POPULAR WIRELESS WEEKLY, JULY 28th, 1923. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

THE "P.W." SET: WHAT EVERYBODY'S MAKING.

Popular Wireless

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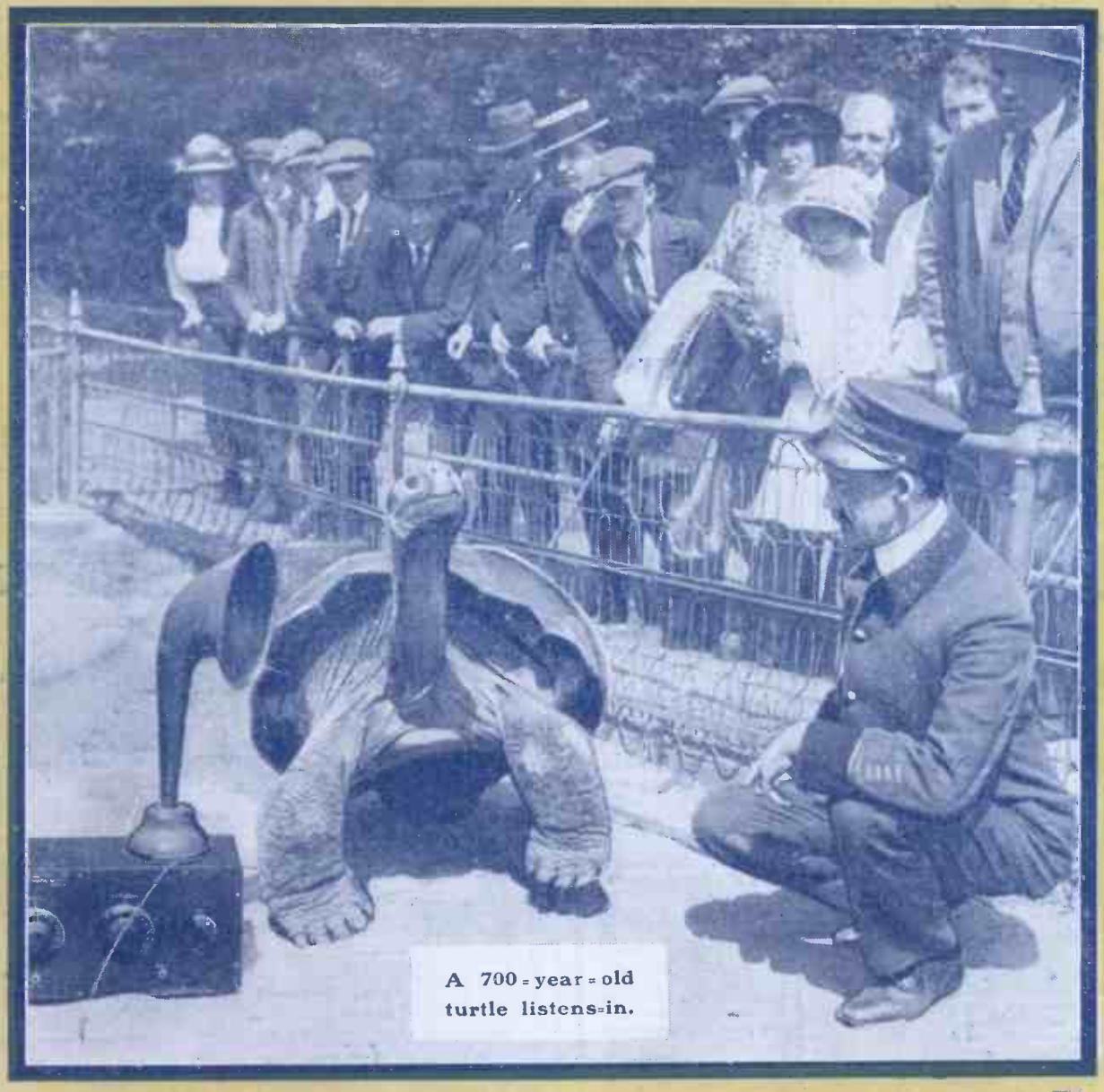
SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc.

July 28th, 1923.



A 700-year-old turtle listens-in.

FEATURES IN THIS ISSUE.

A Frame Aerial Single-Valve Set.
Notes on Crystal Rectification.
Selection of Constructional Materials.
Simple Wireless Calculations.
Page of Practical Ideas.
An Open Core Transformer.

And a long, well-illustrated article on "Protection Against Lightning," by H. Cotton, M.B.E., M.Sc., M.I.E.E.

POPULAR WIRELESS

July 28th, 1923. SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc. [Every Friday.

TOPICAL NOTES AND NEWS.

The Man Hunt.

THE B.B.C.'s "stunt" proved quite successful. Uncle Jeff seems to have had the most exciting time. Whilst he was travelling along the Edgware Road at a good forty miles an hour, he was stopped by a policeman for exceeding the speed limit. The protector of the highways and the public surveyed the car, and with a wink told Jeff to run along. "You are one of the B.B.C's criminals." This is the first time I have ever known of a policeman allowing a criminal to go scot-free.

* * *

A Bad Man.

ON his travels Jeff felt that a little drink wouldn't do any harm. But as time was pressing he hastily rushed into a bar and told the maid that he wanted a "Ginger-beer, quick," as he was running away from the police, having stolen a pearl necklace. The maid threw up her hands in horror. "Lor', sir, have you r e a l l y? Here, take a drink and hop it!" Truly a striking instance of how the handsome "villain" secured the aid of an adoring maiden. Jeff should consider the rôle of Raffles more seriously. Such influence over the female mind is a priceless gift. I wish I had it.

* * *

Leafield and Cairo.

MY attention has been drawn to the fact that since the temporary withdrawal of Leafield's evening service to Cairo, reception in Oxford has improved wonderfully. A friend of mine informs me that the breathing into the microphone by the person broadcasting is distinctly audible.

* * *

Pullman Cars and Wireless.

WIRELESS receiving sets are to be installed on all Pullman railway coaches in the near future. After careful consideration it has been decided not to use loud speakers, because of the possible annoyance they may cause to passengers who prefer to travel in silence. Instead, headphones of the ordinary type will be fixed within reach of every passenger.

1/- Wireless Set.

AT the trade exhibition of toys and novelties at the Royal Agricultural Hall I noticed a small crystal wireless receiver, for the price of one shilling, with a range of some 15 miles.

* * *

2 L O's Programmes.

ON the 9th of next month Mr. Cecil Hallet is giving a lecture on Egyptology. Mr. Hallet is a lecturer to the British Museum. On the 13th, S. G. Bristow, S.C.I.S., F.S.S., the general secretary of Commercial Motor Users Association, will speak on the "Relation of Broadcasting to the Motor Industry." On August 28th Mr. H. A. Bromley, Examiner of Supplies to H.M. Stationary Office, on the "Evolution of Paper and Paper Making"; and on the 20th, Prof. E. W. McBride, F.R.S., D.Sc., Vice-President of the Geological Society, will talk about our Acquired and Inherited Characters.

* * *

Value of Wireless at Sea.

ONE of the many advantages of wireless at sea is shown by a report from the Prince Line steamship "Saxon Prince." During the last voyage of that vessel, one of the seamen was taken seriously ill, and instructions were given by the captain to the operator to ascertain if there was a ship in the vicinity carrying a doctor. A reply to the wireless call was received from the Spanish steamship "Manuel Arnus," and the vessels altered their course in order to meet. As they were approaching each other instructions as to treatment were wirelessed from the Spanish ship.

* * *

Direction-Finder Used.

THE "Manuel Arnus" is equipped with a Marconi wireless direction-finder and, as the result of bearings taken with this instrument, the vessels were able to meet with a minimum of delay. But for the direction-finder they would probably have spent a good deal of time in searching for each other. The Spanish surgeon boarded the "Saxon Prince" and, on examining the patient, found the case so serious that he decided to move the man to his own ship. The transfer was accomplished without mishap, and the vessels resumed their interrupted voyages.

* * *

Wireless in the West Indies.

WIRELESS is rapidly taking its place in the daily routine of places all over the world. The "Trinidad Guardian" has realised the value of this new science, and has fixed up a special set for the reception of the news bulletin broadcast from the States every night. This news is published in the next morning's paper, and thus easily races the old system of land line communication.

* * *

New Address.

I AM told that Messrs. Burndept, Ltd., have moved their Executive Departments, Management, Sales and Advertising, from Blackheath to Aldine House, Bedford Street, Strand.

* * *

"The Nighthawks."

THE letter from "Curious," Larne, published in POPULAR WIRELESS of July 14th, has brought in scores of letters from readers who have heard the same "burlesque." The mystery has been

(*Continued on page 826.*)

AN INVITATION TO READERS.

SINCE the commencement of the series of articles describing the construction of the "P.W." Combination Set, many readers have written in anxious to have "all the details at once."

This, of course, is not possible; but as this desire appears to be prevalent among so many on account of the fact that some readers find it hard to believe that the "P.W." Combination Set fulfils all we claim for it, readers are specially invited to make an appointment to view the set at this office, when they will be given a short demonstration by one of the technical staff. The interior of the set may also be viewed, and the full wiring diagram seen. Readers desiring to avail themselves of this offer should make an appointment by writing.

The set can only be viewed between the hours of 11.30 and 12.30, any day except Saturday. A postcard to the Technical Editor, POPULAR WIRELESS, Fleetway House, Farringdon Street, E.C.4, giving, if possible, a day's notice, will entitle the sender to test the set for himself. Every prospective builder of the "P.W." set is cordially invited.

* * * * *

THE "P.W." Combination Set has been prominently dealt with in this journal, because it is the considered opinion of the Technical Staff and myself, that it is "a real good thing," and therefore, we are anxious for every reader to reap the advantages of building such a set.

Considerable publicity has been given to the articles dealing with the construction of the set, and I am anxious that every amateur constructing it shall have every opportunity to gain the most detailed information we can supply. So if you have any queries—send them in. They will be fully answered.

I should like to take this opportunity of bringing to my readers' notice the fact that "P.W." once more proves its claim to the title of the oldest established broadcasting journal, as well as the most popular. POPULAR WIRELESS has the largest circulation of any Wireless Weekly, and enjoys the full confidence of its readers and advertising clients.

THE EDITOR.

NOTES AND NEWS.

(*Continued from page 825.*)

cleared up, however, by a letter from the "culprit." The station belongs to Mr. H. Green, of Manchester, call sign 5 O W, and is the headquarters of an amateur society called "The Nighthawks."

* * *

Amateur Broadcasting.

THIS society lays itself out to broadcast between 11.15 p.m. and 2 a.m. every Wednesday. The wave-length used on the date in question was 417 metres, but since then it has been changed to 365 metres. The "Announcer" of the station, Mr. F. Storey, Majestic Picture House, Patricroft, Eccles, will be very glad to hear from amateurs receiving these concerts, and intends in future to announce the address of the station every time.

* * *

"Radio Golf."

AUSTRALIA is now taking up the game of "Radio Golf," and records are being broken every day. The game, which originated in America, consists in seeing how many miles you can cover in one hour, using a receiving set. Each station can only be counted once, but already one enthusiast has covered 39,345 miles in 14 hours, about 3,576 miles per hour.

* * *

Don't Use Reaction.

APPARENTLY you switch on to Glasgow, say, 200 miles away, and record a score of 200 miles; then on to another station, this time 80 miles away—total 280 miles, and so on. The game is no doubt very exciting and tremendous distances can be covered if you work hard, but if this is the national radio game of America, no wonder we hear so much about the reaction problem. So don't use reaction on the aerial if you try "Radio Golf."

* * *

5 L F

THE Editor wishes me to point out that an error appeared in the caption of the photograph of the amateur station, 5 L F, which was published in POPULAR WIRELESS of July 14th. This station belongs to Messrs. Secretan & Mallett, Ltd., of 149, Lowther Parade, Barnes.

* * *

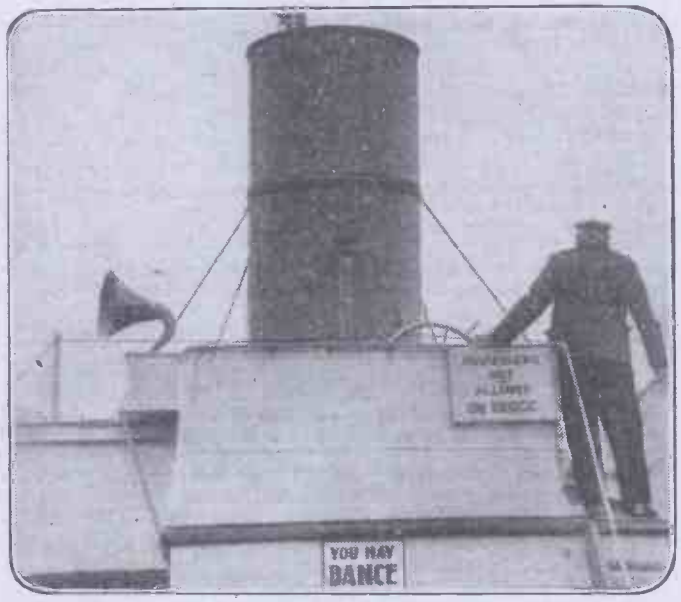
Features at 2 Z Y.

JULY 27TH.—Dance programme by the Shorrocks Syncopated Dance Orchestra. July 28th.—The Radio military band. July 29th.—A Mendelssohn orchestral evening, with Frank Taylor, tenor, singing a number of Mendelssohnian excerpts. July 30th.—Herbert Ellingford, the well-known organist to the Liverpool Corporation, will give a chat on "The necessity for a broader outlook upon music in Cathedrals and Churches." Jas. Worsley and Nell Davies will also "appear." July 31st.—Fredk. Garnett, whose caricatures are a feature of the English Press, will give a talk on "Caricature," and Mr. McCafferty, Irish baritone, and Madge Taylor, the operatic soprano, will perform with the Radio orchestra. August 1st.—Lee Thistlethwaite and Florence Holding will together offer delectable fare.

* * *

The "Man Hunt" Prizes.

LAST Friday, July 20th, the B.B.C. invited the three prizewinners in the Criminal Man-Hunt Competition to attend a luncheon at Simpson's Restaurant, in London, to be presented by Lord Gainford with the three £5 prizes offered by the B.B.C. Lord Gainford referred to the great success of the post-card criticisms sent in by listeners-in, and said that 78 per cent of them showed complete satisfaction with the present type of programmes; 2 per cent were adversely critical; while the remaining 20 per cent suggested various changes.



The "Queen of the South," a pleasure boat which plies from Brighton, has been equipped with a wireless receiver and several loud speakers. The trippers take great advantage of the invitation extended by the bottom notice.

He also announced the fact that, the Post Office agreeing, it was likely that eleven relay stations would be erected in this country.

* * *

Well "Received."

MR. BURROWS, in referring to the Man-Hunt, gave many interesting details which, owing to lack of space, we cannot print in this issue. There was one joyous moment after luncheon when Mr. Reith called on Captain Eckersley to give a solo on the piano. This took the form of a life-like imitation of an Italian tenor whose song was being interrupted by reaction fiends, and met with tremendous applause on 369 metres.

* * *

Advice from Capt. P. P.

AFTER the luncheon, the company adjourned to the steps of the B.B.C. offices, where Lord Gainford presented the prizes to the three lucky amateur detectives. A Pathé Frères cinema-operator recorded this momentous occasion and managed to take successful pictures, despite Captain Eckersley's humorous suggestion that he should add another valve!

* * *

Effects of Lightning.

THE recent thunderstorms all over the country have given many opportunities for amateurs to see for themselves whether the presence of an aerial is a protection or a danger. In this connection I should be glad to hear from any reader whose aerial has actually been struck by lightning, or whose apparatus has been damaged in any way by electrical discharges.

* * *

Useful Reports.

WHEN you make your report, it would be of value if you would give details as to the aerial and earthing system, whether or not an arrester or earthing switch was used, and, if so, whether inside or outside the building. Further, the result of electrical discharges on the set also should be given, especially if the set was in use at the time when the damage was done.

ARIEL.

BROADCASTING TRANSMISSIONS.

Regular transmissions of news and concerts take place daily from the following stations. Full details appear in the daily press.

London	2 L O	369 metres
Birmingham	5 I T	420 „
Manchester	2 Z Y	385 „
Newcastle	5 N O	400 „
Glasgow	5 S C	415 „
Cardiff	5 W A	353 „

Other stations of interest to listeners-in in Great Britain are:—

Eiffel Tower	F L	2,600 metres	Throughout the day.
Radio-Electrique, Paris	S F R	1,780 „	5.5 to 6 p.m. 8.45 to 10 p.m.
School of Posts and Telegraphs	—	450 „	7.45 to 10 p.m. (Tuesdays and Thursdays.) 4.30 to 7.30 p.m. Saturdays.
The Hague	P C G G	1,050 „	3 to 5.40 p.m. (Sundays.) 8.40 to 9.40 p.m. (Mondays and Thursdays.)

PROTECTION AGAINST LIGHTNING.

By H. COTTON, M.B.E., M.Sc., A.M.I.E.E.

In view of the recent heavy thunderstorms, and weather that gives every indication of further similar demonstrations, this article should prove of utmost value and interest. Written by an acknowledged authority on the subject, it shows in a lucid manner, the types of lightning discharges that are dangerous and the most efficient methods of protection against them.

FROM time to time wireless amateurs write to the press asking for information regarding the danger of lightning discharges, and the proper means of guarding against this danger. Unless proper precautions are taken this danger may be very considerable, both to the apparatus and to the operator himself, but if the hints given below are observed there need be no occasion for anxiety.

