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POPULAR WIRELESS Weekly

3d.

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

KING'S NORTON WIRELESS CLASS

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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.

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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.

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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

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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."

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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.

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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.

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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.

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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 reeently 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.

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Ireland Up-to-date.

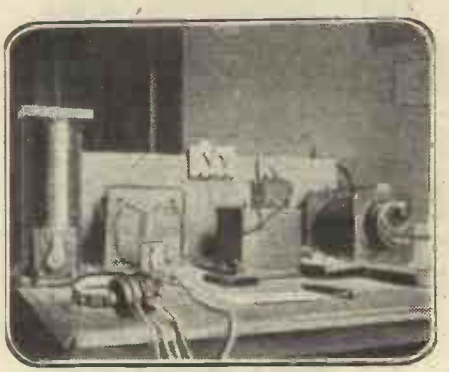
IRELAND is a distinctly unhealthy spot these days, and one never knows when a battle or a free fight is going to break out next, and naturally the police are having an exceptionally busy time.

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.

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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.

* * *

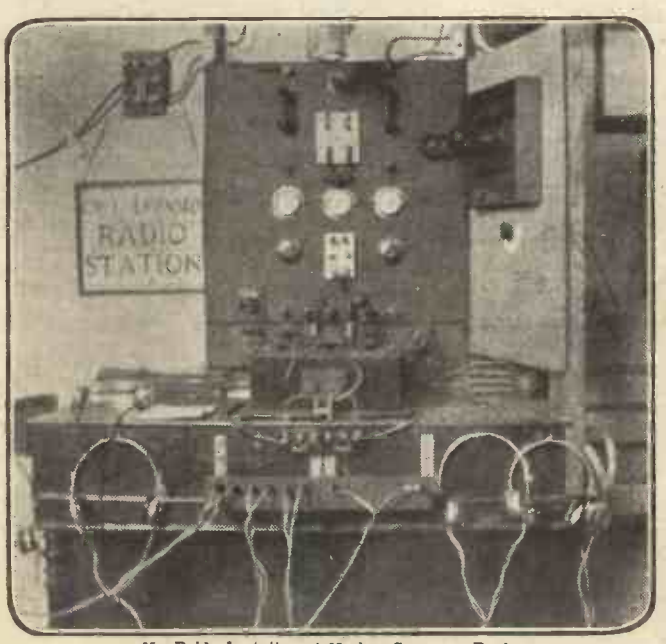
Radio Swindlers.

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.

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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. Vladimir 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."

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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.

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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.

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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.

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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.

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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.

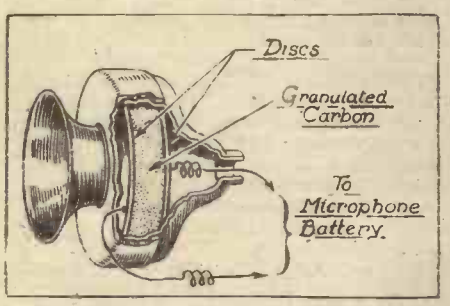


Fig. 2.

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.

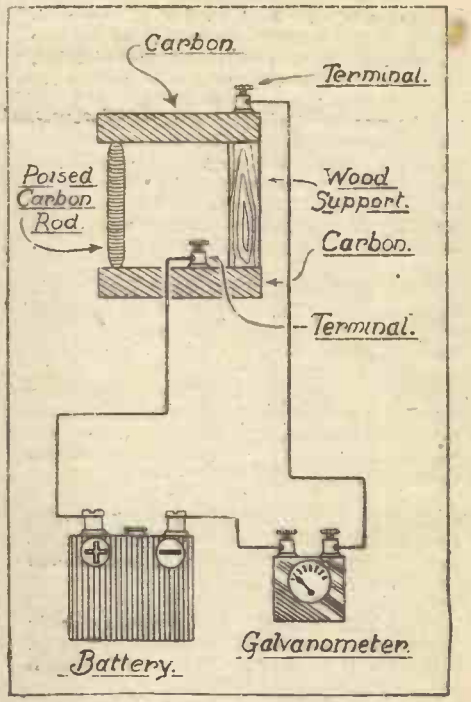


Fig. 1.

