signals and speech from several high-power stations without any outside aerial at all.

WIRELESS VALVE TRANSMISSION.

By JOHN SCOTT-TAGGART, A.Am.I.E.E., F.Inst.P.,
Author of "Wireless Valves Simply Explained," "Elementary Text-book on Wireless Vacuum Tubes" and "Thermionic Tubes in Radio Telegraphy and Telephony."

ONE of the most important uses of the thermionic valve or vacuum tube is as a generator of alternating currents. The currents may be of high or low frequency, but if we desire to use the currents for wireless transmission we arrange that the valve shall produce high-frequency currents which will send out waves of the desired length.

To understand how a thermionic valve can produce wireless waves we need to understand the broad principle of what may be called "back-coupling." It is well known that the three-electrode valve is an amplifier; that is to say, that the energy applied to its input or grid circuit is less than the resultant energy in its output or plate circuit. If the output energy is not greater than the input energy, the valve is not acting as an amplifier. It is by virtue of its action as an amplifier that the valve generates continuous oscillations.

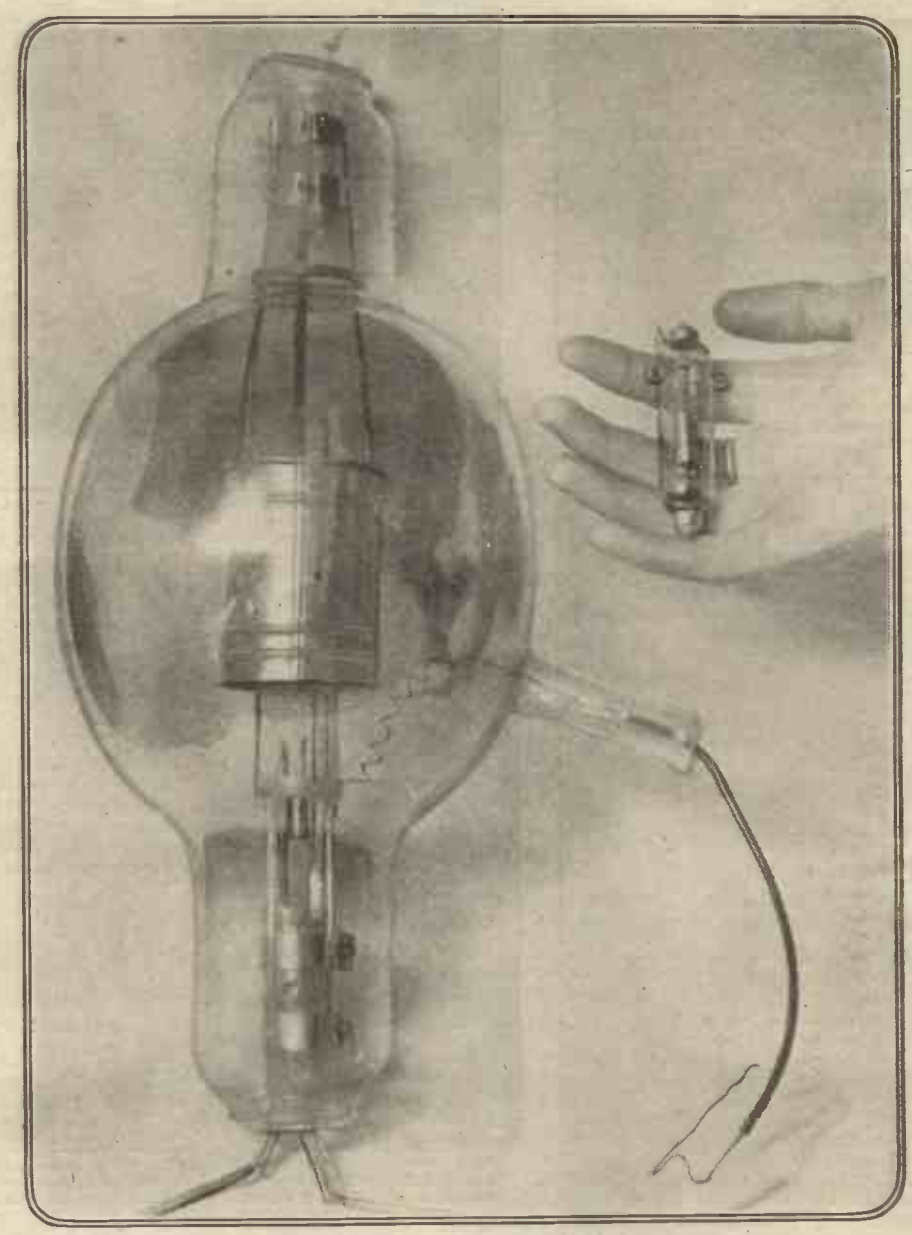
When we speak of back-coupling in a three-electrode valve or in any kind of an amplifier, we imply that the output circuit is connected to the input circuit so that some of the energy is taken from the output side of the amplifier and transferred to the input side for the purpose of strengthening the input currents.

It is a property of all amplifiers that if the output currents are transferred back to the input circuit, self-oscillation is produced: that is to say, alternating currents are automatically generated by the amplifier.

One of the earliest oscillating amplifiers was the buzzer-microphone oscillator. If a telephone ear-piece and a microphone be connected in series with the battery, and the ear-piece and microphone placed close to each other, the arrangement will produce alternating currents which will cause the apparatus to emit a loud buzzing note.

Now this arrangement is really an amplifier in which the output energy is transferred to the input side of the amplifier. If we consider the microphone and telephone receiver separated, we will see that when speaking or whistling into the microphone, considerably louder speech or whistling will be produced in the telephone receiver. The microphone, in other words, acts as a magnifier or amplifier of the input energy in the form of sound waves striking the microphone diaphragm.

Such an amplifier arranged as described will not produce alternating current. It is only when we place the microphone near to the telephone receiver, so that any note given out by the telephone receiver will send sound waves into the microphone, that we get the self-oscillating phenomenon. If the microphone and telephone receiver are not close enough together, no self-oscillation will be set up. If, however, they are close enough together, the energy in the telephones will be communicated to the microphone and re-amplified.



Maximum and Minimum.—A Transmitting and a Receiving Valve used in wireless work.

If we assume an initial whistle or other note, we will see that it will be amplified by the microphone, will produce a note in the telephone receiver of greater magnitude, and this note will work the microphone which will amplify it once more, and so the process goes on until a strong note is built up which will persist.

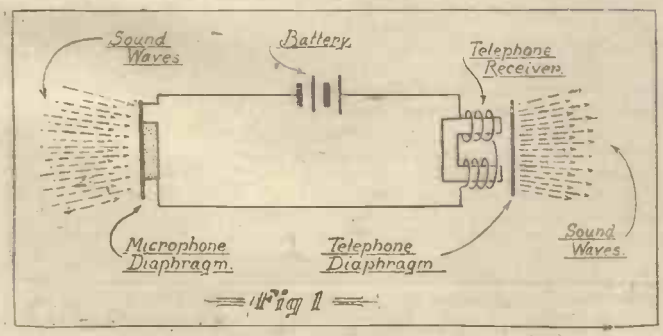


Fig. 1

Fig. 1 shows a microphone consisting of a carbon diaphragm and carbon granules connected in series with a battery and the coils of an ordinary telephone receiver ear-piece. By whispering into the microphone it will be found that quite loud speech will be heard in the telephone ear-piece. The microphone is, in fact, working as an amplifier. Fig. 2 shows the mouth of the microphone placed close to the diaphragm of the telephone receiver. If this circuit is connected up it will be found that the slightest noise, knock, or vibration will start the arrangement oscillating, and the diaphragms will vibrate and emit a whistling sound as long as the battery supplies current to the circuit. Such a generator of oscillating currents has, although not generally known, been used as a continuous wave wireless generator, although the frequencies obtained are low on account of the mechanical inertia of the parts.

A wireless valve acts as a transmitter in exactly the same way. Fig. 3 shows a simple valve circuit operating as an amplifier of high-frequency alternating currents. The valve contains a filament F, heated by current from the accumulator B1. The oscillation circuit L1 C1 will apply oscillating potentials to the grid G and magnified oscillations will appear in the circuit L2 C2, which is another oscillation

circuit tuned to the same frequency as L1 C1 and included in the plate circuit of the valve V. The extra energy really comes from the high-tension battery B2. This arrangement is very similar to Fig. 1, but has the advantage that there are no moving parts, the valve consequently being able to act as an amplifier or magnifier of currents of high frequency.

If we couple the circuit L2 C2 to the circuit L1 C1 by bringing the coil L2 near to L1, the arrangement will produce exactly the same effect as is obtained by placing the microphone next to the telephone receiver: the apparatus will become a generator of continuous oscillations; these will have a frequency approxi-

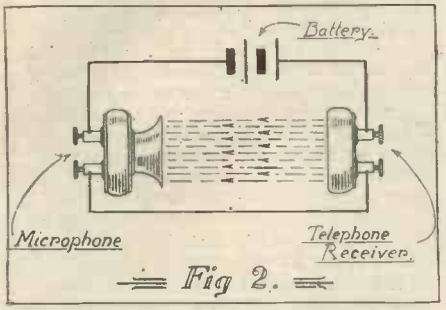


Fig 2.

mately equal to the frequency to which the circuits L1 C1 and L2 C2 are tuned.

When amplifying high-frequency currents the anode or grid coil may be left untuned, and most receiving circuits using a valve as a generator of continuous oscillations leave the anode circuit *aperiodic* or untuned. When valves are used for transmitting, the anode circuit is tuned and the grid circuit is often aperiodic. Since the anode circuit oscillations are the most powerful, it is this circuit which is connected to the aerial and which is tuned.

Fig. 4 shows a valve generator circuit in which the anode circuit L2 C2 is tuned, while the grid coil L1 is aperiodic but is coupled to L2. Let us see what happens when the valve is first switched on: A sudden flow of electrons passes from the filament to the anode and through the coil L2, also charging the condenser C2. The sudden flow of currents sets up two or three oscillations in the circuit L2 C2; that is to say, in addition to the steady anode current flowing through L2 there will be an oscillating current flowing backwards and forwards in the circuit L2 C2. This oscillating current will normally rapidly come to rest. If, however, we could assist the oscillating current by additional spurts of current through the oscillating circuit, it would be possible to keep the oscillations swinging to and fro in L2 C2.

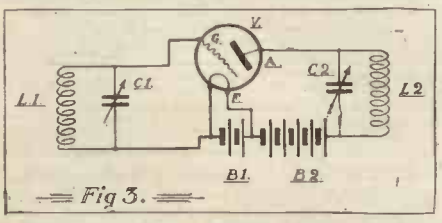


Fig 3.

Let us consider a child's swing. If it is normally held to one side and then suddenly released it will swing to and fro and very soon come to rest. If, however, we give the child a slight push at the end of each swing, the swing will not come to rest. In the same way, if we can give the oscillations in L2 C2 a push at the right moment, they will keep on swinging. The actual "push" in the case of an oscillating valve is produced by an extra spurt of current round the anode circuit, and this extra spurt may be produced by a positive potential on the grid of the valve. It will be seen that if we correctly time the potentials on the grid of the valve, the changes in anode current will keep the oscillations flowing in the anode circuit. When we use a circuit of the kind shown in Fig. 4 we actually derive the grid potentials from the main oscillating circuit L2 C2, and consequently the arrangement is self-timing. The potentials on the grid are derived indirectly from the oscillating currents in L2 C2, and are so timed that they produce increases and decreases of anode current which strengthen the initial oscillations in L2 C2, which are thereby maintained, the device being automatic.

It is very much as though a child in a swing could, at the right moment by pressing a button, cause some mechanical device to give the swing a push at the right moment and so keep it swinging.

It is important to notice that the "push" in both the case of the swing and the case of the oscillating circuit should come at the right moment. To give the swing a push as it rapidly approached you would probably result in it coming to a standstill.

In the case of Fig. 4 the coil L1 should be coupled the right way round with respect to L2, otherwise the timing of the variations of current will be incorrect and the arrangement will not oscillate.

A particularly useful analogy to understand how a valve produces oscillations is that of the ordinary steam-engine.

In the very early days a steam-engine was worked in the following manner: A flywheel was provided, and was connected through a piston-rod to a piston moving in and out of a cylinder; this cylinder was supplied with steam through a tap; when the tap was turned on, steam rushed into the cylinder, forced the piston outwards, and moved the flywheel.

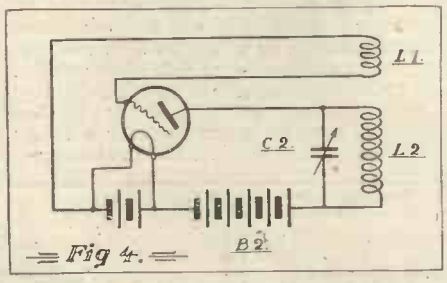


Fig 4.

The steam was then turned off, the piston returned to its former position, and the steam was once more turned on. A boy was employed to turn the tap on and off at the correct moment. This arrangement may be compared with the ordinary high-frequency amplifying action of the three-electrode valve. The input oscillating potentials correspond to the turning on or off of the tap. Just as the tap sets up powerful mechanical forces which act on the flywheel, so do the oscillations on the grid of a vacuum tube produce powerful oscillations in the output or anode circuit. It occurred on a memorable occasion to the boy who operated the tap, that since he always had to turn it on at a certain moment, or, in other words, at a certain point on the stroke of the piston, he could connect the flywheel or output side of the steam-engine to the tap which let in the steam. He, therefore, connected the tap to a point on the flywheel by means of a rope, so that the flywheel itself, when it came round to a certain point, opened the tap, which subsequently was closed until the same operation took place at the next revolution. In this way the output side of the engine was connected to the input or controlling side, and the whole arrangement became automatic.

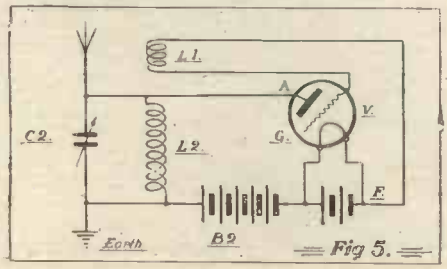


Fig 5.

In the case of the three-electrode valve, we can consider the arrangement as an automatic amplifier in which the output side is connected to the input side, output currents being liberated at suitable moments by the timing of the potentials in the grid circuit.

Another example of back-coupling is found in watches and clocks. The swinging to and fro of the balance-wheel, or pendulum, is maintained by giving it taps at the right moment by means of the escapement, the energy for the taps coming from the main-spring; the timing of the taps is done by the swinging balance-wheel itself.

Coming back to wireless transmitters: We have only to use a circuit like that shown in Fig. 4 and we can use the oscillating current in L2 C2 to energise the aerial of a wireless sending station.

Fig. 5 shows a typical wireless valve transmitter similar in arrangement to Fig. 4, but having an aerial and earth connected across the condenser C2. The oscillating currents in L2 C2 are communicated to the aerial, which radiates continuous wireless waves. These wireless waves do not vary in strength as in the case of the waves sent out by a spark wireless station.

If it is desired to send Morse signals, a tapping key would be included in the anode circuit, so that when the key is not depressed, no anode current flows, and the valve does not generate oscillations.

A circuit similar to that shown in Fig. 5 may be used for wireless telephone transmission by suitably modifying (or modulating) the nature of the continuous oscillations produced.

Some of the various ways in which these effects may be produced are described in another article.

HELPING THE WIRELESS CAUSE.

Leslie McMichael, M.I.Radio.E., Hon. Sec., Wireless Society of London.

AMATEURS who are now interesting themselves in the all-absorbing science of wireless telegraphy and telephony reception will find it difficult to place themselves in the position of those of us who are comparatively old hands, and who for years prior to the war had to be content with reception of spark signals from half a dozen European land stations, and any shipping signals which could be picked up on our primitive crystal receiving sets.

Amateurs in those days had no music or speech to listen in for. In almost all cases they had to set themselves the task of mastering at least an elementary text-book, of gleaning all possible knowledge from such publications as the "Marconigraph" or the "English Mechanic"; of constructing their complete receiving station, or, at least, nine-tenths of it, with their own hands, and finally settling down to learn the Morse code.

After such an apprenticeship, it is not to be wondered at that the wireless amateur of pre-war days was not only enthusiastic in his wireless work, but necessarily possessed a much more intimate knowledge of the working of his instruments, and the "whys and wherefores" of them, than is the case to-day.

That he was not wasting his time was proved by the fact that when the war broke out, the Wireless Society of London was able to offer to the Government the skilled assistance of scores of its members. Wireless amateurs and experimenters throughout the country joined up in large numbers, and obtained in many cases highly important positions in wireless work in one of the three Services.

The amateur of to-day needs none of this apprenticeship to which I have referred. He can, for the outlay of a few pounds more or less, according to his financial position, purchase a complete set, place it upon his table, and within a few hours he and his family can enjoy the music and speech which are now so easily available in the ether.

But I would warn the would-be enthusiast that unless he is prepared to take some trouble to find out at least the fundamental principles of this most wonderful science—not only will he soon get tired of it, but he will not enjoy to the full the pleasure afforded.

To take an analogy. Everyone who drives a car knows the added thrill and pleasure there is to be obtained by possessing at least a rudimentary knowledge of the mechanism. For what more helpless and pitiful is there than a man who drives a car like an automaton, knowing only that certain levers *should* have a certain effect on the car's progress?

So in wireless work. The man who knows *why* he must put the high tension supply on the "H.T." terminals and not on the "L.T.," and why he must use high resistance telephones or low resistance, and why continuous wave signals can be picked up on a valve set but not on a crystal set, will be adding tenfold to his ultimate pleasure in his new-found hobby.

As one of the founders of the Wireless Society of London, and as honorary secretary of that society, to-day I cannot too strongly urge all those interested in the science to join a wireless club or society.

There are upwards of 100 now throughout the country, the majority of which are affiliated to the Wireless Society of London. Weekly or monthly lectures are arranged, exchange of ideas is made possible, and the amateurs and experimenters throughout the country become possessed of a power collectively which cannot otherwise be possible.

The agitation for a broadcasting scheme, which we all hope and believe will be an accomplished fact within a few weeks from now, originated among amateurs, was supported by the Wireless Society of London, backed by a petition to the Postmaster-General, and signed by the affiliated societies throughout the country, representing some thousands of experimenters.

We should see to it that the privilege thus obtained is not abused.

It is of the greatest importance that where valve reception is used the valves are kept off oscillation point, otherwise energy is emitted *from* the aerial which will cause interference with other stations.

Another argument in favour of my suggestion to the amateur to "get wise about his set": it is only about two years ago since it was necessary to get a permit from the G.P.O. to purchase a valve.

We move quickly these days—in wireless work, perhaps, more so than in any other science, and in moving quickly we must be sure we are moving carefully and in the right direction.

AMONG the most common faults may be found the following: Loose and bad connections, broken wires, short circuits, bad insulation, bad contact with crystal, or bad contact of valve prongs in the socket.

These faults are often the most troublesome, and can only be found by careful inspection of the apparatus piece by piece. Care should be taken that the leads are on their respective terminals.

