POPULAR WIRELESS WEEKLY, MARCH 3, 1923. REGISTERED AT THE G.P.O. AS A NEWSPAPER

SPECIAL EXHIBITION NUMBER.

Popular Wireless

No. 40. Vol. III. PRICE THREEPENCE WEEKLY. March 3rd, 1923.

BROADCASTING A SERMON.

FEATURES IN THIS ISSUE.

The Wireless Section at Olympia.
A Special Review of the Exhibits.
Advantages of a High Aerial.
The Cardiff Broadcasting Station.
Another Four-Page Beginners' Supplement.
Part II of the Valve for Beginners.
A Tuned Anode Coupler.
A Page of Ideas for Amateurs.

THE FIRST OF A SERIES OF ARTICLES BY SIR OLIVER LODGE.

POPULAR WIRELESS

March 3rd, 1923.] SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc. [Every Friday.

TOPICAL NOTES AND NEWS.

Our New Cover.

HOW do you like our new cover scheme? The Editor tells me that a good many readers seem disappointed in the old cover, and, to tell you the honest truth, I did not care very much for it myself. After all, POPULAR WIRELESS has the largest circulation of any wireless paper in the country, and it is only right that its cover should be a little more dignified.

This number is rather a special effort, as I think you will agree when you glance through the pages. For one thing, it carries the announcement that Sir Oliver Lodge has accepted the appointment of scientific adviser to POPULAR WIRELESS, and the first of a series of articles by him appears on page 3.

Altogether a "bumper" number.

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Northern Ireland Licences.

IT has been arranged with the Government of Northern Ireland that licences for wireless stations for the reception of music and other matter broadcast by wireless telephony shall be issued at the Belfast Head Post Office in approved areas to persons in Northern Ireland. Forms of application for such licences will be stocked at all head and branch Post Offices, but not at sub-Post Offices. No broadcast receiving licence will be issued except where the Ministry of Home Affairs has approved the application. Licences for the reception of broadcast matter are confined to apparatus which is manufactured by members of the British Broadcasting Company, and which bears the registered trade mark of that company, indicating that the apparatus is of a type approved by the Postmaster-General.

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Glasgow Broadcasting Station.

THE Glasgow broadcasting station at Port Dundas will open in the first week of March. Mr. J. C. W. Reith, general manager, and Captain P. P. Eckersley, chief engineer of the British Broadcasting Company, have selected a site for the studio and office, the equipment of which will be carried out without delay.

* * *

Wireless in the "House."

WHETHER the Post Office will introduce a new measure to regularise the new position created by the advent of broadcasting is not yet decided. It may be recalled that the late Postmaster-General, Mr. Kellaway, introduced the Wireless Telegraphs and Signalling Bill on June 13 of last year "to make further provision with respect to the regulation of wireless telegraphy and visual and sound signals." The change of Government, however, held up the measure, and the point now is, whether it would be advisable to reintroduce it as it stands or scrap it, and bring forward an entirely new Bill.

Higher Education Broadcast.

IT is reported that lectures given at the Sorbonne, the College de France, and other seats of higher education in Paris are to be broadcast by wireless. At first lectures will be confined to topics of general interest, but if the experiment succeeds, it is hoped to send out courses on specialised and technical subjects.

* * *

An Up-to-date "Charabanc."

A MOTOR coach was seen recently in Birmingham fitted with a wireless installation. An overhead aerial enabled the passengers to hear all the broadcasting programme by means of a four-valve set and loud speaker.

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The Radio Association.

IT is announced that Sir Arthur Stanley, C.B.E., C.B., M.V.O., has accepted the Presidency of the Radio Association.

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Wireless in Warfare.

AN informative lecture on the subject of the development of radio signalling was delivered recently by Major Rupert Stanley, LL.D., M.I.E.E., principal Municipal College of Technology, Belfast, to the members of the Belfast Transport Officials' Club, at their rooms, Queen's Square.

The lecturer gave a vivid description of the use of wireless telegraphy during the war. He explained how the movements of batteries were detected, and, in consequence, how the British became informed as to where the "push" was about to take place. By means of listening-in, too, they knew the movements of Zeppelins, and were able to send accurate information, regarding them to the proper sources.

* * *

Wireless on Lifeboats.

AN order for 14 lifeboats for some of the leading steamship companies has just been completed by Messrs. Harland & Wolff, Ltd. The first to be delivered includes a wireless installation in the forecastle, and it is a good indication of the value placed on wireless in this capacity when it is noted that the seating accommodation is reduced from 40 to 36 in order to make room for it.

* * *

An "Aerial Hunt."

THE Norwich and District Radio Society recently conducted, under the auspices of a special committee, an "aerial hunt" to locate and endeavour to "round up" local amateurs not yet members of the society. I cannot help wondering how many "licence dodgers" were startled by these worthy "investigators" during the above proceedings.

* * *

A Reduced Wave-length.

THE Cardiff Broadcasting Station had not been in operation for many days before it became apparent that 395 metres was much too near the 385 of

(*Continued on next page.*)

OUR SCIENTIFIC ADVISER.

It gives me great pleasure to announce that Sir Oliver Lodge, F.R.S., D.Sc., M.I.E.E., has accepted the post of scientific adviser to "Popular Wireless." The contributions made to science—and especially Radio science—by Sir Oliver Lodge are too well known to need recapitulation here; but I feel sure that readers of this journal will keenly appreciate the acquisition of the services of such a well-known scientist as Sir Oliver Lodge in the capacity of scientific adviser to "Popular Wireless."—The Editor.

One of the latest photographs of Sir Oliver Lodge.

NOTES AND NEWS.

(Continued from previous page.)

Manchester and that listeners-in situated in midway districts were having a pretty "thin" time. Therefore Cardiff was dropped to 353 metres and this will be its permanent wave-length. There are still a few grumblers in Wales who complain that the five-valve sets installed especially for 2 L O will now be rendered useless by jamming from Cardiff. However, if the intentions of the B.B.C. are carried, as they will be if the public support them, there will be no cause to grumble as to the quality of the Cardiff transmissions. Anyway, five valves will bring in some excellent French broadcasting on very dissimilar wave-lengths.

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Still Increasing.

ACCORDING to the "Birmingham Post" there are now 10,000 wireless sets in use in Birmingham and districts. I wonder whether a margin is allowed in this estimate for the "Bilkers."

* * *

Novelty Wearing Off.

THE B.B.C. state that the cost of upkeep of their various stations is very considerably increasing. In the early days of broadcasting in this country people were inclined to give their services at a more or less nominal fee, but now that the first "edge" has worn off more normal figures are being charged. That is the reason for the increase in expenses put forward by the B.B.C. I cannot help thinking, however, that there will always be a very large number of artists willing to broadcast for not much more than a matter of "expenses" in order to obtain the publicity that broadcasting offers. It is about as good as the proverbial "stolen jewels."

THE IDEAL HOME EXHIBITION.

The Daily Mail Ideal Home Exhibition, at Olympia, should be visited by every reader of POPULAR WIRELESS. In the New Gallery Hall there is a special Radio Section. Some forty-two prominent wireless manufacturers have booked stalls, and some of them are reviewed in this number of POPULAR WIRELESS. The review will be concluded next week, and will be followed by a summary and criticism of the most original and useful features seen at the Radio Section of the Exhibition. Special photographs are being obtained for this critique. Readers in the provinces who are unable to attend the exhibition will find the completed review of the exhibits of great use, and as there is sure to be a big demand for future numbers of POPULAR WIRELESS it would be advisable to order a copy in advance.

THE EDITOR.

* * *

The B.B.C. Programmes.

A DEPUTATION from the Broadcasting Co., consisting of Sir William Noble and Mr. J. C. W. Reith, was recently received at a joint conference of the council of the Newspaper Proprietors Association. It was decided that newspapers might insert the B.B.C. programmes at their own discretion for a period of six months, when the matter will again come up for consideration.

* * *

The Ideal Home Exhibition.

ALL roads lead to Olympia, and all readers of POPULAR WIRELESS should do their best to pay a visit to the "Daily Mail" Ideal Home Exhibition. The wireless section is situated in the New Gallery Hall, and some 42 prominent firms are exhibiting there.

At POPULAR WIRELESS stall experts will be in constant attendance to answer queries, and a very special attraction will be a 24-page book—a complete "Outline of Wireless"—presented free to all who ask for it.

So roll up in your thousands!

* * *

A Talk for Scouts.

I HEAR the B.B.C. have arranged regular "Talks to Scouts" for a period of ten minutes every Thursday—from 6.50 to 7 p.m. This feature should be of considerable interest to the thousands of Scouts who are interested in wireless.

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Various Items.

MESSRS. A. W. GAMAGE, Ltd., inform me that their stand number at Olympia will be 19, and not 26 as given in their report of their exhibits to the Editor.

* * *

Glasgow station is expected to commence with the opening of the Glasgow opera season, on March 19th.

* * *

I have just examined a very novel terminal produced by the Birmingham Products Co., which should have quite a vogue with experimenters. The Birmingham Products Co. will be pleased to give details to readers asking for particulars.

* * *

The Editor asks me to state that he has received several new catalogues from various firms which will be reviewed in a subsequent issue.

* * *

The Radio Waveora Co. has removed to 1A, Garvan Road, Hammersmith, W. 6.

* * *

Messrs. Peto-Scott Co., Ltd., state that owing to an unfortunate mistake a number of "Turrode" plugs have been sold to customers incorrectly wired up. Will customers please return these plugs at once, when new ones will be supplied.

* * *

Messrs. Alfred Graham & Co. state that in a recent issue of this paper the Amplion Junior Loud Speaker was priced at 45*s.* instead of 50*s.*

* * *

Mr. Ben Tillett is to ask the Prime Minister whether he will consider the practicability of arranging for the proceedings of the House of Commons to be broadcast, in order that there may be closer touch between Parliament and the people.

ARIEL.

Broadcasting Programmes

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

TELEPHONY AND MUSIC TRANSMISSIONS.

Station.	Call sign.	Wave-length in metres.	Remarks.
London Broadcasting Station, Strand ..	2 L O ..	369 ..	Usually every evening, 5 to 5.45 p.m.; 7 and 9.30 News; 7.15 Orchestra; 8.25 to 10.30 Music.
Newcastle Broadcasting Station	5 N O ..	400 ..	As a rule from 7 to 10 p.m.
Manchester Broadcasting Station	2 Z Y ..	385 ..	Every evening, usually from 4.30 to 10 p.m.
Birmingham (Witton) Broadcasting Station	5 I T ..	425 ..	Every evening, usually from 6.30 to 10 p.m. (News, Concerts, etc.).
Glasgow Broadcasting Station	5 S C ..	415 ..	Commencing shortly.
Cardiff Broadcasting Station	5 W A ..	353 ..	5 to 10 p.m.
Croydon	G E D ..	900 ..	Throughout day to aeroplanes.
Paris	F L ..	2,600 ..	11.15 a.m. Weather report; 6.20-7 p.m. Weather report and Concert; 10.10 Concert.
Königswusterhausen ..	L P ..	2,800 ..	4 to 6.30 p.m.
The Hague	P C G G ..	1,085 ..	Sundays, 3 to 5 p.m. (Concert.)
Haren	O P V H ..	1,100 ..	12 o'c. and 16.50 o'c. Telephony.
Radio-Electrique, Paris	—— ..	1,565 ..	5.5 p.m. News Items; 5.15 to 6.10 Concert; 8.45 p.m. News Items; 9 to 10 p.m. Concert.
School of Posts and Telegraphs, Paris ..	—— ..	450 ..	Every Tuesday and Thursday, 7.45-10 p.m. Saturdays, 4.30-7.30 p.m.

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

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

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

All times given are G.M.T.

SOME WIRELESS OBSERVATIONS.

By SIR OLIVER LODGE, F.R.S., D.Sc., M.I.E.E. (Scientific Adviser to POPULAR WIRELESS.)

Sir Oliver Lodge has written a series of articles for POPULAR WIRELESS, the first of which is given in this issue. This series is primarily intended for the experimenter, and constitutes the commencement of a regular weekly feature for the advanced amateur. The Beginner is catered for in another special supplement. Readers will be glad to learn that Sir Oliver Lodge has also accepted the appointment of Scientific Adviser to this journal.—THE EDITOR.

AT the outset I want to acknowledge the help of my assistant, Mr. Edward E. Robinson, whose practical experience and instinctive recognition of the kind of problems which occur in connection with the winding of coils and other arrangements for wireless telegraphy has been of great assistance; and to him some of the incipient ideas here worked out are due.

The main essentials of a wireless installation are capacity and self-induction; introduced, for a receiving station, into a collector and a detector; and, for an emitting station, into a generator and an emitter. The emitter and the collector are one and the same. Transfer from generator to detector is effected by a switch. Capacity and self-induction are the essential ingredients of an aerial, and it is on them that the wave-length depends. But it is a question what value the capacity and self-induction shall have, and how they shall be arranged.

Confine Capacity to Aerial.

It is obvious that the more open the capacity, the better will it serve as emitter or collector; hence, whatever capacity is used, it should mainly be in the aerial, for highest efficiency. Any defect of capacity in the aerial can be supplemented by a closed adjustable capacity, which, of course, is very convenient, and will always be subordinately required for tuning.

If the aerial could be arranged so as to extend to a great vertical height, its capacity would be as open as possible, and its efficiency as emitter or absorber would be correspondingly high; for both the radiating and the absorbing power is proportional to the square of the height.

But there are practical limitations to the height convenient, so that when the greatest available height is attained, any bulk of the aerial beyond that is naturally horizontal.

In every ordinary case, however, the figure expressing the electrostatic capacity of an aerial in metres is small. It depends on the length of wire used, but is always incomparably smaller than the length of that wire. Expressed in electrostatic measure, we shall find that for an open vertical wire the capacity is about one-twentieth the length of the wire, and that the capacity of an aerial is seldom more than one-fifteenth of the wire used in its construction. Often it is much less.

The wave-length, however, depends on the capacity and the self-induction, being indeed six times the geometric mean of these two lengths. So, for any considerable wave-length, the length representing electric capacity being small, the length representing magnetic induction must be great.

Hence, to get any reasonable wave-length, the capacity of the aerial must be supplemented or reinforced and made effective by a considerable amount of self-induction. But whereas the capacity area may with advantage be as extensive as possible, there is no advantage in extending the self-induction; on the contrary, there is an advantage in compressing it into small compass, so that quite a minute coil will serve for a great wave-length.

Why should there be this advantage in constricting the self-induction coil? Because any capacity which it possesses is useless and, to some extent, deleterious. There is no gain in mixing up capacity and self-induction. They should be kept distinct and separate. The upper part of the aerial, combined with the earth below it, should have all the capacity; and the self-induction coil should have as little as possible. Then the wave-length has a chance of being clear and definite.

Whatever capacity exists between the turns of the coil has the effect of shunting some of the oscillation, and making it useless. The shunted portions would have any number of indefinite frequencies, and would not contribute to the main wave-length.

Use of Stranded Wires.

This has become known to practical men, and, as a result, what is called *basket* winding has often been adopted, in order that the turns of wire may have some intervening space between them, and so not lie too close together. Of course, this has some effect in diminishing self-induction as well as capacity, since the magnetic influence of the turns of wire on each other is diminished. But the reduction in capacity is found to more than compensate this disadvantage, and it is easy enough to get sufficient self-induction by making the coil bigger.

Only, of course, then more wire has to be used for the coil; and the more wire it contains, the more capacity it has. So it is evidently a question of compromise, and the best result has to be found by practice. Some capacity between the turns is inevitable; and, apart from basket winding, we may consider how best to secure a minimum of it.

First of all, then, thin wire is indicated. From the capacity point of view, the thinner the better. The only disadvantage of thin wire is that its resistance is high. But resistance only affects the damping of the vibrations; and the vibrations are usually sufficiently persistent to cause damping to have no great importance, unless it be excessive. Damping by radiation of energy is inevitable, and moreover useful. Other damping is of no use, but it is usually small in comparison. Of course, the wire must be of the highest conductivity. But, given that, there is a gain in keeping its thickness very small, say No. 40 S.W.G., or even thinner.

If in any case so much wire has to be used that its resistance does become excessive, then instead of making the wire thicker it would be better to have several wires in parallel, the said wires being very thinly insulated from each other, and then stranded or laid together.

A strand of this kind forms a very perfect conductor for high-frequency oscillations, inasmuch as every part of a thin wire helps to carry the current; whereas only the outside of a thick wire is effectively conductive for an extremely high frequency of oscillation, so that the effective resistance of a thick wire is considerably greater than it would appear to be when measured in the ordinary way with steady currents and a Wheatstone bridge. Such considerations do not apply to a strand of fine wires, however thinly insulated from each other they are.

Advantage of Cotton Covering.

It may be said—why insulate the parallel wires from each other at all? But it is clear that if they are in metallic communication, all along their length, they virtually constitute a thick wire. The ether waves cannot then gain access to more than the combined periphery. The inner wires will be screened by the outer ones, just as the interior of a thick conductor is screened. Whereas if there is any insulating material between them, however thin, the ether waves can, as it were, soak in and utilise the conducting power of all the wires. (It must be remembered that it is the ether, and not the copper, which really transmits the energy; the function of the insulating material is vital.)

Given then as thin a conductor as suffices for the quantity of electricity to be conveyed, the expression for the capacity of such a wire shows that in order to keep it small the turns of wire in a coil had better not lie close together. They can be separated by an air space, or they might be separated by a thick cotton covering outside the real insulation—a covering as airy and uncompact as it can conveniently be made.

However that may be, and however the distance between the wires is secured, it can be allowed for in the calculation; and the best method of obtaining the separation can be left to instrument makers.

The main consideration is to use as little wire as possible in the self-induction part of an aerial; or, in other words, to wind the coil so as to get the maximum self-induction out of a given length of wire. This will have a double advantage. It will keep down the resistance, and it will keep down the capacity—both of which must obviously depend on the length of wire used.

As far as I know, insufficient attention has hitherto been paid to this important consideration, and I doubt if coils are often wound so as to obtain the maximum self-induction. I regard this as important, and propose to take it fully into consideration.

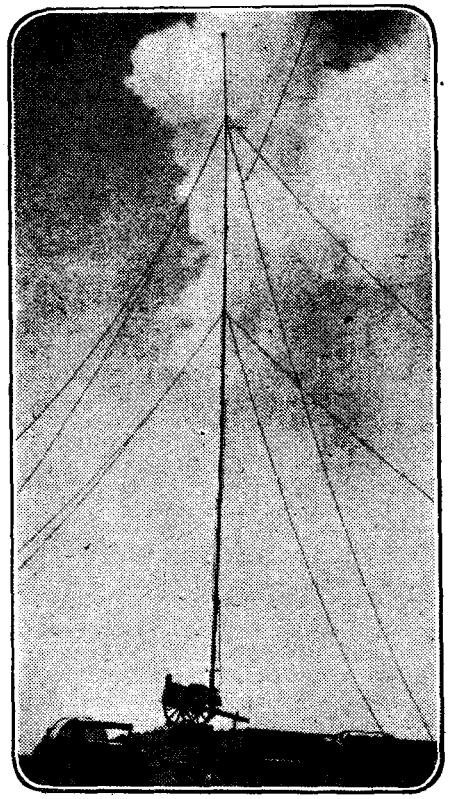
(*Another article by Sir Oliver Lodge next week.*)

THE ADVANTAGE OF A HIGH AERIAL.

By "NORAB."

MOSUL, that "bone of contention" of the Eastern dispute, looms very much to the fore in public discussions to-day. The writer was fortunate in being one of the first to enter the town in November, 1918, when our troops occupied it, and, as a wireless enthusiast, was delighted when we discovered that the German wireless station had fallen into our hands, intact.

The first point of interest and surprise was the very high aerial that the station possessed. It stood out defiantly against



Portable Mast used at Mosul by our troops during the War.

a background of beautiful blue sky, relieved only by small "cotton-wool" clouds. I had been engaged on war-time stations in that vicinity since 1914, and had many times cause to swear at the Mosul radio, because he worked incessantly and "jammed" our reception unmercifully.

Every Possible Foot.

The installation was of the usual mobile Telefunken 1½-kw. pattern, with a normal range of 250 miles, but I have reason to be certain that a much greater distance was spanned when it was so desired. The Telefunken apparatus has always proved itself remarkably efficient in regard to transmission over great distances, and "out East," where very strong "static" interference was present, the advantage of the "quenched" spark, employed by that system, was amply demonstrated.

In addition to the benefit obtained from using such a discharger, I was convinced, from the many captured enemy stations I saw, that advantage was always taken of every foot of mast that could possibly be erected, and this factor very materially assisted both the transmitting and reception distances covered by the stations.