The enormous power of a lightning discharge can be gathered from the following figures. It has been computed by Dr. Russell that the difference of potential between the two points across which the discharge takes place, *e.g.* cloud and earth

An extraordinary photograph of a clock tower actually being struck by lightning, taken by the General Electric Co.

or cloud and cloud, may be as high as one thousand million volts. From calculations made by Steinmetz and others it appears that the current in the discharge may be anything up to ninety thousand amperes.

Every Possible Chance.

On the other hand, it has been proved by photography that the time during which the discharge takes place is such a minute fraction of a second that the quantity of electricity flowing is very small indeed. In fact, measurements of the quantity have been made in some cases, the result being, on an average, something of the order of fifty coulombs. Readers will probably know that a quantity of one coulomb of electricity is displaced through a circuit when a current of one ampere flows for one second.

The enormously high potentials which may be set up between the clouds and earth show that there is every possible chance that an aerial will be affected, and the higher the aerial the greater will be the probability. The most likely effect of the electrification of the atmosphere is the accumulation by the aerial of a static charge due to electrostatic induction. As, however, even a poorly constructed earth connection will allow a static charge to escape no anxiety need be felt about this. When the apparatus is in use there is a path to earth through one of the coils, and this is good enough to allow the charge to leak away, although it would offer an enormously high resistance to a dynamic discharge, because of the very high frequency. In the case of lightning the frequency is of the order of one million cycles per second.

An Electric Wind.

If a lightning discharge takes place it may or may not strike the aerial. If it does there will be no appreciable effect on an ordinary aerial because it is not sufficiently long to have currents of any appreciable magnitude induced in it. If the discharge actually strikes the aerial, then there is only one thing which can save it and the installation, and that is a heavy straight connection to a good earth, the apparatus being at the same time disconnected from the aerial. In order to estimate the chance of any particular installation being struck direct it should be noted that there are two kinds of discharge, which have been termed by Sir Oliver Lodge A and B strokes.

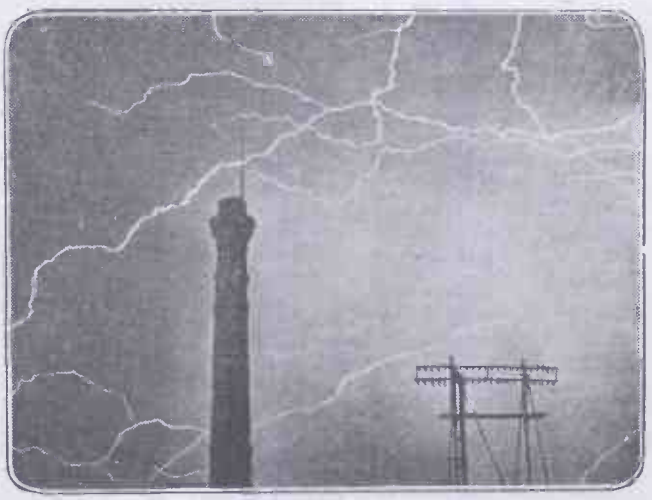
The A stroke takes place as follows: If a charged cloud is near to some very prominent object, such as a church steeple or a high tree, it induces a charge on this object. The manner in which this induced charge distributes over the object depends upon the shape. If there is a sharp point at the top, as in the case of the steeple, a very considerable concentration of electric potential takes place there, and as a result the air near to it is ionised, that is the particles of air becomes charged. As a result the particles of air are attracted to the point, they acquire the same potential as the point and are then repelled from it. This causes a stream of charged particles to flow away from the point producing the phenomenon commonly termed an electric wind. The effect of this is to lower the resistance of the path between the charged cloud and the point until ultimately the potential difference between the cloud and earth is able to break down the path between them, and a lightning discharge takes place.

The Danger of "Kinks."

On the other hand, the B stroke is a discharge which is *induced* by an A stroke taking place not far away. As a result, it is found that an A stroke always takes place to the highest object in the neighbourhood, whereas a B stroke makes no such selection, but strikes low or tall, sharp or rounded objects indiscriminately. In fact, B strokes have sometimes been observed persistently to avoid the tallest neighbouring object. These results have been verified experimentally.

From the above it will be seen that in the case of the great majority of amateurs' aerials, the heights of which are only of the order of thirty or forty feet, there is very little danger of their being struck by an A discharge, and that they possess an even chance with all other neighbouring objects of about the same height of receiving a direct B stroke. Thus the chance of a direct stroke either A or B is in such cases very small. If the aerial is situated on high ground and is the highest object for a considerable distance round, then it will be easily understood that when a thunderstorm occurs in the neighbourhood it stands every chance of being struck. An installation on very high ground suffers from the further

(*Continued on page* 828.)



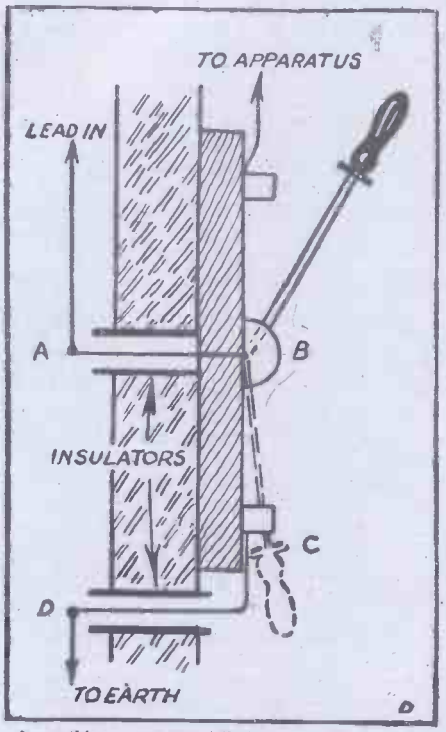
Amidst a dangerous display of forked lightning, this tall chimney is quite safe, owing to an efficient lightning conductor.

PROTECTION AGAINST LIGHTNING.

(*Continued from page 827.*)

disadvantage that the atmospheric potential gradient is greater at such localities than it is in the plains, the result being that the apparatus is more prone to the accumulation of static charges.

We come now to the method of protection. The set will always be protected from static charges if the owner will make it a matter of strict routine always to connect the aerial direct to earth when he is not operating. This precaution is not always observed, and the reader is strongly advised to take it. If a direct lightning stroke, either A or B,



An earthing arrangement that is worse than useless.

takes place then only one thing will save the installation, and possibly the house itself, and that is a good heavy, perfectly straight earth connection to a well-made earth plate. The presence of a kink or sudden bend in the connection to earth may give it sufficient self-induction to cause the potential to pile up until the discharge will leap across the bend and possibly do all sorts of damage. Most people have seen photographs showing the damage done by lightning discharges to trees and buildings, so that there is no necessity to labour this point.

Would Demolish the Wall.

The important question to be solved is how best to make the earth connection. The figure shows an arrangement which is very neat and very convenient, but which should be avoided like the plague. The lead-in and earth connection are both brought through the wall or window frame into the room, and a single pole throw-over switch is arranged, as shown, in such a way that when in one position the aerial is connected to the apparatus, and when it is in the other position the aerial is connected to earth. The fault lies in the fact that when the aerial is earthed the path to earth contains the rectangular loop A B C D, the inductance of which will, for a dead certainty, cause a discharge, if one takes place, to jump across the gap AD. If this happens the wall will probably be demolished.

Good Earth Essential.

The change-over switch is a good arrangement, but it must be *outside*, and preferably mounted on a bracket a foot or so from the wall, so as to make the angle between the lead-in and the earth connection as obtuse as possible. It is also a good plan to take off the lead-in from the aerial as near to the house as possible since this makes the run of the connection from aerial to earth nearly straight. Of course, this may not be possible if there are metal pipes on the wall which if too near might react. If the change-over switch is mounted on a bracket a little way from the wall this difficulty will be overcome, and at the same time it will make possible a vertical lead-in which will be in alignment with the vertical earth connection.

The earth connection should be a stout one, and a ribbon, such as is used for ordinary lightning conductors, is better than a wire of circular cross section. The reason for this is that when very high-frequency currents flow through conductors the "skin effect" takes place. That is, most of the current flows through the outer skin of the conductor, practically nothing flowing through the central portion. The best shape of conductor is, therefore, one which possesses the greatest perimeter for a given cross section. In this respect the flat rectangular section is much superior to the circular section.

Now for the actual "earth" itself. A metal water pipe is very good *if it is always in contact with water* in the drain to which it is connected. If it only penetrates the soil a little way and is then connected to an earthenware pipe which is nearly always empty, then although it will be efficient for reception purposes it will be practically valueless if called upon to pass a lightning discharge. Never be tempted to use a gas main as an earth connection, or the passage of a discharge may be attended by disastrous results. If a water pipe is used it should be scraped, and then emery papered perfectly clean and a good connection made by a metal clamp. It is no use wrapping a wire round the cleaned part and then trusting to luck, since in a very short time the exposed metal will oxidise, thereby rendering the connection very inefficient. Soldering might be tried, but it is very difficult to make a good job when soldering on to iron. Of course if a lead pipe coming from a water main is available then this will make a very good earth.

In order to obtain a really safe earth connection it is best to bury a sheet of stout copper several feet in the ground, the hole being sufficiently deep to ensure that it is permanently damp. The plate should be soldered and riveted to an ordinary cable thimble into the socket of which the earth wire is soldered. It should then be packed round with washed coke, well rammed all round, watered, and the hole then filled in. The size of the plate depends upon the nature of the subsoil. If this is permanently damp within a few feet of the surface, as for example, where there is a bed of clay, a plate of area twenty square feet, reckoning both sides, will be ample. If the subsoil is well drained so that it is doubtful whether it will be wet in the summer, a larger plate will be advisable.

If there is any uncertainty it is a good plan to make a vent from the coke bed to the surface and to pour a pint or two of water down every few days. This may appear to be an unnecessary precaution to some people, but it should be remembered that the efficiency of an earth plate depends entirely upon the dampness of the soil. Some writers advocate the periodical testing of an earth connection, but such a test, to be carried out properly, is beyond the resources of the average amateur, and is rendered unnecessary if the above precaution is adopted. It is certainly a good plan to dig up the plate, say, once a year, to see that the connection to the earth wire is still good.

Safer to "Close Down."

In conclusion, the writer strongly urges the advisability of discontinuing listening-in or experimenting whenever it is known that a thunderstorm is approaching the neighbourhood. If this is not done, and a direct stroke occurs on the aerial, wireless telegraphy will probably lose one enthusiast and this journal will lose a subscriber. It is very easy to determine about how far away a storm is by counting the number of seconds between a lightning flash and the peal of thunder which it produces. The velocity of sound in air is approximately a mile in five seconds, so that if the time observed is divided by five the result gives the distance of the storm in miles.

A terrific lightning flash takes place over a wood. One tall tree, to the left of the photograph, was completely destroyed.

WHEN THE COMMITTEE AWAKES.

(With Apologies to Mr. H. G. Wells).

By THE EDITOR.

Every amateur in the country is heartily disgusted with the dilatory behaviour of the special committee set up to consider the Broadcasting situation. A few days ago some one awoke for a brief moment and announced that the verdict would soon be delivered. It was an abortive announcement. Up to the time of going to press we are still "in the dark," and the broadcasting problems are becoming more and more involved.

SOME eleven weeks ago we woke up one morning to read in the newspapers that a Broadcasting Committee had been appointed by Sir William Joynson Hicks, the then Postmaster-General. Since that particular morning we have awakened from slumber many times, and have scanned our morning papers in vain for any concrete evidence of the committee's activities.

Can it be that unlike we humble amateurs the members of the committee have gone to sleep, and *have forgotten to wake up?*

This is a terrible thought. Sleeping sickness is not unknown in this country, but as many of the committee's members are well-known public men, the hypothesis that all of them are emulating the late Rip Van Winkle is not tenable, and we are forced to consider the matter in a more prosaic if less scientifically interesting light.

Important Items.

Let us first of all glance at the activities which were supposed to have occupied this committee. According to Sir William Joynson Hicks, the Broadcast Committee was appointed to consider (1) broadcasting in general; (2) the validity of licences and contracts, granted and to be granted; (3) various uses of a broadcasting system; (4) restrictions on its ultimate (possible) development.

The above four items are the chief ones in the programme, although there are other minor "turns" in the repertoire. The committee consists of the following members: Field-Marshal Sir William Robertson, Viscount Burnham, Sir Henry Noel Banbury, Mr. Charles Trevelyn, Mr. J. C. W. Reith, Major-General Sir F. H. Sykes, Major the Hon. J. J. Astor, the Rt. Hon. Sir Henry Normann, Bt.; Mr. F. J. Brown, and Professor W. H. Eccles.

Two Alternatives.

This is not the time of the day to consider the selection of committee members made by Sir William Joynson Hicks. It is too late to remedy in any case; but what every sincere wireless man is concerned about is the verdict of this committee on the various problems they have been eleven weeks considering. Admittedly the problems are not easy—but that is no excuse for such an inconceivable delay in informing the public what progress has been made—if any. The persistent reticence shown by the committee forces one to the conclusion that they are not able to cope with the problems they have set out to solve. In which case let us thank them courteously for their efforts but request them, equally courteously but more emphatically, to resign and hand over the task to a more competent committee.

The committee's silence is having a most serious effect on the wireless industry and the "listening-in" public; the absence of some signs of activity, the disgracefully inadequate Press reports of progress made, combined with the natural restiveness of amateurs who are anxious to get on with their experiments on the right side of the law—all combine to exercise a most depressing effect on what promised to be a new and healthy industry.

As Editor of this journal and of "Wireless Review and Science Weekly," I am in a position to state that, from personal knowledge, the long-delayed verdict of the committee is having a most disastrous effect on the morale of thousands of prospective amateurs—amateurs who are also prospective customers in wireless gear, and prospective applicants for licences. But until they know which way the wind is going to blow, or in other words, until they have read the verdict of the committee's deliberations, they are "sitting on the fence."

United Protest Required.

Consequently trade is bad; few fresh applications for licences are being received, and everyone is heartily tired of the whole farce. The remedy lies with the committee. It is "get busy or get out!"—which is terse but strictly to the point. The new industry created by the advent of broadcasting in this country is far too valuable to be jeopardised by a committee which takes eleven weeks to formulate a scheme which half a dozen practical members of the Radio Association and the Radio Society of Great Britain could have satisfactorily produced in half the period, and it is high time that amateurs in general, and the trade in particular, took concentrated action in the matter, not only for the good of wireless broadcasting in this country, but as an indication of the affront which has been offered them by the obstinate silence of the committee and the generally unsatisfactory way in which their interests are apparently receiving consideration.

Therefore I strongly urge every amateur and every trader who has the interest of wireless broadcasting at heart to voice his dissatisfaction, and protest in a letter to the Postmaster-General, and to do so without delay at that. A copy of this article will be sent to the Postmaster-General and to the secretary of the Broadcasting Committee.

THE "MAY" CIRCUIT.

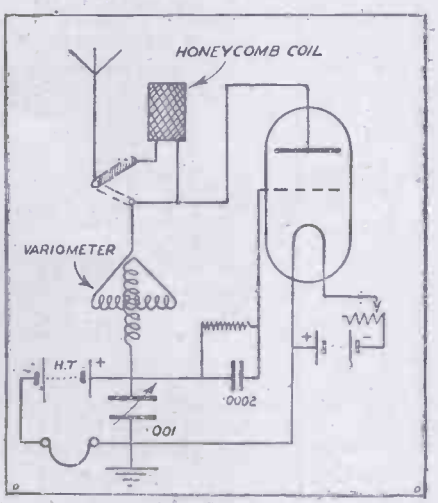
DURING the course of the last few months, many novel and interesting types of circuit have been evolved, and the following single-valve receiver has evoked a considerable amount of interest in America. It is known as the "May" circuit, after its designer, George W. May, and it is claimed that the general efficiency of this instrument is very high.

It will be observed that a honeycomb coil is employed between the plate of the valve and the aerial, but the introduction of this coil into the circuit is optional, a two-way switch being provided for the purpose. The coil is not at any time utilised to obtain reaction, but is only incorporated so that it may be used with a variometer, when it is desired to tune in the longer wave-length.

Variable Leak Preferred.

The tuning of the circuit can thus be adapted to receive over a wide range of wave-lengths, merely by the incorporation of a suitable honeycomb coil. It is a simple circuit to construct, and has much to recommend it to any amateur who is making his first experiments with valve circuits.

A variable condenser of ·001 mfd. capacity is connected between the variometer and earth, and thus by cutting the honeycomb coil out of circuit, very low wave-lengths are easily obtainable. The value of the grid condenser should be ·0002.



The ohmage resistance of the grid leak is admittedly a critical factor and no values are given, as this is better found by adjustment, a variable leak being perhaps the best solution of this problem.

The value of the plate battery given is 22½ volts, but this also should be found from experiment, as it is liable to vary for different designs and makes of valve.

Useful Experimental Circuit.

It is claimed for this circuit that the reception of signals from high-power European stations such as POZ (Nauen, Germany), FL (Eiffel Tower, Paris), MUU (Wales) and IDO (Italy) constitutes no difficulty under normal conditions, and that the set is easily tuned and not prone to self-oscillatory effects—altogether the ideal single-valve circuit.

In a recent issue of the "Radio World," to whom we are indebted for a description of the instrument, it is stated that for the reception of broadcasting the honeycomb coil may be dispensed with altogether.

THE "P.W." COMBINATION SET.

Built and described by the Technical Staff.

This week sees the completion of the construction of Unit One, and with three circuits at their disposal, amateurs can place the set into immediate use. Next week Unit Two will be dealt with.

IT is left to the constructor to decide what type of crystal will be used as detector. Either the double crystal combination shown or the well-known hertzite, permanite, or other prepared galena can be employed, but either will give good results, and it is merely a matter of choice. In the set constructed by the staff a double crystal detector using zincite and bornite is shown, and this combination has the advantage of being more stable than the "cat's-whisker" type. Two clips as shown in Fig. 14 are required to hold this detector.

