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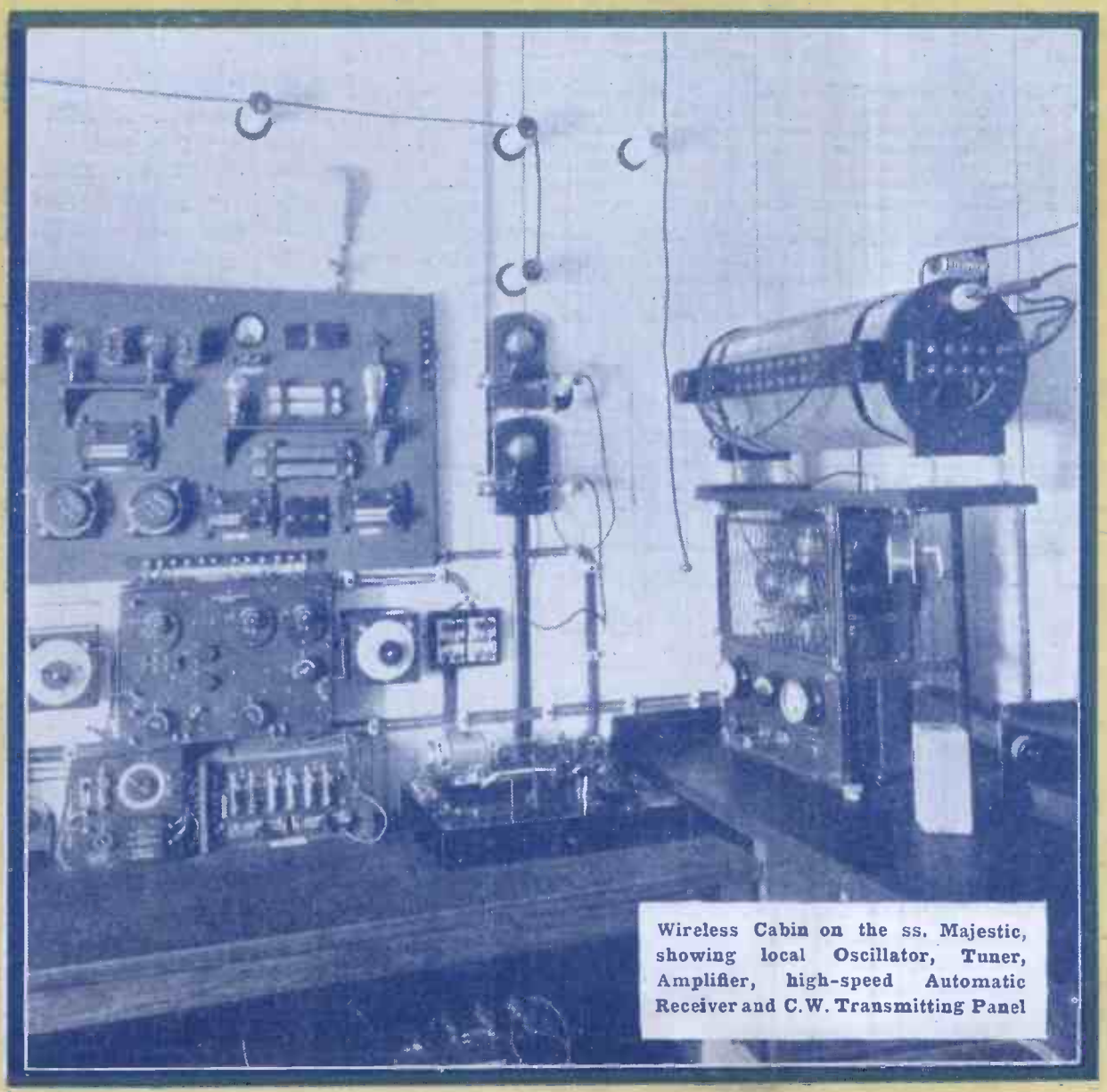
May 5th, 1923.



Wireless Cabin on the ss. Majestic, showing local Oscillator, Tuner, Amplifier, high-speed Automatic Receiver and C.W. Transmitting Panel

FEATURES IN THIS ISSUE.

A Short-Wave Transmitter and Receiver.
H.R. and L.R. 'Phones.
Page of Ideas for Experimenters.
The Noden Valve.
A Unit Receiver.
Control of Grid Potential.

And an Illustrated Report of the Gala Concert.

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POPULAR WIRELESS

May 5th, 1923. SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc. [Every Friday.

TOPICAL NOTES AND NEWS.

An Invention.

I WAS informed of an invention the other day that is claimed to cut out jamming and interference. I am sure our readers will welcome such an invention. At the moment I am waiting for more information. I believe, however, that it embodies three electrode variable condensers which entirely revise the circuits hitherto in use.

* * *

2 L O Received in Italy.

A FRIEND of mine in Milan tells me that he hears 2 L O and Cardiff quite distinctly on a three-valve set of Italian manufacture. Considering that these two stations are, after all, fairly limited in power, and that the distance is over 1,000 miles, this must be something of a record.

* * *

Missing Something Good.

I HAVE been asked by quite a number of readers why the London Broadcasting Station did not link up with the other broadcasting stations by means of a land line, so that listeners-in who have not long range sets could hear the All Star concert. I made inquiries at the London Station, and was told that they had endeavoured to do this, but that the short notice given did not permit of the necessary arrangements being made.

* * *

A Great Success.

THERE is no doubt that Thursday's concert was a success unparalleled in the history of broadcasting. The artistes who took part enjoyed the experience as much as the listeners-in enjoyed the programme. Miss Madge Titheradge told me that she was very nervous at the thought of broadcasting. "It is so uncanny," she declared. This clever actress cannot speak her lines without accompanying them with suitable gestures.

* * *

A Hopeless Muddle.

UNTIL the discussions between the G.P.O. and the Broadcasting Company concerning licences have been settled the much needed improvement in broadcasting is temporarily suspended. The proposed erection of the southern station is to be postponed for the present, although I have heard that experiments are taking place with a view to deciding on its location. The estimated cost of installing a station and running it for one year is £20,000.

* * *

Something New.

THE different types of filament resistances on the market at present are almost as varied as crystal sets. I had one sent me the other day for inspection by Messrs. Mitchells' Electrical & Wireless Co., Ltd. The ebonite knob has a square hole in it and is clamped to the end of the spindle by a locking screw so that no strain comes on the screw itself. A hexagon nut is used to clamp the regulator on to the panel, and the former is made so that the resistance wire is kept right away from the panel. The whole construction is a credit to the designers.

* * *

Some Problem!

WORDS spoken in a public hall reached a listener 2,550 miles away, before they were heard by a listener 150 feet from the speaker. This statement looks a bit fantastic, but it is absolutely true. The apparent absurdity becomes reasonable when it is realised that the speed of sound is

Captain Lewis of 2 L O—Uncle "Cactus" to the children.

1,126 feet per second at a temperature of 58 degrees Fahrenheit, and the speed of electrical vibrations or radio waves is 186,000 miles per second. The listener in the back of the hall heard the words in 0·1332 seconds. A microphone connected to the radio transmitting equipment of the station was two feet in front of the speaker, and picked up the words in 0·002 seconds. The time required to transform sound waves into electrical energy is 0·002 seconds. The time required for electrical vibrations or waves to pass from listener to transmitter is 0·0137 seconds. The time required at the receiving end to convert electrical vibrations into sound vibrations is 0·001 seconds. The total elapsed time from the speaker to the radio listener was 0·0187. The listener in the hall heard the words in 0·1332 seconds. The other listener heard the words 0·1145 seconds sooner. The period of time elapsing between the spoken word and its reception via radio 2,550 miles away can be illustrated as follows: 0·0187 seconds is the time required for a spectator at a cricket match to hear the impact of bat against ball when he is standing twenty-one feet from the batsman. Now you know!

* * *

A Point of Law.

AN interesting point regarding the legality of the B.B.C. agreement has been raised by Captain Reginald Berkeley, M.P., who considers that the licence to the B.B.C. is not binding because it has not been approved by the House of Commons, and I believe it is his intention to ask the P.M.G. whether, in view of the provisions of Standing Order No. 72, he will notify the B.B.C. that its licence is not binding until approved by the House, and whether he will take steps to bring the licence before the House without delay, with a view to a resolution being taken on it.

* * *

A Useful Invention.

I HEAR that the problem of the broadcasting of the speeches of celebrities, owing to the difficulty they sometimes experience in finding time to attend the Broadcasting stations, has been overcome in America by means of a new instrument called the pallophotophone. This contrivance can be installed in the speaker's house, and takes a record of a speech by an arrangement which converts the sounds into "dots and dashes" of light which are photographed by a cinema camera. The film can then be taken to the broadcasting station when required and there the picture, composed of dots and dashes, is converted into sounds for transmission.

* * *

The P.M.G's Committee.

THE following Committee has been appointed by the Postmaster-General to consider the broadcasting question:

Major-General SIR FREDERICK SYKES, M.P. (Chairman).

Major the Hon. J. J. ASTOR, M.P.

Mr. F. J. BROWN, C.B., C.B.E., Assistant Secretary, General Post Office.

SIR HENRY BUNBURY, K.C.B., Comptroller and Accountant-General, General Post Office.

VISCOUNT BURNHAM, C.H., Chairman, Newspaper Proprietors' Association.

W. H. ECCLES, Esq., F.R.S., President, Radio Society of Great Britain.

The Rt. Hon. SIR HENRY NORMAN, Bt., M.P.

J. C. W. REITH, Esq., General Manager, British Broadcasting Company.

Field-Marshal SIR WILLIAM ROBERTSON, Bt., G.C.B., G.C.M.G., K.C.V.O., D.S.O.

CHARLES TREVELYAN, Esq., M.P.

(Continued on page 422.)

NOTES AND NEWS.

(*Continued from page 421.*)

Harrods' Great Wireless Concert.

SIR WOODMAN BURBIDGE tells me that the Gala Wireless Concert proved very successful from Harrods' point of view. In this mighty store over 3,500 people assembled to "listen-in." Seven loud speakers were used in the larger of the two great dining-rooms, and five in the smaller. Three were provided for an audience of 600 or so in the comfortable lecture-room and two for another 600 who assembled in the Piano Department. The majority of the people arrived at about 6.30, and did not begin to leave until about 10.20—clear proof of the excellence of reproduction and quality of the programme.

SIR WOODMAN BURBIDGE,
The Managing-Director of Harrods.
Sir Woodman was responsible for the Gala Concert recently broadcast from 2 L O, and every listener-in will appreciate his initiative and generosity in providing such an excellent entertainment.

* * *

A Royal Receiving Set.

THE Duke of York, as an officer of the Royal Air Force, has always taken the keenest interest in wireless, and I hear that the set which he is having installed at his new home in Richmond will probably be one of the most efficient of all the privately owned sets in London. It is to be fitted with a valve apparatus capable of picking up signals from the most distant stations, and I can imagine the royal pair spending many happy evenings enjoying the delights of listening-in.

* * *

Broadcasting Station for Sheffield.

A CORRESPONDENT from Sheffield states that the B.B.C. are to build in or near Sheffield a relay station for the purpose of picking up broadcast programmes and redistributing them. The crystal enthusiasts will come into their own when it is possible to use these for broadcast reception, for Sheffield is as keenly interested in and technically acquainted with wireless as any other city in the country. The Sheffield University is taking a leading part in assisting local wireless development, and the University has promised the B.B.C. that all their available [illegible] placed at the disposal of the B.B.C. in order to facilitate the work. It is expected that the relay station will be in operation some time during the next month.

Next week's POPULAR WIRELESS will contain another long article by our Scientific Adviser, Sir Oliver Lodge. This article, complete in itself, is the first of a new series written specially for POPULAR WIRELESS by Sir Oliver Lodge.

A Great Pianist.

WILLIAM MURDOCH appeared to be having a great time when I saw him last Thursday evening at 2 L O. "It's not half as bad as I thought it would be," he told me, "in fact, I thoroughly enjoyed myself and didn't feel the least bit upset by the presence of the microphone."

* * *

Investigating "Statics."

I AM told that the experts of the Radio Research Board station at Aldershot have been closely investigating the character and causes of "Atmospherics." By the means of an ingenious apparatus coupled to an aerial 500 metres long, it has been found that their wave-length is normally about 600 kilometres, and that their intensity is, on the average, forty times greater than the signals of our most powerful transatlantic stations. In one case they were 800 times stronger.

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,	2 L O	369	11.30 to 12.30 every morning and usually every evening, 5.30—6.15 p.m.; 7 and 9.45, News; 7.30, Orchestra; 8.25 to 10.30, Music. Sundays from 8.30 p.m.
Newcastle Broadcasting Station	5 N O	400	11.30 to 12.30 every morning. Every evening, usually from 5.30 to 10 p.m.
Manchester Broadcasting Station	2 Z Y	385	11.30 to 12.30 every morning. Every evening usually from 5.30 to 10 p.m.
Birmingham (Witton) Broadcasting Station	5 I T	425	11.30 to 12.30 every morning. Every evening usually from 5.30 to 10 p.m. (News, Concerts, etc.).
Glasgow Broadcasting Station	5 S C	415	11.30 to 12.30 every morning. 5.30 to 10 p.m.
Cardiff Broadcasting Station	5 W A	353	11.30 to 12.30 every morning. 5.30 to 10.30 p.m.
Croydon	G E D	900	Throughout day to aeroplanes.
Paris	F L	2,600	11.15 a.m., Weather Report; 6.20 to 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 5.40 p.m., Concert. Thursdays, 8.40 to 9.40 p.m., Concert.
Haren	O P V H	1,100	12 noon and 4.50 p.m. Telephony.
Radio-Electrique, Paris	——	1,780	5.5 p.m., News Items; 5.15 to 6.10, Concert; 8.45 p.m., News Items; 9 to 10 p.m., Concert. 2 to 3 p.m. Sat., Concert.
School of Posts and Telegraphs, Paris	——	450	Every Tuesday and Thursday, 7.45 to 10 p.m. Saturdays, 2.30 to 6 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.

FORTHCOMING EVENTS FROM THE LONDON BROADCASTING STATION (2 L O).

SATURDAY, 5th inst.—Society News, Household Hints, Poultry, etc. Sir Bertram James on "What Is Capital?" Chat on Racing by the Pall Mall.

THURSDAY, 10th inst.—An address by E. A. Bates, Esq., M.A., D.Lit., on "Cave Exploring as a Sport," at 9 p.m.

WEDNESDAY, 16th inst.—Sir Montague Sharp, K.C., D.L.C.A., an address at 9 p.m.

SUNDAY, 20th inst.—The Prince of Wales, Earl Haig, and Marshal Foch will speak from the Queen's Hall to the British Empire League. All the broadcasting stations throughout the country will be connected with landlines for the purpose of broadcasting these speeches.

THURSDAY, 24th inst. (Empire Day).—Rt. Hon. Lord Islington, G.C.M.G., D.S.O., P.C., address at 8 p.m. Rt. Hon. Earl Meath, P.C., G.B.E., address at 9 p.m.

FRIDAY, 25th inst.—H. E. Blain, Esq., C.B.E. Chairman of the London Safety First Council, address on "Safety First," at 9 p.m.

A SIMPLE VARIABLE CONDENSER.

By E. JAMES.

Many articles describing the construction of various types and forms of variable condensers have appeared in this and other journals, but that detailed in this article is both as neat and efficient as any of its many predecessors.

THE writer has noticed, on various occasions, articles in wireless papers describing the construction of divers varieties of variable condensers, all of which seem to have been devised with a view to saving the cost of "air" condensers of the orthodox kind. But most of these devices require accurate adjustments to make them work, which may delay for some time the using of the fitment. This is not the case with the one here described; it can be turned out from the raw material in about an hour and a half, being very simple in construction. The writer made himself one for about 10d., a testimony to the fact that it is cheap.

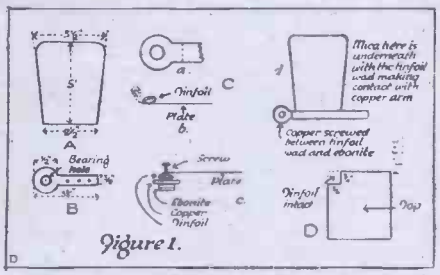


Figure 1.

The first necessity is a couple of pieces of mica of fair size—the writer obtained two pieces, of the shape and approximate size shown in A, Fig. 1, for twopence the two. The top edges were not rounded as shown, he did that himself. These pieces of mica form the stiffening for the moving plate of tin-foil as well as the dielectric of the condenser. The other materials required for this moving plate are a piece of tin-foil, a copper arm, and a small strip of ebonite.

The tin-foil is cut to the shape of the mica, but $\frac{3}{16}$ths of an inch smaller at the top and sides, a length of about one inch being left in excess of the length at the lower end. This tin-foil, with the extra length projecting, is fastened between the two mica plates, the whole being stuck together with shellac varnish and placed under a weight until dry. Next, the copper arm is prepared, which is of the shape and dimensions of B, Fig. 1. Any thin stiff copper sheet may be used for this, or brass of course, if preferred, and three small holes are drilled in the arm large enough to clear the shanks of three brass $\frac{1}{4}$ in. wood screws, which should have large heads. In the projecting "lug" is drilled a hole to clear the shank of a "three division" terminal. This must be made a smooth fit as it is to be the bearing.

Arrangement of Parts.

The ebonite arm is merely a piece of $\frac{1}{4}$ in. ebonite, $\frac{3}{8}$ in. wide, and may be as short as $3\frac{1}{2}$ in., or as long as one chooses to make it, if one fears capacity effects. The original is only $3\frac{1}{2}$ inches long. Having this prepared we can quickly complete the moving plate after consulting C, Fig. 1. Bring one end of the ebonite strip to the position on the copper arm shown by the dotted line in "a," and drill three holes corresponding with those in the copper, to a size according to the gauge of wood screw used. It should be noted that these screws will have to bind in the ebonite, in order to hold the copper and mica. Now tightly roll up that 1 in. of extra tin-foil on the moving plate, making each fold about $\frac{3}{8}$ in., and letting the resultant thin "wad" lie on the lower edge of the mica as in "b." Next make three holes for the wood screws in both mica and tin-foil, and see that your screws have large heads. Arrange the three components as shown in "c," *after consulting* "*d*," and screw up tightly with the wood screws. If the screws have large flat heads and are screwed up tightly, they are not likely to cause any trouble in moving the plate when they come to the bottom, as in "d," which shows the proper arrangement of the parts when the plate is lying face upwards.

How It Is Assembled.

The fixed plates should not cause much trouble, as they are stuck direct on to the base and top. The base consists of a piece of hard wood $6\frac{1}{2}$ in. by $5\frac{1}{2}$ in., the top of a piece of stout millboard $5\frac{1}{4}$ in. by 4 in. These should be well dried and shellacked, and then the fixed plates, of very smooth tin-foil, are stuck on with shellac varnish. They are made the exact size of the top, and the position of the bottom one may be gauged by bringing the top and left side to the edges of the base. Two thin narrow strips of cardboard are stuck along the edges to raise the top sufficiently to give clearance to the moving plate. A corner should be taken out of the top, *leaving the tin-foil intact*, as shown in D, Fig. 1.

The final assembly will not take very long. The top is placed in position, tin-foil down, and screwed down on *two edges only*, as shown at A, Fig. 2. The moving plate is slipped in before the final tightening, and the pressure of the screws adjusted to provide an easy movement. Holes of a size to clear the shanks of two terminals are drilled as at "a" and "b" in A, Fig. 2. It should be noted that the hole "a" commences at the bare tin-foil exposed by taking the corner out of the top, so care must be taken not to tear it.

Must Work Smoothly.

A two-piece terminal may now be placed through "a" and the nut at the back screwed on, it being easy to see the reason for the removal of the corner. Really efficient contact is made with the fixed plate by the flat lower half of the terminal. The three-piece terminal is placed through "b," and tightened up with a nut. The lower division of the terminal is the pivot for the bearing of the moving plate, and it will be necessary to bend the copper strip, so that the bearing hole works freely on the lowest solid portion of the terminal, while the plate lies snugly on the baseboard as in B, Fig. 2. The next division of the terminal is screwed down to allow the plate to move easily, the top piece of all being used as a locknut. Leads may be taken from the backs of the terminals and the condenser is complete, and in the writers' case is approximately of the order of ·00085—quite a reasonably high capacity.

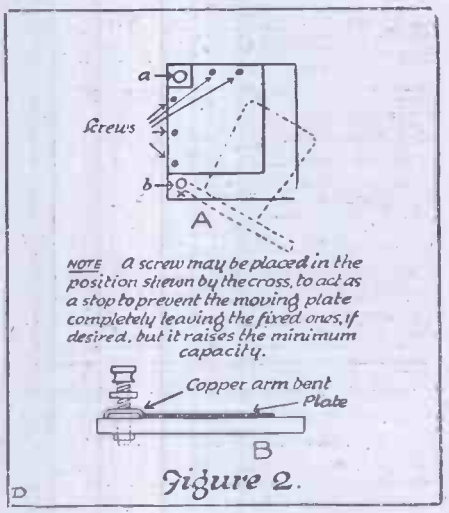
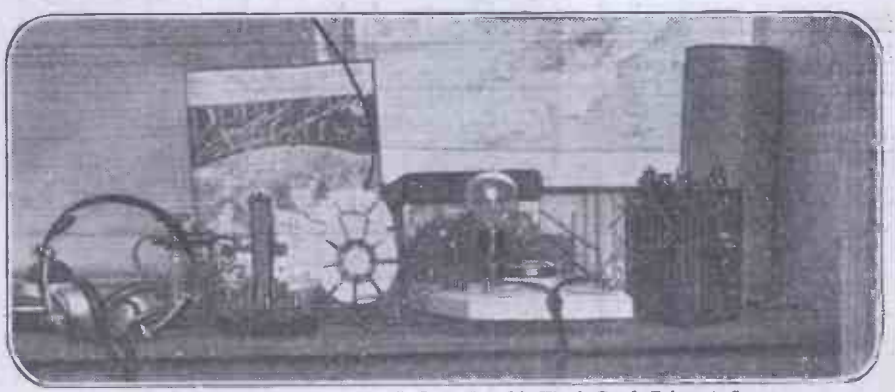


Figure 2.

The only part which calls for any special care in adjustment is the bearing, as this must work quite smoothly. If it is properly adjusted for tension a really efficient instrument results.



Single-valve set constructed by Mr. S. J. Moffat, 14, King's Road, Belmont, Surrey.

A PAGE OF IDEAS FOR THE AMATEUR.

LOOP TAPPINGS.

THE accompanying two diagrams show a simple method for taking tappings from a coil. At the required point for tapping, a loop is taken in the wire, as shown in Fig. 1. Holes are drilled beneath

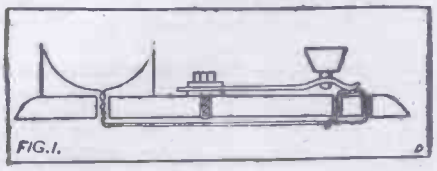


FIG. 1.

the coil in line with the tappings and the looped wires taken beneath the baseboard, up through one hole, and down through another, finally being made fast in the manner indicated.

These "stitches" are arranged radially as shown in Fig. 2, and a single switch arm

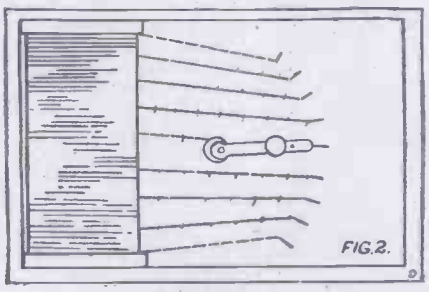
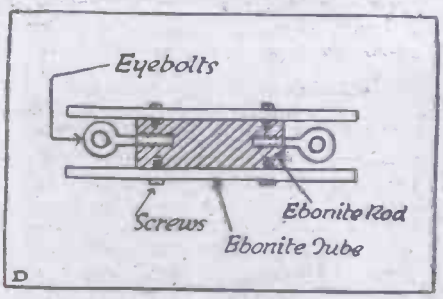


FIG. 2.

constructed to run over them and make contact. Dimensions and details are left to the individual constructor.

A WATERPROOF INSULATOR.

IT is universally agreed that transmission over long distances is considerably better when it is either raining or threatening to do so. But this fact is generally more than counterbalanced by the non-weatherproof qualities of the average amateur's aerial insulators, which are usually wholly exposed to the rain.



The insulator it is proposed to describe, therefore, has a long leakage path, and is entirely unaffected in its insulating qualities by anything short of a hose.

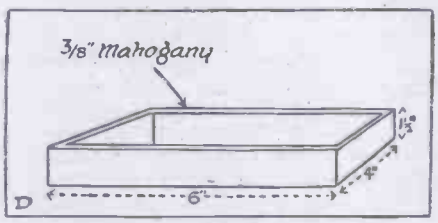
It consists, primarily, of a piece of 1 in. diameter ebonite rod 3 in. long into the ends of which are screwed two eyebolts. (These must have strong threads and be of fairly large size, but not exceeding ¾ in. across the eyelet.)

The whole of this is sheathed in a piece of ebonite tube of 1 in. internal diameter and 6 in. long, so that it projects 1½ in. over either end of the rod. It is affixed to the latter by four small screws. The construction will be apparent from the sketch.

A USEFUL TELEPHONE SWITCH.

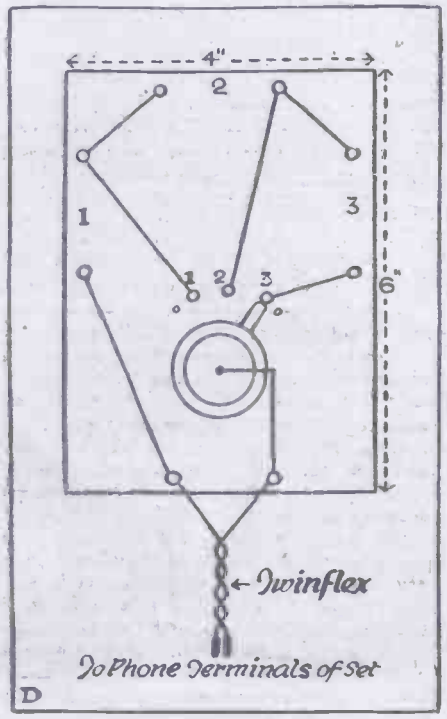
USING three pairs of 'phones, I have often found it necessary to cut one or two pairs out of circuit quickly, therefore I constructed a panel in the manner shown in the accompanying diagrams.

The materials required are as follows: Ebonite, 6 × 4 × ¼; 1 switch arm with



knob, 8 'phone terminals, 3 contact studs, 2 stops, 18 in. insulated sleeving wire for connections, wood for box.

I think the diagram explains itself. This panel is used downstairs, it being connected to the set by fifteen yards of twin flex, and no reduction of signal strength occurs.



AN EFFICIENT "LEAD-IN."

TAKE a block of wood, about 2½ inches in height and exactly the length of the window sash, and in thickness also the thickness of the sash. Bevel top and bottom to the section of the sash (Fig.

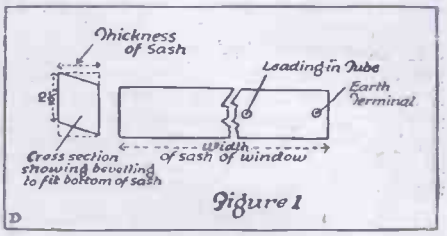


Figure 1

1), and place in position under the bottom sash (Fig. 3). The beading, up and down which the window slides, will firmly hold the block. Through the block bore the hole, and pass through it this leading-in terminal. As the window closes down upon the block

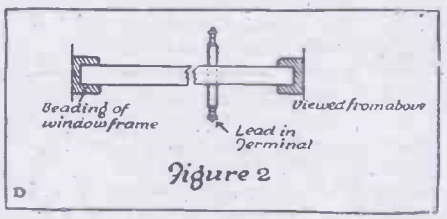
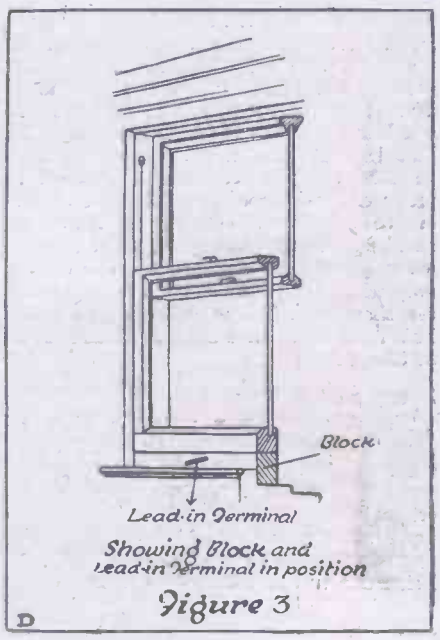


Figure 2

all moisture is kept out. The terminal, too, for the earth lead may be attached to this block, and if desired the latter may be painted black, or to match interior decoration. A good finish is thus obtained, while little tabs will add to the appearance. Figs. 2 and 3 supply the remaining details.



Showing Block and Lead-in Terminal in position
Figure 3

THE FIRST WIRELESS GALA CONCERT.

THURSDAY, April 26th, 1923, will long be remembered, not only as the date of a popular Royal wedding, but as a red-letter day in the history of broadcasting. It is due to the enterprise and foresight of Sir Woodman Burbidge, Bart., C.B.E., that many thousands of people—in fact, we cannot estimate the number—were able to enjoy for the first time an "All Star" concert in their homes to celebrate the occasion of the most noted marriage of the year.

IT was only a few days before the wedding that Sir Woodman's intention to provide "listeners-in" with this first-class programme became public, and almost immediately afterwards I called upon him and found him hard at work organising the concert which has proved such a wonderful success and a triumph for broadcasting.

I soon discovered that Sir Woodman is a keen wireless enthusiast and a firm believer in its enormous benefits to the public, the artiste and the business man. Wireless to him is something more than a vogue. In his opinion, it is the greatest civilising force of the age, and on that account, only the very best of talent, only the best brains of the country should be allowed to be transmitted into the homes of the nation. For this reason, Sir Woodman spared neither trouble nor expense in procuring the leading artistes of the day to delight the biggest audience that has ever listened to an "All Star" concert, and, one might say, that it was the biggest audience that has ever listened to a wireless concert in this country—for few owners of receiving sets, within range of Marconi House, would have missed last Thursday's gala night, thanks to the enthusiastic preparations made by the promotor and his colleagues.

In addition to the many thousands of "listeners-in" to Sir Woodman's concert, some two thousand members of the public were admitted to a splendid reception in the Georgian Hall at Messrs. Harrods, where a number of loud speakers recorded the concert with wonderful results under the supervision of Mr. Close, the manager of the Wireless Lounge at Messrs. Harrods.

Everyone who heard the "All Star" concert on Thursday night will feel grateful to Sir Woodman for his pioneer work in showing what can be achieved in wireless concerts, and we may be confident that while there are such public-spirited men as Sir Woodman championing the cause of wireless, this new wonder of the twentieth century will never cease to look forward and to become the greatest boon and companion mankind has ever known.

As regards the distinguished artistes who took part in Harrods' Wireless Gala Concert, it will be interesting to those who heard them in their homes to know what these artistes themselves think about broadcasting. Their opinions, which we give below, were obtained by a special representative of POPULAR WIRELESS.

MR. BILLIE MERSON.

Having gained admittance to Mr. Merson's dressing-room at the London Hippodrome, where the famous comedian is playing in "Brighter London," I had not long to wait before the distant sound of thunderous applause told me that my interview would soon begin. A moment later the door of the dressing-room flew open and behold! A vision of Hamlet, or rather, Billy Merson in this tragic rôle, followed by a seven-foot bearded giant, who was apparently chasing him. Having had a rather sumptuous meal not long before, I began to have grave apprehensions as to my safety. I stepped hurriedly backwards and slipped into the folds of a heavy curtain and waited. The giant disrobed, and before me stood a hideous skeleton. I crept further into the folds of the curtain when a deep uncanny voice exclaimed:

"If thou must shed tears, be prepared to shed them now!"

At length, I summed up courage and ventured forth. The apparition had vanished and little Hamlet, looking anything but the corpse I expected to find, was calmly converting himself into some semblance of the popular comedian I had come to question on the subject of wireless.

Thinking that I was a friend of Mr. Merson, jun., who was present, and I had come in for a chat on the absorbing subject of wireless, Mr. Merson, sen., asked me what I thought about it.

"That is just what I have come to ask you, Mr. Merson," I answered.

"Oh, I like it. I think it's good fun," said Mr. Merson.

"Did you look forward to that broadcasting last Thursday?" I inquired.

"Yes, although it would not have been a new experience for me as I have broadcast before."

"Do you miss seeing an audience?"

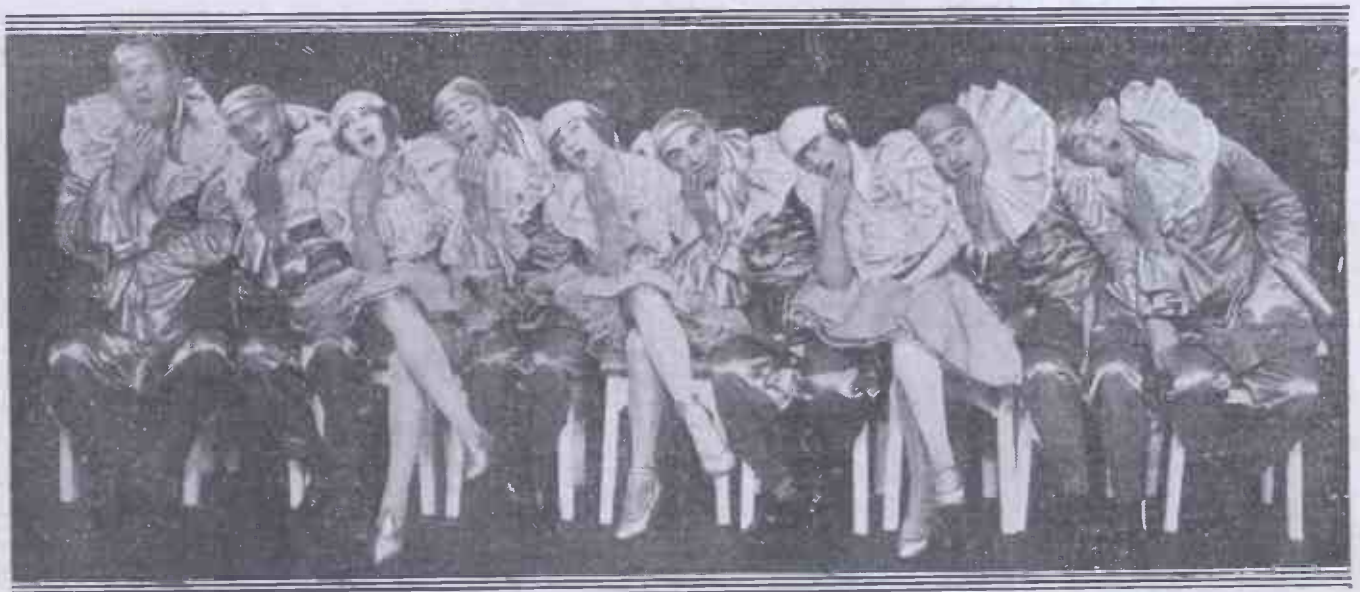
"That's just my complaint. When you are broadcasting you never know at the time how you are appreciated, and this is very trying to a comedian who is not accustomed to his jokes being received in silence. Long afterwards people will come and tell you all about your efforts. On one occasion recently a friend told me that I rolled my r's like 'rrrrrrrrh' and that I spluttered my t's like an empty soda syphon, but he never told me what sort of a receiving set he heard me on."