The photograph of the mast at Mosul reminds me of the height question. Experiments have proved that up to a distance of about 200 miles reception varies directly as height of aerial. This is very remarkably demonstrated when working over deserts. I have known instances where the hoisting of an aerial 10 ft. more has made all the difference in "good" and "bad" signals, and has made regular communication possible, where otherwise it would have been useless to have attempted to carry on.

Many persons will not, of course, be able to erect an aerial as high as they may wish, owing to local conditions, or lack of space for masts, but I would advise all who can possibly increase their aerial height at all to do so. We have only to consider the aerial systems of the navies of the world, and also land stations, to realise what a definite factor height plays in efficiency of radio.

So pull in that "slack" and aim high!

"HARASSED HUMOUR."

An Impression of F. W. Thomas Broadcasting at 2 L O.

By K. D. R.

THERE is a peculiar, weird, and almost paralysing atmosphere about a broadcasting studio, with its horrible silence and heavy draperies. I have watched many vocalists and entertainers go cheerfully up to that seventh floor of Marconi House, bound for the studio of the London Broadcasting Station for the first time, chatting gaily, as if speaking into a microphone was the easiest thing in the world; but the moment that they enter the room itself a great change comes over them. The gay manner and flippant air have gone, and as you look round you are inclined to wonder whether you have not stepped into the waiting-room of some dentist, while instinctively you listen for the dread "Next, please!"

Mr. F. W. Thomas, the well-known humorous writer of "The Star," was no less perturbed than the rest by the uncanny stillness that pervaded everything when he went to 2 L O to read one or two of his stories the other evening.

Not at All Funny!

Laughing and chatting cheerfully as he went up the long corridor to the "torture chamber," he came to a sudden stop when he saw the forbidding looking instrument into which he had to speak. He glanced behind him as if seeking escape, but the door had swung quietly to, and there was nothing for it but to go on and hope for the best.

"Whatever did I come here for?" he groaned.

We explained that he was going to read one or two of his stories, and that he had come to be funny.

"Funny?" he gasped. "I am not a funny man, and even if I were I couldn't be funny down a thing like that."

He pointed to the awe-inspiring pile of sugar boxes and wire and cylinders into which he had to speak.

He was further assured that it was quite an easy thing to talk into the microphones, and at last he cautiously advanced towards the monster.

Quite Harmless.

Upon closer examination, Mr. Thomas saw that it was apparently "harmless," and he was shown how and where to stand while he delivered his speech. Then "time" was called and, pulling himself together, the humorist launched forth into one of his funniest stories. And the funniest thing about it was the fact that his story really *was* funny.

At the end of the first tale he decided he had had quite enough, but after a little persuasion consented to read another.

"Well, what did you feel like?" I asked, when he had finished.

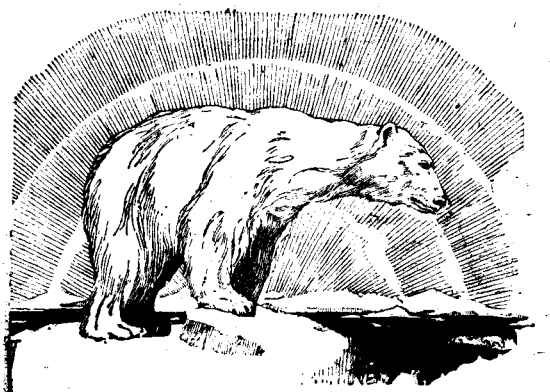
"Feel like?" he said; "like nothing on earth! It is about the worst evening that I have ever gone through. Ugh!"

"I am sure it went off quite all right," I remarked.

"I hope it did. All the afternoon my friends have been pulling my leg about it, and I know that several of them intended to listen in while I was speaking. Just to be able to congratulate me, as they said, when they see me to-morrow.

"Worst of all," he went on, "my family, including the children, have been listening also, and I sha'n't half know about it when I get home. I think that there ought to be some arrangement here so that the speaker can hear what it sounds like while he is speaking. I suppose it is rather a difficult business, though. I wish I could have heard what sort of an idiot I was making of myself. Still, I shall soon know when I get home."

Once more he was assured that he really had not made "an idiot of himself," that his stories had been heard quite distinctly, and that everything had gone off as it should, but he was not satisfied, and went home, as he remarked, "to hear the worst."

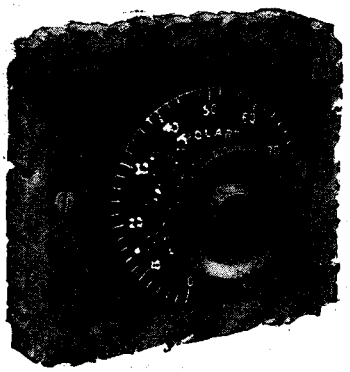


"POLAR"

SETS SERVICE SIGNALS

CONCENTRATED EFFICIENCY

—the Condenser Condensed.



The new "Polar" Variable Condenser embodies maximum efficiency with minimum dimensions at minimum cost.

Made in three ranges:

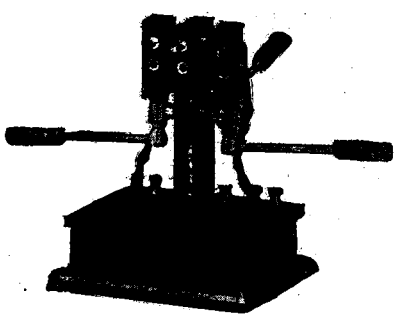
.0001 to .001 mfd.
.00005 to .0005 mfd.
.00005 to .0003 mfd.

All types are of the same dimensions—3 ins. by 3½ ins. by 1 in.—and sold at the same price:—

14/9 for panel mounting. Post free.

20/9 mounted in polished wood case. Post free.

"POLAR" THREE-COIL TUNING-STAND.



Of sound design, good workmanship, and fine finish.

The centre coil is rigid, while the outer ones can be rotated independently about their axes of support, or swung both together in planes parallel to that of the fixed coil. The former movement is controlled by two independent handles, one at each side, the latter by a single handle at the rear. The length of the handles is such as to prevent the hands of the operator from adding temporarily to the capacity while making the adjustments.

The coil-holders are of ebonite arranged for standard coil-plugs. They are carried on solid brass swivels. The whole is mounted on an ebonite panel supported by a polished wood base. All brass parts are highly lacquered, and the complete instrument is finished in a first-class manner.

Price 31/- *Post free.*

THE

RADIO COMMUNICATION Co LTD

35, NORFOLK STREET, LONDON, W.C.2.

BRANCHES:

NEWCASTLE: 17 Sandhill. SOUTHAMPTON: 19 Queen's Terrace. CARDIFF: Atlas Chambers, James Street. LIVERPOOL: 67 Dale Street. GLASGOW: 116 Hope Street.
WARRINGTON—37 Bridge Street. ABERDEEN—9 Hadden Street.

IDEAL HOME EXHIBITION—Stand 40, New Hall Gallery.

THE CARDIFF BROADCASTING STATION

(By Our Representative in Cardiff.)

5 W A on the waves at last! And be it placed on record that the launching ceremony was both sparkling and impressive. Well, "South Walians" have waited long and impatiently. Many receiving instruments were ready before last Christmas, by which time the station was expected to be ready. January passed; hope was deferred. At last February 13th proved to be the date, and the success achieved has compensated for the delay.

Distinguished Visitors.

Through the great courtesy of the station director, Mr. Fred Roberts, our special representative was enabled to witness the inauguration in the company of Lord Gainford (Chairman of the B.B.C.), the Lord Mayor of Cardiff (Alderman Dr. J. J. E. Biggs), Sir William Noble, Sir W. R. Smith, Mr. John Duncan, Mr. J. C. W. Reith (General Manager of the B.B.C.), Mr. John Cory, Capt. Crompton, O.B.E. (Supt. Engineer of the Cardiff G.P.O.), and Mr. Arthur R. Burrows (director of programmes for the B.B.C.).

Speaking into the microphone, Mr. Reith introduced Lord Gainford to listeners-in, and referred to a new microphone to be installed shortly, which would do the work of the eight phones now in use, with expected improvement in transmission.

The King's Speech.

Lord Gainford opened his speech with the appended message from Mr. Lloyd George:

"It is with great satisfaction that I learn of the opening of a wireless station in Cardiff. I am following with the greatest interest the developments of this marvellous discovery, and am glad that Wales is taking part in, and benefiting by, the progress which is being made in this direction."

In the course of his address, his lordship mentioned that the Broadcasting Company had endeavoured to secure permission for the King's Speech to be conveyed directly from the House of Lords to all broadcasting stations. Unfortunately, and without apparent reason, the suggestion had been turned down.

Dealing with Possibilities.

Sir William Noble, a director of the company, then addressed the unseen audience, concluding with the hope that the great musical festivals of Wales would be broadcast, "so that many thousands sitting by their own fireside would agree with the poet who wrote:

"And the night was filled with music,
For the cares that infest the day
Fold up their tents like the Arab
And as silently steal away."

The Lord Mayor very gratefully voiced the gratitude of all listeners-in for the nightly service of wireless telephony. "The standard of intellectual and artistic life," he said, "will be raised." He concluded with the moving words:

"We have begun to recognise that there

(*Continued on next page.*)

The Lord Mayor of Cardiff Opening the Station. Left to Right:— Mr. Reith, Mr. Burrows, Mr. Fred Roberts, Lord Gainford, Capt. Crompton, O.B.E., the Lord Mayor of Cardiff (at the Phone), Sir Wm. Noble, Mr. John Cory.

Listening-in with the presentation set in the Mayor's Parlour at the City Hall. Mrs. Coope and the Lady Mayoress are seated in the front row.

Left to Right—Front Row:—Mr. Mostyn Thomas (at the Phone), Miss Gladys Palmer, Mr. W. E Carston, Madame Fairburn, Madame Dilys Jones-Thomas.
Back Row—(standing) Mr. John Hill, Mrs. John Hill, Mr. Ronald Chivers, and Mr. Fred Roberts.

THE CARDIFF BROADCASTING STATION.

(Continued from previous page.)

are around us in the ether activities, powers, and if an appropriate transformation of electrical energy can enable the waves of sound to be projected to an almost indefinite distance, what further effects may not be produced in the ether by some similar transformation? This is a dream, of course; but may not, for example, the vibrations of light be projected in a comparable manner, and may it not become possible actually to see in this country the scenery, the architecture, the statuary, and the paintings of Italy, Greece, and Egypt?"

The "Music Room."

The station was then formally declared to be open. Undoubtedly Dr. Biggs carried out his part in a manner right worthy of the official head of a great city. A more impressive and appropriate ending to a speech on such an occasion can hardly be conceived.

Meanwhile another ceremony was taking place in the Mayor's parlour at the City Hall, where Mr. Cooper, acting district manager of the Metropolitan-Vickers Company, presented a receiving instrument, on behalf of his firm, to the then head of the city and future Lord Mayors. The Lady Mayoress accepted the gift, and thanked the company for their generosity. The acceptance was supported by members of the City Council, and those present spent the evening listening-in to the proceedings recorded above and the subsequent programme of music.

It is necessary to state that the music room is installed above the premises of the Castle Street cinema, about three minutes walk from the City Hall, and one and a half miles from the transmitting instruments housed at the Canton Power Station. Owing to this latter, the transmission can be tested every few minutes on a receiving instrument placed in the ante-room to the music chamber. Transmission is thus found capable of improvement by the immediate adjustment of the position of the microphones.

During the evening frequent messages were received from all parts of the country giving evidence of satisfaction with reception.

Taking the Photographs.

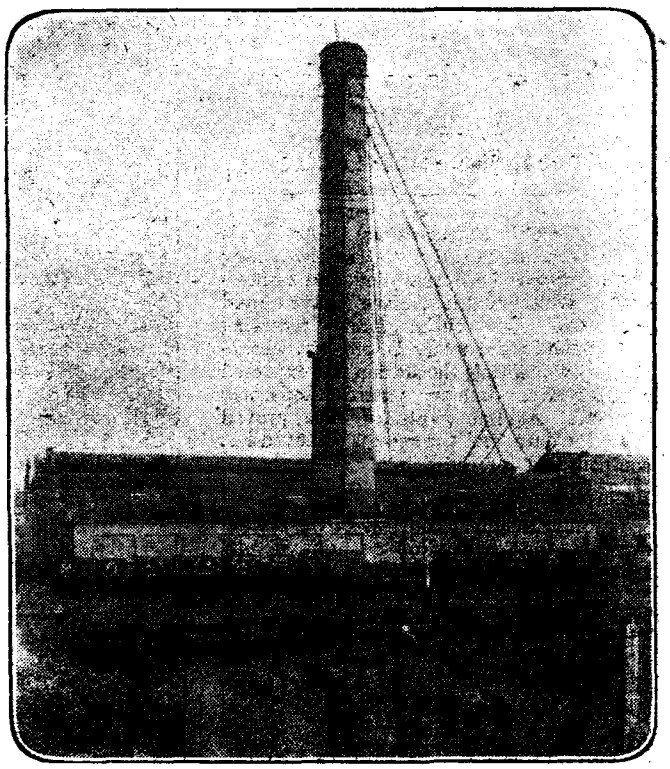
In the music room the scene at times was an animated one. Photographers were admitted in small groups, and occasionally opened fire from the doorway, for the room would not comfortably hold more than the officials, the musicians, and two or three guests. Pleasure was manifest on all faces, success being assured. On two occasions the listeners-in were asked to "stand by" while special photographs were taken. This was for the benefit of the readers of POPULAR WIRELESS. Unfortunately one of the negatives, that of the Lord Mayor speaking, was spoiled owing to the crush in the doorway. The one shown herewith takes its place. The second special photograph is that of the artistes, with Mr. Mostyn Thomas singing, and with our special representative standing at the back.

A Telegram Arrives.

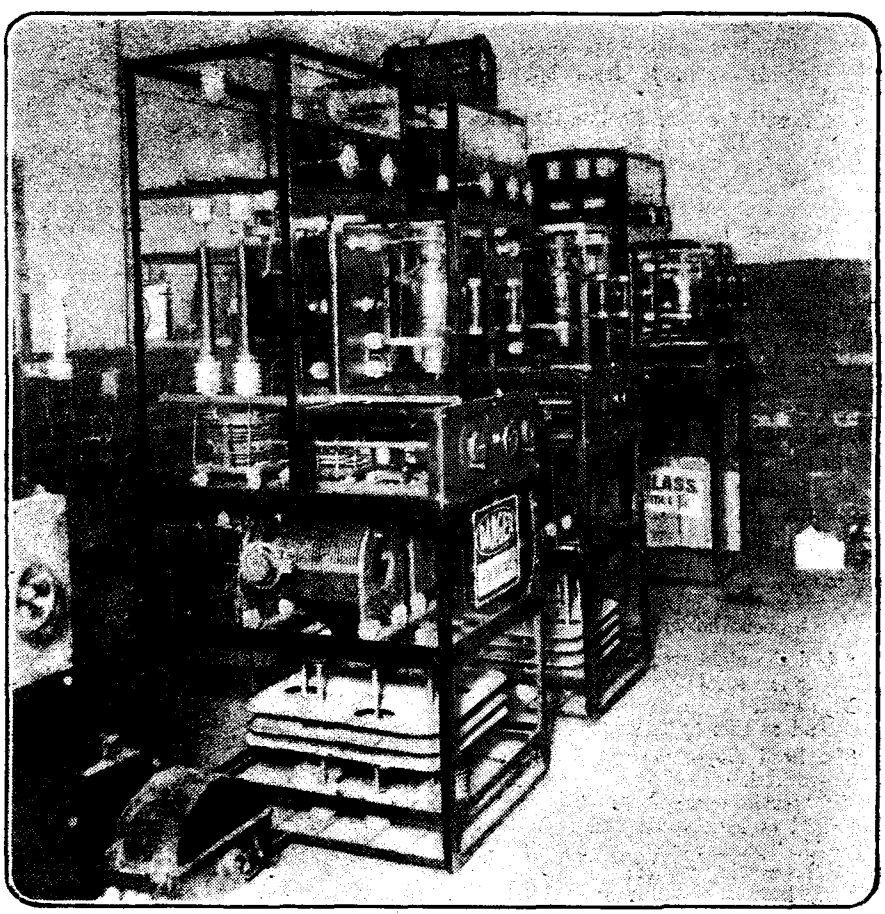
Our heartiest congratulations to Mr. Fred Roberts on his successful debut as director of music. His programme was both high-class and extremely pleasurable. High praise, too, has been earned by the Marconi engineers for their most efficient work. The engineer-in-chief, Mr. H. McCulloch, has been ably seconded by his colleagues, Messrs. Chesterfield and Boxer.

It remains to mention that during the evening a telegram was handed in to Lord Gainford, from Swale, Richmond, Yorkshire. It was from his son, Lieut. the Hon. Joseph Pease, conveying congratulations on his lordship's speech, and which had been clearly heard by Mr. and Mrs. Pease.

Illustrated descriptive articles of the Broadcasting stations are welcomed. Copy should not exceed 1,000 words in length. Photos should be very clear and "sharp."



The aerial at the Cardiff Broadcasting Station is attached to a tall chimney and has proved extraordinarily effective.



The valve-transmitting apparatus at the Cardiff Station of the British Broadcasting Co. These photos were specially taken for "Popular Wireless" by Mr. G. E. Thompson, of Cardiff.

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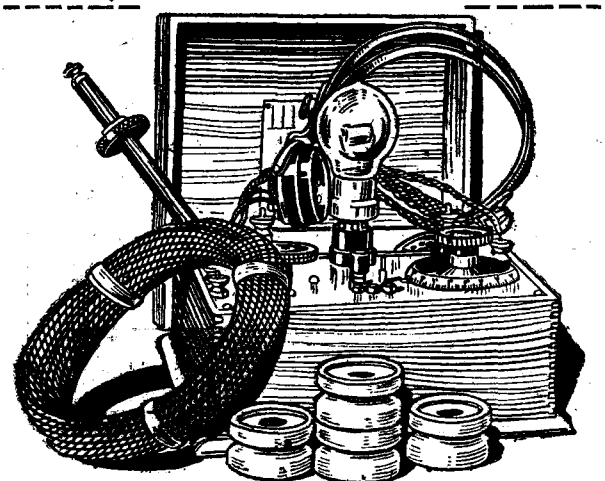

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Complete and self-contained. Fully licensed and passed by the Postmaster-General, Regd. No. 1043. The tuning Coil (tapped in three places) and Variable Condenser give a wave-length of 300 to 620 metres. Further stages of amplification can be added, and with a low-frequency amplifier a loud speaker can be effectively employed. This compact set will receive Telephony and Concerts 30 to 40 miles with surprising clarity. The Cabinet contains a section to hold 'phones and valve when not in use. The lid can then be placed on, keeping the set free from dust and preventing damage, etc. Price, including Royalties and complete with all accessories **12 GNS.**

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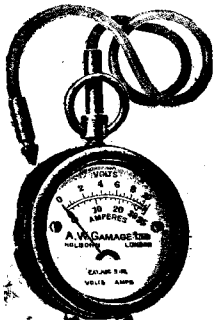

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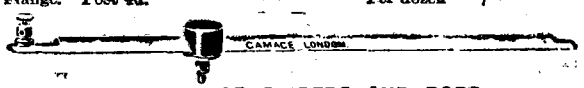

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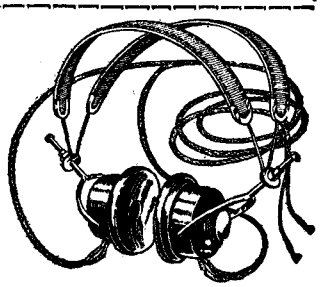

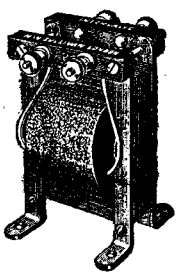

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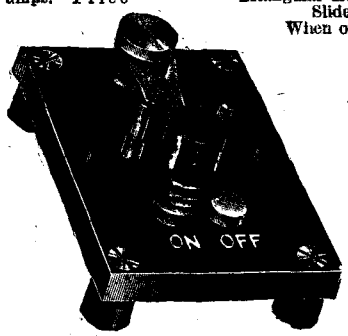

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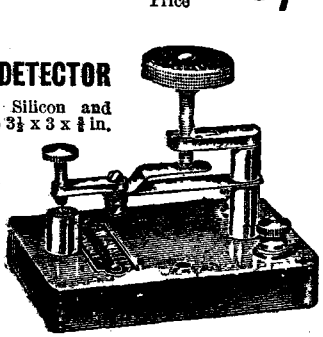

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LESS RANDOM REMARKS.