Two cups $\frac{1}{4}$ in. deep by $\frac{3}{8}$ in. diameter can be made out of $\frac{3}{8}$-in. diameter rod by drilling a $\frac{1}{4}$-in. hole to a depth of $\frac{5}{16}$ in., as shown in Fig. 14. These cups should also be tapped to take a 4 B.A. screw, as shown. The adjusting spindle is 1 in. long, and carries a ball and spring, as shown in Fig. 14. This ball should be turned out of the solid. The handle is composed of $\frac{1}{4}$-in.-diameter ebonite rod $\frac{1}{2}$ in. long tapped to fit the spindle. The other cup is fitted with a 4 B.A. screw and two nuts to clamp it to the clip.

Circular ebonite caps $\frac{3}{4}$ in. diameter and $\frac{1}{8}$ in. thick, recessed to take a piece of glass tube $\frac{5}{8}$ in. diameter and 1 in. long, are fitted to each end, one of which is also recessed to form a spherical seat for the ball on the adjusting spindle.

The Fixed Condensers.

A filament rheostat and valve-holder should be purchased, as should the two jacks required. Six terminals will also be necessary. Two fixed condensers are also required, and these should be made by clamping copper foil between mica sheets. For the ·001 mfd. condenser six pieces of foil 2 cm. by 1 cm, and seven pieces of mica 3 cm. by 2 cm., ·002 in. thick, are necessary, and for the ·0002 mfd. condenser two pieces of foil and three of mica of the same size. Condenser cases can be obtained at a moderate price, and these can be utilised, or the usual method of forming the cases from pieces of ebonite can be adopted, taking care that the mica and foil are kept in intimate contact.

The panel on which these components are mounted is 12 in. by 12 in. and $\frac{1}{4}$ in. or $\frac{5}{16}$ in. thick. It should be carefully squared on the edges, and, if desired, may be given a matt surface by rubbing with emery cloth.

The "Lay-out."

Many people experience difficulty in marking out a panel for drilling, but, even if such marking out can be satisfactorily effected, it is much safer to lay out all the items on a sheet of paper of the size of the panel and mark the positions of the holes on this sheet of paper. The sizes of the holes can then be pencilled on the paper, which may be subsequently secured to the panel either by gum or by bulldog clips. For this reason it is not proposed to give a drawing showing the drilling of the panel, but the disposition of the various items is shown in Fig. 16, two views, one above and one below, being given.

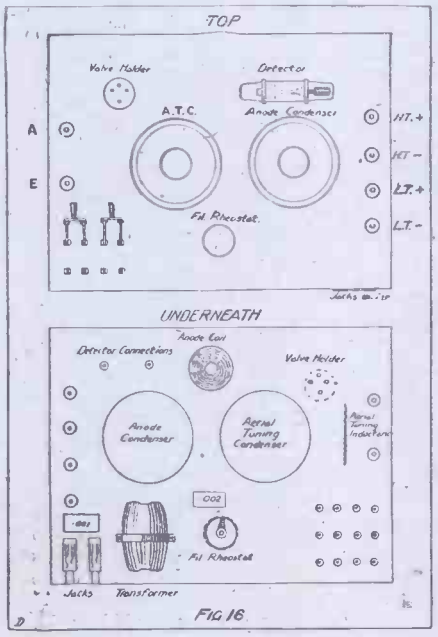


FIG. 16.

The anode coil is fixed to the panel by a screw in the position shown, whilst the aerial tuning inductance is carried on a piece of No. 18 copper wire connected to the condenser terminal as shown in Fig. 17. This piece of wire also forms the connection between the condenser and the inductance, one end of the basket coil winding being soldered to it as shown.

Wiring should be carried out with No. 20 enamelled wire. A length of wire should be fixed to a nail in the wall and stretched by pulling heavily on the end; by this means it will be found that the wire can be made to lay straight, and to take whatever sets or bends are given to it. Particular care should be taken to keep the wires spaced as far as possible to prevent trouble from capacity effects. The two jacks are fixed to the panel by two countersunk screws, which also secure a piece of wood $\frac{1}{2}$ in. by $\frac{1}{2}$ in. by $1\frac{1}{2}$ in., through which they are fitted as shown in Fig. 18.

(To be continued.)

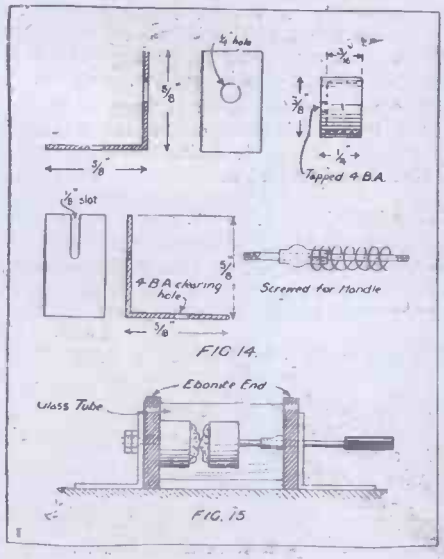


FIG. 14.

FIG. 15.

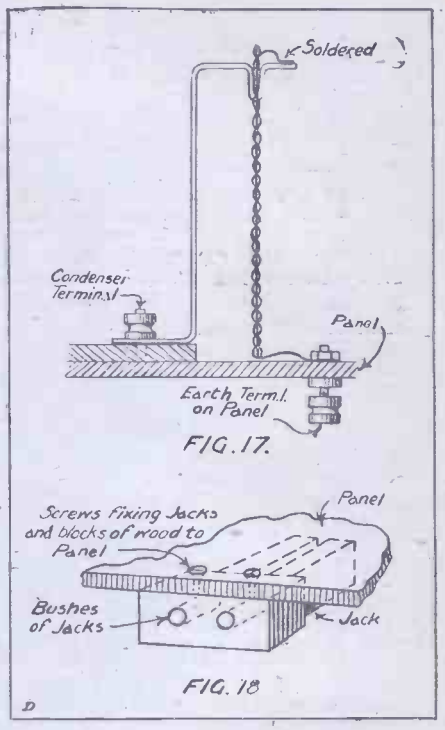


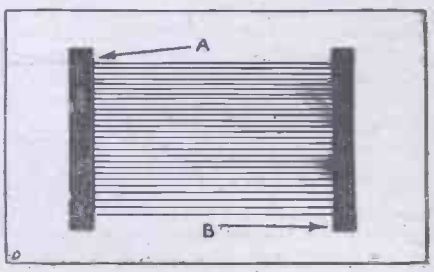
FIG. 17.

FIG. 18.

AN EASILY ADJUSTED GRID LEAK.

AN easily made grid leak which is capable of very critical adjustment is simply made by drawing 32 fine pencil-lines, each $\frac{1}{32}$-in. apart, on a piece of drawing-paper. The lines should be $1\frac{3}{4}$ in. long and connected together by a thick pencil-line as at A. About $\frac{1}{16}$ in. from the other end another oblong pencil contact is made as at B.

A and B are then slipped under the grid condenser clips, and one by one the lines are extended to the oblong blacklead contact B until the critical point is found. The unused lines are then cut off, and the leak covered by a piece of well-shellacked mica to prevent it being disturbed by misuse.



THE SELECTION OF CONSTRUCTIONAL MATERIALS.

By RADIOGRAPH.

These are not "theoretical words of advice," but suggestions of a really practical nature, given by a writer whose experience in mechanical as well as wireless matters is a sufficient guarantee of their value.

WHEN the average amateur starts in upon a new phase of electrical or mechanical construction, or, indeed, upon any form of scientific research, the local supplier of such commodities as he will require beams with satisfaction; so one can judge the feelings with which the advent of amateur wireless construction was hailed by retailers of materials and tools.

Now, as I happen to be a genuine wireless amateur myself, you and I can discuss our various little problems quite frankly, and in the first place some of us have to admit that the organisation of our workshop, as far as materials and stock are concerned, is a little on the weak side. So many amateurs tend to develop a very unseemly haste to get a move on; but, by failing to make haste slowly, they are not only delaying the final consummation of their designs, but are also spending more money in certain directions than is needed.

Their operations, even though conducted as a scientific pastime, are characterised by waste, both of time and hard-earned cash. Lack of due care in selecting materials, and wasteful methods of manipulating them when purchased, certainly benefits the supplier; but nobody at all reaps any advantage, unless it be the bootmaker, from the time one wastes by repeated journeys to the local shop for material which could be better purchased and afterwards stocked in the amateur's workshop all ready for use.

The Plan of Operation.

One could elaborate almost indefinitely upon such obstacles to amateur progress as I have indicated above, but the suggestion will doubtless be sufficient to cause many readers to look into their own methods of dealing with materials.

In wireless construction, as in every other phase of human activity, success is very largely dependent upon the thought devoted to the early stages of the preparations. Many potentially good jobs have turned out as second-grade productions, not because theoretical knowledge or craftsmanship has been missing, but simply by reason of an imperfected plan of action and badly arranged preliminaries.

Here is where the obvious value of periodicals devoted to wireless matters is demonstrated more than ever, in enabling amateurs to lay full plans of operation before actually commencing constructional details.

Economising

The facility of using working drawings prepared by successful constructors not only appeals to the amateur from an instructional standpoint, but enables him to predetermine the exact nature of the materials he will require for his particular purpose.

At this point readers are reminded that a full appreciation of the purpose of working drawings will assist in the economical purchase of materials. Standardisation of such fittings as may be required in a given piece of apparatus, is, of course, very important, but a careful classification of materials is of equal moment. For example, the universal employment of one convenient size of screwed stock should be adopted wherever possible, so that, instead of having an assortment of short pieces left over at the conclusion of a job, there remains practically no surplus. Odd pieces thrown into the scrap box are used up sometimes, but more often represent as much £ s. d., which lies for months as a silent witness of wasteful methods.

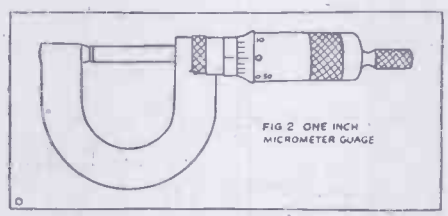


FIG 2 ONE INCH MICROMETER GUAGE

Having made up our minds as to the class of constructional work about to be undertaken, we may proceed to specify our requirements; but, before doing so, let me offer a hint as to the manner of purchasing.

Procuring the Materials.

I take it that amateurs are compelled to devote the larger proportion of their time in ordinary business avocations, and so economy of time and cash, with respect to the acquisition of materials, becomes a matter of no small interest. The principle of mailed orders has a good many advantages, but it is much better to select requirements on the spot. The man who hands supplies over the counter has no personal interest in the ultimate success of your efforts, and, consequently, the nearest available article to your requirements is good enough for him, but if you are there to insist upon getting the right thing, it is generally forthcoming.

Therefore, make up your list of materials, go to the large supplier, and be prepared to spend an hour, if need be, at his counter until your wants are satisfied. Bulk orders cost less than attenuated purchases, and receive more attention from the supplier, the delivery of the goods to your workshop involves but little delay, and, as a result, you are fully provided with the minimum amount of expenditure, lost time, and personal inconvenience.

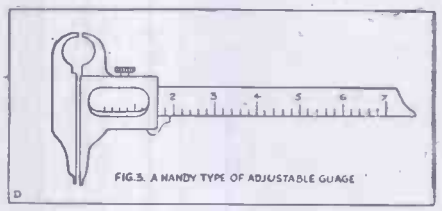


FIG.3. A HANDY TYPE OF ADJUSTABLE GUAGE

Another very important point with regard to purchasing is that of gauging the material you buy on the spot. The purchaser should arm himself with a pocket Standard Wire Gauge, which is used for sheet metals as well as wire, a rule, and, if possible, a one-inch micrometer calliper gauge. Let the assistant see the end of the latter projecting from your waistcoat pocket, and he will realise he is faced by a customer who will not be put off with the "next nearest" thing.

Another Pitfall.

Calculations are often upset, and shop processes become more involved, if one finds they have been palmed off with some material of the wrong gauge or dimensions, besides which "the odd $\frac{1}{8}$ in.," which is of little concern to the supplier, may frustrate the amateur's plans entirely.

Be careful over the choice of B.A. screws and nuts, as, unless you try the two together when you buy them, the chances are that you will be disappointed when you get home and attempt to force a nut on to its screw.

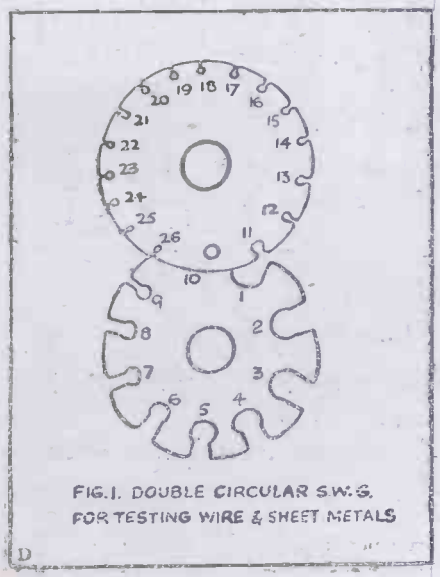


FIG.1. DOUBLE CIRCULAR S.W.G. FOR TESTING WIRE & SHEET METALS

Capt. Frost controlling the apparatus in 2 L O's instrument room. The window is the communicating link with the studio.

NOTES ON CRYSTAL RECTIFICATION.

The following article, one of the clearest explanations of this phenomenon yet put forward, should do much to dispel the mystery generally attributed to the action of a crystal detector.

THE following theory of crystal rectification is probably as near the truth as any which has been propounded, and has the merit of being extremely simple. It is based on the production of an electric current when the junction of the two dissimilar conductors is heated. Of course, a discussion on the basis of the electron theory of thermo-electricity would take us into deep water, but starting with the given fact of the production of electricity by a thermo-couple, the whole matter is, from a qualitative standpoint, not difficult of explanation. I shall proceed first of all to enunciate various points and mention the simple experiments which support them. These experiments can easily be repeated by my readers, and no doubt greatly extended.

1. The junction of any two dissimilar solid conductors can be a rectifier.

It is not at all essential to use a "crystal" to receive wireless signals. It is true that various minerals do possess a combination of qualities which render them particularly effective in this direction, but it will be found that strong signals can be obtained by arranging a suitable contact of any two conducting bodies. No doubt many readers have noticed that signals may be received when a copper "cat's-whisker" is applied to the brass crystal cup. Strong signals may also be obtained by a light contact between bismuth and antimony. Altogether I have tried copper, brass, steel, bismuth, antimony, lead, and tin, and in all cases have received signals.

Resistance of the Crystal.

The chief difficulty is that the contact must first be made firm, to break through the oxide film on the metals, and then must be made exceedingly light, so that it is difficult to get reception for more than a few seconds at a time. An easier way of getting results is to use a short double-ended steel needle between plates of the two metals being tested. The resultant effect, always providing the contact at both plates is light, is that of the two metal plates alone, the steel only serving as an intermediary conductor.

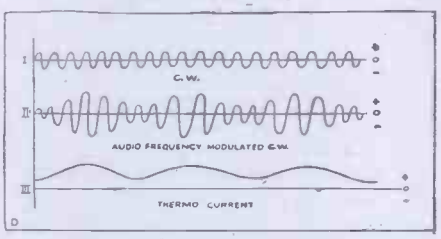
It is, of course, well known that any combination of crystals or of a crystal and a metal will give more or less good reception.

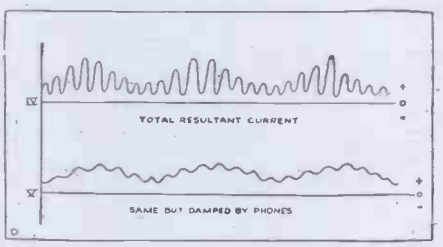
2. It is unlikely that half the incoming H.F. vibrations are stopped.

If the contact on a crystal or metal pair be made quite firm, it will be found that small currents will pass in either direction with equal facility. It is somewhat unreasonable to assume that on making the contact lighter any change occurs which blots out a half-wave from an A.C. vibration. Possibly a better proof can be given by other workers on this point, of the truth of which, however, I feel well assured.

3. With nearly all crystals changing the contact position may reverse the direction of the rectified current.

At about 7 miles from 2 L O, using a single wire P.M.G. aerial and hertzite with a copper wire, the rectified current from the London transmission flowing through a pair of 8,000 ω. 'phones is 25 microamps. If the 'phones be taken out of circuit, the current rises to 43 microamps., indicating that the crystal junction resistance is of the order of 10,000 ohms. If, now, the "cat's-whisker" be moved to various spots on the crystal, it is possible to find sensitive spots where the galvanometer deflection is in the opposite direction. This phenomenon is well marked with galena, but has been observed with silicon, pyrites, and other crystals, and no doubt is exhibited with all.





The resistance of the contact with various detectors, perikon, copper wire on hertzite, galena, and silicon, is from 9,000 to 12,000 ohms. It is obvious, considering the high resistance of the crystal substance, that the area of contact is quite considerable, and cannot fairly be called a "point" except in common parlance.

Thermo-Electric Effects.

From the foregoing it will be seen that my idea of crystal rectification is as follows: The alternating current in the detector circuit produces a rise of temperature at the high resistance crystal contact according to the well-known law $H \propto C^2 R$. Since the square of the current is concerned, both halves of the incoming oscillations are effective. This rise of temperature produces a direct thermo current, so that in the circuit there will be flowing a direct current having impressed on it an audio-frequency modulated H.F. current.

The microphone modulated C.W. in II. will set up a varying thermo current III., so that the total resultant current would theoretically be as in IV. In practice, however, the insertion of telephones would damp the H.F. ripple, and leave us with a D.C. modulated at audio frequency. In any case, of course, the H.F. ripple would be entirely inaudible, even supposing the telephone diaphragm could respond to such frequencies.