At this point, Mr. Merson's son, who knows something about wireless, gave me full particulars of this friend's set and entered into a long chat on regenerative circuits and reactance, which finally closed the interview with Mr. Billy Merson, sen.

THE CO-OPTIMISTS.

After a very successful run in London, this brilliant and versatile troupe of pierrots is now enjoying a well-earned holiday, but they visited London specially to give a forty-five minute continuous programme

(*Continued on page* 426.)



The Co-Optimists. Left to right: Davy Burnaby, Melville Gideon, Betty Chester, Laddie Cliff, Phyllis Monkman, Gilbert Childs, Elsa Macfarlane, H. B. Hedley, Stanley Holloway.

THE FIRST WIRELESS GALA CONCERT.

(*Continued from page 425*)

from their extensive repertoire on that memorable Thursday evening. It might be mentioned that these artistes have generously offered to send the fees for their services, after their expenses have been met, to the Actors' Orphanage Fund.

MISS PHYLLIS MONKMAN.

This exceedingly clever dancer of the troupe has not broadcast before, and said she felt at a greater disadvantage than her colleagues, because her chief accomplishment could not be transmitted.

MISS JOSÉ COLLINS.

This great favourite of musical comedy had just emerged from a triumphant reception on the stage when she gave me a few moments between the acts of "The Last Waltz" to describe her opinion of broadcasting.

Miss José Collins.

"Do you like broadcasting?" I asked her, remembering that "The Last Waltz" had been broadcast from the Gaiety Theatre quite recently.

"I love it," she replied. "Yet it overawes me when I think that there are thousands hearing me sing and I cannot tell how it sounds to them."

"Then you are nervous?" I suggested.

"Yes—very. On every occasion I simply dread it, but yet it fascinates me, it is so wonderful."

At this, Miss Collins hurriedly left me to return to the stage, and I could picture her quite at home before her admiring audience, and it left me wondering how strange that this popular actress should feel nervous at singing to an invisible audience.

MISS MADGE TITHERADGE.

Who is playing with Norman McKinnel in "Bluebeard's Eighth Wife," and who recited "Song of England," by Alfred Noyes, on Thursday evening, has never broadcast before.

"I found it strange speaking without a visible audience," she said. "And I am not able to recite without acting as I would before people."

LIEUTENANT C. H. HASSELL.
(Conductor of the Band of H.M. Irish Guards.)

When I asked Lieutenant Hassell whether he found any difference in conducting a band for broadcasting and on ordinary occasions, he said: "There is not much difference and it is just the same as playing for a gramophone record."

MR. LADDIE CLIFF.

The original producer of the Co-Optimists delivered his great Bolshie song with great gusto. He tells me that he was sorry he could not reproduce his "own face" whilst singing that song, but he hopes that his hearers endeavoured to imagine that it was there all the same.

MR. GILBERT CHILDS.

This clever comedian gave a song which he hoped appealed to all admirers of the British Navy. It was entitled "Don't Scrap the British Navy." He thinks it should have been well received by the guardians of our shores.

MISS BETTY CHESTER.

"It was just like singing into a gramophone," she said. "But I would rather have the public before me."

MR. DAVY BURNABY.

Familiarly known by the Co-optimists as "Uncle Davy," Mr. Burnaby announced the various items of the programme.

When asked whether he had looked forward to being broadcast, he replied, "Yes, I had anxiously awaited the experience, as I am a wireless enthusiast. I am afraid I have been somewhat critical as a listener-in of the broadcasting efforts of my friends. I hope, however, they returned good for evil when they heard Uncle Davy doing his bit."

MR. MELVILLE GIDEON.

The great man at the piano and talented writer of the Co-optimists' songs thought that the concert was an exceedingly novel experience, both for the artistes and their audience. His one anxiety was for the correct pitch of the piano used. "Woe betide the B.B.C. had their piano not been of good pitch. I had thought of taking my own, but luckily it turned out not to be necessary."

2 L O's GALA NIGHT.

An Impression.

By "ARIEL."

THE most bitter of 2 L O's critics must have been satisfied by the fare provided for the realm of wireless on Thursday evening—the evening of the Royal wedding. What a programme! Even Uncle Caractacus, whose voice has sounded so sad of late, cheered up, and the news went with a good hearty punch behind it.

I arrived at the studio just in time to meet Mr. George Robey, dashing along the corridor in his hat and coat, with a pitiful look on his face.

"Shush!" he said, raising his finger mysteriously. "They won't let me!"

"Won't let you?" I said. "What do you mean?"

"My agents won't. I can't broadcast after all." And he flung himself into a chair.

The news flew round, and Mr. Burrows hastened out.

"And Billy Merson can't either," went on George. "Oh, shurrup!"

And he hung his head in sorrow.

And so we had to go without those two inimitable comedians. And the microphone—stern tyrant of the studio—rejoiced inwardly among its carbon granules.

But it was not to have all its own way, in spite of its solemn autocracy. For after being buffeted about by the Irish Guards with their big "pom-poms"—bassoons, I believe they are called—right under its very diaphragms, and soothed by Miss José Collins and the Gresham Singers, it was flouted by the Co-Optimists.

Rather a long pause ensued before the Co-Optimists really got going, because 2 L O decided to do a little furniture removing first. In order to enable one of the items to be performed, two pianos were necessary. And an attempt was made to bring another along the narrow corridor through the tiny door into the studio.

After great efforts by all the "uncles" and several others, the piano arrived halfway through the door, and then jammed. After desperate efforts, it still refused to budge, and was left there, securely blocking the door.

But it was discovered that the Co-Optisists were outside, and couldn't get in. So a further attack was made upon the instrument. And, by dint of much pushing and tilting, it was induced to move a little, so as to allow the artistes to pass.

Keeping it Going.

As soon as they entered the room the whole atmosphere of the studio changed. Was the microphone a thing to be held in awe? Not a bit! Mr. David Burnaby referred to it as "soap-boxes," while the party carried on, regardless of whether the switch was in or out.

Dodging up and down in front of the edifice, they gave out their first concerted item, each poking his or her head close up to the cylinders when it was time to say a line or two. The procedure was very like a series of jack-in-the-boxes bobbing up and down.

Then the "soap-boxes" were moved, and a song at the piano was sung. A pause while the erection was moved again, and another item was broadcast.

They kept us going—both themselves and those few members of the B.B.C. present—in fits of laughter from start to finish during a whole hour.

As I said before, the propriety of the microphone and studio had a rude shock when the Co-Optimists began. And the blow must have reached the climax, when, in sympathy with the ragtime rendering of "When the Sun Goes Down" on the piano by Mr. Melville Gideon, Mr. David Burnaby and Mr. Laddie Cliff broke into a one step, and proceeded round the room, using the microphone as a pivot.

The fun waxed fast and furious. And it was indeed a short hour that flew by while the "Co-Ops." were rattling off item after item. In fact, one would have thought that Mr. Burrows had put the clock on, except for the fact that he was enjoying it so well that I believe he had serious intentions of putting it back.

But the time went at last. And at ten to ten the "Co-Ops." retreated down the corridor, still singing their last song, "Bow-wow," and taking the piano that had wedged in the door away with them. Nothing could resist the "Co-Ops."

Uncle Caractacus then proceeded with the weather report and the news, though it was all he could do to keep himself from laughing. And there I left him announcing that Cardiff had 30.12 inches, and with the chorus of "Bow-wow" still ringing in the corridors of erstwhile stately 2 L O.

A UNIT BROADCAST RECEIVER.

By H. G. HERSEY (Member of the Wireless and Experimental Association).

This article is a continuation and completion of the constructional details of the H.F. Panel, Part 1 of which appeared in No. 47 of "Popular Wireless."

5.—THE H.F. PANEL. (Part 2.)

WITH the ebonite panel marked out as per Fig. 3, which appeared in the previous H.F. article, we can commence drilling, etc. Seven contact studs are required for the tappings from the anode coil. The holes for these should be first drilled, also the hole for the switch, the latter to be a simple radial switch-arm of 1 in. radius. Next nine holes are drilled in the position below the condenser. These are for the studs from the potentiometer. The switch-arm of this should be of the same size, etc., as the anode tuner switch. The holes for the valve holder are next drilled to take the legs, and the holder may be mounted to the panel. The filament resistance next is mounted under the panel in the position shown "B" by means of screws provided upon the resistance.

The Anode Coils.

The anode coil calls next for attention. This coil should be wound upon a cardboard cylinder, 4½ in. long and 3½ in. in diameter. The cylinder should be well shellac varnished, and the winding may then proceed. Commencing half an inch from one end, wind on 40 turns of No. 32 S.W.G. enamelled wire. Pierce a small hole in the cylinder with a pin, and pass the end (after breaking) through the hole. Two inches from the edge of the cylinder from the starting end another small hole is pierced (opposite the previous hole). The end of the 40 turns is now brought up through this hole, and a joint made with a loop for tapping. The winding should now be continued in 20-turn sections, a tap made after each, until we have 160 turns in all, and leaving about ½ in. of the cylinder to spare, as at the starting end. It is observed that the coil now has 40 turns then a break or space of about ⅝ in., and then 120 turns—in all seven tappings. In the ⅝ in. space a hole should be made about ½ in. diameter. It is through this that a spindle is to pass, and a coil to be rotated.

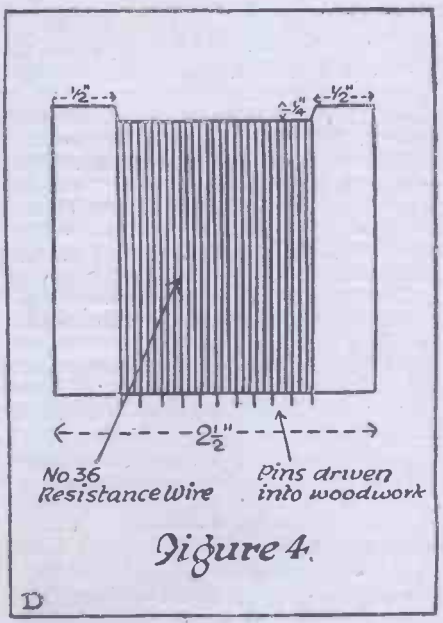


Figure 4.

The reaction coil can now be constructed. A piece of ⅛ in. (approx.) ebonite is cut into a circular disc, 2¼ in. diameter. Eleven slots, ¾ in. deep, are cut around the edge, so as to make a former for winding basket coil fashion. This former should now be wound with No. 30 or 32 gauge wire with about 30 to 35 turns. The ends of this coil should be soldered to a length of twin flex, about 15 inches, preferably rubber covered. Two pieces of wood, ½ in. thick by 3½ in., are cut and tacked to the extremities of the anode coil, so as to leave a clearance of 1½ in. between the coil and the panel when in position. The wood ends should be so tacked or secured to the anode coil former so that the hole for the reaction spindle will come under the position marked upon the ebonite panel.

The Grid Potentiometer.

The coil may now be mounted in its position by means of two screws at each end passed through the panel at D E and the woodwork. The reaction coil should now be mounted inside the anode coil upon a spindle, the latter to be adjusted and revolved from the panel front. The actual method of mounting is left to the reader's means and resources, for some may be fortunate in being able to turn up fittings of any description, while others have to resort to what is available. The actual method of mounting in the writer's instrument is the same as described for the rotating coil in the tuner detector article.

Careful Wiring Necessary.

The variable condenser should next be purchased or made up and mounted in the position shown. This condenser should be on the small side, i.e. about ·0002 mfd., or 6 fixed and 5 moving vanes. The grid potentiometer is next constructed. A piece of wood 2½ in. by ⅜ in. thick and 1¾ in. long is cut, as per Fig. 4. Along the bottom edge 11 pins should be driven and cut off, leaving about ½ in. length. The wood should now be well waxed. A small quantity of resistance wire is now purchased. The actual gauge is not important so long as it is not too thick to run the accumulator down. The gauge in the neighbourhood of 36 S.W.G. D.C.C. resistance wire is about the most convenient. Solder the end to one end pin, and wind evenly round the wood in one layer till the next pin is reached. Bare the wire, twist round the pin, solder, and continue the process till the last is reached. The coil formed should be screwed to the panel in the position F by passing a screw at each end to pass into the woodwork at the protruding ends, the coil being at right-angles to the panel. The terminals may now be screwed to the panel, and the wiring commenced.

The anode coil should be first connected to the studs, the tap from the first 40 turns going to stud 1, 60th turn tap to stud 2, etc.,

(*Continued on page* 428.)

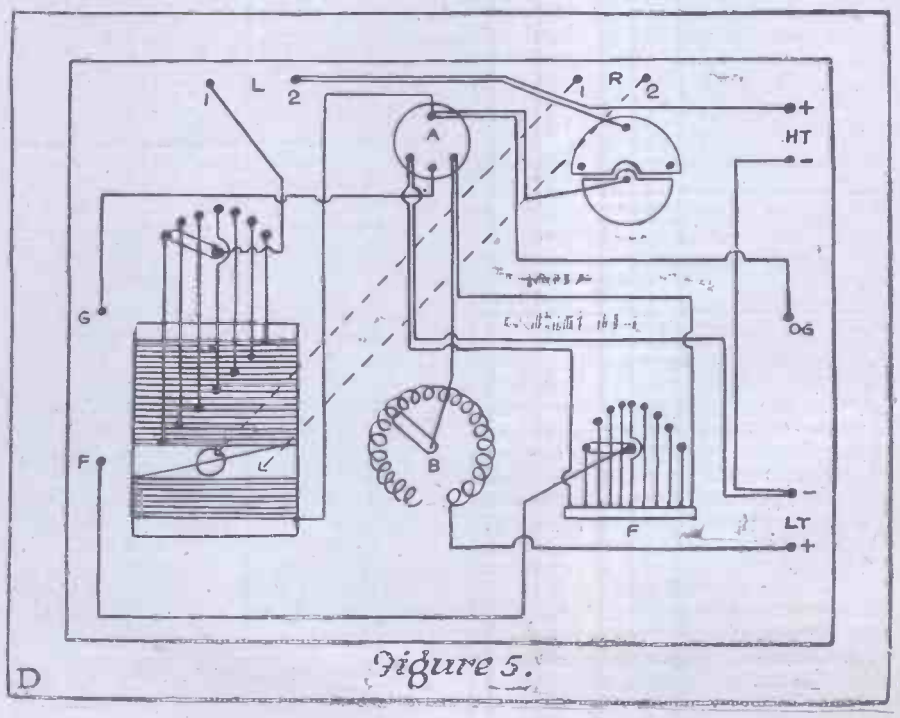


Figure 5.

A UNIT BROADCAST RECEIVER.

(*Continued from page 427.*)

up to No. 7 stud. Next, the potentiometer. Leave the two end pins for external connection, and commencing from one end, solder from pin 2 to stud 1, pin 3 to stud 2, etc., till the 9th stud is reached. The general wiring up may now be carried out. Use wire of about No. 22 or 24 gauge, and well insulate same. If possible, cover with sistoflex, also keep all wires as far apart as is convenient. This is most important in H.F. circuits. The wiring diagram is shown in Fig. 5.

The Panel Completed.

Commencing with the filament, solder a lead from L.T.+terminal to the filament resistance. From the resistance spindle connect to right-hand filament leg of valve holder. Next connect from L.T. – terminal to left-hand filament leg. From the input terminals connect G terminal direct to grid leg of valve holder, and F terminal to the switch arm of the potentiometer. Now connect the two extremities of potentiometer coil to the filament legs, as shown. The H.T. circuits may now be wired.

From H.T. + terminal connect to terminal L2, and from L1 to the switch arm of the tuned anode coil. From the commencing end of coil connect to the anode leg of valve holder. Thus it is seen that the plate or anode is fed through the inductance, the circuit being broken between terminals L1 and L2. These are normally short-circuited, and for longer waves it is only necessary to place a loading coil across L1 and L2. In order to tune this circuit the condenser is placed across the coils by connecting from anode leg to the condenser moving vanes, and from L2 terminal to the fixed vanes.

Next the H.F. currents are taken from the lower end of coil by connecting anode leg to terminal OG. Now the condenser to by-pass these H.F. currents is already fitted to the detector panel, but should the reader use this panel with any other type of detector panel he should at first ascertain the position of the grid leak in the same, for obviously it must not be across the condenser but between the grid and filament leg. It now remains to connect from the reaction coil to terminals R1 and R2, and to join H.T. – and L.T. – together. The panel is now complete, and should be mounted to the cabinet.

Hints on Adjustments.

The panel should be connected to the detector and L.F. panels, etc., as shown in Fig. 6. This panel, as stated previously, is most critical in its adjustments, but once the reader has made himself acquainted with the various tuning positions he will find the instrument very selective and highly efficient. The various adjustments and recommendations are as follows: Firstly, the valve should be one with a low internal capacity, and fairly hard. An Ora valve is used by the writer. Light the valve well up, and temporarily short the reaction coil across the terminals R1 and R2. Now, assuming the reader knows the approximate tuning of his nearest broadcasting station, place the anode coil switch upon stud 3 or 4

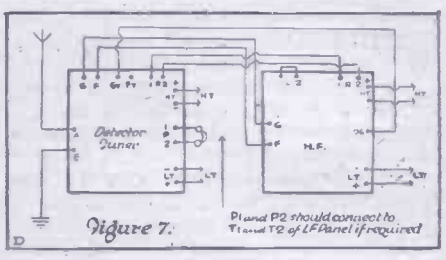


Figure 7.

and the potentiometer switch right over to the negative side, i.e. the end connected to left-hand filament leg.

Now upon adjusting or tuning with the condenser a point is reached where the set will howl. At this point the A.T.I. and the H.F. coil are in tune, and the set will cause reradiation. If the A.T.I. is tuned to a station it only remains to move the potentiometer switch a few studs and the desired potential will be applied to the grid to render the set stable. The anode coil condenser should now be retuned slightly, and the adjustments noted.

To Avoid "Howling."

It can be noted that the anode coil adjustments will remain practically constant wherever the set may be used, provided that the H.T. battery value is not radically altered. When the reader has mastered the instrument so far he may bring the reaction coil into use by taking the short off the R1 and R2 terminals. If the set tends to howl or break into self oscillation, irrespective of the reaction adjustments, give the grid more positive potential.

The instrument described is most valuable for distant reception. Used upon 2 L O, in London, with a single detecting valve it was found to give as much volume as one detector and one L.F. The panel, if used with the detector tuner panel, should be connected as in Fig. 7.

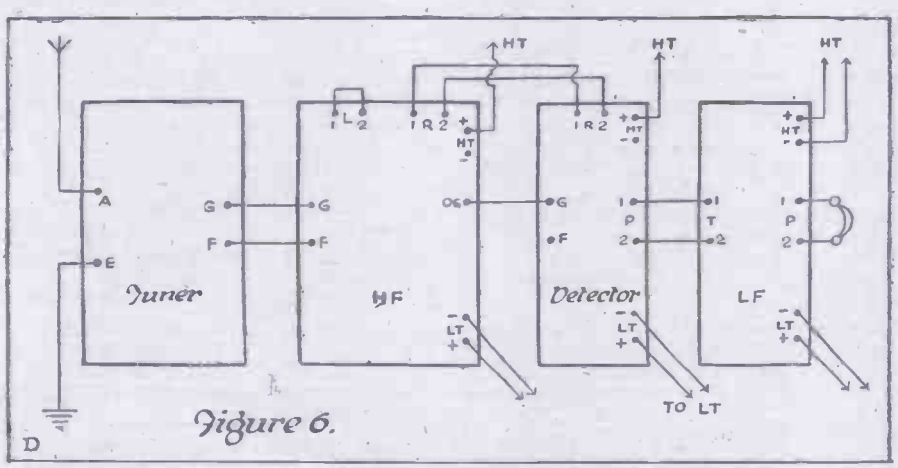


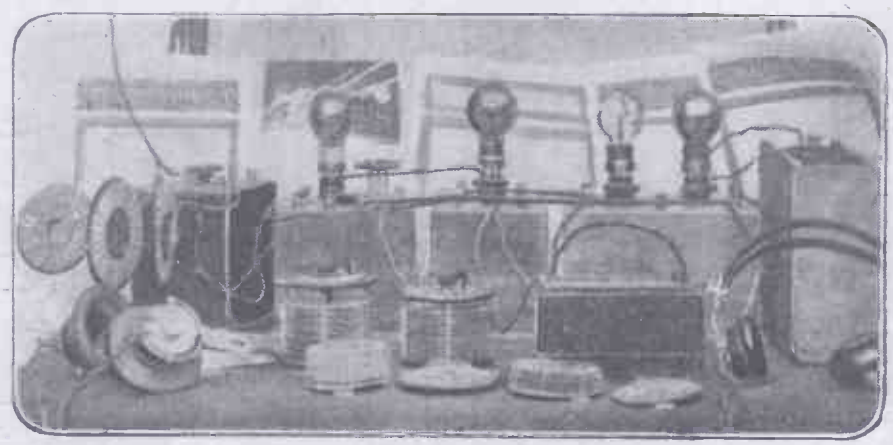
Figure 6.

A COIL WINDING WRINKLE.

BEFORE winding the coil, place the wire to be used near a fire or stove or even in a moderate oven until it becomes quite warm, then take one end of the wire and commence to wind the coil, leaving the residue, if possible, in a position where it is still influenced by the heat.

If the wire cools before the process of winding is complete, it should be again heated before proceeding to complete the coil. Once the coil is finished, the ends should be securely fastened.

This will be better understood when it is stated that every fifty feet of wire heated to approximately 100 degrees Fahr. will, when cooled, shorten by almost ½ in.



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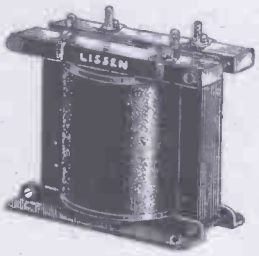

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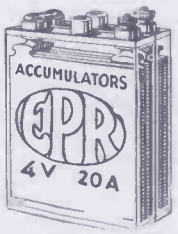

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THE NODEN VALVE.

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

This article describes the construction of a cheap but efficient rectifier suitable for accumulator charging from A. C. mains.

THE supply from an alternating current system is, as its name implies, alternating in direction—that is, it reverses its direction of flow so many times a second. The number of times it reverses is called the periodicity of the supply, or it is said to have a periodicity of so many cycles per second. During each cycle the current grows from zero to a maximum in one direction, dies away to zero, reverses, and grows to a similar maximum in the opposite direction, and then falls away to zero. In a supply at a periodicity of 50 cycles per second, the current would go through 50 of these complete cycles per second.

Explaining Direction Flow.

It is difficult to visualise these changes, but they can be appreciated by imagining a stick fastened to the end of a rotating shaft. If the observer stands in such a position that his eye is level with the shaft, and that he looks along the stick when it is in a horizontal position, he will only see the end of the stick when it is in this position. As it rotates in an upward direction, he will see more and more of the stick until he will see it at its full length when it stands vertical. As it falls again to the horizontal he will see less and less until the end only can be seen. As the shaft continues to

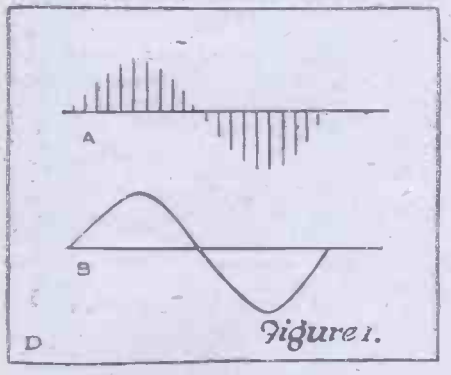


Figure 1.

rotate he will see more and more of the stick below the level of his eye, until it reaches a maximum, finally falling away to a point again to repeat the cycle.

If a series of pictures of the stick taken at equal intervals of time are drawn at an equal distance apart along a horizontal line to represent equal time intervals, a figure as in Fig. 1A will be obtained. If all the tops of these vertical lines are joined as in Fig. 1B, a curve will be obtained, the vertical height of any point of which represents the value of the current at that particular point in the cycle. This curve is known as the sine curve, and all alternating currents have this general form, although the curve is sometimes distorted by harmonics.

Such a current is clearly not suitable for accumulator charging, as an accumulator would be charged for half the cycle, and discharged in series with the supply when the current reversed in the other half of the cycle.

If it can be arranged to cut off the negative half of the cycle, the current flowing would be as in Fig. 2A. By reversing the direction of flow of the current during the negative half cycle, twice the number of positive half cycles would be obtained, and the current flowing would be as in Fig. 2B. Such a current supply is quite suitable for secondary cell charging, and can be obtained by means of a rectifier.

The Noden rectifier has been in use a

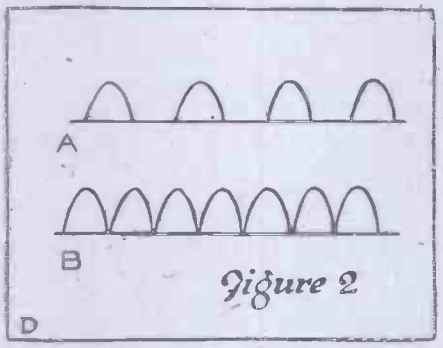


Figure 2

good many years for this purpose, and is really a very useful rectifier, although many adverse criticisms have been passed on it. It is quite admitted that there are more efficient rectifiers, such as the mercury arc, the Tungar, or any of the mechanical rectifiers, but for an inexpensive and easily maintained type for amateur use with small currents, the Noden valve is hard to beat.

It takes several types, all with an aluminium plate with a lead or iron plate in a solution of ammonium phosphate, borax, or sodium bicarbonate. All these various components have their exponents, but the writer's experience favours the use of aluminium and lead plates in a solution of chemically pure ammonium phosphate.

Such a rectifier only permits the current to flow from the lead to the aluminium, and entirely prevents any flow in the opposite direction.

Construction of Container.

If, therefore, two valves of this type are connected as shown in Fig. 3, with an accumulator and secondary winding of the transformer described in a previous article, the current will be completely rectified as in Fig. 2B.

Assume the induced E.M.F. in the transformer is tending to cause a flow of current from A to B in the transformer, there will therefore be a current in the external circuit B to C to D, but not in the circuit A C D, as the Noden valve will not permit current to flow from C to A. When the current reverses in direction there will be no flow of current in B C D, as current cannot flow from C to B, but a current will flow from A to C, and thence to D—that is, in the same direction through the accumulator as it was in the previous half cycle.

In making a Noden rectifier, stoneware jars should be used; and a convenient size

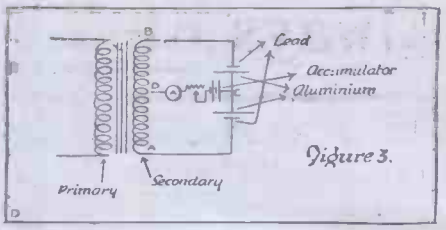


Figure 3.

is 6 inches in diameter by about 8 inches deep. It is of course not necessary that jars exactly of this size should be obtained, but they should be as large as possible in order to obtain a good bulk of solution.

The lead and aluminium plates, which should be at least $\frac{1}{32}$ in. thick, should be cut as shown in Fig. A. The lugs should be drilled to suit the particular type of terminal it is intended to use.

A bottom block of wood should be cut to fit in the bottom of the jar with two grooves $1\frac{1}{2}$ in. apart, as shown in Fig. 4. This piece of wood should be soaked in paraffin wax. The top block is $1\frac{1}{2}$ in. wide by 7 in. long, to which a piece to fit the top of the jar is fitted, as shown in Fig. 4. This should be similarly treated, and the plates of lead and aluminium fitted to its sides by means of screws.

After fitting the terminals, the whole should be assembled in the jars, as shown in Fig. 5. A concentrated solution of chemically pure ammonium phosphate should be made and poured into the jar until the plates are covered to within $\frac{1}{2}$ in. of the top; a layer of paraffin oil, $\frac{1}{4}$ in. thick, on top of the ammonium phosphate completes the cell. The concentrated solution may be made by using one pound of phosphate to a gallon of water, similar proportions being used for a greater or lesser quantity. Particular care must be taken

(*Continued on page 432.*)

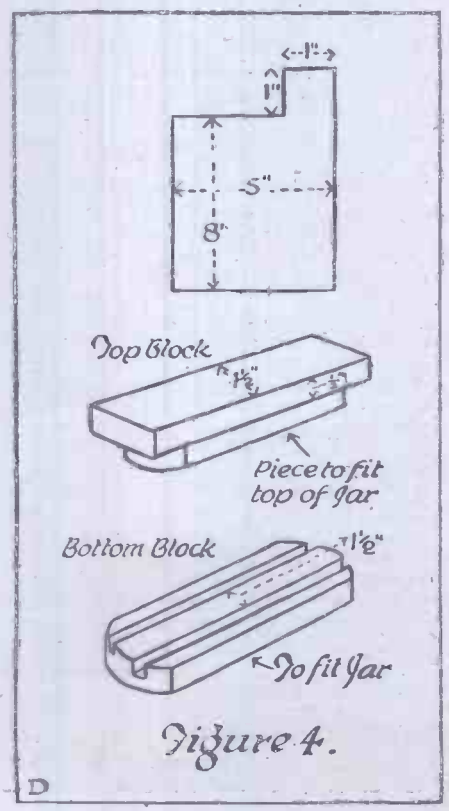


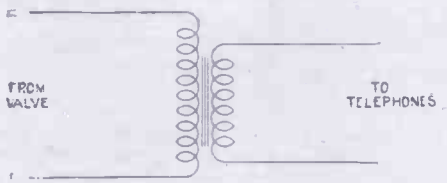
Figure 4.

HIGH-RESISTANCE v. LOW-RESISTANCE TELEPHONES.

By L. McMICHAEL, M.I.R.E.

Mr. Leslie McMichael will be known to most readers as the secretary of the Radio Society of Great Britain, and his authoritative remarks on what is one of the most puzzling points to the "new amateur" will doubtless be read with the greatest interest by the advanced experimenter as well.

THE present-day habit (for it is nothing else but a habit) of using high-resistance telephones and loud speakers for valve circuits is rather extraordinary in view of the fact that nothing justifies their use in modern valve circuits where low-resistance telephones, in conjunction with telephone transformers, can be used with far better results. The cult of the high-resistance telephone no doubt originated owing to the fact that for crystal circuits, the only ones in use before the war, the higher the resistance of the telephone the better the result; and owing to this fact, no doubt, the impression is now that the high-resistance telephone is also more suitable for valve circuits, which is, of course, a fallacy, and one which is the cause of great disappointment, annoyance and expense to many.



To most amateurs the addition of a telephone transformer into the output 'phones or loud-speaker circuit of wireless apparatus is an addition of which the extra cost does not seem to balance the extra half a crown or so for a pair of telephones or a loud speaker wound for high resistance. They are told that 2,000 ohms is a good all-round value for such detecting instruments, and that there is no particular advantage in using a telephone transformer. A little thought will show how erroneous this is.

'Phones or loud speakers are wound for 60 ohms, 120 ohms, 2,000 ohms, 4,000 ohms and 8,000 ohms. The 60 ohms and 8,000 ohms are rare, and will, therefore, not be considered. As is well known, for the efficient operation of a crystal receiving instrument, detecting 'phones of high resistance are essential, and, therefore those wound for 4,000 ohms are the most suitable. For valve work, owing to the fact that the 'phones are connected in circuit with the H.T. battery, considerable resistance is also required, and in this case 2,000 ohms most suitably fills the bill.

Demagnetisation

Leaving crystal circuits, and considering only valve circuits where the 'phones must be in the H.T. battery circuit, we find that the high pressure and high-frequency currents flowing in this circuit tend to demagnetise the permanent magnets of the telephone receiver if they are misconnected: that is, if the circuit is such that the induced polarity of the electro-magnetic pole pieces aids the permanent magnets, well and good; if, on the other hand, it is working against their action, demagnetisation must follow. True, it is slow, but nevertheless sure; also, it is not an easy matter to guarantee that demagnetisation will not take place, however they are connected.

The next point that we discover is that it is not actual resistance which is of importance where telephone receivers are concerned, but that the effective *impedance* is the real factor governing the action of the receiver. The fact is that the lower the actual electrical resistance, the more efficient it should be.

From the foregoing facts we deduce that it is not desirable to include the 'phones in the H.T. battery circuit at all, and the telephone transformer offers a reliable and efficient means of avoiding this.

Prevents Possible Damage

If a suitable, well-made transformer is connected with what normally is its secondary in the H.T. battery circuit, then the necessary impedance is introduced into the valve output circuit, and low resistance 'phones can be used connected to the secondary, or what, in a transformer, is normally its primary. Maximum all-round efficiency is thus obtained, and possible electrical damage to the telephone receiver made impossible.

Telephone transformers are step-down: that is to say, their input circuit contains a large number of turns of relatively small gauge wire, while the output circuit consists of a smaller number of turns of a more liberal gauge of wire (the ratio is usually about 6 to 1) (see diagram).

Leakages are Negligible

Demagnetisation of the telephone receiver (using a telephone transformer) is practically impossible, the effective impedance of the valve output circuit is maintained constant and at its most efficient value, and a further and highly important and useful point is that the leakage factor is reduced almost to zero. When the high voltage currents are taken *via* telephone cords and connections from the wireless receiving or amplifying set to the 'phones or loud speaker, leakage in some degree or other is always difficult to prevent, which brings with it those annoying noises which so often disturb a vocal or musical broadcast selection at its most pleasurable point. When, however, a telephone transformer is fitted to the set, the currents in the cords and connections are at such a low pressure that leakage is negligible.

THE NODEN VALVE.

(*Continued from page 431.*)

to use only chemically pure ammonium phosphate, and when pouring the solution into the cell splashing must be prevented, or corrosion of the plates above the layer of oil will result.

Two of these cells are required, and they should be fitted in a wooden tray, at one end of which an upright board carrying an ammeter and rheostat is mounted. Three terminals should be mounted on the top of this board, the two outside ones being connected to the lead plates, and the centre one to the ammeter, thence to the rheostat, and the two aluminium plates, which should be joined together. When charging, the positive of the accumulator should be connected to this terminal, and the negative to the centre terminal of the transformer secondary. The outside terminals should be joined to the respective outside terminals of the transformer. For the cell under discussion, which has a maximum capacity of 5 amperes, a rheostat having a maximum resistance of 2·5 ohms, formed of wire capable of carrying this current without undue heating is required.

Such a cell will carry this current without overheating, it being of importance to prevent the cell from overheating, otherwise its rectifying action is reduced or stopped altogether.

Heating may be avoided to a large extent in cases where larger currents are required by arranging for larger containers, and consequent greater bulk of solution. It may even be found economical to immerse the containers in water to assist the cooling. Another method which is sometimes used is to make the lead plate of a coil of lead pipe, as in Fig. 5, surrounding an aluminium plate. This lead pipe is connected to the water supply by means of a rubber connection (to insulate it from earth), and a stream of water is kept constantly flowing through the pipe whilst the rectifier is in use.

In making rectifiers for larger currents than 5 amps. these points should be borne in mind, and the immersed surface of the plates should be proportionately increased.