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.

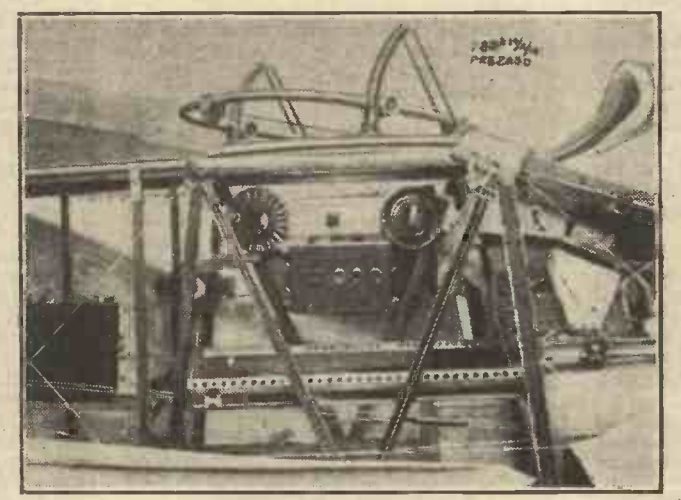
Long wires connected them, along the whole length of the aircraft, to the receiving instruments in the wireless cockpit, which was usually situated in the nose of the machine immediately behind the engine. This position of the relays was, of course, quite inaccessible during flight. Hence the whole success 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!

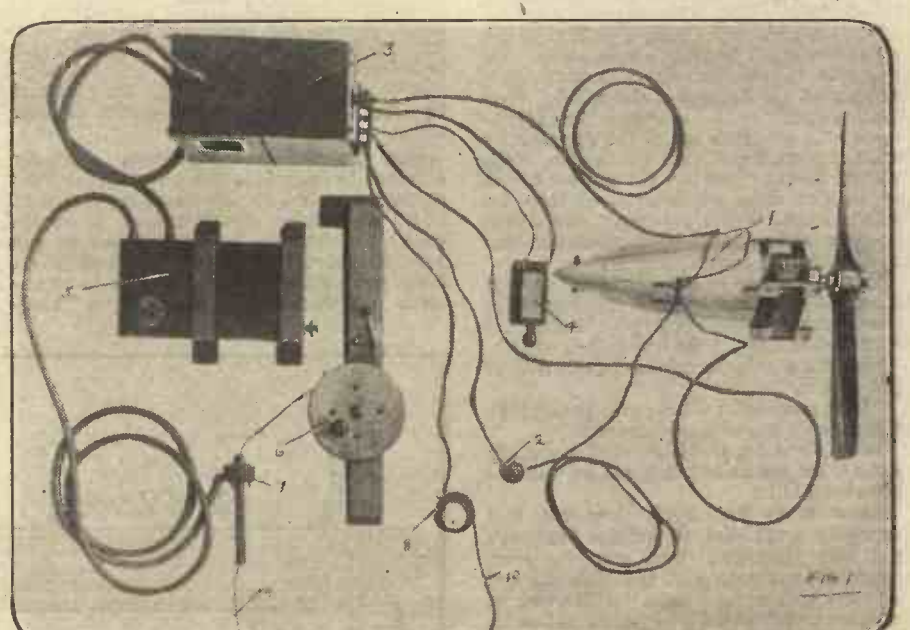
But I remember once having to come down three times in half an hour to readjust relays that had been dislocated each time in the course of "taking-off." It was rather a gusty day and the machine hit every available little lump on the aerodrome before it decided to take the air. One such hit was usually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