Condenser troubles are often caused by the plates touching each other and thus making a short circuit. This fault can be tested by putting the condenser in series with a dry cell and a pair of telephones. Rotate the condenser plates completely round, and should they touch anywhere a click will be immediately heard in the 'phones.

Valve trouble is often experienced as a result of the filament sagging on to the grid, and should be remedied by lifting the filament wire by means of a strong magnet.

High-resistance telephones, especially those of the reed type, are easily damaged by rough or careless handling. When faulty, noises loud enough to drown the signals are the result. Occasionally short circuits occur on the leads, and can be tested by connecting one lead to the positive terminal of a battery, and flicking the other on to the negative terminal. If the leads are good a click will be heard at the moment of contact.

Other faults are diaphragm adjustments, bad lead contact, or loose terminals.

Telephones should never be dismantled. They should be returned to the makers.

Basket Coils.

The basket type of coil is perhaps the simplest for the amateur to construct, and for this reason is probably the most popular.

All that is required is a wooden cylinder or rod about 8 inches long and 1 inch in diameter, and 17 pieces of stiff wire ⅛ inch in diameter and about 4 inches long. Around the circumference at the end of the rod 17 equidistant holes should be drilled, into which the 17 pieces of wire will fit tightly.

The easiest method of spacing the holes around the circumference of the wooden cylinder is to take a strip of gummed stamp paper long enough to reach round the wooden cylinder. Draw a pencil line along the middle of the paper, and by means of the dividers mentioned in POPULAR WIRELESS, No. 4, mark off 17 equal divisions. This done, stick the paper round the end of the wooden cylinder and drill holes at the marked points.

In winding the coil use No. 30 gauge (S.C.C. or D.C.C.), and make fast to one of the projecting rods, leaving a few inches of loose wire. Pass the wire round the left-hand side of the next peg, then round the right-hand side of the third, and so on all the way round.

On completing the first layer and commencing the second, it will be noticed that the winding is on the opposite side to the first layer, thus making a basket pattern. When winding, care should be taken to keep the wire tight and close to the former or wooden cylinder. The winding should be continued to a depth of 2½ inches, the end then being made fast with a few inches of wire to spare.

To connect various parts of the coil to the tapping studs, simply loop the wire for a few inches and twist it back on itself at the position chosen for the tap. After completion the coil should be placed in a bath of paraffin wax, drained off, and allowed to set. The pegs may then be withdrawn, and the coil removed from the former.

Panel-making.

When constructing a valve panel the amateur is recommended to draw the positions of all the various items on a piece of stout white paper or thin cardboard cut to the exact size of the panel. He should measure the exact diameter of the terminal screws, switch posts, contact studs, and valve pins, and enter them on the paper for reference.

When the drawing is made the paper should be pasted on to the ebonite panel, and when dry the various centres are centre-punched, and the holes drilled to the required dimensions.

By this means the work is done both accurately and expeditiously, without doubt or guesswork.

After drilling all the holes the paper may be soaked off with warm water.

The arrangement of terminals should be such as to allow the H.T. and L.T. terminals to be near to each other and at the back of the panel; by so doing they are out of the way, yet convenient to each other. The telephone terminals should be in the centre and front of the panel, in order to give an easy connection, as well as to maintain a good finish. The aerial and earth terminals should be either at the back and in line with the H.T. and L.T. terminals, or may be placed at either side of the panel.

The distances between all terminals should be the same, and the terminals used all of the same type.

The Grid Leak.

A grid leak can be made by laying a small piece of paper on a piece of ebonite or hard wood and drawing across it with a soft lead pencil or Indian ink a line about 1½ inches long. Two brass screws put through the paper, one at each end of the line, form the terminals.

The resistance of such a line depends directly upon its length, and inversely upon its width or thickness.

For such a grid leak blotting-paper is perhaps the most suitable.

Another form of grid leak is made from a piece of slate pencil with metal-capped ends, the resistance again depending upon length and diameter.

Though by no means a necessity, a little experimenting will go to show that a grid leak is a very useful accessory in spite of its easy construction. The resistance most generally accepted for this small unit is between two and four megohms in value, a megohm being equal to one million ohms.

A NEW SERIES OF
CONSTRUCTIONAL ARTICLES
BY
PHILIP R. COURSEY,
F.Inst.P., B.Sc., A.M.I.E.E.,
WILL COMMENCE NEXT WEEK.

WIRELESS CLUB REPORTS.

The Editor will be pleased to publish concise reports of the meetings of wireless clubs and associations, reserving the right to curtail the reports if necessary. An asterisk denotes affiliation with the Wireless Society of London.

Barnoldswick Wireless and Technical Society.

A SOCIETY bearing the above name has been formed in Barnoldswick (Yorkshire), and there is every promise of rapid development. The prime object of this society will be the study of wireless as a science.

The society is commencing work with a course of progressive lectures in theory and practical construction. These lectures will be augmented by a special class in practical physics and applied science.

The following officers have been elected: President, Mr. B. Holden, chairman (pro tem.); treasurer, F. Openshaw.

Address of the hon. sec., John Balderston, 6, Clough Terrace.

* * *

Newcastle and District Amateur Wireless Association.*

The annual general meeting of this society was held on July 3rd. The following officers were elected:

President, Dr. Smallwood: chairman, Mr. Dixon; secretary, Mr. C. Bain; librarian, Mr. Fabian.

Technical committee: Mr. White, Capt. Stevens, Mr. Douthwaite.

The financial report showed a balance to carry forward of £2 1s. 3½d. This is very satisfactory when an expenditure of £17 on new instruments is allowed for. Voluntary collections gave a total of £4 11s. 1d. for the year. It was then decided to reduce the annual subscription.

The society's membership is now 56, and a number of fresh applications are still in hand. Applications for membership to be addressed to the hon. sec., Mr. Colin Bain, 51, Grainger Street, Newcastle-on-Tyne.

* * *

Ilkley and District Wireless Society.

A meeting was held at the Regent Café, Cowpasture Road, at 7.30 p.m. on Wednesday, July 5th, with Dr. J. B. Whitfield, president, in the chair.

Following the reading of the minutes of the previous meeting, the committee were elected. It was decided to hold further meetings on the second Thursday in the month, and to arrange a series of practices in Morse.

The chairman then called upon Mr. H. G. Evans, B.Sc., to give his lecture on "Radio Telegraphy and Telephony."

The lecturer dealt briefly with the properties of the thermionic valve, and its application to simple wireless circuits. The lecture was illustrated with lantern slides, among which were representations of some of the British high-power stations.

After the lecture, Carnarvon, Leafield, etc., were tuned in on a very fine set which the lecturer had brought with him.

Unfortunately the telephony which was expected did not come through, on account of a slight misunderstanding as regards the time.

At the conclusion a hearty vote of thanks was accorded to Mr. Evans, and the audience, which comprised a large number of visitors, including several ladies, adjourned to inspect the apparatus used by the lecturer.

Twelve new members were enrolled.

The hon. sec. will be pleased to hear from anyone interested, and will furnish particulars of membership, together with the objects of the society, on application to the address below.

Next meeting, Thursday, August 10th, at 7 p.m., at the Regent Café.

Hon. sec., E. Stanley Dobson, "Lorne House," Richmond Place, Ilkley.

* * *

Stoke-on-Trent Wireless and Experimental Society.*

At a meeting of the Stoke-on-Trent Wireless and Experimental Society on Thursday, July 6th, some buzzer practice for the benefit of the new members was followed by a lecture on "A Short Wave Tuner," by Mr. A. H. Wilson.

The lecturer, after outlining points concerning wireless receiving sets as a whole, which, if neglected, would greatly reduce the efficiency of any tuner, dealt with the construction of a short wave tuner, on which telephony from local amateur stations and the wireless concert from the Marconi station in Essex could be received with excellent results. A home-made tuner of the Variometer type, constructed by the lecturer, several other tuners, and a large number of tuning coils were exhibited and handed round for inspection.

Mr. Wilson was heartily applauded, and the lecture was greatly appreciated by the members, who showed their keenness by plying him with a large number of questions.

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

* * *

The Hackney and District Radio Society.

The Hackney and District Radio Society.

The above society held open meetings to the public at their meeting hall, 111, Chatsworth Road, Clapton, on the evenings of July 6th and 7th, at 8 o'clock.

The lecture given at the opening by Mr. E. R. Walker was on the "First Principles in Wireless Telegraphy," showing the audience how the aerial became charged so that it produced waves, and so opened up the present-day means of long-distance communication. After seeing that the audience had more or less grasped the situation, our second lecturer, Mr. D. R. Ison, gave an explicit explanation of reception of the waves, with the aid of a Marconi 31A tuner, a great number of questions being asked by our interested audience. During the lecture various items of telephony were received, and thanks were given for the loan of a Brown loud speaker.

Considering how our membership has greatly increased, we shall have to be on the look-out for a more or less centralised meeting hall to be made into permanent headquarters to accommodate our 40 odd members.

Anyone wishing to join our society will be welcome at our meetings every Thursday at the above address.

Hon. sec., Mr. E. R. Walker, 48, Dagmar Road, South Hackney, E.9.

* * *

Chelsea and Fulham Club.

It is proposed to form a Wireless Amateurs' Association for Chelsea and Fulham. Will all those interested, and who live in one of the districts named, please communicate as soon as possible with Mr O. Rogers, 220, King's Road, Chelsea, S.W.3.

FATHER GETS F L TIME SIGNAL.

SEND YOUR QUERIES TO "POPULAR WIRELESS."

RADIOTORIAL

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

In this issue of POPULAR WIRELESS readers will find the first of a new series of special articles by Mr. John Scott-Taggart, one of the greatest living authorities on valves.

Mr. Scott-Taggart's articles will appear from time to time in POPULAR WIRELESS, and no amateur should miss them on any account.

Next week I shall publish the first of a new series of constructional articles by Mr. Philip R. Coursey.

Mr. Coursey will explain in detail how a single-valve short-wave receiver may be made at home. The set will be very suitable for the reception of telephony and music on the shorter wave-lengths which will be employed by the broadcasting stations.

Writing of broadcasting stations reminds me that the outlook in that direction is now much more hopeful.

The manufacturers of wireless apparatus in this country have been granted protection from foreign competition for two years, and as this was one of the chief points which delayed the settlement of an agreement, I now hope that definite plans will result, and the speedy commencement of a broadcasting service.

Many readers have written in expressing their opinion that broadcasting in this country is "all talk." Readers of POPULAR WIRELESS may take it from me that broadcasting will soon be a reality.

It is true there has been a lot of talk, and many breakdowns in the negotiations between the various parties concerned, but when one considers the magnitude and responsibility of the service to be undertaken, it is hardly to be wondered at.

At any rate, I think we can now look forward to something really definite, and before long I hope to publish a regular programme of the services to be broadcasted in this country.

EDITOR.

G. A. P. (Westcliff-on-Sea) asks for the dimensions of a loose coupled tuner with a wave-length range up to 6,000 metres.

Primary, 250 turns of 22 S.W.G. on a 6-in. former with a variable condenser of ·001 mfds. capacity. Secondary, 350 turns of 32 S.W.G. on a 5½-in. former with a variable condenser of ·003 mfds. capacity.

* * *

S. M. L. (Windsor).—What is the capacity of a condenser having 9 fixed plates with a radius of 3 in., and 8 moving plates with a radius of 2½ in.? They are separated from each other by a quarter of an inch.

If you mean the space between the fixed and moving plates is ¼ in., ·0015, but if it is the distance separating similar plates, ·0028 mfds.

* * *

"WIRE" (Southend-on-Sea).—Does it matter if when winding an inductance the wire touches at each turn? I am using 22 enamelled.

No.

* * *

H. J. D. (Brussels).—Is it safe to use 4,000-ohm 'phones in a valve circuit using not more than 60 volts?

Fairly, but the risk of damaging them can be entirely obviated by the use of a telephone transformer. In the case of high-resistance telephones such as these the usual "step down" transformer will be unsuitable. The ratio should be 1-1.

* * *

W. A. P. (Plaistow).—Is it not possible that a lot of these so-called "atmospherics" may be waves sent out by the thousands of moving motor vehicles' magnetos?

It is true that the magnetos used for ignition in petrol engines act as small transmitters. In fact, one hears the magneto "transmission" from the powerful engines used on an aeroplane, for instance, to an annoying degree when tuning in a telephony set while the machine is in the air. But the waves so radiated are very damped and very short, so that they do not travel far. The range of disturbance caused by an ordinary magneto would be but a few yards.

* * *

S. F. P. (Monkstown).—Is it possible to drive an electric motor by wireless?

No, but it could be *controlled* by wireless.

* * *

J. A. G. (Leighton Buzzard).—Can you tell me the gauge and quantity of wire required to rewind a single 1,000-ohm 'phone to make it of 4,000 ohms resistance?

500 yards of gauge 47 S.W.G.

* * *

A. H. (Coventry).—Am I obliged to take out a licence before I have my station in working order?

Yes.

* * *

"WIRELESS KID" (Burnley).—I have tried to obtain a licence at the post office, but without success. Where shall I write to, and how much will it cost?

Apply to the Secretary, G.P.O., London. 10s. per year.

* * *

N. C. H. (London).—Why are high-resistance telephones so often said to be necessary when a low-resistance telephone would allow greater current to pass through it?

It is not a question of the resistance itself being the desirable factor in a high-resistance telephone receiver. The strength of the electro-magnet, and therefore the loudness of the signals, will depend not only on the current passing through the winding, but also the number of turns of wire surrounding the core. Bearing in mind that the crystal detector has a resistance of some 15,000 ohms or more, and that the telephones are in series with the detector, you will see that the number of turns of wire on the small magnet could be increased without increasing the total resistance appreciably.

* * *

"SAFETYVALVE" (Long Eaton).—Can you let me have particulars of the construction of a high-frequency intervalve transformer for wave-lengths between 400 and 600 metres? The one that I have in use has a range from 600 to 1,000 metres.

25 turns or so of 36 D.S.C. for both primary and secondary on a 1-in. former.

* * *

S. E. D. (Southend-on-Sea).—My aerial is attached to the chimney stack at one end. I have heard that trees can be used as aerials. Can I, therefore, attach the other end to a large tree some 60 feet away with good results, and how should I join it to the tree?

Trees can be used, although not in the manner you suggest. Were you to attach the free end of your aerial to this tree, the only effect would be to earth it. You should fix a rope to one of the higher branches and erect an ordinary double aerial. Keep the wire well away from the leaves and branches.

* * *

L. H. (Herne Hill).—Is a variable condenser essential for a receiving set (crystal)?

No; but if placed across the inductance it will permit fining tuning.

* * *

"CRYSTALGAZER" (Bolton).—How am I to know the adjustments necessary to give me the wave-length of the station from which I wish to receive?

Only by experience. You will have to search round, slowly varying the adjustments until you hear the required station.

* * *

D. R. P. (Exeter).—The telephone that is installed at my house is out of use. Can I use the wires as an aerial and the receiver for the telephone of my set?

No; neither will be suitable for wireless work.

* * *

W. R. (N.W.I.).—Will a condenser consisting of two plates improve crystal set as given in your first number?

Placed across the telephones it will improve the quality and tone of the signals.

What is the simplest form of grid leak, and how can I make one?

Three-quarters of an inch of ordinary lead pencil, with the wood removed, sprung between two pieces of brass or copper.

* * *

"PIPPY" (Hull).—My aerial is erected, although I have not finished my receiver. The aerial is a single wire, 35 feet long and 18 feet high. Can I expect good results using a crystal set?

If you could increase the height somewhat and make it a double aerial, you would have more reason to do so.

* * *

A. M. (Crediton).—The figures of the scale of the adjustable condenser on my set are marked to 180. Does this signify metres or thousands of metres?

Neither. It is merely a guide to adjustment. The 180 indicates that the moving vanes have turned 180 degrees, giving full capacity.

* * *

G. A. R. (Ardbeg).—Why are the metal parts of an airship coupled and wired together?

To prevent the accumulation of static charges on isolated parts of the metal framework. If this was not done, there would be a possibility of a spark caused by the above igniting the gas.

* * *

W. F. S. (Tamworth).—There is a space between two chimney stacks of about 35 yards. Would a single or twin aerial be best?

A single wire aerial this length.

(*Continued on page* 140.)

QUESTIONS AND ANSWERS.

(Continued from page 138.)

F. C. (Athlone).—I live exactly in the centre of Ireland. Will a crystal set allow me to listen in to the English broadcasting stations ?

No. A crystal set is limited to a range of 15 to 20 miles at most for the reception of telephony.

* * *

B. T. F. (Cambridge).—Can I arrange my aerial and earth leads in various rooms similar to the wiring of electric light, in order to be able to plug the set in any room I like ?

No. The results would be very poor. The earth lead must be as short as possible, and the aerial lead should follow the straightest possible line from the aerial to the set.

* * *

G. D. (New Shildon).—Can I use an electric bulb to receive flash signals instead of the ordinary receivers ?

No. As explained to a reader who wanted to use a buzzer for a similar purpose, the received current is far too small, that of the strongest signals not exceeding 40 micro-amps or so.

* * *

F. C. A. C. (Bristol).—Will I be able to hear the large station at Carnarvon working on a crystal set at a distance of 23 miles ?

No. This station transmits continuous wave signals, and it would be necessary to have an interrupter, such as a buzzer, in your circuit.

* * *

"Sparks" (Coventry).—Would not rubber be a better insulator for the aerial and lead-in tube than glass ?

Not unless it has been vulcanised, as it rapidly deteriorates with exposure to light and air.

* * *

T. C. C. (South Shields).—I have unlimited space for the erection of an aerial. Most of the stations from which I will desire to receive lie in the direction of London. Is any advantage to be gained by pointing the aerial in that direction ?

Yes. The free end of the aerial should point away from the direction from which you desire to receive the strongest signals.

* * *

C. G. (Harrow-on-the-Hill).—If I used two crystals instead of one, would I hear any concerts, or would three be better ?

You would be more likely to do so using only one.

* * *

"Electron" (Oldham).—In reference to your Number 2 issue I notice a question concerning audibility of signals from Aden during a passage in the Red Sea. This reminds me of an experience I had during several trips in the Gulf of Mexico. I noticed that during a northwesterly course from Key West, Florida, what seemed to be a blind area in which I could receive long-distance signals from east, Tampa (Florida), and west, Tampico, but I could not detect the signals from Galveston and Port Arthur, due north, until within quite a short distance of these stations. The reason for this phenomenon was much discussed by my colleague and myself, but we never arrived at a satisfactory conclusion. I would be extremely obliged if you could enlighten me. Of course, atmospherics were extremely troublesome, quietening down somewhat during the early hours of the morning.

It is evident that between you and the stations that you were unable to receive from there was a local electrical storm. This would cause a state of electronic activity that would tend to absorb the radiated waves of those stations that lay beyond the affected area.

* * *

J. H. M. T. (Oldham).—Would the insertion of a cell or cells in the circuit of a crystal set improve the signals ?

No, except in the case of the carborundum crystal, for which a battery and potentiometer are required.