The second of two special articles of interest to amateurs

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

IN writing my article last week I took the liberty of soaring beyond my usual sober text-book style and subject, but there was method in my madness, inasmuch as I wished to direct the reader's attention to universal principles preparatory to the following attempt to show how wireless is simply a special department of one great fundamental organisation which is at work in Nature.

A working universe, like a great business, must be ruled by the execution of a certain number of basic principles, which the presiding genius adopts, specialises, or develops to meet various needs and contingencies. One of the great ruling ideas in the universe is called gravitation.

Matter in atomic or greater dimensions *attracts* similar masses, in direct proportion to the product of the masses and in inverse proportion to the square of the distance between the masses. Matter in *electronic* dimensions *repels* matter of similar dimensions; hence, as matter is composed of electrons, this simple law in uncontrolled operation would resolve the universe into electrons separated each from each infinitely. But that would bring to naught the idea of the universe as we perceive it, and so a by-law is enacted which forbids electrons to fly apart.

Harmonic Motion.

That by-law we conceive as a thing and name it "positive electricity," a stuff we imagine to be endowed with the power to attract electrons. Theory places a quantity of positive electricity at the core of every atom, its function being to hold or tend to hold the other components of the atoms (electrons) in position, like a sun with its attendant planets or a girl and her galaxy of mesmerised male admirers.

Another master idea is evolution, which also has its by-laws, all working towards that "one far off, divine event" towards which moves the one stuff, be it in the form of inorganic matter, living matter, or the mental and psychic bodies associated with these and manifested as Society. I apprehend that my readers will not welcome, at the moment and in these pages, an expansion of this particular idea, even though wireless has played and will play no small part in social evolution. Therefore we will pass on to yet another master idea, to which I referred last week, namely, motion.

Everything is in motion. Brought to absolute zero temperature particles of matter might cease their eternal dance, but in the aggregate they would still revolve with the earth around its axis and around the sun, and move with the rest of the solar system through space. If eternal vigilance is the price of security, eternal movement is the price of existence. Forms die and crumble to dust; the heart and brain of man become dust, but that dust is for ever unwearying in movement. The atoms which once composed the earliest living forms are still dancing; Plato's brain, Michael Angelo's hand, Buddha's heart, still move as to their ultimate particles.

Perhaps the most widely distributed form of motion observable in natural phenomena is harmonic motion, the recurrence of similar events. Periodicity runs like a refrain throughout the play of creation. "Consider the lilies;" first the seed, then the plant, and the flower, and thereafter again the seed. Consider those vital functions breathing and blood-circulation, how rhythmic the movement of the intercostal muscles and the rise and fall of the thorax, how regular the systole and diastole of the heart, the tick of the pulse.

Science is Measurement.

Think of the ebb and flow of tides, the regular succession of the seasons, and the recurrence of day and night, the swiftly spinning earth with its magnificent swoop round the sun, itself a revolving body. Wrench the mind from astronomical magnitudes to dwell upon the vibrations of sounding bodies, the incredibly rapid oscillations of electrons, and the infinitesimal and eternal ripples in the ether. You cannot entertain any doubt but that one of the by-laws is periodicity. It rules the life of the individual, the community, and the race. It enters so deeply into those causes which shape our being that one may say without exaggeration that periodicity has made us what we are.

A simple case of harmonic motion is that of a point moving uniformly round the circumference of a circle; another example is the motion of a piston in a cylinder, the piston-rod being imagined infinite in length. The particles of water move up and down in harmonic motion during wave-propagation, and so also do electrons in alternating or oscillating currents.

The outstanding characteristic of simple harmonic motion is that it follows a *sine law*—that is to say, it may be represented by a sine curve. I am warned off mathematics by a discriminating Editor, but I will permit myself to remark that amateurs interested in wireless theory must learn about sine curves or they will not progress very far. To have drawn a series of sine and cosine curves and to have digested their significance and uses is the beginning of a liberal education in wireless theory, and as some grasp of theory is equivalent to "knowing what you are doing"—well, a nod is as good as a wink to a keen fellow.

By means of these sine curves we can represent electrical oscillations and calculate the frequency and wave-length concerned and the amplitude of the current or E.M.F. at any moment of the cycle; we can show differences in phase by means of a plurality of curves plotted on a common base line, we can show how "beats" are set up, and what are their frequency and amplitude, and from the areas of curves we can calculate the power in a circuit.

Tackle this subject, and you will find keener delight in your hobby by being able to draw curves from figures taken from your own apparatus in operation. In this connection I will repeat once more the words of the sage, "When you can measure a thing you know something about it." Science is measurement.

THE P.M.G. AND HOME-MADE SETS.

INTERVIEWED at Birmingham by a representative of POPULAR WIRELESS on the vexed questions of wireless amateurs with home-made sets, the Postmaster General, Mr. Neville Chamberlain, remarked that it was evident that the position in regard to broadcasting is unsatisfactory from the point of view, both of the people who cannot afford to pay high prices for their sets, and that of the British Broadcasting Company and the Post Office.

"What the Government tried to do was to secure a sufficient revenue to enable those who erect the broadcasting stations and provide the programmes to maintain a high standard of quality, and on the other hand to avoid doing anything which would hamper the progress of experiment and invention.

"My predecessor seems to have thought that the man who made his own set could fairly be reckoned to be a genuine experimenter, but he did not give sufficient credit to the ingenuity of the manufacturer who supplies all the parts of a set, with a diagram enabling anyone to assemble them.

"This is simply evading the just and proper obligations of those who get the benefit of the broadcasting programmes.

"I recognise, however, that the majority of those who, having a little knowledge of electrical engineering, have been making their own sets, are now finding themselves in a difficult position.

"I do not want to check in any way the development of the present desire to share in the benefits of a very remarkable invention. The only difficulty is to find the most practical method of combining this with a due regard to the interests of all the parties concerned.

"I hope, before very long, to announce modifications in the regulations which will surmount the present difficulties."

THE KALLIROTRON.

An interesting article describing a wonderful valve combination.

TO obtain a two-thousandfold amplification of signal energy by the use of only two valves appears an incredible result, yet that is what has been accomplished by the circuit illustrated in Fig. 1. This powerful combination is due to Mr. L. B. Turner, who has named it the Kallirotron, from the Greek word *Kalliroos*, meaning "easy flowing."

As will be seen, the valves are connected together so that the plate of one is joined to the grid of the other, and vice versa, somewhat after the fashion of the mythical serpents who each seized and swallowed the other's tail until they both deteriorated into a spot of grease.

The analogy is not unapt, because the retroaction effects set up by the energy

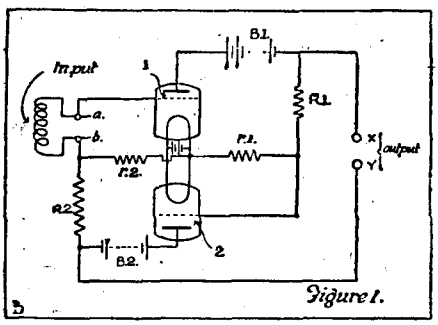


Figure 1.

flow through such a system create an increasing "negative resistance," which diminishes or destroys the ordinary ohmic resistance until the application of a minute electromotive force at the input is sufficient to give rise to an extremely large current flow through the device; in actual fact, it results in a voltage variation at the output end corresponding to such a current.

In other words, the device approximates as closely to an infinitely sensitive relay as appears to be possible within the limits of actual practice.

Regarding the circuits more closely it will be seen that the plate of valve 1 is supplied with a high tension voltage from a battery B 1, and that it is connected in the first place to its own filament through two high resistances, R 1 and r 1, and in the second place it is joined to the grid of the valve 2.

A Cumulative Action.

Similarly the plate of the valve 2 is fed by the voltage from a battery, B 2, and is likewise connected to its own filament through resistances R 2, r 2, and also to the grid of the first valve.

The input or signal energy is applied across the terminals *a*, *b*, between the grid and filament of the first valve. In order to keep the grids of both valves at a suitable negative potential small auxiliary batteries should be inserted in both grid circuits, but these have been omitted from the drawing for the sake of clearness.

Suppose, for example, that the applied signal causes an initial rise in the potential of the grid of valve 1, then a larger current will flow in the plate circuit of that valve. The potential drop across the resistances r 1 and R 1 increases accordingly, the voltage fall across any resistance being equal to the product of the resistance and the current flowing through it.

In other words, the potential gradient between the positive end of the battery through the valve and the two external resistances R 1 and r 1 becomes steeper, so that the voltage on the grid of the valve 2 (which is the same as that of the adjacent ends of the resistances r 1, R 1) is lowered. It follows that the current flowing through the plate circuit of that valve and across the resistances R 2, r 2 is diminished accordingly.

This fall in current in turn lessens the voltage drop across the resistances R 2 and r 2, because the whole potential gradient of the system is flattened out. The potential of the junction between the resistances R 2, r 2 will accordingly rise and increase the positive potential initially applied by the incoming signal. And so the process goes on.

Results on Test.

In a given test of the apparatus, using a high-tension of 95 volts on each plate, with an applied negative charge of 4 volts on the grids, an impulse of 5 millivolts across the input gave an output pressure of 8 volts, or an amplification ratio of 1,600. In this experiment the value of both the resistances marked R 1 and R 2 was 55,000 ohms, r 1 was 9,500 ohms, and r 2 13,600 ohms. Ordinary French or R valves were employed.

The actual degree of amplification obtained is, in fact, a function of the product of the two resistances r 1 and r 2.

As an example of its efficiency when used as an amplifier for ordinary line telephony it is sufficient for a person to speak in a conversational tone twenty feet from a pair of high-resistance telephones lying on a table, and connected to the input terminals of a Kallirotron in another room, for loud speech to be heard in a second pair of phones connected across the output terminals.

As the circuits are aperiodic (*i.e.*, contain practically no inductance or capacity) the device gives substantially equal amplification over wide ranges of frequency, a feature which is of great importance, as it avoids distortion effects when used for amplifying speech currents.

By removing both resistances R 1 and R 2 from the circuits, the output amplification of the Kallirotron may be made to

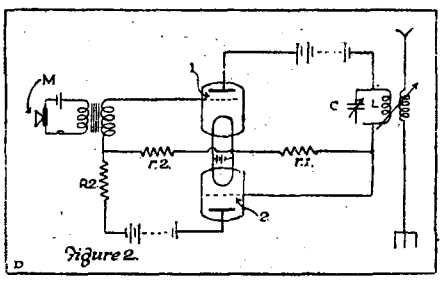
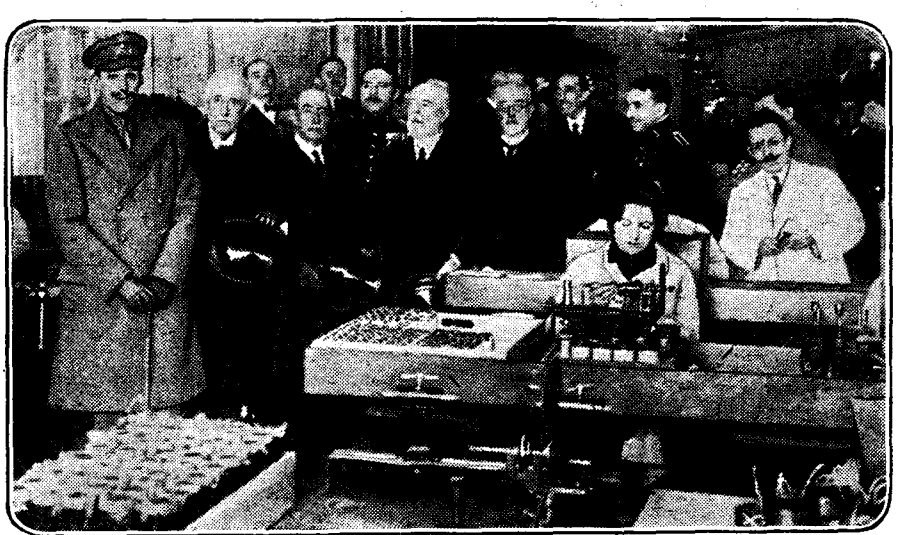
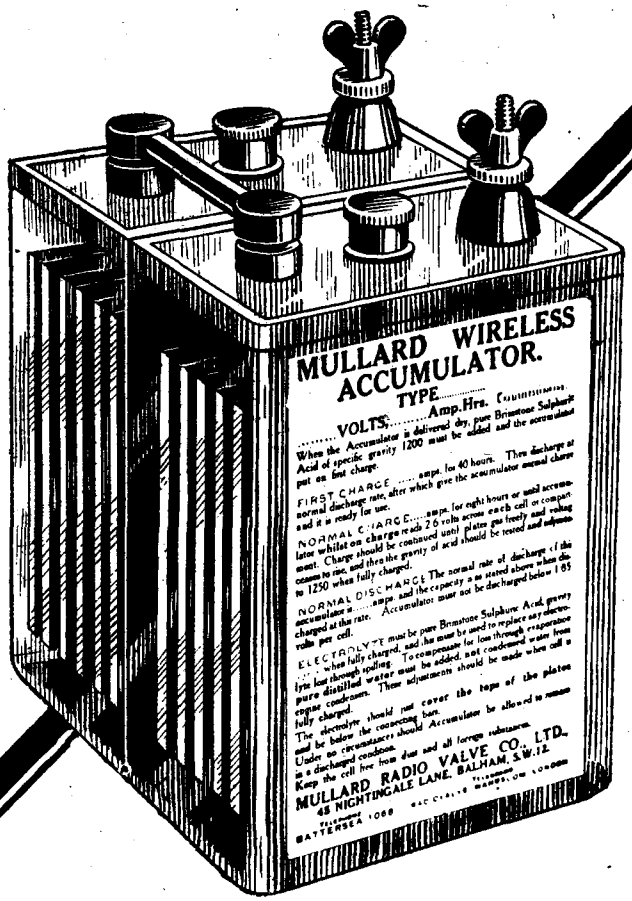


Figure 2.

reach a maximum value for a given small input, and thereafter to diminish, so that it can be usefully employed as a limiting device for minimising the effect of strays and other atmospheric disturbances, or for selecting a given note in preference to undesired jamming signals.

Fig. 2 shows the device in operation as a generator of high-frequency oscillations for the transmission of wireless telephony. The frequency of the carrier wave is determined by the tuned circuit L C, which replaces the resistance R 1 in the plate path of the first valve. Speech variations are applied to the grid circuit through the microphone M.


The King of Spain visiting a wireless instrument factory near Madrid.



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These are not idle claims; we cordially invite you to test them for yourself by calling at our demonstration-rooms any evening during the Broadcasting Concerts—*i.e.*, 5.0 to 5.30 or 7.0 to 10.30.

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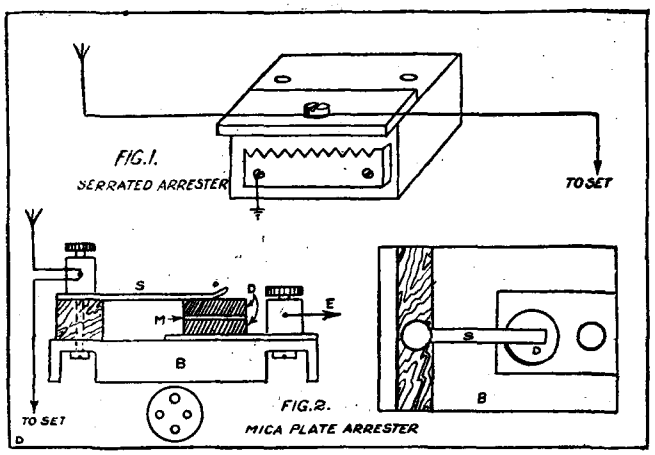
THE CONSTRUCTION OF EARTH ARRESTERS.

By H. E. HAYES.

MOST amateurs, taking up an unfamiliar subject, are at first unduly anxious as to what is going to happen: (*a*) If I do a certain thing, and (*b*) If I do not do it. Fortunately, even the worst accident in most hobbies only affects one's pocket; but in certain subjects—steam, electricity, and chemistry, for examples—certain precautions are very necessary. Now, at the present time a large number of aerials are erected, or in course of erection, and many ill-informed people talk freely concerning lightning discharges and the consequent danger to life and property.

When the dimensions and height of the regulation aerial are considered, this alarm is, to anyone with even a slight knowledge of the subject, quite unfounded. In a town or city, with its numerous high buildings, nearly all well-protected against lightning discharges, an aerial conforming to the regulations would scarcely receive the first attention from a discharge, unless by some freak cause, improbable but not impossible. The chances are 10 to the *n*th power that the aerial will never be damaged by lightning; yet, just to make it absolutely safe, an arrester can be made and fitted at an expenditure of a shilling or two, and isolated country houses with high aerials are recommended to do so.



The Straightest Path.

Investigation has proved that a lightning discharge to the earth's surface (an infrequent occurrence in our climate) can be safely conducted there by an elevated system of earthed points; and, further, that the existence of such points acts as a conductor and leakage arrangement for the charged cloud, or clouds, and consequently is a preventive of the discharge occurring.

It is also known that given a comparatively easy path to earth, any high pressure discharge will take this in preference to traversing even a single turn of a winding, such as a tuning coil. In fact, it will not turn a sharp angle on the copper tape of the lightning conductor wiring system, and for this reason such runs are wired as straight and direct as possible. Most readers have seen an electric spark jump from one point to another, for instance, across the minute gap of a sparking-plug, or the 6 to 10 inch discharging points of a powerful X-ray induction coil.

Damage May Result.

Now, a cloud is a mass of minute water globules, and, as such, can acquire a very high potential—much more than if it was a solid body of water. Many factors contribute to the charging of a cloud, such as evaporation, friction, rotation of the earth, etc. A second charged cloud may join the first one, and, assuming they are of equal mass and equally charged, the resultant potential on the combined cloud is, for reasons which will not be considered now, greater than that possessed by either before contact.

When this electrical pressure (or voltage) reaches a certain value, a discharge will occur from the cloud to the earth's surface, or vice-versa. A discharge may also occur from one cloud to another, but oppositely-charged, cloud. Roughly, a voltage of 50,000 is required to overcome the resistance offered by one inch of dry air. The enormous pressure or voltage of a lightning flash which will jump several miles can scarcely be realised.

The discharge, when it does take place, travels the path of least resistance to earth, and if this is provided by a tall, unprotected building or *isolated* tree, considerable damage may result. Many years ago it was observed that a charged, pointed conductor rapidly lost its charge, and that by providing elevated, pointed conductors, efficiently earthed, not only did they provide a path to earth if a discharge occurred, but by steadily neutralising and keeping in check the potential of the storm clouds actually prevented such discharge.

A large wood or forest would act in a similar way, as it presents a multitude of earthed points in the form of leaves. In large cities the amateur's aerial is by no means the most elevated point (he heartily wishes it was!). But just as a matter of precaution, one of the following simple lightning arresters should be made and fitted as near as possible to the point where the aerial is brought in.

Fig. 1 is called the "serrated" lightning arrester. It consists of a block of ebonite, or other insulator, on which are fixed two plates, one having saw teeth cut as shown. The distance between those teeth and the fixed plate should be as small as possible. The fixing holes on the serrated plate may be filed out to an oval shape, to allow of a close adjustment.

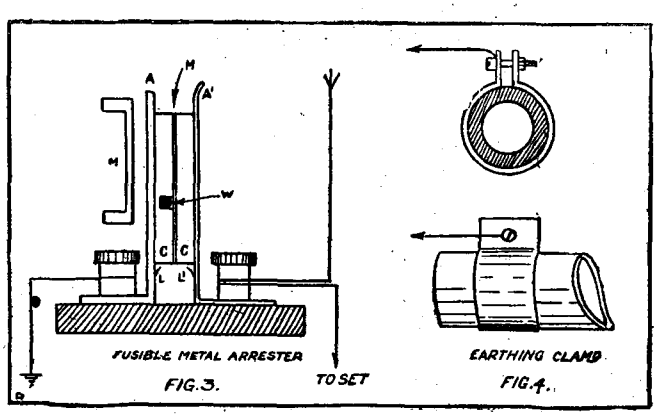
The "Earth" Arrangements.

Fig. 2 shows a better type of arrester—the "mica plate" arrester. Its construction will be evident from the plan and side elevation. D are two heavy brass washers separated by a piece of mica of similar diameter. Four holes should be made in the mica, as shown in separate sketch. S is a piece of springy brass or steel, and should bear tightly on the top washer. The usual ebonite base is provided.