The fact that with the same crystal the thermo-current may reverse in direction disposes of the objection which has been raised to the thermo junction theory of rectification, namely, that the currents produced by heating the junction may be in opposite direction to those produced by H.F. Evidently the thermo-electric properties of a crystal vary with the orientation of the molecules at the junction. It is possible that with anisotropic crystals we may have one axis along which a contact would give rise to currents in one direction, another axis giving an opposite current, and and the third axis giving no current at all. This also explains why powdered crystals do not usually give rectifying action since there will be an equal number of contacts of each sort, and hence the thermo currents will partially or wholly neutralise.

Applied Potentials.

The great effectiveness of crystals in rectification arises from the fact that a reasonably large contact can be made of fairly high resistance, and that the heat produced at that contact is not conducted away too quickly. With metals it is necessary to make the contact exceedingly light, so that the resistance is high enough to give a reasonable amount of heating, and at the same time the small area of contact prevents the heat from being conducted away so rapidly that the temperature cannot rise. If it were possible to find two bodies far apart in the thermo-electric scale, of fair conductivity for electricity and a very low specific heat and heat conductivity, there is no doubt a very efficient rectifying contact could be made from them.

The question of an applied potential is probably merely a question of heating the junction to a steady temperature. Probably, therefore, passage of a current through a carborundum-steel couple junction brings the junction to a temperature at which much greater variations of E.M.F. are produced for a given change in temperature.

A three-valve set, constructed by Mr. E. Jones, 7, Bodfor Street, Rhyl.

BETWEEN SIGNALS.

By C. G. GIBBONS.

A cheery chat on divers matters radio.

TO say that I was puzzled hardly expressed it—I was annoyed. From the loud speaker came a steady synchronised humming, not in any way resembling Morse, either of the hand-key variety or the output of a hundred words per minute "automatic," but a steady synchronised humming. I had endeavoured to eliminate it—I had ingloriously failed. I substituted an indoor aerial for an outdoor one, suspecting I know not what, but this foreign noise continued.

Then I happened to walk to the window whilst filling my pipe, to have my ears assailed with the "noise" peculiar to the running engine of a motor-car. To be exact, one ear, nearest the window, was assimilating the "ticking" of the car while the other was still "harking" to the measured "signals" emanating from the Amplion—and both sounds were in "time." Then, and only then, did I find a solution to the "mystery"—my aerial was picking up the radiation from the magneto of the grocer's Ford van standing outside the house. I felt almost disposed to go down and congratulate the driver on the excellent "timing" of his engine.

Dealing with Sceptics.

A few evenings ago I was endeavouring to give a friend a few practical illustrations of electro-magnetism, subsequent to his expression of belief in the recent assertion of certain people that "broadcasting, by liberating thousands of volts nightly into the air, is responsible for our abnormal weather."

A little discourse on "electric strain," "ether waves" and "lines of force" soothed him somewhat, but an experiment with a bar magnet and iron filings only invoked a query—"What has pattern weaving to do with it?" I endeavoured to convince him by placing a galvanometer near to a small circuit containing a battery. Having caused the galvo-needle to "kick" by making and breaking the circuit, my querist remarked, "Couldn't that be due to atmospherics?" Well! Well!

It is surprising how items of news in the daily press referring to the science of electrics are, these days, absorbed by the "man in the street." This interest, of course, we can attribute to broadcasting and the many hundreds of "electricians" it has produced. In some it has aroused a dormant talent, in others, the belief of a natural aptitude for the dissemination of advice, and the creation, for their friends, of wondrous and weird circuits. But whose interest in radio is quicker to fade than those of the latter class?

I am mindful of the disparaging remarks anent broadcasting to which I recently listened, voiced by a person who, probably by virtue of a claim to having once fixed an electric bell, had assumed the air of an "expert." "Rotten programmes—Dud music—Too expensive a hobby—Nine days wonder." In the ears of several potential "listeners-in" this condemnation was certain to arouse doubt and hesitation unless refuted, a task made easier when I had elicited from the "wet blanket" the information that his experience with "wireless" had existed solely in a crystal "set," and his only broadcast reception the transmission of the London station. 'Twas ever thus!

There is a famous advertisement which has for its slogan, "Always complete but never finished." Isn't that also typical of the "set" of your true "wireless" man! With each new success, each improvement, comes an incentive, an irresistible desire to go farther. If the voice of the Newcastle announcer brings satisfaction, Glasgow

Master Peter Beghin, aged 3, son of Dr. Beghin, of 25, Daresbury Road, Chorlton-c-Hardy, Manchester, thinks listening-in is great fun.

would mean still more; the "Morse" of Gib. is sought in preference to that of Niton; the "Bon Soir" of Levallois-Perret means a greater thrill than the "Good-night" of 2 L O.

And So It Goes on.

The "time signals" of Arlington are more gratifying than those of F L; the log-books shows ten "amateurs" "tuned-in" — better were it twenty; "high" or "low" frequency, "tuned anode" or "resistance coupling"—in each an avenue of exploration, fascinating, illimitable.

There is a "certain liveliness" in the ether on Sundays which makes an hour or two with the 'phones particularly interesting. Switching on two valves, H.F. and Detector, and "standing-by" on 900 metres, there's not long to wait ere a station, 'plane or ground, indicates the activity of the commercial airways. "Hallo, Handley Page—Croydon calling. Over." Now where's that 'plane? Ah, here he is, "passing over Biggin Hill."

On "600" Metres.

I like to conjure a mental picture of those operators up in the air, cheerily chatting away with the sang-froid of a conversation over the land-line from a call-office. Somebody asking for his position! Must be hazy somewhere! H'm, that fellow's got an accent—a Frenchman? "South—east of Paris—Plage," says Croydon. Paris—Plage? Of course! Near Etaples. Etaples? La Guerre! Oh, horrid thought. "Hallo, Croy-don! Avez vous——" Shall have to polish up my French! It's Le Bourget! That's better! Useful thing is reaction.

Now let's see what the amateurs are doing—no, just five minutes on "600" first. Traffic's a bit slack it seems. By jove, who's this ear-splitter? Must be well up the river!" "C Q—C Q"—what's this? Niton asking "all stations"—Q T C. Not much doing 'tween ship and shore, so here's for the Amateurs. What a medley! "I ain't nobody's darling" (too bad) hetero-dyning a gentleman who is holding forth on "choke control," and another hoarse-voiced experimenter who wants to know if 2—is working, and if so, he'd like a call, as he's been trying to get 2—for 15 minutes. 'Sposing 2—is still in the arms of Morpheus!

Very nice people, these "ten-watters." So very affable to each other, invariably say "old chap" and "old man," and hand out their "kind thanks" very liberally. One-two-three-four-five, yes, and a sixth, all working over fifteen degrees on my aerial condenser. Now, what is *this* gentleman talking about? "The desirability of employing high-frequency"—that reminds me of a person who had visited a hair-dresser's and later, when in conversation with a friend on the subject of radio, remarked, "Didn't know that barbers were using wireless!" "How? Not sure exactly, but I saw a notice to-day in a saloon which read: 'High-frequency' massage!"

Too Close to be Pleasant.

It's very useful to have a "ten-watter" situated almost on one's doorstep, particularly so when the operator obviously has an excellent taste in music, but there are times when his proximity becomes somewhat trying. One hundred yards, as a radio wave travels, from my habitation there resides, in full glory of his "ten-watts," an amateur transmitter, a most admirable operator with perfect modulation. He works, habitually, on 440 metres—and works hard. But when his "carrier-wave" smites my ear I usually, resigned to the inevitable, go "abroad" on a long "wave" or close down. He's just switched on!

EARL HAIG AT 2 L O.

Interviewed by "ARIEL."

I HAD been enjoying a quiet half-hour at the London Studio the other night, watching my old friends, the Uncles, delighting the kiddies with their "Many Happy Returns, Gladys! How are you, Freddie?" etc., etc., when one of them told me (I think it was Uncle Rex) that Earl Haig would be arriving very shortly to broadcast an address on the subject of "The British Legion Imperial Sports Rally."

In the lounge were Press reporters, photographers and representatives of the Sports Legion.

At about 6.45 p.m. Field-Marshal Earl Haig, K.T., G.C.B., O.M., G.C.V.O., K.C.I.E., accompanied by Lady Haig, was received in the studio by Mr. Arthur Burrows. After a preliminary test, which the earl made on the new microphone, the address was read out by the famous commander-in-chief in a clear tone.

At the conclusion of his address, Earl Haig was much impressed when told that he had spoken to at least a quarter of a million people.

"I hope a good percentage of my hearers will give their support to our coming Sports Rally," he remarked.

Earl Haig then glanced round the studio and appeared to take a great interest in what he saw. At that moment Mr. Burrows came forward and explained how, after numerous experiments, all echoes had been eliminated from the studio.

"It is probably the only completely echo-less room in the world," said Mr. Burrows. "And to achieve this, several layers of canvas on frames have been fixed all round the room.

"We are always experimenting for improvements," continued Mr. Burrows, "and if you would care to come into our receiving room, I will show you a novel loud speaker which we are now testing."

"Perfectly Marvellous."

Earl Haig expressed himself delighted to do so, and accompanied by Lady Haig, he proceeded across the hall to the adjoining receiving room.

I took the opportunity here to ask Earl Haig what he thought of broadcasting.

"I think it perfectly marvellous and, at the same time, one of the most useful means of communicating rapidly to the masses."

"Would you be good enough," I asked him, "to autograph a photograph of yourself to be published in POPULAR WIRELESS?"

"I should be very pleased to do so," he readily answered, and I regretted that I had not a photograph of him at hand, but, of course, the signed photograph which accompanies this article has since been obtained from Earl Haig.

We next listened to the news bulletin through the novel loud speaker mentioned by Mr. Burrows. This consists of a square-shaped, three-ply wooden horn tapering about four feet in length. It was certainly a most successful loud speaker.

A Generous Offer.

Earl Haig's attention was drawn to a four-foot square frame crossed with several strands of wire. Mr. Burrows explained that it was the aerial, and moved it about eighty degrees, causing the reception to be considerably reduced.

On the way to the lift Earl Haig was asked if he would like to broadcast again.

"I should be only too pleased to broadcast again if I can be of any service to my fellow countrymen," replied the distinguished soldier.

Earl Haig broadcasting an address from 2 L O.

NEWS FROM THE BIRMINGHAM BROADCASTING STATION.

By Our Special Correspondent.

THE Birmingham Broadcasting Station is expected to commence broadcasting from its new home on August 7th. During the next few weeks, however, another important change will be carried out.

As has been announced in these columns before, from very early in its existence as a broadcasting station 5 I T has had great hopes of removing from the Witton site—some 3½ miles from the heart of the city to a far more central position, and towards that end the first important move was the acquisition of premises at the Birmingham Corporation Electric Power Station at Summer Lane, a fairly central position, for the erection of the transmission plant and the aerial.

But that first step was not practicable just then, owing to the great difficulty which was experienced in finding a really suitable position for the central broadcasting studio. A prolonged search throughout the heart of the city was made for a suite of rooms which could be utilised for this important purpose, but it seemed for overlong that the company were doomed to failure. Suite after suite of rooms were examined but found wanting in some respect. Then, after prolonged negotiations, the station director—Mr. Percy Edgar—met with success, and as a result it is hoped on August 7th to start broadcasting from a studio to be situated over the New Street Picture House.

"Relaying" Possibilities.

The accommodation secured there seems to be ideal in every respect. Within a very few yards is the Theatre Royal, and in comparatively easy distance are the Prince of Wales Theatre, the Town Hall, the Council House, the two music-halls, several picture palaces with excellent orchestras, other public halls, the principal hotels, as well as the two chief railway-stations. From the point of view of accessibility, the site could not be bettered, and from the possibilities it offers when link-ups with theatres and other places of public interest become the rule, there is little doubt that the new broadcasting studio possesses every advantage.

The station, I understand from the station director, is to have a whole floor, and this provides accommodation for the studio, which will measure 25 ft. by 27 ft., a control-room adjoining, a band-room, a lounge entrance-hall, and a reception-room as well as one or two offices for the station staff.

5 I T has always held that its conditions in the studio are most effective, and therefore little change is to be made in the matter of studio design, and Witton patterns will be followed. Communication to the studio will be through sound-proof doors, on the inside of which will be hung heavy curtains. Two layers of felt will be used for the draping of the walls and ceiling.

From the studio to the transmission plant the distance is rather under a mile, and the Post Office authorities have at the time of writing almost completed the laying of the connecting land line. When this and the studio are ready, together with the erection of the T. cage aerial, consisting of six wires between two high chimney-stacks, broadcasting will be inaugurated from a new home with all the characteristics of a happy send-off that a bumper programme and a wireless gala night can offer. And the change over, it is hoped, will be accomplished within twenty-four hours and between the two broadcast programmes.

SOME SIMPLE WIRELESS CALCULATIONS.

By C. E. FIELD, B.Sc.

Being a short, interesting introduction to the mathematics of radio-work. Mr. Field does not weary the reader with long explanations of an unnecessary nature, but deals with the subject in its direct application to practical constructional work.

I. CALCULATIONS ON THE ELECTRIC CIRCUIT.

NEARLY all calculations necessary in wireless work resolve themselves into the application of formulæ, some of which are more easily derived than others, but all of which are quite simple to apply.

Some of us are apt to regard formulæ as terrifying objects, comprehensible only to the skilled mathematician; but we are really using them every day, quite unconsciously. For instance, suppose that a train travels 80 miles in 2 hours, none of us would hesitate to say that the average speed of the train was 40 miles per hour. How do we get it? What we really do, without thinking about it, is to say that the speed of the train is given by dividing the distance travelled by the time taken; or, in other words, if S be the speed of the train in miles per hour, M be the miles travelled, and H the number of hours taken, then $S=\frac{M}{H}$ That is, $S=\frac{80}{2}=40$ miles per hour.

If we wanted to find the distance travelled in 2 hours by a train travelling at 40 miles per hour, we would say that distance = time × speed, or $M=H\times S=2\times 40=80$ miles. In order to find the time taken to travel 80 miles at 40 miles per hour, we divide the distance by the speed, and say that

$$H=\frac{M}{S}=\frac{80}{40}=2 \text{ hours.}$$

These expressions are exactly similar to the most fundamental of all electrical equations—those which give the relations existing between electric current, voltage, and resistance in a simple circuit.

An electric current is a movement of electricity, but before any electricity can move there must be some force to push it along.

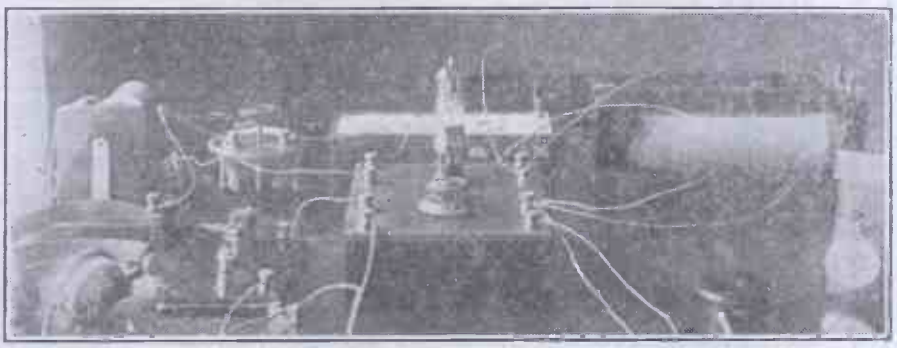
Dealing With Resistance.

This force is called electrical pressure, electromotive force (E.M.F.), or voltage, and the amount of electricity flowing in any particular circuit will naturally depend upon the amount of electrical pressure pushing it along. Also, the amount of electricity pushed along by a given electrical pressure will depend upon the *resistance* that must be encountered in the circuit through which it has to flow.

Electrical pressure is measured in *volts*, and electrical current is measured in *amperes*. From the foregoing it will be seen that there must be a particular value of the resistance of a circuit which will limit the current driven by 1 volt to a value of 1 ampere. This resistance is called an *ohm*, and resistances are nearly always measured in *ohms*.

Construction of Rheostats.

Since 1 volt will send 1 ampere through a resistance of 1 ohm, obviously 2 volts would be required to send 2 amperes through the same resistance, whereas 5 ohms would limit the current driven by 1 volt to $\frac{1}{5}$ ampere, and 10 volts would send 10 amperes through 1 ohm, or 20 amperes through $\frac{1}{2}$ ohm, and so forth. From these examples it will be seen that in every case the current (in amperes) flowing in any circuit is given by the pressure (in volts) divided by the resistance of the circuit (in ohms). Expressing this as a formula, we can say that $I=\frac{E}{R}$, when I, E, and R denote current, voltage, and resistance in amperes, volts, and ohms respectively.



A single-valve receiver assembled from parts by Mr. W. K. Turner, 64, St. Brannock's Park, Ilfracombe.

Just as we altered the formula for finding the speed of a train, so we can alter this formula according to which of the three quantities we require to find. If we require to find the voltage necessary to send a current of I amperes through a resistance of R ohms, we can write the formula thus, $E=I\times R$; while, in order to find the resistance of a circuit through which E volts will drive I amperes, we say $R=\frac{E}{I}$. These are by far the most important formulæ used in electrical work, and the amateur will be well advised to spare no pains in becoming quite familiar with the use of them.

It is proposed in this and subsequent articles to give some examples of the practical application of these formulæ, and others which will be explained briefly as they occur.

Suppose that we possess a Marconi "R" valve, rated for use on 4 volts, and we only possess a 6-volt battery with which to work it. How shall we decide upon the design of a resistance which will keep the current through the filament to its normal value when the 6-volt battery is used?