* * *

"Puzzled" (Bristol).—Is a licence necessary for a receiving set, and, if so, where and how is it obtained ?

Yes, a licence is necessary. Write to the Secretary, G.P.O., London, for a form of application.

* * *

"Spark" (Middlesbrough).—What is the best crystal detector to use ?

That known as the "Perikon," which is zincite pressing against chalco or copper pyrites, is as good as any.

* * *

H. P. (Caerphilly).—Would the set mentioned in Number 2 receive telephony from Cardiff, a distance of 7 miles, without using a condenser ?

Yes.

Will I be able to have 60 turns on a former 14 in. long, using 20 S.W.G., without it being necessary to have two layers ?

Yes. You should be able to wind 350 turns single layer.

Will a pound of this wire be sufficient ?

You do not mention the diameter of the former, so cannot say. A pound will be about 250 feet.

What ohms resistance 'phones are required with this set ?

As high resistance as possible, 4,000 ohms upwards.

* * *

"Novice" (Folkestone).—Would a frame aerial used in series with a 60-foot twin aerial give results on a crystal set ?

Yes. But it would merely amount to a clumsy method of adding inductance to the outdoor aerial, and would not increase the latter's efficiency for reception to any appreciable extent.

Will the enclosed specimens of wire do for aerials ?

Yes, quite well.

* * *

A. B. C. (no address).—In the first number of Popular Wireless you gave the description of a simple receiving set. I can follow everything except as to where the other end of the wire on the coil goes to.

It goes nowhere. The circuit is completed via the moving arm.

STERLING - - - No. 1 CRYSTAL W/T RECEIVING SET.

The Sterling No. 1 Crystal Receiver has been specially designed for use in connection with the Wireless Telephony Broadcasting Scheme, and is suitable for a range of about 25 miles.

The set comprises:—

1. TUNER.—This consists of an inductance which can be varied by means of tappings taken to stud switches. Two of these are fitted, one for coarse and the other for fine adjustment. A separate coil is provided which can be plugged into a fitting at the back of the instrument (as illustrated) for reception of time signals, etc., from Eiffel Tower.

2. DETECTOR.—This is of the crystal type, requiring no battery, and is designed to give universal adjustment over all parts of the crystal.

The apparatus is mounted on ebonite panel and fitted in polished walnut case.

The equipment includes one pair of No. R1258 DOUBLE HEAD TELEPHONES wound to a total resistance of 2,000 ohms the pair.

PRICE £7–12–6 (subject to trade discount).

IMMEDIATE DELIVERY.

Sterling Telephone & Electric Co., Ltd.,

TELEPHONE HOUSE,

210/212, Tottenham Court Road, London, W.1.

Telephone No.: 4144 Museum (7 lines). Telegrams: 'Cucumis, Wesdo, London'

Works: DAGENHAM, ESSEX.

BRANCHES: **NEWCASTLE-ON-TYNE: 9, Clavering Place. CARDIFF: 8, Park Place.**

Special Offer!

DOUBLE SLIDE TUNING COIL
8 in. by 4 in. Polished mahogany ends. Range 180—2,000 metres. Specially Designed for Telephony - - Price 21/-

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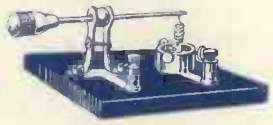
In ebonite case, with terminals - - - - - Price 3/-

ONE PAIR FRENCH 'PHONES
With cords. These are new and highly sensitive - - Price 35/-



CRYSTAL DETECTOR
(as illustrated). Ready for use with crystal - Price 4/6

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No. 9.—HOW TO MAKE A SHORT WAVE RECEIVER

POPULAR WIRELESS Weekly

3d.

No. 9. Vol. 1.
July 29, 1922.

SIGNOR MARCONI DANCING TO WIRELESS MUSIC ON HIS YACHT "ELETTRA."

IMPORTANT ARTICLE BY P. J. RISDON, F.R.S.A.

THERE IS NO ETHER?

THERE IS NO ETHER?

A Special Article

BY

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

Appears in this Issue.

Popular Wireless

TOPICAL NEWS AND NOTES.

SIR OLIVER LODGE will CONTRIBUTE an important article to Next Week's POPULAR——WIRELESS

Order Your Copy Now.

Still Growing.

THE demand for wireless sets is about five hundred a week in this country, and about 12,000 receiving licences have been applied for.

* * *

Wireless in Ireland.

IN connection with the projected system of wireless "broadcasting" in England, it is understood that the Irish Post Office has two systems under consideration, and that the administration is keeping in touch with developments elsewhere with a view to seeing to what extent and how soon a system can be put into force.

* * *

Radio Exhibitions.

A WIRELESS exhibition, arranged by the Wireless Society of London, is to be held in September at the Horticultural Hall, London.

Two other wireless exhibitions have been arranged at the Central Hall, Westminster, one for the beginning of September and another in October.

* * *

"Under-Earth" Wireless.

A WIRELESS experiment was conducted in the Blue John mine at Castleton recently by members of the Sheffield Wireless Society. From a depth of about 300 feet a successful telegraphic message was sent to Hope, thus demonstrating the possibilities of wireless in coal-mines. About two dozen members of the Society attended the demonstration.

* * *

A Reminder.

THE Editor asks me to remind readers that he is prepared to pay 10s. 6d. for every amateur wireless photograph published in POPULAR WIRELESS.

If the photograph is used as a cover plate, a fee of £2 2s. will be paid.

Photos should be clear and "sharp." Half-plate size is the best, but smaller sizes stand just as good a chance, provided they show details clearly.

* * *

Radio Teas.

A WIRELESS receiving apparatus has been fitted up in a café at Leicester, with a pair of 'phones on several tables.

Customers are thus able to listen in to concerts sent out from Writtle and the Continent.

A stentorphone is also being introduced into the café, so that concerts given at The Hague wireless station will be clearly heard all over the café.

* * *

Free Lectures.

I HEAR that, in view of the growing popularity of wireless, Messrs. Harrods, of Brompton Road, are giving a series of special demonstration lectures, at which the principles of wireless telegraphy and telephony

Latest photograph of Signor Marconi on his yacht "Elettra."

will be explained, and practical demonstrations of wireless reception will be given.

The lectures will be held daily from 11 to 12 a.m. and 3 to 4 p.m. in Harrods' new wireless lounge, where every type of wireless instrument may be seen in use.

Messrs. Harrods invite the public to attend.

* * *

The Imperial Scheme.

MR. HUGHES, the Australian Commonwealth Prime Minister, has received from the Secretary of State for the Colonies an outline of the Imperial Government's wireless proposals as expounded in the House of Commons on Friday, states "The Times."

He regards the scheme as a complete justification of his attitude at the Imperial Conference in favour of direct communication. All doubts are now removed as to the efficiency of the high-power stations to communicate over such vast distances.

He is awaiting further details of the British proposals.

* * *

Schoolboys' Wireless.

NORTH KELVINSIDE SCHOOL, Glasgow, has now been equipped with a wireless receiving installation by Mr. Walter Jamieson, B.Sc., principal science master.

Even with the present temporary fixing of the aerials Lyons, Rome, Berlin, and Paris can be heard, and the Education Authority have given a small grant towards erecting a permanent set.

The Wilkinson Motor and Engineering Company, Kilburn, London, has presented a fine double-wound magnetic detector, made by the Marconi Company, to the school as a free gift.

The Editor asks me to say that he will be pleased to hear from other schools that have fitted up a wireless installation.

* * *

Wireless in Court.

A WIRELESS receiving set was installed in Mr. Justice Lawrence's court the other day for the purpose of demonstrations in connection with an action brought by the Marconi's Wireless Telegraph Company, Ltd., against the Mullard Radio Valve Company, Ltd., for alleged infringement of two of plaintiff's patents for the improvements in wireless receivers and in vacuum tubes of the Audion type.

Telephony was sent from Marconi House, and the judge and counsel (Mr. Gray) "listened in."

Mr. Gray: Your lordship has heard?

The Judge: Yes, it is most interesting!

"Is the gentleman at the other end still reading?" asked the judge when the demonstration had ceased.

Mr. Gray: Yes, and will, I expect, for some time. (Laughter.)

The Judge: He seemed to be getting rather hoarse. (Laughter.)

But I should not be surprised if Mr. Justice Lawrence instals a wireless set at his house before long.

* * *

'Phone Tapping.

THE following is an interesting report which appeared recently in the "Daily Mail":

"A resident of Westcliff-on-Sea, Essex, who recently had a telephone conversation with a friend, which he assumed could not be heard by the outside world, received a letter from a neighbour on the following day stating: 'You will be interested to know that yesterday I was at the house of a friend in Westcliff, whose son has a small wireless set. About nine o'clock I put the receiver on my head and heard you ask for a trunk call on the telephone. . . .'

"An interesting solution of the mystery was given by a wireless expert to a 'Daily Mail' reporter.

"'The only similar instance I know of occurred during the war, when ordinary telephonic messages spoken by the Germans ten miles behind their lines were picked up by our wireless men,' he said.

"'It is a matter of induction. In the case at Westcliff the ordinary telephone wires must at some point be running parallel with the aerial of the wireless receiving set, and as a result the telephone sounds induce similar sounds which are received on the aerial. It was the occurrence of such phenomena as this that led to the first experiments in wireless.

"'The fact that telephone messages can thus be overheard by wireless serves clearly to show what those engaged in research in such matters have always known—that there is no method of modern communication that can be guaranteed to be absolutely private.'"

NEWS AND NOTES.
(Continued.)

Business and Wireless.

THE Amalgamated Wireless (Australasia), Ltd., has decided to increase its capital to £1,000,000 by the issue of 800,000 Ordinary £1 shares, paid up to 2s. in the first instance.

* * *

2 L O Concerts.

THE Marconi Impromptu concerts from 2 L O (Marconi House Experimental Station) are a welcome feature to those who listen about 5 o'clock.

A Marconi House official told me the other day that it is impossible to give adequate notice of these transmissions, but the 360-metre wave is generally used, and Fridays and Saturdays are favourite days for the transmission.

* * *

Poldhu.

O VOICE from out the wilderness of space,
Whose cadences still linger in the memory,
Farewell! from those who oft have listened eagerly
For thy C.Q.'s. in some far foreign place

No more shall thy curt sentences reveal
The troubles that each day beset our countrymen,
No more provide an argument for mess,
For M P D has ceased to transmit press.

A. J. A. L.

* * *

Marble Arch Wireless.

A FEW days ago at the Marble Arch Pavilion there was a demonstration of wireless telephony allied to the "Magnavox," the loud-speaking instrument owned by Basil Davis, of the Pavilion circuit of theatres.

This invention has the power of magnifying the smallest whisper into a voice of vast carrying capacity, and Basil Davis has only recently succeeded in devising a method of linking it up with the wireless telephone.

He has his own wireless equipment and research factory at Brentford. The roof of the Marble Arch Pavilion has been turned into an important receiving station; call sign, "2 B Z."

* * *

Broadcasting Licences.

IN the House of Commons the other day, Mr. Kellaway (Postmaster-General), replying to Lieut.-Colonel Arthur Murray, said he had intimated to the committee representing the manufacturers of wireless apparatus in this country the conditions on which he proposed to grant licences for broadcasting, and these proposals were to be submitted to the general body of manufacturers: "That in the event of their supplying the capital required, and providing efficient broadcasting service, he would make it a condition in licensing apparatus for the reception of these services that such licences should for two years be restricted to apparatus manufactured in Great Britain."

* * *

Various Items.

IT is reported from America that an American Japanese wireless company with a capital of 200,000,000 yen has been formed.

* * *

A scheme is on foot at Benton Church, Rawdon, for the installation of a powerful wireless apparatus.

* * *

General the Earl of Cavan, Chief of the Imperial General Staff, recently inspected the Eton College Officers' Training Corps.

He urged all ranks to study wireless, and he hoped the college authorities would encourage "listening-in."

ARIEL.

THE "DAILY MAIL" AND WIRELESS

Amateurs throughout the country have heard with joy the announcement that the "Daily Mail" has arranged a service of wireless concerts to be broadcasted from the Hague. Without a doubt, the "Daily Mail" has relieved the disappointed feeling caused by the delay in starting the official broadcasting service, and every amateur in the country cannot but feel in the debt of the newspaper which has so splendidly stepped into the breach at the crucial moment. Our thanks and congratulations to the "Daily Mail."

EDITOR.

A NEW step in wireless broadcasting has been achieved by the "Daily Mail." This go-ahead paper has completed arrangements for a regular service of wireless concerts from the Hague Wireless Station. The promise of these concerts by the "Daily Mail" in May followed the Postmaster-General's announcement on the subject of broadcasting. Owing to the delay in the provision of a national wireless broadcasting scheme, the "Daily Mail" has now entered into an arrangement with the famous Dutch wireless concert organisation, the Nederlands Radio-Industrie, and every Thursday evening a special concert will be broadcasted by radio.

The Programmes.

Crystal sets will be practically useless for reception of the Hague concerts; but thanks to the speech modulator apparatus invented by Mynheer H. H. Idzerda, the electrical engineer and director of the Nederlands Radio-Industrie, it will be possible for users of the frame aerial to hear the concerts perfectly without the necessity of an outside aerial, providing valve amplification is used.

The programme will include not only classical and popular concerts, but also bed-time tales for the children taken from the popular "Teddy Tail" series. Also dance music will be transmitted, and, given the necessary amplifiers, hosts may invite their guests to dance to music from the heavens.

Increased Power.

Between 7 and 8 p.m., English summer-time, on Thursdays and Sundays, there will be sent out on a 1,050-metres wave-length and a power of 800 watts the famous concerts of the Dutch service. This means that the "Daily Mail" concert can be heard over a distance of 1,000-miles range. Listeners-in at Aberdeen in the north, Penzance in the south, Galway in the west, will be able to hear perfectly the music from Holland.

Furthermore, on August 3rd the Dutch service will be broadcasted at a power of 1,500 watts, giving a range of 2,000 miles, where valve reception is employed.

"Daily Mail's" Wireless Record.

Since the "Daily Mail" had its wireless receiving set installed in May, 1920, there has been a long succession of wireless feats, each surpassing the last in usefulness and importance.

In May, 1920, a news message was sent to the "Daily Mail" by wireless—the first time that a news message had been sent by these means. The message was sent by wireless telephone from Chelmsford, in Essex, and it was heard all over the country.

The next notable stage in wireless history was in the following month, when Melba sang to the world through the wireless telephone, and the diva's voice was heard clearly over a great part of Europe. It was probably the most unique concert that has ever been given.

Then an experiment of great usefulness was carried out. A "Daily Mail" reporter who was walking across Hampstead Heath was called to the office by means of a wireless telephone message sent out by the "Daily Mail."

The March of Progress.

The day afterwards a "Daily Mail" reporter, by means of a portable wireless set, received a summons from his office while he was travelling in a train between Bromley and Bickley.

In December, 1921, the first direct wireless message was sent to Australia from England, the message being a greeting from the "Daily Mail" to its correspondent at Sydney, New South Wales.

On May 12 last an important piece of news was broadcast for the first time. On that occasion the "Daily Mail" broadcast the news that Carpentier had won his fight with Lewis at Olympia. Thousands of amateurs received it successfully.

More recently still, on June 2, the "Daily Mail" organised a test in which an imaginary criminal was hunted down by a detective by means of wireless.

Broadcasting Programmes

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

THE Writtle concerts still carry on every Tuesday evening at 8 o'clock, B.S.T., on a wave-length of 400 metres. The call sign is 2 M T. The concert lasts from twenty to thirty minutes.

Königswusterhausen transmits telephony usually at 7 and 10.30 a.m., G.M.T., on a wave-length of 2,500 metres. The station is situated near Berlin. Call sign, L O.

The Eiffel Tower Radio Station (call sign F L) may usually be relied on for a telephony transmission (and sometimes a concert) at 5 o'clock, B.S.T. A weather forecast is sent in French at 6 o'clock. The wave-length is 2,600 metres.

Croydon (G E D) may be heard in radio-telephonic communication with various aeroplanes on the Continental air routes at all times of the day.

Other aviation centres which transmit telephony include Castle Bromwich (G E C); Didsbury (G E M); Hinton-Admiral (sign not allotted yet); Lympne (G E G); Renfrew (G E R); Pulham (G E P).

In all cases the 900-metre wave-length is chiefly used.

The Sunday concert at the Hague is sent out at 2.30 to 5 p.m. on a wave-length of 1,050 metres. The call sign is P C G G. The latter half of the concert is sent in English.

The special "Daily Mail" concerts from the Hague are sent every Thursday evening on the same wave-length between 7 and 8 p.m., B.S.T.

NEW SERIES FOR BEGINNERS.

By E. BLAKE, A.M.I.E.E.

PART 2.

SUMMARY OF LAST ARTICLE.

The essence of wireless communication is the transference of energy across space.

Energy may be defined as the "ability to do work."

Energy and matter are the only two physical things; both are indestructible, and therefore constant in quantity.

When work is done, energy changes its form. There is the energy of matter at rest, or potential energy; there is the energy of moving matter, or kinetic energy; there is the energy of heat, light, and electricity.

Electricity has been isolated as electrons, which are tiny bodies composing atoms. Atoms consist of a core of positive electricity surrounded by electrons, which are called negative electricity. The mutual attraction between the positive and negative electricity maintains matter in equilibrium, for electrons tend to repel each other.

Because of the collisions of the moving atoms of some kinds of matter, a number of electrons are knocked off them, and there are thus a number of "free" electrons. Such substances are called "conductors." Substances containing only a few free electrons are called insulators.

WHEN electrons move through a conductor in one direction only, we call that a direct current of electricity. When they move backwards and forwards we say we have either an alternating current or a high-frequency oscillating current, according to whether the current flows to and fro slowly or very rapidly. It is the very rapid oscillations of current with which we have to deal in wireless work.

An electric battery is an apparatus in which by chemical means there is created what is called an electromotive force or E.M.F. A battery may be regarded as an electron pump. If we join the ends of a wire to the terminals of a battery, whether it be a dry cell battery or a Leclanché battery, a bichromate battery, or a number of accumulators, the result is that electrons move through the wire from the negative terminal of the battery to the positive terminal, and then through the battery to the negative terminal and through the wire, and so on in a steady one-direction current.

Resistance.

The pressure at which the electrons are forced through the wire—or, in other words, the voltage of the battery—depends simply on the kind of battery used. A good dry cell will give 1·4 volts, an accumulator will give two volts, and a Leclanché cell, such as is used for house bells, gives a pressure of 1·4 volts.

When a certain number of electrons per second move past a point in an electrical circuit (path of the current) we say that a current of one ampere is flowing. The number of electrons could be written down, but it is so enormous that it would make no appeal to the reader's sense of magnitude, for it runs into trillions.

Conductors oppose a certain amount of resistance to the passage of an electric current. This resistance varies according to the material of the conductor, but, irrespective of that, the longer and thinner the wire the greater its resistance. In forcing its way through a conductor in the face of this resistance the current does work, and therefore some of its energy is changed into another form; in this case into heat. If the current is small, the heat generated is not easy to detect; but when the current is large and the wire is thin, the latter may become so hot as to melt. It is this phenomenon which is utilised in electric radiators, cookers, flat-irons, and in electrically heated clothing for airmen.