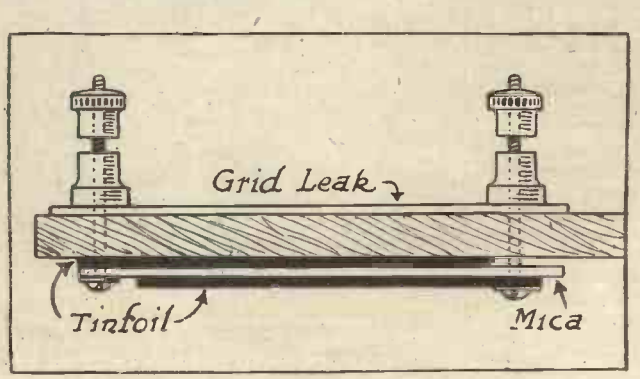
Bore two holes in the wood half an inch in from each end to take the screw of the binding post. Lay one piece of the tinfoil on the wood with $\frac{1}{8}$ of an inch margin along the sides and one end, and $1\frac{3}{8}$ inches margin the other end. Next put on the waxed paper or mica, with holes in 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.

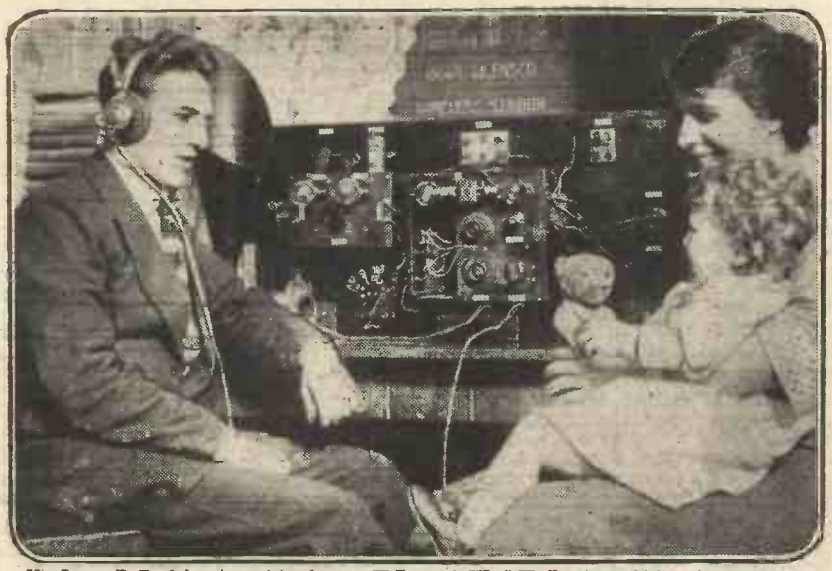
* * *

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.

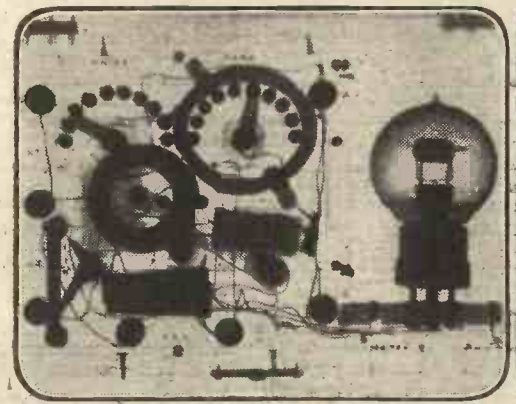
* * *

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.

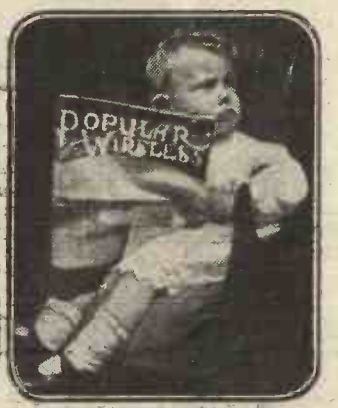
LISTENING TO 2 M T.



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.