If we look at the valve socket, we will see it stated that the filament takes a current of 0·65 ampere at 4 volts. We have seen that in any circuit $R=\frac{E}{I}$ so that when the valve is connected to the 4-volt battery, and a current of 0·65 amperes flows, we can say that $R=\frac{4}{0\cdot65}=6\cdot15$ ohms; i.e. the resistance of the valve filament is 6·15 ohms. We require eventually a circuit which will only allow 0·65 amperes to flow when a pressure of 6 volts is applied.

The resistance of this circuit is therefore given by the expression $R=\frac{6}{0\cdot65}=9\cdot23$ ohms. As we already have a resistance of 6·15 ohms, the necessary additional resistance is 9·23 − 6·15 = 3·08 ohms. This, of course, is supplied by the filament rheostat, which, in order to provide a little working margin, could be made with a resistance of 4 or 5 ohms.

We must now find out how much wire is necessary to give us a resistance of, say, 4 ohms. The resistance offered by a wire to an electric current depends upon the material of which the wire is composed, and upon the length and sectional area of the wire, an *increase* in resistance being brought about by an *increase* in the length or a *decrease* in the area.

Dimensions of Wire.

A short piece of thick wire, measuring 1 cm. in length and 1 sq. cm. in sectional area, is taken as a standard sample of any material, and the resistance of such a sample is known as the *specific resistance* of the material, and is denoted by the symbol ρ (*Rho.*). The resistance of a piece of copper 1 cm. long and 1 sq. cm. in sectional area is about 1·7 microhms (a mic rohm is one-millionth of an ohm), i.e. for copper, $\rho=\frac{1\cdot7}{1{,}000{,}000}$ ohms.

If the length of the sample were doubled, the resistance would be doubled; while if the area were doubled, the resistance would be halved, and so on. Hence we can say that the resistance of any piece of wire is given by the specific resistance multiplied by the length and divided by the area, and can be represented thus: $R=\frac{\rho\times L}{A}$ L and A being the length and sectional area of the wire in centimetres

(*Continued on page* 849.)

WIRELESS WORRIES.

By L. McMICHAEL, M.I.R.E. (Secretary of the Radio Society of Great Britain).

This concludes the series of articles specially written for the beginner by Mr. McMichael. Further articles of a similar nature will appear in future issues of "Popular Wireless" from time to time.

IV. POINTS OF INTEREST.

ATMOSPHERICS is the term used in this country for natural electrical disturbances which are the greatest bane existent of practical wireless telegraphy and telephony, by reason of their interference with wireless signals, although to the student they are a point of interest. These electrical disturbances are known by several other names than atmospherics. For instance, in France they go under the name of "parasites," whilst in America they are invariably called "strays," or "statics," or "X's." They make themselves known by several descriptions of crashing, crackling, hissing, or spitting, and even cause incoming signals to be quite unintelligible.

The Origin of Atmospherics.

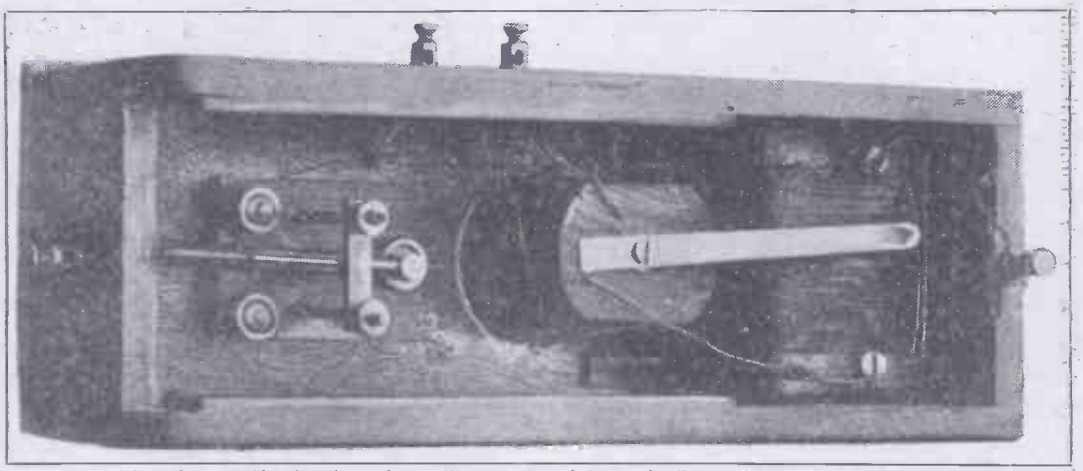
Atmospherics are supposed to be due to electrical discharges and disturbances in the terrestrial atmosphere such as in thunderstorms and violent disturbances such as occur in the sun. It is found that they attain their greatest prevalence in parts of India, in the Tropics, and in South America where sometimes long distance telephony is rendered impossible. In Europe they are not so objectionable, but are at their worst in the afternoon, and after dark in the spring and summer months. Among the peculiarities attached to atmospherics there is the possible fact of them having some relation with the sun; for it is found that when the sun is farthest north the disturbances are increased enormously. This is especially noticeable on the Equator and the Southern Hemisphere, and ships in that part of the hemisphere find that the reception is sometimes interfered with more when travelling in one direction than if they completely reversed and travelled back in the direction from which they had come.

Another point of interest is the subject of "blind spots." It is found that there are certain spots in England, for instance, at a certain distance from a broadcasting station where reception is almost impossible. Yet ten, twenty, or even fifty miles farther away from the station, results are wonderful. For instance, places in the north like Leeds and Sheffield experience great difficulty in receiving Manchester broadcasting which is about 40 miles distant; but they receive London 200 miles distant none too badly. Again, the same places do not receive London in any degree as well as it is received in Aberdeen—in fact, it has been said that it is possible to receive London in Aberdeen on a crystal set. The causes are not exactly known, but it is said to be due to intervening mountains, or ranges of hills which have the effect of screening places at which it is required to receive broadcasting.

"Freak" Reception.

There is many miles from the earth's surface what is known as an "outer layer," the density of which will not admit of penetration by wireless waves. It is thought that the wireless waves radiated from a wireless station, when they reach this outer layer are reflected back to the earth again at a certain angle, and the possible cause for "blind spots" is that stations do not lie in a direct line with the reflected waves or perhaps a range of hills lies between, and so has the effect of screening.

There is sometimes much talk of "freak" reception, such as receiving America on a one-valve set. This, however, is quite possible, although rather incredible, especially if the reasons stated with regard to "blind spots" are in any degree true.



A neat crystal receiver capable of quite good reception, constructed by a schoolboy. Photograph by J. W. Nicholls, of 381, Cavendish Road, S.W.12.

SIMPLE CALCULATIONS.

(*Continued from page* 839.)

and square centimetres respectively. Another way of writing the above formula would be as follows: $L=\frac{R \times A}{\rho}$ a form which will be convenient for use in calculating our valve rheostat. A suitable wire to use for a rheostat is No. 22 S.W.G. "Eureka" wire, "Eureka" being a material with a very high specific resistance. Looking up a table of wire gauges, we find that the sectional area of No. 22 wire is 0·0039 sq. cm. The specific resistance of "Eureka" is $\frac{49}{1,000,000}$ ohms, so that the length of this wire necessary to give our required resistance of 4 ohms is given by $L=(4 \times 0039) \div \frac{49}{1,000,000}=318$ cm. There are about 2½ centimetres to an inch, so that the length of wire required will be $318 \div 2\frac{1}{2}=127$ inches, or 10½ feet.

Many amateurs desire to charge their own accumulators from their electric lighting mains, and require to know how to limit the current through the battery to the most suitable value for charging. This is most conveniently accomplished by inserting some ordinary electric filament lamps in series with the batteries to be charged. In order to ascertain how many lamps are required, we must know first of all what charging current is necessary.

Charging Accumulators.

The best maximum charging current is obtained by dividing the ampere-hour capacity of the battery (continuous discharge rating) by 10; thus, a 40 ampere-hour accumulator should be charged with a current of 4 amperes. We then require to know the voltage of the electric lighting supply. This is usually 110 or 220 volts. Finally, the current which will pass through any particular lighting bulb must be determined. On the glass or the socket of the bulb there is nearly always stated the number of watts which the bulb consumes, and the current which passes can be determined by dividing this number by the voltage of the circuit.

Let us suppose that we are supplied with electricity at 100 volts, and we wish to charge a 40 ampere-hour accumulator, our only available lamps being of the 60-watt size.

The charging current required $=40 \div 10 =4$ amperes.

The current passed by one bulb $=60 \div 100=0{\cdot}6$ amperes. In order to pass a current of 6 amperes, we shall therefore require 10 of these lamps, each carrying 0·6 ampere, the lamps being connected in parallel with one another.

AN EFFICIENT OPEN-CORE TRANSFORMER.

By J. H. REYNER, B.Sc., A.C.G.I.

An instrument designed to give less distortion and quieter working than the usual closed-core type.

A VERY satisfactory intervalve transformer of the open-core type may be made up as follows: Procure a piece of fibre or ebonite tube ½ in. internal diameter and about $\frac{1}{16}$ in. thick. A length of this, 2½ in. long, should be cut off, and the ends screwed with a fine thread for a length of ⅜ in. Two end cheeks of ¼ in. ebonite, 2½ in. square, are then prepared, in the centre of which a hole is drilled and tapped to take the ebonite tube. This constitutes the former for the transformer.

The former is then mounted in a lathe or suitable winding device, and 25,000 turns of 43 gauge D.S.C. wire are wound on, the ends being brought through holes in the end cheeks.

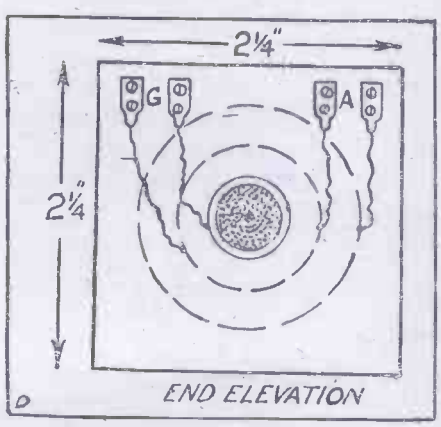
A layer of brown paper is then wrapped round and a further 12,000 turns of the same wire are wound on. A further layer of brown paper will compete the winding operation.

If there is no ready means available for counting the number of turns, the windings can be wound to an external diameter of 1¾ in. and 2¼ in. respectively, as indicated in the figure. This will give approximately the correct number of turns.

The Windings.

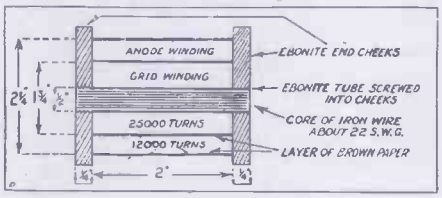
The windings should be started with thicker wire (about 30 S.W.G.), to which the fine wire should be soldered after a few turns have been wound. The actual join should be wrapped with tissue paper and shellacked when finishing the windings off. If the fine wire is brought out direct there is a risk of breakage where it comes through the cheeks. Both windings and the interleaving layers of paper should be well shellacked during the winding process. About ¾ lb. of wire will be required for the complete transformer.

The ends of the windings may be soldered to any convenient form of connection plate or terminal. The only remaining item now is the core. For this purpose a coil of soft iron or, better still, "stalloy" wire about 22 S.W.G., is procured and cut up into 2½ in. lengths. As many of these pieces as possible are then packed into the core of the transformer.



Careful Insulation Advisable.

The transformer is then complete, and may be connected up in the usual manner. The 12,000 turn winding is the anode winding, and is put on last, because if the transformer should break down in use the fault is more likely to occur in the anode winding, since this winding has to carry a permanent small current from the H.T.



battery. Every time the valve is switched off this current is broken, and this gives rise to a sudden high voltage in the winding. Special care should be taken with the insulation, therefore, to minimise the risk of breakdown.

This transformer will be found to give as good amplification as the usual closed core type, but is much quieter and freer from distortion. The figure gives a section through the completed instrument.

WIRELESS IN LATIN AMERICA.

By P. F. MARTIN, F.R.G.S.

THE success attending the establishment of wireless communication between the Republic of Colombia and the outside world has encouraged similar enterprise upon the part of other Latin American States. The large station at Bogotá—the first of its kind to be established in Latin America—is being employed for external communication and for collecting messages from other internal stations for transmission to neighbouring countries, while it has been found possible to introduce rates for external communications lower than existing cable rates.

In order to bring the Latin American States into closer communication with the United States, the Radio Corporation of America, in conjunction with the General Electric Company of Schenectady, have raised $20,000,000 (roughly £4,000,000) to be devoted to service in Central and South America. The former British interest in the Marconi Company has been acquired by the General Electric Company, and the ownership and control of all operations of the Radio Corporation are now vested exclusively in Americans.

In Cuba all wireless service is henceforth to be considered public service, restricted only by certain rules made by the State. All stations installed on national territory will become subject to official inspection by the Department of Communications, under the Secretary of the Interior, while no experimental stations may be erected without a permit from that Department.

Honduras Takes the Lead.

In Argentina the Compañia Transradio Internacionál has almost completed the erection of a wireless station at Monte Grande, located on the Buenos Aires Great Southern Railway. This station—which will form one of the most powerful of its kind in the world—is to be opened in the coming month (July) with some ceremony. It is hoped that the President of the Republic will preside at the function.

Wireless has made decided progress in Brazil, where the latest achievement of importance has been the successful transmission of Ministerial speeches from the Praia Vermelha station at Bello Horizonte. The speeches—which were delivered by the Ministers of Communications and Justice—were distinctly heard at such distant points as São Paulo and Juiz de Fora.

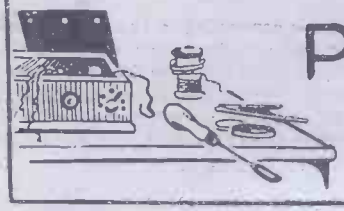
In Central America, Honduras has taken the lead in the establishment of the most powerful wireless station. This has been erected by the Tropical Radiotelegraph Company, and consists of two towers—each 450 feet in height—1,152 feet apart.

Progress in Mexico.

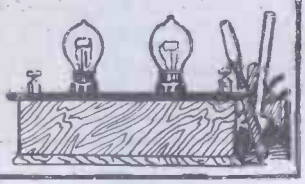
While the present antennæ are composed of thirteen wires—of which ten are direct and three intermediate—it is intended to add thirteen more almost at once. The necessary electricity for the operation of the station and plant is furnished by a 75-h.p. Fairbanks-Morse motor with an auxiliary of 15 h.p. The current is 2,200 volts. The station is able to communicate directly with the United States, or, by relay, with any station in the world. The erection of the buildings and the installation of the necessary plant have cost approximately $500,000 (£100,000).

The Mexican Government has decided to equip all its embassies, legations, consulates, and commercial agencies with wireless receiving stations, so that they may be in a position to obtain without delay all necessary information regarding laws, decrees, and items of international and commercial significance, which will be transmitted from a powerful station in Mexico.

Capt. G. H. Mallins, the famous aviator, broadcasting from 2 L O.



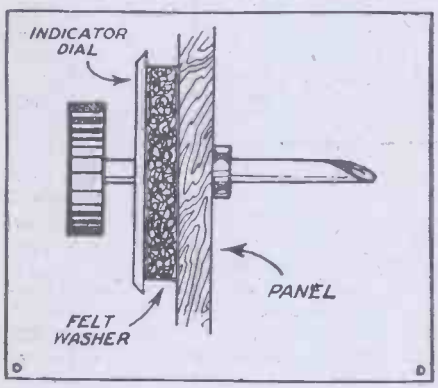
PRACTICAL IDEAS FOR THE AMATEUR



NOISELESS ADJUSTMENT.

MANY amateurs, especially those interested in long-distance reception, are aware of the annoyance which is often caused by the scraping of a faulty indicator dial on the surface of the panel. By making use of the following tip, this undesirable friction can be completely avoided.

Remove the indicator dial from the instrument, and cut a circular felt pad a little smaller in diameter than the actual dial. The centre of the pad should also be cut out to allow of the passage of the supporting shaft. The felt pad should then be glued to the back of the dial and the instrument reassembled. The pad should be approximately an eighth of an inch, and certainly not more than a quarter of an inch, thick. The appearance of the panel will then not be in any way affected by the presence of the felt, which from the front of the instrument will be invisible.



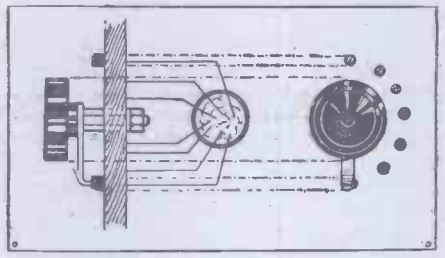
In replacing the dial see that it fits tightly against the panel facing before finally securing it in position.

Dials treated in this manner will work smoothly and efficiently, and, what is of equal importance where the reception of weak signals is concerned, without setting up undesirable noises in the telephones.

A NOVEL CRYSTAL CONTACT.

THE accompanying diagram shows a novel method whereby a sensitive point on a crystal detector may be easily and quickly found.

A series of stops or studs such as are



commonly employed for the tappings taken from the ordinary cylindrical former of an inductance coil are employed, together with the orthodox switch-arm.

Tappings of suitable wire are taken from the studs in question to make contact with the crystal on as many sensitive spots as can be found. Should one adjustment then be placed out of order for some reason, it is only necessary to move the switch-arm to the next stud to readjust the set.

Stable Contact Ensured.

To those readers who are of a mechanical turn of mind, many elaborations of this idea are possible, but space will only permit of one being given here.