Wasted Energy.

The change of electrical energy into heat spells waste to the wireless man, except in the case of wireless valves, and therefore should be avoided by keeping the resistance of all conductors as low as possible. This can be done—firstly, by using the best possible conducting materials as are consistent with price and durability. Copper, phosphor-bronze, brass, silicon-bronze, and aluminium may be used. Secondly, very thin wire should not be used. Sometimes it is necessary to wind a great length of wire in a spiral; and in order to keep the spiral down to reasonable dimensions we have to use thin wire, but we lose energy thereby. Aerial and earth wires should be stout and composed of several strands, and all connections between instruments and batteries should be of fairly thick stranded or braided copper wire, as short as circumstances will allow.

The resistance offered by a wire to high-frequency oscillating currents is greater than that offered to direct currents, but this evil is overcome to an appreciable extent by the use of stranded wire.

Ohm's Law.

From the foregoing remarks about resistance we can understand a very useful hint relative to the construction of wireless receivers. A small aerial, if it is to receive long waves, has to be associated with a large coil of wire, concerning all of which we shall learn later on. Now, the smaller the aerial the more wire must be used for the coil, and hence the more electrical energy will be wasted. That means weaker signals. Therefore we have a very forcible reason for using the largest aerial we can. It is true that the larger the aerial the more wire used, but aerial wire does not dissipate energy nearly so much as the thinner single-strand wires used for coils.

The unit of electromotive force is the volt.
The unit of current is the ampere.
The unit of resistance is the ohm.
These are called after three scientists—Volta, Ampère, and Ohm respectively. One volt is the pressure which can force one ampere of current through one ohm of resistance. These three electrical quantities are connected by a simple law which was formulated by Ohm himself, and applies to direct currents. As I do not wish to introduce formulæ into these articles, I must explain that, according to Ohm's law:

1. The current passing through an electrical circuit may be found by dividing the number of volts by the number of ohms. The answer will be in amperes.
2. If the current is known the resistance can be found by dividing the volts by the current. The answer will be in ohms.
3. If the resistance of the circuit and the current flowing through it are known, the voltage may be found by multiplying the number of ohms by the number of amperes. The answer will be in volts.
4. If the voltage remains the same and the resistance be doubled, the current will be halved. If the voltage be increased, the amperes will increase in proportion.

Power.

Power is expressed by the product of volts and amperes, and its unit is the watt.

1 volt	multiplied by	1 ampere	= 1	watt
or 2 volts	,,	½	,, = 1	,,
or ½-volt	,,	2	,, = 1	,,
		746 watts	= 1	horse-power

The power allowed for most amateur transmitting stations is 10 watts; Marconi House Station has a power of 1,500 watts; the Marconi station at Writtle transmits its concerts on 250 watts; the average ship station is about 1,500 watts; and the power of some of the large transocean stations is rated at hundreds of thousands of watts. In referring to the power of a wireless station, I must point out that sometimes this means the power of the "input" to the transmitter and sometimes the actual power delivered by the transmitter to the aerial. In the next article we shall consider some of the properties of an electric current.

(To be continued.)

TWO WIRELESS POSSIBILITIES.

JUST at present, when amateurs are busy with the installation of their "listening-in" sets, their minds are too much occupied to contemplate the actual range of what a revolution has arrived in the way of disseminated knowledge. Nevertheless, in our great hospitals wireless telephony will bring about one of the biggest steps forward that has been known in recent times.

Medical and nursing staffs are always anxious to take the patients' minds "off themselves," and to this end various entertainments are provided, sometimes through the kindness of professional entertainers, but more often than not the nursing staff sacrifice their "off-duty" time in working-up and presenting a programme of one kind or another. It is, of course, wonderful how much is done in this way by voluntary—and often valorous—effort, but such entertainments are always a problem to provide and an anxiety when presented.

Wireless telephony, and the "loud speaker," will bring sunshine to many saddened hearts in our hospitals. The greatest musicians and the most gifted orators can render signal service, not only without loss of valuable time, but practically at the hour best suited to the needs of the patients. Some hospitals have their own private chapels, but here, again, the service of the cathedral, with what is unknown to hospitals—the musical part of the service rendered by trained and gifted choristers and organist—can now be conveyed to those bed-cases who, by their very infirmity, are otherwise debarred from the "comfortable words" of their particular creed.

Possibly, also, the time is at hand when the specialists of the whole world can give their advice, or "hold a consultation" over difficult or dangerous cases; the house physician diagnosing at the bedside and the specialists commenting and advising in reply from miles distant.

It was a very ancient prophet who said "knowledge shall be increased," and we of the present day are just beginning to visualise, if not realise, the vast extent by which knowledge, and all the safeguards knowledge provides for those who acquire it, is being shorn of the difficulties which hitherto have been to some insurmountable.

EYES THAT FLASH BY WIRELESS.

By W. B. HOME-GALL.

LONDONERS are puzzled and perplexed, but wholehearted in their admiration of a novel animated sky-sign that has just been erected at the Elephant and Castle, London.

Thousands of people gather every night to watch the flashing eyes in the sky spell out the messages they have to tell on their signboard.

The sign consists of a long, narrow strip fixed in front of the top storey of a corner building. Along this narrow strip, from dusk until midnight, illuminated advertising messages run along without cessation, the first letter of a word appearing on the extreme right of the strip, and moving along to the left until there is room for the second letter to appear.

All the Latest News.

Nor are advertisements always the sole reading matter exhibited. During the Carpentier v. Lewis, Beckett v. Cook, and Lewis v. Burns boxing matches, the progress of the fights was received by wireless, and announced on the sign at the Elephant and Castle, simultaneously with the receipt of the messages from the ringside. The results of these fights were probably known to the crowds beneath the sign before they were known outside the doors of the theatres where the contests took place. In the case of the Carpentier v. Lewis fight, the result was flashed upon the sign in less than 30 seconds after the decision had been given in the ring.

First of all a C appeared on the extreme right of the notice-board in brilliant electric lamps. That C moved speedily towards the left until an A appeared on the right of the C. Then followed an R, a P-E-N-T-I-E-R, a small gap, W-O-N.

At this point a hearty cheer arose from the multitude in the street below, but still the sign spelt out the message it had received by wireless:

"L-N. T-H-E F-I-R-S-T R-O-U-N-D."

Then on it went with its messages from large firms advertising their wares. Many of the messages contained references to the fight, whose result was not yet being sold in the newspapers in the streets below—until at midnight appeared the final message:

"G-O-O-D-N-I-G-H-T-!"

But, although in this case the eyes that flash by wireless beat the newspapers, and, although the Scintillating Sign Company, who control the sign, intend to take advantage of wireless broadcasted news when regular broadcasting news centres are inaugurated, yet they will not attempt to run in opposition to the newspapers. But they will write in their electric letters any very important messages that they receive.

1,000 Lamps Used.

And when those news messages do appear they will be real Stop Press items, so fresh and hot from the nest of their origin that they will beat the grocer's eggs.

Speculations run rife as to the method by which the mysterious signboard works. Its inventor, a young Englishman, is very reticent about it. Rumour says that the idea for it came to him in a dream.

The sign introduces itself every night, and tells a few of its secrets to those who wait to read.

"We are the Scintillating Sign Company, Ltd., of Temple Bar House," it proclaims. "This is an entirely British invention. There are over 40 miles of electric wiring, 1,000 electric lamps are used, and 6,000 electric flashes are created every second."

The messages may be "set" in any kind of type, and an alteration can be made in any announcement just before it is shown. Only five minutes' notice is required.

"It is a marvel to me how it works," one man in the crowd announced the other night. But no one responded to him; they were all too deeply engrossed themselves in the unique novelty.

The Scintillating Sign Co.'s aerial at the Elephant and Castle.

In a week or so's time the name of this paper will travel in letters of coruscating brilliance across the forty-foot screen.

"R-E-A-D P-O-P-U-L-A-R W-I-R-E-L-E-S-S" will appear for about fifteen seconds at varying intervals throughout the evening, and perhaps a title or two of future features to appear in the paper.

The Receiving Set.

The wireless receiving apparatus embodies all the latest and best features. A lofty twin aerial is employed with a span of 45 ft., the twin wires being spaced 7 ft. apart. The interior reception set is of 4-valve amplification with detector valve and Crocross tuning coils. A separate calibrated heterodyne is used in conjunction with the amplifier; valve oscillation is thereby overcome, and interference with other local receiving stations completely avoided.

The set is complete with wave-meter and loud speaker. The latter is installed in the control-room of the sign, and does not appear in the photograph. With this powerful set messages from trans-oceanic stations are regularly received.

That this wonderful sign is a triumph in electrical ingenuity must be at once admitted. It is to be hoped that the scheme with which the Scintillating Sign Company has experimented at one of London's busiest thoroughfares will be introduced into other parts of London and in many of our large provincial towns.

Messages of importance are picked up by wireless and are then flashed on the electric signboard.

THERE IS NO ETHER?

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

IN the July issue of "Popular Radio" (New York) there appeared an interesting article by Dr. Charles P. Steinmetz, chief consulting engineer to the General Electric Company, and an eminent American physicist. It being a prerogative (though happily one not always exercised) of scientists, eminent and otherwise, to express themselves dogmatically, we confine ourselves to the suggestion that a little more explanation and a little less dogm tism would have carried greater conviction in the minds of a good many readers.

Moreover, after carefully perusing the article twice, we confess to a feeling of disappointment that it is apparently not "to be continued in our next," for it must have left the average reader completely in the dark as to the conditions in space responsible for the "field of force" or "field of energy," the conception of which, Dr. Steinmetz holds, must replace our conception of the ether.

Nevertheless, no one will suppose that Dr. Steinmetz has gone out of his way to deny its existence in such emphatic terms, either for amusement or upon any grounds other than the fact that he believes the ether to be a misconception, and that in its place there exists a field of force, or a field of energy throughout space devoid of matter. Anything from his pen must command attention and careful consideration. and, moreover, he is not the only physicist who holds this view.

The Ether Mediums.

The subject being essentially of interest to those who practise the gentle art of wireless, we propose to discuss the article in question in a purely impartial spirit—indeed, the writer is one of those who are far from satisfied that the ether is the "last word," or that it presents a solution of certain problems that obtrude themselves—as Dr. Steinmetz truly implies.

Before doing so, however, it will be quite relevant to consider the reasons for the adoption of the ether hypothesis—even at the risk of boring readers who are already familiar with them.

For our present purpose it is unnecessary to attempt to explore space beyond that portion of it that lies between the sun and our own little world. If we are to believe the evidence of our senses—and that is what Dr. Steinmetz (like every other scientist and human being) comes back to in the end—we must conclude that. in the present phase of our solar system, we derive from the sun everything that makes life possible on the earth. Observations of certain phenomena, such as light, and the results of experiment, indicate that, in order for these benefits to reach us, there must be some *medium* in the intervening distance of 93,000,000 miles that sep rates us from our luminary.

A medium was therefore assumed, called the "æther" or "ether," the supposed properties of which have no parallel within human experience. In the first place, in order to facilitate the passage of light and other waves, and yet not interfere with the movements of suns and worlds in space at the enormous speeds at which they travel, the ether was assumed to possess the apparently conflicting properties of almost absolute rigidity—far greater rigidity than any known solid—and of extraordinary tenuity at one and the same time.

A more modern view of the ether is that it must be more than a million times as dense as any kind of matter that exists in it, so that it permeates all the interstices between atoms of matter and even between electrons, and yet that it is non-viscous and hinders the movement of matter through it far less than water hinders the movement of the lowest microscopic forms of life that exist in water. It is even thought possible that the ether may be the ultimate substance from which matter itself is evolved.

Now, it must not be supposed that the assumption that space is occupied by an ether possessing these astonishing and, to the ordinary mind, almost incomprehensible properties, is wrong, merely because we find no parallel in actual experience. If science had always relied upon experience only. we should probably have advanced but little, in a scientific and in many another sense, beyond the degree of knowledge possessed by our ancestors thousands of years ago. Many of the greatest discoveries of scientists have been largely the result of deduction. Thus, assumptions have been made, based upon observed phenomena, and from them theories have been built up, mathematical proofs advanced, and wonderful discoveries made.

It was by such means that the planet Neptune, 2,700,000,000 million miles from the world at its nearest, was discovered. The existence of Neptune had been proved long before that planet had ever been seen, and so accurately was its position calculated that, upon searching for it in the spot predicted, at a certain time, sure enough there it was.

So far. then, the conception of an ether possessing the properties named is a rational one, and was disputed by but a small minority of scientists, since it fulfilled the conditions obtaining.

Einstein's Theory.

Then came Einstein's Theory of Relativity, which, in conjunction with the theories of electro-magnetism and electro-optics, gave rise to doubt in the minds of men of science as to the possibility of the existence of such a thing as the ether, which, if it does exist, must, as Dr. Steinmetz implies and Sir Oliver Lodge admits, possess structure of some kind. So far as the writer has seen or recollects, Einstein has not actually denied the existence of the ether, but, on the grounds of the theory of relativity, Dr. Steinmetz asserts its impossibility.

Dr. Stinmetz's Contention.

It is not our purpose to enter into a detailed discussion of the theory of relativity, but, since it is the basis of Dr. Steinmetz's contention, it becomes necessary to consider in what way. A definite conclusion drawn from the theory is that the motion of every body in space is purely relative, *i.e.*, that its motion is relative to that of some other body or bodies, and that there is no fixed point in space at all.

From this Dr. Steinmetz argues that the ether is an impossibility, on the grounds that, if it exists, the motion of all bodies would be ascertainable in relation to it. He produces no proof and leaves readers to wonder why—for it is no more obvious that the ether, even if fixed as a whole, gives us any fixed position from which to gauge the motion of bodies *all* of which are moving in it, than that such a position would be given by fields of force or energy; although Sir Oliver Lodge is of opinion that the motion of matter in space may ultimately be determined in relation to the ether as a fixed whole.

Dr. Steinmetz also argues that, if the ether stands still and the earth moves through it, there would be such friction between the earth and the ether as to increase the length of the year and increase our distance from the sun This is apparently a commonsense argument,. but, unfortunately, quite opposed to a proper conception of the nature of the ether. It amounts simply to saying that it is impossible for the ether to possess the properties attributed to it. That may be true, but it is not sufficient merely to say so. It is an idea that must first strike any ordinarily intelligent person when first attempting to grasp what is meant by the ether. If it exists, it must necessarily possess properties which, as already pointed out, are very different to the properties of matter familiar to us.

"Ether or Æther (says Sir Oliver Lodge) is the name given to a super-sensible, elusive medium supposed to fill all space: not only the spaces between worlds, but the spaces between atoms of matter, even in the most solid object. Most authorities consider it to be an all-permeating, perfectly continuous substance linking the otherwise detached particles of matter together, and welding the whole into a coherent cosmos. . . . . The modern view of matter is that matter and not ether is the rare and tenuous substance, a milky way or gossamer structure of detached particles, immersed in a substantial medium and held together by the force it exerts. . . . Electric strain can exist just as well in a fluid as in a solid, for the strain is not really in the matter, but in the intervening and connecting medium."

An Easier Conception.

Dr. Steinmetz gives some simple and interesting examples of magnetic and electro-magnetic fields, but the belief that "nothing material is moving in the alternating current," and that it is a periodic wave and not a wave motion, does not help the imagination to a conception of space as consisting of a limitless energy field to the exclusion (for the most part) of matter, and Dr. Steinmetz does not offer any explanation or assistance. An electric current constitutes the restoration to a condition of equilibrium of natural forces that have been disturbed or displaced. So far as we know, current would not flow without the assistance of matter, in some form—or it may be ether—and the idea of magnetism independent of matter or the ether is not easy to grasp.

If the other theory be incorrect, and the energy field theory right, we can only remark that the latter imposes a task upon the imagination compared to which the conception of the ether is a comparatively simple matter. Pending further convincing details of the new theory, we must fall back upon the ether to assist us to an understanding of many things which are otherwise inexplicable.

The fact that electrical engineers have been able to evolve formulæ governing the practical application of electricity without reference to the ether appears to be somewhat beside the point. A structure such as the Forth Bridge can be designed and constructed in accordance with intricate calculations without considering the composition of the wind, or consciously invoking the aid of the laws of universal gravitation.

Sir Oliver Lodge has suggested that the ether of space itself may constitute an illimitable reservoir for the storage of energy imparted to it, and on this assumption the energy field required, according to the theory of the new school, is easier of conception than an energy field practically devoid of matter or "structure."

NEXT WEEK—
Special Article by
SIR OLIVER LODGE, F.R.S. D.Sc., LLd.

HOW TO MAKE A SHORT-WAVE RECEIVER.

By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.

ONE of the chief desires of the serious amateur radio experimenter beginning wireless work is to build his own receiving "set." While there are many excellent receivers on the market which can be purchased ready-made, there is always more interest attaching to actually constructing the apparatus rather than to merely operating it.

With this object in view it is well to begin with the construction of a simple type of receiver, using not more than one valve and having a limited range of wave-lengths. Although useful work can be done with a crystal detector the extra expenditure involved in the use of at least one valve is usually justified in view of the better results that can be obtained. It is proposed in this series of articles to describe in detail the building of a single-valve receiver suitable for tuning-in signals of wave-lengths between the limits of about 150 and 750 metres. This range covers the band of shorter wave-lengths allocated for experimental work in this country (viz., 150 to 220 metres), the 440-metre wave-length for amateur telephony and C.W. transmission, the band of wave-lengths allocated for the proposed broadcast transmissions (350 to 425 metres), and the ship transmissions on 300, 450, and 600 metres.

These wave-lengths are ones on which there is a considerable amount of traffic, both commercial and amateur transmissions, and it is therefore a range very suitable for incorporating in a receiver with which to commence wireless experimental work. Although perfectly feasible to do so, it is seldom advisable to strive for too large a wave-length range in any one receiver, as without taking special precautions it is difficult to avoid troubles due to undesired reactions between the various coils which must be employed. It is for this reason that receivers using interchangeable plug-in coils often give better results than those in which all the windings are fixed inside the box.

The receiver to be described is fitted with a single detector valve and a reaction coil for use merely for strengthening the signals by retro-action, or regeneration as it is also called. On these short wave-lengths the reaction coil should not be used to make the valve oscillate, as if it is desired to receive telephony, not only will it be impossible to obtain clear or readable speech or music while the valve is oscillating, but also all other experimenters for a considerable distance round will be seriously interfered with in their work. The coupling of the reaction coil to the main tuner windings should therefore only be increased up to the value where strengthening of the signals takes place, but the valve does not oscillate.

This point cannot be too strongly emphasised, as the use of a valve receiver in the oscillating state, when it radiates energy from the receiving aerials, is strictly prohibited by the Post Office, and persistent violation of this rule may only result in the curtailment of the privileges granted to the wireless amateurs in this country.

It is always quite easy to ascertain whether or not one's receiving-valve is oscillating, so that it is therefore also easy to avoid the use of the receiver in this state. This point will be referred to again later.