Fig. 3 is an improvement on the two foregoing types. This arrester, known as the "carbon" arrester, automatically earths the aerial in the event of a discharge, but may be set clear again without trouble. A, A^1 are two brass angle-pieces, shown approximately full size. A^1 should be of a springy nature, to hold the carbon blocks (C C) tightly together, but separated by a piece of mica, shaped like a broad U and shown separately in Fig. 3.

Two small leaves are cut in the upright brass contacts, and pushed inwards to help keep the carbon blocks in position, as indicated by L, L^1. A small hole is drilled (about $\frac{1}{8}$ in.) in one of the carbon blocks, and filled up flush with the face of the carbon with Wood's metal, as used for fixing crystals. The effect of any sparking or discharge taking place is to cause the metal to melt and make contact with the second carbon block, thus directly earthing the aerial.

A substantial earth connection should be made to the nearest water-pipe; if any other piping is passed on the route it is advisable to connect to that also. Failing soldering the wire on the water-pipe (this cannot be done while water is in the pipe), a collar should be made from sheet brass slightly smaller than the pipe, and clamped on the pipe by means of a small nut and bolt, under which the wire should be secured. Fig. 4 shows this arrangement.



CORRESPONDENCE.

The Editor, POPULAR WIRELESS.

Dear Sir,—It appears to me that with the progression of the amateur wireless movement in the direction that it is taking, a great deal of what one can only term "unfairness" is going to result owing to the present licensing conditions. It is easy to make destructive criticisms. I have therefore outlined a suggested plan for levelling up matters a little.

At the present time a person desiring to receive the extremely fine broadcasting programmes that are being sent out can obtain either an experimental or a broadcasting licence, either of which is going to cost him the same. With a broadcasting licence he buys a receiving set and, in doing so, pays a considerable fee to the Broadcasting Co., to pay for the excellent entertainment he is receiving. No reasonably minded person can possibly object to pay £3 or £4 for what amounts to years of first class nightly entertainments. In no other way than the reception of broadcasting can an individual obtain such cheap amusement, and even education.

Avoiding the Tax.

On the other hand, there are a tremendous number of people who, in order to avoid payment for their share of the entertainments, apply for and obtain an experimental licence under the pretext that they are desirous of carrying out wireless experiments. I am afraid that in many cases this is also encouraged by the trade.

I, personally, have been carrying out experimental work in wireless telegraphy and telephony since 1912. I am also a member of the Radio Association, and therefore nobody can accuse me of being an ardent and biassed supporter of the Broadcasting Co. I venture to say that at one time when I saw my liberty being considerably interfered with, I was one of the first to criticise the Broadcasting organisation, and I am afraid I have at times, like many other people, groused about the monopolies of the ether, etc., but after three months sampling of broadcasting transmissions and a very careful searching into the intricacies of the trade and the difficulties with which the Broadcasting Co. are confronted, I think we owe them our thanks and congratulations for having so successfully carried through the difficult task.

A Suggested Solution.

The point remains, however, that there are a very large number of people who have only become interested in wireless because of the broadcasting, who are paying nothing whatever other than a licence fee for the very wonderful entertainments they are nightly receiving. This spells either of two things—the cessation of broadcasting owing to its failure to pay for itself, or else the man with the broadcasting licence paying for the entertainment of the man with the experimental licence.

The number of people desirous of really carrying out serious research work in matters connected with wireless are very few. It is one thing building up a set and adding valves to it in order to try and improve the reception of broadcasting, and it is another thing delving into the scientific depths of wireless reception. The man who is doing this latter work necessarily requires fairly expensive instruments of equipment, and broadcasting will only appeal to him from the point of view of being a fairly continuous supply of radio transmissions on which to test apparatus. If he wishes to listen to broadcasting, as a rule he will be the first to be willing to pay for his entertainment.

A Third Licence.

It appears, therefore, that instead of two different types of licences, three should be issued, the first the ordinary broadcasting licence, *and it would be just as well if the Post Office were to send an inspector round to examine the apparatus held by people with this licence.* It is a most extraordinary thing how many people with broadcasting licences seem to be able to get their sets to oscillate.

The second licence should be an experimental and broadcasting licence. This licence, given to people who desire to make their own sets and who wish to try the effects of different circuits on the reception of broadcasting, should include in its cost payment to the Broadcasting Co. on the same scale as that paid by people who are buying broadcasting receivers, *i.e.*, for a crystal set a man would pay a royalty on a crystal set, etc. If a person had a licence to receive on a two-valve set desired to use a third valve, he should be able to obtain permission by paying the difference in the royalties to the Post Office. After the issue of the first licence it could, of course, be renewed at the ordinary licence fee

Something for Nothing!

The third licence, which should be very sparingly issued, should be issued only to serious research workers with considerable experience. This purely research licence, as it might be called, should enable the holder to receive or transmit with certain restrictions, such as are already in force.

If some such licensing arrangement were in operation, the success of the Broadcasting Co. would be more probable, and everyone would be paying their fair share for the entertainment received. I think nobody would grumble at the serious research worker being exempt from the broadcasting fees, as they would to a certain extent compensate him for the expense and time he was putting in to further radio interest.

It would be extremely interesting if others of your readers, holders of broadcasting and experimental licences, would put forward their views, more especially if, before doing so, they would endeavour to look into the matter in as broad-minded a way as possible, realising that in this world it is impossible to obtain something for nothing, and that there is no more reason why they should expect certain sections of the community to pay for their amusement than for entirely unknown people to regularly present them with free tickets for the theatre.

Yours faithfully,

"EXPERIMENTER WHO ENJOYS BROADCASTING RECEPTION."

The Editor, POPULAR WIRELESS.

Sir,—In view of the reports appearing from time to time in the daily Press of so-called "Diddlers" who are listening-in without Licences, I should be glad if you could definitely solve this problem for me.

The question is, are *all* the unlicensed listeners-in "diddlers," or is it not a question for the Post Office authorities to answer, inasmuch as no licences are issued even when applied for.

Take my own case, for instance (and I know of several others): I made my own 1-valve set about a month or six weeks ago, and at once applied to the P.M.G. for an experimenter's licence. I received the necessary form of application, and returned it duly completed, *without delay*; since then I have had no further word from them.

What then is the position? I certainly have no intention of evading the licence fee, and should be only too glad to have this matter settled.

Scrap the Set?

This, no doubt, is the experience of scores of other amateurs. Therefore, I repeat, whose fault is it that there are *so-called* "diddlers," when the P.M.G. might surely adjust matters, and issue licences more speedily, thereby adding to the Revenue and, incidentally, the B.B.C. receiving their just proportion.

Finally, does it seem feasible that, failing the issue of a licence by the P.M.G., an amateur is going to refrain from using his set or, "better" still, scrapping it?

I should be obliged if you could settle this point by an answer in your valuable paper.

Thanking you in anticipation,

I am, sir, yours faithfully,

CHARLES A. SHELDRICK.

13, Cromford Road,
West Hill,
London, S.W.18

The Editor, POPULAR WIRELESS.

Sir,—My client, Alfred Dinsley, Ph.D., of Great Crosby (call sign 5 I L), has requested me to write to you with reference to the recent abuse of his call sign.

Dr. Dinsley is at present using his station solely for research purposes, and it is regretted that some person or persons, at present unknown, have been using and abusing his call sign for the purposes of transmission.

If this practice does not immediately cease, strictest investigation will be made, and the facts reported to the Postmaster-General.

As this practice is not only unfair, but is also calculated to hinder and retard research work, I should be glad if you would insert this letter in your next issue.

Yours faithfully,

FRANK H. HENRI,
Solicitor, Liverpool.

HAVE YOU IDEAS?

The Editor welcomes short contributions from readers of "Popular Wireless." If published, they will be paid for at our usual rates.

POPULAR WIRELESS EXHIBITION REVIEW.

A Concise Summary of the Wireless Exhibits at the "Daily Mail" Ideal Home Exhibition, Olympia.

RADIO INSTRUMENTS, LTD.

Our stand contains one of the most representative displays of wireless apparatus, both instruments and components, made in this country. Everybody interested in wireless should not fail to inspect the magnificent collection of instruments and accessories displayed here.

Twenty-four different types of broadcasting instruments are shown, including sets fitted with 1, 2, 3, 4, 5, and 7 valves. There are also a number of our well-known artistic "Lyrian" cabinet sets fitted with and without frame aerials; those fitted with frame aerials can be used in any place without wires or connections of any sort, the instrument being completely self-contained. All "Lyrian" sets are fitted with loud speakers. Two new fine cabinet models are shown in Chippendale and Jacobean styles.

The famous R.I.I. Low-frequency transformers and a wide range of high-frequency transformers suitable for wave-lengths of from 150 to 30,000 metres in one unit are also shown at our stand. All the R.I. components used in wireless and made in our own works can be seen. Experimenters will be well repaid by inspecting these components.

A large range of our improved crystal sets are also shown. These are fitted with the R.I.I. Micrometer Adjustment, which considerably increases the sensitivity.

* * *

A. W. GAMAGE, LTD.

Once again the well-known firm of A. W. Gamage, Ltd., are offering to the public the right apparatus at the right price, so that one and all may enjoy these nightly concerts transmitted by the British Broadcasting Company.

At the Ideal Home Exhibition they will have on show a complete range of their apparatus capable of filling everybody's requirements from crystal sets to multi-valve sets. In particular every one should examine their Ideal Crystal set, which is constructed on sound lines, every detail being carefully considered, so that consistent maximum efficiency may be obtained. They have only been selling these sets for a short period, and the reports of concerts enjoyed are continually arriving, which proves that there is nothing complicated in these sets.

Everyone is also interested in amplifiers for Crystal sets for the purpose of working either several pairs of telephones, or a loud speaker; this has also received their attention, and their single stage amplifiers are all that may be desired for this purpose. They easily claim to have in their stock the finest single-valve receiver yet offered to the public, and this will be on show at this exhibition. The workmanship is perfect throughout, and the guaranteed receiving range is 40 miles for telephony.

They will also be putting before the public a range of new cabinet sets consisting of 3, 4, 5, and 6 valves constructed to give the maximum efficiency with the minimum of trouble at prices which will be worth considering.

There will be several unique features, particulars of which will be found in the circular obtained at their stand. There will be an efficient technical staff to answer your questions and to give you every possible advice as to the purchase of your wireless set. A large range of useful accessories will also be displayed.

* * *

L. McMICHAEL, LTD.

We shall be showing a complete range of our receiving sets, among which we should like to draw attention specially to our M.H.3 3 valve receiving set which consists of one high frequency valve, 1 detector valve, and 1 low frequency valve complete in polished mahogany cabinet. This set has been consistently receiving the American broadcast concerts from different parts of the country and may be purchased, complete with all accessories, for £27 10s., this making a complete station.

Our M.H.4R. set, which has 1 valve high frequency, 1 detector and 2 valves note magnifier, a high frequency being obtained by tuned anode. We have the M.H. Loose Coupler, which we recommend to go with this set, both being mounted in desk shaped mahogany cabinets, making a very handsome pair of instruments. The total cost of such a station would be in the neighbourhood of £40 complete with all accessories. With such a set as this the London broadcast stations have been heard as far away as the north of Scotland, South of France, and indeed so far distant as Norway.

We are also showing the very last word in broadcast sets, our M.H.B.R.2 being a highly efficient set and stamped B.B.C. complying with all regulations. The cost of complete station, embodying this 2 valve receiving set, is about £23, and a further 2 valve of amplification for those desiring to use loud speaker can be added at an extra cost of 9 guineas.

In addition to the sets mentioned there will be a good selection of ex-Government apparatus reconditioned, and in some cases reconstructed for present day use as broadcast receiving sets, these of course being highly efficient, as everyone realises the very good workmanship which was put into Government apparatus, regardless of expense.

Another interesting feature on our stand will be our radio blocks or unit system, each unit being in specially fine machined aluminium case. Thus a good screening effect is obtained, and it is possible at comparatively little expense to build up a 4 or 5 valve set with these units. High frequency is arranged for either by the transformer plug-in method or by reactance capacity.

* * *

TINGEY WIRELESS, LTD.

Messrs. Tingey will be exhibiting:

SINGLE-VALVE BROADCAST SET.—Stamped B.B.C. Entirely self-contained with exception of batteries. Wave-length 300–3,000 metres. Broadcast reception up to 50 miles for speech; also Paris time signals.

TWO-VALVE BROADCAST SET (Type A).—Stamped B.B.C. Entirely self-contained with exception of batteries. Wave-length 300-3,000 metres. One H.F. and 1 Detector. Broadcast reception on headphones 100 miles. Also possible to hear Paris speech and Hague.

THREE-VALVE BROADCAST SET.—Stamped B.B.C. Entirely self-contained with exception of batteries. Wave-length 300–3,000 metres. One H.F., 1 Detector, and 1 L.F. valve. Broadcast reception on headphones up to 300 miles. Capable of Low Frequency extension.

FOUR-VALVE BROADCAST SET.—Stamped B.B.C. Entirely self-contained with exception of batteries. Wave-length 300–3,000 metres. One H.F., 1 Detector, and 2 L.F. valves. Broadcast reception on headphones up to 300 miles.

FIVE-VALVE BROADCAST SET (Type A).—Stamped B.B.C. Entirely self-contained with the exception of batteries. Wave-length 300–3,000 metres. Two H.F., 1 Detector, and 2 L.F. valves. By means of switches any combinations of two or more valves may be used. Capable of receiving broadcasting from all British and Continental broadcasting stations.

FIVE-VALVE BROADCAST SET (Type B).—Stamped B.B.C. Entirely self-contained with exception of batteries. Wave-length 175–28,000 metres. Two H.F., Detector, and 2 L.F. valves. Three or five valves can be used by means of a switch. Separate inductances for each range of wave-lengths.

TINGEY UNIT SYSTEM.—For holders of experimental licences only. The most effective type of apparatus produced. Any combination of valves may be built up by the purchaser to suit his individual needs. American speech has been successfully received on numerous occasions with these units. Special patent coils with exceptionally low self capacity are sold for use with this instrument.

TWO-STAGE POWER AMPLIFIER UNITS.—For addition to any of our sets when exceptionally loud signals are required.

* * *

THE IGRANIC ELECTRIC CO., LTD.

The Igranic Electric Co., Ltd., say their exhibit will consist of a collection of modern wireless units, as manufactured in their factories, featuring their:

Filament Rheostats, Plain and Vernier types. Intervalve Transformers. Honeycomb Inductance Coils, Plug and Gimbal mounted. "Triplug" Coil Holder, for table and panel mounting of plug type Honeycomb Coils. "Micro Adjusta" Coil Holder for plug type Honeycomb Coil. "Gimbolder" Coil Stand for Gimbal mounted Honeycomb and Slab Inductance Coils. Variometers of the Ball and Socket type. Vario-coupler of the Ball and Tube

(Continued on next page.)

POPULAR WIRELESS EXHIBITION SUPPLEMENT

(Continued from previous page.)

type. Tapped Inductances of the Honeycomb Coil type.

Special attention is drawn to the Gimbal Mounted Honeycomb Coils and "Gimholder" stands, which represent the latest development in the art of wireless telephone and telegraph signal reception. The use of gimbal mounted coils on the "Gimbolder" stand entirely obviates the need for aerial tuning and results in much sharper tuning and consequently less damping of the received signals.

The damping of the received signal is further decreased by the use of the honeycomb form of winding, owing to the fact that the high frequency resistance is thereby reduced to a minimum.

The combination of the "Gimbolder" stand and Gimbal mounted Coil actually provides a variometer and coupler of very low distributed self-capacity. When arranged in this way the Gimbolder system has considerable advantage over the standard variometer, which is limited in wave-length.

Other interesting items on view will be Coil Winding Machines in operation, one winding the famous Honeycomb Coils, and the other winding the noted Cotton Interwoven Intervalve Transformer coils. This latter winding is used on all Igranic Intervalve transformers and ensures maximum efficiency and silent working.

* * *

ELECTRIC APPLIANCES, LTD.

The Electric Appliances Co., Ltd., are showing a complete range of instruments for the reception of Broadcasting. This range includes:

1. *Eureka Loose-coupled Crystal Set.*—This set is capable of giving very selective tuning (in cases of serious jamming) owing to the "coupled circuits," while, by means of the "tune and stand-bi" switch, a single circuit may be used. No batteries or valves are required. The set is complete for reception of broadcasting and has a range of 25 miles. For telegraphy and time signals 300 miles or more. Wave-lengths 300 to 600 metres.

2. *Eureka 2-Valve Broadcast Receiver.*—This set is specially designed for the reception of Broadcasting within a radius of 50 to 80 miles. In the construction of this set simplicity has been the keynote. A child can "tune-in" a Eureka Valve Receiving Set at the first trial. Only two adjustments are necessary: (1) Rough tuning; (2) fine tuning. Valves are enclosed—very accessible—and a vent over each serves the double purpose of ventilation and examination. The panels are mounted at a convenient angle, which is much better than if horizontal or vertical.

3. *Eureka 3-Valve Broadcast Receiver.*—This set is built on similar lines to the 2-Valve Set previously described. Its range for Broadcasting is from 80 to 120 miles—thus a number of transmitting stations can be heard. With this set a Loud Speaker may be used. The tuning is extremely simple, and the set can be operated by a child or anyone without the slightest technical knowledge.

4. *Eureka 4-Valve Broadcast Receiver.*—This is the most powerful instrument of its kind on the market, and there is no finer Broadcast Receiver manufactured. Its manipulation is extremely simple, being precisely the same as for the 2 and 3-valve sets. The range is considerably increased, and Broadcasting can be received from all stations in the British Isles and from the principal Continental stations as well. This set will operate with or without a Loud Speaker.

All Eureka Valve Receivers can be supplied to work on either outdoor or indoor aerial, as required, and absolute satisfaction is guaranteed with every set, whether used with outside or inside aerial.

* * *

RADIO PRESS, LTD.

"Modern Wireless" the largest British Wireless Monthly, and a full range of wireless books are amongst the publications of the Radio Press, Limited. The beginner will find in "Wireless for All" and "Simplified Wireless" a non-technical explanation of the fundamental principles of wireless telephony and telegraphy. "How to Make Your Own Broadcast Receiver," and "The Construction of Wireless Receiving Apparatus" are two little books which will be found invaluable for constructional information. "Wireless Valves Simply Explained," and "Practical Wireless Valve Circuits" are two excellent books suitable for those who already have some slight knowledge of the subject, while "Elementary Text-book on Wireless Vacuum Tubes" is suitable for the more advanced student. "How to Erect Your Aerial," and the Radio Press "Wireless Directory" of commercial and amateur call signs are two indispensable books.

* * *

S. G. BROWN, LTD.

The Type A Telephone Head Receiver (Adjustable reed).—These phones represent the highest development in the production of a super-sensitive receiver. For the detection of weak signals, and for all cases where the greatest efficiency is demanded they are without equal. By their use the range of a given receiving set is much increased.

The Type D Head Receiver.—This is of the flat diaphragm design, and, while not so efficient as the Type A, is, nevertheless, a thoroughly efficient instrument for all-round use. It is particularly good for telephony (speech and music). In fact, it differs from the Type A only in price, and is lacking the ultra-sensitiveness of the dearer instrument.

The Type F Featherweight Phones.—These have been produced in response to the demand for a phone that shall be almost as good as the Type D, but lower in price. They have the added merit of extreme lightness. The workmanship is quite up to our usual standard, and this receiver constitutes the best possible value for money. They are wound either to 120 or 4,000 ohms; the price, 30s., being the same for both.

The H1 Loud Speaker.—This is the premier loud speaker, both in respect of volume of sound and clearness. It has a scientifically designed horn, free from all distortion.

The H2 Small Loud Speaker.—Where so large an instrument as the H1 is not called for, or where price is a consideration, this receiver, which is practically a miniature edition of the famous H1 loud speaker, affords the amateur the best possible way of allowing a number of people to listen-in simultaneously. In common with the H1 instrument, it operates on the adjustable reed principle, and it has, likewise, our patent logarithmically-expanding horn.

The Microphone Amplifier.—This instrument constitutes a robust and efficient device for amplifying wireless telegraphy and telephonic currents. It is simple and cheap; very reliable, and its upkeep cost is negligible. It gives amplification greater than that obtained from the use of two valves. Speech of a given loudness in a pair of head phones will, by the use of the microphone amplifier, be of the equivalent loudness from a loud speaker.

* * *

ROGERS, FOSTER AND HOWELL, LTD.