Carefully remove the crystal from the cup and bore as many small holes through the side of the cup as there are contact studs on the face of the panel. Small needles are then placed in small insulating bushes, through the holes, and the crystal replaced until it is being gripped by the needle points on various parts of its surface. The tappings from the studs are then taken to the end of the needles. The advantage of this method is that the crystal contacts are not easily dislodged, and a certain amount of stability of contact is ensured.

A FEW TIPS.

When telephones are being used in a different room to the set, the following method proves more satisfactory than the usual way providing an earth is available in the second room. Connect one tag of the telephones to the one of the telephone terminals connected to the set and connect the other tag, not to the other terminal, but to a second earth in the room in which the 'phones are being used.

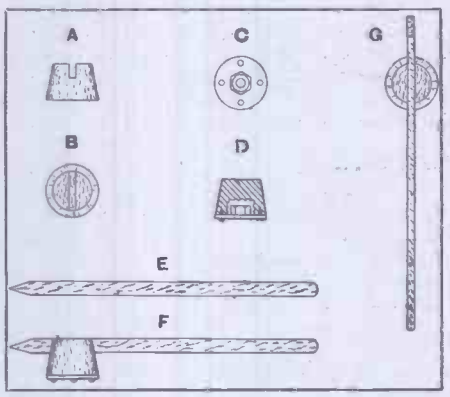
* * *

Most amateurs like to make every possible part in their sets, but usually do not attempt to make their own crystals. It is worth trying, however. Take equal volumes of flowers of sulphur and lead, melting the lead in a tin lid and removing any dust that may accumulate on the molten surface. Then add the flowers of sulphur and stir until the mixture turns hard and black. When cool, quite a satisfactory crystal will result.

A SIMPLE ANTI-CAPACITY HANDLE.

APART from the main purpose of eliminating body capacity effects an elongated handle is always preferable to a small diameter knob, since by its use it is possible to obtain very fine adjustments. The writer, having made up a number of these fitments with the greatest of ease and at a cost which is practically negligible, proposes to pass on the idea to any readers likely to be interested.

A piece of round hard wood 1 in. in diameter by about 1 in. long is slightly tapered and provided with a slot at the top



as shown at A and B. A disc of $\frac{1}{16}$th in. sheet brass 1 in. in diameter has a $\frac{5}{16}$th in. hole drilled through the centre and over this is soldered an ordinary 2 B.A. brass nut, which has been previously filled with clay or plaster of Paris, to prevent the solder adhering to the threads. This, of course, is removed when the nut is securely soldered in position. Four small holes are drilled round the disc for the purpose of attaching same to the under side of the wooden hub by means of small wood-screws. C shows the nut soldered in position on the disc.

Finishing Touches.

The under side of the hub is recessed to take the nut and the disc is now screwed firmly in position, as shown at D. A strip of wood, E, is made a "friction tight" fit in the slot, and, if necessary, secured with a little glue. About $1\frac{1}{2}$ in. of the strip is extended as indicated at F, and this end is cut to a point and made to function as a pointer. The length of the strip is optional—the longer the better. The completed fitting is now cleaned up smoothly by means of a piece of glass paper and given one or two coats of black enamel, or it may be finished in any other suitable way. G shows a top view of the completed fitting F.

A SINGLE-VALVE SET FOR USE WITH A FRAME AERIAL.

A circuit, simple to construct and manipulate, that will actuate a loud speaker up to a range of fifty miles.

THE single-valve receiver described below is an adaptation of the circuits incorporated in the instrument which Major Armstrong designed, and which he refers to as his "flivver." The apparatus need not necessarily be confined to one valve, although the following description is so limited.

The particulars of this interesting circuit were recently described in the "Radio World" by W. S. Thompson, and due acknowledgment must be given for a very concise and clear outline of the set. It is apparent that in the circuit shown, the single-valve is made to perform as much work as the ingenuity and exhaustive knowledge of the designer could possibly make it.

Only Two Tuning Controls.

Enormous amplifying properties are claimed for this type of circuit, and it is also stated that the simplicity, not only in the construction of the instrument, but in the method of tuning, in no way impairs the amplification, despite the fact that super-regenerative circuits are employed.

A frame aerial is employed, as no advantage would appear to be gained in going to the trouble of erecting an outdoor aerial. An aerial of the "open" type, moreover, would necessitate so loose a coupling, in order to eliminate undesirable noises, that any additional advantage that might be derived from making use of such an aerial would be nullified, and no appreciable difference in the strength of the received signals would result.

The usual method adopted in connecting a frame aerial to a receiving set is to wind the frame with the number of turns required to obtain the desired wave-length, a variable condenser being connected in parallel with the frame winding for the purpose of fine tuning. This method will answer nicely as far as tuning the grid circuit of the apparatus is concerned. It must be remembered, however, that to make use of reaction, the plate circuit must be coupled back to the grid circuit, and in this instance regeneration is obtained by connecting a variometer in the plate circuit, which is thus capable of being tuned.

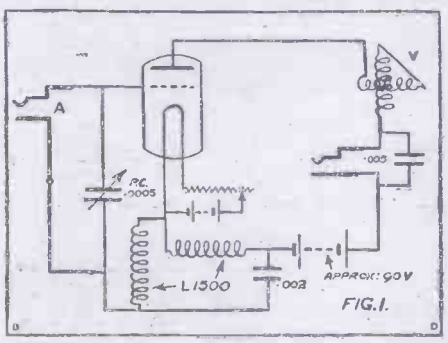


FIG. 1.

It is not within the scope of this article to deal with the many advantages to be derived from employing this form of regeneration. It appears to be admirably suited to sets using frame aerials, and was, therefore, adapted to the circuits under consideration.

The next point described is the manner in which the valve was made to oscillate, and thus set up the self-oscillatory circuits at the high frequency essential to this type of circuit. The orthodox plan is to include in the plate and grid circuits high inductance coils of the honeycomb variety, and to shunt them with variable condensers, the coils being coupled inductively. This method of tuning obviously calls for three adjustments, as each condenser must be adjusted in turn, and the proper degree of coupling between the coils found. If the relative values of the honeycomb coils are carefully considered, and the coils well matched, the variable condensers may be dispensed with and the coils coupled with the fixed condenser.

Assuming that this plan is adopted, only two tuning controls are incorporated in the complete set, unless the filament resistance be taken into consideration, which would make a third.

The set is, admittedly, not the ideal type of receiver for long-distance working, but for the reception of signals over normal distances it will function, not only as a detector, but will amplify to a considerable extent.

Details of the Frame.

So great, indeed, are the powers of amplification claimed for an instrument of this type that it is stated that signals received on the ordinary broadcast wave-lengths will sufficiently actuate a good loud speaker to fill a small room, provided that the transmitting station is within a radius of fifty miles.

It should not be presumed from the foregoing that the set is of no use for long-distance work, as such signals may be received on the lower wave-lengths. It is, however, more efficient when utilised in the manner described. The construction and design of the apparatus are left to the individual taste of the experimenter, but certain particulars are given which will help a great deal when considering the components to be used in constructing the set.

A frame, 3 ft. square, wound with 10 turns of No. 18 copper wire, will make a good aerial. The wires should be placed approximately half an inch apart. The brass parts of a plug of the torpedo type should be attached to the base of the vertical standard, this operation being performed by removing the tip-posts and screwing the plug to the aerial.

The dotted lines in Fig. 2 show the manner in which the Jack A—for attachment to the aerial—and the coupling condenser C, are connected to the circuit, and mounted on the back of the panel. Before being attached to the main panel, they are mounted, as shown, on a base or secondary panel, which is connected to the top of the variometer, and also to a cleat on one end of the cabinet. By mounting the apparatus on the rear of the panel, as shown in Fig. 2, the grid coil may be very loosely coupled to the variometer, and this will help to stabilise the regeneration.

Adjustments and Tuning.

As the tuning of the set is very critical, the use of a Vernier rheostat and a Vernier condenser for tuning the aerial are advised. Mica condensers of good make, in which the plates and dielectrics are held firmly together, should be procured when considering the telephone and coupling condensers, as it is important that the capacity of these instruments should remain always of the same value.

Use discretion in choosing the filament accumulator, as if the best results are to be obtained from the set, the grid of the valve should have a normal negative potential. As the chief feature of the set is its power of amplification, the plate battery should be of rather higher voltage than that usually employed.

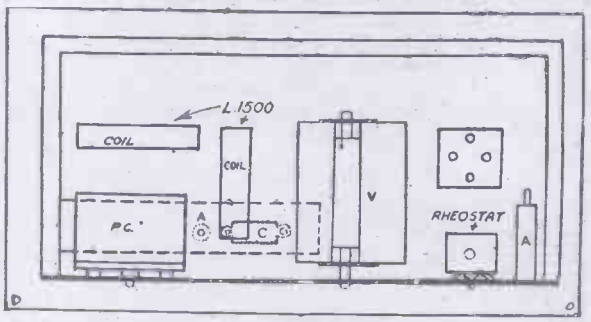


Fig. 2.

The two honeycomb coils should be so arranged that they are perpendicular to each other, using the value for the coupling condenser shown.

The panel should be well shielded, and the shield "earthed." An outline of the components required is given below:

1 Vernier air condenser, 0·0005 mfd., 1 variometer, 1 valve, 1 valve-socket, 1 Vernier rheostat, 2 single-circuit jacks, 2 mica condensers (values respectively 0·005 mfd. and 0·002 mfd.), 1 main panel, 1 secondary panel or base for mounting jack, etc.

These are the chief items, and do not, of course, include wire or terminals, or other small items necessary to complete the instrument.

In tuning the apparatus, adjust the filament rheostat until a high-pitched note is heard in the telephones. It will generally be found that in order to obtain this the filament will be a little brighter than is usual, but be careful not to take out so much of the resistance that the valve is endangered.

Adjust the tuning condenser at about one quarter of its capacity, and then slowly proceed to couple the variometer. If everything is in order, the regenerative properties of the circuit will begin to make themselves evident by the familiar hoarse roar peculiar to regenerative circuits. When the correct adjustment has been found, this noise will cease, and the only sounds audible to the operator, other than X's or jamming, will be legitimate signals.

GEARY AS AN EDITOR.

By HIGHAM BURLAC.

Describing the adventures of the inimitable Geary in the world of "technical" journalism.

I'VE mentioned Geary before, if I'm not mistaken. He is one of the numerous things the gods have sent to annoy me. When he told me he was thinking of starting a paper in the interests of the amateur wireless fraternity I encouraged him warmly—and quite against my better nature. The way of a Wireless Editor is not unduly cumbered with milk and honey, as some of us have discovered, and is more like the way of a man with a maid or the way of a rabbit with a rattlesnake—deuced awkward at times.

Yes, I confess I hankered to see Geary all lashed up with a stumer of a circuit and a mob of raging subscribers battering at the front door. I yearned to see him sobbing over galley-proofs full of formulæ in which subscripts were all capitals and the π's and ω's all omitted by an intelligent compositor who didn't "believe in this 'ere new-fangled arithmetic wot's all cabalistic signs." So I helped Geary all I could.

Qualifications!

He first mentioned his ambition to me one night when we were walking home from the local wireless club, of which he is president, and of which I am a sort of fairy godmother—the sort that buys new valves, does all the repairs, and pays the deficit on the annual outing.

"Why ever do you want to do it?" I asked. "Aren't there enough on the bookstalls for you already?"

Geary suspended the publication of all the current radio magazines with a Napoleonic wave of the hand.

"Bah! With the exception of the 'Highbrow Wireless Gazette,' they're all useless, and even that is becoming fossilised. Look at the 'Oscillator'! Tripe! Look at 'The Modulator'! Balderdash! Look at 'Wireless Notes Quarterly'! Jimson runs that. Squirts out pages paraphrased from Gaybang's Radio Manual, which he had to learn by heart before he dashed into the firing-line at St. Omer as an Assistant Batman to a Deputy Second-Class Instructor (Acting) in the Dry Cell Section of the Canteen Radio Corps."

"Why don't you contribute to some of these unworthy organs of public opinion, and thus improve them?" I asked.

Geary Butts In.

"I've offered. Why I even offered to assist Jimson for nothing in the evenings, but he laughs. I've offered a complete history of wire-drawing to all of 'em, in fortnightly parts. I've offered 'em a series of biographies of eminent Clapham engineers. Very rude they were, most of 'em, in a polite sort of way. Specially Galloway of the 'Highbrow Wireless Gazette.' He turned right round in his swivel-chair, and said:

"'Geary, why must you butt in? You're a brewer's accountant, but *I* don't keep worrying *you* with advice how to keep beer books. Go away and leave editorising to those who understand it. Yes, you're a nut on valve circuits, I know. Better teach the Boy Scouts. Little devils, bless their hearts!'

"*That* decided me to start a paper myself."

"Righto!" I said. "What are you going to do about it?"

"Oh, I shall start with a Summer Number. Two hundred extra pages, and a Free Gift Picture of the Editor."

The First Number.

"If I were you, Geary," I replied, "I should see a printer, inquire about paper prices, and then work out the estimated loss per copy. But don't let me throw cold water on you. All I say is:

"*Eena deena dinah doe,*
Veni vedi vici et wot ho.

"That's a Latin couplet by Horace—you know Horace? Used to keep a peanut stall on the Bridge, and it means, 'Those on whom the Big-Joss desires to tie the Can, he first turns Blotto.'"

By virtue of the asinine obstinacy generally possessed by those who suffer from fixed ideas Geary actually got into print with "The Loud Speaker Weekly." It had ten pages of editorial matter, enlivened by a few inset advertisements relating to the curative properties of certain pills. It was largely advertised in the "Clapham Free Advertiser," and round at the club, whose members subscribed to a man. Geary said each copy cost him tenpence, so he charged a shilling. Here is the contents list of Number One.

"THE LOUD SPEAKER WEEKLY"
Vol. I. No. 1.

THIS NONSENSE MUST STOP AT ONCE.
A Word with the Post Office Committee on Broadcasting.

WIRE-DRAWING. TEN CENTURIES OF PROGRESS.
By A. Geary (Editor).

HOW I INVENTED THE A.C. DRY CELL.
By Higham Burlac.
(As a matter of fact, I dreamt it.—H. B.)

LITTLE TITS' CORNER.
An Hitherto Undisclosed Valve Circuit.
By the Editor.
(EDITOR'S NOTE.—No home should be without it.)

RECIPES FOR VALVE CIRCUITS.
By the Editor.

(*Here I must tell you that this striking article begins like a cookery book: "Take any old circuit. Halve it. Double the result. Insert a Primus Valve, though any other would do as well, perhaps. Cook up generally, adding any sort of guff to taste, and serve with paper frills.*—H. B.)

INTERVIEW WITH AN EX-MAYOR OF CLAPHAM.

A CHAT WITH UNCLE CARACTERUS.
(Uncle C. is a friend of mine, and he told me that Geary was the first editor he had succeeded in chucking down the ash-lift with one hand.—H. B.)

HOW TO RECEIVE 2 L O WITHOUT VALVE OR CRYSTAL.
A Visit to the Broadcasting Salon.

WORKSHOP WANGLES: 1.—The Hammer.
(Copiously Illustrated with Photographs of Hammers.)
HOW TO SELL RECEIVERS.
By "Ex-Salesman."
(The "Ex-" is illuminating.)

MONTHLY REPORT OF CLAPHAM WIRELESS SOCIETY.

NOTES, NEWS, PATENTS, LIFTED PARAGRAPHS, FILL-UPS, ETC.

A GOOD BOB'S-WORTH. SEE THE WEEK AFTER NEXT OUR HITHERTO UNDISCLOSED COHERER CIRCUIT.

Completely Eclipsed.

Well, Geary sold out. All London screamed for more, and though space does not permit me to give you the contents of the succeeding issues, I may say that "The Modulator," etc., began to take notice. The Editor of the "Oscillator" resigned, and went to Latvia. Jimson, of "Wireless Notes Quarterly," developed fits. "Punch" engaged new humorists, not as casual contributors, mind you, but *on the staff*. Geary bought a car and lowered the price of "The Loud Speaker Weekly" to fourpence three-farthings.

Then he added sixty-four pages to the rag, and induced Henry of Wigan, the world-famous Lancashire Comedian, to write for it to the extent of a hundred lines a week. Finally, Henry appeared as "Our Comic Editor," and Geary developed a double chin and an astrakhan coat.

You ask why Geary still keeps beer books. Well, it's a case of an eclipse. His paper was just about to be sold to a syndicate for an enormous sum when the new broadcasting regulations issued by the first Labour Government were made public, and the laugh went round in the other direction, and the Labour P.M.G. was taken on by the syndicate at £350 weekly. Though the heavens fall, England must laugh.

In this instance, Geary beat me. That reminds me. Did I ever tell you how Geary ran a revolution in San Blanca? No? Another story, *mes amis*.

Wireless Club Reports

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

South Dorset Radio Club.

The first of a series of lectures on Wireless and allied subjects drew a large attendance of members and potential members of the South Dorset Radio Club to Weymouth Guildhall on Tuesday evening, the 5th inst., when Capt. Hobbs (2 O Y), the well-known Wareham experimentor, discoursed on "The Practical Application of Theory."

Hon. sec., E. B. Cartwright, 18, Newberry Terrace, Weymouth.

Walthamstow Amateur Radio Society.*

On Saturday, June 16th, the club held the first field day of the season. A very useful aerial was erected in a quiet spot, without damage to either person or property, and experiments were the order of the evening. It is hoped to repeat the tests at an early date, making use of the knowledge gained.

Hon. sec., Mr. H. J. Sarson, Belle Vue House, Beacontree Avenue, Walthamstow, E. 17.

Battersea and District Radio Society.*

On Tuesday, June 12th, a lecture on "Accumulators" was given by Mr. G. E. Reeves, which proved of great interest to the members.

The society is now affiliated to the Radio Society of Great Britain, and it is hoped that this will help to extend the club's activities.

Hon. sec., A. E. P. Walters, 31, Holden Street, Lavender Hill, S.W. 11.