The general outline of the receiver to be described is indicated in diagrammatic form in Fig. 1 (a) and (b). This outline is drawn in two parts, one of which indicates the arrangement of the component parts of the receiver for reception of the shorter wave-lengths within its range, while the other shows the connections for longer wave-lengths.

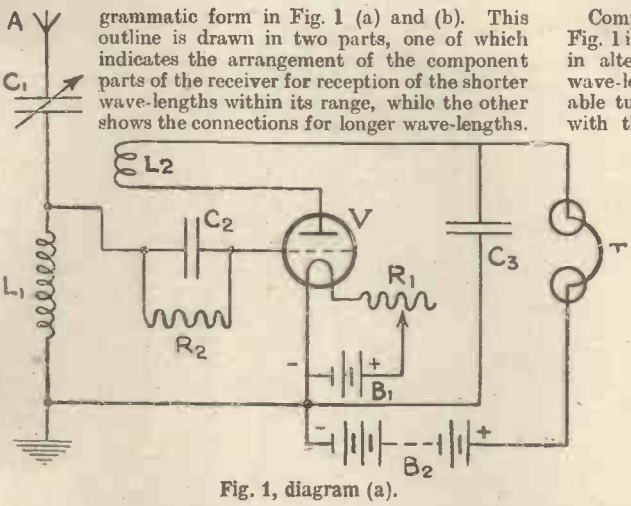


Fig. 1, diagram (a).

In these diagrams corresponding letters have been used for corresponding parts in the two arrangements of the circuits. It is not intended that the actual external connections of the receiver shall be changed in any way when altering the tuning from short to long wave-lengths, as the change in the connections from diagram (a) to diagram (b) (Fig. 1) will be effected by means of the wave-length range switch to be fitted in the instrument.

This switch has been omitted from the circuit in Fig. 1 (a) and (b), as these are intended to be diagrammatic only and the actual wiring of the components of the instrument will be given later. In these diagrams (Fig. 1) A represents the aerial wires and E the earth connection. C_1 and L_1 are respectively the tuning condenser and tuning coil. V represents the valve, of the usual three-electrode type, with a condenser and grid leak C_2, R_2 connected in its grid circuit, and a reaction coil L_2 in its plate or anode circuit. The battery necessary for heating its filament is indicated at B_1, with an adjustable filament rheostat R_1 in series with it.

The plate circuit of the valve is in each case completed through the telephone receivers T and high-tension battery B_2, with a bypass condenser C_3 connected across the two. This condenser is necessary to provide a path back to the filament for the high-frequency impulses which pass from the anode to the valve through the reaction coil, and which serve to magnify the strength of the incoming signals by means of reaction coupling between the coils L_2 and L_1.

These high-frequency impulses would be choked out by the high impedance and resistance of the telephone windings were this condenser not provided.

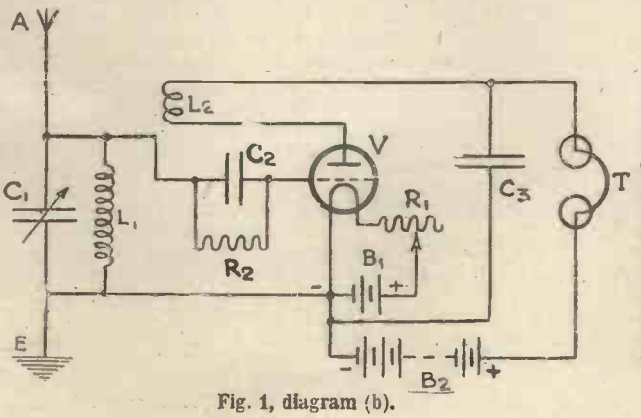


Fig. 1, diagram (b).

Comparing diagram (a) with diagram (b) in Fig. 1 it will be noted that the change effected in altering the circuit from short to long wave-lengths is the changing over of the variable tuning condenser C_1 from being in series with the tuning coil L_1 to being in parallel with it. The connections shown in diagram (a) are employed for the reception of signals below about 350 metres wave-length, while those in diagram (b) are used for longer waves. Each of these wave-length ranges, viz., 150—350, and 350—750, is sub-divided into two parts, as by this means much finer tuning is possible to any given wave-length.

While this is not any great advantage for the reception of spark signals on the longer wave-lengths, it is extremely useful when picking up telephony, and enables much better and clearer articulation to be obtained.

This sub-division is effected by constructing the tuning coil L_1 in two parts so that either a part or the whole of the coil can be employed. This changeover has also been arranged on the one-range switch so that in order to set the apparatus to any one of its four wave-length ranges it is merely necessary to move a single switch knob. The complete connection scheme for the receiver is therefore that shown in Fig. 2, in which the various parts have been given the same reference letters as were employed in Fig. 1.

The additional part that is shown in this diagram is the range switch S, which, it will be seen, consists of two linked switches, each provided with five contacts, the first one of which connects the aerial to earth and corresponds to an "off" position for the set, while the other four give the four wave-length ranges, which are approximately 140 to 250, 200 to 370, 350 to 500, and 450 to 750. These ranges are those obtainable with an aerial of average size licensed by the Post Office, viz., 100 feet of single wire or 140 feet of two-wire aerial. They will vary slightly with different sizes of aerial, but sufficient overlap has been allowed on each range to cover most variations in aerial size that are likely to be met with in practice. Details of this range switch and the other components will be given in following articles in this series.

The complete instrument can be mounted in a wooden box, of which the inside dimensions are 12 inches by 12 inches by 4½ inches deep. This box can be constructed out of any convenient wood, preferably a hard wood, such as walnut, teak, or mahogany, of about ¼ to ⅜ of an inch thickness. The top of the box should be left open, as it will be covered by an ebonite panel of the requisite size.

This ebonite should not be less than ¼ inch in thickness or it will sag when the parts are mounted upon it. A thickness of $\frac{5}{16}$ inch is preferable.

The sheet of ebonite for this panel should be obtained 12¼ inches square and should be trimmed up with a file so as to fit neatly on top of the wood box without overlapping the edges. The parts of the box itself should be glued together and fastened with small brass pins or thin nails unless the edges are dovetailed together. The use of iron or steel screws or nails should be avoided in the construction of all wireless apparatus, as they tend to introduce losses and thus impair the efficiency of the apparatus.

(*Continued on next page.*)

SENDING PHOTOGRAPHS BY WIRELESS.

THE other day I stood in a small cabin and watched some complicated-looking instruments reproducing a wireless photograph. That photograph was being sent from a town nearly seventy miles away.

How is such a thing done?

In the first place the picture is photographed through a special screen which has the effect of producing on the film a large number of dots more or less close together (half-tone photographs for the newspapers are prepared in a similar fashion). When the film is developed these dots appear slightly raised above the level of the rest of the film.

This film is then placed on a revolving drum in the same way as the barrel-shaped records of the old-fashioned phonograph were placed on the revolving cylinder.

How it is Done.

Resting lightly on the film is a very fine needle, somewhat like the needle attached to the sound-box of a modern gramophone. In each complete revolution of the film this needle moves forward a distance equal to its own thickness, which is considerably less than a millimetre, until it has covered the whole film.

Now, every time the needle strikes against one of the raised dots it is lifted up, and this needle, on being raised, brings certain wireless instruments into operation, which cause a definite amount of energy from an electric battery to be radiated into the atmosphere, via wires suspended between two masts—the wires called the aerial.

This energy is radiated into the atmosphere in exactly the same way as the wireless signals are sent from a ship at sea. In fact, the needle acts just like the Morse key which every wireless operator taps when sending a message.

Therefore it follows that for every dot on the film the needle sends out a burst of electrical energy into space.

These bursts of energy, following closely in the footsteps of one another, travel through the atmosphere in the form of waves in the medium called ether. Ether pervades all space and conducts wireless waves at the rate of 300,000,000 metres a second.

Recent experiments between Rome and New York have resulted in the transmission and reception of very clear photographs over a distance of thousands of miles.

Receiving the Photo.

Supposing the photograph is being sent to a station 100 miles away, in a very short space of time these bursts of energy strike against the aerial wires of this distant station and flow down into the wireless cabin, where they enter an ordinary wireless receiving apparatus.

After travelling 100 miles the energy is very weak—for a great deal of it has been lost in space—but attached to the receiver is an instrument called an amplifier, and this greatly magnifies the energy which does arrive.

This energy now passes through various instruments until at length it reaches a particular coil of wire. Running through the centre of this coil is a short iron bar, and the fact of the energy flowing through the coil of wire sets up a magnetic field which turns the iron bar into a magnet. This iron bar magnet now attracts one end of a thin metal rod which is pivoted in the centre.

Attached to the other end of the metal rod is a pen suspended over a sheet of paper, and this paper is wrapped round a drum which is revolving in the same way as the film 100 miles away.

All Dots.

When, therefore, the magnet attracts one end of the metal rod, the pen attached to the other end moves forward and marks or jabs a dot on the paper wrapped round the revolving drum.

This pen, like the needle over the film, moves its own thickness in one complete revolution of the drum.

To summarise, what takes place is this: At each dot on the film the needle sends a burst of electrical energy into the atmosphere which strikes the aerial wires of the station 100 miles away in 1/186,000 (one hundred and eighty-six thousandths) of a second.

Each of these bursts of energy causes a pen to mark on the revolving paper, and thus a photograph of dots is produced which is exactly the same as the photograph of dots on the film.

Now examine closely the photographs in any newspaper and you will find that they are composed entirely of very fine dots. This will give a very good idea of what a wireless photograph is like when it has been transmitted by wireless in the way described above.

HOW TO MAKE A SHORT-WAVE RECEIVER.

(Continued from previous page.)

The outside of the box when completed can be varnished with shellac or polished. When the ebonite sheet for the top panel of the instrument is trimmed up to fit the box, its edges can be polished with very fine emery paper. Its upper surface may likewise be given a dull finish by means of very fine emery paper worked over it with a circular rubbing motion until a uniform surface is obtained.

This finishing can, if preferred, be carried out after the panel has been drilled, details for which will be given in the next article.

(To be continued.)

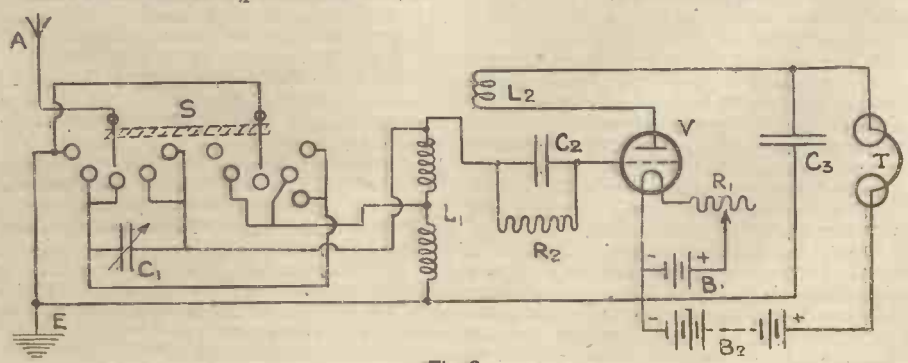


Fig. 2.

THE WIRELESS ALPHABET.

REFERENCES are frequently being made to the names of stations in what must seem to the uninitiated to be "baby talk." Thus the Writtle station will announce herself as Two Emma Toc, Croydon as Gee Emma Don, and it is little wonder if the average amateur wireless listener in, who has not had the advantage of any army signal training, wonders what it all means.

When a party of military signallers are out "flag wagging," it is fairly obvious that if the man watching a distant hill-top for the movement of that station's flag were to take his eyes off the spot to write down on paper what he had read, he might easily miss the succeeding movement of the flag.

Letter by Letter.

It was, therefore, ordered by the Army authorities that there should be a reader; that is, a man whose duty it is to read and call out the signals being received; and a writer, whose job it was to write down the letters as they are called out by his companion. The reader has nothing at all to do with the sense of the message. His duty is to read out letter by letter, and he does not generally encumber his memory with letters after he has called them out.

The writer has to satisfy himself as he writes down that, if in paragraph form, the message reads sensibly; and, if he is not clear, to ask for doubtful words to be repeated.

Anyone who has studied singing or elocution knows that the most prominent points in a spoken language are the vowel sounds—that is, the variously pronounced letters A.E.I.O.U. Most other letters are called consonants, because, with their sounds in conjunction with the vowel sounds, they together make up intelligible speech, and are more or less of the nature of diluents, or the parallel of the water in a glass of grog.

The New Language.

Now the army is, if anything, cosmopolitan, and it is conceivable that two comrades hailing, we will say, from Bethnal Green and Bury (Lancs) respectively, will give their vowel sounds quite different "quantities," as the amount of stressing is called. So much so, that it was found that A and I were constantly being confused, and other letters made by no means certain.

To the geniuses who christened the dash and the dot of Morse "umpty" and "iddy" respectively, as indicating a heavy and a light sound, the overcoming of this difficulty was easy work. They added a tail to the letters so as to distinguish them. Thus A became Ack, B became Beer, C Cork, D Don, E Eddie, I Ink, J Jug. M Emma, P Pip, Q Quod, S Esses, T Toc, and V Vic.

Useful to Know.

Telephone operators experience the same difficulty, and surmount it by a more cumbersome method. Thus A is for Arthur, O is for orange, etc. It is no fault of wireless transmission as such that speech is confused, or as wireless engineers describe the phenomenon, having whiskers on it.; but some parts of the apparatus appear to have a clinging fondness for some sounds, and are quite curt with others.

One can notice this for themselves apart from wireless, if they listen to a whispered conversation, when the gutturals are suppressed and the sibilants come into greater prominence in consequence.

The reader may find it very useful to memorise at least some of the nicknamed letters.

HOW TO CHARGE ACCUMULATORS

PART 2.

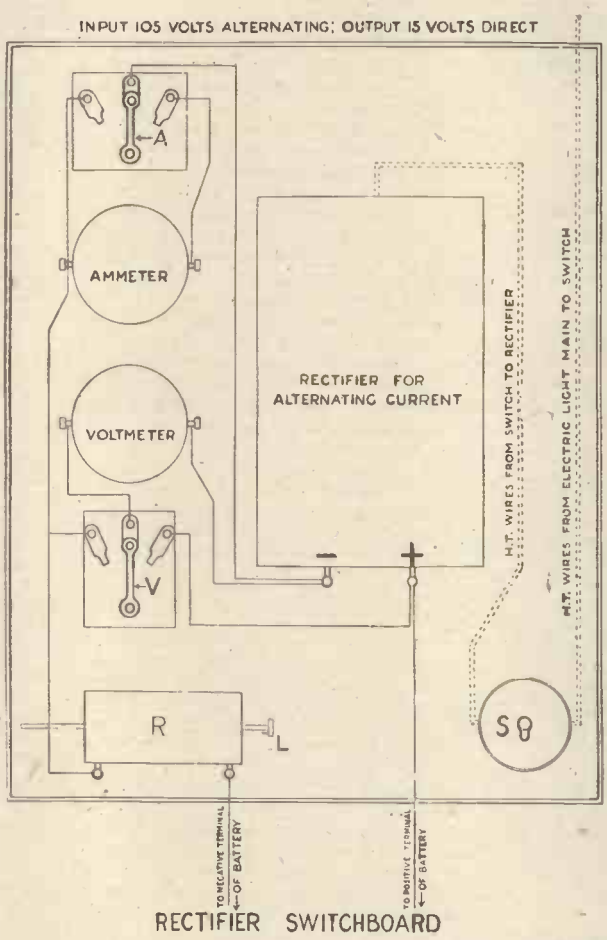
IN the last article, the charging of accumulators by direct current from electric light mains was described, and it remains for us to deal with the problem of charging them from an alternating current supply, which is a very different proposition. As previously mentioned, they can only be charged by a direct current, and means have therefore been devised for converting high-tension alternating into low-tension direct current.

On a big scale, for power and lighting purposes, this is done by means of rotary converters, but on a small scale it may be done either by what is known as a "rectifier" of the vibrating type, by a valve similar in its function to a thermionic valve, or by electrolytic means, such as the Nodon valve.

Vibrating Rectifier.

The accompanying diagram and list of instructions illustrates a rectifier (vibrating type), mounted on a switchboard with variable resistance, voltmeter, ammeter, and switches, exactly as fitted up and used by the writer in his garage for charging the lighting and ignition accumulators on his car, when laid up during the war. In this instance, the rectifier was rated for converting 105-volt alternating to 15-volt direct current, and was suitable for charging a lighting battery of from 4 to 12 volts.

The wires from the electric light mains were brought to the main switch S, to which the corresponding high-tension wires to the rectifier were also coupled. From the low-tension positive terminal of the rectifier, one wire was led to the positive terminal of the accumulator, and one to a contact plate on the voltmeter switch.



From the negative terminal of the rectifier, one wire led to the voltmeter itself. Another led to the ammeter switch and thence to one of the terminals on the resistance coil, the negative terminal of the accumulator being wired to the other terminal of the variable resistance. The rest of the low-tension wiring is explained by reference to the instructions.

With this type of rectifier there is the possible risk of the vibrator stopping, in which case, if the ammeter switch be not immediately turned to a neutral position, damage may result both to the rectifier and to the accumulator. In the course of some two years, however, the writer never found this to occur, although he frequently left the apparatus charging accumulators for twelve hours at a stretch. Nevertheless, the addition of an automatic cut-out and time-limit switch, in case of failure of the current supply, and to avoid accidental overcharging, would constitute a safeguard. This particular rectifier gave entire satisfaction.

Improved Type.

We understand that, in the latest type of Zenith rectifier (vibrating type), the following improvements are incorporated:—

(1) The parts are so designed and connected that the alternating current is rectified and passes through the battery in unidirectional impulses which serve to charge it equally well, independently as to how the positive and negative terminals are connected. As soon as the accumulator has been wired up for charging, a small current flows through a magnetising coil on a soft iron core, and the direction of the resulting magnetic field determines which of the two half-waves of the complete alternating current cycle is utilised, but the one thus automatically selected is the correct one to ensure that the accumulator is charged with current in the right direction, independently of how the terminals of the accumulator and rectifier are connected.

(2) When the alternating current is switched off, the tungsten contacts do not touch each other, and current cannot therefore pass either into or out of the cells except for the very small amount taken by the high-resistance winding on the soft iron core, so that, if for any reason the supply current fails, the cells would not become discharged.

The present price of the Zenith rectifier ranges from £11 10s. 0d. to £15 8s. 0d., exclusive of switchboard, resistance, and other switchboard instruments.

Tungar Rectifiers.

Another type, on an entirely different principle, is known as the "Tungar Battery Charger." This comprises a small case containing a transformer, a reactance, and a bulb that acts in much the same way as a thermionic valve and only permits the current to pass in one direction, so that it is impossible for the accumulator to discharge back through the rectifier, and should the current supply stop or fail altogether no harm is done.

With the Tungar battery charger, the wiring of the switchboard may be somewhat simplified. A length of flex and an ordinary adapter is provided on the high-tension side for connecting the charger up to any lamp socket, or, if preferred, with a plug to fit a wall socket. Another length of flex is provided on the low-tension side for coupling up to the accumulator terminals.