On Stand No. 13, in the new Hall Gallery, Rogers, Foster & Howell, Ltd., radio engineers, of Edward Road, Birmingham, have a comprehensive exhibit of their well-known wireless receiving sets. As is to be expected, great importance is given to their New Reaction Sets for use under the ordinary broadcasting licence. The great advantage of these new sets is their great selectivity, which enables them to cut out any local broadcasting station at will, even if this is only a mile or two from where the instrument is installed. Such sets also eliminate risk of interference from spark transmitting stations which in certain parts of the country give so much trouble to wireless users. The effective range of the instruments with the new circuit is also greatly increased; to take only one instance, the 2-valve instrument when used in Birmingham will receive telephony from Paris, the Hague, London, Manchester, Newcastle, Cardiff, etc. The instruments exhibited of this new type comprise 2-valve, 3-valve, and 4-valve sets.

Of the non-reaction type there are on exhibition specimens of the 1-valve, 2-valve, and 3-valve sets. In the way of crystal sets there are on view a number of the firm's Model O Class "A," an extremely attractive and well-finished crystal receiving set. There are also various receiving sets shown in different styles of pedestal cabinets in various "period" designs, especially suitable for the lounge or drawing-room, and forming attractive pieces of furniture. Various 2-valve and 3-valve amplifiers, and a number of special 7-valve sets are on view, together with a varied stock of wireless components and parts.

* * *

RADIOPHONES, LTD.

The wireless enthusiast who wishes to go in for a large set, but does not want a lot of panels, wires, and batteries all over his room, will find the stand of Messrs. Radiophones, Ltd., very interesting and helpful.

The chief exhibit, besides the standard 2 and 3 valves sets, will be a large 4 valve cabinet set. It is completely enclosed in polished mahogany of artistic design, and embodies the whole equipment except the aerial. A loud speaker is contained at the top of the cabinet, and this can be used if desired, or can be switched off and telephones attached to the terminals provided. Batteries are included and the valves are coloured red to prevent glare. The whole set is completely encased when not in use, two swing doors hiding the whole apparatus. The range of wave-lengths is very large, being from 250 to 3,000 metres, thus including all the British broadcasting, the French telephony, the Hague, and also the Paris time signals from the Eiffel Tower.

(To be continued next week.)

It speaks for itself in a loud, clear and perfectly natural tone

With the highest amplification of all Wireless reception, and particularly of Vocal and Instrumental music, the clarity and tonal purity of the AMPLION is unapproached in any other form of loud speaker. The adjustment is simplicity itself, and "volume" may be regulated to a nicety.

THE

AMPLION

LOUD SPEAKERS

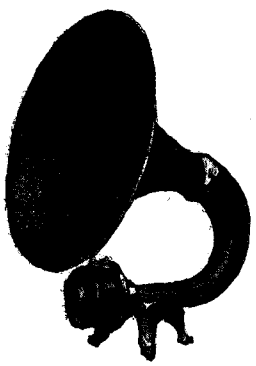
The World's Standard

are supplied in a series of 10 models, suited to every service—the Home, Laboratory and Concert Hall—and the prices range from fifty shillings to fifteen guineas.

The registered Trade Mark AMPLION on a Loud Speaker is a guarantee of efficiency and reliability, and an assurance of Improved and Perfected Reception.

Ask for Folder "P.W."

Type A.R. 15.
Table Type with "Music Master" style horn, 14-inch bell mouth.
2,000 ohms £6:2:6
Other resistances supplied.



Type A.R. 19.
Table Type with independent receiver.
2,000 ohms £5:5:0
Other resistances supplied

Type A.R. 17
Concert Grand Model with 23-inch bell mouth.
2,000 ohms £15 : 15 : 0
Other resistances supplied.

Ideal Home Exhibition
STAND 24
Gallery —— New Hall

ALFRED GRAHAM & CO.,
St. Andrew's Works, Crofton Park, London, S.E. 4.

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A NOVEL CRYSTAL SET.

By W. S. SHOLL, A.M.I.E.E.

THE set made and designed by the writer and fitted into a cigar box 1 in. deep is in no wise a "freak," but a highly efficient receiver put up in a rather novel form. The set was made as an attempt to get away from the more or less stereotyped form of apparatus, but the necessity of high-class workmanship and good insulation was kept in mind throughout in view of the limited accommodation available for the various units.

The set is a "made" one, as distinct from an assembled proposition, the whole of the apparatus being constructed from the raw material, nothing having been purchased but the ebonite, wire, and terminals.

In view of the limited amount of room available the spider-web type of coil was adopted for the tuner, two of these coils being made up and connected in series; tuning being accomplished by mounting the top coil upon a hinged ebonite panel so as to vary the coupling between the two coils.

The accompanying photograph gives a good indication of the lay-out of the set.

Mr. W. S. Sholl.

Space Economy.

The lower ebonite panel measures $3\frac{3}{4}$ in. by $4\frac{9}{16}$ in. bare, being eased down to a snug fit and screwed down to the bottom of box. The upper panel measures $4\frac{1}{8}$ in. by $4\frac{9}{16}$ in. bare, and just works freely into the sides of the box, and, being screwed flush with the right-hand edge of the pivoted member, which is $\frac{3}{4}$ in. square, is capable of easy adjustment in relation to the fixed coil, as the square piece—of wood—is pivoted at either end by screws as shown.

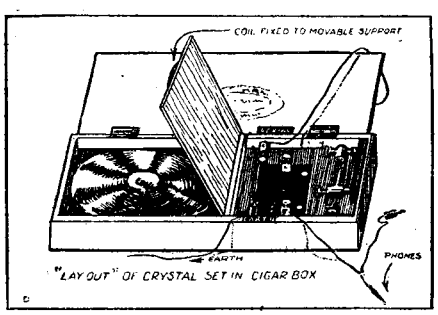
An ebonite knob is shown for tuning, but this is not really necessary, as a tab of leather can be screwed to the upper panel and the necessary adjustment made with the fingers.

All contacts are mounted on ebonite, and to save room the blocking condenser has telephone pattern terminals screwed directly into it to accommodate the tag ends of the headphones.

The detector is the author's own pattern, and is fully described in a former article dealing with the construction of a broadcasting set. The crystal is hertzite, which leaves little to be desired; half a "specimen" of this crystal is ample.

The formers for the coils are cut out of Bristol board, which on account of its comparative stoutness and rigidity is very suitable for the purpose. Nine slots are provided and the winding consists of 44 turns—22 a side—of 28 S.W.G. D.C.C. wire treated with shellac and thoroughly dried.

The inside of the fixed coil goes to earth, the lower terminal, the outside end, is connected to the inside end of moving coil, and the outside end goes to aerial by means of an inch or so of electric lighting flexible to allow free movement.

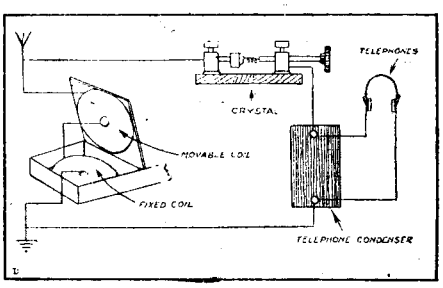


The coils are secured to their respective panels by 4 B.A. screws tapped into the ebonite, which is $\frac{3}{16}$ in. thick throughout, except in the detector base, which is $\frac{3}{8}$ in. thickness.

The condenser is ·003 mfd. capacity, having 11 copper foils $\frac{1}{2}$ in. wide by 2 in. long, the active portion of the foils being $1\frac{5}{8}$ in. with a $\frac{3}{8}$ in. lug.

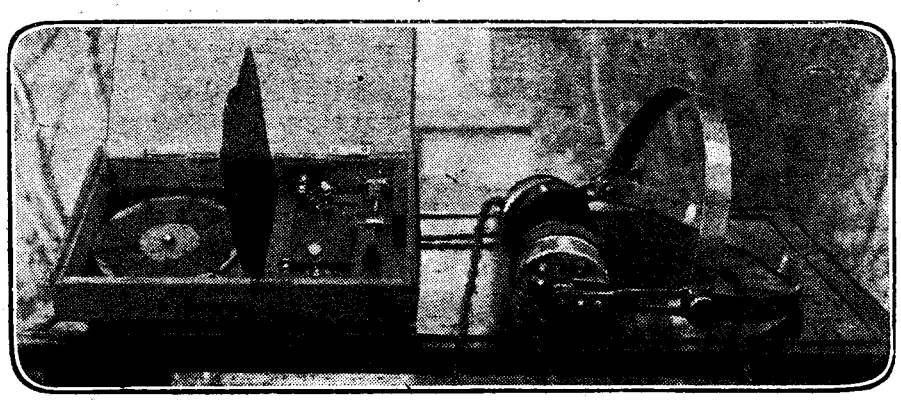
Thirty Shillings Complete.

The small amount of wiring is effected by 20 S.W.G. tinned copper wire encased in sleeving. For the encouragement of those unblest with workshop facilities it may be stated that the whole of the work was carried out on a table in a *bedroom* with the most limited equipment of tools.



Perhaps the Editor will pronounce on the quality of the workmanship? The whole receiver cost just under seven shillings, the phones—British made, 4,000 ohms—£1, and the aerial 8d. The results on broadcasting, eight or ten miles radius, are all that could be desired.

When closed, the tuning set—if knob is omitted—betrays no evidence of its actual nature. The box being very nicely made, and fitted with hinges and a clasp to the lid, makes the set very easy to take about without fear of damage.



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POPULAR WIRELESS Beginners' Supplement

PART VII.—CAPACITY AND INDUCTANCE EXPLAINED.

By MICHAEL EGAN.

THE function of a receiving aerial is to provide some means of reproducing the electrical vibrations which occur in the aerial of the transmitting station from which it is desired to receive. As previously explained in these articles, the vibrations that are produced in a transmitting aerial give rise to waves of energy which move out in all directions through the surrounding space. These waves are capable of vibrating any suitable object that may be placed in their path, and the most suitable object for this purpose is a length of wire.

An Important Factor.

Except for their reduced strength, the vibrations set up in the receiving wire will be exactly similar to those which gave rise to the emission of wireless waves, in the first instance, from the transmitting station. Owing to the distance which the waves have travelled, however, the vibrations set up in the receiving aerial will be considerably weaker than the original vibrations in the transmitting aerial. It is, therefore, advisable to make your receiving aerial very sensitive in order to enable the weakened waves to produce as strong vibrations as possible in it. The distance is only one factor; the sensitivity of your receiving aerial will also play an important part in affecting the loudness of signals.

Maximum sensitivity is obtained by "tuning" your aerial—as a violinist "tunes" the strings of his instrument, There are two ways of tuning a violin string, and they are analogous to the two ways in which a receiving aerial is tuned. When a violinist wishes to produce a particular note from a string, he alters either the *tension* or the *length* of that string. Similarly, when you want to listen to signals which are sent out on a particular wave-length, you must alter either the (electrical) tension or the length of your receiving aerial.

Effect of Inductance.

You have, no doubt, often seen a violinist "tuning up." He turns a little black knob in the handle of his violin, thereby adjusting the tension of the string until it is capable of vibrating at a certain rate, *i.e*, until it can emit whatever note he wishes it to emit. You may not be so familiar, however, with the idea of altering the length of the string to produce the same effect. Yet, he does this also.

The four strings of a violin are, normally, only capable of emitting four different notes —or four notes of different pitch—whereas an ordinary violin selection may contain some dozens of different notes. And the player certainly couldn't alter the tension of the strings to produce these different notes in the course of his performance! He can, however, alter the length of the strings.

This is what he does when he slides his hand up and down the handle of the violin, pressing the tips of his fingers on the strings at different points. When he presses the tip of one finger half-way down one of the strings, he is, in effect, halving the length of the string. The only part of the string that vibrates is the half that extends from the tip of his finger to the "bridge" of the violin. The other half is "dead." By altering the effective length of the strings in this way, he can produce any desired note within the range of his instrument.

A wireless receiving aerial is tuned in a similar manner. In order to receive waves of a definite length, it should be tuned to whatever pitch of sensitivity will make it most susceptible to being vibrated by these waves. This is done by altering its length and its (electrical) tension. The former can be effected by means of a coil of wire—usually referred to as an "aerial tuning inductance." This coil is connected to the down lead of the aerial inside the operating room, and, instead of lengthening the outdoor part of the aerial, you can lengthen it by adding any desired amount of the wire on the coil.

What a Condenser Does

The (electrical) tension of the aerial is adjusted by means of a "condenser." A condenser is an instrument for containing electricity. When it becomes filled it overflows, and the current that formerly filled it surges backwards and forwards in the circuit. The smaller the condenser, the shorter will be the time taken for it to fill and overflow, and the more rapid will be the resulting vibrations.

Condensers are, therefore, variable, as a rule. That is, they are so made that their capacity can be altered at will. This is done by turning a knob at the top of the instrument, just as the violinist alters the tension of his strings by turning a knob at the top of his violin. In practice, therefore, you can tune to a particular transmitting station by adjusting either the "aerial tuning inductance" or the "tuning condenser."

The whole object of tuning, of course, is to *prepare* your aerial to vibrate at a particular rate. For a given length and a given tension, an aerial tends, "naturally," to vibrate at a definite rate. If this natural rate is the same as the rate at which the transmitting aerial is vibrated it will make it all the easier for the wireless waves to set it vibrating. On the other hand, if this natural rate differs from that of the transmitting station, it will offer a certain amount of resistance to being vibrated at the same frequency.

To Obtain Loud Signals.

A certain portion of the energy of the received waves will therefore be consumed in overcoming this resistance, and the remaining energy available for producing signals in the telephones will be small, with the result that signals will be weak. If the difference is very big, moreover, all the energy of the received waves may be consumed in overcoming it, with the result that no signals will be heard at all. The more "closely" tuned you are, therefore, the louder will be the resulting signals.

"Sharp" tuning will sometimes render audible signals that are quite inaudible when the adjustments of a set are run over quickly. Therefore, when tuning-in, turn all the various adjusting knobs slowly and carefully. Remember, too, that the close proximity of your hand may slightly increase the capacity of the set, and, therefore, allow just a little over the adjustment required to compensate for the slight "drop" when you remove your hand.

The amplifying apparatus under the stage at the Hippodrome. Land-line wires to 2 L O carry the strains of the familiar panto.

THE VALVE FOR BEGINNERS

By SEXTON O'CONNOR.

PART II.

IT was stated in the last article that there is an almost perfect vacuum inside the valve. The result is that, of the myriads of electrons which together make up the electric current passing through the filament, some thousands "boil off" or evaporate from the red-hot wire directly they enter the region of reduced pressure within the valve.

We can imagine, therefore, the interior of the glass bulb to be filled with an immense number of free electrons so long as the filament is kept heated.

A glance at the diagram given in Fig. 1 shows, however, that the plate is joined up to the positive pole of the high-tension battery (which is built up from a number

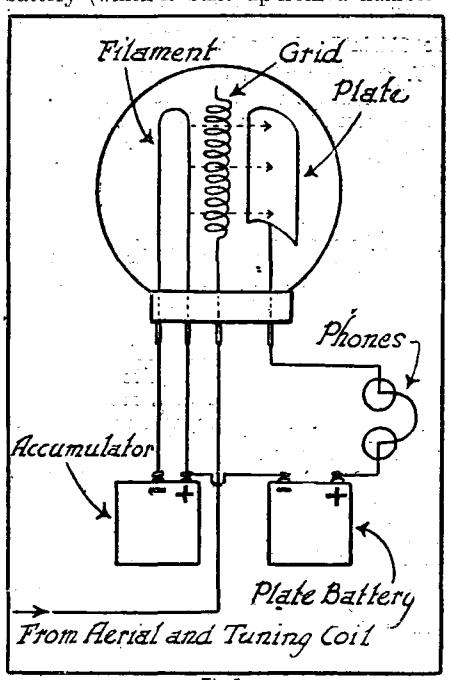

Fig 1.

of ordinary dry cells). There is, therefore, a "positively charged" body (the plate) in the close neighbourhood of the cloud of free negative electrons given off by the glowing filament.

In other words, the plate is thirsting for negative or neutralising electrons, whilst the inside of the bulb is full of unattached electrons continually "boiling-off" from the glowing filament and flying around in all directions with tremendous speed, vainly endeavouring to get outside the closed walls of the bulb. Only one possible thing can happen. The plate swallows up as many of these negative particles of electricity as it can attract or draw within range.

What the Grid Does.

The plate carries a positive charge of some 50 volts or so, according to the size of the large dry battery used, and is able, in ordinary circumstances, to absorb all the electrons that the filament can give off, providing that the latter is not "boiling" too hard, *i.e.*, is not carrying too much filament current from the accumulator.

Therefore, as the other and negative terminal of the H.T. battery is connected to the filament of the valve through the telephone receivers it stands to reason that it will endeavour to complete its circuit from the plate across the path formed by the electron stream in the opposite direction to this latter. This it does in the form of a steady current of a strength proportional to the conductivity of the electron stream which, under normal conditions, is constant.

Such a steady current will not, however, give rise to any audible note. Before broadcast music can be heard, the incoming "signal waves" or energy picked up by the receiving aerial must first be transferred from the aerial to the grid.

The grid interposes the electron stream in accordance with the charge formed on it by the incoming signal current. If this latter is negative it will not permit the passage of negative electrons through it, because all like charges tend to oppose each other, unless the power of the negative charge on the grid is less than that of the electron stream. Therefore, the nature and strength of this charge on the grid will increase or decrease the electron flow from the filament to the plate, and, therefore, its conductivity and finally the current flow of the H.T. battery from the plate to the filament. That is quite clear, isn't it?

Valve as a Detector.

The form or structure of the electric energy radiated from a broadcast station consists of a stream of ether waves or "oscillations," which have been "moulded" into an irregular shape or outline by the effect of the voice or musical sounds applied at the transmitting end.

If they could be made visible the moulded waves might be represented somewhat as shown in Fig. 2.

The first action of the valve on such waves is, in effect, to cut them in half through the line X Y. One half is then "suppressed" altogether, or, rather, not used, whilst the other half tends to alter the H.T. current flow through to the phones by means of its action on the grid. Thus this H.T. current consists of a number of "pulses" all in the same direction, which is from the plate to the filament.

In this form they are able to "push," and so "vibrate" the telephone diaphragms or earpieces, whereas if *both* half-waves could actuate the H.T. current so that it would flow in both directions each half would cause a "pull" in opposite directions at the same time, and the net result would be nothing, even if the diaphragms of the 'phones could vibrate in

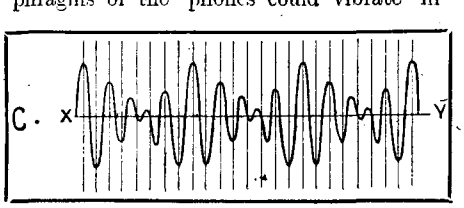

Fig. 2.

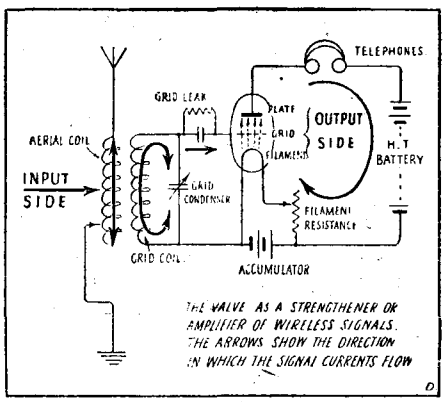

Fig. 3.

time with such alternations—but, of course, they couldn't.

This process of cutting the waves in half is called "rectification," and the valve when so used is acting as a "rectifier" or "detector."

The next point to be considered is the amount of energy that is available for reception, *i.e.*, the actual power transferred through space from the transmitter to the receiving aerial.

In the London Broadcasting Station (2 L O) a considerable amount of electrical power (1½ kilowatts) is applied to the radiating aerial. The ether waves so created spread outwards in all directions, and in so doing naturally fall off in strength very rapidly.

It has been estimated that at a distance of 15 miles a receiving aerial 100 feet long will only tap the one-billionth part (the millionth of a millionth) of the energy poured into the ether at the transmitting station. This is just sufficient to give good signals on a crystal set, *i.e.*, without using any means of amplifying or strengthening the received energy.

Amplifying Signals.

By the use of what is called "reaction" (which will be explained later), a single valve can be used to receive over a distance of about 50 miles, or more than double as far as a crystal, whilst with two or more valves in series, musical signals can be heard over a range of several hundred miles.

The second purpose, then, of the valve is to "amplify" or strengthen the extremely small amounts of energy picked up by the receiving aerial until they become sufficiently strong to operate the phones or a "loud speaker."

This "boosting" or amplifying action constitutes the really remarkable and unique feature of the valve as a receiver. There are many other types of useful rectifiers or detectors (for example, crystal, coherer or magnetic detector), but none of them amplify or strengthen the signals in the way a valve does.

When acting as an amplifier the valve is best regarded as a simple "relay" having certain special features. A relay, it should

(*Continued on page* 1011.)