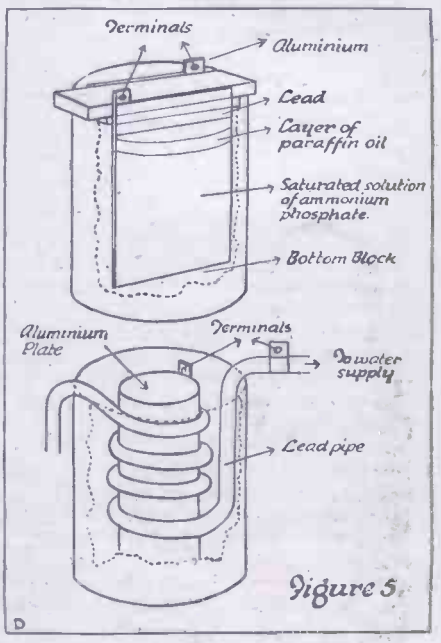
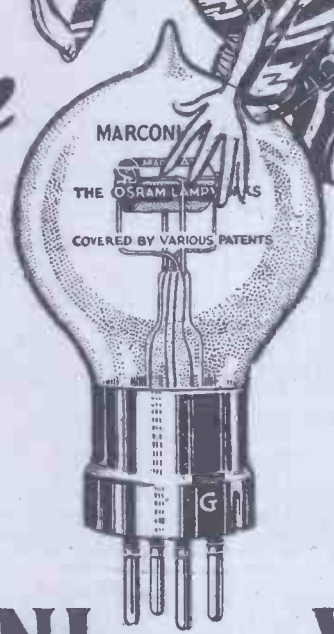


Figure 5.

When you are "Listening in"



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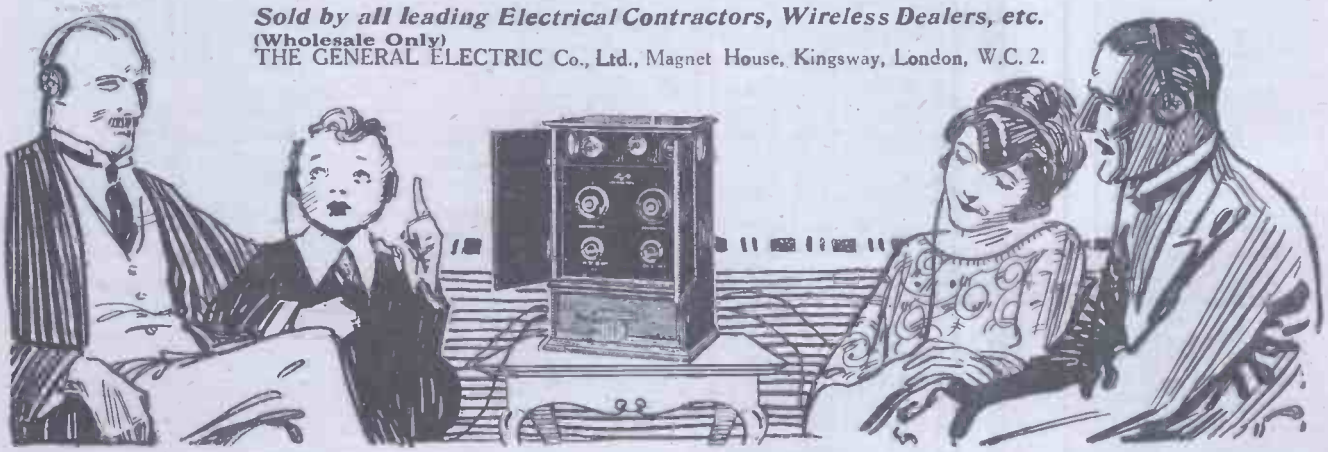


AN AUTOMATIC BASKET COIL WINDER.

Basket coils are extremely useful for tuners, anode couplings, etc. This little machine should be constructed by all experimenters desirous of rapidly winding such coils.

FIRST of all a strong baseboard is required, 1 inch thick, 12 inches long, and 6 inches wide. On this, at one corner, is mounted a metal frame containing the worm, pinion and gear wheels which operate the spider on which the coil is wound and the rocker crank (*see* Figs. 1 and 2). This frame must be very rigid and firmly screwed to baseboard.

Having a Meccano pinion with 19 teeth and ½ inch in diameter, the writer decided to use it on the spider spindle, and consequently the spider had 19 spokes. Meshing with this pinion is a worm fixed on a spindle at the end of which is a gear wheel having 25 teeth and ¾ inch in diameter, which engages with another gear slightly over 1¼ inches in diameter and having 50 teeth, the distance between the centres of these two spindles being exactly 1 inch. On the spindle with the 50-tooth wheel is a crank with a throw of half an inch, and the other end of the spindle is cranked to form a handle. The crank is for operating the rocker. This completes the mechanism in the gear-box. Reference to the elevation, Fig. 1, and the plan, Fig. 2, should make the construction of the gear-box quite easy.

The Coil Former.

Having finished this, the rocking arm may be made. It is necessary that this arm be very strong, to withstand the strain imposed on it by the taut wire. For this a piece of brass 6½ inches long by 3½ inches wide at the base and 1¾ inches wide at the top is required (Fig 3.) On the top is left a lug, ⅞ inch long, with a hole drilled in the centre and ⅛ inch up it, the purpose of which will be described later. Down both sides of this brass blank a line is scribed, ½ inch from the side, and the resultant strips are both bent upwards. Through the base of these turned-up strips a hole is drilled to take a piece of ⅛-inch steel spindle. Now a bearing is required for the rocker, and will be easily understood from Fig. 4. A pulley will be mounted as shown.

The lug at the top of the rocker is now bent at right angles to the upright, and a strip of brass, 2 inches long by ½ inch wide, is firmly bolted on, but free to swivel, if required, for adjustment. At the other end of this strip a pulley running in a small bracket is fixed and must be free to swivel easily, or, when working, the wire being wound will jump the pulley (*see* Fig. 5). A connecting rod 2½ inches long is fixed to the crank and rocker as shown in Fig. 5. The bearing bracket is screwed to the baseboard by the side of the gear-box but ½ inch in front, as shown in Fig. 1.

The spider former should be ½ inch wide and 1½ inches in diameter. A hole was drilled through the centre, exactly, and a bush wheel secured to it by means of two wood screws, this bush wheel having a set screw to clamp it on the spindle. It now requires to be drilled with 19 equidistant holes of a diameter to suit the spokes to be used. These holes must be absolutely accurately drilled, both radially and vertically. This is almost impossible to do without special appliances. The writer overcame this difficulty after some thought, by the method about to be described.

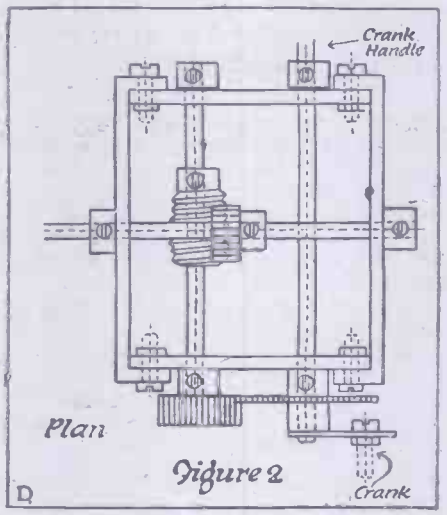


Figure 2

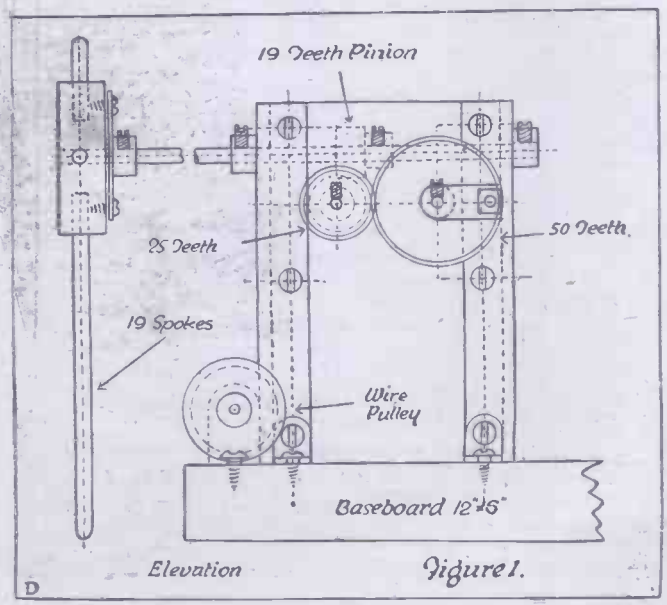


Figure 1.

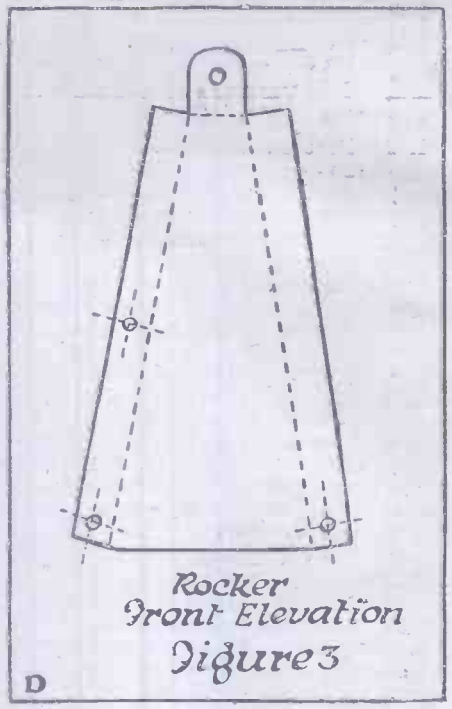


Figure 3

A strong metal frame was made, as in Fig. 6. The spider hub was then clamped on a spindle together with the 19-tooth pinion, and meshing with this pinion is the worm wheel on a cranked handle. Two pieces of brass were soldered on the frame, and a hole drilled through all three thicknesses which will ensure correct alignment of the drill, which should be slightly less in diameter than the spokes. The crank was turned to dead centre (bottom), and a hole drilled. The crank was then turned a complete revolution and another hole drilled, and this was repeated until all 19 holes were completed.

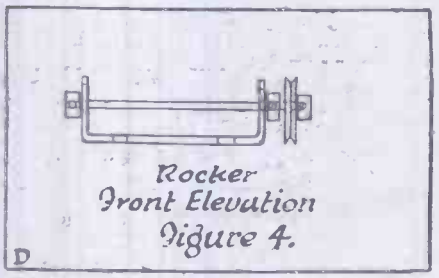


Figure 4.

The drill should protrude just so far out of the chuck as to limit the depth of the holes to ⅛ inch. If this "jig" is carefully made it will enable a perfectly accurate hub to be produced. The spokes used by the writer were of Meccano spindle, 3¼ inches long by ⅛ inch (approx.) in diameter. One end is tapered and the other nicely rounded. A bobbin for holding the wire can be easily constructed, though a spring should be made to press against it to keep the wire taut.

Now let us see how the machine works. The wire is led under the pulley at the base of the rocking arm, over the pulley in the swivelling bracket and twisted twice round one spoke. On turning the handle half a

(*Continued on page 436.*)

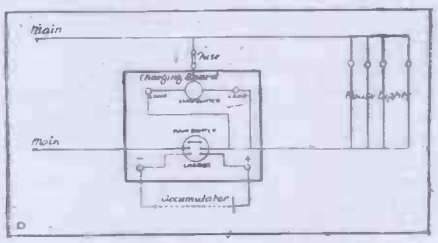
CORRESPONDENCE.

The Editor POPULAR WIRELESS.

Dear Sir,—In a recent issue you had an interesting article on charging accumulators at home from DC and AC. Just lately a good deal of attention has been given to this question, and various methods described for charging from DC all seem to favour resistance in the form of mats, carbon lamps, etc., and while these methods are satisfactory so far as charging is concerned, I have found it most expensive.

I have a 4-valve set which I use, say, 3 hours a night, taking about 2·5 amp., or, say, 8 amp. per night, which has to be put back, 8 amp. × 200 v. — 1·6 units @ 10d. (Bromley, Kent) — 1s. 4d. per day. Unfortunately it was not until I had my quarter's bill, which had risen to £10 instead of the usual £4, that I realised what it was costing to charge with carbon lamps, and it was then I started charging on the following system, which costs me nothing except a little light, and is quite efficient, and I would recommend anyone on DC. to use it.

I found in my house that after dark there were always certain lights on—hall, nursery, etc.—which took just under 2 amps.



I therefore cut the main and wired in a double pole 2-way switch as shown in attached drawing. I also wired two lampholders in which carbon lamps can be put for charging independently of the house lighting.

After using my set in the evening, I connect up accumulator and switch over. This dims the light very slightly, taking 6 volts out of the 200; but it is hardly noticeable, and higher CP lamps could be added if desired. When I take the accumulator off next night, generally after dinner, about 8 o'clock, it is nicely charged. Of course, this is in the winter, and as the evenings get lighter no doubt the carbon lights will have to be used or else a second accumulator. One of the two would then always be on charge, and both when set was not in use. In a large house it might be necessary to take in only a few circuits from the fuse board. It should be remembered that any decent accumulator will stand a short charge at high rate—no doubt mine gets more than its 2 amps. for short periods; but it is in excellent condition, and my quarter's account is down to £4 again.

Yours faithfully,
GUY WILLIAMSON.

Dunedin, London Lane, Bromley, Kent.

To the Editor, POPULAR WIRELESS.

Dear Sir,—I am constantly being asked why it is that Sunday is such an empty day for listeners-in. Before broadcasting was commenced, the public were promised that one of the principal attractions would be an almost continuous programme on Sunday. Quoting from the "Times" of August, 1922.—"The broadcasting service is intended to provide a six-hours' programme every evening, from 5 p.m. till 11 p.m., with the exception of Sunday, when the programme will occupy practically the whole day." As it is, instead of the listeners-in being able to make fuller use of the set on Sunday, there is less doing than on a weekday! Considerably less, as it is not until about 8 p.m. that anything comes through.

It is quite right for some distinction to be made between the matter broadcast on weekdays and Sundays, but, in my opinion, the tendency to overdo this is very marked, and I cannot imagine why a part, at least, of the Sunday programme cannot be in lighter vein. One must remember that all sorts and conditions of people are listening, and that a very small percentage indeed of these prefer, just because it is Sunday, for the selected items to be of a lugubrious or high-brow character.

What is wanted is an interlude of a jolly, rollicking order, clean and bright, that would cheer everyone up, to fill the day (as it was expected it would be filled). It should be possible to broadcast a sermon in the morning, and perhaps a sacred concert at night. A period of the afternoon might well be used for the jolly performance suggested above. Any persons of the Stiggins type, who object to a good hearty laugh on a Sunday afternoon, are, after all, not compelled to listen! Over 90 p.c. of listeners, I am sure, would welcome the brightness such an entertainment would bring.

I am convinced it is only by seeing the vital importance of, by some such means, turning the great army of adverse critics into hearty and contented friends that the B.B.C. can hope to retain the support of listeners, which, obviously, it must have to carry on.

Yours faithfully,
P. MORRIS.

62, Haydon Park Road,
Wimbledon, S.W. 19.

To the Editor, POPULAR WIRELESS.

Dear Sir,—I have made this set (The P.W. super crystal set), but diverged slightly from the original set described. Instead of two sets of tappings the primary is tapped every five turns with a condenser ·0005 in series, also a Dewar switch has been introduced to get either "stand by" or "tune," which also has the advantage of allowing a basket coil to be plugged into aerial circuit to receive the Paris time signals, without introducing a similar coil into the closed circuit.

With this set 2 L O was plainly received at Cambridge, roughly 52 miles, despite the fact that the A.T. condenser was forgotten, so that it was only possible to tune the aerial in steps of five turns. Grimsby, North Foreland, Ostend, and also ships at sea were picked up. The aerial was rather a good one, being 35 ft. high at one end and dropping to about 20 ft. at the house end.

The set is very selective, but adjustments are critical. The detector used was Hertzite with a 40 S.W.G. copper contact.

Yours truly,
H. G. FROST.

22, Crescent Road,
South Woodford, E. 18.

AUTOMATIC BASKET COIL WINDER.

(*Continued from page 435.*)

revolution, the worm turns round once (due to the two-to-one gearing), thus causing the spider to rotate one-nineteenth of a complete turn, and simultaneously the rocker moves forward with the wire. Then another half-revolution causes the rocker to move backwards, thus lacing the wire between the spokes.

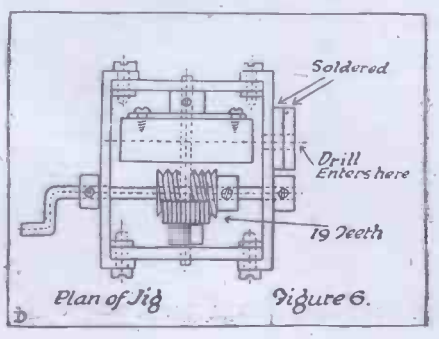


Figure 6.

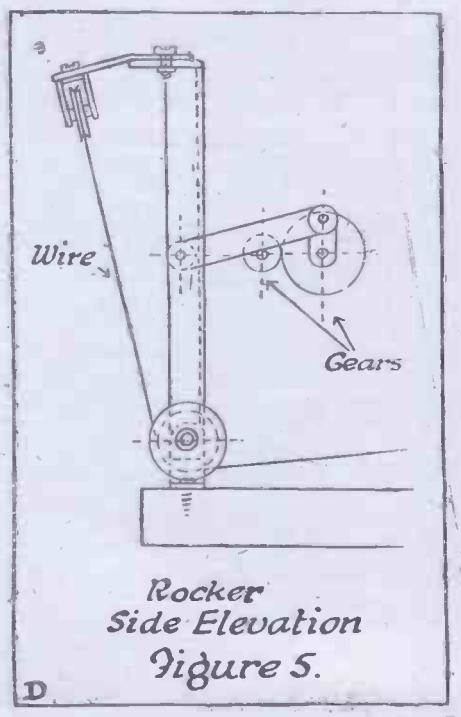


Figure 5.

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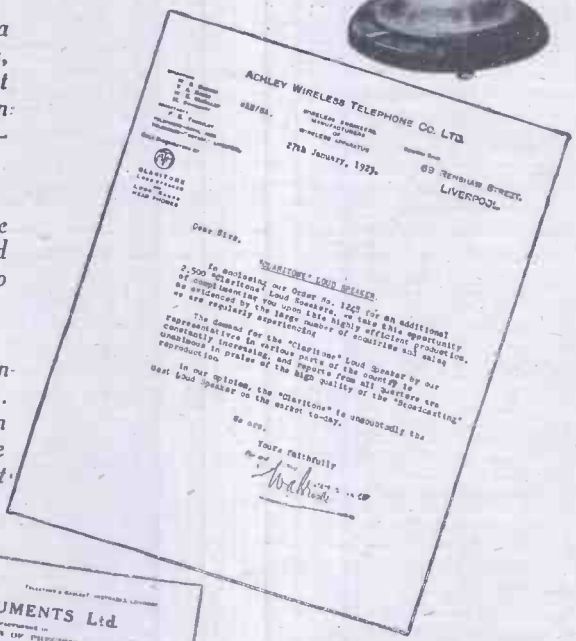

ASHLEY WIRELESS TELEPHONE CO. LTD.

27th January, 1923.

69 RENSHAW STREET, LIVERPOOL.

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"CLARITONE" LOUD SPEAKER.

In continuing our Order No. 1248 for an additional 2,500 "Claritone" Loud Speakers, we take this opportunity of commending the "Claritone" upon its merits, as we have highly efficient products, as evidenced by the large number of enquiries and sales we are regularly experiencing.

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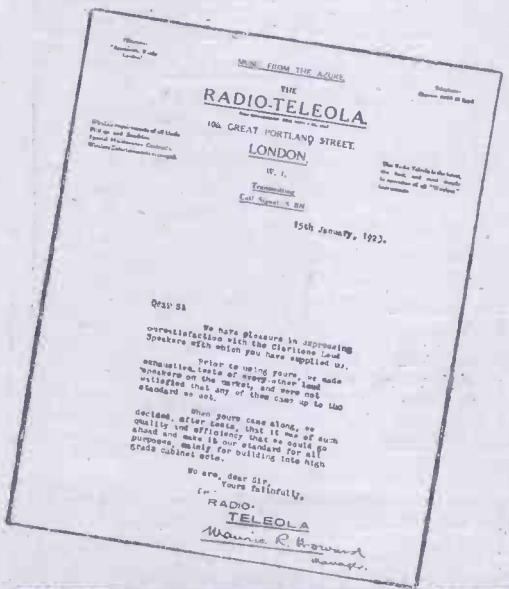
In our opinion, the "Claritone" is undoubtedly the best Loud Speaker on the market to-day.

We are,

Yours faithfully



MUSIC FROM THE AZURE.

THE RADIO-TELEOLA

106, GREAT PORTLAND STREET, LONDON, W. 1.

Telegraphic Address: Call Signal: 5 BH

15th January, 1923.

Dear Sir,

We have pleasure in expressing our satisfaction with the Claritone Loud Speakers with which you have supplied us.

Prior to using yours, we made numerous tests of every other Loud Speaker on the market, and were not satisfied that any of them came up to the standard we set.

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We are, dear Sir,

Yours faithfully,

RADIO-TELEOLA

RADIO INSTRUMENTS Ltd

WIRELESS APPARATUS OF PRECISION

12 HYDE STREET, NEW OXFORD STREET, W.C.2.

15th January, 1923.

Dear Sirs

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It is freer from distortion than any other Loud Speaker we have tried and the adjustment is simple and reliable.

We have no hesitation in recommending this Loud Speaker for use with Wireless Apparatus as it is a thoroughly efficient reproducer of radio telephony.

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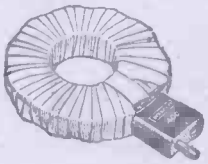

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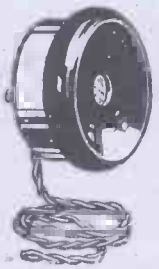

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K9/2000 ohm.	6/- each.	Postage	6d.
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CABINET CONSTRUCTION.

A neat cabinet constructed on the lines detailed in the article will greatly improve the appearance of a "home-made" set. Many listeners-in say, "You've got to pay for the polished case." Well, why not make the case, too ?

IT is the intention of this article to provide a few simple rules for the proper construction of a good cabinet, eliminating as far as possible the necessity of employing expensive tools.

A saw, hammer, and screwdriver are necessary, and a tee-square, foot-rule and a lead pencil. Unless the wood of which the cabinet is to be manufactured is purchased ready "dressed," a smoothing plane with an 8 in. or 10 in. face will be required, and a small hand-drill would also be a very useful addition to the tool-bag.

The wood to be used will, of course, depend upon the pocket and the taste of the individual. The more expensive cabinets are generally constructed of mahogany or

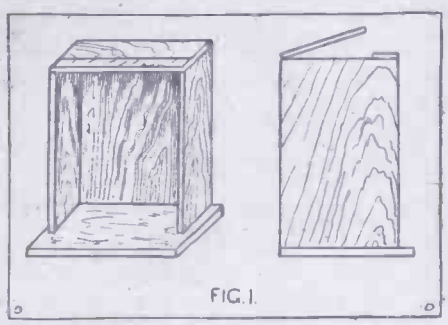


FIG. 1.

oak, and in some cases walnut. A cheaper wood, however, is bass, or "American white wood." If the reader is a novice and intends to make his first cabinet, this wood is recommended. It is easy to "work," and moreover will readily take stains of any shade.

For the average-sized cabinet procure wood about ⅜ in. thick. It is easier to manipulate than heavier material, and at the same time is not liable to split like thinner wood. The base of the cabinet might be constructed from heavier stock, although even this should only have a thickness of about half an inch, and should not exceed three-quarters. Do not judge the amount of wood required promiscuously, but if possible obtain some idea of the quantity needed by a rough calculation before buying. Make allowances for the unavoidable waste that will be entailed in cutting and trueing the several panels to their exact dimensions.

"Cutting to Waste."

It is surprising how much wood is wasted by a saw-cut, especially if one is calculating measurements to a fraction of an inch, and care should always be taken when sawing to a measurement to see that the line followed by the saw is on the outside of the indication by which it is guided. This rule is sometimes known as "cutting to waste." Make allowances for the cover when calculating the width of the back piece and when measuring and cutting the ends. Due allowance should also be made for the thickness of the panel when determining the distance over which the front of the base shall project.

In cutting the panels, remember that it is usual for the grain of the wood to run in the direction of the longest dimension of the panel. If this is not practicable, and the wood is taken haphazard, definite rules must be followed in finishing and trueing up the panels. Take a panel and observe which way the grain runs; then level it with the plane, moving the tool in the direction of the grain. If you are doubtful as to the correct direction, try planing first in one way and then in the other, and the correct direction will soon make itself evident. Mark this side "A," when completed. Do not make the error of setting the plane iron or cutter too deeply—i.e., do not have it projecting too far from the bottom of the plane. It should be borne in mind that the plane is being used for smoothing purposes and not to remove pieces of wood, which, by courtesy, are called "shavings."

Select the end of the panel that appears most square, and take off the farther corner within the waste space with the plane, which should be moved in the direction of the arrow, as shown in Figure 2.

Obtaining That Finish.

Do not forget that the plane iron must be set as finely as possible for this work, as it is necessary to work on "end-grain," and when doing this the plane should be moved forward at an angle and never straight along the edge of the wood.

Always plane towards the prepared corner of the panel, and when that end is squared and true with the first side mark it "B." Attention should now be given to the other end. Remove its corner in the manner described when dealing with the corresponding end, and then mark the length from the first end and plane down to the line, moving the plane as before in the direction of the cut end. To keep the panel square use the tee-square at intervals to make certain that you are planing on the correct level. When this edge has been trued up, mark it "C." The planing and trueing of the one edge left completes the panel, and all the panels should be prepared in a similar manner.

It is possible, of course, to construct a very nice-looking cabinet by using the saw alone, and dispensing with the plane, but such a cabinet will lack the finish obtained by employing a plane, and great care has to be exercised in making the saw-cuts.

A more definite finish can be imparted to the cabinet by bevelling the edges of the base panel with a plane.

If a hinged cover is required, the top panel is sawn down its length at about a distance of 1½ in. to 2 in. from one edge, and the smaller piece is permanently fixed. This adds strength to the whole cabinet.

In putting together the various panels, either nails or screws may be used, and glue added as a final precaution. The length of the nails or screws will, of course, depend upon the size of the cabinet. These will need to be supplemented by two small hinges of a suitable size and also some small device, such as a tiny bolt or hook in the case of cabinets employing a hinged cover.

The edges of the wood should be thinly coated with glue, and this should first be applied to the edges that fit against the side pieces. The two end pieces should then be nailed or screwed into position. If nails are used, they should be driven in at an angle in the manner shown in the illustration.

The narrow top piece should then be placed in position and finally the bottom panel fastened in place.

If screws are used, it is advisable to first bore holes with a hand-drill.

Applying Stain.

In fitting the hinges, mark their position on the wood before attempting to screw them down; then remove the wood in the marked-out space, with a sharp chisel, to the depth of the thickness of the hinge.

This operation is performed on the underside of the cover as well as on the back edge. It is then an easy matter to fit the hinges in position with suitable screws. Now take a coarse sheet of sandpaper and mount it over a block as shown in Figure 3. Use this to remove all blemishes on the surface of the wood, giving the whole panel a final smoothing with a finer piece of sandpaper.

If nails are employed, a punch should be used to drive the heads below the surface of the wood, and the resultant cavity should be filled in with putty.

Stain is then applied either with a brush or a piece of cotton-waste. If an open-grained wood has been used in the construction of the cabinet, and the pores are visible, a filler must be used to obtain the best results, and this can be purchased already prepared in the form of paste. It is easily applied with a putty-knife or any other blunt-edged instrument that will not mark the wood.

The final finish is obtained by applying

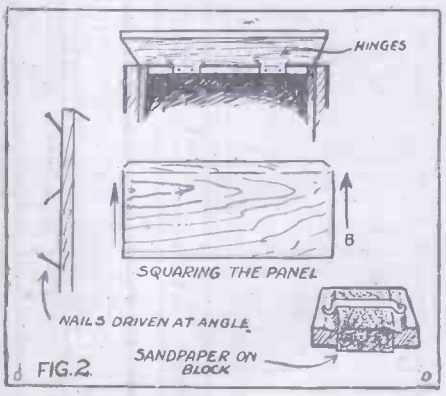


FIG. 2.

thin coats of shellac one on top of the other. It must, of course, be understood that each coat is allowed to dry thoroughly before the succeeding coat is applied. When putting on the shellac, work speedily, for it dries very quickly. Two or three coats are all that is necessary. If a dull finish is desired, go over the second coat with a sheet of fine sandpaper, and give the cabinet a final rub with prepared wax or furniture oil.

A SHORT-WAVE TRANSMITTER AND RECEIVER.

In view of the recent interesting experiments conducted by Marconi in short-wave transmission, this article should prove of the utmost interest to both "listeners-in" and experimenters.

THE wave-length of the transmitter illustrated depends principally upon the length of the system, but this wave-length may, of course, be increased slightly by the inclusion of suitable material. The distribution of energy in the ideal system would be such as to emit a wave the length of which would be twice as long as the oscillator. This would only apply, however, to a free rod in space, and unfortunately practical necessities demand that leads shall be attached to the induction or spark-coil and other parts of the apparatus, and this will be found to lengthen the resultant wave to some extent. The receiver, therefore, will have to be tuned to the transmitted wave by adjustment.

Construction of Transmitter.

In Fig. 1 the transmitter is shown. A wooden handle, R, 12 in. in length, supports two rectangular blocks of insulating material such as bakelite or prepared wood indicated at B. Two "choke" coils, C, are wound upon a ¾-in. diameter fibre tube. The coils are wound with several hundred turns of No. 36 enamelled copper wire. The ends of the winding are taken to terminals to enable them to be connected in series with the oscillator rod and the secondary of the induction coil as shown in the theoretical diagram (Fig. 1A). The rods, K, should preferably be of brass $\frac{3}{32}$ in. in diameter, and each rod shall be 18 in. long.

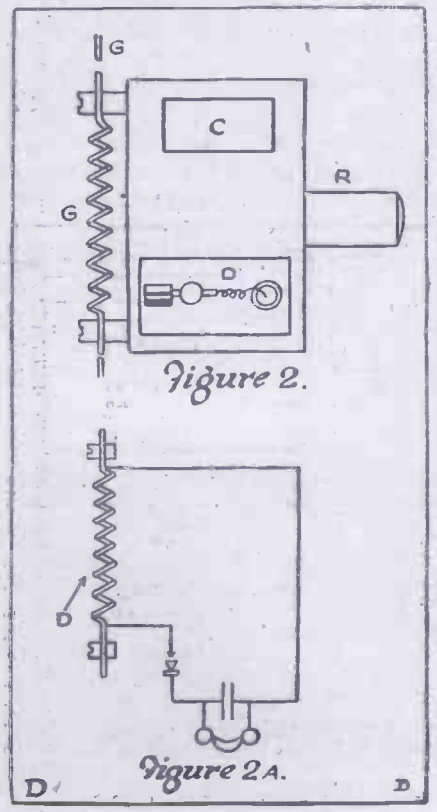


Figure 2.

Figure 2A.

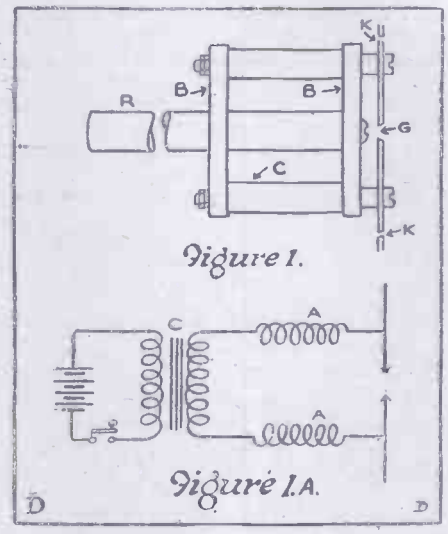


Figure 1.

Figure 1A.

A theoretical diagram of the transmitter is shown in Fig. 1A. Two straight rods of equal length are indicated in the open oscillatory circuit, and are separated by a small gap commonly referred to as the "spark gap." The secondary of the induction coil, C, is then connected in series with two small "choke" coils, A, which in turn are connected—one to each rod—as indicated in the diagram. The primary of the coil is connected across a suitable battery, and the closed circuit thus formed is broken by the inclusion of the transmitting key included in series between the coil winding and the source of supply.

Action of Chokes.

The high-frequency currents generated in the aerial system are prevented from flowing back into the coil windings by the two "chokes" already referred to. The capacity between the coil and the leads is rendered ineffective by the "chokes" retarding the high-frequency currents, which tend to move back into the circuit. Figs. 2 and 2A show the receiver, which, it will be observed, is of the simplest type possible. It must be remembered that in picking up the received signals a minimum of apparatus in the circuit is essential, and, as the radiated energy over a distance is very small, the obtaining of satisfactory signals is by no means an easy matter, and the open rod does not tend to make matters easier at the receiving end, owing to the difficulty of obtaining sufficient potential to influence the detector.

It will be seen from the illustration that a small helical coil of several turns is placed exactly in the centre of the rod. A small fixed condenser of 500 m-mfds. is then shunted across the coil, as shown in Fig. 2A. The condenser in turn is connected in shunt with the receiving telephones.

The Receiver.

The maximum potential distribution is at the extremes of the coil during reception, the centre, therefore, being at zero. It will thus be seen that, by applying this small coil, a sufficient drop to operate the detector is obtained without in any way lessening the effect of the apparatus as an oscillator.

The general appearance of the receiver is better shown in Fig. 2, and is somewhat similar to the transmitter, excepting that an additional base is necessary on which to mount the crystal detector and the small fixed condenser already described.

The rod of the receiving apparatus, G, is of brass 30 in. long, and this includes the coil, B. In actual operation the two instruments will be found critical as regards length, the receiver being shorter, a difference of 1 in. being sufficient to cause considerable alteration in the resultant strength.

A four-valve set built into a small writing bureau by Mr. R. K. Common, 9, Pett Terrace, Stirling, N.B.

EFFICIENT CONTROL OF GRID POTENTIAL.

By THOS. B. HYDE, B.Eng., A.I.Mech.E.

THE efficient working of a valve, either as a detector or as an amplifier, depends upon the grid being at the correct potential, and the smallest departure from this value will result in the signals being very much weakened, if not rendered entirely inaudible.

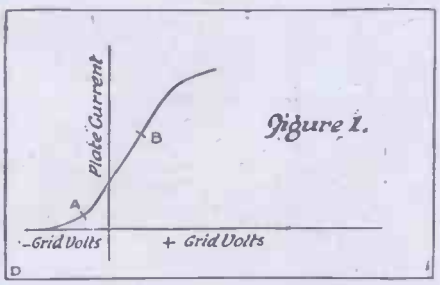


Figure 1.

A brief reference to Fig. 1 will make this clear. The curve shown is a typical valve characteristic—i.e. a curve obtained by plotting plate current against grid volts. In order to work the valve as a detector, the conditions must be those represented by point A; whilst along the straight portion of the curve, say at B, the valve works as an amplifier. Whenever the point A is on the left of the axis it is, quite

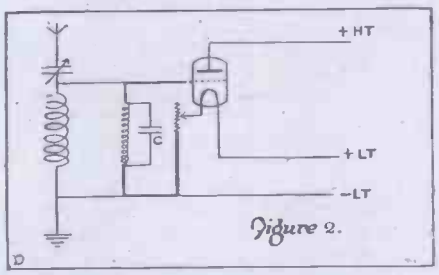


Figure 2.

clear that the grid must be negative, whilst in order to attain the conditions of point B it must be positive.

Use of Grid Leaks.