Burnley and District Radio Society.

The usual fortnightly meeting was held on Thursday, June 21st, at the Mechanics' Institute, when Mr. F. Drinkwater, of the Hart Accumulator Company, gave an instructive lecture on "The Care of Accumulators."

Hon. sec., W. H. Thornton, 16, Bridge Street, Burnley.

Wimbledon Radio Society.*

A very successful meeting of the above society was held at headquarters, the Red Cross Hall, 59, Church Road, Wimbledon, S.W. 19, on Thursday, 21st June, when a lecture was kindly given by Mr. Atkinson, of the Igranic Electric Co., Ltd.

Hon. sec. (pro tem.), C. G. Stokes, 6, Worple Avenue, Wimbledon, S.W. 19.

White Hart Lane Estate Welfare Association (Radio Section).

At the above association's meeting, held on Monday, July 2nd, at the Risley Avenue Schools, we had a very interesting lecture given by one of our members, Mr, Williams, on "Crystal Detectors."

Hon. sec., Mr. W. J. Messer, 224, Tower Gardens Road, N. 17.

Sydenham and Forest Hill Radio Society.

An interesting lecture was given before the above society by Mr. C. A. Percival, of the Edison-Swan Electric Company, on the intricacies of the Thermionic Valve manufacture.

Also, at a recent meeting, a lecture and demonstration on "Dual Amplification" was delivered by Mr. Voigt.

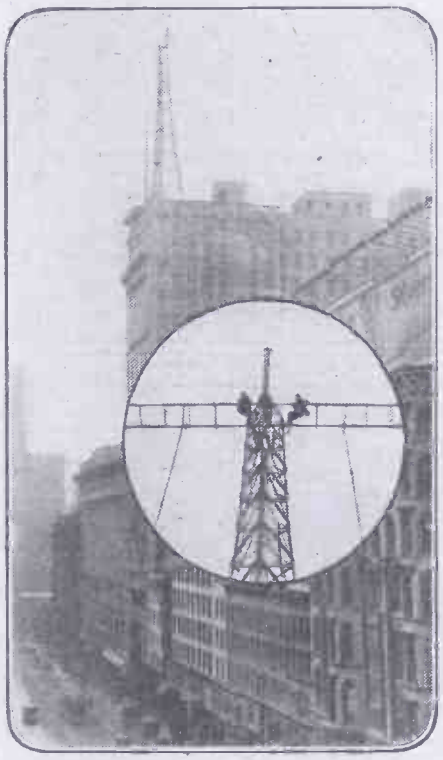
Hon. sec., M. E. Hampshire, 139, Sydenham Road, S.E. 26.

Honor Oak Park Radio Society.

At a meeting of the society held at St. Augustine's Hall, on June 27th, a lecture on "Dual Amplification," followed by a demonstration, was given by Mr. J. C. MacVey.

Messrs. Alfred Graham & Co. have offered to the society the services of their principal electrical engineer in an advisory capacity.

Hon. sec., G. J. Price, 22, Honor Oak Park, S.E. 23.



America's latest and largest radio broadcasting station in the course of erection by the Radio Corporation of America on the roof of the Æolian Hall, New York. Inset, two workmen, 326 ft. above the street, putting finishing touches to the top of the tower.

Catalogues Book Reviews Etc.

Two interesting little handbooks—"How to Tune your Radio Set," and "100 Wireless Hook Ups"—have been published by the "E I" Company of New York. These books are extremely interesting, and we hope that soon they will be published by some enterprising English firm.

A neat, cheap, yet efficient little wavemeter that should appeal to all wireless enthusiasts, has lately been put on the market by The Bowyer-Lowe Co. This instrument has been designed to meet a growing need among amateur experimenters for a reliable means of measuring short wave-lengths, calibrating coils, transformers, etc.

* * *

"Radio in Summertime" is the title of the Sterling Telephone and Electric Co.'s new catalogue. Besides containing a list of their new sets, telephones, etc., it also gives eight sketches of the uses to which their sets may be put during the summer months. We have also received a leaflet describing the Sterling "High Tension Smoother," which has been designed to enable users of valve instruments requiring a plate voltage of from 100 to 300 volts, to employ the direct current electric supply where available, and the use of which involves freedom from undesirable noises.

* * *

We have received from Will Day, Ltd., their fine price list of components and complete crystal and valve sets. This firm stocks every component that is likely to be needed by the amateur at a very reasonable price, and no wireless enthusiast should be without this catalogue.

* * *

Radiax, Ltd., have forwarded us their latest catalogue dealing with complete sets and components. Of special interest is the "Radiax Unit System," designed for the experimenter. Complete sets can be supplied in parts, with full instructions for putting them together. Another interesting item is their "Reactance System," which can easily be applied to any set using the H.F. method of amplification.

* * *

A very neat "Combined Lightning Arrester and 'Phone Hook" has been placed on the market by George Palmer, Ltd. This little instrument is in no way unsightly, and should be a very useful accessory for all amateur sets.

* * *

Leaflets describing the "Cosmos" crystal set amplifier and the "Cosmos" Radiophone Protective Device have been forwarded to us by Metropolitan-Vickers Electrical Co., Ltd. The "Protective Device" deserves special mention. It is extremely neat, and is designed for the protection of wireless installations against damage by lightning or atmospheric discharges. Moreover, when the Protective Device is used, it is quite safe to listen-in even during a severe thunderstorm.

* * *

A good L.F. transformer is absolutely essential to the good working of a set using this method of amplification. A very goop transformer of the hedgehog pattern has been forwarded to us for test by the Griffin Wireless Supplies Co. It is wound with the best D.S.C. wire, and has a ratio of 4·7—1, and is tested to 1,500 volts. It is guaranteed absolutely distortionless, and the amplification has proved to be very good under test. The insulation is of Empire cloth and is guaranteed perfect. The core is of best Swedish iron. It can be supplied for panel mounting or mounted on a box for a little extra.

Everything wireless at Autoveyors

Only the best products will give you really satisfactory results in Wireless. Here is a brief selection of the best obtainable. Note the prices:

P.M.G. AERIAL, 100 ft., 7/25 best tinned copper wire, heavily insulated (insulators are unnecessary with this aerial).....each 7/-

CRYSTALS, specially selected and tested—Volumite, 2/-; Talite, Hertzite, Zincite, Permanite, Tellurium, Selenium, 1/9; Molibdinite, 1/6; Iron Pyrites, 1/-; Bornite, Galena, Carborundum, Silicon, 6d.; Graphite, 3d.

TENTACLES: Iridia Platinum, 1/3; Gold, 1/-; Silver, Tungsten, Aluminium, Nickel Chrome, Nickel Copper, German Silver, 3d.; Zinc, 2d.; Copper, Brass, Steel, Lead, 1d.

FILTRON VARIABLE GRID LEAK, for precision control of rectification.....each 5/-

FILTRON COMBINATION, a variable grid leak (zero—7 megohms) coupled with a variable grid condenser (zero—.0007 mfd.).....each 10/-

STATIC-ROTER: A lightning and Static Discharger which may be fitted to any set and ensures perfect safety either during operation or otherwise.....each 3/6

PLASTIC-METAL-GOLD SEAL, for mounting crystals within an assured metallic continuity....per pkt. 6d.

PORTABLE AERIALS FOR RIVER CRAFT, heavy insulation and multistrand conductor.....each 7/-

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to all engaged in

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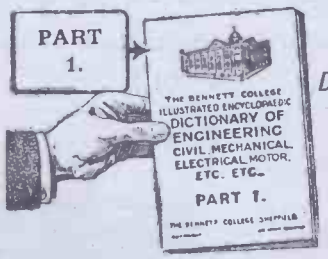

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(Do not fail to give the particulars required and use this full address.)

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VARIABLE CONDENSERS

COMPLETELY ASSEMBLED WITH EBONITE ENDS AS SHOWN IN SKETCH.

		ASSEMBLED BUT WITHOUT EBONITE ENDS.	
·001	8/-	·001	6/6
·00075	6/9	·00075	5/6
·0005	5/11	·0005	4/6
·0003	4/11	·0003	3/6
·0002	3/11	·0002	2/6
·0001	3/8	·0001	2/3
Vernier	3/3	Vernier	1/9

Pair of ebonite drilled ends to fit yourself on above 1/- extra.

NOT A BAG OF PARTS.

NOTE.—Postal Charges 9d. per set, otherwise not executed.

To callers 1d. in the 1/- discount off condensers.

Variometer on ebonite, W. 250/750 metres, internally wound. Very fine. Sell at sight, 17/11.
Fixed Condensers (from .0002 to .006), 9d., 10d., 1/-, 1/6.
Ebonite Dials (with knob 0-180), 1/4 and 1/6.
Turned Ebonite Valve Holders, 8 nuts, 1/-.
Fil. Resistance, 1/8, 1/10, 2/3.
Fil. Resistance, 7 ohms, 3/6.
French "R" Valves, 9/6.
Moulded Valve Holders, with nuts, 9d.
Perikon Crystal Detectors, glass, 2 crystals, 1/4, 1/6 and 2/8.
Glass Dustproof high-class Detector (whisker), 3/-.
Contact Studs and Nuts, doz. 4½d.
Valve Pins, doz. 7d.
2 B.A. Nuts, 3 doz. 7d., 1/10 gross.
4, 5, 6 B.A. Nuts, 3 doz. 6d., 1/6 gross.
Terminals, special offer with nut, 4 for 3½d.
Valve Legs and Nuts, 1d. each, 9d. doz.
Valve Legs with shoulder, 2 for 2½d., 1/- doz.
Switch Arms, very good, 8d., 10d., 1/3.
Twin Flex, 4 yds. 7d., 12 yds. 1/7½.
Genuine (Shaw's) Hertzite, 9d., 1/-, 1/3, 1/6, according to size.
100,000 ohm Resistance, 2/3.
T.M.C. 'Phones, 4,000 ohms, B.B.C., 22/6.
Grid Leak & Condenser, .0003, 2/-.
Coil Holders, 3-way, on ebonite, 6/- and 6/6.
2-way Coil Holders, good value, 5/-, 5/6.
15 v. H.T. Batteries, 2 plugs, 2/6.
30 v. H.T. Batteries, 2 plugs, 4/6.
36 v. H.T. Batteries, 2 plugs, 4/9.
100 feet 7/22 Aerial wire, 4 Insulators, the lot, 2/6. No post orders.
Real Ebonite Knobs, 2 B.A. Bush, 3d.

Please note that a special discount 1d. in the 1/- is given off many articles in the windows where not marked NETT. This must save you a large sum, as in any case profits are reduced to a minimum.

Marconi R Valves, latest type, 45-60 v., 14/11.
Brunet 4,000 ohm genuine 1st quality Headphones, 17/11.
N. & K. 6,000 ohm Headphones, extra loud, 15/11.
H.T. Batteries, 2 Wander plugs, 66 volt, 8/6.
H.T. Batteries, 2 Wander plugs, 60 volt, 8/-.
Aerial Wire, 7/22 per 100 feet, 2/3¼ and 2/11½. No post orders.
Rotax Accumulators, 4 v. 40 amp., 15/6.
'Phone Cords, double, extra long, 10d.
5-1 Intervalve L.F. Transformers, 11/6.
Wound Coils, 6 x 3, Turns 180, W.L. 1,100, 1/6.
Wound Coils, 12 x 4, Turns 400, W.L. 3,800, 2/6.
Variometers, very good value, 250/750, 3/5.
Crystal Detectors (whisker), extra value, 1/1 and 1/3.
Large Telephone Terminals, 2 B.A., with nut and washer, 2 for 3½d.
Terminals, all kinds, with nuts and washers, 4 for 6d.
Basket Coils (6 in set), up to 3,000 metres, well made and efficient, 2/6.
1 Switch Arm, 12 Contact studs and nuts, the lot 1/-.
Sleeving, takes 18-gauge wire, 3 yards for 1/-.
Insulating Hooks, 3 for 3½d., 1/- doz.
D.P.D.T. Switch, compact, high-class article, 2/3½.
4 yards Copper 18-gauge connecting wire, 2d.
6 yards Bell Wire, 2½d.
6 yards Bell Wire, D.C.C., I.R., 3½d.
Radio Instruments, Ltd., L.F. Intervalve, 25/-.
6 v. 60 a. Accumulators, extra bargain, 30/-.

SPECIAL PRICES RADIO CLUBS AND TRADE.

IN STOCK.—Mullard Ora, Cossor, Ediswan Valves, and Crystals of every description.

Everything you want for your set.

We want your business by post, but MUST have postal charges as follows: Up to 10/- 2d. in the 1/- (or any part); Up to 20/- 1½d. in the 1/- (or any part). Over 20/- carriage paid. (Condensers excluded).

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RADIOTORIAL.

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

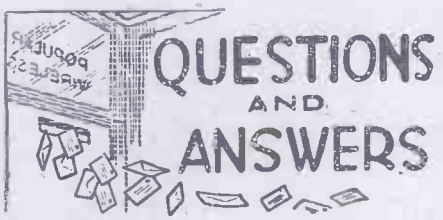
Since the introduction of the POPULAR WIRELESS Combination Set, the need for a constructor's licence has been even more greatly felt than during the past months of waiting and wondering. Unit One of this unique receiver provides three circuits, none of which can cause interference by re-radiation, while Unit Two is merely a stage of note magnification which, however, increases the number of available circuits to six. It will be seen, therefore, that no trouble could arise even if a hundred thousand amateurs built and placed the POPULAR WIRELESS Combination Set into commission, although legally, they are required to possess experimental licences before doing so. However, I hope that shortly a constructor's licence will become available and permit those amateurs unable to obtain an experimental licence, to go ahead with the construction of the most useful set yet designed.

The EDITOR.

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be exercised in answering queries. Until further notice three questions from one reader will be the limit for one letter. All questions should be addressed to POPULAR WIRELESS Queries Department, Room 138, Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send the necessary postage for reply.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.



D. O. S. (Streatham).—I am leaving this address for about six or eight weeks, and wish to pack up the set until I return. What is the best way to store the accumulator ?

If you intend to leave the battery for a long period without attention, you will have to take special precautions to preserve its condition. Give the cells a good slow charge so that they gas freely for several hours and then empty the acid out. Rinse the cells several times with clean distilled water, and when they are quite clean leave them to dry. The negative plates may be found to warm up a little during the process, but this will not result in any injury. When you wish to use the accumulator again fill up with fresh acid of 1·25 specific gravity, and give the battery a long, slow charge until the cells gas freely for about six hours. After this, the battery may be used as usual. It is advisable to go through this process if the cells are to be left for any length of time, otherwise, sulphating and crumbling of the positive plates may occur.

* * *

L. D. (Hendon).—Is it necessary to have a lightning conductor on the aerial pole ? Should the earthing switch of the set be outside the house ?

It is not usual to have the aerial mast protected in this way, but as an extra safeguard it would be a good plan to make use of a conductor. This should consist of a flat copper strip about 1 inch wide and ¼ inch thick and it should run from the bottom of the pole, sunk in the ground, to about 8 or 12 inches above the upper end. The upper end should be shaped into more or less of a point, though this need not be sharp, of course. If you are unable to use copper strip, thick galvanised iron wire—about No. 12 gauge—can be employed. As regards the earthing switch it is advisable to have it outside the house, so that a direct path to earth can be provided. If you use a water-pipe earth it is best to provide an alternate 'lightning earth," in the form of a straight wire to the ground, where it should be buried to a depth of two or three feet. The switch should then be arranged to connect the aerial either to the set or to the direct earth, the water-pipe " earth " being left connected to the set. In arranging the switch and earth connections bear in mind the fact that the path provided for lightning or any electrical discharge should be as straight as possible, otherwise the discharge will spark across any corners, and tend to damage the building.

* * *

" POTENTIAL " (Tottenham).—Please give me details of a potentiometer for use in a valve set.

Procure a piece of ebonite 7 inches long, 1½ inches broad, ⅛ inch in thickness, and carefully round off the corner edges. This should then be wound within an inch of both ends with 32 S.W.G. enamelled Eureka resistance wire. It should now be mounted on ebonite legs and a suitable slider attached.

* * *

B. D. E. (Leeds).—How can I cure the sulphating which is taking place in my accumulators ?

Sometimes sulphating can be cured by giving the cells an overcharge. They should be on charge for about six or seven days at a very slow rate. Should this fail to cure them, sometimes the sulphate may be scraped off, but if the positive plates are badly covered you will find it very difficult to move the coating, and new plates will have to be procured. If you decide to scrape the plates, you must be very careful over the positives or they will begin to crumble and disintegrate.

* * *

" BATTERY " (Durham).—What is the simplest method of constructing a Daniell cell ?

The following description of a Daniell cell should give you all the details you require. The outer vessel consists of a glass jar—an ordinary jam jar will do—which contains a solution of H_2SO_4 (sulphuric acid)—1 part of acid in 12 to 20 parts of water. In this is placed a zinc rod. In the centre of the glass jar is now placed a porous pot which contains a strip of thin sheet copper and a saturated solution of sulphate of copper. The zinc is preferably of the Leclanché form, and it will be found to be cleaner, to last longer and be cheaper than a zinc sheet, besides which it is thoroughly amalgamated. The top of the porous pot should be dipped in paraffin-wax. This prevents the solutions creeping. A few crystals of copper sulphate should be left in the porous pot, taking up a quarter of the pot. Only the purest chemicals should be used. The best acid to use is that known as " Brimstone " sulphuric acid. When the battery runs down, an addition of sulphuric acid to the outer jar and a few more crystals to the porous pot will start it again. If desired the sulphuric acid may be replaced by a concentrated solution of zinc sulphate. Full details of the Daniell cell appeared in POPULAR WIRELESS of July 14th.