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ough accidental short-circuiting, and even if the terminals not be spoiled or seriously injured.
months.
xtent, as this is mostly caused through cells standing in rough accidental short-circuits.
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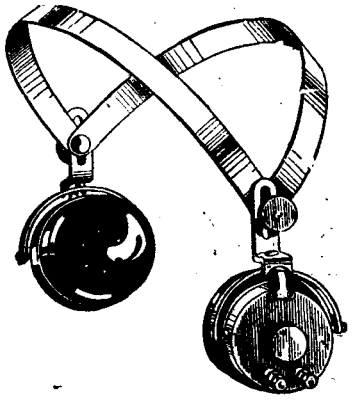

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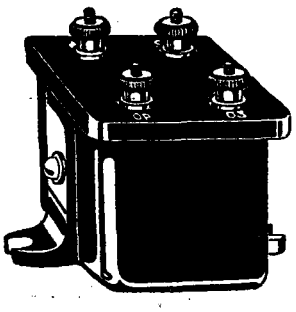

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GETTING AT THE "WORKS."

WHEN you hear someone say, "I wonder what's inside?" and no satisfactory answer is forthcoming, or even if it is, you can bet your last cent that the "lid" of the innocent wireless set will eventually be unscrewed in order to satisfy that curiosity bequeathed to man since Adam. Then, again, that "*I'll* make it work" remark directed to an erring set will certainly have the same result.

What it is expected that there will be seen when the interior is revealed, depends upon the extent and vividness of the imagination of the amateur "surgeon"; certainly wheels of various sizes and numbers are expected to figure largely in the construction of anything that looks and acts mysteriously. In the case of wireless sets, however, the first glimpses of the "innards" are apt to be disconcerting to the uninitiated, owing to just what isn't inside. Take, for instance, those handsome-looking "Desk" type sloping panel wireless receiving sets.

Differences In Sizes.

There is room enough inside one of these for the "works" of half a dozen alarm clocks, and yet, upon removing the ebonite panel, it is seen that all the "underworkings" could be comfortably stowed away in a cigar-box. Moreover, they are all neatly fixed on to the back of the panel, and come away with it, leaving a huge vacant wooden cavity.

Perhaps you are shown two complete one-valve sets, one the size of a coal-scuttle, and the other little larger than a cigar-box; this will make you ask yourself the question, "Why the bulk?" or "Why the stunted growth?" as the case may be. The answer is that it is not so much a matter of the size of the component parts—"works"—as the design or "lay out" of the wiring.

Whilst very small sets look neat and take up less room, "crowding," especially in the case of multi-valve sets, does not lend itself to efficiency. Take, for example, the well-known type of single-valve amplifying panel that has a small black box neatly mounted on the top of the ebonite panel; apart from this, which is what is known as a low-frequency transformer, there is nothing absolutely essential in the whole box of tricks. Underneath will be found nothing but the small coil and moving contact of the filament resistance, which is really but a refinement, although a very useful refinement, and the wires connecting up the terminals, valve-holder, and transformer mounted on the outside of the ebonite panel. I say "nothing," but there may happen to be a small fixed condenser in shape similar to a small block of chocolate neatly screwed to the underside of the ebonite.

Identifying the "Parts."

In the case of the tuning and detecting cabinet there will be either inside or outside, attached to the ebonite panel, a tuning coil or coils, variable condenser, and filament resistances, the shapes and appearances of which will be familiar to most people. Then there is what is known as the "grid leak," similar in appearance to a couple of inches of slate pencil, held by clips and mounted above, or rather under, what is known as the "grid condenser." This latter is a fixed condenser of a suitable value, the appearance of which may vary slightly with different makes, but can easily be recognised by its close proximity and connection to the grid leak. In addition there may be another small fixed condenser known as the "bypass" condenser or "phone condenser." All the various component parts are mounted upon the ebonite panel and are removed as a whole when this latter is raised, the wooden cabinet merely acting as a protective case.

Someone may venture the question, "What is inside a crystal set?" and the answer is, in most cases—nothing at all. In fact, 50 per cent. have no "insides," unless the inside of the inductance coil is included in the question, and there is nothing inside that. Anyway, have a look at some of those crystal sets mounted on just plain, flat bases. The various instruments that appear on this will be duplicated in various different shapes and forms in the interior of the "cabinet" type of crystal set.

Finally, so long as your set is working efficiently don't worry about its "innards," and even if it isn't, leave them alone until you have acquired that little knowledge on the subject that will prevent you following the example of the man who tried to repair a German alarm clock and found that the works, like Shakespeare's "brief candle," once out, stayed out.

THE VALVE FOR BEGINNERS.

(*Continued from page* 1096.)

be explained, is any device wherein a small applied or "input" force releases or controls a large "output" of force. As a simple instance, a slight pressure with the finger is sufficient to close an electric circuit, which may release sufficient power, say, to start a train.

Looking at the simple valve circuit shown in Fig. 3, from this point of view the control or "input" circuit is that connecting the grid and filament. It contains a coil of wire called an "inductance coil," which is coupled or linked with a similar coil in the aerial A; there is, also, a condenser for "tuning" the circuit. (The grid condenser and leak will be referred to later.)

Across the "Bridge."

The "output" or controlled circuit is that containing the plate and the filament. It comprises the high-tension battery (which is the source of the released or "controlled" power) and the telephones.

The "connecting link" between the "input" and "output" parts of the valve is formed by the continuous stream of electrons. These, as we have seen, are emitted or thrown off by the red-hot filament, and are then caught up by the plate and thus form a "bridge," which completes the circuit consisting of the telephones and the high-tension or "power" battery. Some confusion may arise owing to the fact that the H.T. current and the filament electron stream flow in opposite directions, but when it is remembered that this latter consists of purely negative electrons the charge they convey, as, of course, they form an electrical current, is negative, and therefore the direction of the current is opposite to that in which the particles or electrons are moving, Sounds complicated, but think of the electron stream as a bridge across which the current from the H.T. battery can pass.

On its way to the plate the stream passes through the spiral grid or "input" electrode, which "controls" it in the manner described previously.

Commencing with the aerial we will assume that wireless waves from a certain station are being received upon it. When the aerial is "tuned" to the same wavelength as these waves, the impact of each wave creates the largest possible effect—just as in the case of properly timed pushes applied to a swinging pendulum.

From the aerial the waves are transferred to the grid circuit, and there set up a swinging electric current which charges each plate of the grid condenser, first negative and then positive in rapid succession.

It will be seen that the upper plate of the condenser is connected to the grid and therefore shares this charge, rhythmically changing from positive to negative in sympathy with it.

Glancing again at Figs. 1 and 3, it will be seen that the grid stands immediately in the path of the electrons coming from the filament, and striving to reach the plate.

When the grid is thrown positive by the incoming signal waves it will obviously assist the attractive action of the plate on the electrons, as both will be pulling them in the same direction. The grid does not physically obstruct the path of the electrons, as it is in the form of an open spiral of wire, through which they can readily pass.

But it adds to the general effect or "pull" of the plate, and as it is situated quite close to the filament, this action of the grid is sufficient to increase the total number of electrons reaching the plate, increasing, as it were, the size of the "bridge" which, of course, allows an increased value of current to pass across from the H.T. battery through the plate and through the phones.

When, however, the grid is thrown negative (in sympathy with the upper plate of the condenser) its effect is far more pronounced. Instead of *attracting* the electrons, it repels them, and crowds them back towards the filament and away from the plate, causing a very decided *decrease* in the current passing from the H.T. battery through the phones.

So sensitive is this action that an extremely small amount of energy transferred from the aerial to the grid is sufficient to "control" the relatively large current passing across the bridge formed by the electron stream from the H.T. battery through the phones.

This is the explanation of the amplifying or strengthening action of the valve.

(*To be concluded next week.*)

QUESTIONS & ANSWERS FOR BEGINNERS.

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

Q. How brightly should a valve glow ?

A. This should be regulated so that the valve is just bright enough to give the best results. If it is allowed to glow more brightly than is necessary, you will find that instead of an increase in signal strength you have possibly a decrease.

* * *

Q. It has been said that reaction is not allowed on B.B.C. stampedsets. Is this right ?

A. To a certain extent. You are not allowed to have reaction capable of energising the aerial and thus probably causing interference. This, of course, forbids reaction on a one-valve set. There is, however, a method of employing this in a way that will prevent interference. This is possible on two or more valve sets provided one of the valves is actingas an H.F. amplifier.

* * *

Q. What is the cause of crackling noises in a valve set ?

A. Probably a loose connection somewhere, or it may be due to atmospherics. A very frequent cause of crackling is a loose filament resistance. If the crackling continues steadily it may be due to a faulty cell in the high-tension battery. In this case the noise frequently resembles the spluttering of frying bacon and is therefore often referred to as a "frying" sound.

* * *

Q. How can the "frying" noises be cured ?

A. This may sometimes be done by connecting a large condenser of about ·02 mfd. across the high-tension battery. If this has no effect, the only thing is to search for the faulty cell and short circuit it. A voltmeter will come in useful here. The cells, if possible, should be tested in groups of about three, and if their voltage has dropped below 75 per cent. they are probably causing the noise. The voltmeter is not an infallible test, but it will be found very useful.

* * *

Q. What is the "grid" of a valve ?

A. It is the spiral of wire which can be seen between the filament and the plate—a metal sheet usually in the form of a cylinder. The grid controls the stream of electrons across from the filament to the plate, and, indirectly, the current through the telephones. The grid is connected to the aerial and thus the incoming oscillations are acting on the grid automatically and controlling the action of the valve.

* * *

Q. What is meant by the natural wave-length of an aerial ?

A. It is the wave-length the aerial has when connected directly to earth, there being no coils or condensers connected to it. It is not necessarily the same as the fundamental wave-lengths of an aerial, as this is the wave-length to which the aerial is tuned by the addition of coils and condensers. It will respond most readily to signals of that wave-length, though it may also respond slightly to impulses whose wave-lengths are harmonics of that fundamental.

* * *

Q. Must I have a grid leak ?

A. For efficient working a grid leak is necessary to allow the electrons that have collected on the grid of the valve to "leak" away to earth. If the leak was not there these electrons would render the valve far less sensitive to the incoming oscillations, or impulses. Another thing, one leak, which is of high resistance, may suit one type of valve, while it does not at all suit another. For this reason various leaks should be used until one is found that will work efficiently with the valve you intend to use. In connection with this, a variable grid leak is a useful piece of apparatus to have.

* * *

Q. Why does carborundum need a battery ?

A. Because with this type of crystal a peculiar thing happens. If a voltage is applied across the mineral the resistance of the crystal gradually decreases. At a certain voltage the resistance decreases very suddenly, and then goes on slowly decreasing. Thus, if an incoming signal current is passed through the crystal when it is so adjusted that the slightest extra voltage will cause a large increase in current, as it will if the voltage across the crystal is properly adjusted, then, on the addition of that tiny impulse from the aerial, a tremendous drop in the resistance of the mineral takes place.

Thus a large amount of the current from a battery which is always connected, flows through and a loud signal in the phones is heard. When no signals are coming in, the resistance of the crystal is high, and very little current is flowing, the incoming signal just upsets the balance, as it were, and a large rush of current takes place at each incoming signal.

Q. Why is it dangerous to use a gas-pipe for an earth ?

A. Because, although it is not a very great possibility, a very heavy lightning discharge might cause an ignition of the gas, especially in cases where leaks exist. Apart from this, a gaspipe makes a poor earth, owing to the fact that the materials used for the joints are not at all conductive.

* * *

Q. What is meant by characteristic curve as included in so many articles about valves ?

A. Just curved lines on graph paper to indicate, by comparing different positions on the curve against divisions along the sides and the bottom of the paper, various effects caused when various adjustments are made. Thus a simple example is the characteristic curve for plate current variations caused by altering the current of the L.T. or filament flow by means of the variable filament resistance.

* * *

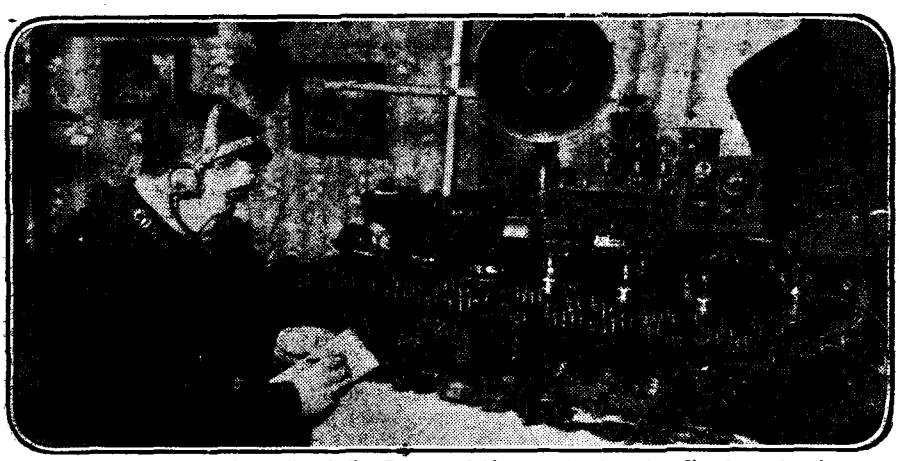
Q. Why has a crystal set such a short-range for telephony ?

A. Because the impulses received by the aerial from telephony waves are fairly weak, and a crystal set requires quite a considerable amount of energy to operate it. Thus, unless it is fairly near a transmitting station, the comparatively weak impulses due to the telephony waves are not powerful enough to operate the crystal satisfactorily. Spark stations send out much more energy, and so, of course, you can hear them on a crystal set from much farther away than you can hear telephony on the same set.

* * *

Q. What is a choke coil ?

A. A highly inductive coil employed to choke back high-frequency currents or to smooth out irregularities in the current received from a generator supply.

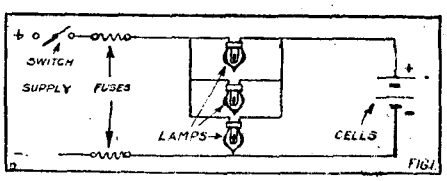


P.-c. Wooding, of the Metropolitan Police Force, and his fine set. P.-c. Wooding hears American amateurs regularly.

THE CHARGING OF ACCUMULATORS

By R. G. De WARDT, M.I.R.E., A.M.I.E.E.

THE problem of the supply of heating current to the filaments of valve sets is one which, until such time as the low temperature emitters now on the market are retailed at a reasonable figure, can only be solved by the use of accumulators. When such accumulators become discharged (a habit which they have of doing just when they are particularly wanted), it is necessary to take them to a garage or other charging station, except in those cases where plant exists for charging at home.



Where an electric supply is available in a house, comparatively simple arrangements can be made by which the necessary charging can be undertaken at home. The cost will in some cases be higher than the cost of charging at a garage and in some cases lower, depending on the type of the supply, *i.e*, whether continuous or alternating current and the price per unit.

An accumulator may be regarded as a primary cell, the elements of which are renewed at each charge. Its efficiency in ampere hours under the conditions appertaining to valve reception will be about 80 per cent., that is to obtain a discharge of 80 ampere hours necessitates a charge of approximately 100 ampere hours. Ampere hours are the product of the current flowing and the time it is flowing, and are the measure of the quantity of electricity carried in a circuit.

Cost of Charging

A current of two amperes flowing for two hours from an accumulator represents an output of four ampere hours, six amperes for half an hour represents three ampere hours, etc.

Consequently, if we have an accumulator with a rated output of 30 ampere hours, it will be necessary to supply it with $\frac{100 \times 30}{80}$ = 37·5 ampere hours to enable it to discharge its rated capacity. The current flowing during the charge should be such that this input should be given to the cell in nine hours, and it may be here remarked that the charging rate in amperes of any cell should be such that the normal charge is given in nine hours.

In this case the required charging current from our definition of ampere hours is equal to $\frac{37·5}{9}$ which equals approximately 4·2 amperes.

To obtain this current where the supply is continuous current, it is necessary to insert resistance in series with the accumulators and the supply. The cost of this method of charging depends on the voltage of the supply, and the price per unit.

For instance with a 100-volt supply at fourpence per unit or kw.h. (1,000 watt hours), the consumption of energy is equal to 100 multiplied by 4·2 or 420 watts, and the consumption of energy per hour being 420 watt hours or ·42 kw.h. The watt being the unit of power and equal to the product of the pressure in volts and the current in amperes, the watt hour being the product of volts, amperes, and time in hours the current is flowing, the kw.h. (kilowatt hour), or Board of Trade unit, being 1,000 watt hours.

For a nine hours' charge the energy consumed would be ·42 multiplied by 9, or 3·78 units, which, at 4d. per unit, would cost 15·12 pence. When the supply voltage is 200 and the price per unit the same, the cost would be exactly double this figure. It is usually possible, however, to arrange with the supply authorities for a supply for such a purpose to be given at the "power" rates, which range from one penny per unit upwards, at which price such arrangements become an economical proposition.

By applying the foregoing calculations to each individual case the amateur will be able to determine whether it will pay him to charge his own cells.

The most convenient form of resistance to use is the carbon filament lamp. These lamps consume approximately 4 watts per candle-power, and if 32-candle-power lamps are used, each lamp takes 128 watts. Having determined the total watts required, as previously shown, the number of lamps necessary can be easily calculated.

Batten lampholders should be obtained, and mounted on a board connected as shown in Fig. 1, the supply leads being connected to the charging boards through a suitable switch and fuse. The positive plate of the battery being connected to the positive terminal of the charging board, and the negative plate to the negative terminal.

Various Methods

Where the supply is on the alternating current system, much more economical arrangements can be made by taking advantage of the fact that current at a much lower voltage than the supply can be obtained without practically any loss by means of transformers. In principle the transformer consists of two separate coils wound on an iron core, and if an alternating current be supplied to one winding a similar current will be induced in the second winding, and the voltages in each winding will be in proportion to their number of turns of wire.

For example, assume a transformer with 1,000 turns on one winding (the primary) connected to a supply at 100 volts, then, if the second winding (the secondary) has 100 turns, an alternating current with a voltage of 10 will be induced in it.

The power in watts given out by the secondary will be the same as that supplied to the primary except for the slight loss due to heating of the windings and in the core, losses which may be ignored for the present purpose. If, therefore, a current of 5 amperes is taken from the secondary of the transformer under consideration, the power taken from the mains by the primary will be approximately equal to 50 watts.

Of course, alternating currents cannot be used for charging accumulators, as such currents reverse their direction of flow once during each cycle, and a supply given at say 50 cycles per second means that there are 50 pulsations of current in the positive direction and 50 in the opposite or negative direction each second. If we can arrange to reverse direction of the current flowing during the negative periods, we shall have one hundred pulsations per second, a state of affairs which is quite suitable for battery charging.

There are several methods by which these reversals may be effected, the simplest for the case under review being dependent on the fact that plates of aluminium and lead when immersed in a solution of ammonium phosphate have the peculiar property of permitting the current to flow only from the lead to the aluminium and not in the contrary direction.

Advice to Amateurs

By making four of such cells or "Nodon Valves" as they are called, and connecting them as shown in Fig. 2, it will be seen that when the current is flowing from the transformer in the direction A to B it passes through cell 4 of the battery under charge, cell 2 to B. When it reverses, and flows from B to A, it passes through cell 3, the battery *in the same direction as before*, cell 1 back to A.

The power consumed by using such an arrangement and a suitable transformer, in the case of the 30-ampere-hour cell used in the previous example, assuming a secondary voltage of 10, would be 10 x 4·25 watts per

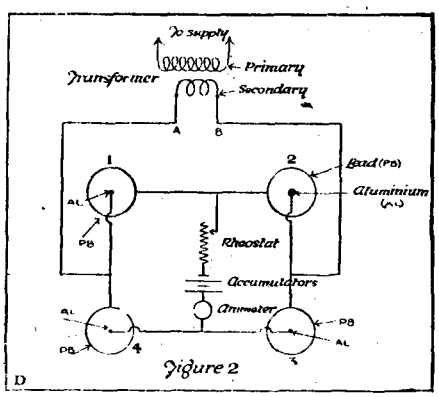


Figure 2

hour, that is, 382·5 watt hours or ·328 units in the nine hours which at fourpence per unit would cost only 1·5 pence.

Transformers of this type can be purchased at a reasonable price, and the Nodon Valve can be made up quite cheaply by using stoneware jam jars as containers, the ammonium phosphate being obtained of any chemist. An ammeter should be fitted as shown in Fig. 2, together with an adjustable rheostat to regulate the current as required.

The amateur who proposes to charge cells at home would be well advised, however, to consult the local electrician, to ensure that anything that is done is carried out in accordance with the Local Supply Authorities Regulations.