Now, since the heated filament of a valve emits electrons, which are negative charges of electricity, and since a number of electrons collect on the grid, it is clear that the grid acquires a negative potential in the normal course of working. If the grid were to be

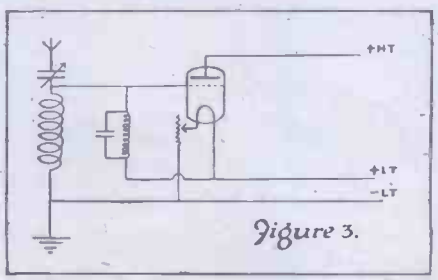
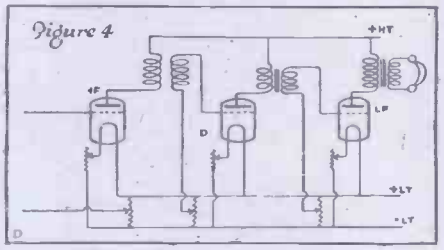


Figure 3.

connected to earth—i.e. to the negative limb of the filament—the charge would leak away so quickly that the grid would never attain its negative potential. Now, we can obviously keep the grid at any potential we desire, between the limits of zero and the potential which would result if no grid leak were used, by controlling the rate at which the electricity leaks away. This we can do by connecting the grid, through a very high resistance, to earth, and the value of this resistance decides the rate of leakage, and hence the resulting potential.

Independent Grid Control.

This arrangement is shown in Fig. 2, the heavy lines showing the grid circuit. The condenser C is put in to enable the high-frequency oscillations to complete the grid circuit. This condenser does not, of course,



have any effect upon the grid leakage which is purely of a direct current nature. Furthermore, its value is not a critical one.

It is clear that, if we are to give the grid a positive potential, we cannot do it by any arrangement of leak, but must employ a battery for the purpose. Diagram 3 shows a method of employing the filament battery to this end. The special feature of this circuit is that the grid is connected, through the leak and condenser, to the *positive* side of the filament battery.

The ideal method of ensuring that all the

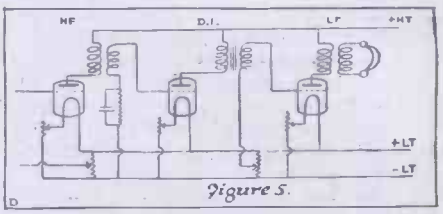


Figure 5.

valves in a set are functioning as efficiently as possible is to use a potentiometer for the grid of each valve. This arrangement, shown in Fig. 4, enables us to maintain each grid at any desired potential within the limits allowed by the filament battery.

A variable grid leak is a very useful piece of apparatus for controlling the detector valve, and Fig. 5 shows a circuit similar to Fig. 4, but using a variable grid leak instead of the second potentiometer.

If all the amplifying valves in a set are exactly similar, they may be worked off one potentiometer.

A FRAME AERIAL WITH AN EARTH CIRCUIT.

IF one hears of an amateur who is constructing a frame aerial for use with a crystal set, one is fairly safe in assuming that such an amateur is, to say the least of it, very "amateurish" indeed. The use of frame aerials with single valve sets is also generally condemned.

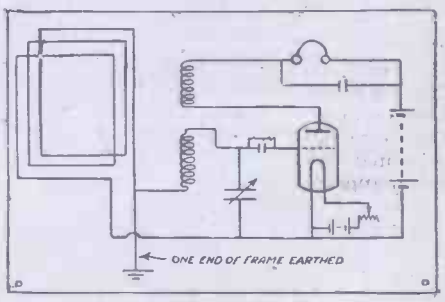
The diagram of the one-valve set shown in the illustration has, however, been specially designed for use with a frame aerial and is unique in design in that one end of the frame winding is connected to earth. This is admittedly a disadvantage when considering the results which can be obtained by making use of the directive properties of a frame aerial to obtain selectivity in tuning.

Tuning Is Sharp.

The generally increased efficiency of the circuit obtained by connecting one end of the frame winding to earth is claimed to outweigh this drawback, and, therefore, to give better all-round results.

As a frame aerial cannot compare with an aerial of the "open" type as an absorber of energy, reaction is employed in order to counterbalance to some extent the comparatively poor absorption of radio energy. Tuning is extremely sharp, thus necessitating very fine adjustments. These are obtained by means of a Vernier condenser connected as shown, and it is also as well, if possible, to use a Vernier rheostat.

The construction of a set of this nature should undoubtedly prove popular to those many amateurs who have no facilities for erecting a satisfactory outside aerial of the ordinary "line" type, or who, for any other reason, are not disposed to incur the expense of elaborate "out-of-door" fittings.



To conclude, perhaps a few hints on the construction of the frame itself will prove useful. For the reception of broadcast telephony a four-foot square frame is a suitable size. This may seem large when constructed, but it should be remembered that the sensitivity of a frame aerial increases with an increase in size. Five complete turns of 24 S.W.G. spaced ¼ in. will suffice with a variable condenser not of a greater value than ·0005 mfds.

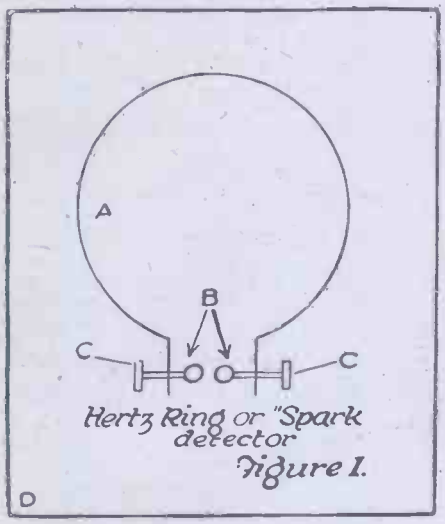
A SHORT HISTORY OF WIRELESS RECEPTION.

By SEXTON O'CONNOR.

An interesting account of the progress of the search for sensitive detectors commencing with the coherer and culminating in the invention and improvement of the thermionic valve.

HERTZ first produced ether waves of the kind now used in wireless by discharging a condenser through a spark gap. This device he called an "oscillator." To detect the presence of these waves, he employed a metal hoop or ring with a small opening, in which were fitted two small balls, B, as shown in Fig. 1. The distance apart of the balls could be adjusted by micrometer screws, C. This he called a "ring resonator."

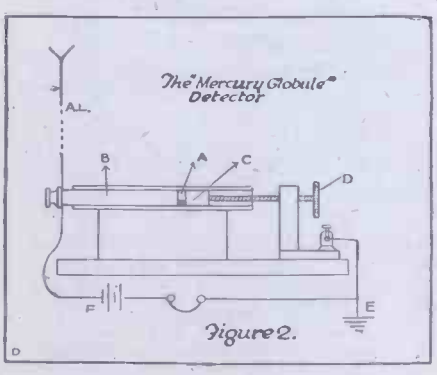
When the resonator was placed some distance away from the oscillator, minute electric sparks passed between the two balls



B, showing that electric energy of some kind or other was passing to the ring across the "space" separating it from the oscillator. This combination, in fact, formed the first wireless transmitter and receiver. It was certainly very inefficient—the range was only a few yards at most—but it contained the germ of modern wireless signalling.

The Coherer.

Incidentally, the ring resonator was the forerunner of the present "loop aerial" or "direction-finder." Sparks appeared between the balls B only when the plane of the ring pointed directly towards the oscillator. They disappeared if the ring was turned round through a right-angle. It is obvious that this effect could be used to discover the location of an invisible "oscillator."



Marconi first used his upright or elevated aerial in 1896, and in four years of steady progress increased the range of wireless signalling from a few yards to hundreds of miles. For such distances the ring resonator was useless, and a more sensitive instrument had to be found.

The first detector to give successful results over comparatively long distances was the "coherer," the peculiar properties of which were first discovered by a French professor, Branly by name. It consisted simply of a glass tube filled with loosely-packed metallic scraps or filings.

Some Ingenious Types.

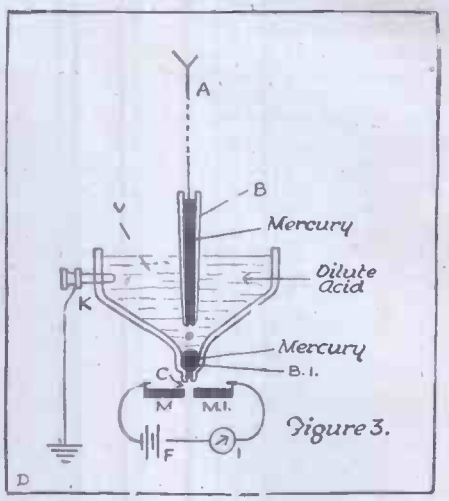
In the ordinary way such an arrangement, if placed across the poles of a small battery, will form a perfect insulator. The small air spaces between the adjacent particles of metal possess sufficient resistance to prevent any passage of current. However, if ether waves from a distant transmitter are caused to act upon the mass of filings, the insulation of the air spaces is broken down, and the instrument, for the moment, becomes a conductor and allows a pulse of current from the battery to pass. By using this current to operate a telephone, magnetic needle, or similar device, the receipt of wireless signals can be indicated.

A serious drawback to the use of the coherer in actual practice lay in the fact that after the first impact of ether waves the filings became insensitive to further signals. Marconi succeeded in removing this defect by the use of an ingenious "tapping device" which "shook up" the filings regularly after each signal. In this improved form he inserted the coherer directly in series with his receiving aerial, and in parallel with a local circuit containing a battery and indicating device, and so obtained satisfactory signals over long distances.

Another interesting type of coherer used in the early days is shown in Fig. 2. A tiny ball, A, of mercury, about a millimetre in diameter, is held in a glass tube between two plugs—one, B, of carbon; the other, C, of metal. The part C is adjusted by means of a screw, D, until the mercury drop is just barely in contact with the ends of the two plugs. A local battery, F, in series with a pair of telephones, is placed across the instrument, which is then inserted directly between the aerial lead-in, AL, and the earth lead, E, as shown.

When properly adjusted a very faint continuous hissing is heard in the 'phones, changing to a sharp "crackling" sound of long or short duration, according as the Morse dots or dashes are being received.

Fig. 3 shows an ingenious example of another type of detector which depends upon an electrolytic—or, rather, electro-capillary—effect. A vessel, V, contains dilute acid. Dipping into the acid is a fine glass tube, B, kept filled with mercury by

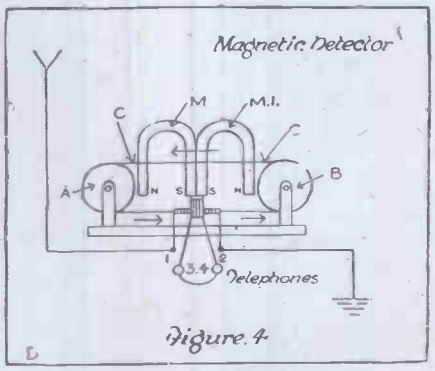


means of a suitable syphon arrangement (not shown in the drawing). At the bottom of the vessel V is an orifice, C, so narrow that mercury will not normally flow through it.

A Mercury Detector.

The end of the tube B is equally narrow, but a certain amount of the fluid is first forced through under pressure to form the "blob" of mercury marked B1 at the bottom of the vessel V. The aerial lead-in A dips into the mercury contained in the tube B, whilst the earth lead is joined to a terminal K in contact with the dilute acid.

Once these adjustments have been made, an electric current coming in at A and flowing through the mercury column and acid and out to the earth lead has the curious effect of lessening the surface



tension of the mercury at the extreme end of the tube B, causing a small globule of mercury to fall. The impact of this on the blob of mercury B1 in turn causes a corresponding small portion of the latter to issue out of the bottom orifice C. This second drop falls between two strips of metal, M, M1, and "bridges" the small gap between them, so that a momentary current can flow in the local circuit containing a

(*Continued on page* 444.)

A SHORT HISTORY OF WIRELESS RECEPTION.

(*Continued from page 443.*)

small battery, F, and a pair of 'phones or an indicating needle, I.

Following these early types of receiver we come to a much more efficient instrument known as the magnetic detector. The action of the magnetic detector depends upon the fact that, when a bar of soft iron is magnetised by passing a current through a wire coiled about it, the full state of magnetisation so created lasts only for as long as the current is flowing. There will remain, however, a certain degree of magnetism after the exciting current has been stopped, but this "residual" magnetism is of a peculiarly unstable character. It will, for instance, disappear if the bar is dropped or struck violently. Also, it is found to be affected by the passage of high-frequency currents such as those used in wireless.

Origin of the Crystal Detector.

The form of apparatus as patented by Marconi in 1902 is shown in Fig. 4. A bundle of fine insulated iron wires is made up into an endless band, C, which is moved by means of two rotating pulleys, A, B, in the direction of the arrows, slowly past the pole pieces of a pair of magnets, M, M1, having similar poles placed next to each other.

As the wire nears the first magnet, it becomes magnetised in a certain definite direction. The second magnet, however, being of opposite polarity, tends to destroy —or, at least, to *reverse*—the direction of the first magnetisation. The result is that

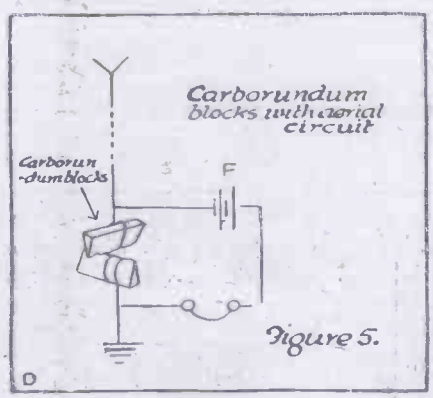


Figure 5.

whatever magnetisation remains is left in a very sensitive or "highly strung" condition.

If, when the band is in this state, signal currents received by the aerial are led through the coil shown connected to the terminals 1, 2, they act as the "last straw," and either wipe out the magnetisation entirely, or else swing it all into one definite direction. In either case they disturb the distribution of the magnetic lines of force which are threading through the secondary coil (joined to the terminals 3, 4), and in so doing send a short "click" of current through the 'phones. As the band is continuous, and fresh portions are continually passing across the pole-pieces of the magnets M and M1, the device is always "receptive" or ready for action. Unlike the coherer, it requires neither "shaking-up" nor a local battery.

Crystals did not come into use as wireless rectifiers until about the year 1906. General Dunwoody, of the American Army, was apparently the first to describe the use of carborundum for this purpose. In one arrangement he employed two pieces of the crystal having sharp edges in contact, as shown diagrammatically in Fig. 5. In another he used the crystal in contact with a steel needle as in Fig. 6. As will be seen, the original circuit arrangements were somewhat different from those now in use, the detector being placed directly in the aerial circuit, and being shunted by a local circuit containing a battery and a pair of 'phones. Carborundum, it should be explained, is the trade name of an artificial compound of silicon and carbon, made by fusing these substances together in an electric furnace.

Introduction of the Valve.

Closely following upon the use of carborundum came the discovery that other crystals such as perikon (copper pyrites or chalcopyrites, and zincite or zinc oxide), manganite, pyrolusite, silicon, galena, and many others would also act, with varying degrees of sensitivity, as rectifiers or detectors of wireless signals.

Finally we come to the thermionic valve, which has practically replaced all other forms of detector, with the exception of the crystal (for short ranges).

The valve was first invented by Professor Fleming in 1904, but did not, in fact, come into general use as a detector until the addition by De Forest in 1908 of the grid or third electrode. In this form it rapidly developed into the most sensitive receiver known. No other device is capable of detecting, and at the same time strengthening or relaying, high-frequency currents such as those used in wireless.

And then, Regeneration.

The introduction in the year 1913 of the principle of regeneration, or, as it is sometimes called, "reaction" or "back-coupling," endowed the valve with still more remarkable powers both as an amplifier and as the perfect generator of continuous oscillations for heterodyne reception.

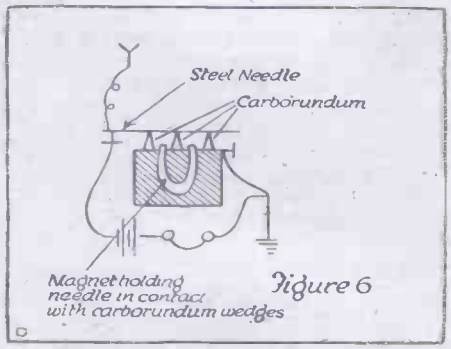


Figure 6

It only remains to be added that within the last year Armstrong has succeeded in upsetting and surpassing all previous valve records by the use of his amazing discovery of the method of "super-regenerative" reception.

USEFUL HINTS.

Crystals should be handled as little as possible, as the natural grease from the hands is liable to make them insensitive. Where the crystal is unenclosed it should be regularly dusted with a fine camel's-hair brush.

* * *

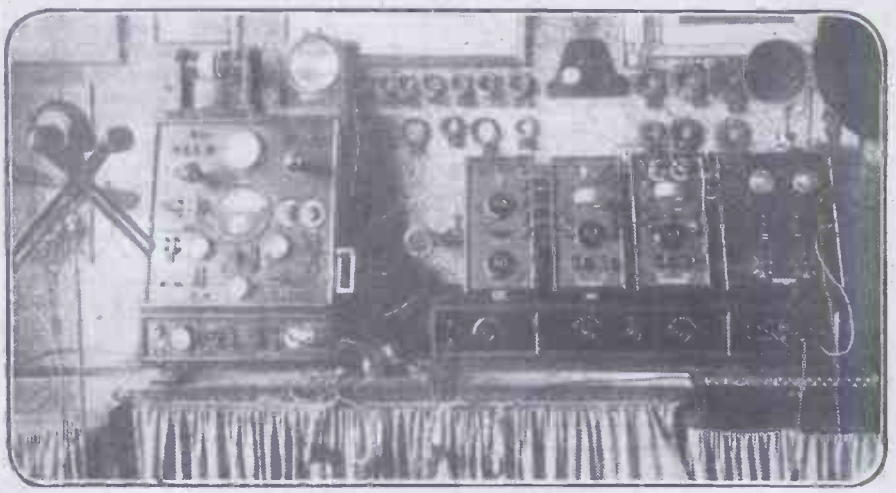
An H.T. fuse should find a position on every experimental set. There is nothing more exasperating than the sudden flash that denotes that your valve filaments come into contact with the H.T. battery. A 2·5 volt pea lamp forms an excellent fuse.

* * *

Magnesium ribbon cut to a point makes a good catswhisker, and works very well in conjunction with hertzite.

* * *

A good way of marking the terminals on the ebonite and saving the expense of ivorine tablets is with rubber stamps and Chinese white thinned down with turpentine. If this is spread evenly over the type with a knife and the stamp pressed gently in the correct place on the panel, regular letters will result.



2 K O, the well-known amateur station controlled by Mr. C. S. Baynton, of 48, Russell Rd., Birmingham.

SHOULD PLAYS BE BROADCAST?

By "ARIEL."

An important controversy concerning the broadcasting of theatrical productions has been interesting "listeners-in" for some time. Miss Sybil Thorndike, the greatest living actress of the day, gives her views on this interesting question.

JUST now wireless is passing through a stage of development which might be described as "feeling its feet," or finding a place in the realm of public amusements, and, in doing so, provoking unrest, consternation, and fear among its brethren in the entertainment world as a new and possibly serious rival.

Theatrical producers and musical providers are beginning to look upon the broadcasting of plays, operas, and concerts as an encroachment on their preserves, which may result in a considerable reduction in their box-office receipts. Quite recently a meeting was held in London of representative theatrical managers, authors, and actors, and a resolution was passed against the broadcasting of plays, music, songs, etc., as being "gravely prejudicial" to their interests.

Miss Sybil Thorndike.

There are some managers and artistes who take an opposite view, and are inclined to regard broadcasting as a splendid advertising medium for their shows. In order to give to readers of POPULAR WIRELESS the opinions of various well-known personalities of the theatrical profession, the Editor of this journal has asked me to call upon some of our leading actors and actresses, inviting them to say what they think about the broadcasting of entertainments to the public. So it came about that I called upon Miss Sybil Thorndike at the Criterion Theatre just after a matinée performance of "Advertising April," which is now touring the provinces with this famous actress.

Greatest Advertising Medium.

"What do you think about broadcasting as an entertainment?" I asked.

"As a novelty I think it has caught on wonderfully," she replied. "But, of course, I cannot believe that it will ever quite take the place of seeing the actual show, of which it only gives a part, and that not always the most important—I refer to that which appeals to the sense of hearing."

"Then you do not fear a possible falling off in theatre goers if the public can 'listen-in' to theatrical performances?"

"Quite the contrary," was the reply. "It would probably be the greatest advertising medium that we have ever known. You see, only a very small portion of the play or opera could be broadcast in an evening—just enough, you know, to whet the appetite, and if the public like it they will flock to see it."

"If broadcasting of theatrical performances would be so good an advertisement to producers, would it not be more fitting that the producers pay the broadcasting company for the privilege of this advertisement, instead of the producers themselves being paid?" was my next question.

"I am afraid I am not qualified to give an opinion," answered Miss Thorndike with a smile. "That is a matter for producers and the broadcasting company to decide for themselves."

The Theatre's Lure.

"What is your reason for thinking that broadcasting will not affect the welfare of the theatre?" I asked.

"There is more than one reason. For instance, there is the acting itself, the personality of the player, the setting, the glamour of a well-filled house, and the pageantry of pretty gowns from the women's point of view, which is not altogether lost on the male fraternity."

"Well, do you think that broadcasting would improve theatre booking?"

"Certainly, if the broadcasting advertised the play. I have been told that following upon the broadcasting of 'Polly,' when it was at the Kingsway Theatre, the booking showed very healthy signs."

"Are you of opinion that theatrical managers should be allowed to select what part of their productions should be broadcast?"

Continued "In Our Next."

"Of course, the producer should have the power to decide what part of his show should be broadcast. This is obviously essential in the case of plays where the dénouement must not be disclosed indiscriminately. Take 'The Bat' as an example of what I mean. It would ruin the enjoyment of seeing the play if scraps of it were broadcast without any regard for the plot. But, if handled properly, and an extract were chosen something after the manner in which a popular serial story in a magazine is continued 'in our next,' then the 'listener-in' would be anxious to see how the hero gets out of his dilemma as the magazine reader would be impatiently waiting for the next instalment of the exciting serial."

Unfortunately, it was at this juncture that Miss Thorndike was called away and brought an end to our very interesting conversation on the stage and broadcasting.

A SIMPLE MICROPHONIC AMPLIFIER

THE amplifier about to be described was completely self-contained in a cigar-box, 8 in. by 5 in., and has given good results where signals were quite faint. The component parts, including dry cell, cost exactly 2s. 4½d. The components are three carbon rods, of the solid not the cored variety, two large terminals, dry cell, and a length of flexible copper wire about 1 yard long.

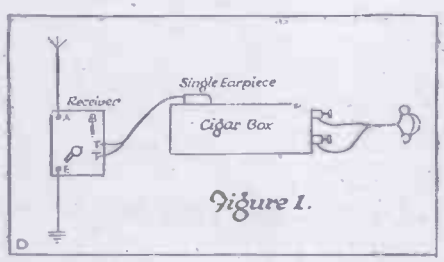


Figure 1.

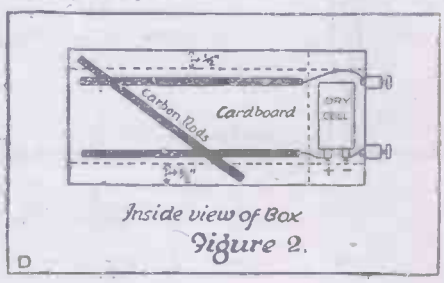
A large hole, big enough to allow a single telephone earpiece to fit in tightly, was first cut in the lid. Two pieces of ½-in. square wood were glued at the opposite ends of the box, to fit in exactly into the box lengthwise (see Fig. 2), and about ½ in. from the bottom. A piece of thin cardboard was next glued to the ½-in. wood, but enough space was left to contain a 4-volt dry cell.

The ends of two of the carbon rods were copper-plated in the following manner: An ounce of copper sulphate was procured at the chemist's, dissolved in a small bowl of water, and a few drops of sulphuric acid added. A piece of copper foil is then connected to the positive terminal of a 2 or 4-volt battery, and the carbon rod to the negative terminal.

The copper was placed in the prepared solution, and the end of a carbon rod was dipped in. After a few minutes a deposit of copper appeared, and both carbon rods were treated thus. A short length of copper wire was then soldered to the plated ends of the carbon rods, and one was connected direct to one of the terminals fixed in the side of the box, and the other one to the positive terminal of the battery, and the negative terminal to the other terminal in the side of the box. Then the third rod was laid across the two.

The single earpiece was connected to the 'phone terminals of the receiver, and then fitted tightly into the hole in the lid. The two terminals in the side are for the headphones.

A complete diagram of the amplifier is shown in Fig. 1.



Inside view of Box

Figure 2.

WIRELESS TELEPHONY TRANSMITTERS.

By SEXTON O'CONNOR.

Describing the interesting stages through which wireless transmission passed, from the simple spark to the wonderful telephony systems of the present day.

THE manner in which "spark" messages in the Morse code are sent through the ether is generally "pictured" by making reference to the ripples set up or across the surface of water by a falling stone. To make the analogy complete, one must imagine a number of stones dropped at regular intervals, of which, say, ten are necessary to give a Morse "dot," whilst twenty go to make a "dash." In the interval between the dot and dash no stone is dropped, and the ether for the moment is undisturbed. Moreover, even during the actual time when signals are being received, the ether waves do not extend in an un-

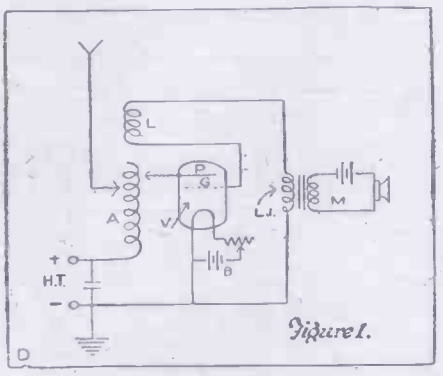


Figure 1.

broken chain from beginning to end of their journey.

The frequencies involved are so tremendous that successive groups of ripples do not follow hard on each other's heels. In actual fact each group is separated by a tenfold distance of undisturbed ether. Such a method of transmission is not capable of carrying speech or music. Before the transmission of telephony can be attempted, it is necessary to set up in the ether a continuous chain of "carrier" waves, which extend in an unbroken line from transmitter to receiver. In other words, just as there is a conducting wire between two persons using the ordinary line telephony, so there must be a "special" connecting link in wireless telephony. The ether itself is, of course, in one sense such a link, but if parts of this are quiescent, prolonged sounds or notes, such as those which form speech or music, will not bridge the "tranquil" gaps, and therefore will not get through to the distant receiver.

Simple Valve System.

Before the discovery of the "oscillating" valve, the only means of conversing by wireless lay in the use of the Poulsen Arc, special high-frequency alternators, and similar generators of "continuous oscillations," none of which, however, proved so successful or convenient in operation as the valve.

Fig. 1 shows a single-valve telephony set, which clearly illustrates the simplicity of the apparatus now used to throw the human voice across the barriers of space.

The plate P of the valve V is connected to the positive pole of a dynamo or other source of high tension through the aerial coil A. There are two coils, L and L 1, in the grid circuit. The coil L is placed near—i.e., is "coupled" to the aerial coil A—whilst the other coil, L1, is linked with a microphone circuit. As soon as the valve filament is lit from the battery B and the plate P connected up to the high tension, the interaction that takes place between the coils A and L causes the valve to produce a continuous flow of oscillatory currents. These are fed into the coil A, and set the aerial "alive" with surging energy which spreads outwards as an unbroken flow of ether waves.

This flow continues incessantly whether the microphone is spoken into or not. However, once the "connecting line" has thus been set up, the transmission of speech becomes possible.

Detailing Modulation.

The effect of the voice on the microphone is to create variations in the strength of the current flow in that circuit. These fluctuations are passed into the coil L1 and reappear as changes of potential on the grid. When the grid is thrown positive more current is fed into the aerial coil A by the plate. When the grid is thrown negative the supply of current to the aerial is diminished.

The result is that, whilst the aerial is never actually quiescent, it oscillates at times more strongly than at others, the controlling factor being the voice at the microphone. Instead, therefore, of a steady output of uniformly shaped waves being radiated from the aerial, these now give place to an unending supply of irregularly shaped waves,

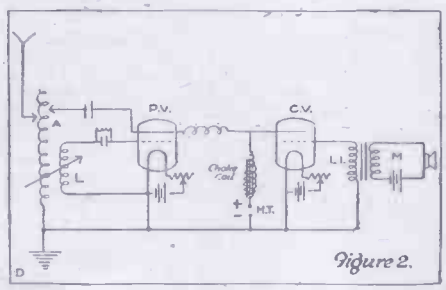


Figure 2.

the irregularity arising from the varying "strength" of the supply current.

If, for example, the note "doh" of the tonic scale is sung softly into the microphone, the strength of the original "carrier wave" is varied at a constant *rate* corresponding to the "pitch" of that note. If the same note is next shouted into the 'phone, the carrier wave is again strengthened at the same rate but to a greater *degree*, giving the effect of varying "loudness." When, however, the voice is changed to the note "soh," the intervals between the "strengthened" portions of the carrier wave are shortened to a *quicker rate*, thus giving the higher "pitch."

The quality or "timbre" of the voice and the difference between vowels and consonants is reflected in the varying *outline* or *shape* of the "strengthened" portions of the radiated waves, as distinct from the *rapidity* with which they follow each other or the degree of their strengthening.

Separate "Control" Valve.

The carrier waves when so altered by the voice at the microphone are said to be "modulated." They are "picked up" in this form by the aerial at the receiving end, and the effect of the detecting crystal or

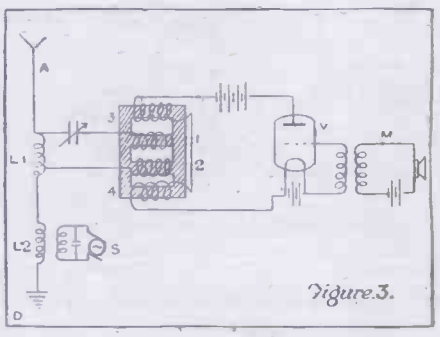


Figure 3.

valve is to sift out or separate the various irregularities, and convert them back into the same sounds as those from which they originally sprung.

A somewhat more efficient form of telephony transmitter is shown in Fig. 2. Here the regular and continuous "carrier" wave is fed into the aerial from the plate circuit of the oscillating or power valve marked PV. The microphone circuit M is in this instance linked with the grid circuit of an amplifying or control valve marked CV. The original speech currents from the microphone are accordingly passed through the amplifier before being utilised to regulate the strength of the output from the power valve into the aerial.

The Choke Coil.

Passing from the plate of the valve CV they attempt in the first place to flow through the "choke" coil shown on the drawing. This, however, refuses to pass them, and throws them back in the shape of voltage variations on to the plate of the power valve.

As the effect of increasing the voltage on the plate of a valve is to enlarge its output of current, the result of the action of the "choke" is to cause the valve PV to feed more or less energy into the aerial circuit in sympathy with the amplified speech currents, thereby securing the same result as in the previous example.

Fig. 3 shows a distinctly ingenious method of transmitting speech or music. In this case the "carrier" wave is supplied to the aerial from a separate valve or other generator marked S.

Every B.B.C. Station from London to Glasgow.

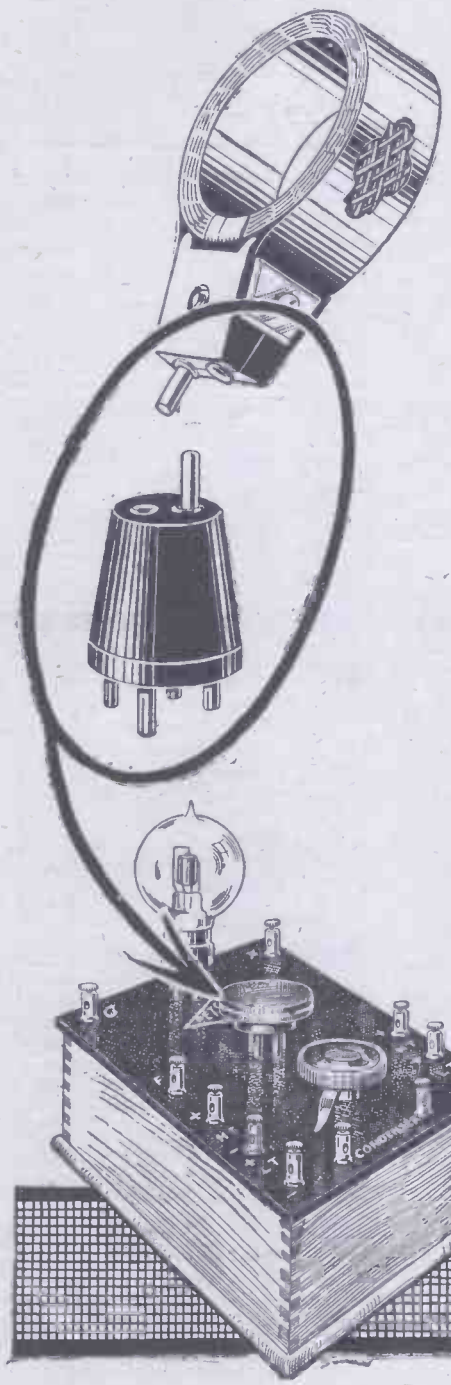
South Coast Amateur gets some remarkable results.

Hastings, Sussex.
15.4.23.

Dear Sirs,

Sometime ago I purchased from you one of your All-In Series No. 4a Set of Parts and I am receiving such wonderful results using a single valve set. I am able to receive concerts from all the British Broadcasting Stations, they are 2 L O, 5 N O, 2 Z Y, 5 I T, 5 W A, 5 S C, and the School of Posts and Telegraphs, Paris, all these are loud and clear. I must say that receiving concerts from 5 S C, Glasgow, is wonderful for a single Valve Set. I sent a letter to the Glasgow Station stating that I was receiving their concerts on a Single Valve Set, and also a copy of the programme which I received. I have had a reply from them saying that my set must be very efficient. I must say that your Grid Condenser and Leak you supplied me with, with the No. 4a Set of Parts, is great.

I remain,
Yours truly,
W. G. SAUNDERS.



IN Wireless Instruments, as in everything else, quality is sure to be the predominant factor eventually. Before finally deciding upon your new Set—or if you have already experienced disappointment—ask yourself this question. *"Has it a proved record of Guaranteed Service?"* Peto-Scott Instruments were designed and sold long before Broadcasting started. Thousands of experimenters up and down the country have proved their worth and wonderful value, as their letters to us have testified.

Remember—if you start with Peto-Scott Standardised Radio Units you commence with a proper *System*—one which will permit of ready expansion according to the length of your purse and capacity for gaining experience and knowledge.

If you would know more about this method which enables an enthusiast to build up at home a first-class Receiving Set, employing one to five valves at a figure very much below ready built Sets, send 6d. for a copy of "Radio," our new Booklet, explaining the whole system.

Price List of Units

(in sets of parts ready for home construction).

No. 1 Tuner Unit	27/6
No. 2 Condenser Unit ..	42/-
No. 3 H.F. Amplifying Unit	13/6
No. 4 Detector Unit ..	17/6
No. 5 L.F. Amplifying Unit	33/6
Cabinets for 1, 3, 4 and 5 ..	3/6
Cabinets for No. 2	7/-
Catalogue of all Radio Components, 32 pp.	3d.

Postage 9d. per Unit extra, but paid on all orders of £2.

The Tunode Plug

(Registered Design.)

An exclusive feature of Peto-Scott Units is their versatility. For instance, the High-Frequency Amplifying Unit shown here permits a choice of three different methods without altering a single connection. Resistance capacity, transformer or tuned anode can all be used.

For the tuned Anode circuit, use this **Tunode** Plug and any plug-in Coil. Without any trouble, you then have a very selective and sensitive Amplifier which will enable you to receive music and speech over much greater distances and without fear of interruption.

The price of this **Tunode** Plug is **3/6**
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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.

Stafford Y.M.C.A. Radio Club.

A wireless club which has been formed at the Y.M.C.A., Stafford, has now become firmly established with a membership of forty. The meetings are held each Friday evening at 8 p.m., when lectures and demonstrations are given. All radio amateurs residing in the district who are interested in the society are invited to write to the secretary for full particulars. It is proposed during the summer months to conduct experiments with portable sets, and use the headquarters of the club as a transmitting station.