The price of the Tungar rectifier, suitable for charging small accumulators or batteries, varies from seven to twelve pounds according to the voltage of the high-tension current supply and the amperage of the output. For instance, the price is seven pounds for a rectifier for converting a 100-volt alternating current to a direct current of from 7½ to 15 volts and 2½ amperes for continuous service.

Incidentally it may be mentioned that Tungar rectifiers are made for much greater outputs if required, up to 75 volts and 12 amperes, costing with self-contained switchboard £95, but these, of course, are unnecessary for charging accumulators of amateurs' receiving sets.

As already mentioned, the bulb acts in the same way as a thermionic valve. The discharge of electrons takes place between a low voltage and tungsten filament (the cathode), and a graphite electrode (the anode). The bulb is charged with argon (an inert gas), and the combination of the heated filament and the gas provides the valve action, since current only flows from the anode to the cathode. The adjustment of the current to the voltage and value required is effected by the transformer and the reactance.

An important point is that there are no moving parts. Once started, the rectifier can be left charging almost indefinitely, providing that it is not carrying more than 2·5 amperes. There is a direct-current fuse plug and fuse to provide against short circuit or reversal of the battery.

The only part requiring renewal is the bulb valve. Although this may be good for 3,000 hours charging, the average life is about 1,000 hours, and, the price being £2 for a replace valve, it follows that the average cost of a twelve-hour charge is about sixpence, apart from the cost of current consumed.

I may point out that in cases where wireless amateurs are the fortunate possessors of motor-cars, and are on an alternating circuit, rectifiers are valuable for keeping ignition and lighting accumulators properly charged.

The Nodon Valve.

This is quite a useful device when properly made and used, but, owing to its rapid deterioration, unless carefully constructed and maintained, some firms at one time associated with its manufacture and sale now recommend the vibrating type of rectifier in preference, and only make the Nodon specially to order.

It is possible for an amateur to construct a Nodon himself, but unless he be a skilful hand at that kind of thing I do not recommend him to do so, for unless it be properly done one's accumulators may suffer for it, and it may prove dearer in the long run than purchasing the latest improved type.

The writer is indebted to Mr. L. F. Fogarty, an electrical expert responsible for a number of great improvements on the original type of electrolytic rectifier, for the following details of those improvements.

If aluminium electrodes be immersed in certain solutions contained in an iron vessel, or in a glass one with a lead electrode, current will only flow through in one direction, so that if such a combination be placed in series

with an accumulator in an alternating current circuit, the resulting current will be direct.

This rectifying action is believed to be due to the formation of a microscopically thin film of gas on the surface of the aluminium electrodes. As a rule, the greater the voltage of the alternating current the greater the number of such rectifying cells used to be required. Thus four cells were necessary for a 100-volt supply. Another great drawback was the generation of heat in the electrolyte, and the consequent deterioration and failure of the valve.

Many different solutions may be used, some of which are secret, but quite a good one is ammonium sulphate. Mr. Fogarty uses a secret, non-poisonous solution, and includes in the apparatus a special transformer with a middle point tapping, so as to obtain full rectification of both half waves on a single-phase supply, whilst employing only one rectifying cell.

The Nodon valve was virtually superseded by Mr. Fogarty's Grisson valve, and this in turn by the improved Grid type, the advantages of which, in addition to those named, are, from the amateur's point of view, much greater efficiency and reduction in price, the cost of a set for charging a 6-volt cell being from about £8.

When ordering a rectifier it is necessary to state the voltage and periodicity of the alternating current to be converted, and the maximum and minimum number of accumulator cells to be charged in series. It is also as well to ask for full instructions as to its use.

Instructions.

The main current switch S must always be turned on and the rectifier vibrating before the ammeter switch is turned to the right or left, and the latter must always be moved to central position before S is switched off.

If the vibrator stops accidentally, instantly switch off A. If these points are ignored serious damage to the apparatus may result.

To charge battery or accumulator proceed as follows:—

1. See that switch A is neutral, and that resistance pin L is pushed right in.
2. Connect pos. term. of rectifier to pos. term. of battery and neg. to neg.
3. Turn on main current switch S.
4. Turn switch V to the right, and see that voltmeter registers 15.
5. Turn switch A to the right, and switch V right over to the left.
6. Adjust resistance R by pulling out L until the ammeter registers not more than 3½ amps. (allowing for correction this equals 3 amps.). At the same time the voltage will be found to drop according to the number of cells being charged in series. Thus the charging current on 12-volt set will be from 13 to 15 volts and 1¾ amps. (really 1¼ amps.) with the resistance rod L out as far as it will go. For a 4-volt accumulator the voltmeter should register 5 volts and the ammeter about ¼ amp. If the ammeter hand sticks, tap the glass gently.
7. When the resistance has been adjusted, switch A right over to the left position, and switch V to central position. The charging process will then continue.
8. If the battery be removed and another put on charge, the resistance must be re-adjusted.

To test voltage across the terminals of rectifier, when latter is vibrating, turn switch V to the right.

To test the charging voltage of the whole circuit through resistance and battery when rectifier is vibrating, turn switch V to the left.

To test the discharge voltage of the battery, turn switch A to central position, turn off main switch S, and turn switch V to the left.

When charging is completed and the apparatus not in use, see that switches A and V are in central positions, turn off switch S, and disconnect wires from battery terminals.

ENERGY FROM THE AIR.

IN the first issue of POPULAR WIRELESS WEEKLY, reviewing the future possibilities of wireless, the following occurred:

"And what if we could harness Nature's wireless to do our bidding? Whenever lightning flashes, a terrific radio signal is being sent out. Can we use this energy to drive motors and other machines?"

Although the accomplishment of this feat is one that generation after generation of scientists has sighed to perform, it is not generally known that, quite recently, Herr Plauson, a German, has not only carried out experiments with that end in view, but that he claims to have actually succeeded in harnessing, on a small scale, a portion of the vast natural reservoir of power, by means, strangely enough, almost exactly corresponding to the Editor's forecast, namely, converting such energy into useful work by the medium of electro-magnetic waves in the ether—the same class of waves upon which wireless telegraphy and telephony depend.

Franklin's Experiments.

In speaking of Nature's great reservoir of electrical energy, however, we must be careful not to fall into a common error. It is only when Nature herself upsets the equilibrium of her forces that it is possible to take advantage of them as a source of power. Thus, a thunderstorm is the result of a natural difference of potential arising as between different portions of the atmosphere, or between the atmosphere and the earth.

For a very long time it has been known that there is a difference in potential between the upper atmospheric strata and the earth. In the year 1753 Franklin experimented with a kite with a wetted string and succeeded in conducting electricity to the ground and charging condensers with it. Afterwards Romas, using a metallic string, drew electricity from the atmosphere and produced sparks nine feet in length.

It must be borne in mind that the difference in potential is due to charges of static electricity which are believed to be positive in relation to the earth. It is something like charges on the plates of a condenser charged from a Wimshurst machine, or by other means. But although a charge may be conducted to earth, or reach the earth from a cloud with a flash that we call lightning, it is not the same thing as a current of electricity, and cannot be used to drive electric motors directly as a current can.

Harnessing Nature.

The explanation simply is that the current from a dynamo is generated and used at a certain predetermined rate, whilst in a static atmospheric charge there is a large amount of electricity, at a very high potential difference, that endeavours to reach the earth all at once.

When we consider that a current of 10,000 volts is necessary to spark across a ½-inch gap, it is easy to appreciate what an enormous potential difference there must be for a charge to produce the enormous length of spark through air that we see as a flash of lightning.

Although the vast amount of dormant energy represented by the difference in potential between the atmosphere and the earth has long been known of, no satisfactory means of harnessing it have hitherto been devised. Recently, however, Herr. M. H. Plauson, of the Traun Research Laboratory, in Hamburg, has prepared a scheme for utilising this potential energy, which may be described as power transmission by waves through the ether, on much the same principle as wireless telegraphy is practised.

Herr Plauson's scheme comprises a number of balloons with metallic surfaces covered with spikes. These balloons are sent up to a height of several thousand feet. The charge is conducted to earth by a metallic cable attached to each balloon, all the cables being connected by a circular conductor fixed to high masts.

By means of special transformers (details of which are not yet available), atmospheric charges are converted into electro-magnetic vibrations of the ether, these vibrations being so powerful as to operate motors attuned to respond to them, in the same way, but of course on a far more powerful scale, that a receiving aerial responds to waves from a transmitting aerial.

Preventing Thunderstorms.

It must be borne in mind that early experiments with atmospheric electricity, whether with kites like Franklin's or by means of metallic rods projecting high into the air (such as that used by Richmann in 1753, who was killed by a great discharge through his apparatus), were made more especially when thunderstorms were imminent. Herr Plauson, however, would not wait for these conditions, which arise from accumulations of electricity on minute particles of moisture, etc., in the air, that collect locally and thus set up such a powerful influence that the charge breaks through the resistance of the lower strata of air and flashes to earth.

His idea was to take advantage of the *average* difference of potential, by which means he believes that thunderstorms would actually be prevented in given localities where his apparatus is at work on a big enough scale; by maintaining more or less a condition of local equilibrium, and thus preventing the accumulations that are necessary before lightning can occur.

The Future Will Show.

Whether he is right or not in his forecast can, of course, only be proved by further experiment. Up to the present it has not been attempted on a big scale, but it is stated that, with two balloons at a height of 1,000 feet, he obtained power equal to 81½ kilowatt hours per day. He calculates that with ten balloons he would secure an annual output of 210,000 kilowatt hours. How the latter figure is arrived at is not stated, nor is it stated to what extent the proposition is estimated to be a paying one.

Nevertheless, the scheme is extremely interesting, and further developments will be awaited with interest, especially considering the possible effect that such installations might have upon wireless stations all over the world.

BOOK REVIEWS.

The Home Radio: How To Make and Use It. By A. Hyatt Verrill. (London and New York: Harper & Brothers. Pp. 105. Illustrated. Price 3s. 6d. net.)

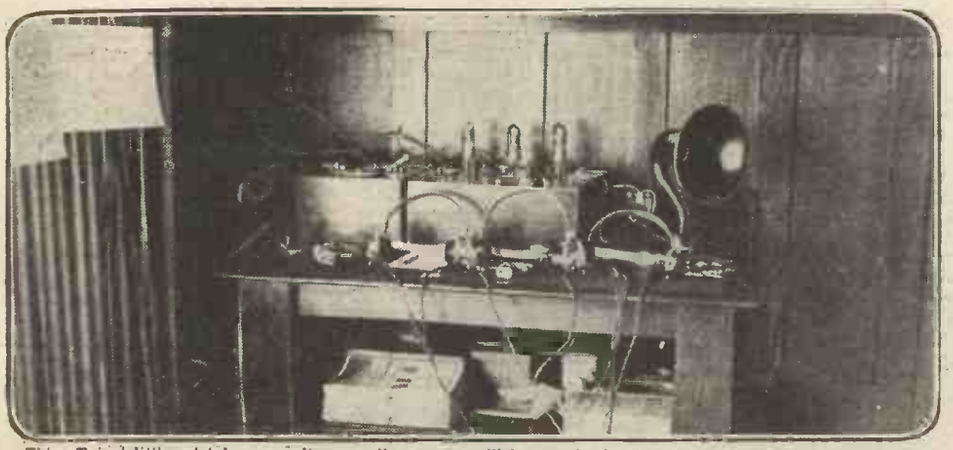
Although this little book is chiefly for the use of American amateurs, it contains much that will prove useful and interesting to the amateur in this country.

The author has avoided the indiscriminate use of technical terms, and makes his explanations as simple and clear as possible. The novice will find the text free from complicated formulæ and intricate diagrams—a boon these days when so many of us merely wish to study a fascinating subject purely as a hobby, and not as a profession.

Wireless For The Home. By N. P. Hinton, B.Sc. (London: Sir Isaac Pitman & Sons, Ltd. Pp. 87. Illustrated. Price 2s. net.)

This little book is an excellent guide for the amateur who intends installing wireless apparatus. The style is simple and non-technical, and will have a wide appeal among the latest recruits to the hobby of wireless.

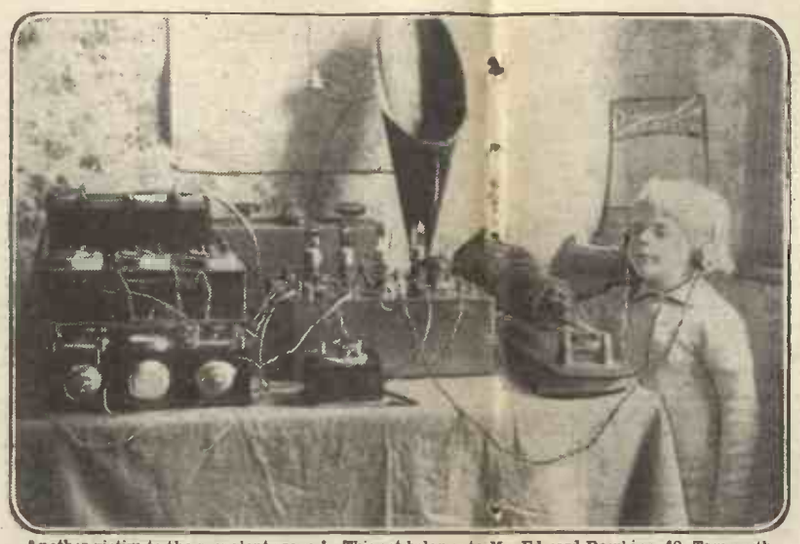
A MANCHESTER SET.



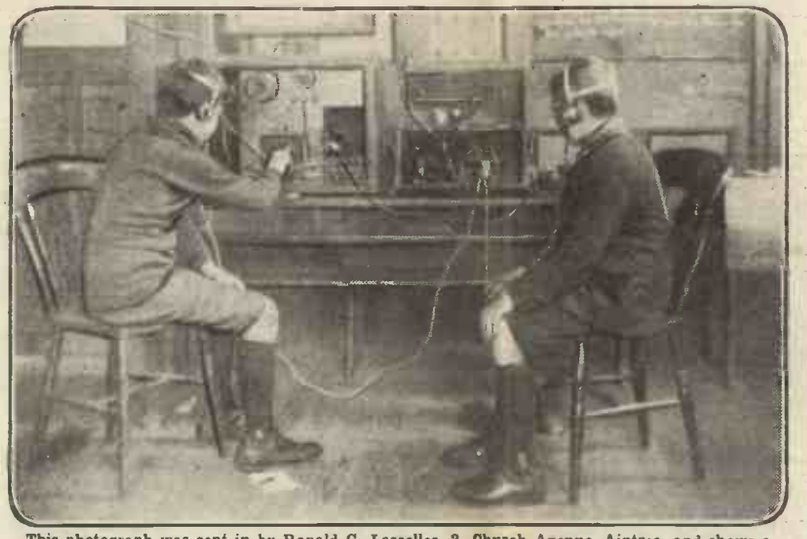
This efficient little set takes up quite a small space, as will be seen in the above photograph. It belongs to Mr. H. G. Dryson, a member of the Manchester Wireless Society, who has his own set at Temperley, Cheshire.

A one-man broadcasting station in America. The instrument is of the one-string variety, and is played upon with an ordinary violin bow. A microphone is attached to an ordinary gramophone diaphragm to reproduce the louder tones.

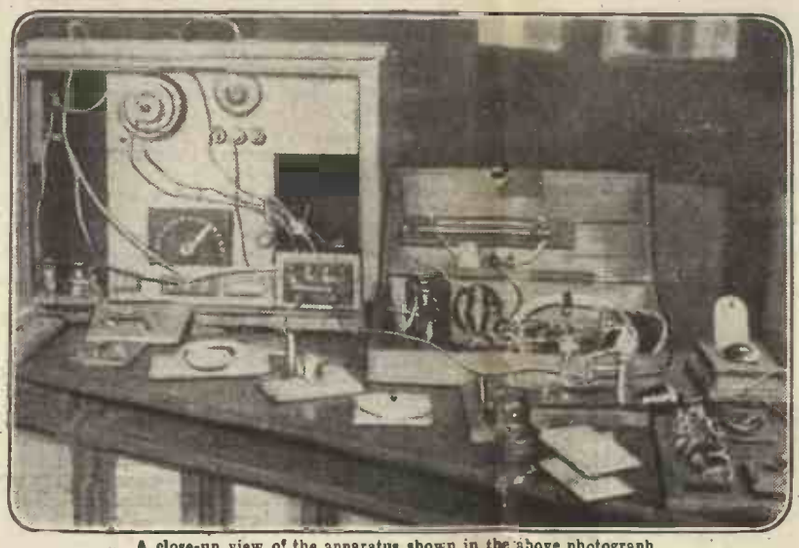
HARK! HARK!—THE SPARK!



Another victim to the prevalent craze! This set belongs to Mr. Edward Dawkins, 48, Tamworth Street, West Brompton, S.W. 6. Using four valves, the loud speaker justifies its name.



This photograph was sent in by Ronald G. Lascelles, 3, Church Avenue, Aintree, and shows a home-made set fitted up in his school. Young amateurs who have sets fitted up at their schools are invited to send photographs to this paper. If published, 10/6 will be paid to the owner of the photograph.



A close-up view of the apparatus shown in the above photograph.

WIRELESS AT A DRAPER'S.

A wireless receiving set has been fitted up by the staff of a big South London draper's at Clapham Junction. Our photograph shows some of the staff listening to 2 M T.

At the Fun City, Bridlington, a public receiving set has been instituted. For sixpence a time one can listen in for ten minutes. The Hague, Writtle, and Marconi House concerts draw large crowds. A six-valve set is employed, and there are ten pairs of 'phones. Our photograph shows a rather puzzled patron having his money's worth.

Step by Step in Wireless

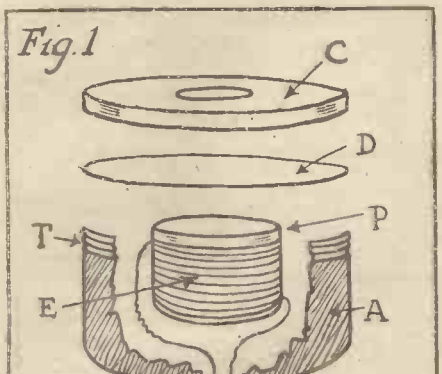
No. 9.—ACTION OF RECEIVING TELEPHONES.

THERE are many wireless amateurs, including some who have quite a good practical and theoretical knowledge of wireless telegraphy, who are puzzled over the large ohmage resistance of their receiving telephones.

The majority of amateurs are fully aware that resistance, unless introduced into a circuit for a special purpose, is an undesirable factor. Why, then, they ask, do telephones possess such an enormous resistance as 1,000, 2,000, or perhaps even 4,000 ohms? Surely, they say, it is necessary to help the received signals; to amplify them, not to place some thousands of ohms resistance in their path. As a matter of fact, the resistance in the telephones is unavoidable, owing to the number of turns of wire which compose the winding of the electro-magnet or magnets.