A SIMPLE WIRELESS RECORDER.

By Prof. M. DAISOMONT.

THE essential feature of the recorder is as follows. A thin blade of soft iron-plate hangs in the strong magnetic field of a polarised electro-magnet, and vibrates synchronously with the variations of the current circulating in bobbins of the electro-magnet. As the vibrations of the small iron blade have a certain amplitude, a contact existing on it can be modified by the vibrations, and a strong relay of any type, or the recorder directly, can be operated by the current of a distinct electric circuit interrupted or established by the vibrating blade. As now the variations of the first current in the bobbins of the electro-magnet are determined by the Morse signals, the vibrations of the blade will follow the same vibratory motion, and, as a natural consequence, the stronger relay, or the writing stylo or pen, will directly transfer the signals on to the paper.

The stronger relay and the writing device are by no means a special feature of our recorder. Any strong and rapid relay and any writing device both moved by an electro-magnet of the "electric bell" type will do. The paper can be in the shape of a long tape moved by a clockwork or a small electro-motor, or a sheet of paper on a cylinder, turning with a helicoidal movement.

Suspended Vibrator.

It was comparatively easy to find a polarised electro-magnet. We took a heavy German trench telephone, and, removing the magnet, we wound it to 1,000 ohms instead of 200, and fixed it on a board. Flexible wire, taken to a plug, was fixed to the terminals of the bobbins, to lead in the varying current coming from the receiving set (Fig. 1).

The more delicate piece was *the vibrating*

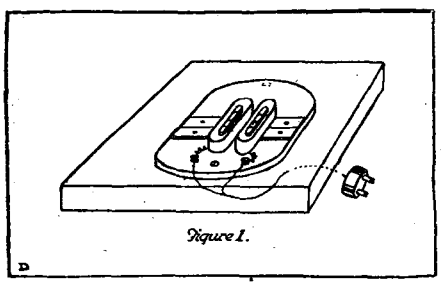


Figure 1.

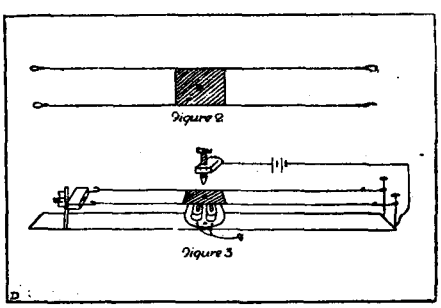
blade and its suspension. This was the manner of its construction. Out of a tin box that had contained a typewriter ribbon we cut a square piece just the size of the two poles of the electro-magnet. Just in the centre of the blade a very small piece of platinum (found in a German trench microphone set) was soldered; then two 10-in. copper wires were soldered to the blade, and running parallel to each other, were fixed with eyelets for the suspension (Fig. 2).

The vibrating system was suspended in such a way that, on the left, the wires could be tightened by means of a nut and a screw; on the right were arranged two screws to lower the whole as near as possible to the electro-magnet, but without touching it. A copper wire, soldered to the metal part on the right, made electric connection with the vibrating blade possible (Fig. 3).

Above this vibrating blade a micrometric screw with a platinum point was fixed to enable very fine contact to be obtained. Another wire fixed to the metal support of this screw made it possible to have an electric current circulating from the screw to the blade, and to interrupt it when the latter was vibrating.

High Speed Work.

When the electro-magnet is connected in the right way to the receiving set, and when the current in the bobbins is varied by the strong Morse signals, the vibrating blade makes or interrupts the contact to the micrometer screw. The recorder being directly in circuit, or by means of a stronger relay, will bring the signals on to the paper, if it is so constructed that it can mechanically follow the speed of the transmission. If well



made, the recording system just described can record up to 100 words per minute.

Four small rubber heels should be placed under the corners of the board bearing the vibrating system to prevent trouble from mechanical vibrations. Further, trouble due to sparking in the relays can be avoided by the choice of just the necessary current to actuate the mechanism and by connecting fixed condensers across the contacts. These condensers are easily made of tinfoil and waxed paper, and should have a capacity of about 2 mfds.

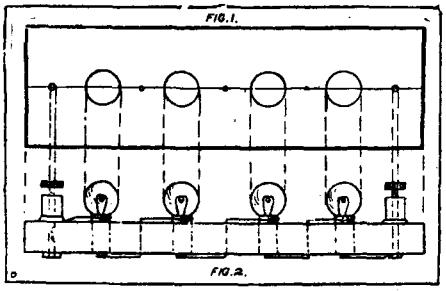
TESTING H.T. BATTERIES.

THE following piece of apparatus will be found very useful for testing H.T. batteries of the 15-volt type, now so much in use. In fact, similar apparatus may be made for testing any voltage.

The necessary articles are four "flash-lamp" bulbs, a piece of wood 4¼ in. by 1½ in. by ⅜ in., a piece of tinned copper wire, and two small terminals.

Take the piece of wood and draw a line down the centre as in Fig. 1, and drill four ⅜ in. holes 1 in. from each end and ¾ in. apart. Between each of these holes drill a small one, about ⅛ in. or so, also a hole at each end to take the terminals.

Next, fasten a piece of wire to each lamp just below the bulb and around the brass by passing it around and twisting it; or, if preferred, this may be soldered. Now press each lamp into the ⅜ in. holes.



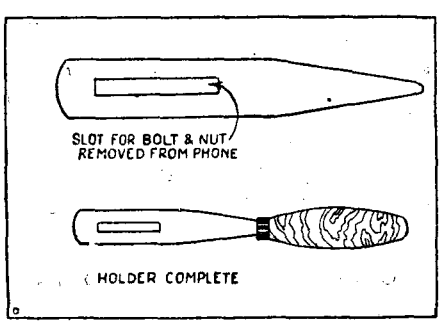
The wire from the first lamp should be passed under the nearest terminal, the wire from the second lamp through the small hole and soldered to the base of the first lamp. Fix the third and fourth lamps, pass the wire through their respective holes, and solder to the second and third lamp respectively. A short wire must also be soldered to the bottom of the fourth lamp and taken under the screw or nut of the other terminal (see Fig. 2).

The bulbs are now connected in series. By connecting two leads to the terminals, and touching them for a second on each of the lugs of the 15-volt unit, each lamp should light up brilliantly if the battery is in good condition.

A PHONE HOLDER.

IF your set is sufficiently near a broadcasting station to obtain a good volume of sound, the usual pair of phones may be split up, making one pair do for two people. As something is required to hold each earpiece comfortably, the following can be easily made up.

Purchase an ordinary boxwood chisel-handle from the local ironmonger's (cost, about 4½d.), and then cut a piece of brass (about ⅛ in. thick) ¾ in. wide and 3 in. long. Cut a slot in the centre and shape the bottom half so that it can be easily driven into the handle. The bolt and nut taken from the phones will be used to fasten the holder to the earpiece.



TO AMATEURS

If you have made an original or particularly useful piece of apparatus, send a short descriptive article to "P.W." If accepted, it will be paid for at our usual rates.

A "PHASE" OF WIRELESS.

By Sir K. D. MACKENZIE, Bt.

"WHAT'S the least I need spend on this blessed wireless? I've no spare cash to chuck away on such foolishness. How far will five bob go?" Thus my old friend Samkins a few months ago.

"Not far, I'm afraid. It hasn't quite come to that yet," I replied laughingly. "But if you're game to spring a tenner or so, I'll take you where you'll get good value for your money, and something worth having; but nothing very elaborate, of course. How'll that do?"

"What! A tenner? Good heavens! Can't I get anything for less than that?"

"Of course you can, but you'd better come along and see and hear for yourself. It'll interest you, anyway, to have a look at the things, and you can see, then, what you care to spend on them."

"All right," he answered grudgingly, "I suppose I'd better, or I'll never get any peace from the family. But I'm not going to spend a penny more than I can help, anyway."

I know Samkins of old. He's like that. A very good fellow at heart, and really generous, but queer-tempered at times and rather easily upset. "Liver," perhaps, I suppose, like many of us. Anyway, I took him along to a firm I deal with, knowing he would be safe enough with them, and get his money's worth for whatever he bought.

When Samkins saw all the beautifully got up apparatus and instruments of all kinds, both crystal and valve receiving sets, in their highly polished mahogany cases and ebonite panels, with all the brightly burnished and lacquered brass fittings, he got quite excited and eager, especially when the assistant, who explained things to him, switched on a loud speaker, and we heard a band playing at the broadcasting station, the music being so distinct and clear that one would almost have thought it was in the same room.

Spick and Span.

I had at last to actually curb his eagerness to buy the things I knew would be quite beyond him, and a sheer waste of money to start with, knowing, as he did, nothing of radio. So I only let Samkins get what he and his boy would be able to manage easily, and a book on wireless called "How to Become a Wireless Wizard in a Week," and we left the shop, he as pleased as Punch, and in a very different frame of mind from that in which I had met him. I thought to myself as we parted, with many grateful thanks on his part, that precious little amusement would his *boy* get from handling that set so long as his father was about.

"You'll have to get a licence, you know," I reminded him, on parting, "and by the time you've got it your aerial will be fixed up. Good luck, old man; I'll look in in a day or so to see how you are getting along."

. . . . .

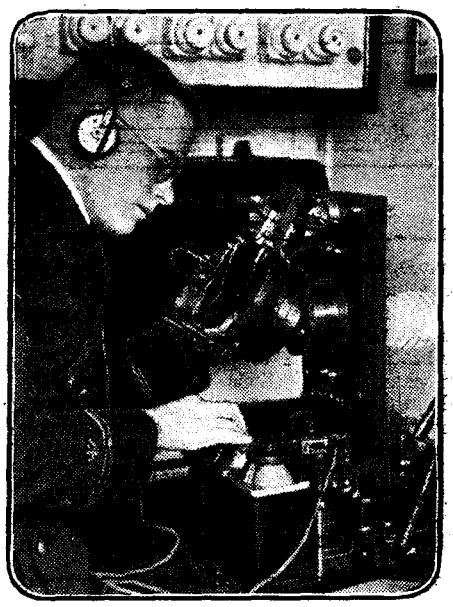
It was not till about a month later that I was able to call and see Samkins to find out how he was getting on with his new toy and I often wondered how he had taken to it, and whether his opinion of broadcasting had changed.

When I reached his house one Saturday afternoon I noticed a fine aerial stretched from a pole fixed to the side of his house, the other end being supported by a beautiful seventy-foot iron mast standing in the corner of the grounds at the back; everything very spick and span.

Catching the "Fever."

"Hallo! He's been going it!" I thought to myself. "He didn't buy that when we were together that day, I'm sure." It was quite another Samkins who greeted me at the front door, a very much more cheery body.

"My dear fellow, I *am* glad to see you!" he exclaimed, as we shook hands. "I've been wondering ever so long when you'd come. I've got such a lot to show you now. By Jove! You are a *converter*, you've been a complete *transformer* of all of us here!



The operator is tuning in on a typical Telefunken Receiver. A change over switch at the back connects the aerial to the transmitter.

I thought I had some *capacity* for *permeability*, but *jam* me if your *power* for overcoming my *specific resistance* hasn't completely taken away all the *impedance* and *reluctance* I had when I met you that day! Gad! I'm a *coherer* to radio now, and no mistake! I feel sure that all the *resistance* I showed that day when I met you was only a *loose coupler* after all, entirely due to the *frequency* of my general worries and bothers."

"I say, old man," I cried out, "by gad, you've caught it badly. A regular attack of 'radioitis,' it seems to me. Has the boy got the fever, too?"

"Oh, Henry! Yes, he's as keen as I am, and, what's more, the first *skin effect* has entirely gone from all of us, so that the *tuning* between us all here now is perfect. A regular case of *induction*, I assure you. Let's *switch over* to the library, where all the things are. I'll *lead in*," and I followed him into what used to be his old sanctum, but now was evidently the haunt of the whole household.

"Yes, as I was saying," he continued, "Henry, as the unit of *inductance*, naturally infected me; I gave it to the wife, and her mother evidently caught it from her, owing to the *audible frequency* of her expressions of delight. By Jove! By now its *quantity* is quite beyond the *power* of any *rectifier* to act as a *choking coil* on any of us! Even the cook has got a *phase* of it, and calls flour a gravy *condenser* when she uses it as a *thickener*, and told the wife her wages must be raised owing to her increased *capacity* as a cook!"

Quite a Brainwave.

What a change had come over dear old Samkins! I found he had got a very much more elaborate set than what he had bought that day with me; evidently his "tenner" had been multiplied several times to satisfy his keenness for wireless, a matter he had looked upon then with contempt and disdain. His son Henry was busily engaged listening to some ships signalling from somewhere, and told me he had quite got a grip of Morse by now, and could read fifteen words a minute easily; a sharp boy, I could not help thinking.

"Sit down, old fellow, and light up," said Samkins, as he offered me a cigar. "Henry and I have been puzzling how on earth the name 'Henry' should have been given to a unit. Who was that particular 'Henry,' what was his surname? I'm *jammed* if I know! If the unit of *inductance* is called a 'Henry,' why shouldn't that of 'allowance' or '*impedance*' be called a 'Bob'? I allow Henry so many 'bob' a week, and he is often *impeded* from getting what he wants because he hasn't enough of them.

"It strikes me, too, that 'Harry' would be a very appropriate name for the unit of '*interference*'; we're all 'harried' more or less by someone's silly *interference!* And 'Dickey' as the unit for *oscillation* or *stability;* what's wrong with that? The financial situation in Europe is decidedly 'megadickey' at present. What? How does it strike you?"

"Quite a brain-wave, old boy," I replied. "I don't see why your idea shouldn't be extended, though I wouldn't keep to male names only, as some qualities are decidedly feminine in nature. 'High frequency resistance,' for instance. You might call that a 'Polly,' that word having something to do with 'many,' and a parrot generally resists when you want to stroke it! Any female name would do for the unit of 'group frequency,' as at mothers' meetings women with all names attend.

"Your idea seems worth thinking out. However, you might add 'Bill' to your list as the unit for '*reluctance*,' for the man who pays his bills with 'microbill' celerity is indeed a 'rara avis.' But, my dear old fellow, don't let this new phase get too big a hold of you; be an *alternator* now and then for a change, and restrain the *natural frequency* of your thoughts from running in one direction only.

"Let me ask you something—a silly riddle: Who was Ma Coney? Give it up? Why, Ole Brer Rabbit's wife, of course! See? Now I must really be off, or '*shunt*,' as you would say. I'll look in again soon, and see how you are getting on."

WIRELESS CLUB REPORTS.

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

The Tottenham Wireless Society.

The chief feature of this meeting was a very excellent lecture by the chairman, Mr. F. A. Bourne, on the subject of "Crystal Detectors."

Mr. Bourne not only fully explained the theoretical side of the question, but also fully explained the construction of a crystal set that everyone could make for themselves.

Presentations were made to the society of a crystal set, set of coils and coil holder, and a battery of accumulators. It is hoped shortly to give a demonstration on wireless subjects for the benefit of the local public.

Prospective members should apply to the hon. sec. Mr. R. A. Barker, No. 22, Broadwater Road, Tottenham, N.17, for full particulars.

Swansea and District Radio Experimental Society.

A very successful meeting of the above society was held at their headquarters, the Y.M.C.A., recently, when a very interesting lecture and demonstration was given by D. W. Walters, Esq., of Gowerton.

Having had permission from the Postmaster-General, an aerial was erected, and a wireless receiving set was installed, which was used by the lecturer to demonstrate his lecture, entitled "Hints on Tuning," a very appropriate lecture at a time when Swansea is experiencing a considerable amount of interferences from local amateurs.

The president of the society, Capt. Hugh Vivian, occupied the chair, and gave a very encouraging address as to the prospects of a very bright future for the society.

Later in the evening, Continental telephony was listened to on a loud speaker.

The society has a very interesting programme for the season, and all interested in wireless are invited to join.

Hon. sec., Herbert T. Morgan, 218, Oxford Street.

The Ilford and District Radio Society.

A meeting was held recently at headquarters, St. Mary's Hall, Ilford. Mr. J. E. Nickless, A.M., I.E.E., was in the chair.

Mr. F. C. Grover gave a very interesting lecture on "Elementary Electro-Statics." The characteristic curves of two valves were also plotted and Mr. Grover explained the practical uses to which such data could be put.

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

Sutton and District Wireless Society.*

Meetings are held on the second and fourth Wednesdays in the month at 8 p.m. at the Adult School, Benhill Avenue, Sutton (near tram terminus). All those interested in radio work in the district are invited to join. Every effort is made to ensure that the society will be a real benefit to its members. There are now about forty members, but there is plenty of room for more, so please come along and help make the society a complete success.

At the meeting held on Wednesday, February 14th, a lecture was given by Mr. Bentley, of Messrs. Dickie & Co., on the care of accumulators. Some of the latest types of accumulators were exhibited, together with sections of plates, and a very interesting discussion followed. The important question of charging was dealt with, and Messrs. Dickie & Co. have a system of collecting, charging, and delivering which should go a long way towards solving the problem of valve current supply. The lecturer was accorded a hearty vote of thanks, and the meeting closed at 10.15 p.m.

Hon. sec., E. A. Pywell, Stanley Lodge, Rosebery Road, Cheam, Surrey.

The Streatham Radio Society.*

The first annual dinner and wireless concert of the above society took place at the Telegraph Hotel, Brixton Hill, on the 14th inst.

Over fifty members and visitors were present, including a large number of ladies. A large amount of work had been put in prior to the meeting by the committee in the erection of a set for the evening, but owing to the short time at their disposal, and the fact that an indoor aerial under a metal roof had to be used, the results obtained left much to be desired. However, plenty of local talent was available, and the evening proceeded merrily enough.

The dinner came to a close, after a very interesting evening, at 11.15 p.m.

The next general meeting of the above society will be held at the headquarters, 35, Streatham Hill, on March 14th, when Mr. A. G. King will give a lantern lecture.

Intending members (both sexes) are invited to ask for particulars from the hon. sec., Mr. S. C. Newton, 5, Pendennis Road, S.W. 16; or, in his absence, the assistant sec., Mr. A. G. Wood, 93, Upper Tulse Hill, S.W.2.

The Stratford-on-Avon and District Radio Society.

The fourteenth general meeting of the above society was held on Monday, February 12th, at headquarters, with Mr. F. A. Sleath occupying the chair. After the business arising from the previous meeting had been dealt with, it was announced that the president, Capt. H. C. J. A.-R.-West, R.N., invited members to visit his residence at Alscot Park to inspect the experimental station there. The next item on the agenda was a talk by Mr. Sleath on the Single Valve Rectifying Panel, and the lecturer dealt in a simple and concise manner with the parts required and their function. Keen interest was shown when the matter of reactance was brought up, and the cause of re-radiation was explained. A very successful evening was concluded by switching on the club set and listening to the close of 5 I T's Concert.

Hon. sec., E. W. Knight, 17, Park Road, Stratford-upon-Avon.

Ilkley and District Wireless Society.*

A general meeting of the society was held on Monday, January 14th, at which Dr. J. B. Whitfield presided. Following the meeting, Mr. J. C. Croysdale, of the Leeds and District Amateur Wireless Society, was called upon to give his lecture on the "Armstrong Super-Regenerative Circuit." The lecturer described the action of the ordinary regenerative circuit, and showed how Major Armstrong had succeeded in utilising the maximum amplification of the valve by means of his new circuit. Mr. Croysdale then gave some useful values for the components utilised in this circuit, which he had found from experience to give the best results. The lecturer then gave a demonstration of the circuit on a three-valve set of his own construction. After a little patient tuning, Manchester was received strong enough to operate a loud speaker, with neither aerial nor earth connected, nor even the orthodox frame.

On Monday, February 5th, an enjoyable evening was spent listening to the broadcasting programmes on a Gecophone receiver and loud speaker kindly lent by Messrs. Francis Law, Ltd. The demonstration was undertaken by Mr. Francis Law and Mr. Lynn, of the General Electric Co., Ltd., of Leeds.

Hon. sec., E. Stanley Dobson, "Lorne House," Richmond Place, Ilkley.

The Forest Gate Y.M.C.A. Amateur Radio Society.

The above society has been formed, with headquarters at the Y.M.C.A., Woodgrange Road, Forest Gate, E.7. Meeting nights—Tuesdays, Wednesdays, and Thursdays.

Intending members are invited to any of the above meetings.

Full particulars can be obtained of the hon. sec., T. W. Moore, 90, Claremont Road, E. 7.