Hon. sec., F. Flatman, Y.M.C.A., Victoria Road, Stafford.

Redditch and District Radio Society.

At the meeting on Friday, March 2nd, Morse practice was continued. Good progress is being made, and a good reading speed should soon be attained. The first two valves of the receiving set under construction by the society were temporarily assembled for the evening, the London and Birmingham concerts being successfully brought in.

Hon. sec., C. E. Chamberlain, 98, Beoley Road, Redditch, Worcs.

Liverpool Wireless Society.

A meeting of the above society was held on Thursday, the 22nd inst., at Royal Institution, Colquitt Street, at which the president, Professor E. W. Marchant, D.Sc., gave an exceedingly interesting lecture on "Methods of Reducing Interference in Wireless Receiving Sets." The lecturer explained diagrammatically several circuits designed specially for the elimination of atmospherics and interfering signals. A set made on the Hinton circuit principle admirably demonstrated to the meeting the selectivity of this circuit.

Hon. sec., G. H. Miller, 138, Belmont Road, Anfield, Liverpool.

Middlesbrough and District Wireless Society.

A very successful wireless and electrical exhibition was held at Dorman's Assembly Room between February 26th and March 3rd, 1923. The proceedings were opened at 6.30 p.m., on Monday, February 26th, by the Mayoress (Mrs. Stanley Sadler), supported by his Worship the Mayor, in the presence of a large number of people.

Apparatus was exhibited by various firms, who gave demonstrations daily in addition to the demonstrations by the society. Several new members were elected during the week of the exhibition.

A meeting was held on Monday, March 19th, Mr. E. A. Pryer in the chair, and after the business of the evening, the chairman called on Mr. Chas. Thowliss for his paper on "Aerials," which was most interesting and very acceptable to the recently enrolled members. An interesting discussion followed, when many items were brought up for consideration. Mr. Gerrard then gave a demonstration on his home-made set.

Hon. sec., Mr. Frank King, 45, Queen's Road, Linthorpe, Middlesbrough.

Hackney and District Radio Society.*

At the meeting held at the Y.M.C.A., Mare Street, Hackney, on Thursday, 5th April. Mr. Bell, who has presented the frame of a frame aerial to the society, demonstrated the wiring of the same, and some excellent signals were received on the society's set by means of the frame aerial.

On the 10th of May a lecture will be given by Mr. L. L. Robinson, M.Inst.C.E., M.I.E.E., M.I.Mech.E., Hackney Borough Electrical Engineer, on "Electrical Currents, Minute and Large."

Hon sec., Mr. C. C. Phillips, 247, Evering Road, E.5.

Sale and District Radio Society.

The official opening and exhibition of the new society headquarters took place on Saturday, April 7th. The exhibition was divided into two sections: One a show of apparatus entirely the work of amateurs, and the other of sets and parts by well-known local dealers, though a somewhat crowded attendance at night made the task of a general inspection rather difficult.

The section for amateurs was large and comprehensive, and included examples of work by Mr. J. R. Burne, winner of last year's transatlantic test. Mr. Burne (2 K W) showed a seven-valve set made by himself; and Mr. Lewis (2 W K) a complete transmitter and six-valve receiver which he himself had made from the raw material.

The secretary will be pleased to welcome anyone wishing to join the society, in either the adult or juvenile sections.

Hon sec., Mr. H. Fowler, "Alston," Old Hall Road, Sale.

The Radio Society of Bradford-on-Avon.

The village of Broughton Gifford enjoyed a new experience recently, when a few members of the above society went there by request to give a demonstration of radio reception.

A four-valve receiver was used (the property of the society), also a Brown's microphone amplifier, and a Western Electric loud speaker.

Hon. sec., H. Helps, 4 Ivy Terrace, Bradford-on-Avon, Wilts.

WIRELESS IN SUMMERTIME.

£5 FOR A PRACTICAL SUGGESTION.

Interest in wireless is without doubt universal at the time of writing. But with the approach of summer and longer daylight hours, some people are inclined to the opinion that broadcasting will wane until the autumn. There is no real reason why this prediction should not prove to be wrong, and POPULAR WIRELESS offers a prize of £5 to the reader who sends in the best postcard suggestion for keeping up a steady interest in wireless throughout the summer.

The Editor will also be pleased to give careful consideration to any articles from readers who can offer practical suggestions as to how wireless broadcasting can be utilised by the average listener-in while out of doors. Articles should not exceed 750 words in length, and diagrams, if any, need only be drawn in rough.

More than 100,000 people purchase a copy of POPULAR WIRELESS every week, and doubtless many bright ideas will pour in when this offer is read; but every contribution will receive the individual attention of the Editor, and the more entries the better.

Postcards should be addressed to—

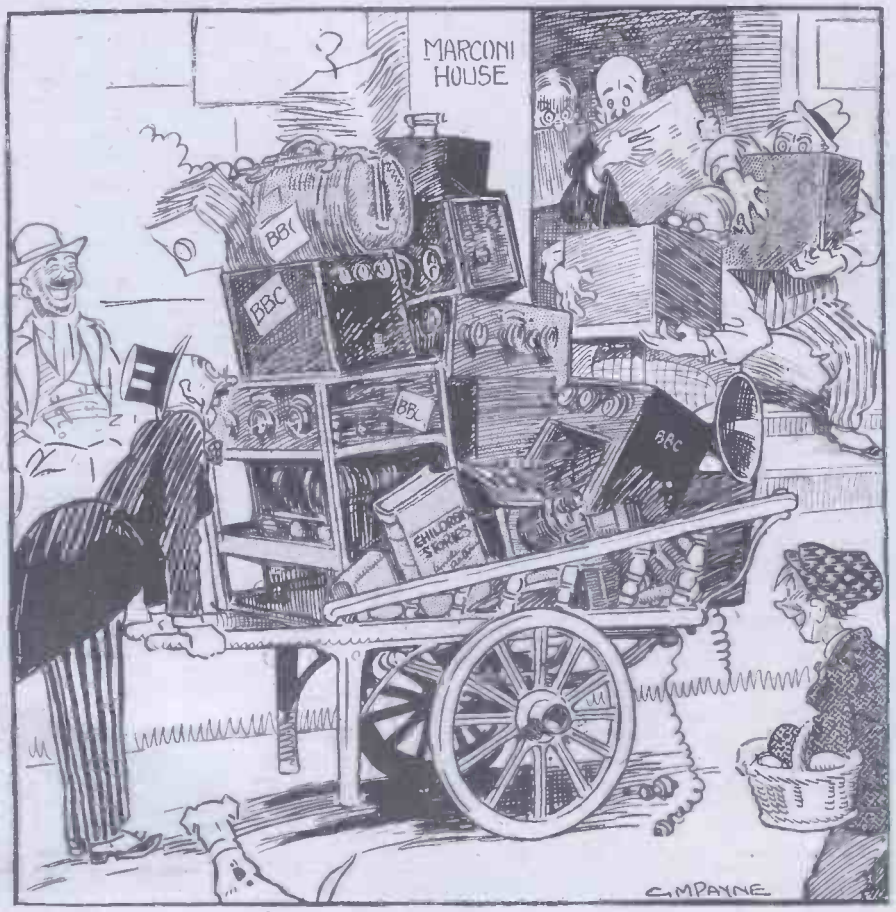
THE EDITOR,
POPULAR WIRELESS,
The Fleetway House,
Farringdon Street,
London, E.C.4.

and should reach this office not later than May 27th.

The following new societies have been started, and are making good headway.

The Humber Radio Club, in connection with the famous cycle firm of that name.
Lewes and District Radio Society.
The Mildmay Wireless Club.
The Harpenden Radio Society.
Wimbledon Radio Society.
The Loughborough and District Radio Society.

2 L O's MOVING DAY.



RADIOTORIAL

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

A committee has been appointed by the Postmaster General to consider the broadcasting question. The selection of the members of this committee is by no means a happy one; the committee is not fully representative of the hundreds of thousands of amateurs in this country. No representative of the Radio Association is chosen—and the Radio Association is certainly representative of the "listener-in." And one or two of the gentlemen selected to serve have no particular claim to a thorough knowledge of the real situation of the amateur to-day who wishes to make his own apparatus.

It would have been much better to have selected a committee consisting entirely of practical instead of theoretical experts.

The committee is charged to consider broadcasting in all its aspects, the contracts and licences which have been granted, or may be granted, the action which should be taken upon the determination of the existing licence of the B.B.C., uses to which broadcasting may be put, the restrictions which may need to be placed upon its use or development.

In the House the other day, the P.M.G. said, "everybody on the committee would more or less represent the listener-in." A list of the committee members will be found on the Notes and News page. In the opinion of POPULAR WIRELESS they represent, on the whole, the listener-in rather less than more. But it is hoped that the result of their labours will end in a satisfactory solution of the present broadcasting problem.

THE EDITOR.

Questions Answered

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

Readers are requested to send the necessary postage for reply.

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.

"INTERESTED" (London).—(1) If an earth wire is connected to a cold water tap, and during a thunderstorm earth-aerial switch was employed, would a person touching the tap be in danger if lightning struck aerial? (2) Is a cold-water pipe connected to a cistern a good earth. If not, what is best? (3) If a buried earth is used, what is the earth lead to be attached to (old iron?), and does this need periodically moistening?

(1) Not in any great danger. (2) This would make quite a good earth, but a buried one would be more satisfactory. (3) Zinc sheet is best. Pack coke tightly around it and bury it as deep as possible Periodical moistening would certainly help.

* * *

D. N. (London).—Please give me dimensions and construction of an H.F. transformer to tune to wave-lengths of about 500 metres to get broadcasting.

A suitable transformer for this purpose consists of a flat bobbin of ebonite 3 in. diameter, ¼ or ⅜ in. in thickness, with a groove cut in the outer edge about ⅛ to ¼ in. deep. Four brass pins are fitted to the under side of the bobbin, and these are spaced in a similar manner to the pins of an ordinary R type valve. A transformer of this type giving wave-lengths from 400-500 metres should have about 70 turns of 40 D.S.C. S.W.G. copper wire for the primary, and a similar number of turns for the secondary The windings should be in the same direction and should be separated from each other by strong waxed paper. A variable condenser of about ·0002 mfd. should be used across the primary for tuning.

* * *

A. E. W. (Brighton).—How is the resistance capacity method of coupling accomplished?

This method of coupling is effected by inserting a resistance of about 50 to 100,000 ohms in the plate circuit of the amplifying valve, while the plate is also connected to the grid of the next valve by a fixed condenser in series. This condenser has a capacity of about ·0002 or ·0004 mfds. while the grid of the second valve is also provided with a grid leak to earth, the leak having a resistance of 2 to 3 megohms. This resistance value is best obtained by experiment, as the most efficient value will vary according to the valve used. By using a resistance capacity coupling, the usual tuning of the H.F. plate circuit is avoided. It must be remembered, however, that this method of coupling is only satisfactory, as a general rule, on wave-lengths above about 1,200 metres. Below this wave-length you will find that the tuned anode (single coil) will give the best results, though, of course, this latter requires very careful tuning.

* * *

G. H. M. (Chelsea).—What is the unit of inductance and how can the inductance of a coil be simply calculated?

The inductance of a circuit is measured in terms of a unit called a henry. The amount of inductance denoted by one henry is such that the application of a difference of potential of one volt would cause a current change of one ampere to take place in the circuit in one second. As this unit of inductance is rather large for practical purposes, the one-millionth part of it, the micro-henry, is used as being a more convenient unit for wireless purposes. The inductance of a coil can be roughly determined by the following formula:

$$L = \frac{4\pi A N^2}{l} \times 10^{-9} \text{ henries.}$$

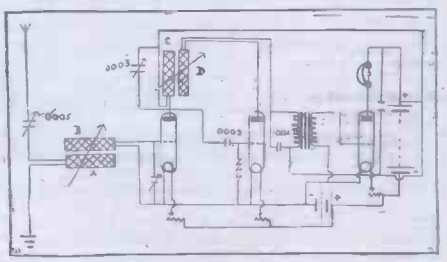
Where A equals the sectional area of the coil in square centimetres, N equals the number of turns and l equals the length of coil in centimetres. This formula is only applicable to coils having air cores, and does not take into account the effect of the insulation of the wire.

NEXT WEEK.

Next week's issue of POPULAR WIRELESS will contain another special article by Our Scientific Adviser, Sir Oliver Lodge, F.R.S., D.Sc.

(Order your copy NOW!)

J. B. K. (Norfolk).—Can you recommend a circuit that will enable me to hear most of the Broadcasting stations?



The circuit of a three-valve set given above should enable you to hear London, Birmingham, Newcastle and Manchester, and possibly Glasgow and Cardiff, though these latter may be difficult to tune in. Of course the French stations will be audible and the Hague also. Reaction is provided by coupling the coil D to the tuned anode, C. All the coils are of honeycomb fashion, mounted in two sets of two coil holders. A and B are together and C and D are together in another holder. The values of the coils for broadcasting should be somewhere near the following: A is 50 turns (honeycomb), B is 75 turns, C is 75 or 100 turns, and D is about 50-75 turns. The condensers are as shown, while the condenser across the coil B should be from ·00075 to ·001 mfd.

(Continued on page 456.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 454.)

"RENEWED" (Hornsey).—I have a French R valve and a Marconi Osram. Is it worth while having them repaired?

It is hardly worth while having the former renovated, as for a few shillings more you could buy a new valve. The M.O. valve, however, will probably be worth it. But you must not forget that though the renewal of the filaments is quite successful you will not have exactly the same valve on its return from the repairers as you did at the outset. Though the plate and grid are the same, the degree of vacuum seems slightly different, while those valves that we have tested appear to take more current than they did before renovation.

* * *

M. D. (Radlett).—How can the wooden cabinets of wireless sets be polished?

There was an article dealing with woodwork in POPULAR WIRELESS of April 7th in which this point was detailed at length. The wood must be stained a mahogany red or any other colour that is desired. To obtain the former a solution of Bismark brown in methylated spirit is used. The next step is to smooth the surface of the wood with very fine sandpaper. Finally the wood is polished with French polish, using a cotton wool pad, and going over the box time after time until a good finish is obtained. The process of polishing must be carried out carefully, very little pressure being applied to the polishing pad.

* * *

R. S. P. (Suffolk).—What are the connections for adding an H.F. valve to the super-crystal set described in POPULAR WIRELESS No. 38?

Your easiest plan would be to add the H.F. panel described in our issue No. 34. As has already been explained in these columns, the primary and secondary of the crystal set are disconnected from the detector and the 'phones. Thus in this case the primary coil connections are exactly as shown in the article on the crystal set, but the secondary is connected one end to the grid of the H.F. valve (terminal G) while the other end goes to the filament (F on panel). The .001 variable condenser also goes with the secondary, being connected on to the same terminals. The H.F. panel is left as shown in POPULAR WIRELESS No. 34 except that the lead from the secondary of the H.F. transformer that is connected to L.T. minus on the panel is connected to a new terminal which should be inserted between O.G. and L.T. minus. Thus the secondary of the transformer is now connected to O.G., and to the new terminal. The crystal connections then become, one side of crystal to O.G., other side to blocking condenser, same side of blocking condenser to one side of 'phones, other side of 'phones to second terminal of the blocking condenser and to the new terminal on the H.F. panel. So, running over the connections, we have: Aerial and earth to primary as before; secondary to G and F on panel, to which terminals go the connections from the variable condenser also. One side of crystal to O.G. and other side to 'phones and 'phone condenser, other side of condenser and 'phones to new terminal on panel.

* * *

"PUZZLED" (New Cross).—What is the simplest form of spark transmitter that will have a range of 100 yards?

The transmitter consists of a small spark coil, such as a Ford spark coil, which is connected to two brass balls used as the spark gap. To these balls rods are fixed each having at its free end a large metal disc. The primary of the coil is connected to a 6-volt accumulator and tapping key in series with it. A condenser placed across the spark gap will help to intensify the spark and create a more truly oscillatory discharge. A small condenser should be connected across the vibrator or make and break contacts to eliminate excessive arcing at this point. This apparatus must not be connected to the ordinary aerial and earth as it gives an untuned wave and would not be permitted by the P.M.G. if this were done. We believe that no permission for use has to be obtained where only the discs are employed and neither aerial nor earth in the proper sense of the word is utilised, but in the interests of other wireless amateurs the apparatus should not be used during broadcasting hours.

* * *

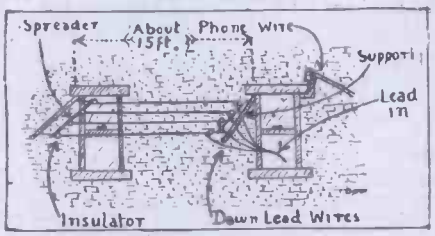
T. A. (Glasgow).—I live in a top floor flat with two windows overlooking nothing but bricks and mortar. Through one window passes a 'phone wire. Would a frame aerial outside the other window be O.K. for receiving the Glasgow station on a crystal set?

(Continued on page 458.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 456.)

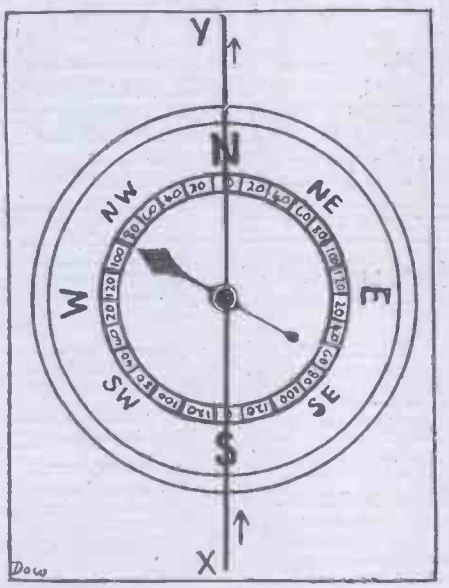
No, a frame would not be much good. We would recommend a short four or so wire aerial of the type shown in the accompanying sketch. The usual earth is of course required.



* * *

P. R. (Aylesbury).—How can one test the polarity of an electric main with a compass? Is it possible?

Quite possible. A rule easily remembered is that in connection with a conductor and a compass needle current travelling from South to North Over compass deflects the needle to West. Remember the word "Snow." Now the current travels always from positive to negative, so that suppose there is a cable in circuit with a lamp or something, running over the compass as in the accompanying diagram, if the current is passing from X to Y the needle will deflect to the West, therefore towards X is the positive pole.



* * *

"Regular Reader" (Plaistow).—(1) I am shortly putting up an aerial. Which type do you recommend, the single or the double, when the length will probably be about 25 ft.? (2) Is the lead-in of the same calibre wire as the aerial or is it a finer wire?

(1) The double wire would be more satisfactory when you only have such a small length. Get it as high as possible. (2) The same wire as the aerial will be suitable for the down lead.

* * *

"Ignorant" (Birkenhead).—Is it necessary to have an accumulator in a receiving set? If so, to what purpose is it put?

With a crystal set no local current whatever is required except with a carborundum crystal. But with a valve set an accumulator of 4 or 6 volts is required to heat the filament. A crystal set would be satisfactory for receiving Manchester broadcasting from Birkenhead.

* * *

"Winkle" (Durham).—On an inductance coil 12 in. by 4 in., could I get down to 5 N O's wave-length (400 metres), and what would be the highest wave-length?

You should be able to tune between 300 and 2,000 metres, winding your coil with 22-gauge wire.

RECENT WIRELESS INVENTIONS.

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

Grant of the following Patents can be opposed and printed copies of the full specifications purchased.

193,379.—GES. FÜR DRAHTLOSE TELEGRAPHIE.—VALVE GENERATORS.—A closed circuit is inductively coupled both to the filament heating circuit and to a tuned portion of the output circuit of a valve generator. Owing to this back-coupling the electron stream is controlled in rhythm with the oscillations of the tuned circuit and a two-electrode valve will act as an oscillation generator. The cathode may be a coil of wire having small heat capacity, and if a grid is used it is also linked with the back-coupling circuit.

193,387.—GES. FÜR DRAHTLOSE TELEGRAPHIE.—VALVE GENERATORS.—The grid of a generating valve is given a negative potential by means of a variable resistance shunted by a condenser inserted in series in the plate circuit between the filament and the negative pole of the high tension supply.

193,525.—S. G. FROST.—VALVES.—The grid supports the filament, for which purpose it may consist of a helical spring surrounding and exerting tension upon the filament which it supports by an adjustable wire and a silica insulating sleeve. Insulating rods may brace the grid turns or legs of the filament, and the whole may be constructed to form a self-contained unit.

193,628—L. G. PRESTON AND B. HODGSON.—VALVES.—The leads and metallic supports for the electrodes are shrouded within and without the valve by tubes so that the discharge is wholly or almost entirely between the electrodes themselves.

193,629.—L. G. PRESTON AND B. HODGSON.—VALVES.—The electrodes are resiliently mounted in the envelope, but are practically rigid with respect to each other. For instance, a cylindrical plate may be supported by springs within the envelope, and the centrally arranged filament is supported rigidly by insulating pieces on the ends of the plate. The leads to the electrodes are flexible.

193,690.—H. P. P. REES.—RECEIVING SET.—A loud speaker is arranged within the casing of a valve receiving set, and may be switched on in place of the headphones when desired by a switch at the side of the box. Switches on the lid allow the high or low frequency amplifiers to be cut out, or the detector filament circuit to be adjusted. Further, any of six different high-frequency transformers may be plugged in as desired by a plug switch co-operating with sockets on the box lid.

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VARIOMETERS, complete with base, engraved dial and knob 27/6
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" " 4BA 12" .. .. 2½d.
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R/R

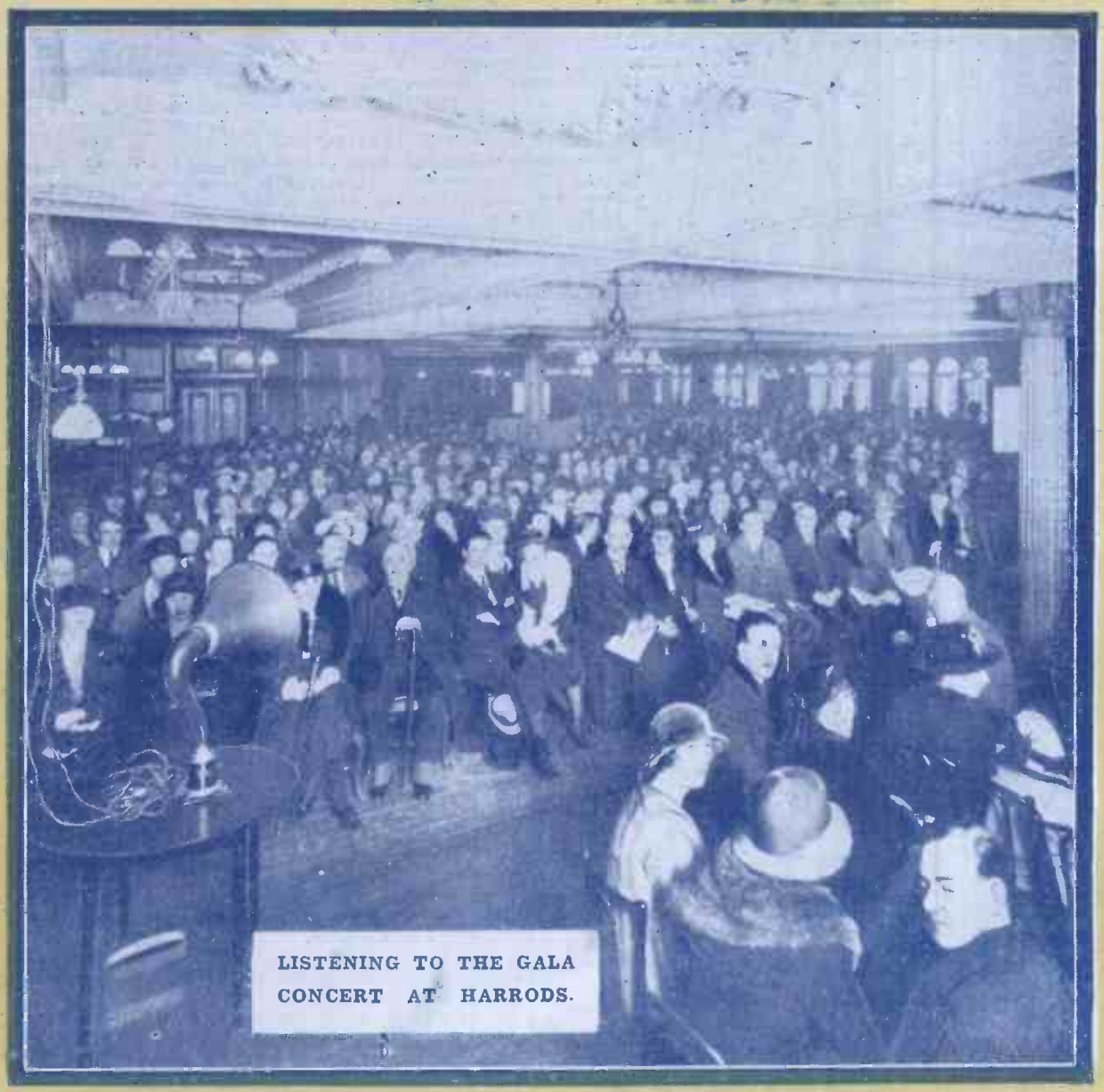
POPULAR WIRELESS WEEKLY, May 12th, 1923. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

SIX SIMPLE VALVE CIRCUITS.

Popular Wireless

PRICE 3d.

No. 50. Vol. III. SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc. May 12th, 1923.



LISTENING TO THE GALA CONCERT AT HARRODS.

FEATURES IN THIS ISSUE.

A Card Inductance Tuner.
H.F. Transformers.
An Efficient Amateur Set.
Uni-Directional Aerials.
Norman Long Broadcasts.
Easily Made Detector.

SPECIAL ARTICLE BY SIR OLIVER LODGE
and a Chat to Scout Readers by Scout Marr.

POPULAR WIRELESS

May 12th, 1923. SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc. [Every Friday.

TOPICAL NOTES AND NEWS.

Telephoning to Ships.

GREAT strides have been made lately in connection with telephony on the high seas, and in this respect Germany has led the way. One of her steamers, the General San Martin, has been equipped with a long-distance radio-phone, and the day when we shall be able to pick up our telephone and call up any ship in the Pacific or Atlantic, which only a few years ago would have been considered a fantastic dream, now does not seem very far distant.

* * *

The Cardiff Wireless Exhibition.

I HEAR from Cardiff that every kind of preparation is being made for the Wireless Exhibition and Radio Convention which is to be held in Cardiff from May 12th to 19th. The organisers of this exhibition are installing their own plant in order to give continuous broadcasting the whole time it is open, and manufacturers of all kinds of wireless sets will show them at their various stalls, and give practical demonstrations of how to work them. Many London firms will be at the exhibition, and other leading firms will show their goods through the innumerable well-known Cardiff firms who are exhibiting.

* * *

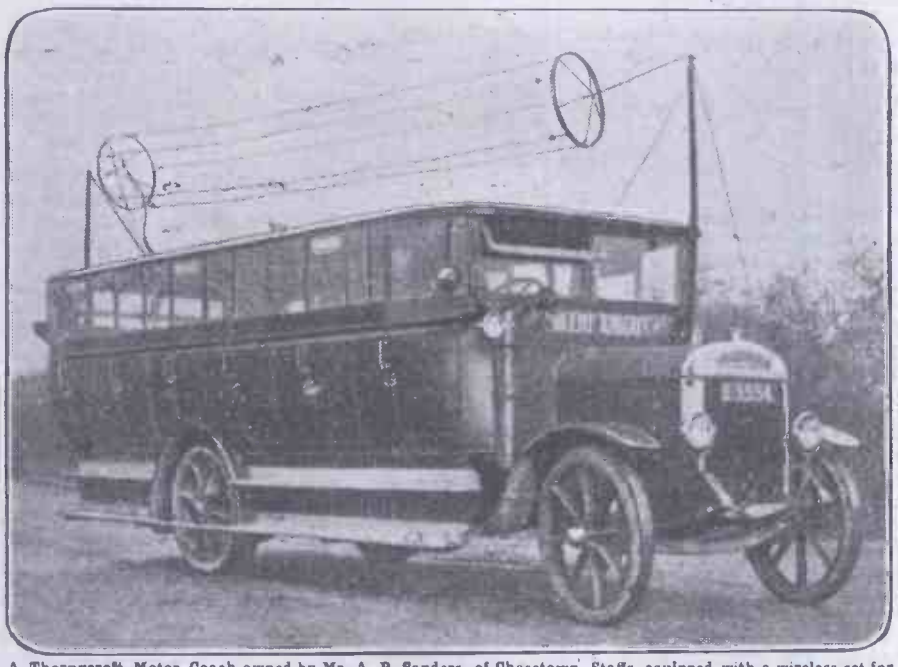
Wireless on Light-ships.

THE machinery of coastal navigation is likely to be extended, so I am told, by means of wireless stations ashore, which will transmit signals continuously in much the same way as light-houses in clear weather and fog-horns in bad weather warn ships at sea. The Northern Lighthouse Board has a wireless directional station working at Inchkeith, on the Forth, and it is now being arranged to fit two groups of lightships guarding the sands at the northern and southern entrances to the Thames estuary with wireless telephony. I hear that the North Goodwin lightship has actually got the apparatus in working order, and ten other lightships and one lighthouse are to be fitted with it in order to help ships in distress. If the existing system is successful, it will probably be extended in other directions, and the Smalls light, off Milford Haven, now in touch by cable, may be changed over to wireless.

* * *

Wireless in Ceylon.

I HEAR from Ceylon that, in spite of the increasing interest in wireless amongst Europeans and Ceylonese in the island, development moves very slowly, and the proposed Ordinance to permit amateur wireless in Ceylon has not yet been published. It is expected that in the near future wireless broadcasting will be introduced in most of the big cities of India, whereas it appears that wireless telephony has not yet even been demonstrated as an experiment! I only hope that those who have banded themselves together as the Ceylon Wireless Club will be able to take some definite steps to make the Government move in the matter.



A Thornycroft Motor Coach owned by Mr. A. P. Sanders, of Chasetown, Staffs, equipped with a wireless set for the entertainment of passengers.

* * *

Educational Value of Wireless.

I SEE that Sir W. Joynson-Hicks states that applications for the use of wireless in schools of all kinds will be "favourably considered," but he cannot grant licences in such cases on more favourable conditions than those applicable to other licensees. When one thinks of the enormous educational possibilities of wireless, and the opportunities it would give for widening the present rather restricted educational ground covered by the average school curriculum, it seems that it is quite time the vexed question of licences was settled once and for all.

* * *

A Loud Speaker Experiment.

A FURTHER development in broadcast reception has been introduced by the Marconi Company, and experiments made at Wembley. A new type of loud speaker was used which did not distort the voice in the usual manner of such instruments. Five high-frequency valves with one detector valve were used, while to supply the current to the specially constructed loud speaker an additional five valves of rather heavier construction were employed. The aerial was about 20 ft. in length, single wire. In its present form it represents the most efficient method yet devised whereby one person can address a large audience in the open air. The set was only installed at Wembley temporarily.

* * *

Flying by Wireless.

TESTS with aeroplanes flying under the control of wireless have resulted in the perfection of a machine equipped with an automatic gyroscopic stabiliser, and fitted with rudder and elevator controls which are operated through relays by wireless signals transmitted from a ground station. A hinged rod some 12 ft. long, hanging below the under-carriage, is coupled up to the elevator, so that when the rod touches the ground the machine is automatically "flattened out." The machine has been flown with two passengers, and the pilot's controls sealed. The whole flight was controlled by wireless, plus the "landing stick." The trial appears to have been quite successful.

* * *

Summer Preparations.

I HEAR that a provincial firm of motor-coach proprietors propose to install receiving sets on all their coaches for the entertainment of passengers. No aerial is employed, and the receiving set

(*Continued on page* 466.)

NOTES AND NEWS.

(*Continued from page 465.*)

is mounted on the woodwork by the side of the driver, and they have a loud speaker which can be placed in any position outside or inside the coach.

* * *

A Correction.

IT has been pointed out to me by Messrs. Burndept that Mr. Goodfellow's set, of which a photograph appeared on page 376 of our issue of April 28th, greatly resembles the Burndept Ultra IV receiver and the Burndept tuner. In these circumstances, of course, the set would not be a home-made one, as stated.

* * *

Ericsson Telephone Receivers.

IN the full-page advertisement taken by the British L. M. Ericsson Mfg. Co., Ltd., in last week's issue of POPULAR WIRELESS their 2,000 ohm Ericsson 'phones are priced 21/-, this should of course be 31/-.

* * *

The Opening Night.

THE concert arranged for the opening of 2 L O's new studio was decidedly interesting. The studio arrangements were admirable. Among those present were Lord Burnham, Lord Birkenhead, Lord Gainford, Sir William Bull, Bt., Sir William Noble, and others.

Most of the guests remained in the studio during the progress of the concert, and Mr. Norman Long, that ever-popular entertainer, raised much laughter which I daresay you heard when listening-in.

* * *

A Star Turn.

NORMAN LONG'S arrival at the studio is always heralded by universal grins among the staff. When not entertaining you he is full of fun and jolly humour, and even Mr. Burrows cannot keep a straight face when Mr. Long is about. A friend of mine who knew Mr. Long in the Army tells me he was the life and soul of his regimental concert-party.

* * *

Princess at 2 L O.

I THOUGHT Princess Alice, Countess of Athlone, looked very charming when she came to the new studio of 2 L O to "open" the Women's Hour on Wednesday last. She spoke for some time, and seemed quite at home in front of the microphone. By the way, all the Royal family seem to have excellent broadcasting voices.

* * *

Presentation to Princess.

A TOUCHING scene followed the reception of H.R.H. by Lord Gainford when a little six-year-old blind girl, Barbara Furniss, whose only recreation is listening-in, presented the Princess with a large bouquet of flowers. Barbara regularly corresponds with the "Uncles" in Braille.

* * *

Quest for Knowledge.

LADY MAY CAMBRIDGE and her brother, Viscount Trematon, accompanied their mother, and, after she had spoken, rushed over to the transmitting-room in the Strand to see "how it is all done." Later the Viscount returned to Eton.

* * *

Mr. Percy Pitt.

MR. PERCY PITT, the well-known conductor, who has for so many years been closely associated with opera at Covent Garden, has joined the B.B.C. as a musical director. He tells me that his object will be to give programmes which will appeal to all kinds of musical tastes, and that he has no intention of catering solely for "highbrows."

* * *

Wembley and Wireless.

I AM told by an official of the Broadcasting Company that if broadcasting appliances had been installed in the Wembley Stadium, much of what happened at the Cup Final could have been prevented. He said the company were anxious to broadcast an entertainment for the benefit of the crowd, but at the last moment permission was refused. Had it been given, he added, it would have been possible to have addressed the crowd through the loud speakers.

* * *

Wireless In Prisons.

AN important step in prison reform is the dream of Mrs. Ballington Booth, the famous leader of the Volunteers of America, who suggests that wireless sets should be installed in every prison. She contends that such a proceeding would in no way pamper the prisoners, but would help them from an educational point of view, and, by means of bringing them into touch with the outside world, would dispel the unhealthy belief that everyone is against them.