The telephone earpiece is used to convert the rectified signals received into sound, and it is as well at this juncture to give a brief description of the component parts of the telephone. The relationship between electricity and magnetism has already been briefly dealt with in the pages of POPULAR WIRELESS. It will therefore be sufficient to say that the functioning of the telephone depends primarily upon the action of an electro-magnet. To avoid confusion a diagram is given in Fig. 1, showing the fundamentals necessary for a telephone receiver. A is the case or container, and C the cover which is usually affixed to the case by screwing it on to the thread T. In many types of telephones the screwing on of the cover serves also to keep the diaphragm D in place, over the electro-magnet E. The electro-magnet consists of an iron core P, which, unlike the cores of most electro-magnets, is permanently, although weakly, magnetised.

A certain number of turns of wire are wound upon this core to complete the electro-magnet, and it is this winding which determines the resistance of the telephones. The strength of the magnetic field which emanates from an electro-magnet will vary according to the number of turns of wire taken round the core, and also the amount of current flowing in the coil. These two factors reckoned together are known as "Magneto-Motive Force."



As the iron core must of necessity be small to go inside the telephone earpiece, it is obvious that the only way in which a considerable number of turns of wire can be wound on the bobbin is to use a very thin wire. The thinner the wire used, the greater the number of turns, and therefore the magneto-motive force. The resistance of the telephone earpiece will, however, also be increased.

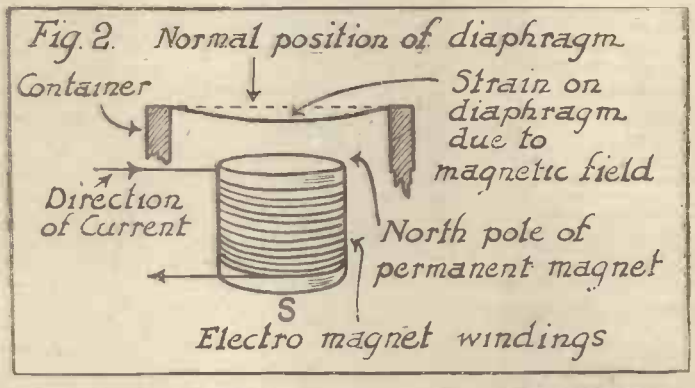
But when the telephones are connected in the receiving circuit, the increase in magneto-motive force is greater when the bobbin of the magnet is wound with a large number of turns of fine gauge wire, than when it is wound with fewer turns of thicker wire. Therefore, despite the additional resistance offered by the thinner wire, greater magneto-motive force will be obtained from the telephones with the higher resistance.

It has already been shown in POPULAR WIRELESS that if a wire be wound in the form of a spiral, and a current of electricity passed through the wire, the lines of force radiated will give the coil of wire definite magnetic properties, one end of the coil becoming a south pole and the other end a north pole, according to the direction taken by the current. What, then, will be the effect of winding such a coil of wire round the weak permanent magnet which is used as the core of the electro-magnet in the telephones?

There is already a certain amount of magnetic influence being exercised upon the diaphragm of the telephone receiver by one pole of the permanent magnet, shown in Fig. 2 as the north pole, and if the field thus radiated from the permanently magnetic "core" is strong enough, the diaphragm, being very thin, will tend to bulge downwards towards the magnet. If a current now flows round the winding of the electro-magnet in the direction shown in Fig. 2, the magnetic field created will assist the magnetic field already influencing the diaphragm, which is consequently drawn nearer to the electro-magnet.

If the current flows as in Fig. 3, however, the strain evinced by the "core" magnet upon the diaphragm is weakened and the diaphragm recedes from the magnet. Any alteration of the density of the magnetic field between the magnet and the diaphragm will cause it to vibrate.

Received signals passing from the aerial through the detector to the telephones flow round the windings of the electro-magnet, and in doing so vary the steady magnetic field existing between the magnet and the diaphragm. The magnet is therefore made stronger and weaker, alternately, and the diaphragm vibrates according to the variation in the



magnetic field influencing it, as already explained. When the received signal has passed the electro-magnet ceases to function, and the diaphragm consequently stops vibrating.

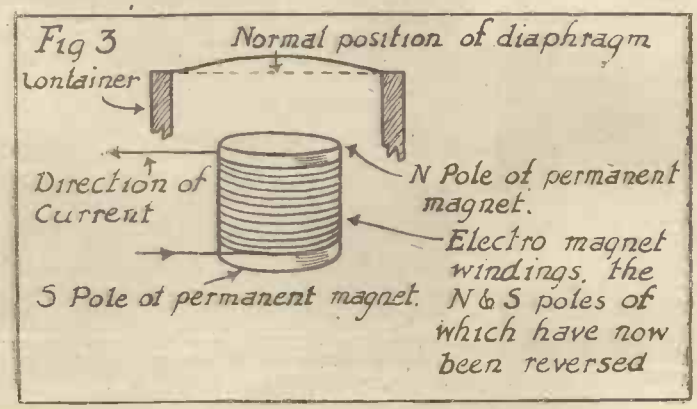
Telephones having an ohmage resistance of something in the neighbourhood of 60 each earpiece are known as low-resistance telephones, and are included in the receiving circuit of a wireless set by connecting them through a telephone transformer. Telephones having a resistance above 1,000 ohms each earpiece are "high-resistance" telephones, and may be included directly in series with the receiving circuit without including the transformer.

In the wiring diagrams of many single-valve circuits the telephones are shown connected between the positive terminal of the high-tension battery and the plate of the valve. Good results can be obtained by connecting up in this manner, but the method of inserting the telephones between the negative lead of the filament battery and the negative lead of the high-tension battery is probably the better.

By using the latter method the positive voltage applied to the plate does not flow through the windings of the telephones. Treat your telephones with as much care as you do your valve. They are sensitive instruments. Remember that heavy blows given to a permanent magnet will weaken it, and careless handling does not improve them.

If telephones are worn for long periods during hot weather, unscrew the "cap" and dry the diaphragm. You will find it is quite moist, and as the diaphragm usually consists of soft iron, it may rust if left unattended.

Finally, overhaul the flex leads occasionally. They are apt to fray on the edges of the table, or parts of the set, being continually in movement when the set is in use. If the insulation is frayed off of both wires, the resultant short circuit will cut the telephones out of circuit altogether.



WIRELESS CLUB REPORTS.

The Editor will be pleased to publish concise reports of the meetings of wireless clubs and associations, reserving the right to curtail the reports if necessary. An asterisk denotes affiliation with the Wireless Society of London.

The North London Wireless Association.*

THE above meets on Monday evenings in the Physics Department at the Northern Polytechnic Institute. Some very interesting lectures and demonstrations have been given in the past, and an extensive programme is being arranged for the future.

A powerful receiving apparatus has been installed, designed and made by members of the club.

Inquiries from prospectve members will be welcomed, and young enthusiasts are specially catered for.

Hon. secretary (pro tem.), Mr. V. J. Hinkley, Northern Polytechnic Institute, Holloway Road, N.7.

North Middlesex Wireless Club.*

The 94th meeting of the club was held on Wednesday, June 28th, at Shaftesbury Hall, Bowes Park. In spite of the inclement weather there was an excellent attendance. The chair was taken by the president, and after a few preliminary remarks he called on Mr. W. Gartland to deliver his paper, entitled "The Miscellaneous Applications of the Thermionic Valve."

Those of the members who have heard Mr. Gartland on previous occasions were anticipating something interesting, but all were surprised to hear the very good and consistent results obtained by Mr. Gartland on apparatus which he had just brought to the hall and had had very little time to adjust. Anyone who has had the unpleasant experience of bringing a lot of instruments for a lecture, and has failed to produce the results intended, will the more readily understand how gratifying it is to be able to record that Mr. Gartland's experiments did *not* fail, but were a great success.

The chief instrument was an altered Mark III. Receiver, and by means of an ingenious barrel contact switch, either one, two, or three valves could be used as desired. This enabled the lecturer to show the valve being used for detecting and amplifying. Speech and music was received from several stations, and by means of a simple loud speaker was rendered audible to all present.

Unfortunately the time passed so quickly that Mr. Gartland was unable to go fully into the many other uses of the valve, but the brief outlines which he gave were sufficient to show that the applications of the thermionic valve were only just beginning to be realised. The members will look forward to hearing Mr. Gartland again at an early date.

Particulars of the club may be obtained from the hon. secretary, E. M. Savage, "Nithsdale," Eversley Park Road, N.21.

Croydon Wireless and Physical Society.*

A meeting of the Croydon Wireless and Physical Society was held on Saturday evening, July 1st, at the Central Polytechnic, Croydon.

Although the attendance was not so large as usual, this was more than compensated for by the enthusiasm of the members present. Mr. A. H. Peakman, a member of the society, very kindly provided two buzzer sets for Morse practice, and the members divided into two groups, one consisting of the more advanced Morse readers, who practised high-speed work, and the other of the less experienced gentlemen who were desirous of improving their Morse reading.

After spending a profitable hour, the members had an informal talk on innumerable radio subjects, ranging from the harmonics of G B L (Leafield) to the date on which broadcasting would commence, these subjects in particular calling forth some forcible remarks. The meeting terminated with a vote of thanks to Mr. Peakman for the loan of his instruments.

The secretary, Mr. B. Clapp, "Meadmoor," Brighton Road, Purley, wishes to announce that there will not be a meeting of the society in August, the next meeting being held on Saturday, September 2nd. He will be glad to hear from any lady or gentleman who may be desirous of joining the society.

Leeds and District Amateur Wireless Society.

A general meeting was held on Friday, July 14th, at the Leeds University, Mr. G. P. Kendall, B.Sc. (vice-president), taking the chair at 8. p.m. The chairman called upon the hon. secretary to discharge certain business, which included an announcement to the effect that as a result of a meeting of the committee it had been decided that any person who is elected to the membership of the society during the course of the remainder of this session shall be entitled to all the benefits attached to the membership for that period, upon receipt of entrance fee of half-a-crown. The chairman then called upon the hon. secretary to deliver a paper on the subject of "Maritime Wireless Communication."

The lecturer commenced his paper with a consideration of the great advantages that were resultant upon the installation of wireless apparatus at sea, and briefly reviewed the very many facilities that such apparatus readily presented. The subject was outlined historically from the day when Marconi installed his plant aboard the Italian cruiser "San Martin," exactly twenty-five years ago, through the progressive years that followed, until the present day, when wireless has become almost an essential part of a vessel's equipment.

After a vote of thanks had been accorded to the hon. secretary, the meeting was declared closed towards 10.30 p.m.

Hon. secretary, Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

Liverpool Wireless Society.*

At a recent meeting of the Liverpool Wireless Society, an informal exhibition of apparatus was held. Mr. A. L. Lyon exhibited a German valve set; Mr. Vere-Smythe a single-valve set of his own construction; and several other members lent apparatus of interest to everyone.

Mr. J. H. Swift, the hon. treasurer, then started his 3-valve home-made set up, and the reception of telephony and music was accomplished in a manner which surprised everyone.

A vote of thanks to Mr. Swift and the other gentlemen who helped to make the evening a success was passed unanimously.

At a committee meeting it was decided that Mrs. Skelden, being the first lady to apply for membership, should be elected an honorary member.

The next meeting will be held on July 27th at the Royal Institution, Colquit Street, off Bold Street, at 7.45 p.m.

Hon. secretary, James K. Wilkie, "Avondale," Knowsley Road, Cressington Park, Liverpool.

WIRELESS CLUB RULES.

By GEORGE SUTTON, A.M.I.E.E.

IF one happens to be a wireless man, taking his walks abroad, he notices every flag-staff and appraises its value, not in terms of its usefulness for displaying a big flag, but as a potential anchorage for an aerial. He compares or contrasts it with his own achievement or possession, and by that empirical standard assesses its right to exist.

The writer offers these remarks as an excuse, or at any rate as a palliation for those which follow, for, being the secretary of a wireless society, he reads the notices of the other clubs with a critical eye and, he hopes, an understanding brain.

Why the Embargo ?

The following notes appearing recently in a contemporary journal brought him up "all standing," and he trusts that a brief consideration of their purport will be of benefit to the secretaries of other wireless clubs who happen to read them.

"Discussion on various rules for improvement of the society and the admission to the society of various firms dealing in wireless apparatus and not at present holding receiving licences. After a lengthy discussion, it was decided to call all the members together and hear their views. There were 14 new members' names submitted for membership, but they were not at present holding receiving licences, and as the rule stands they could not be admitted to the society. This will be brought up at the next meeting. Listening in on the club set brought the evening to a close at 9.30 p.m."

The phrase "not at present holding receiving licences" seems to be the whole point of the case, and the writer earnestly suggests that the club which has such an embargo in its rules should go out of its way at once to expunge it.

Of course, there is much which might be said for its retention as keeping the meetings for the assistance of those who had really found difficulties, and not encouraging newcomers who were only asking for trouble. But, for all that, it seems to savour too much of the Irishism of refusing to put on a new pair of boots until one had worn them a day or two.

Catch Them Young.

We are supposing that the members of the club whose secretary wrote the notice are one and all convinced that in wireless they are on a good thing, that it is a highly desirable and gratifying experimental science. But is there really any reason why we should not open the door to others who, not at present practitioners, are just as likely as we ourselves to make good when they are fully qualified by possessing a receiving permit ?

So, much rather than tell them to go and get a receiving licence and then call again, let us gather them in and tell them how to go about the work of asking for the permit. You can do much with a boy, or any other wild animal, if you catch him young, and you have made a friend of the wireless amateur if you have helped him to become one; assisted at his birth, so to speak.

Previous to the above notice the same society issued the following :

"As the membership is increasing so rapidly, all those interested in wireless in —— and district would be well advised to make early application for membership, as there are likely to be drastic alterations in rules re entrance fee, etc."

We would not suggest or support the idea of putting up a barrier to entrance because many were striving to come in, and we might be crowded. As wireless societies we have not always been fashionable, and it is very possible that the future may hold for us such hard times that we shall be glad of everyone who can in any way befriend us.

History is full of examples of regrettable restrictions to progress, which, if successfully barricaded back at one point, is almost sure to find a way through at some other, the more irresistibly for having been checked earlier on in its course.

Useful Men.

Even wireless apparatus dealers have their uses as members, for are they not out to supply the demand of the amateur ? And where better can they learn of his needs than in the club meetings ? On the other hand, also, they often have advance information of new apparatus, even if they are unable to let their fellow-members have a privileged glimpse of it before it is put into stock. Then, too, their knowledge of the best brands of cells to use for H.T. batteries, and—tell it not in Gath—a possible discount to club members.

About the only good reason for excluding an applicant for membership is incompatibility, and the rules should be so framed that members should have a voice in electing those with whom they are expected to associate, though any frivolous objection, or one of mere dislike, should be ruled out.

The Best Model.

The committee cannot be expected to know everybody who applies for an entrance form, but other members, being more numerous, might be able to supply little details of personal character not otherwise available. "Let 'em all come," and then be as critical as you like, but the desire to join the society should not be a disqualification any more than the non-possession of a wireless receiving permit.

The Wireless Society of London is the model upon which all wireless society members should base their aspirations, for at their meetings are gathered all that is great, dignified, wise, and resourceful in the world of wireless matters.

After the affiliation of your club is granted your secretary will be able to introduce a member or two to any meeting of the Wireless Society of London, and all who can should certainly avail themselves of the privilege.

Your association will not have the material to rival the parent society, but you can see to it that your meetings are as orderly, and that your members are as loyal to their regularly elected officers.

The generality of members of a wireless society are painfully shy for a long time after joining. The diffidence with which they filled up the application form for membership and left blank the space headed "qualifications" still clings to them.

They hear perhaps with awe one of the senior members airily explaining a way out of the difficulties that have been experienced by another member, and contrast their own abysmal ignorance with the shining knowledge of the speaker, speaking, it may be, for the most part in what is for them an unknown tongue. They make up their minds that they will conceal their ignorance rather than expose it.

Now it is here that the agenda committee has its chance. The chairman and secretary and the remainder of the members in committee nominate as many members as they can persuade to stand for five vacancies.

These five committeemen when elected represent : I. The Very Elementary ; II. The Intermediate : III. The Advanced Members ; with two others to represent the classes of members intermediate between I. and II. and II. and III. It may take a whole evening, possibly two, to get this matter settled, but it is well worth the time.

With tact in the chair there is no need for heartburning over the result of the grading process into the five classes. It is of course obvious that the representative of any class must belong to that class. It has generally been found that members are anxious to grade themselves down rather than up, and this is where the tact of the chairman will be drawn upon.

Hidden Talent.

It is expected that the members of the agenda committee shall actively canvass their constituents for agenda subject-matter, and as they are not responsible for the answers to any questions which they put forward on behalf of the others, they usually work very assiduously.

The subjects so gathered are sorted out, rearranged, and classified by the chairman, secretary, and co-opted members, and it is really surprising how nearly self-supporting this plan makes the meetings.

Apart from the five classes above indicated, you will have among your members specialists in various branches of theoretical and applied science, and though perhaps at first their professional bent may not seem to lie along the same lines as wireless, a little ingenuity will probably discover some connection between the apparently divergent interests. Look for it in the personal connection between the man and his hobby, and how he brings his professionally set ideas to bear upon the latter.

Such men, when started going, often prove a gold-mine of interesting and useful information, and no effort should be made to narrow down their treatment of any subject they may elect to discourse upon.

An occasional competition, if a subject can be devised, raises a great deal of emulation and not a little interest. A competition for the neatest basket-wound coil, the smallest receiver, the best kind of grid leak, and most efficient detector, are suggested as types rather than examples.

Little Things That Count.

The attendance register, again, is a very important book. Minutes of previous meetings which do not record the previous week's attendance are incomplete. There is no need, even in a fairly large society, to keep the book at the door. It had better circulate during the meeting.

If it is possible, a cup of coffee and a biscuit occupying ten minutes at "half-time" should be an institution, as it makes a lively break between two halves of a programme. If, however, preparation for this devolves on any club members, it had better not be started. It can probably be easily arranged by the hall-keeper at no greater liability to the club or its members than paying for what they consume individually.

We have said nothing so far about the name of the society, and as this should be incorporated in Rule I. its discussion now is very late. Do not let the word "club" appear in the title you adopt. You must use it occasionally in description and discussion to provide a synonym.

Get "wireless" or "radio" or some such word into the title to make it distintive, and though the word "amateur" has fine associations and derivation, it is not a *sine qua non*.

Encourage by every possible means the exhibition by members of their sets and special appliances. He will be a clever man who is so perfect that his set cannot be improved in some particular, and a dull one who cannot offer some suggestion as to how he would have gone differently to work to achieve a certain effect.

In no office is tact more needed than in that of the treasurer. Some of your best members would hate to feel that they were being "dunned" for the subscriptions they had laid out and forgotten to bring away with them.

HEROES OF WIRELESS.

By T. C. BRIDGES.

IT was at the beginning of the present century —to be exact, in the year 1900—that steamships first began to instal Marconi's system for wireless telegraphy in their vessels. One of the first to be so equipped was the Princesse Clementine, of the Belgian Royal Mail Steam Service.