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RADIOTORIAL

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

Questions Answered

I think most of my readers will agree that this week's POPULAR WIRELESS is well worth 3d. Thousands of amateurs who will not be able to visit the "Daily Mail" Exhibition at Olympia will find in this number the first instalment of a special review of the exhibits shown by Wireless Manufacturers. For the experimenter and student there is the first of a series of articles by Sir Oliver Lodge which, I am sure, will cause considerable interest.

I must say a word here concerning our new Scientific Adviser. I am sure all my readers will be glad to hear that Sir Oliver Lodge has accepted this appointment. As one of the most brilliant scientists of the day, and one of the most advanced pioneers in radio work, Sir Oliver Lodge has certainly honoured POPULAR WIRELESS in accepting this appointment.

This week's number also sees the commencement of a new cover scheme. I feel perfectly sure that 99 per cent of my readers will prefer this new cover to the old one. I should like to hear from readers on this point, as I am always doing my best to improve the appearance of the paper.

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 136, The 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.

A. T. I. (Bedford).—I have a two-valve set and cannot tune in London at all; but a friend of mine tried it the other day and got it at once. I use a three-coil holder. Why cannot I get London?

Your tuning is probably at fault. If you have no switch for "stand-by" and "tune," try the following. Disconnect the secondary from the set, and connect up the set to the primary coil, aerial, and earth, and tune in. When you have got the station tuned in properly, note the position on your condenser dial, and replace the secondary and old connections. Then tune in the secondary coil, leaving the primary as it was. When you hear faint signals, vary both the condensers and the coupling between the coils until you obtain maximum strength. A "stand-by" switch merely obviates the necessity of changing the connections.

* * *

P. D. M. (London).—I have a hertzite crystal set, and would like to improve it. Will a battery help? If so, can I use a filament resistance as a potentiometer?

No, a battery will not noticeably assist you with that type of crystal. In any case if a battery is used, and this should be with carborundum, not hertzite, a filament resistance is far too small a resistance. You need about 200-300 ohms for the potentiometer, whereas a filament resistance has only about 5 to 7 ohms.

* * *

"EVLAV" (Plymouth).—Why do soft valves usually have a shorter life than hard ones?

The reason why very soft valves have a short life compared with the harder type is this. When a soft valve is in action, the electrons flying off the filament keep on colliding with the residual gas atoms, and of course the softer the valve the more atoms there are, and more chances of collision are obtained. When, however, the electron has collided with the atom, the atom is to a certain extent burst. It loses electrons which go on with the main electron stream, and thus help to increase the flow of plate current, which of course gives us a sensitive detector. But the rest of the atom, having lost some of its negative electrons, becomes positively charged. Thus it is naturally repelled by the positive anode, and attracted by the negative filament. This atom residue, or positive "ion," rushes off to the filament. Therefore, in a soft valve the filament is always being bombarded by a stream of positive "ions," and it is this steady and violent bombardment which eventually breaks the filament down. In a hard valve the number of collisions with gas atoms is very much less, and therefore the bombardment of the filament by positive "ions" is decreased, and the filament has a longer life.

"FRED" (Tottenham).—My neighbour told me laughingly this morning that I "howled" a lot the previous night, and as I do not use reaction, although I have an experimental licence, I thought it safe to bet him that I could not cause interference. Am I right?

Although in the circumstances we are inclined to think that you were not guilty of the interference, such would be quite possible, even although you possessed no reaction coil or "artificial" arrangements for regeneration in your circuit. Mr. Shaughnessy, O.B.E., detailed in an article that appeared in a recent number of POPULAR WIRELESS the Post Office test for regeneration and self oscillation caused by a grid-plate capacity in quite simple valve circuits, and therefore it is quite possible that your set, if not of an approved B.B.C. type, is capable of the same action.

* * *

G. L. P. (Durham).—Why is it that in the case of a valve we are told that the current flows from a negative point always to a positive point, whereas in all other electrical and wireless practice we are told that a current always flows from a positive point to a negative. Also, why is it that in the case of valve work it is said that the negative point has the most electrons and therefore electricity and the positive is the undercharged point whilst in all other practice the positive point is said to hold the most electricity? Anyway, why is it that the signs plus and minus are still used when obviously the negative or minus point is a plus quantity if we are to believe in the electron theory?

To explain the phenomenon of the electron emission from a valve filament and the effects which are associated with it, it is necessary to accept the theory that electron flow takes place from a negative to a positive point, the former being that which holds the greater number of electrons, these being presumed to be negative particles of electricity. However, it need in no way confuse with former and other electrical practice if the view is taken that simply because an electron stream is passing from one point to another relatively there will be a current of electricity flowing in the opposite direction, *i.e.*, from positive to negative. Take as a simple analogy two trains that have stopped at a station and you are in one of them. It doesn't matter which of them moves first, but if you are looking at the other train it will momentarily appear as though both trains are moving, the one in the opposite direction to the other. Call the electron stream the moving train and say that to all intents and purposes the current of electricity appears to flow in the other direction. Ballantine makes it a definite statement that "The stream of electrons to the plate constitutes an electric current; and since the charge conveyed is negative, *the direction of the current* is opposite to that in which the particles are moving." The italics are his.

* * *

P. C. L. (St. Albans).—What coils do you advise for different purposes?

Single layer cylindrical type of the well-known

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 1022.)

solenoid pattern known as single and double slide, tapped cylinders, etc., for all crystal work and for short wave or small ranges of valve work, basket coils for short wave valve work and the several forms of duolateral or honeycomb lattice, etc., type of coil for long wave valve work. By short wave we mean up to, say, 800 or 900 metres.

* * *

D. D. (Hull).—Is reaction, regeneration, self-oscillation, heterodyning, howling, etc., all the same thing, or can a valve set do all sorts of different things in the way of interfering with other receivers?

Generally speaking, all those terms are used to denote the regenerative effects of a circuit that tend to cause self oscillation, although the terms vary in their strict application. In practical, as opposed to absolutely and strictly accurate theoretical practice, "howling" is the audible note produced in the phones by the heterodyning of two oscillating currents of different frequency, or the interaction between transformers or other components of a set, whilst regeneration causing self-oscillation only will not be audible in the phones unless the self oscillation is impressed or has impressed upon it other oscillations of dissimilar frequency.

* * *

F. B. (Leyton).—What is an amplification factor?

The ratio between the plate voltage and grid voltage for constant plate current.

* * *

What is plate resistance?

The rate at which the plate voltage changes with respect to the plate current.

* * *

E.D. (Bolton).—In experimenting could It vary the grid leak by drawing pencil lines along the top of the ebonite panel from the grid leg of the valve to the aerial terminal?

Yes, your idea is perfectly sound. You will find, however, that it is apt to cause future trouble unless you either shellac the line when the correct value has been determined or carefully erase it if not required.

* * *

P. F. H. (Plumstead).—I wish to build a three or four valve set, but do not want to build the whole thing at once. What sort of set shall I build?

We should advise you to build a set on the unit system, commencing with the detector panel, and then adding H.F. and L.F. as desired. You will find the set described in our issues of Nos. 26, 34, and 35 very useful.

* * *

P. P. T. (Birmingham).—I have a crystal set which tunes up to 2,000 metres. Can I increase this to 2,600 metres? What is a loading coil?

Yes, you can add another coil in series between your present tuner and the aerial. This coil will have the effect of increasing the inductance in the aerial circuit, and thereby increasing its wave-length. If you add a coil—basket type will do—of about 100 turns of 24 on a 1½ inch centre former, winding with about 11 spokes, it should bring your wave-length up to 2,600 metres easily. A loading coil is one which adds, or loads, inductance to any circuit.

(Continued on next page.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page* 1023.)

F. H. T. (S.E.1).—I am about 2 miles from 2 L O, and wish to use a frame aerial with my crystal set. What size wire and how many turns should I use ?

We do not advise the use of an aerial for that type of set, not if the transmitting station is more than a few hundred yards away. You would need a four or six foot frame, winding 5 or 3 turns of 22 D.C.C. wire respectively. Spacing would be about ¼ inch between each turn. Use ebonite strips at the corners where the wires will be in contact with the frame.

* * *

W. W. C. (Barry).—Could I hear Cardiff, 10 miles away, on a crystal set and outdoor aerial ? Must the aerial be above the houses, or can it slope from a chimney to a post in the garden ? Can a landlord forbid the erection of an aerial ?

You should be able to hear Cardiff quite well. The aerial can be sloping, as you suggest. We believe that a landlord has a right to refuse to allow an aerial to be erected on his property. In any case, we would advise you to ask his permission before you go to the expense and trouble of setting up the station.

* * *

P. J. L. (Hendon).—I have a two-valve set, and want to increase my range. Will a crystal detector and two H.F. valves be quite efficient, or do you advise a valve detector ?

You will find that the crystal rectifier will operate quite well, but the worst of crystals is that they are so unstable in their adjustments. You will find a valve detector easier to operate, but, of course, it will cost more in upkeep.

* * *

L. S. D. (Dundee).—Is it true that the Dull Emitter valves last longer than the ordinary type ?

Yes, we think that you will find this type of valve, although it is so costly, will eventually be worth it in the end, especially if you have difficulty in having accumulators charged. As the filament of this type of valve only needs to be red hot, the low tension current can be obtained from a primary battery, a dry cell being quite suitable. Also the filament will be found to last much longer than that of the ordinary valve which takes about ·7 amp.

* * *

A. S. K. (no address) asks if the presence of large gasometers near his house will have any effect on the quality of his reception.

Yes, in all probability you will find that such large masses of iron in the near neighbourhood of your aerial will deflect the wireless waves to a certain extent. From certain directions we are afraid you will be badly screened if these gasometers are very near you. It should not prevent you obtaining results, however, though you may have to use an extra valve to counteract the effects of the iron screen.

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page* 1024.)

B. T. K. (Skipton).—I have a loose-coupled crystal set, and want to use an H.F. amplifier. What connections and alterations do I make?

Disconnect your crystal and phones from the secondary circuit, leaving the primary coil as it is. The secondary is now connected, one terminal to the grid of your H.F. valve, and the other terminal to the low tension negative. The plate of the valve goes to a coil (preferably a plug-in type of size to suit the wave-length required) called the anode tuning coil. This coil is wound so as to cover the wave-lengths desired. It may be a large slider coil if you wish, but we prefer the smaller ranged plug-in type. The other end of this coil goes to the crystal detector and to the H.T. positive. From the detector the circuit is continued to the phones—usual blocking condenser across them—and back to the first terminal of the coil (terminal connected to the plate). Across the coil, in shunt, is connected a small variable condenser, about ·0002 for tuning. The further connections for the valve circuit are, of course, H.T. negative to L.T. positive, L.T. negative to the secondary of loose coupler as mentioned before. The filament of course goes to L.T. plus and L.T. minus.

* * *

C. I. L. (Doncaster).—I have a solenoid type tuner of about 150 to 200 turns on a 4 in. diameter former. I should like to use this coil on a valve set with reaction. If I use the solenoid type of reaction, how big should it be?

You will need a reaction coil of about 75 turns of 28 D.C.C. on a 3 in. diameter former. For efficient working this should be tapped two or three times to allow you to cut out some of the turns when listening-in on low wave-lengths. The reaction coil tappings can be evenly spaced, say one at the 30th turn, one at the 45th, and the other at the 60th turn.

* * *

L. W. (Bushey).—I want to use honeycomb coils for low wave-lengths on a two-coil holder. How many do I need? I shall not be using reaction.

Probably five or six coils will be best. Wind one of 35 turns, one of 50, then 75, 100, and 120 turns. This will give you four combinations, using two coils at a time, the smaller being used as the primary, while the next size is used as the secondary. You will of course need two variable condensers for tuning purposes, one for each coil.

* * *

F. V. T. (Brighton).—Is resistance coupling efficient for H.F. amplifiers?

We do not advise its use for wave-lengths under about 1,000 metres. Above that it may be used quite successfully. You will have to use more H.T. voltage on the plates of your H.F. valves when you are using this type of coupling, than when you use the ordinary tuned anode or transformer. The resistance of the coupling should be about 80,000 ohms.

* * *

F. G. (Brussels).—What are the diameters in millimetres of the following wires? S.W.G. Nos. 18, 20, 22, 24, 26, 28, 30, 34, 36, 40, 42, 44, 48?

The dimensions are as follows, measured in millimetres: ·1219, ·9144, ·7112, ·5588, ·4572, ·3759, ·3149, ·2337, ·1930, ·1219, ·1016, ·0813, ·04064 respectively.

(*Continued on next page.*)

RADIOTORIAL QUESTIONS AND ANSWERS.

(*Continued from page 1025.*)

"ENQUIRER" (Tooting).—Supposing I was to connect two accumulators together, each of exactly six volts, with their like terminals, would not the pressure in each direction cause no current to flow, or would they simply short each other because each has negligible internal resistance?

Owing to the opposition of current, or rather the potential at each end of the connecting wires being equal, no current flow would result. However, as exactly similar voltage seldom exists between different accumulators, it would not be wise to attempt an experiment of this nature without the insertion in the circuit of suitable fuses.

* * *

B. M. (Birmingham).—Two condensers in parallel, one ·001 mfd. capacity and the other ·0005 mfd. What is the total capacity?

Merely the sum of the individual capacities when condensers are placed in parallel, *i.e.*, ·0015 mfd.

* * *

"EARTH" (Wolverhampton).—I am troubled by leaky electric cables and the electric railway. Can I avoid this?

You may be able to avoid the disturbance caused by the stray currents in your earth wire due to leaks in the electric cables, by having a capacity earth instead of the ordinary type. This earth is comprised of insulated wires, running parallel with and directly under the aerial. Three or four wires may be used, suspended by insulators about two or four feet above the ground. To this "earth" the set is connected in the ordinary way. It is essential that the capacity earth should be as well insulated from the real earth as is the aerial, so that the lead-in from the earth will have to be well insulated. Keep the aerial and earth leads as far away from one another as possible.

* * *

R. C. (Bolton).—How much wire should I need to wind a 5 inch by 5 inch former with 24 enamelled? What wave-length would I reach on it?

About 5 ounces of wire should suffice. The wave-length would be roughly 300 to 1,600 metres.

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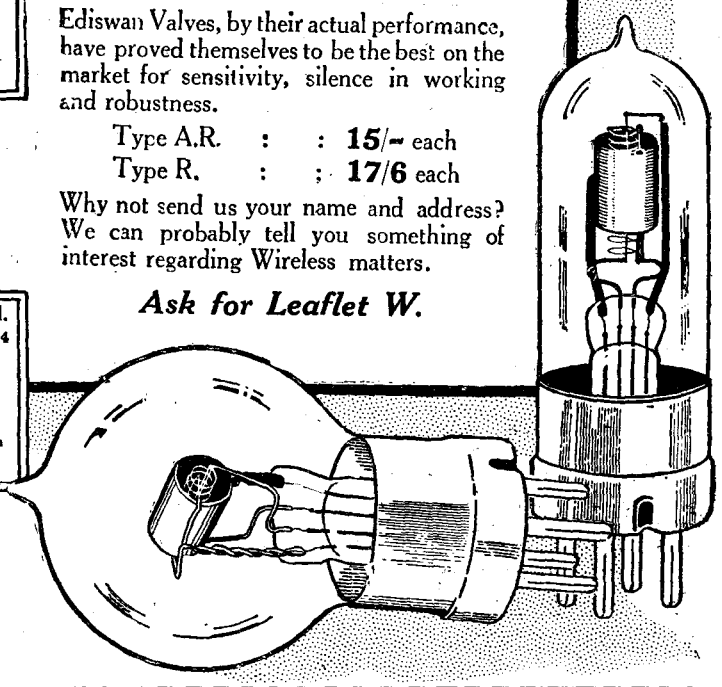

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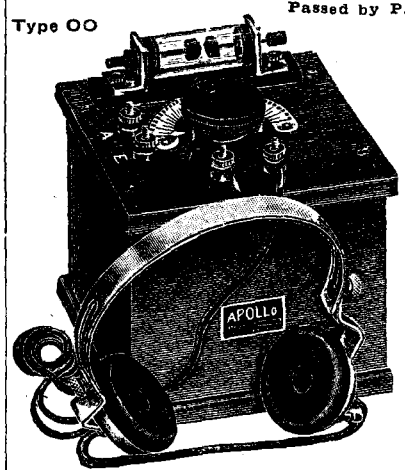

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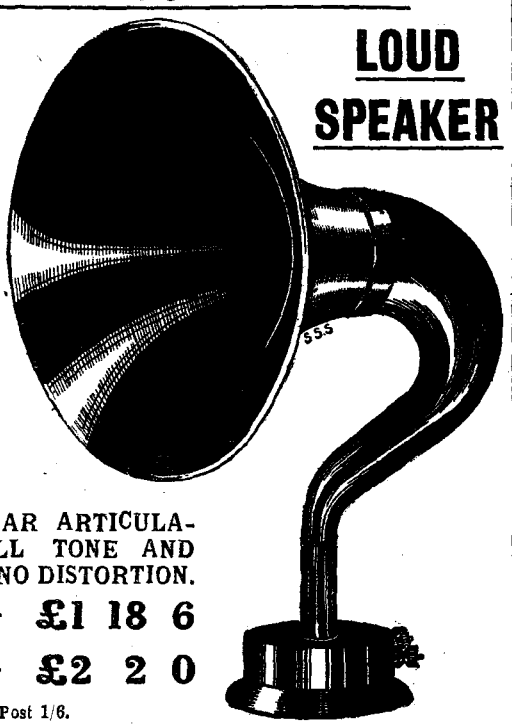

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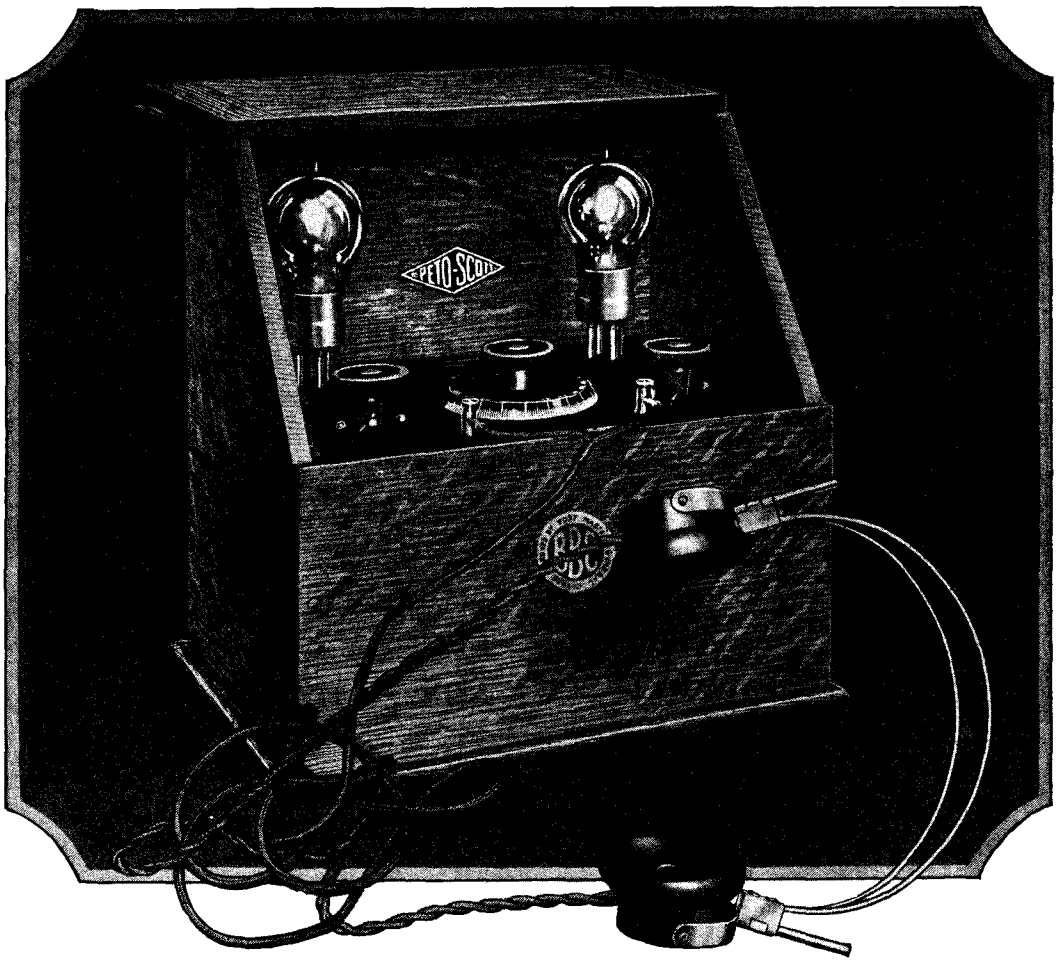

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