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,	2 L O	369	11.30 to 12.30 every morning and usually every evening, 5.30—6.15 p.m.; 7 and 9.45, News; 7.30, Orchestra; 8.25 to 10.30, Music. Sundays from 8.30 p.m.
Newcastle Broadcasting Station	5 N O	400	11.30 to 12.30 every morning. Every evening, usually from 5.30 to 10 p.m.
Manchester Broadcasting Station	2 Z Y	385	11.30 to 12.30 every morning. Every evening usually from 5.30 to 10 p.m.
Birmingham (Witton) Broadcasting Station	5 I T	425	11.30 to 12.30 every morning. Every evening usually from 5.30 to 10 p.m. (News, Concerts, etc.).
Glasgow Broadcasting Station	5 S C	415	11.30 to 12.30 every morning. 5.30 to 10 p.m.
Cardiff Broadcasting Station	5 W A	353	11.30 to 12.30 every morning. 5.30 to 10.30 p.m.
Croydon	G E D	900	Throughout day to aeroplanes.
Paris	F L	2,600	12.15 a.m., Weather Report; 7.20 to 8 p.m., Weather Report and Concert; 11.10.
Königswusterhausen	L P	2,800	5 to 7.30 p.m.
The Hague	P C G G	1,085	Sundays, 4 to 6.40 p.m., Concert. Thursdays, 9.40 to 10.40 p.m., Concert.
Haren	O P V H	1,100	1 p.m., and 5.50 p.m. Telephony.
Radio-Electrique, Paris	——	1,780	6.5 p.m., News Items; 6.15 to 7.10, Concert; 9.45 p.m., News Items; 10 to 11 p.m., Concert. 3 to 4 p.m. Sat., Concert.
School of Posts and Telegraphs, Paris	——	450	Every Tuesday and Thursday, 8.45 to 11 p.m. Saturdays, 3.30 to 7 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. All times are B.S.T., not G.M.T.

FORTHCOMING EVENTS FROM THE LONDON BROADCASTING STATION (2 L O).

WEDNESDAY, 16th inst.—Sir Montague Sharp, K.C., D.L.C.A., an address at 9 p.m.

SUNDAY, 20th inst.—The Prince of Wales, Earl Haig, and Marshal Foch will speak from the Queen's Hall to the British Empire League. All the broadcasting stations throughout the country will be connected with landlines for the purpose of broadcasting these speeches.

THURSDAY, 24th inst. (Empire Day).—Rt. Hon. Lord Islington, G.C.M.G., D.S.O., P.C., address at 8 p.m. Rt. Hon. Earl Meath, P.C., G.B.E., address at 9 p.m.

FRIDAY, 25th inst.—H. E. Blain, Esq., C.B.E. Chairman of the London Safety First Council, address on "Safety First," at 9 p.m.

MR. NORMAN LONG BROADCASTS.

A cheery chat by 2 L O's most popular entertainer.

HULLO! Hullo! Hullo, everybody. In one minute Mr. Norman Long will talk to you on his experiences and opinions of wireless broadcasting. Mr. Norman Long. Stand by one minute, please.

(Two minutes elapse.)

There is a story being told of an old-time actor, who, finding himself down to his last shilling, applies to a well-known cinematograph company for an engagement to act for the films. The manager asks him if he has ever had any experience in acting without an audience, to which he replies sadly: "Laddie, it is just the fact of acting without an audience that has brought me to my present regrettable position."

Mr. Norman Long.

A friend (?) of mine recently suggested to me that this was possibly the reason that I appeared to "get over" on the wireless. However, I put this down entirely to professional jealousy (he was another entertainer), and take it from whence it comes. Be that as it may, I suppose the first question I am always asked whenever the conversation turns on to the wireless is "What does it feel like to entertain an invisible audience?" Well, it is naturally a trifle strange at first; more so for a humorist than a "straight" singer, as one is apt to wait for laughs that one gets when performing before a tangible audience, and when these laughs fail to materialise it is a little disconcerting until one gets used to it. Still, familiarity breeds contempt, as Shakespeare said (or was it Ethel M. Dell, I forget?), and you very soon find yourself visualising your audience and imagining the laughs that you fondly hope are being created by your songs and gags. But there is one great and glorious advantage that entertaining the invisible audience has over the visible and that is this: *However hard the audience throw and however straight their aim may be, THEY CAN NEVER HIT YOU.* And that is some consolation, *ber*-lieve me.

Speed of Light!

Then again they say: "Don't you wish you could hear yourself?" and in this connection I claim to be the only artiste who has sung into wireless and then run all the way home and arrived in time to hear his own voice coming through. Thousands refuse to believe this. No doubt you will. In any case you're quite at liberty to please yourselves. I am usually considered to be a perfectly truthful and trustworthy young lad.

But putting all jokes on one side (said he, adopting a much more serious note), my entertaining on the wireless has been the means of my getting into touch with several friends whom I had lost sight of for a long time past. Not long ago I had a letter from an old and very great friend of mine who was with me for a long time during the war and of whom I had lost all trace. He had got hold of a rumour after the war that I had gone under and he always believed so until he saw my name in the paper one day in the Broadcasting Programme. He listened in to me right up in the north of Scotland, and even at that distance recognised by my voice that it was the same Norman Long as in the old days of the war. He has since been to London and we have met, so that the wireless has been the means of bringing together two great friends who but for that might never have set eyes on each other again.

That "Theatre" Question.

There has been a lot of controversy lately as to whether broadcasting is going to benefit artistes or harm them. My own humble opinion on this is that the general public will never adopt listening-in as a *substitute* for plays or concerts. They will undoubtedly entertain themselves with it on those evenings on which they would have stayed at home in any case, but I do not think that they would stay at home and listen-in *instead* of going to a theatre. Some friends of mine have always made two nights a week "Theatre nights." They have recently had a very fine wireless set installed, but still have their two nights a week at the theatre, while on the other nights they have large parties of friends in to listen-in, which to say the least is at any rate good for the wine merchants. I myself have had the electrophone on at my house for some years and can get any of the principal theatres every night; but I have never once stayed at home especially to listen to a play or concert instead of going to see it. I have frequently heard part or the whole of a play, and have afterwards gone to see that play, and that to my mind is precisely the effect of wireless broadcasting.

Does Personality "Get Over?"

I dare say some of you will remember that some time ago I gave a "cod" conjuring show on the wireless which I am given to understand caused some amusement in certain quarters. In this connection I had rather an amusing experience shortly afterwards in a small Lancashire town to which I went to give an entertainment. As soon as I got to the hall I was greeted by the Secretary of the concert with: "Eh! We heerd thee on t' wireless t' other neet and we don't want thee to do any of that there conjuring oop 'ere. We've got plenty of conjurers of our own and we engaged thee to sing songs at t' pianner and that's what tha've got to do."

Another question that frequently crops up when wireless is the topic of conversation is "Does personality get over to any extent on the wireless?" My experience is that it does very considerably. People will often argue that provided the voice carries well it does not matter very much who is putting it over from the other end, but from an entertainer's point of view I am quite certain that my personality gets over to a very great extent and helps the show a lot. This is quite inexplicable, of course, and open to argument, but that is my personal opinion. I have also known friends of mine who have formed quite accurate mental pictures of the artistes who are singing or talking to them from the various stations. I was listening-in some short time ago at a friend's house who had a loud speaker, and we were all intently listening to a very fine male vocalist who was rendering an operatic selection. In the middle of giving this a young and rather frivolous lady who was amongst us suddenly remarked, "I'll bet he's fat." Although this was perhaps hardly a polite way of putting it, the fact remains that she was perfectly correct, as I knew the gentleman in question well, and he was indeed very portly.

I have never had my voice trained in any way. (No! That is perfectly obvious. —Editor.) Sorry, ladies and gentlemen, the Editor's getting personal now. More jealousy, I expect, so I'll pack up. Cheerio! everybody, and keep smiling.

Hullo! Hullo! Hullo, everybody. That was Mr. Norman Long giving you some of his views and experiences of broadcasting. In one minute something else will happen with a bit of luck. Stand by one minute, please!

A typical informal club lecture is holding the absorbed attention of a group of enthusiastic amateurs in the clubroom of one of the wireless societies.

CONTRASTING METHODS OF AERIAL EXCITATION.

By SIR OLIVER LODGE, F.R.S., D.Sc. (Scientific Adviser to "Popular Wireless").

This is the first of another series of articles by our Scientific Adviser, intended primarily for the experimenter and student. Each article is complete in itself.

I WILL introduce this subject by an analogy. There are two types of model or toy locomotives on the market: one type driven by potential energy, the other by kinetic energy. The first is energised by twisting an indiarubber or tightening a coiled steel spring. This is an example of static energy, stored in the shape of material strain. The other type is energised by spinning a fly-wheel, much as a top is spun by a piece of string. The energy thus imparted is kinetic; and by resting the axle of the fly-wheel on a larger wheel, the whole thing progresses slowly like a steam-roller, till the energy is exhausted.

The above is an example of two different types of mechanism. But a smaller difference can exist between the modes of excitation of a single type. Thus take a violin string for instance. There are two ways of making it sound; one by gently bowing it, or by blowing on it, or in some other way working up the oscillations gradually to a sufficient intensity. That is one way. The other is by plucking it—that is to say, by pulling it forcibly aside till it has acquired a certain amount of potential energy, and then liberating it, so as to oscillate freely until that energy is exhausted.

Where "Interference" is Desirable.

A string struck by a hammer, as in a piano, belongs to the kinetic type; for the energy is imparted in the form of motion; but it is imparted very suddenly, and it virtually amounts to shock-excitation.

Thus we have three different methods of exciting a string: a pre-arranged strain, or static method, illustrated by plucking; a gradual working up of the oscillations, as illustrated by some form of friction, or bowing; and the shock-excitation method, illustrated by striking, as in a pianoforte. A harpist, presumably, is able to utilise at pleasure any one of the three methods. But most wind-instruments depend on the gradual working-up method. Whereas drums and triangles, and other such devices—the *batterie de cuisine*, as a musician has jocularly called it—are obvious examples of percussion.

In exciting an aerial for wireless telegraphy all three methods have been employed. In the early days, working on the lines of Hertz, a spark gap was introduced into the aerial, the upper area was charged positively, the lower area negatively, setting up a strain between them, until the air between the spark knobs gave way, a rush occurred, and oscillations began. That is the steady strain or pre-arranged method—by static electrification. And on this principle many Lodge-Muirhead stations were worked. It is a very powerful method, and very difficult to tune out, since the initial jerk is rather violent. For some purposes this is a defect; for others it is an advantage. It was found to be a defect when arranged on the Great Eastern Railway line of steamers between Harwich and Antwerp; for though very efficient, it was rather too efficient, and the Government forts in the neighbourhood found they could not always tune us out. With better tuning devices and without earth connexion it could be done; but it was admittedly not easy.

The advantage of this mode of excitation is felt when tuning-out is *not* wanted; that is, when you desire every station within range to hear, to whatever wave-length it may be tuned. This is the case with an S O S signal. And accordingly for distress purposes this method of excitation used to be employed on board ship, and possibly is still employed. It should be.

Then came the percussion method of excitation, utilising what I used to call a "B spark,"—that is, the rush between the outer coatings of two Leyden jars whenever a spark takes place between their inner coatings. In that case the aerial was not pre-charged at all, but was charged with a rush or a blow, by the impact of the liberated induced charges in the outer coats of the jars or condensers employed. This method of shock-excitation has been used a good deal; and the quenched spark system is a modification of it, since the vibrator is left to oscillate freely after receiving a blow, like a bell.

A Decided Improvement.

The third method of excitation, that by gradual working up, is now largely employed in various forms at continuous-wavestations. But so far as I know it was introduced at spark stations by Marconi in his famous 7777 Patent, the aerial being excited inductively by an oscillating discharge in a closed circuit, to which it was coupled. Inductive connexion at the receiving end had been patented before, viz., in my patent of 1897, but not at the sending end. For though shock-excitation is in that patent specification clearly foreshadowed, the continuous working-up method remained for future development, and when introduced was regarded as a decided improvement. For the oscillations do not now begin with any suddenness. They are gradually worked up from zero to a maximum, just as you may bow a tuning fork or a bell, instead of striking it; and thus excite a purer tone, more satisfactory to deal with, and easier to tune out when not wanted.

A Few Examples.

In this inductive method of excitation there is, in one sense, a prearranged static charge, at least at a spark station; but it is not a charge in the aerial itself. The potential energy is all in a closed local circuit. It is in the spark gap of this circuit that the strain is suddenly relieved, by fracture; and the oscillations which then begin are employed to stimulate oscillations in the coupled aerial. The spark in the primary may be quenched as soon as it has achieved its function, so that the aerial may be left free to oscillate, without being hampered by anything like tight coupling to a closed circuit, which, as is well known, is liable to give waves of double periodicity—that is to say, a double kind of wave instead of a single one, a wave with two peaks, both of which it is difficult to tune out simultaneously.

Sir Oliver Lodge in his laboratory at Salisbury.

The valve and arc methods of excitation are representative of the continuous-wave system, like an organ pipe steadily blown from a bellows, and the oscillations are varied artificially by the operator, who makes them respond to the movements of his signalling key, the key being arranged sometimes so as to give variations in pitch instead of in amplitude, as in a flute or other keyed wind-instrument.

The inductive method of excitation, whereby the energy is communicated to the

(*Continued on page* 471)

SOME REMARKS ON HIGH-FREQUENCY TRANSFORMERS.

By A. G. WOOD.

THE great drawback to using H.F. transformers, in most cases, is the fact that they have to be bought ready-made, but the writer has been experimenting recently in connection with the above and intends to give some data to enable the reader to wind his own H.F. transformers. The advantage of transformers over the tuned anode method of H.F. amplification lies in the fact that a larger number of H.F. valves can be used, as their grids can be controlled through the secondary winding of the transformer.

The writer uses "Vim" cardboard tubes for winding all his coils, as they are of a convenient and standard size and the household consumption keeps him with enough tubes for his wants. These tubes should be well waxed by impregnating them in a basin full of melted wax. It is best to fix the tube in some sort of winder—it can be put together out of Meccano or something of that nature—as it facilitates the winding-on of the turns of wire.

Resistance—Capacity Coupling.

Procure about 4 oz. of D.C.C. copper wire No. 36 S.W.G. and wind on the requisite number of turns (see table below). When this has been done give the layer of wire a coating of shellac. Allow to dry, and then wind on the secondary over the first layer with the same number of turns. Shellac this layer in its turn, and then, if the windings do not look very secure, bind empire cloth round them, making sure that the ends of the wire do not get lost in the process.

The writer finds that old valve bases make excellent holders for these transformers, and they can then be plugged into a valve socket as required. The primary coil will need a small variable condenser across it.

The use of this condenser is to tune the transformer over the band of wave-lengths—i.e., from its fundamental to that of the next transformer. In this manner all the

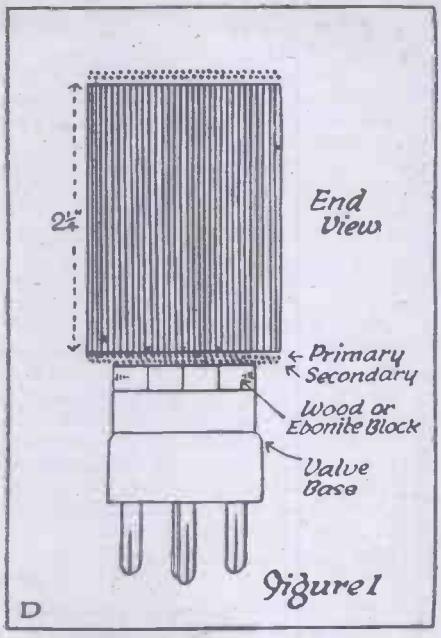


Figure 1

wave-lengths are effectively covered. The condenser should have about four or five moving plates and the necessary number of fixed to go with them. Below is given the data for winding, together with diagram of fixing. (See Fig. 1.)

No. of turns of No. 36.	Wave-length without condenser in.	Wave-length with condenser in.
40	180 metres	230 metres
70	225 metres	275 metres
100	275 metres	325 metres
130	325 metres	375 metres

It is necessary to see that the primary is wired up the right way round in relation to the secondary, as the set will refuse to function if this is not done. Therefore if the set will not oscillate try reversing one set of windings. To control a large number of H.F. valves take the lower end of the secondary windings to the slider of a 300-ohm potentiometer shunted across the filament. Then by making the grids slightly positive the set can be controlled to a nicety.

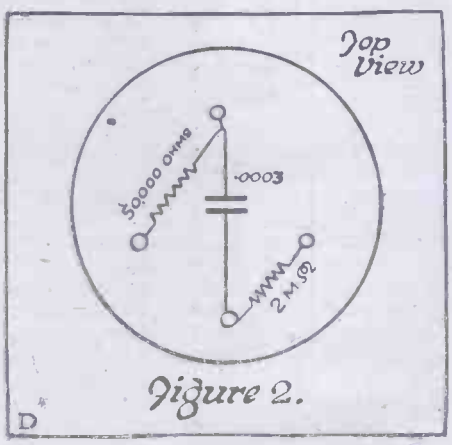


Figure 2.

If it is required to use the set on long wave-lengths—that is, above 1,000 metres—resistance capacity coupling can be employed and the valve holders for the transformers can be utilised to take a special fitting, consisting of a resistance and condenser, as shown in Fig. 2.

This method of amplification should not be employed on wave-lengths below 1,000 metres, as it is inclined to be inefficient on short waves.

CONTRASTING METHODS OF AERIAL EXCITATION.

(*Continued from page* 468.)

acrial kinetically instead of by static strain. bears some analogy with the fly-wheel kind of model spoken of at the beginning of this article, as contrasted with the static energy of a wound-up spring. There is initial strain in the latter or potential energy case; there is none in the kinetic mode of excitation. The act of throwing a ball is an example of a kinetic method. The liberation of an arrow from a bow, or a stone from a catapult, is an illustration of stored potential energy suddenly liberated. So is the projection of a bullet by the chemically stored energy of cordite. But a magnetic gun, if such a thing is ever made, is more kinetic in its action. The two necessarily shade into one another, because suddenness is a relative term; but a pre-charged aerial, charged to bursting point, is a definite fact.

CATALOGUES, BOOK ETC.

WE have received from the Western Electric Company, Ltd., a colour catalogue of "Ornamental Loud Speakers." They include eight new standard designs and every instrument is hand painted with the greatest delicacy and artistic skill, there being a design or a colour to harmonise with any existing style of furnishing or scheme of colour. They claim that these loud speakers are unequalled for general efficiency and clarity of tone.

* * *

Radiophones, Ltd., have issued a leaflet giving full details of their four-valve "Listoleon" cabinet. The manufacturers have aimed at simplicity of manipulation, which in no way impairs the efficiency of the set. It includes a loud speaker and all batteries, etc., are contained in the base of the cabinet and are readily accessible.

* * *

The Director of Publication to H.M. Stationary Office has sent us a copy of the "Admiralty Handbook of Wireless Telegraphy" (7/10 post free from Imperial House, Kingsway, W.C.2.). This book covers an immense field in its 500 or so pages and is copiously illustrated with diagrams. It is a work that is almost essential for those intending to seriously study the subject. It is of extraordinary value in respect of the mathematical side of wireless as not only are all formula clearly and simply explained but examples of working are given. Also a long appendix deals with elementary notes on mathematics. algebra, trigonometry and mechanics. Altogether it forms a most valuable addition to the library of the wireless amateur.

* * *

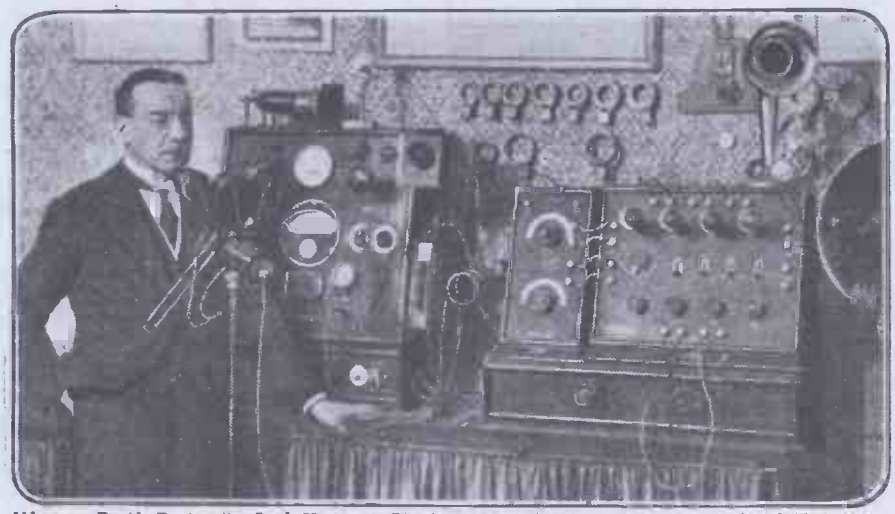
In their new catalogue, Rogers, Foster & Howell, Ltd., have divided their instruments into three classes—A, B, and C—to avoid confusion. Class A is for the amateur living close to a broadcasting station. Class B are instruments of greater selectivity and power; while Class C includes their special reaction sets which are fully approved by the P.M.G. and stamped B.B.C. With a two-valve set of this latter type they claim that all British broadcasting and continental telephony can be heard. The instruments are all well made and highly finished. The catalogue also contains illustrations of their high-class accessories.

WIRELESS IN BIRMINGHAM.

Alderman David Davis, the present Lord Mayor of Birmingham, who was the first Lord Mayor to broadcast in this country, gives his opinion of broadcasting to a special representative of "Popular Wireless."

THERE are many pages in the history of wireless which still require filling; an authoritative history still waits the writing, and when it is written it will constitute a reference book from which cities and towns will cull facts of discoveries and pioneers with which to garnish the pages of their own local records, and thus share in the glamour that a great science possesses.

This idea was in my mind when recently I visited the Birmingham Council House, and sought an interview with Birmingham's Lord Mayor, purely and simply on the matter of wireless. The word that is applied these days to anyone who is interested in wireless is "enthusiast," and enthusiasts are expected to be guilty of an immoderate zeal for what the ordinary man is happy to ignore. Knowing that I was dubbed an enthusiast, I wondered if the municipality of Birmingham, with its motto of "Forward!" with its super-efficiency of local government, could yet find time to appreciate this hobby, this interest, which I knew was possessing so many thousands of its citizens, and slowly, but certainly, causing a new growth to spring up in back-yard and garden from end to end of the city.



Alderman David Davis, the Lord Mayor of Birmingham, at the famous amateur station 2 K O, from whence he broadcast a charity appeal.

As I sat in the anteroom to the Lord Mayor's private room, I could see through the window the old pile of buildings which represents the original home of Birmingham's University, at which, when its principal, Sir Oliver Lodge pursued those researches which led to many important additions to the knowledge of wireless. It was in those buildings that he first sent a message from one room to another, and as I waited I recalled the impressions which a journalistic colleague had described of an early demonstration of this marvel of marvels as it then seemed some thirty years ago.

An Historical Event.

I was to ask Birmingham's chief citizen, a Birmingham business man, what he thought of wireless. That he was familiar with it I knew, for it is to Birmingham's credit that the first Lord Mayor of any city to broadcast was Alderman David Davis, the present Lord Mayor of Birmingham. He broadcast, to use a paradox, before there was broadcasting.

In October last year, a noted Birmingham experimenter, Mr. C. S. Baynton, of 2 K O, obtained a special licence from the Postmaster-General, for the express purpose of broadcasting an appeal on behalf of the Birmingham Hospitals. This, many readers will no doubt recall. After the experimenters on that pre-broadcasting date had been duly warned, and in Mr. Baynton's words, "quietened down," the Lord Mayor made an effective appeal for the good cause. Experimenters had gathered their friends together for the event, and while messages of congratulation upon the broadcast came from all over the country, so, too, the funds of the hospitals were considerably aided by the money which was also sent.

Sooner Have a Gramophone.

Further, more recently still, when in order to satisfy the young Birmingham listeners-in of the existence in the flesh of the two 5 I T uncles of the time—Uncle Edgar and Uncle Thompson—a wireless demonstration was given at the Birmingham Town Hall, the Lord Mayor spoke from the station at Witton, on behalf of his fund for the local unemployed.

A committee meeting over, I was shown into the Lord Mayor's room, and it is interesting to remark that the first thing which met my eyes was a large photograph on the mantelpiece (see illustration) taken on the occasion of the Lord Mayor's broadcast experiment, and showing him standing against Mr. Baynton's transmission set.

His lordship greeted me affably, and listened carefully as I stated the purpose of my visit. I indicated the photograph, and asked him what he thought of just that aspect of wireless.

"Wonderful!" he said. "It was remarkable to be able to speak and to know that all over the country there were many hundreds of people able to hear what I was saying. That impressed me as a most marvellous thing."

"You were the first Lord Mayor to broadcast," I reminded him.

"Yes; and I also have broadcasted from Witton, you know." There was a pause. "But I am not enamoured of wireless," he went on. "There is so much that is bad in the present broadcasting."

I suggested that his experience may have been an unfortunate one, and he related how, during a recent visit to the south, he stayed near London, and the loud speaker of his host proved a perfect nuisance.

"I'd much sooner have a gramophone," he said.

"That, I am afraid," I rejoined, "is what misguided enthusiasm is doing for wireless. Inefficient loud speakers and over-amplification are destroying the charm and promise of wireless for many people."

He mentioned the location, and it was apparent that his experience, when 2 L O was in full blast, could have been anything but pleasant.

"There is another point," he went on. "Before broadcasting will be satisfactory, the broadcast programmes will have to be improved. Look at this." He indicated a published programme for one of the provincial stations. "Now, do I want to hear anything of that? We want the best if anything is to come of wireless."

Better Programmes Wanted.

"There are difficulties in the matter of obtaining services," I reminded him.

"They will have to pay," he rejoined. "Now, assume that a million people in England subscribe, and there should be that number if first-class programmes are provided. That will be a million ten shillings, half of which will go to the broadcasting company. With £250,000 it should be possible to provide something well worth having."

"What of wireless in its other aspects?" I asked. "Wireless in trains, wireless in the schools, and so forth?

"I regard them, at the moment, as so many experimental applications, very interesting, but hardly yet of great value."

I suggested diffidently a bolder vision. Why not use wireless to express the municipal spirit.

"You have never addressed the full ear of the city. Yet wireless broadcasting through loud speakers would enable you to do it."

"Yes, if there was a receiver in every home. But that will not be yet."

My time was up, but I managed to tell him before I took my leave, of the Hague concert I enjoyed a few Sundays ago, when with a wooden horn and a really fine apparatus I heard the orchestra with as much pleasure as if it had been playing in the next room. If the Lord Mayor had heard that I feel sure he would have been more impressed than he was with 2 L O on a loud speaker.

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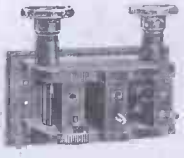

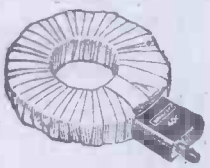

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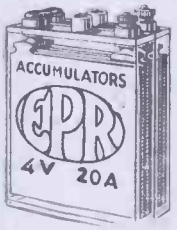

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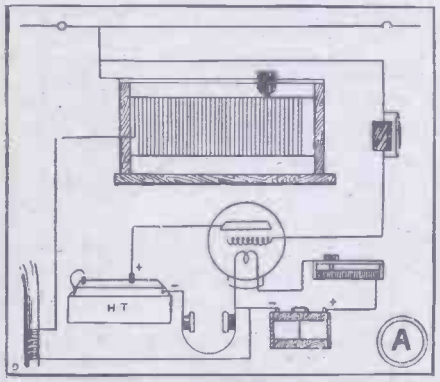
SIX SIMPLE VALVE CIRCUITS.

With so many different "hook-ups" in existence, it is inevitable that some confusion should arise in the minds of the "tyro" who is graduating from the crystal to valves. This article briefly details the "pros and cons" of six simple circuit arrangements involving the use of one valve as a detector.

DIAGRAM A shows the simplest form of valve receiver that can be constructed for use over a reasonable range of wave-lengths.

Tuning is effected by varying the amount of inductance contained in the circuit by means of the single-slider coil. As this is the only means by which the desired wave-length can be obtained, the whole of the



tuning depends upon the correct adjustment of the single plunger. The actual wave range of the instrument will, of course, depend upon the size of the aerial and the amount of inductance contained in the coil over which the slider operates.

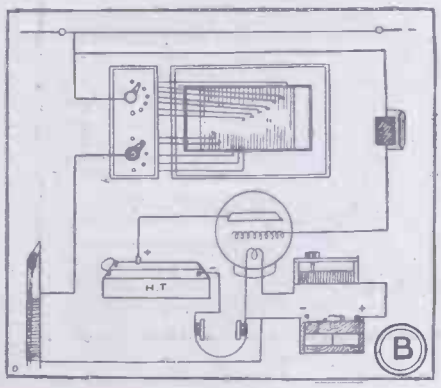
Slide Contacts and Tappings.

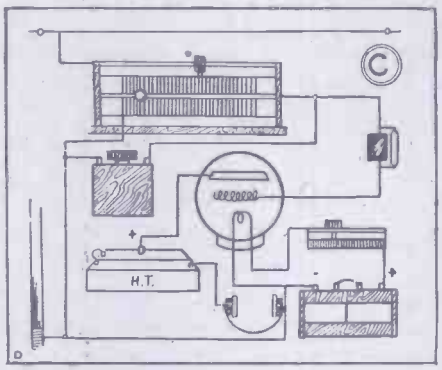
Diagram B shows a similar arrangement, excepting that the coil is not operated by means of a slider, but by means of tappings which are controlled by switch arms as shown.

For purposes of fine adjustment, this method is perhaps less efficient than that obtainable by using a slider, as the tappings referred to usually include several turns of the coil, thus eliminating any possibility of obtaining a really fine adjustment.

When variation of the inductance value in a circuit is obtained in this manner, it is usual to employ a variable condenser connected in parallel to obtain a final and critical adjustment.

Diagram C shows a circuit in which a variable condenser is connected in this



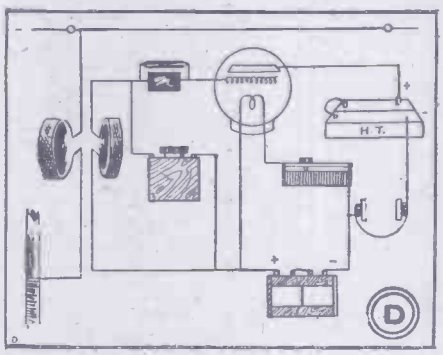


manner. This diagram also shows a coil of the two-slider variety, and the method in which it is connected to the valve circuit.

Diagram D shows a simple circuit of the loosely coupled type, and also a variable condenser in parallel with the secondary coil. For purposes of fine tuning and selectivity, this is a considerable improvement on the circuit shown in Diagram C.

The Use of Reaction.

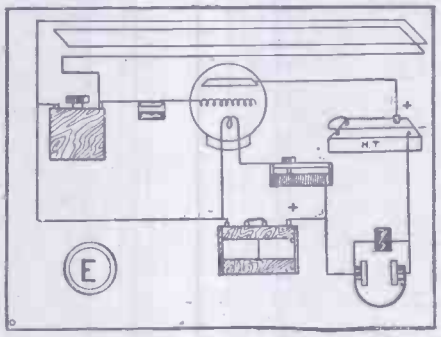
Diagram E shows the simplest method by which the one-valve circuit may be used in conjunction with a frame aerial. It will be noticed that tuning is performed by means of a variable condenser connected in



parallel between the grid and filament of the valve. It might be as well to mention here that if an aerial of the "open" type is discarded in favour of a frame aerial, the two ends of the frame winding should be taken to the aerial and earth terminals of the set after the "open" aerial and earth plates have been disconnected from the instrument.

Diagram F shows a simple one-valve circuit employing reaction. It will be seen that the connection from the plate of the valve, instead of passing directly to the positive terminal of the high-tension battery, is coupled by means of a third coil to the secondary coil of the circuit before being taken back to the telephones via the H.T. battery. It should also be observed that the telephone condenser is utilised in this instance to form a by-pass condenser across the high-tension battery.

If a set of this type is constructed, care should be taken to see that the reaction coil is so arranged that it is incapable of energising the aerial. Carelessness in this respect has already caused a considerable amount of trouble among wireless enthusiasts owing to the fact that if the reaction coil is brought into sufficiently close proximity with the tuning coil of the circuit, it will energise the aerial, and, therefore, cause interference with neighbouring stations.

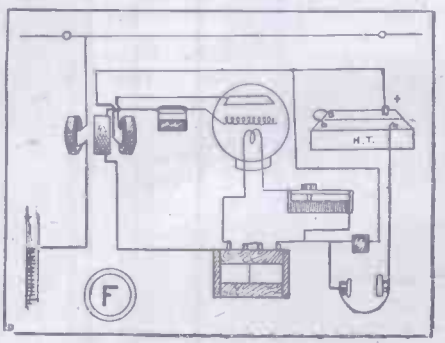


It is, perhaps, not necessary to mention that in connecting up the set, the positive terminal of the high-tension battery must always be connected to the plate of the valve. Too much stress cannot be placed upon this point, as failure to observe this simple rule will render the instrument totally inoperative, and it does not require much imagination to realise what will happen if anything between thirty and seventy volts should, by carelessness, be placed across the filament of the valve.

The filament battery usually has its negative terminal connected to the negative terminal of the high-tension battery, and it is a common practice in simple valve circuits to connect the telephones in series between these two terminals as shown in Diagram D.

It is not essential, however, for the filament battery to be wired up in this manner, as it may be used to aid the plate battery as shown in Diagram E.

The telephones also are sometimes connected in series between the plate of the valve and the positive terminal of the high-tension battery. This practice is, however, condemned by many authorities on the ground that the windings of the telephones are influenced by the passage of the plate current and rendered less sensitive in consequence.



THE UNI-DIRECTIONAL AERIAL.

By G. H. DALY

The following article contains much interesting information on the properties of unidirectional aerials, and suggests considerable scope for amateur experimenters.

THE ordinary frame aerial when used as a direction finder has one serious disadvantage—namely, its inability to indicate the exact direction of the transmitting station. If, for instance, maximum signals are received when the frame is pointing north and south—it is at once known that the transmitting station is on a line drawn north and south, but it is not known whether the transmitter is to the north or south of the frame aerial. This is a rather troublesome drawback for marine work, more especially in the case of a ship in distress in foggy weather.

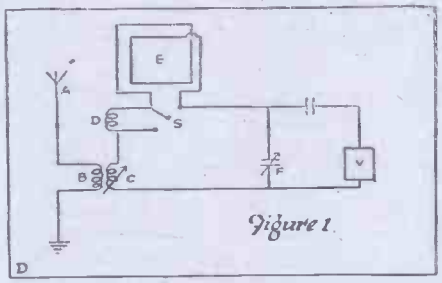


Figure 1.

Sometimes fogs last for days, and ships are compelled to navigate by dead reckoning. Successful navigation by means of dead reckoning has been described as a matter of practice combined with a certain amount of luck. It is not surprising, therefore, that ships sometimes run aground on sandbanks and other obstructions, which should not have existed according to the course worked out by dead reckoning. In such cases, where the position of the distressed vessel is frequently unknown even by its crew, any rescuing ship, if fitted with a direction finder, is unable to determine in which direction to proceed to render assistance.

As a result of this, two systems have been devised and adopted by the U.S. Government for determining, by means of an ordinary frame aerial, the absolute direction of any transmitting station.

The first method to be described makes use of an elevated aerial used in conjunction with the frame aerial, and has been in operation for some considerable time in the U.S. Navy.

Absolute Direction Indicated.

In Fig. 1, A represents a small elevated aerial which is grounded through a variable inductance, B. E is an ordinary frame aerial which is placed in the secondary circuit, which is inductively coupled to the aerial circuit by means of the coil C.

The inductance coil, D, in the secondary circuit is of the same value as the frame aerial, E, so that the tuning of the circuit remains unchanged when the frame aerial is inserted in place of the inductance, D. The valve detector is represented by V.