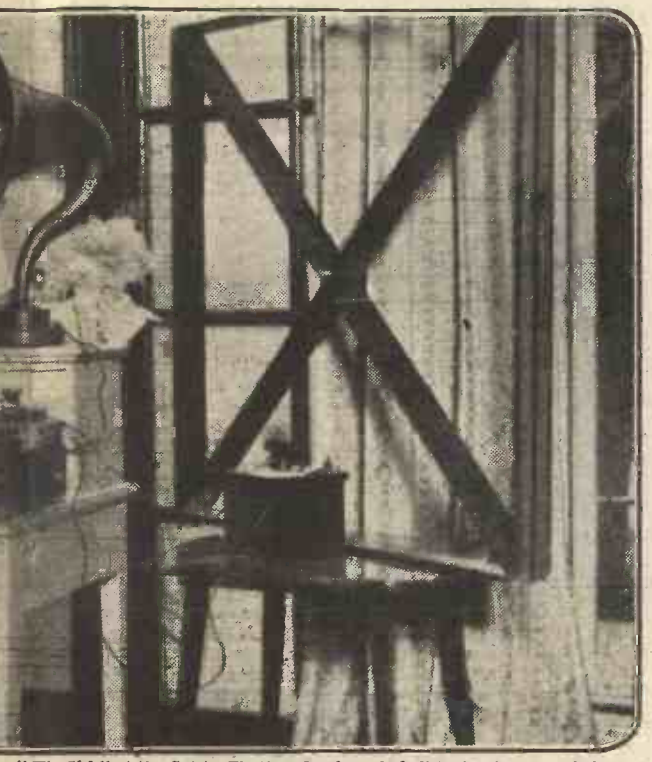
Mr. P. R. Hawton, Chester Road, Erdington, Birmingham, finds wireless useful when out camping, and especially when attacked by hostile Indians and "bad men" from Texas.

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 extreme right of the photograph, and a loud speaker. 2 M T and

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

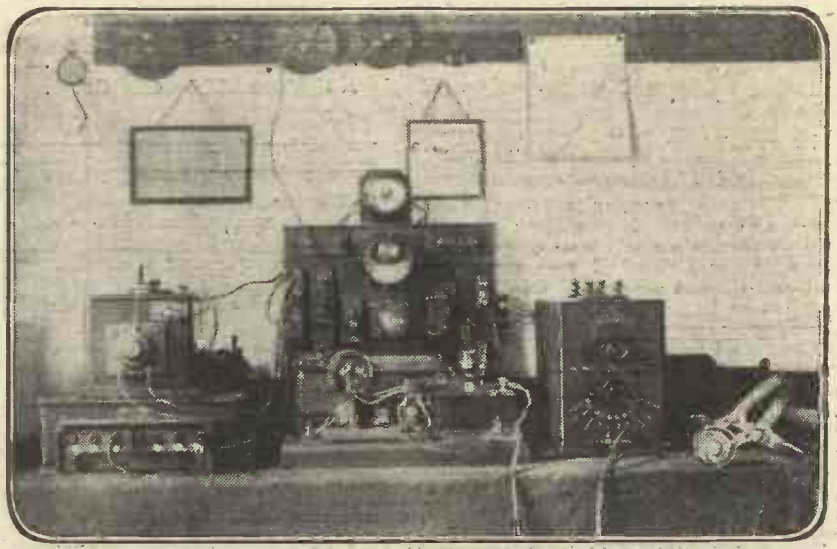
LADY'S BOUDOIR.



y, "His Girl," at the Gaiety Theatre, London, finds listening-in a new hobby. up in her dressing-room. Miss Debenham uses a frame aerial, seen on the 2 L O (Writtle and Marconi House) "come in" quite loud and clear.

ance, and "pick up" good telephony on the aerial shown in the photograph. mber 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.