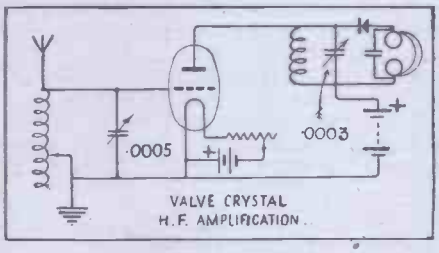
(*Continued on page* 851.)

WIRELESS AS AN ADDITIONAL POLICEMAN DIVERTER.

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page 850.*)

"CRYSTAL" (Watford).—I wish to add a valve to my crystal set, or rather, to rebuild the set, using a valve as amplifier. What is the best circuit to use? Would H.F. amplification be O.K?



Taking into consideration the distance from the nearest broadcasting station, we would recommend the use of the "P.W." Combination Set. This set is now being described in POPULAR WIRELESS, and will give the same results as three valves with the added advantage that only one valve is required. This requires an L.F. transformer, which enables the extra signal strength to be obtained. If you prefer to use the valve merely as an H.F. amplifier, the circuit given will be quite O.K. This gives the value of the condensers, and the coils are basket coils of 35 and 50 turns, the smaller coil being used for the aerial. You will find that an H.F. valve will give you increased signal strength as far as London is concerned, and will also probably enable you to tune in Birmingham. But taking into consideration the advantages of the set, the combination set is by far the more preferable. It enables you to have either crystal, H.F. and crystal, or dual-amplification at will, and also provides for an additional note magnifier.

* * *

W. T. C. (Amersham).—What formula is used for determining the capacity of a fixed condenser?

The formula is the usual one employed where parallel plate condensers are under consideration. It holds good, therefore, for either fixed or variable condensers. The equation is as follows:

$$K = \frac{Ka}{4\pi t \times 9 \times 10^5}$$

where K represents the capacity of the condenser in microfarads, and a is the effective area of one set of plates in square centimetres. The specific inductive capacity, or dielectric constant of the dielectric, is denoted by K, while t is the thickness of the dielectric—that is, the distance between the plates, in centimetres. In the case of air K is unity while the other more useful dielectrics have constants as follows:

Paraffin wax	1·9 to 2·3
Ebonite	2·2 to 3·2
Glass	approximately 3·0
Mica	5·0

This formula is reasonably accurate for all ordinary forms of condensers such as are used for receiving purposes—that is, condensers whose dielectric thickness, t, is small compared with the area of the plates.

In the case of variable condensers the area of the plates must be taken as the area of the rotary or smaller vanes, for the effective area is naturally the area over which there is overlap. In this type of condenser, the plates being semi-circular, it is necessary to work out the area from the formula for the area of a circle, and then divide the answer by 2. The formula for the area of one plate surface for a variable condenser is therefore πr^2 where r is the radius of the moving plates.

* * *

L. B. (Wick).—What is a gravity Daniell cell?

A gravity Daniell cell contains precisely the same elements as the ordinary Daniell cell, but differs in construction. The porous pot is dispensed with, the two solutions being separated by the action of gravity. The heavier of the two solutions, the copper sulphate solution, naturally rests at the bottom of the pot, while the dilute sulphuric acid remains at the top. The copper and zinc plates are made in the form of circular discs, the copper zinc being at the bottom, while the zinc disc is suspended nearer the top of the jar. The absence of the porous pot decreases the internal resistance, but the E.M.F. is the same as in the ordinary type of Daniell cell. Note that these cells should not be left on open circuit, as the solutions then tend to mix, and copper deposits upon the zinc. When not in use, a high resistance should be connected so that the battery discharges a very small current and thus continues in action.

CORRESPONDENCE

To the Editor, POPULAR WIRELESS.

Dear Sir,—It is interesting to live in an age where so many fundamental changes in society are taking place due to the inventive genius of mankind. The telephone, telegraph, motor-car and aeroplane have already changed society fundamentally, and now with the advent of wireless telephony no one really seems to appreciate the astonishing power that is in the hands of the broadcasting companies not only from the point of view of the education of the country, but from the point of view of influencing thought.

The Broadcasting Co. at present is having a very rough time, it has many enemies in the vested interests which it runs up against; but, on the other hand, it has already endeared itself to many thousands, nay hundreds of thousands, of listeners-in, among which I humbly include myself.

It has got to go through its growing-pains, it has made mistakes, it will make more, but it approaches its difficulties with dignity and with humility, and I have little doubt that in the end it will triumph over all its antagonists. Let me say, however, that, although it may be premature now, yet soon it must fight, not only associations who imagine themselves injured, but for the distribution of news to the world. The news supply at present is frankly absurd, though this is not the fault of the Broadcasting Co., who are in the hands of, and in arrangement with, the news collectors, who naturally do not wish to ruin their own business, which is to supply news to the newspapers.

But the fight is bound to come, and the sooner the better, as the time has almost now arrived when broadcasting is not to be allowed to exist on the sufferance of any other vested interest. The situation when the results of big races and world-wide important sporting events are not broadcasted at the minute that the news is known, is frankly ridiculous.

Then we have the present struggle with regard to broadcasting performances, which is too long a subject for me to discuss here, but I am convinced that those artistes who so gallantly stood by the National Opera Co. on its broadcasting programme have done a great service to the country. Opera, to my mind, stands in a different category to anything else. I know myself that the operas I want to go to are only those that I know, and, ludicrous as it may sound, I know that I do not go to new operas because I do not know them. By broadcasting the operas a certain amount of familiarity with the music will be given to the listeners-in, who will then want to see them, and I believe that it is through broadcasting, and broadcasting alone, that opera will be a success in this country, a thing it has never been in the past.

One last word to the Broadcasting Co. I notice the mispronunciation of words by speakers from London, and have a note by me of some 20. It is not my intention in this article to stress the importance of what is known as phonetics, but until all classes speak in the same tone, this country can never be really democratic, because it is peculiar to the English that by the first ten words that a man speaks so can he be placed in one or other grade of society. It is very necessary in broadcasting that words should be pronounced correctly, and no inaccuracies spread throughout the country—I mention as an example the pronunciation of the word "Pytchley" from the London station a few weeks ago.

We have far to go before many of us are satisfied, we shall never get to a point when everyone is satisfied, but criticise as you like the initial start of the Broadcasting Co. and with all the faults which the scheme in theory may be said to have, I believe fundamentally that if it had not been for the arrangement with Mr. Kellaway we should not be as far as we are to-day, and even at present I think we are further ahead than any other country in Europe.

J. T. C. MOORE BRABAZON, M.C., M.P.,
Vice-President, Radio Association.

RECENT WIRELESS INVENTIONS.

The following abstracts are specially contributed by Mr. Harold J. C. Forrester, Fellow of the Chartered Institute of Patent Agents, 88-90, Chancery Lane, W.C.2.

Grant of the following patents can be opposed and printed copies of the full specifications obtained.

197,957.—SOC. FRANÇAISE RADIO-ELECTRIQUE. — RECEIVING CIRCUITS.—A valve receiving circuit for power amplification of telephone currents has the input transformer shunted by a resistance so that distortion due to grid current flow during the positive half of the input alternations is reduced.

Alternatively, two valve sets are employed, the grids of each being connected to opposite ends of the transformer secondary, the mid point of which is connected to the filaments; and the output transformer having two primary coils, which thus produce an additive effect in its secondary.

197,958.—SOC. FRANÇAISE RADIO-ELECTRIQUE. — DIAPHRAGMS. A large diaphragm for loud speakers, etc., is supported in a frame by elastic loops attached in any suitable manner. For instance, it may have a single elastic band alternately connected to the support, and threaded through holes around the edge of the diaphragm; the arrangement permitting of ready adjustment of tension between diaphragm and support.

198,052.—W. DUBILIER.—SIGNALLING SYSTEMS. For transferring with a maximum efficiency from one circuit to another, electric oscillations extending over a relatively broad band of frequencies. A series of tuned circuits of different resonant frequencies are arranged so that frequencies near the resonant point of one circuit are by-passed through the others, the envelope of the resulting curve giving a "broad band" characteristic.

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A splendid opportunity for you to test the joys of wireless without worry, and at the minimum expense. You can have delivered to your house, the aerial erected, a

T.M.C. 3 Valve Set

complete with Loud Speaker
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Every week a competent wireless engineer will call, take away the old battery and replace it with a fresh one. At the end of one month or at any subsequent time, you have the option of purchasing the set outright or we will arrange to maintain it, inspect it and look after it in every way for a further 45/- per month, or at any time you can terminate the arrangement.

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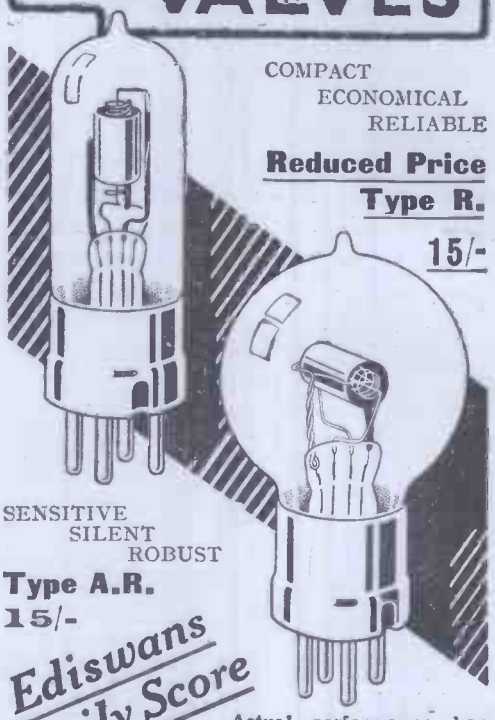

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ONE SATISFIED USER SAYS:—

" . . . Since using Ediswan Valves, with one only on an ordinary circuit, I have received quite distinctly and strongly the following stations, and can pick them up at any time (fading permitting), proving it is not freak reception, 2 L O, 2 Z Y, 5 I T, 5 W A, 5 S C, 5 N O, Radiola, École Supérieure, F L, Croydon, and local amateurs. My aerial is none too good, being a twin, 26 ft. high, 30 ft. long. I have tested Ediswan Valves against many other makes and have no hesitation whatever in stating that for loud signals with the minimum of strain on the accumulator, **Ediswans easily score.**
" (Signed) A. J. S. R., Brighton, May 15th, 1923."

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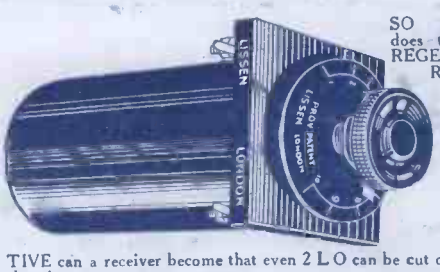
(P. Patent)

The energy induced in the grid circuit by a radio wave is small, and will not reach its maximum strength unless the H.F. resistance and losses in the tuning circuits are neutralised. These small impulses in the grid circuit can, however, induce comparatively powerful impulses in the plate circuit, and it is one of the functions of the **LISSEN REGENERATIVE REACTANCE** to magnetically couple the plate circuit to the grid circuit and to feed back again into the grid circuit duly amplified the comparatively powerful plate circuit oscillations. The **LISSEN REGENERATIVE-REACTANCE** increases in amplitude this cycle of operation, neutralises the losses referred to, builds up energy, and induces a condition of negative resistance, or, in other words, the set is oscillating. This non-interfering oscillation can then be controlled at will by adjusting the reaction coupling on the **LISSEN REGENERATIVE-REACTANCE.**



SO SENSITIVE does the LISSEN REGENERATIVE-REACTANCE make a receiver that under many conditions both aerial and earth connections may be dispensed with.

SO SELECTIVE can a receiver become that even 2 L O can be cut out from right close in.

Range 150—4,000 metres—REGENERATION OVER THE WHOLE RANGE WITHOUT A BREAK.

Tune with a Vernier (preferably the LISSEN VERNIER, designed for fine tuning in H.F. circuits, price 12/6, barely 1 in. in diameter).

REACTION IS ACCURATELY PROPORTIONED—IT IS NOT OBTAINED WITH A SWINGING COIL.

Price **£2 12 6**

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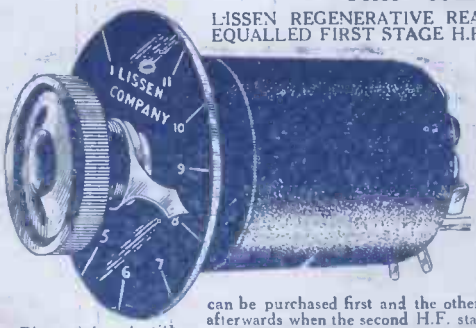
Is your Rheostat a "Lamp Lighter"?— The LISSENSTAT is a CONTROL

Mere lighting of your valve filament is not filament **CONTROL.** Your old wire rheostat will light your valves, but every time it is moved, its jerky action, its violent current fluctuations, sets up such noises in your Detector and H.F. valves that it is impossible to get fine tuning. The tuning of the Detector Valve in particular is such a critical thing that long distance reception is made extraordinarily difficult, and even impossible by the use of the ordinary wire rheostat. See what LISSENSTAT **CONTROL** does—with this new device filament heat can be so regulated that the filament temperature is made exactly right for the perfect tuning of your Detector and H.F. valves. Try the difference on long distance reception!

SAVES ITS OWN COST. LISSENSTAT **CONTROL** lengthens the life of valves because it is impossible suddenly to throw a violent fluctuating current on to the delicate valve filament. Replace your existing rheostats with LISSENSTAT **CONTROL**—See that only LISSENSTATS go into your new receiver! The Detector valve should have a separate LISSENSTAT—each H.F. valve also. Three stages of L.F. may be **controlled** by one LISSENSTAT (although even here separate control is better). Length under 2 in., diameter ⅞ in. LISSEN ONE HOLE FIXING **7/6**



Blue print sent with all LISSEN radio frequency units—all LISSEN ONE-HOLE FIXING—no switch to connect—no complications.

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The LISSEN REACTANCE can be used by itself for one or two stages H.F. The best combination is LISSEN REGENERATIVE-REACTANCE for the first stage and LISSEN REACTANCE for the second stage. Either component can be purchased first and the other added in the appropriate position afterwards when the second H.F. stage is desired.

For best results tune the LISSEN REACTANCE also with a vernier (preferably the LISSEN VERNIER) where aerial reaction is used—it is entirely **self-tuned** if aerial reaction is not used.

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Range 150—1,000 metres **32/6**

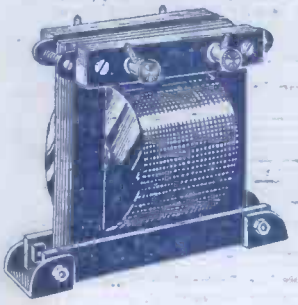
RESONANCE IN TRANSFORMERS IS BAD.

If in the winding of a low-frequency transformer there is any tendency to resonance it is impossible to have perfect reproduction. There are three types of LISSEN L.F. TRANSFORMERS, and the design and construction of each makes resonance impossible.

WHERE TO USE LISSEN TYPE T1.

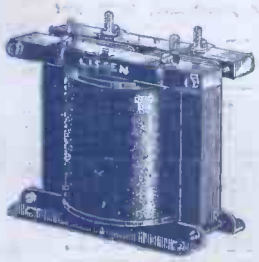
This is the transformer so strongly recommended in the recent tests. It is the only transformer made that is designed to match average valve impedance. No other transformer has a sufficiently high primary impedance to function properly immediately behind the Detector valve. The LISSEN TYPE T1 DISTORTIONLESS TRANSFORMER is ideal in this position because it has the necessary high impedance value. Its coil alone weighs about 8 ozs. Every turn of its many thousands is wound by patent process. It has the most expensive coil of any. A beautiful transformer. Use it (particularly) for the first stage, and also for any stage.

A wonderful power amplifier. **30/-**



WHY THERE IS THE LISSEN TYPE T2.

The transformer for the second and third stage L.F. need not have such a high primary impedance. This LISSEN Type T2 has a larger coil than any similar transformer. It gives perfect amplification in a background of absolute silence. Use it for the first or any stage, but recommended in combination with the LISSEN T1. May also be used for power amplification. .. .. Price **25/-**



THE POPULAR LISSEN TYPE T3.

This is the LISSEN TYPE T3, described in the recent tests as one of the best light transformers made. Amplifies equal to many other expensive transformers. No trace of distortion. Carries the LISSEN name guarantee, and is a really excellent transformer. .. .. .. Price **16/6**

SHORTLY TO BE INTRODUCED. New series of LISSENAGON (P. PATENT) air wound, super-efficient, plug-in coils—SEE THE GREAT AIR SPACE BETWEEN WINDINGS!

WHY THE LISSEN TUNER IS WOUND WITH STOUT WIRE.

The old Type single layer, plain wound inductance has to be wound with comparatively fine wire to keep down its bulk. Its ohmic resistance therefore is high.

The unique LISSEN method of multi-winding makes it possible to use stout wire for the LISSEN TUNER. The ohmic resistance of the LISSEN TUNER is therefore very low, its selectivity high, and tuning very sharp. The turns not in use are shorted, and there is such little "dead-end" effect that it will tune to any given wave-length **as sharply as a plug-in coil wound for that identical test wave-length.** It covers all wave-lengths between 150 to 4,000 metres with a .0005 condenser (preferably use the LISSEN MICA VARIABLE CONDENSER, price 17/6), and yet it is so compact that its length is only 4 in. and diameter 4 in. It has an 11-point switch already mounted and connected—no taps to solder—no switch to connect—panel or table mounting—engraved dial—LISSEN ONE-HOLE FIXING OF COURSE. This LISSEN TUNER is unique in its design and efficiency—it is a tuner you would like to use. *CAN ALSO BE USED AS A VERY HIGHLY EFFICIENT ANODE COIL* **22/6**

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R/R