In order to use this set the frame aerial is first cut out of the secondary circuit by means of the switch S. Signals are then picked up by the ordinary elevated aerial, A, the secondary circuit being carefully tuned to the incoming wave by adjusting the variable inductance, C, and the variable condenser, F.

This having been accomplished, the switch, S, is moved on to the lower stop, thus bringing the frame aerial into the circuit, when signals will be received through both elevated aerial and also the frame.

It is now necessary to adjust the frame aerial. This is done by picking up some station whose exact position is known. We will suppose that the set is situated at Croydon, and that it is possible to hear North Foreland Radio (G N F), which is approximately due east.

The frame should now be rotated through a complete circle of 360 degrees, and the side of the frame which points to G N F when maximum signals are heard should be carefully noted and marked with an arrow. Having fixed this adjustment, the frame can now be made to indicate the absolute direction of any unknown transmitter. As in the case of G N F, the frame is rotated until maximum signals are heard, when the direction of the transmitting station will be indicated by the arrow on the frame.

In order to obtain more accurate readings the ordinary elevated aerial should then be cut out of the circuit. It will then be found possible to obtain the bearing of the transmitting station by the usual minimum method, which gives greater accuracy.

Another Method.

Another slightly different type of unidirectional frame aerial has been developed and patented by Frederick A. Kolster and W. Dunmore, physicist and associate physicist respectively to the U.S. Bureau of Standards. This method is used by the Bureau of Lighthouses and is installed on lighthouse tenders.

In this arrangement—the diagram of which is shown in Fig. 2—the frame aerial, A, is tuned to the incoming wave by means of the condenser, B. Across this condenser is the detector, V, which consists of a three-stage high-frequency amplifier, a detecting valve, and a two-stage low-frequency amplifier.

When the switch, S, is closed to the left, a small condenser, C, is connected across the double condenser, D, and the inductance, L, and the tuning condenser, E, are inserted in the ground lead. By proper adjustment of the condenser, C, and the circuit, L E, it is possible to ascertain the absolute direction of the transmitting station as given by the position of maximum signals, as described above in the case of North Foreland.

Once this has been done, the switch, S, is placed over to the right, thus grounding the middle plate of the double condenser, D, which is utilised for bringing about electrical symmetry of the frame aerial system with respect to earth. The position of transmitting station can then be obtained by the minimum method.

The actual reason why it is possible to obtain absolute direction finding by these methods is as follows:

Normally, the average frame aerial receiving set, when erected haphazardly, receives energy in two ways (1) by the action of the incoming waves striking the frame aerial, and (2) by the energy produced owing to the fact that the actual frame aerial has appreciable capacity to earth.

Now for perfect and accurate direction finding it is necessary that the receiver should obtain energy exclusively from the incoming electro-magnetic wave acting on the frame aerial; and it is equally essential that the energy received through earth capacity should be eliminated.

This latter object is obtained by making the receiving set electrically symmetrical with respect to earth, when the only energy received will be due to the incoming wave striking the frame aerial.

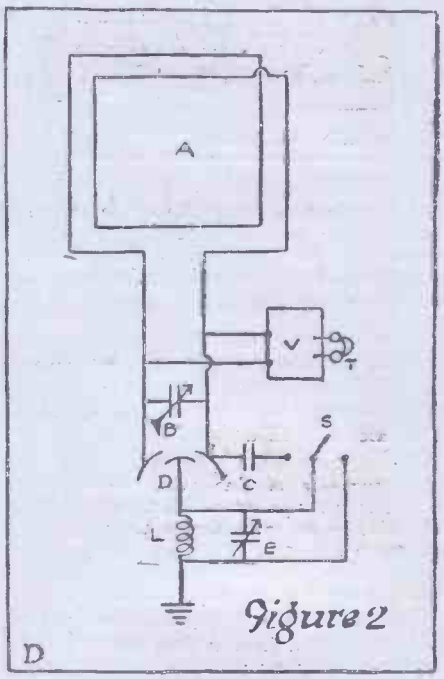


Figure 2.

In the case of the accurately constructed direction finding frame aerial the unidirectional effect is produced by upsetting this electrical symmetry of the set with respect to earth and thereby causing the receiver to be excited by energy due to earth capacity as well as by the incoming wave striking the frame aerial.

Owing to the phase relation of the currents now set up in the frame aerial the intensity of these currents will be differential or accumulative, depending upon which direction the transmitter happens to be, and thus only one position of maximum signals will be obtained. When the absolute direction is found, electrical symmetry is restored by removal of the elevated antenna or action of the double condenser, and the normal directional properties of the frame are resumed.

A WIRELESS CHAT TO SCOUTS.

By Scout J. W. S. MARR.

It will be remembered that Scout J. W. S. Marr was one of the two Scouts chosen from thousands of others to accompany Sir Ernest Shackleton on his last voyage of exploration. Although fraught with tragic memories, the circumstances of romance attending all such trips into more or less unknown regions, together with the fact that Scout Marr spent a considerable amount of time listening-in on the wireless set of the little "Quest," renders him in a position of authority to discuss the romance and fascination of wireless.

IT would be difficult, I think, to find a more interesting hobby than that of wireless. There is literally, no limit to the variety of entertainment that it affords. When you buy, or make, a simple receiver there is nothing to prevent you from listening to messages from all parts of the world at all times of the day and night.

For the small outlay involved in the purchase of a receiver (plus the ten shillings licence fee, of course) all the transmitting stations within range are suddenly placed at your service. They become part of the equipment that enables you to indulge your hobby. What other hobby can claim such wonderful facilities?

S O S, S O S.

Apart from the fascination of listening to signals from different parts of the world, the information conveyed in the messages themselves is often extremely interesting. It is scarcely possible that any amateur receiving aerial should fail to pick up at least one of the big commercial stations that operate throughout the day. Then, for those who live near the coast—or who, living inland, possess sufficiently sensitive receivers—there are always numerous ship stations flashing messages across the ocean to one another.

It is a thrilling experience to listen to a number of ships conversing on the high seas, as each one follows a definite course to some remote port. When two ships come within wireless range of one another, a formal introduction takes place through the ether. Each operator gives the name of his ship, stating whence he has come and whither he is bound. As the two ships draw closer together, conversation becomes more frequent, the operators "pass the time of day" at intervals, and friendly messages are sent from ship to ship. Then, as the ships draw apart again, cheery wishes and good-byes are exchanged.

One day, perhaps, as you are listening to the chattering of numerous ships, a cryptic S O S message is suddenly flashed through space. At the first sound of this dramatic signal the chattering ceases, as if by magic; stillness reigns throughout the ether whilst the operator on the distressed ship sends out his cry for help.

Aircraft Wireless.

Then comes the response. First one ship, then another, proffers its assistance. Within a few minutes half a dozen ships, or more, are hastening to the scene of the trouble, sending out periodical messages of encouragement as they race across the ocean at full speed. An hour or two later the rescue has been effected, the doomed ship has been emptied of its human cargo and the ether tingles anew with the joyful tidings.

Aircraft wireless provides yet another source of thrilling entertainment for the amateur. Practically all the machines on the Continental air routes are equipped with wireless telephony transmitting and receiving apparatus. These instruments are constantly in use during the numerous flights that are carried out each day, and pilots can often be heard conversing with one another in the air, or with one of the various ground stations at the aerodromes along the route.

The Broadcasting Stations.

Then of course, there are the wonderful broadcasting stations, which send out nightly programmes of vocal and instrumental music, news bulletins, weather reports, children's bedtime stories, etc. With such a selection of good things always "on tap," no wireless amateur need ever fear a shortage of ether vibrations with which to carry on his hobby.

The real red-hot amateur, however, will rarely be satisfied to confine his interests to broadcast programmes, no matter how interesting and entertaining these may be. The ether is always quivering with telegraphic messages from all the big commercial stations that are dotted around the world, and these messages can only be interpreted by people who are conversant with the Morse code.

This is an aspect of wireless which should prove of particular interest to Boy Scouts. Even the very earliest stages of a Scout's training include a knowledge of the Morse code. Although the speed at which Morse code signals have to be read in order to obtain certain badges is never very high, many Scouts, needless to say, acquire a much higher standard of proficiency than is required. This gives them a great advantage when it comes to studying the Morse code for the special purpose of receiving wireless telegraphic messages; I think the early stages are the most difficult ones in learning Morse, and these they have already passed.

Apart from the entertainment value of broadcast selections, there is another aspect of these programmes which should make a special appeal to Scouts. We are told on good authority that "broadcast programmes of the future will contain a large element of an educational and instructive nature." This, no doubt, will take the form of authoritative lectures on useful and interesting subjects. Many of these lectures will, I think, be of particular value to Scouts, since the aim of every Scout should be to lay up as rich and varied a store of useful information as possible.

A Haunting Desire.

Finally, there is a great deal of keen pleasure, not to mention valuable mechanical experience, to be gained from the practical side of wireless. Few Scouts will be content with a superficial knowledge of the instruments which yield them such useful and profitable enjoyment. They will want to know "how they work." Moreover, there is always the haunting desire to increase the range of one's receiving apparatus. Once that lure has been felt, there is no limit to the craving for wireless knowledge that follows.

I would like to conclude this article by recommending all Scouts to keep in constant touch with the excellent practical and theoretical information that is always to be found in POPULAR WIRELESS.

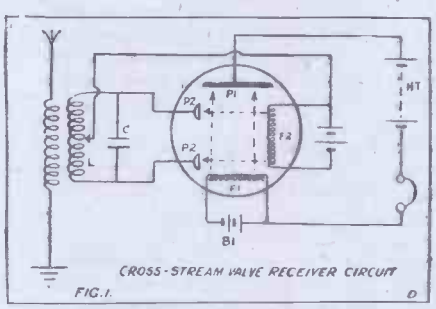
The Wireless Class of the Rothschild Boys' School, Brentford.

CROSS-STREAM VALVES.

By SEXTON O'CONNOR.

There are other methods of employing the valve as a sensitive detector and amplifier of wireless signals than introducing a grid between the plate and the filament, and in this article one of the most successful is described. It will be apparent, therefore, that there is scope for invention even in the field of the valve itself, and that even this "modern Aladdin's lamp" must not be allowed to escape the attention of the earnest experimenter.

THE key to the action of the thermionic valve lies in the amazing sensitivity of the electron stream which flows between the filament and plate. Not only is the value of the internal current regulated in strict proportion to the strength of the controlling E.M.F. upon the grid (within the limits of the straight-line portion of the characteristic curve), but the response to the control is instantaneous. In other words, there is no "lag" between cause and effect, that is, between the applied signal E.M.F. and the resulting plate or telephone current.



In every other known type of relay there are parts to be moved which, however light in weight and accurate in balance, involve inertia effects, with a corresponding "delayed action," and more or less loss of energy. In a thermionic valve, the electron stream is the only moving "part" concerned, and, as the electrons have no perceptible mass, they are able to respond accurately and immediately to the influence of exceedingly small controlling forces.

Control of Electron Flow.

Originally, in the case of the two-electrode type of valve, this control of the electron stream was not utilised to the best advantage. By inserting a grid between the plate and filament, de Forest practically revolutionised the scope and efficiency of the instrument as a detector and amplifier of wireless signals.

Since de Forest's invention there have been many attempts to secure a similarly efficient control of the electron stream by other methods than the use of a grid. In some of these an external circuit is arranged to set up a magnetic or electrostatic field across the path taken by the electrons in their passage between the filament and plate. Signal currents are utilised to vary the strength of this field, which, in turn, reacts upon the flying electrons, and prevents them from reaching the plate, causing the current through the 'phones to vary accordingly.

Yet another means of controlling the electron stream is that indicated in the heading to the present article. Here the interior of a valve is arranged so that there are two independent plate-filament paths, each being located at right angles to the other, and the electron streams set up along the two separate paths are caused to clash or oppose each other in such a way as to repeat in one circuit the effect of signal energy applied to the other.

New Forces Introduced.

As shown in Fig. 1, a spherical bulb is fitted with a filament, F1, heated by a battery, B1, and with a plate, P1, connected through a high-tension battery, HT, and a pair of telephones back to the filament, F1. Arranged at right-angles is a second filament, F2, co-acting with two smaller anodes or plates, P2, which, in this instance, are connected across a tuned secondary circuit, LC, coupled to the aerial. It will be noticed that the centre point of the coil, L, is joined to one end of the filament, F2.

When the high-tension battery is plugged in, there will arise, in the absence of any signals in the aerial, a steady electron stream across the path F1, P1, which will in turn set up a constant current in the plate circuit. Under these conditions, after the first click, no further sound will be heard in the 'phones.

Now, imagine the impact of signals upon the aerial. The first half wave will, let us say, throw the upper anode P2 positive, and the lower anode P2 negative. This will immediately bring new forces to play inside the valve. In the first place, the upper anode P2 will attract electrons straight across the tube from the filament F2, and these, in their passage, will collide with and divert a portion of the electron stream passing between the filament F1 and plate P1. In addition, the anode P2 will attract to itself some of the electrons which would normally flow direct from F1 to P1. In the second place, the lower anode P2, being charged negatively, will repel or thrust back towards the filament F1 many electrons which would otherwise reach the plate P1.

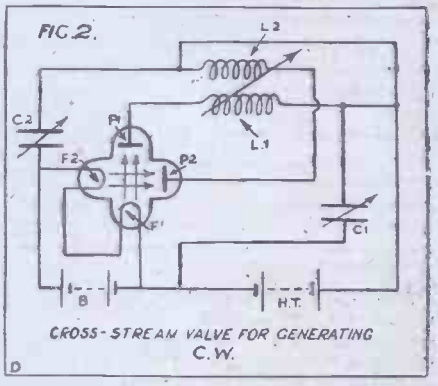
Double Rectification Possible.

The total effect, then, of the first half wave is to considerably diminish the total number of electrons reaching the plate P1 from the filament F1. This results in a decrease in the value of the steady current passing through that circuit, and a corresponding response in the telephones.

The impact of the second half-wave upon the aerial will reverse the potential charges upon the two anodes P2, throwing the upper one negative and the lower positive. A similar conflict again arises between the cross-streams of electrons, with a corresponding effect upon the main current flowing across the path F1, P1, and through the 'phones.

It will be observed that by using two separate anodes P2, and connecting the filament to the mid-point of the induction coil L, each half-wave is utilised to the full, and so gives rise to a "double rectification" effect. In the case of the ordinary "grid," it will be remembered that only one-half of the available signal energy is utilised, the other half being practically wasted.

The circuit shown in Fig. 2 represents a slightly different type of cross-stream valve, which operates as a generator of continuous oscillations, either for transmission or for heterodyne reception. As before, there are two electron paths arranged at right angles to each other. The filament F1 feeds the plate P1, the two electrodes being connected by an external circuit L1, C1, which is tuned to the frequency of the oscillations to be generated. The second pair of electrodes, F2, P2, are arranged at



right-angles to the first across the valve, and are connected externally by a circuit, L2, C2, tuned to the same frequency. A common battery, B, feeds both filaments, and a high-tension battery, HT, supplies the plates P1, P2 in parallel. The inductances L1, L2 are coupled together so that current flowing in one circuit transfers voltage effects across the plate and filament of the other circuit.

Generating Continuous Waves.

When the high-tension battery is plugged in, both the condensers C1 and C2 are charged up. One or other of them will then discharge across its associated plate-filament path. Whilst it is so doing, the voltage effect set up by the resulting current across the coils L1, L2, combined with the barrier formed by the first electron stream, prevents the discharge of the second condenser until the first has been completely relieved.

Immediately afterwards, the second condenser discharges across its own filament-plate path, simultaneously blocking the second or cross path. So the process goes on, each condenser being alternately charged from the high-tension battery, and discharged through the valve. These alternate pulses set up sustained oscillations, which can be fed from the tuned external circuit to a transmitting aerial.

AN EASILY MADE DETECTOR.

IT will be seen from Fig. 1 that the pillar, A, will revolve upon its pivot-screw, D, (which is provided with washers (F, Fig. 4), thus enabling the crystal to be traversed from side to side; the rod G, may slide backwards and forwards, while a twist will raise the cat-whisker, L-shaped as at E, or lower it to make contact. Rigidity is then secured by a turn of the thumbscrew,

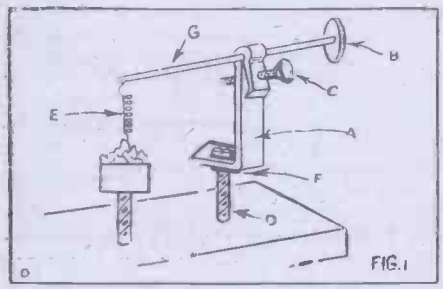


FIG. 1

C, a feature which will be appreciated by users of sensitive crystals.

Total cost, 3½d.

To construct, a strip of brass 3 in. by ¼ in., tapering slightly, is bent to the shape shown in Fig. 4, and drilled $\frac{5}{32}$ in. to take 4 B.A. screws. In the absence of a tap use a 4 B.A. nut to secure the thumbscrew. Fig. 2 shows how this latter may be constructed by soldering a piece of hard brass into the head of a Meccano bolt.

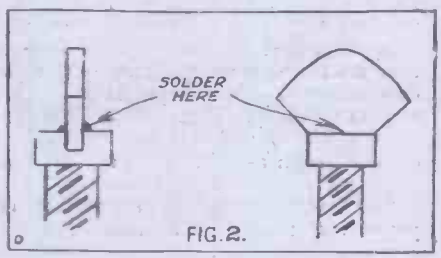


FIG. 2.

Bending the pillar to shape will offer no difficulty if it be wrapped round a piece of No. 8 S.W.G. wire and gripped in the jaws of a vice, subsequently drilling holes for C and finally bending the tip. Fig. 5 shows the strip so gripped.

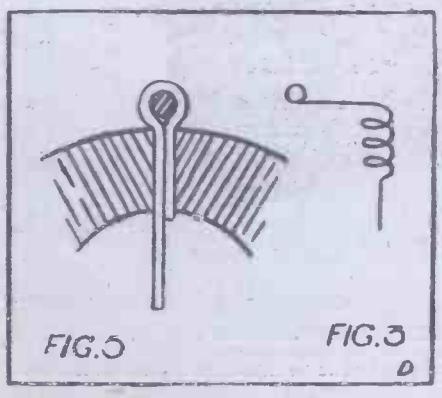


FIG. 5 FIG. 3

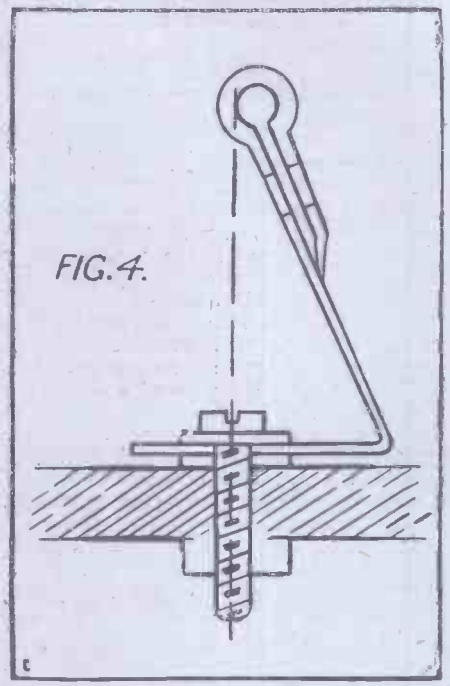


FIG. 4.

After trials with several cat-whiskers, best results were obtained by rubbing down to a fine point a piece of 24 S.W.G. copper wire, which found the sensitive spots, but would not shake off through vibration.

Finally, the knob B came from a vulcanite knitting-needle.

Total cost, including crystal-cup, 3½d.

CORRESPONDENCE.

To the Editor, POPULAR WIRELESS.

Dear Sir,—The deluge of complaints made by listeners-in re the poor quality of the programmes transmitted by the B.B.C., and the subsequent controversy that has arisen on the matter, are deeply interesting to me, and to all concerned with similar societies.

I agree with the letters which have appeared, and the views of those newspapers which have criticised so adversely the programmes that have been provided.

On consideration one can see that the trouble was inevitable where the company responsible for the selection of artistes are experts only as regards the mechanical side of the arrangements. It is obvious that those whose business it is to be experts in all matters affecting the perfection of the wireless apparatus cannot also be experts in the important matter of arranging programmes.

The selection of the artistes whose turns are to be transmitted should certainly be in the hands of an expert well in touch with concert artistes of the highest order, and able to judge on their suitability for wireless work.

The remedy for the existing trouble does not lie in taking away from the B.B.C. the powers vested in it, but in seeing that proper use is made of those powers. For the power to transmit to be in the hands of many—to give freedom of the air, as it has been termed—indiscriminately would only create that chaos which has so far been avoided in this country.

Surely it is possible for the B.B.C. to secure promptly the services of a concert expert—one "au fait" with the leading vocal and instrumental artistes. The growing volume of complaints would, I venture to state, become one of expressions of satisfaction if really good artistes were heard instead of the lamentable efforts over which all the bother has arisen.

Sir William Noble, writing in POPULAR WIRELESS on July 8th of last year, referred to the necessity for providing high-grade programmes, stating "these are essential to permanent success."

On October 7th, 1922, at the All-British Wireless Exhibition at the Royal Horticultural Hall, Sir Henry Norman said that "the cost of broadcasting was chiefly that of the high-class professional programme—the very best of its kind in the world."

These gentlemen are, one sees, fully aware of the essential for success, and, in spite of their public speeches and good lead given, the results have been, under the present system, very poor, but these views could be speedily acted upon, if a capable concert expert were retained to arrange the items of the programmes.

I certainly trust to learn that the B.B.C. will act on the suggestion *before it is too late.*

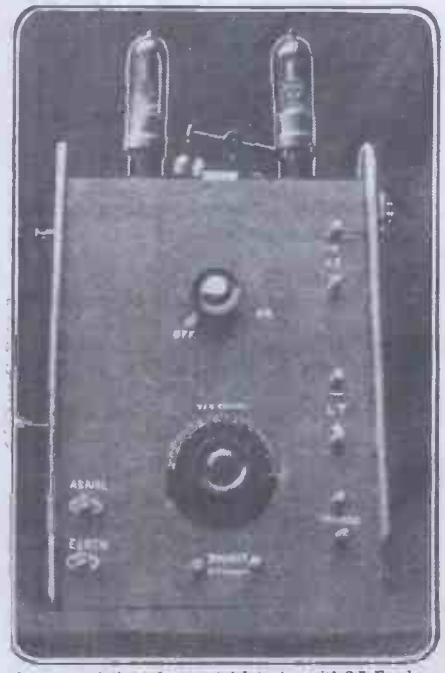
Yours faithfully,

H. HYAMS,

Hon. Secretary,

The Hornsey and District Wireless Society.

(Subsequent to the receipt of this letter the announcement has been made of the appointment of Mr. Percy Pitt, the well known conductor, as a musical director to the B.B.C. This is a step in the right direction.—EDITOR.)



A set, consisting of a crystal detector with 2 L F valves constructed by Mr. H. Parker, 72 Hennon St., Bolton.

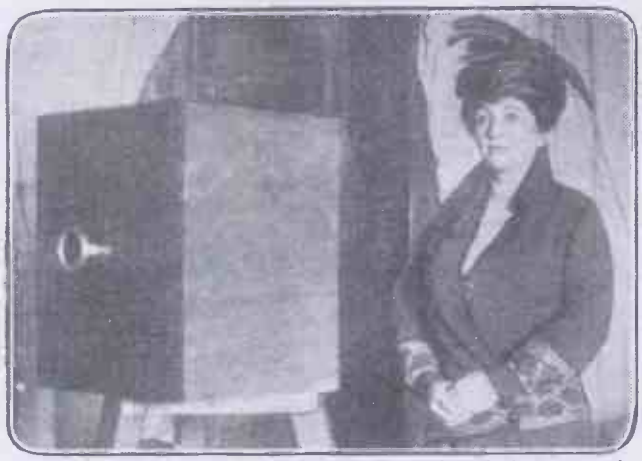
THE CO-OPTIMISTS AND BROADCASTING.

The views of some of the members of this well-known company on the subject of the broadcasting of theatrical productions and wireless in general prove very interesting in view of the controversy that has arisen, and in which the Co-optimists have figured prominently.

"WHAT time do the French stations transmit?" said Mr. David Burnaby (the "Optimist in Chief") as soon as he knew who I was. "I especially want to hear that new station, School of Posts and Telegraphs, do something."

I told him the times of transmission, and that he would find a complete list in POPULAR WIRELESS each week, and asked him whether he was very keen on wireless.

"Oh, rather!" he answered. "I love listening-in. I have had a set for a long time now."



Madame Lily Payling, the famous Australian contralto, who has on several occasions broadcast from 2 L O.

"What do you think of the idea of broadcasting the productions from the various theatres?"

"It's the finest advertisement that the theatres could possibly have," he said emphatically. "I think that to have a production broadcast—or, rather, an act of it, for I am not in favour of transmitting the whole lot—is the best publicity that could be obtained anywhere. The broadcasting of the whole of a performance would rather undercut the stage world, but I cannot think of a better advertisement than to broadcast a portion.

A Case in Point.

"Think of the thousands of people who listen every evening," he went on, "and you will get some idea of the value of that publicity which is sent in such a pleasant form."

I agreed with him, and asked him if he knew of any instance where broadcasting had harmed a theatre in any way

"On the contrary," said Mr. Burnaby, "I could give you one instance where it has helped the stage considerably. There was a theatre in the West End that was doing quite well, but decided to allow the B.B.C. to broadcast a part of their show. The result was immediate, for on the next night the takings had increased by pretty nearly one hundred pounds."

"Ah, that's a bit different!" he said, in answer to my query concerning the gramophone companies. "They have more reason to be alarmed, as the sudden boom in wireless instruments must affect the sale of gramophones quite considerably.

"I don't think the publishers have anything to grumble at, either," added the leader of the "Co-Ops.," "for the same applies to them as to the theatres, only more so. To hear a song sung is far better than seeing a few bars printed on the back of another song, as far as an advertisement is concerned. In this respect broadcasting a piece of music is on a par with having it performed at the Queen's Hall or somewhere like that. I know that my wife has bought many a song because she had heard it sung at 2 L O."

"Well, we hope to hear you all at 2 L O on Thursday," I said, as I wished him good-bye.

"I hope so," he replied, shrugging his shoulders; "but it's nothing to do with me this time. We're ready whenever they like to say 'Go.' Now I'm going to listen-in for that French station."

The next member of the band whom I spoke to was Miss Betty Chester, so I told her that I had been discussing the theatre-broadcasting problem with her leader, and asked what she thought of the situation.

"Oh," she said, laughing, "you must tell me what the others said first!"

I told her.

"That's all right," she agreed. "I am of the same opinion as Mr. Burnaby. As broadcasting is now, I think it is a very useful advertisement for the theatres; but I was at Marconi House the other day, and they told me that in the near future people will be able to see as well as hear, and then I really don't know what will happen."

Quite another view was taken by Mr. Melville Gideon, the last member of the Co-Optimists whose opinions I asked.

"I am quite against broadcasting a show," answered Mr. Gideon when I asked him what he thought about the question. "I have listened-in several times, and I think the effect of broadcasting a theatre show quite poor. Personally, I am of opinion that the broadcasting of a play is not at all a good advertisement. Now, take a thoroughly bad show; the people will not go to see it, however much it is advertised, and broadcasting it will only make matters worse. A very good show will run well whether it is broadcast or not. Then consider the case of the mediocre production. It may need a great deal of advertising to make it a success, but if you broadcast it the players lose all their individuality, and the music or speech alone is quite inadequate, while the noise of the clapping of the audience makes you think that only about three hundred people are present, though the house may be packed.

A Special Arrangement.

"This is only my opinion," added Mr. Gideon, "and I may be quite wrong, but I must say that, as far as I can see, broadcasting will not assist the theatres."

"What about the gramophones?" I asked.

"Well," he went on, "I derive a lot of my income from the gramophone companies, and I am afraid that they are bound to be affected adversely by broadcasting. A little while ago I was staying in the country, and the people there were dancing to broadcast music—not from a near station, mind you, but from Glasgow. Well, that sort of thing, where people can choose their dance programme, is obviously going to prove deleterious to the gramophone companies. Another thing about it, from a financial point of view, is this: the artistes are not adequately paid when they broadcast, and they are therefore not going to break their contracts with other companies to sing at the broadcasting studios. Then, if the fees were adequate and the best performers obtained I am afraid that the theatres and gramophones would be very hard hit."

"But what about the appearance of yourselves on Thursday?" I asked.

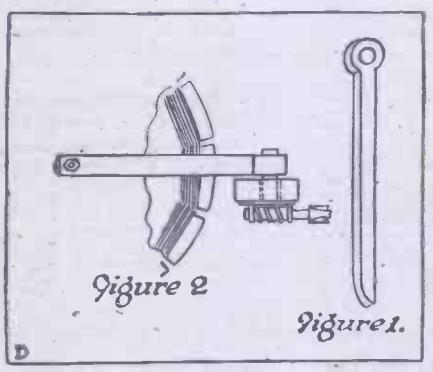
"That is possible under some special arrangement with the powers that be," was the reply, "otherwise we should not be allowed to do it."

Mr. L. Stanton Jefferies, musical director of the B.B.C., who personally accompanied Madame Lily Payling on the occasion of her last visit to 2 L O.

A HOME MADE CARD-INDUCTANCE TUNER.

LOOKING through some old rubbish the other day, I came across a small worm drive, originally used on a guitar or similar stringed instrument, and I found this very adaptable to card inductances for adjusting their proximity to one another for tuning purposes. I thereupon constructed the piece of apparatus about to be described.

I procured a baseboard, 5 in. by 3½ in. by ½ in., a small block of wood, 1¾ in. by 1 in. by ½ in., a strip 3½ in. by ½ in. square, an odd



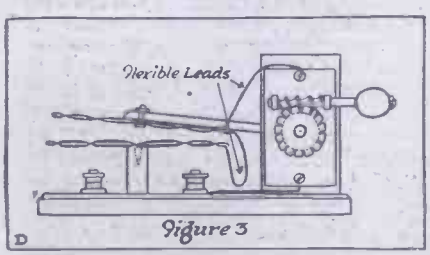
piece to mount a coil upon, a few screws, flexible wire, and two terminals, etc.

Through the small block of wood, in the centre, I drilled a hole slightly larger than the spindle of the cogged wheel, inserted the spindle through it, and screwed the metal plate and the wood block together.

I then took the strip of wood and shaped it as shown in Fig. 1, inserted the projecting portion of the spindle, which had a small hole already drilled through it a little more than a quarter of an inch from the end, into the hole at the large end, and drove home a small nail through the wood and the spindle. This held them together very firmly. (See Fig. 2).

Taking one of the card inductances, which was simply a circular cardboard disc 3½ in. diameter with nine slots cut in it and wound full with 24 S.W.G. enamelled wire, I secured it to the small end of the movable arm by a small bolt and nut. One lead from this coil was connected by flex to the plate of the worm-gear, and the other lead went to one lead of the other inductance card, made exactly the same as the first card.

This inductance I mounted on a vertical wood pillar, in such a position that when

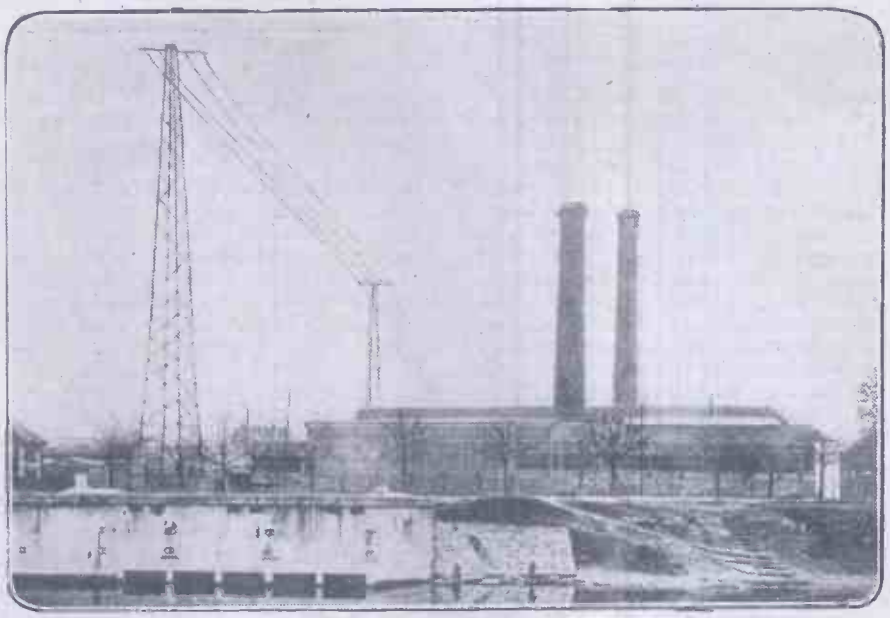


the gearblock was fixed to the baseboard the fixed card was just below the centre of the spindle, so enabling the two cards to lie parallel to one another.

The remaining lead of the second coil was taken to one terminal and the other terminal was connected to the plate of the worm gear. (See Fig. 3.)

This proved to be a very adaptable piece of apparatus, and if used with a crystal detector, 'phones and 'phone condenser, it became a very efficient broadcast wavelength receiver.

On testing, should no signals result, one card inductance should be reversed.



The Headquarters of the Societe Francaise Radio Electrique at Lavallois Perret from whence emanate the popular Radiola Concerts

A SHORT REPORT OF DR. FLEMING'S LECTURE FROM 2 L O.

AN item of extraordinary interest among the items of a good programme on Friday, February 16th, was an address by Dr. J. A. Fleming on the electron valve, its discovery and progress, and the modern methods by which music, speech, etc., are launched out over hundreds of miles.

In 1882, Dr. Fleming told us, the electric incandescent lamp was perfected. This consisted of a glass bulb, exhausted of air, and containing a carbon filament which was made to glow by means of an electric current. After use for some time these bulbs became blackened by the filament burning through. Dr. Fleming, then carrying on his researches at University College, noticed, in these "burnt-out" bulbs, in every case a white clear line on the bulb was left, indicating that the carbon deposit was shot out in straight lines and that the side of the filament had acted as a screen, thus leaving a line free from the black deposit. Later it was discovered that these grains of black carbon possessed the quality of negative electricity. The electron theory was then unknown, and this deposit was considered to consist of molecules, subdivided into atoms the same as all other substances. Atoms, Dr. Fleming explained, were then considered the smallest possible particle of a substance which had all the properties of that substance. There are eighty-two different atoms, and any substance consists of thousands of one or more out of this eighty-two, just as all words are built up from the alphabet. An atom, it is calculated, is so small that 250,000 end to end would equal one inch. An electron, however, compared to an atom, is as a grain of dust compared to the dome of St. Paul's.

Dr. Fleming, in the course of his experiments, inserted a cylinder of metal round the filament, and found that with this he had a means of rectifying a current of alternating potential into a solely negative one. Here Dr. Fleming proceeded to explain the projection of the voice through the ether, starting at the microphone and ending at the receiving headgear. This I need not repeat, as it is general radio knowledge.

Some time after Dr. Fleming's discovery it was improved upon by De Forest's insertion of a grid, thus magnifying the effect of the valve. The electron valve, Dr. Fleming pointed out, could act in three ways, e.g. :

1. The detection
2. The amplification
3. The creation of ether waves

In concluding, Dr. Fleming outlined the inestimable value to radio of this "Modern Aladdin's Lamp," as he affectionately called it. Without it, he reminded us, broadcasting would be non-existent. It is indeed the "master weapon of the wireless engineer."

RANDOM RADIO.

By C. G. GIBBONS.