Seldom has any novelty been so rapidly vindicated, for almost on her first journey, after she had been fitted, a big Swedish barque, the Medora, was sighted, water-logged, on the Ratel Bank. The Clementine's operator called up La Panne: La Panne communicated with Ostend, and within an hour a tug had left for the Ratel Bank, which eventually towed the barque off safely.

Three weeks later the Princesse Clementine herself ran aground in a fog, near Mariakirke, and by means of her wireless called help from Ostend.

The Titanic Disaster.

Within the past twenty-two years wireless has been the means of saving thousands of lives from drowning on other parts of the sea, especially fire—lives which, before the days of this beneficent discovery, would infallibly have been lost.

To give just a few instances out of many.

In 1909 the Slavonia was stranded off the Azores. Help brought by wireless saved 410 lives. In the same year the Republic was wrecked by collision in a fog. The Baltic, in response to wireless calls, rescued 761 passengers and crew.

In 1911 the Delhi was wrecked off Cape Spartel. She had aboard the Princess Royal, the late Duke of Fife, and their two daughters. Wireless signals brought help from warships, and all were saved.

703 lives were rescued from the Titanic in response to wireless calls, and 204 from the Veronese, which lay helpless in a fearful storm on the rocks of the Portuguese coast.

Do you remember the case of the Volturno burning in mid-Atlantic? The passengers and crew were roasting, while her operator flung calls for help through the ether. No fewer than eleven different vessels heard, and, coming racing up from a radius of 200 miles, saved 521 souls from certain and awful death.

The Templemore, the Tasman, the Cobequid, the big Spanish steamer Balmes—here are a few more cases of ships blazing in mid-ocean, yet from which—thanks to wireless—hardly a life was lost.

And what about the men who sent out these life-saving signals—men who stuck to their posts when the ship was reeling to destruction beneath their feet? The roll of the heroes of wireless is already a long one, and it grows from year to year.

A Classic Case.

On a big liner there are always at least two wireless operators. They sleep next to the wireless cabin, and one is always on duty night and day. He sits, with the telephone receiver fixed over his head, ready and waiting for the messages which come out of space across the deep.

And if his own ship is in peril there he must remain to the last, flinging out calls for help. The classic case is that of Jack Binns, wireless operator of the Republic already mentioned, who stuck it out for ten hours on end, ceaselessly calling C.Q.D. Happily, he, too, was saved, with the rest of the ship's company.

Alas! there are other cases in which the end was not so fortunate, cases in which the wireless man has given his life for his friends.

In August, 1909, the steamer Ohio was wrecked off the stern coast of Alaska. George Eccles, of Winnipeg, her wireless man, stayed to the end, and saved the lives of all, except one passenger, three of the crew, and himself.

"I am ——"

The operator at Ketchikan on the coast caught his last message: "Passengers all off. Adrift in small boats. Captain and crew going off. Last boat waiting for me now. Good-bye." A pause, then two more words, "I am ——" After that, silence.

One of the survivors tells how, at the last moment, as the ship made her final plunge, Eccles ran from the cabin and dived into the sea. But in doing so he must have struck a piece of wreckage, for when his body floated up again he was dead. There was a dreadful wound in his head.

Another triumph for wireless and for a wireless man was achieved in the rescue of the steamer Ontario, which caught fire off Montaux Point, on the Atlantic coast of North America.

The first message received was at Newport: "13.4.12, 2 a.m. Big fire below."

The last was 2.45 a.m.: "About to be beached near Montaux. Flames driving me from the wireless room."

The operator had put it mildly. With the flames scorching his back and licking the walls of his cabin, he had stuck to his post for forty minutes. His hair was singed and his skin blistered before he finally dashed out of the death-trap. But he had done his job. Help was at hand, and all were saved.

Close Calls.

Wireless was installed in the liner Kentucky just before she started on a 14,000-mile voyage around Cape Horn. She ran into a fearful storm, her seams opened, and she began to fill. Early on a Friday morning the chief engineer sent word to W. F. Maginnis, the wireless operator, that the ship was doomed. Maginnis began calling, but could get no answer. Half an hour later the electrician told him that the water was creeping up, and that the dynamo power would soon be lost. Maginnis asked that all hands should devote themselves to saving the dynamo. The turbine engine and the dynamo were wrapped in canvas, and within another half-hour an answer came. The Mallory liner Alamo had heard, and was coming as fast as her engines would drive her.

But it was half-past three in the afternoon before she arrived, and by that time the deck of the Kentucky was awash. Yet, in spite of the high seas, all her crew were rescued, and when they had clambered safe aboard the Alamo, the first thing they did was to give three cheers for Maginnis.

Terrible storms rage on the Great Canadian lakes. In September, 1910, a great train-ferryboat was caught in a sudden furious gale. The wireless man called for help, which came swiftly, but just as the rescue steamer came alongside the huge craft rolled over and sank.

Most of the passengers were picked up, but the wireless man who stuck to his post was among the drowned.

WHAT ARE THE WILD WAVES SAYING?

RADIOTORIAL

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

By the time many of my readers turn to this page they will have read Mr. Risdon's interesting article on the new ether theory.

The question as to whether the ether medium exists or not has aroused a heated controversy in America.

Some say there is no such thing as ether; others say it exists, and that Steinmetz and Einstein are simply making assertions which have no scientific value behind them.

Now, the very mention of the name Einstein will probably make some of my readers rather chary of interesting themselves in the ether controversy, because Einstein's theory of relativity, as we all know, is something beyond the comprehension of the man in the street.

But Mr. Risdon's article, if read with care and intelligence, will make clear to the veriest tyro what all the argument is about, and at the same time it will show how fascinating a controversy of this nature can be.

Think of the issue at stake. If Dr. Steinmetz is right in his assertions—and remember, there are many learned men who believe he is—then the theory of wireless communication collapses like a house of cards, and when we attempt to explain how and by what medium wireless waves are propagated, we have no ether to help us.

In next week's issue of POPULAR WIRELESS one of the world's greatest scientists—a veteran of science indeed—will express his views on the new ether theory in a specially written article.

The scientist I refer to is Sir Oliver Lodge, whose experiments and inventions in connection with wireless alone have made his name famous the world over.

In his article, entitled "For and Against the Ether," Sir Oliver Lodge deals with a subject which, I suppose, he knows more about than any man living to-day: but, more important still, he deals with it in a fashion which will appeal to readers of POPULAR WIRELESS who have but recently taken up wireless as a hobby.

Sir Oliver Lodge's article makes fascinating reading, more so because he is such a past master of explaining a difficult subject in clear and non-technical language.

Therefore, it only remains for me to urge readers to order their copies in advance, for it is certain that next week's POPULAR WIRELESS will be in great demand.

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

Readers are requested to send necessary postage for reply.

"CRYSTAL" (Woolwich).—I have a telephone receiver of watch pattern, which is marked on both coils 100, and on the horseshoe magnet 200. What will be its total resistance ?

200 ohms.

What is a megohm ?

One million ohms.

What is Croydon station call ?

G E D.

Could Croydon telephony be heard in Woolwich on a small crystal set with a small and low indoor aerial ?

No.

* * *

D. D. (Edinburgh).—Do I require a licence for a crystal receiver with a twenty-mile range outdoor aerial ?

Yes.

Is a battery required with a crystal set ?

No, unless a carborundum and steel detector is used.

Is a twenty-seven feet twin aerial long enough ?

No. If you cannot lengthen, make it a four-wire aerial, spacing the wires by at least 18 in.

Is twelve feet too long for an earth lead ?

Yes. Endeavour to shorten it; it cannot be too short.

* * *

D. P. (Bristol).—Why am I advised to use stranded wire for all wireless work ?

Stranded wire has a greater area of surface than solid wire. High-frequency currents travel on the surface of conductors, therefore stranded wire has less "skin" resistance. It is also to be preferred on account of its greater flexibility.

* * *

"TRANSFORMER" (Brighton).—I have a pair of 120 ohms resistance telephones. I understand that if I want to use these with a crystal set I must employ a transformer. If this is so, can you tell me the number of turns of primary and secondary winding, and the gauges of the wire I shall require to make one ?

You will find it a very arduous task. The core must be soft iron. For the primary winding you will require 15,000 turns of 42 S.W.G., and the secondary 800 turns of 38 S.W.G. Before you have completed the primary you will probably come to the conclusion that it is cheaper to buy one.

* * *

F. D. E. (Briton Ferry).—Will a group of telegraph wires 250 feet away, and running at right angles to my aerial, be very detrimental ?

No.

* * *

B. T. (Birmingham).—Which is the best to buy, three-valve panel or the three separate panels in their respective units ?

Many prefer the separate units on account of the fact that they can be easily adapted to various experimental purposes, and many others prefer them because they can be purchased in instalments, as it were. On the other hand, the combined three-valve set has the advantage of compactness and portability, and if of good make and design, giving an efficient arrangement of circuits, it is to be preferred.

* * *

S. H. (Bourne).—Can rubber tubing such as is used for conveying acetylene gas to lamps be used to insulate the lead-in wire ?

This can be used, but rubber rapidly deteriorates with exposure to light and air, and therefore it would want constantly renewing unless vulcanised.

* * *

A. K. G. (Bodmin).—I wish to erect a 100-foot single aerial from the house to a tall tree that is about 150 feet away. Is there any objection to the completing of this distance with rope ?

Not at all, but it would be advisable to use a good strong cord to reduce the weight, and you should not forget to let out the aerial a few feet when it rains, and at night, when the dew is heavy, owing to the fact that cord and rope will shrink in those circumstances. This is a little hint that all who have masts supported by rope stays and guys would do well to note. If the guys are left too tight over a night that has had a heavy dew, it will invariably be found in the morning that some of them have broken, and probably the mast has fallen.

* * *

G. F. (Towcester) states that he hears good telephony from Eiffel Tower and Marconi House on one valve, but wishes to know how he can improve reception without adding further valves. This is on a double aerial 25 feet long.

In the circumstances these results are excellent, and shows that there is no room for improvement in the existing set.

D. M. B. (Coventry).—Can you give me the dimensions and wire to use for a loose coupler to tune to 5,000 metres ?

Primary 12 by 6 in. wound with 26 S.W.G.; secondary 8 by 4 in. wound with 30 S.W.G.

* * *

"AMATEUR" (London).—Would a garden 26 feet long be long enough for an aerial ?

Yes ; make the most of the length, and erect a four-wire aerial, spacing the wires not less than 18 in. Make it as high as possible, height being the most important factor.

* * *

F. W. M. (Bloomsbury).—What size and amount of wire must an inductance be to give a range from 400 to 4,500 metres ?

425 turns of 22 S.W.G. on a 6-inch former. 1½ lb. of this wire will be necessary.

* * *

"NEVES" (London) asks various questions regarding the adaptation of a crystal set to a frame aerial.

Crystal sets are not suitable for use with frame aerials, an outdoor aerial of some fair efficiency being essential.

* * *

W. F. (Kilburn).—By what means can I store an accumulator after it has been charged ?

Carefully drain off the acid into a bottle that should have for preference a glass stopper, and then thoroughly rinse the plates with distilled water several times.

* * *

B. G. B. (Sheffield).—(*a*) What is the inductance and wave-length of a tuning coil wound with 28-gauge wire D.S.C. on a former 2⅞ in. by 9 in.? (*b*) What is a "jar" compared to microfarads ? (*c*) Is it possible to receive telephony in Sheffield on a crystal set ?

(*a*) 7,500 microhenries giving wave-length range to 2,900 metres on a 100-foot single aerial. (*b*) ·0011 mfds. (*c*) As possible as anywhere else if there is a station transmitting telephony within 15–20 miles. There is no broadcasting station within that distance, but it is possible that there are amateur stations that transmit telephony.

* * *

F. K. (Bury) states that he can obtain no results with his set. He has a carborundum crystal and telephones of 130 ohms resistance without a transformer.

In the first place, the telephones are not suitable, and unless high-resistance telephone receivers of some 4,000 ohms or so are employed, results will continue to be nil. With a carborundum crystal a battery and potentiometer are necessary.

* * *

"RADIO" (Manchester).—(*a*) I am only four miles from the Metro-Vick station that will broadcast, but there are a number of high houses between. Will I be able to hear this station on a crystal type of receiver ? (*b*) What number O.H.M.S. head 'phones will I require with such a set ? (*c*) When will this station commence broadcasting ? (*d*) Does the ten-shilling licence require annual renewal ?

(*a*) As you are only four miles away from this station, the screening will not seriously interfere with reception.

(*b*) Anything from 2,000 ohms upwards ; 4,000 per earpiece is a good value. Ohms, by the way, is one word, being the unit of resistance, and not an abbreviation of a well-known Government phrase.

(*c*) The date for the commencement of the broadcasting has not yet been fixed. The earliest definite news will be given in POPULAR WIRELESS.

(*d*) Yes.

* * *

L. M. P. (Southend).—Would a large piece of crystal give better results than a small piece ?

No ; the actual size is of no great consequence. The sensitiveness depends upon the actual point of contact between the two elements, and this is extremely small.

* * *

S. E. D. (Manchester).—What does P I, P O, S I, S O, on a transformer signify exactly ?

P and S primary and secondary, I and O beginning and end of the windings, respectively.

* * *

"UNDISCHAGED" (Bradford).—Could a spark coil be used to supply the H.T. plate current providing some suitable rectifier was used ?

No ; this scheme has been unsuccessfully attempted. It is found that the irregularities of the spark discharges renders it quite unsuitable for this purpose.

* * *

W. F. J. (Glasgow).—Will results be more satisfying if I add a valve to amplify signals from my crystal set ?

Yes ; use the valve for high-frequency amplification and the crystal for rectifying.

* * *

"EARTHED" (Swindon).—If my aerial alters its direction in the middle and runs off at a right angle, will it change the fundamental wave-length ?

No, but it will be about two-thirds as efficient as a straight wire for reception.

* * *

J. H. G. (Dunstable).—Will an aerial of two wires, 60 feet long and about 20 feet high, give good results with a crystal detector set ?

Fairly. You should endeavour to increase the height.

* * *

F. B. W. (Paisley) states that he cannot get his valve to oscillate on wave-lengths above 1,000 metres, and asks if there is any means of making it do so.

A small two-plate condenser connected across the grid and plate should have the desired effect.

E. D. (Fleet).—If a crystal is inserted in a buzzer circuit, should it allow the passage of the current in the same way as an ordinary conductor ?

No ; a crystal at its most sensitive point of adjustment will have a very high resistance, exceeding 50,000 ohms or so.

* * *

J. M. H. (Wolverhampton).—Can you give me the gauge of wire, etc., necessary to wind a transformer for 120-ohm 'phones ?

Primary 15,000 turns of 42 S.W.G., secondary 800 turns 38 S.W.G. on a half-inch iron core.

* * *

W. L. N. (Darlington).—Why am I told in some books to have two sliders on a single circuit inductance, and in others only one ?

Two sliders are more or less necessary to give fine tuning if a variable condenser is not used. In the event of the introduction of the latter, however, one slider used in conjunction with the variation of the condenser will give the finer adjustments.

* * *

T. D. K. (Beccles).—What is the difference between a 4-volt 40 ampere hour accumulator and a 4-volt 80 ampere hour accumulator ?

The latter has twice the capacity. It should discharge at the rate of one ampere for 80 hours, but at the same time it hardly need be added that it is not wise to time the discharge of a cell by this without reference to the drop in voltage, which should not be allowed to fall below 1·85 volts per cell on a closed circuit.

* * *

D. F. F. (Forest Gate) describes his one-valve set, and states that although it oscillates perfectly on nearly any wave-length within his range he cannot hear the Dutch concerts.

In order to receive telephony, and more especially weak telephony, it is necessary that the circuits shall not oscillate. If the H.T. and the filament temperature are adjusted to the correct relation it should be possible to find a point in the adjustment of the reactance coupling where but a slight variation either way will cause the circuits

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from previous page.)

to commence or cease oscillating. The critical point for the reception of undistorted telephony is that where a slight tightening of the coupling will cause the oscillating. As the addition of capacity is equivalent to tightening the coupling it is advantageous to have a small variable condenser across the reactance to assist. The correct procedure to adopt is to first of all adjust the reactance until the valve oscillates and then loosen the coupling just sufficiently to cause it to stop. If "play" between the points mentioned is of any appreciable extent it will be due to too much H.T. or a too bright filament, and these should be adjusted until a very small critical point is obtained. It would be a quieter ether for the reception of concerts if every amateur would remember that point. For the reception of undistorted telephony the valve should *not* oscillate. It can also be added that it is by the careful application of this principle that the Hague concerts can be heard in England using one valve.

* * *

"ARCLIGHT" (Birmingham).—Can I use dry batteries instead of accumulators for the L.T.?

No: their high internal resistance renders them unsuitable.

* * *

H. E. G. (Leyton).—Will a circuit that has a reactance operating on a closed circuit or secondary inductance fall into the category of those that energise the aerial?

Yes; it will still do this, but not to the extent that circuits having reactances coupled to the A.T.I. do.

* * *

B. T. M. (Norwich).—A wireless friend of mine frequently alludes to "jars" when talking about radio apparatus. In order that it will not be necessary to reveal my ignorance, will you tell me what it is?

Your friend has apparently been in the Navy, as this "jar" is the unit of capacity equivalent to 1,000 cms or ·0011 mfds, and is a term invariably used by the naval wireless man.

* * *

A. R. (Hetton-le-Hole).—Is it necessary to scrape the enamel off the wire used for the aerial?

No; the enamelling is specifically for the purpose of preventing deterioration by the elements.

* * *

"NOVICE" (London).—Are time signals easy to pick up, say, from Eiffel Tower? What preliminary warning is given?

* * *

Yes, quite easy. At 11.44 p.m. the "T" series commences. This is a series of single dashes commencing on the stroke of 11.44, and continuing for about 55 seconds. A single dot denotes 11.45 The same procedure is followed as in the "T" and "D" series, a dash and four dots being the warning indicator. The single dot in the "G" series indicates 11.49 p.m. The call for Eiffel Tower is "F L" and the wave-length 2,500 metres. Two series are sent out in the morning, one commencing at 9·57 a.m. and ending at 10 a.m., the other from 10.44 to 10.48 a.m.

COMPETITION RESULT.

The Prize-winners for the Competition held in No. 4 of POPULAR WIRELESS are:

Mr. W. OGBORNE,
16, Cambridge St.,
Barton Hill, Bristol.

Mr. CECIL REDPATH,
252, Westgate Road,
Newcastle-on-Tyne.

Mr. G. W. GODFREY,
28, Albert Road,
Addlestone, Surrey.

Mr. Ogborne suggests broadcasting could pay its way if a Broadcasting League was started in the United Kingdom, members paying a yearly subscription.

Mr. Redpath suggests loaning apparatus to theatres, etc., at a higher charge, as they would naturally get much publicity, and should therefore pay a larger fee than the private amateur.

Mr. Godfrey suggests amateurs vote for certain programmes, each voter sending a 6d. stamp. Many would pay this small fee if they wished a certain programme to be broadcasted—and, in any case, amateurs would pay 6d. very cheerfully for a good wireless concert any night of the week.

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