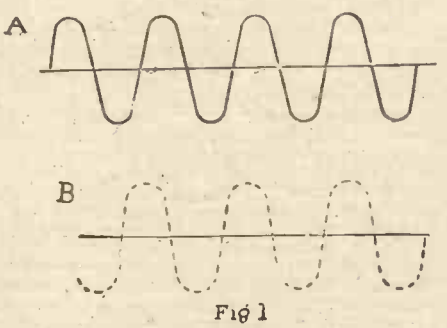


Fig 1

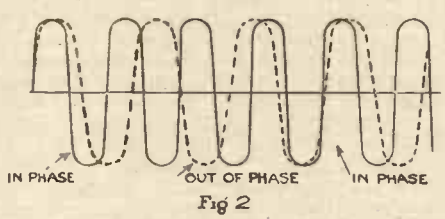


Fig 2

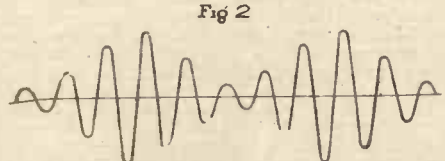


Fig 3

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.33 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.

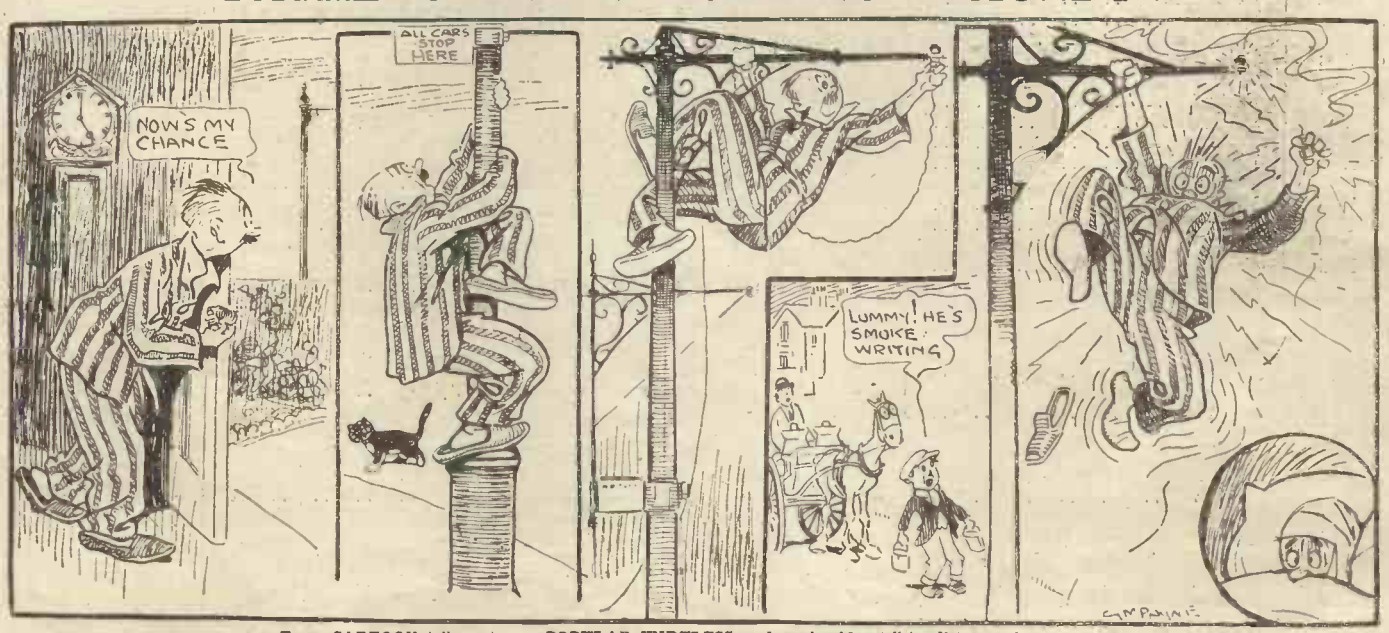
On the whole, readers appear to have found a long-felt want in POPULAR WIRELESS. I only hope they will continue to do so ! The prize-winners are :

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.

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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.

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

No.

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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.

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

Yes.

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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 6¼ inches diameter, with a spacing between the two of one-tenth of an inch.

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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.

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F. G. D. (Liverpool).—Does it matter if the sliding contact of an inductance coil rests on more than one wire?

No.

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"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.

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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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