THE "wireless" picnic promises to be a feature of this summer's outdoor pursuits. Wireless in the woodlands! What scope it offers to the man with a penchant for tools; consider the thought that will be given to the evolving of the "super" portable set. Will chivalry maintain itself when two aspirants for a particular tree arrive at the same moment to attach their aerials? "Mine, I think." "Ours, I hope." Supposing one oscillates?

And on the river! Picture two punts, the occupants of which are being wafted to ethereal realms by the mellow music of a wireless orchestra. The "earth" leads, trailing in the water, become entangled, and the resultant "pull" takes one "set" over-board. Litigation? No, assignation!

Wireless is causing some little consternation these days. Instance the gentleman who "earthed" his outfit to the gas-oven, and whose wife, when a thunderstorm threatened, left the house in a panic and returned to find that someone, taking advantage of an open door, had relieved the place of all loose valuables—and the wireless set.

What of the person who declared that this "agitation of the ether" was affecting his health, because of the incessant passage of radio waves through his body? Many people declare that wireless assists the growth of the hair, but I have heard it suggested that the head-bands of some 'phones exert quite an opposite effect.

There is no doubt that many people afflicted with deafness have derived much benefit from listening-in, but if this has aroused a faint hope that the exponents of the art of extreme reaction, who are particularly deaf to entreaty, will benefit thereby, then I am afraid it has been over-estimated.

"Wireless" and "radio" are accepted as being synonymous terms. But have you heard of the lady who, on a big liner, asked the chief operator when the owners were going to have "radio" installed and bring the ship up to date?

Listening to Uncle Arthur (of 2 L O) telling children's stories on the experimental set constructed by Mr. R. F. Lamport, of 7, Fell Road, Croydon, Surrey.

Oh, for Some Music!

Talking of the men who go down to the sea in ships reminds me of a letter I received recently from a chum who is one of the professional men, a first operator in the Mercantile Marine.

"Your letters and P.W.'s received O.K.," he writes. "What a great time you must have with this broadcasting! Oh, for an evening to tune in the B.B.C. stations and to get away from this eternal dot and dash and atmospherics like miniature thunderstorms!"

Well, roaming the high seas of the Far East for six months must encourage the wish for a change of scenery, but I think I'd "rest" wireless if the opportunity came. But can you get away from it nowadays?

An Excellent Alternative.

If you read Morse, you no doubt appreciate how interesting it is to intercept messages from ship and shore stations. If you don't interest yourself in telegraphy, then please be tolerant with this paragraph. But "a bird in the hand is worth two in the bush," and when there is no broadcasting to soothe your ear, the other is an excellent alternative. It is surprising how the "notes" of ship stations vary. Some, like the lark in exultation, are high and shrill, while others aspire to the blatant tones of a bass baritone. A few, which is merciful, beggar description; if barnacles had grown upon the spark gap, or seaweed had entwined itself around the condenser plates, no more plaintive wailing could result.

Pleasant Associations.

But to come to the coast stations. Where is there a bigger glutton for work than G N F (North Foreland)? And what provides a greater thrill than his call for "Silence! S O S! S O S!"? Then Niton, G N I, close collaborator of G N F, Seaforth, Cullercoats, and Caister, to enumerate a few more. You can get them all on crystal.

Suppose we turn to the Continent. Boulogne (think of the Casino), Le Havre, Dunkirk, and F F S, that most interesting little station in the Bay of Marseilles. Ostend, to remind you of a table delicacy and racehorses; Scheveningen (good test for a spelling bee if you trot it out quickly), and, farther north, several German stations. If your tuning coil is large enough, you can "raise" Karlsborg, Sweden, on 2,000 metres, and F L—dear old F L!—on 2,600 metres.

It's really worth while to learn Morse!

An "Ether" Argument.

When someone suddenly fires a question at me on a subject of much controversy, I become very wary. A few days ago, reclining on a mossy bank and taking the air, my companion roused me from a brown study by ejaculating, "What do you think of this ether theory?" "Do you mean the stuff they use at operations?" I replied. I received a withering glance in answer. "What do *I* think of it? Well, what do *you* think of it?" I prided myself on a good counter-stroke, but no, he wasn't taking any. So I expounded my meagre opinion.

"You think, then, that this medium which the 'great brains' call ether, and which makes wireless possible, actually permeates everything?" said my friend.

"Undoubtedly," said I, vainly trying to think of something crushing. "Can't imagine my dinner oscillating to 2 L O's music, or responding to Eiffel Tower's time signals," came the response. "You wouldn't! At one hundred and eighty thousand miles per second, it would be too fast for you to grasp it!" Which item of wit was responded to with a shower of soft earth. So much for argument!

Have you ever suffered the rude awakening of realising that the faint music you have tuned in on a long wave is none other than the local station defying the concerted efforts of condensers and couplings? Most disconcerting, especially when one is entertaining friends who have been told that the particular set in operation has the fine tuning circuit *par excellence*, and that Glasgow could be tuned in from London across forty other stations on wave-lengths, each differing but by one metre or so, did they exist. Of course, there are hopes of judiciously saving your reputation should you be the first to notice the deception; but if someone else says, "Why, it's 2 L O! That's Uncle Jeff speaking now," then——

But it's all in the game, and these things *will* happen.

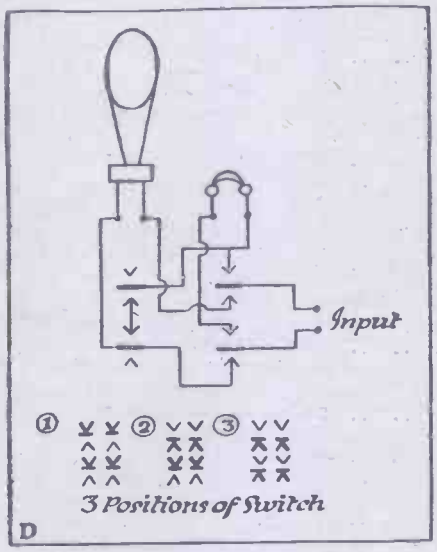
HINTS ON MULTI-VALVE CIRCUITS.

BY 5 M X.

THERE are so many different fittings and switching arrangements, not absolutely necessary for good reception, which can be added to one's set that it is difficult to decide what shall or shall not be incorporated. Refinements may be classed under two headings: (1) Those which in some way or other increase the efficiency of the set; and (2) those which do not increase actual efficiency, but contribute to ease in manipulation, etc.

Heading 2 contains certain devices which actually decrease the efficiency, and it has to be decided whether the extra simplicity or convenience is outweighed or not by the decrease in signal strength, tone, etc.

Now as regards the refinements themselves it is generally desirable, even if only from an economical point of view, to have



some means of switching in or out of circuit from one up to the total number of valves. For this purpose some form of two-pole two-way switch must be employed, and the choice of the switches themselves is a point which should be given serious consideration if anything like the best results are to be obtained.

A Variable Grid Condenser.

A knife switch of sound construction is to be highly recommended, as the contacts are well spaced, giving freedom from capacity effects, and also with a reliable make a good contact is assured. The Dewar type are neater but more expensive, and although the ordinary blade type Dewar is quite efficient for switching the L.F. valves, they are not recommended for H.F. work owing to their self-capacity. The anti-capacity Dewar type switch may be used, but these will be found too expensive for the majority of people.

If H.F. amplifiers are in use a refinement which almost amounts to a necessity (especially for long-distance broadcast reception) is a potentiometer control for the grids of the H.F. and detector valves, so as to stop oscillation by applying a slight positive potential to the grids. Even when this is done it may be found necessary to reverse the connections to the reaction coil so as to apply a small amount of "negative" reaction. For this purpose a two-pole change-over switch in the reaction coil leads will be a great advantage.

If the detector valve is frequently changed, a ·0005 variable condenser in place of the fixed grid condenser, and also a variable grid leak will be found well worth the extra expense and trouble in mounting.

Not a Question of Price.

Most multi-valve sets employ a loud speaker in addition to a pair, or pairs, of head telephones, and it is a great advantage to tune in with the 'phones and then switch over to the loud speaker, or if the loud speaker is in another room it is desirable to have the two in series, so that the operator may know just what is happening. (See diagram). A switch with a position for any of these arrangements will be found mounted on the Fullerphone potentiometer units, on sale in many ex-Government stores. The potentiometer itself is admirably suitable for the purpose previously referred to.

The reader will not have to look far in radio literature to find any or all of these refinements included in many and various valve circuits, with the exception of the 'phone switching, which was thought out by the author to put to good use a switch for which he had no other use at the time.

The tune and stand-by and series-parallel switch should not need suggesting to the serious experimenter, although it is surprising to note the number of sets on which neither of these are present.

In conclusion it may be stated that only the best components are good enough for *your* set, and also that the best is not always the most expensive. For instance, it is practically impossible to secure a better made article than an ex-Government one, although it is very possible to pay three times its price for a weird and wonderful contraption which performs the same duty with half the efficiency.

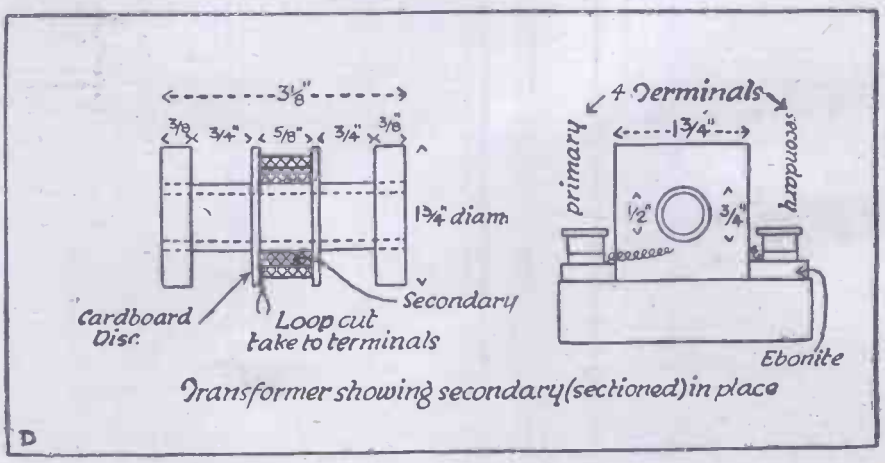
AN EXPERIMENTER'S TELEPHONE TRANSFORMER.

THE former for the coils is made up as shown in the diagram, by cutting two pieces of wood $1\frac{3}{4} \times 1\frac{3}{4} \times \frac{3}{8}$ and two pieces of cardboard, also $1\frac{3}{4} \times 1\frac{3}{4}$, and mounting these firmly as shown on a central piece, diameter $\frac{3}{4}$, and $3\frac{1}{8}$ in. long, with a $\frac{1}{4}$-in. hole through the middle.

Then comes the winding—an awful job, isn't it, but a jolly good winder can be made out of Meccano parts very easily; 2 oz. of 42 D.S.C. wire are enough for the primary. This will give about 8,000 turns. Make a small hole at the bottom of each of the outside wood ends, and thread one end of the wire through this hole. Pass through enough to lead to the terminals. Wind about 3,500 turns in one outside groove and 4,500 turns in the other, fixing the loose ends of the wire temporarily through small holes in the corners.

Now wind 2 oz. of 32 D.S.C. wire, giving about 1,200 turns, in the central groove, bringing one end up the side, preferably in a small cut. When you reach the 700th turn or thereabouts, take out a loop up the side, as shown, and fix temporarily. This loop is afterwards cut and taken to two terminals. Now finish the winding, and stick the whole thing on a base with two screws into the wooden ends. Bring out the eight ends of wire to terminals mounted on ebonite, and arranged down each side, four primary terminals on one side and the four secondary on the other side. Shove the core wires through the centre, and the thing is done.

With the primary coils in series, three ratios are possible by juggling with the secondary side. Then the primary windings can be tried separately and more possibilities explored. Since the primary and secondary are wound separately, the windings can be played about with, more turns being added, and new ratios found *ad lib.*



Transformer showing secondary (sectioned) in place

THE CONTINENTAL BROADCASTING STATIONS.

This comprehensive programme will indicate to those amateurs who possess suitable sets some items of interest well worth "searching round" for should British Broadcasting at any time begin to pall. Much valuable instruction in the various European languages is also available, and those who desire to acquire just that "finishing" accent can readily do so from this extremely interesting source. Apart from this, music-lovers will discover that some of these European concerts are really excellent.

Transmitting Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.
BELGIUM					
Brussels (1)	Brussels	12 noon	Weather report	1100	Working days.
		4.50 p.m.	Aeroplane traffic	1100	When necessary
		6 p.m.	Concert	1300	Sunday, Tuesday and Thursday.
HOLLAND					
The Hague	PCGG	3–5 p.m.	Concert	1050	Sunday.
		8.40–9.40 p.m.	Concert	1050	Monday & Thursday
The Hague	PCUU	7.45–10 p.m.	Concert	1050	Tuesday.
(Laboratorium Heussen)		9.40–10.40 a.m.		1050	Sunday.
The Hague (Velthuyzen)	PCKK	8.40–11.40 p.m.	Various	1050	Friday.
Ymuiden (Middelraad)	PCMM	8.40–11.40 p.m.	Concert	1050	Saturday.
Amsterdam	PA5	8.10–11.10 p.m.	Concert and News	1050	Wednesday.
FRANCE					
Levallois-Perret (Radiola)	SFR	2–3 p.m.	Music	1780	Sunday.
		5 p.m.	Stock Exchange News	1780	Every day.
		5.15–6.15 p.m.	Instrumental music	1780	Every day.
		8.45 p.m.	General News	1780	Every day.
		9–10.30 p.m.	Vocal and instrumental concert	1780	Every day.
Paris (2) (Eiffel Tower)	FL	6.40 a.m.	Weather Forecast	2600	Every day.
		11.15 a.m.	Weather Forecast	2600	Every day.
		3.30 p.m.	Stock Exchange News	2600	Every day.
		6.20 p.m.	Weather Forecast, Concert	2600	Every day.
		10.10 p.m.	Weather Forecast	2600	Every day.
École Supérieure des P.T.T.		7.45–10 p.m.	Radio Concerts	450	Tuesday, Thursday,
Radio-Riviera (Nice)		2.30–7.30 p.m.	Radio Conferences	450	Saturday.
		11 a.m.	News, Concert, tzigane	460	Every day.
		5–6 p.m.	News, instrumental Concert	460	Every day.
		9–10 p.m.	Latest News, Concert	460	Every day.
GERMANY, CZECHO-SLOVAKIA, AND SWITZERLAND					
Berlin (Königswusterhausen)	LP	6–7 11-12.30	Financial News, etc.	2800	Every day.
		4–5.30 p.m.	Financial News, etc.	2800	Every day.
Prague	PRG	7–11 a.m. and 3 p.m.	Weather News, General News	1800	Every day.
		9–2 p.m. and 9 p.m.	Concert	4500	
Geneva	HB	6–7 p.m.	Concert	1200	Every day.

(1) If, at the indicated times, a station has to receive or transmit service communications, the weather transmission will take place after these communications. Tuesday: Operatic selection on the gramophone. Thursday: Various on gramophone. Sundays: Various by artistes.

(2) Special concerts given during the evening are announced in the course of the preceding transmissions.

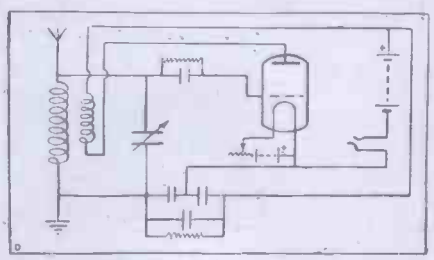
(3) All times are G.M.T., not B.S.T.

A NOVEL VALVE CIRCUIT.

THE following notes relate to a super-regenerative circuit which is growing in popularity in America, where it is known as the "Flewelling" Super Circuit. It is extremely efficient and, unlike some of the other "super" circuits, simple in operation, and, according to a writer in the "Radio World," neither aerial nor earth are needed for reception over short distances, a statement which adds attractiveness to the circuit and renders it an interesting subject for experiment.

Simple to Assemble.

As may be seen from the diagram the components are few and simple to assemble and connect. The inductance coils are of the honeycomb type, and it is with these the tuning is effected. Before commencing to tune the coils are arranged so that the coupling is about 50 per cent. The grid leak



is variable and is adjusted until the whistling is at minimum, or cut right out. The tuning is then completed with the variable condenser and the coupling of the coils. The bank of three fixed condensers is important, and care should be taken that they have the correct capacity, 0·006 μF. The leak associated with them may be of any value between 1 and 3 megohms, the best value being found by trial, and a leak of that value substituted as a permanency.

Equal to Three Valves.

It is stated that this circuit is capable of giving signals equal in audibility to those produced by a three-valve set, there being also a lack of valve noises.

The wiring of the circuit requires some care; in particular, wires running parallel should be separated as widely as possible and short circuits made impossible. If other stages of amplification are added they should not be run from the batteries used on this circuit. It may be desired to employ the more ordinary form of variable coupling, in which case the rotary winding, or secondary, should be re-wound to give about two-thirds the inductance of the primary.

Be prepared for Grand Opera—starting on the 14th of May!

THE British Broadcasting Company are now preparing to broadcast Grand Opera, and every music lover should be ready for this epoch-making event. This is an opportunity that should not be neglected—even the unmusical world will find a new delight in taking advantage of this wonderful occurrence.

It is unnecessary to enlarge upon the merits of the now famous "DESKOPHONE" Sets. Every instrument is thoroughly tested and examined before leaving our workshops, and every endeavour is made to give our customers the most efficient and handsome article that can be manufactured, at the lowest possible price. Concerts, speeches, etc., can be heard to perfection.

Your "DESKOPHONE" Set and aerial can be fitted by a skilled expert at a reasonable charge.

THE DESKOPHONE TWO-VALVE SET

(P.O. No. 2020).

Two-Valve Set, Tuner, High-Frequency Amplifier and Detector, complete with Accessories, including Headphones, H.T Battery, Accumulator, Aerial, Lead-in-Wire, and Insulators.

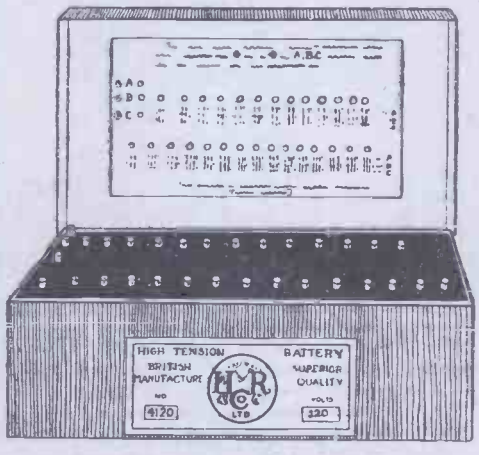
PRICE COMPLETE **£12 : 17 : 6**

PRICE without ACCESSORIES : £9 : 17 : 6

Royalties, £3 : 0 : 0 extra. Valves, Extra.

Provision is made for adding other Units to Amplify.

H.R.C. LTD



A Boon to Amateurs.

Have you seen our latest patented High-Tension Battery? This is invaluable to all amateurs, as it permits of 1½, 3 and 4½ volt variations. Stocked in sizes of 36-volt, 63-volt and 120-volt units. Trade enquiries specially invited.

PRICE **£1 : 7 : 0**

Write for
ILLUSTRATED CATALOGUE
of
Wireless Instruments & Accessories

New Sterling Headphones at the Old Price.

The new type **Double** Pole Sterling Headphones are equal in efficiency to any 'phones on the market and are sold at the same price as the old type. Trade enquiries are specially invited for these 'phones.

PRICE **£1 : 12 : 6**

THE HOLBORN RADIO CO., LTD.,

267, HIGH HOLBORN,
LONDON, W.C.1.

'Phone: HOLBORN 2368. THE TRADE SUPPLIED.

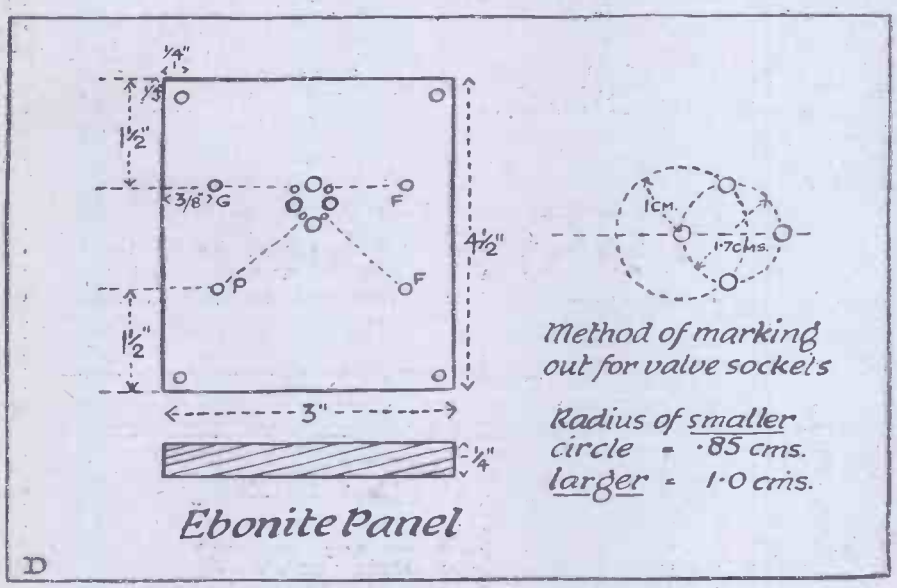
AN EXPERIMENTAL VALVE PANEL.

This little piece of apparatus will prove of inestimable value to the experimenter. Also the method of marking out the holes for valve sockets described in a diagram accompanying this article should carefully be noted ; it will provide greater accuracy than will methods involving the taking of impressions from valve bases.

SELECT a piece of ebonite of the size shown in the diagram and carefully mark out and drill to the dimensions given. Procure four valve legs and insert them into the holes drilled, and likewise for the terminals. A piece of copper wire, preferably of No. 18 S.W.G. copper, must then be soldered to the underside of each of the four valve legs, and thence to each of the terminals.

to the panel ; these can now be purchased for a few pence.

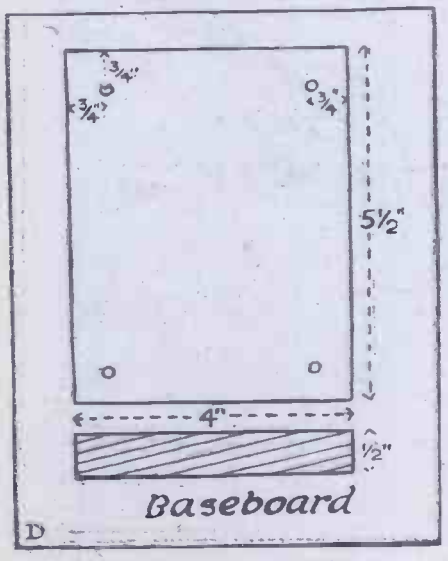
For the baseboard a piece of mahogany or some other such wood must be cut to the dimensions given. Four holes will be drilled in each of the four corners to allow a screw to pass into the wood. In order to prevent the wires touching the baseboard, four pieces of brass tube ¾ in. long by ¼ in.

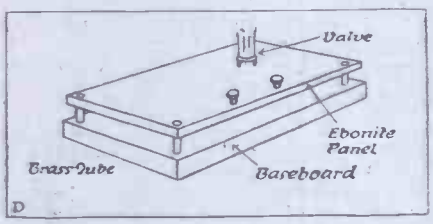


It is advisable to make some form of distinguishing mark on the face of the panel so as to guard against that old and annoying catastrophe of connecting the H.T. to the filament of the valve. The best way of doing this is to fix two separate ivorine tabs

diameter are placed between the underside of the ebonite panel and the top edge of the baseboard, the screw at the same time being placed through the tube.

The dimensions of the holes for terminals, etc., have not been given, as these will be determined by the variety of terminal in use.





TIPS FOR AMATEURS

WHEN using low-temperature valves operated by primary batteries, a small fixed condenser of ·002 mfd. capacity placed across the battery terminals will eliminate the fading often experienced.

Some amateurs find difficulty in cutting panels of various sizes. An easy method is as follows : Take a saw with a fine-toothed blade. Place a piece of wood with a square edge on the panel with the true edge lying directly along the line drawn on the panel where it is to be cut. Clamp the wood and panel together. The piece of wood will act as a guide for the saw, and a straight edge on the panel will result.

* * *

For those who do not wish to go to the expense of ebonite, slate makes a good substitute and has good insulating qualities if well shellacked. It can be cut with a carpenter's saw, and is drilled as easily as iron.

* * *

Telephone headsets usually have an extra piece of woven fabric at the terminal wires which is often a puzzle to amateurs. It should be fastened to the terminal in such a manner that when the receiver leads are pulled, the tension will be on the short end of the cord and not on the wire. This prevents the tips from being pulled off, which frequently happens when the telephones are given a sudden jerk.

* * *

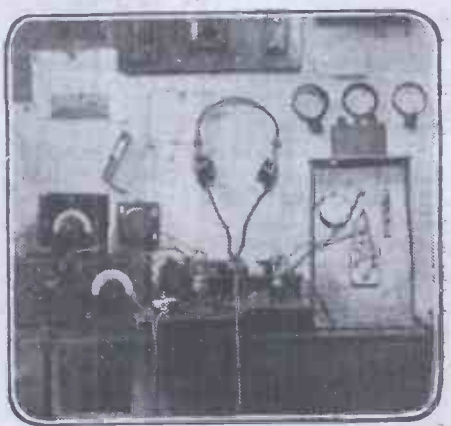
Do not despair if you have fractured your ebonite panel. A good cement for repairing it can be made as follows : Stand some gelatine in concentrated acetic acid for about ten hours, and then melt it down. Having applied this cement to the edges, give it two or three days to set. The two pieces of ebonite should be held tightly together during the setting. Putting the panel between two large books will give the necessary pressure.

* * *

It is usually safer to secure your crystal by means of screws in preference to soldering it in the cup, as the heat of the solder very often impairs the rectifying powers of the crystal. If you are troubled by telephone wires in your garden, erect your aerial as high above and as near right-angles to the wires as is possible, keeping within the P.M.G.'s limit.

* * *

If your ebonite is not quite flat, warm it in hot water or before a fire, then lay it between two pieces of flat wood with a heavy weight on top, and do not move it until quite cold.



The neat little station constructed by Mr. A. MacDonald of 22 Gibson Street, Hillhead, Glasgow.

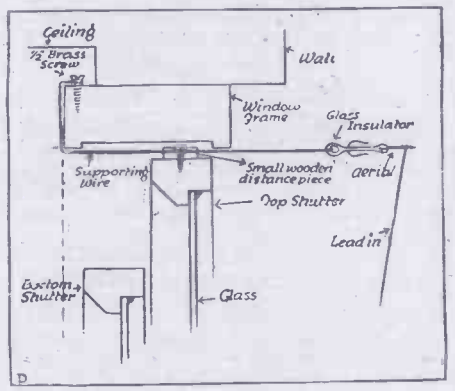
SUPPORTING THE AERIAL.

By H. P. WARAN, M.A., Ph.D. (Cantab.), F.Inst.P.

One of the most frequent sources of trouble arising in connection with the fixing of the aerial is that of forming a support. Perhaps the idea of attaching the supporting rope, or wire, to a point on the wall or window frame, so that the lead-in can be taken down directly through the window of an upper room, will be obvious to the majority of amateurs, but the actual fixing without the troublesome question of "plugging" is dealt with in an ingenious manner in this article.

We have already found that the maximum strain coming over a properly slung aerial is less than about 50 lb., and the addition of the glass insulators, while affording perfect insulation, does not add materially to the weight of the aerial or strain on its supports. In the case of a double wire aerial, the total strain on the aerial support is twice as much.

The rope used for attaching the aerial to its supports must be of a size capable of standing a maximum strain of about 100 lb. Any average heavy rope of even an eighth



of an inch diameter is able to stand this strain. But in the open air the rope deteriorates rapidly, and, therefore, its use is to be avoided. Galvanised stranded steel cable can stand a load of nearly five times as great, and it does not deteriorate so rapidly in the open air. But there is an objection to its use. Iron in any form in the neighbourhood of the aerial or wireless gear of any sort (excepting in transformers, telephones, etc., where they have to be used for other reasons) is strictly to be avoided, since they absorb a part of the high-frequency energy forming the signals. Stranded copper wire 3/22 in 3 wires of 22-gauge twisted together is preferable, since, in addition to being able to stand the strain, it does not deteriorate rapidly in the open air or absorb high-frequency energy from the aerial.

Trees Not Suitable.

The final method of supporting the aerial decided upon is largely dependent on the local conditions. One often likes an imposing pair of masts and its guy wires all round it. But from an amateur standpoint these complications are to be avoided, since they involve considerable trouble in their proper erection and maintenance. Much more satisfactory supports are provided by fixed and firm objects such as trees and houses of suitable elevation. In using trees for the purpose, the point of attachment of the cable from the aerial ought to be somewhere on the main stem and not the top of a weak pole attached to the top branch that gives the aerial too shaky a support.

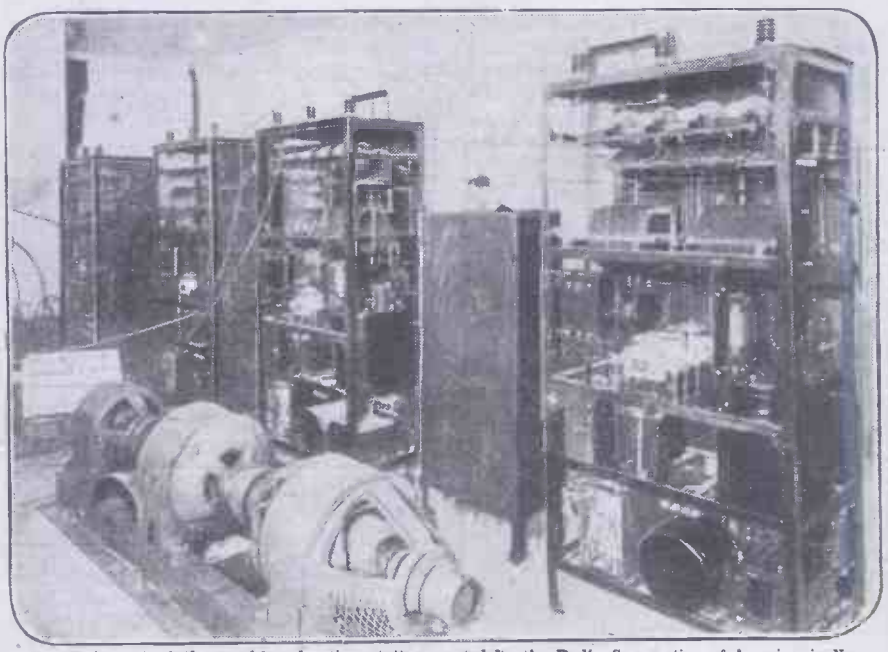
Overcoming Prejudice.

Buildings are admirable supports for aerials, though few people seem to have taken full advantage of their possibilities. There is no anxiety of the support coming down in stormy weather, and neither are there periodical maintenance troubles. Though one can always manage to make proper supporting arrangements at the lead-in end of the aerial attached to the amateur's residence, the main difficulty seems to be to find a suitable support of equal elevation for the other end. Barring the few cases where there are no rows of houses behind one's back garden, the problem is comparatively easy if one can just overcome the natural shyness to approach one of the tenants of the back row of houses for permission to put in a small nail in the corner of his window. In these days when popular enthusiasm in wireless is so very great, very few people indeed would refuse to comply with such a modest request. There may be some ignorant owners of houses who may have to be assured in persuasive language that the aerial has no tendency whatever to attract the lightning or otherwise cause any injury to their property, and that being earthed properly it forms a protector from lightning. In fact, very often such permission is refused only on the ground that the person going on the roof may cause damage to the slates.

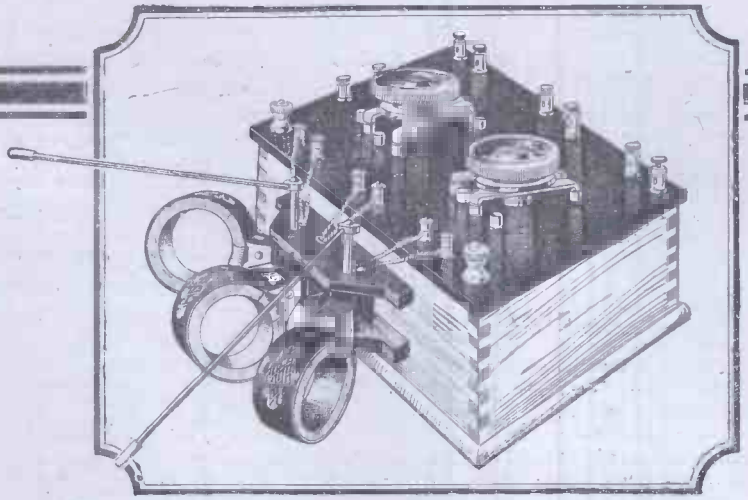
It is inadvisable and rather difficult to attach a strong nail or screw to the outer wall or window frame; even if it can be managed; the pull on the nail is longitudinal, which it is unable to stand, and the nail may also rust and give way in course of time. In practice, the easier operation of attaching the nail inside the house is better for our purpose. The supporting wire from the aerial is passed into the house through the corner of an upper window, as shown in the diagram, and attached to the nail, which need be only a small 1½ in. brass screw, screwed vertically into the window frame.

The Test of Time.

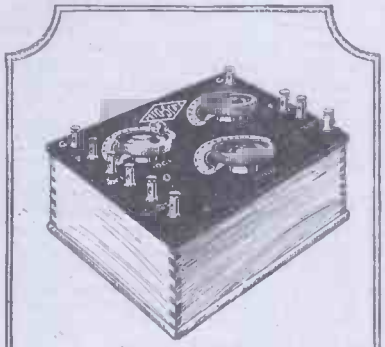
In such an arrangement much of the tension is taken by the corner of the window, and the nail is required only to keep the wire in that position. There is generally enough clearance between the window-frame and the top shutter to let the thickness of the wire in. Even if there is no such clearance, no one is likely to raise any objections to the shutter being open by an eighth of an inch from the top. In this case, to prevent the shutter being accidentally forced right up and possibly scissoring off the wire, a small piece of wood about ½ in. in thickness may be screwed on to the top of the shutter so that it can never be jammed right up to touch the wire. After considerable trouble in climbing over roofs and erecting imposing masts, I finally settled upon this plan for supporting a 200-ft. aerial for some special purposes, and it has never given me a thought since its erection for the last six months.



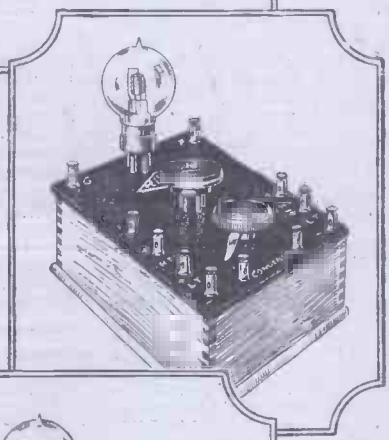
The equipment of the new broadcasting station erected by the Radio Corporation of America, in New York. With this apparatus it will be possible to transmit two items simultaneously on different wave-lengths.

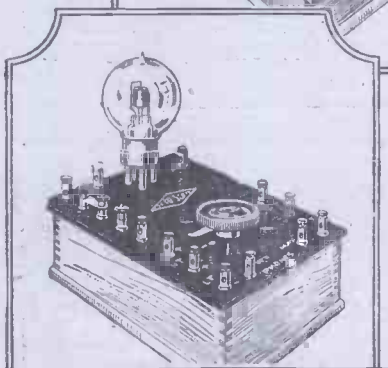


CONDENSER UNIT

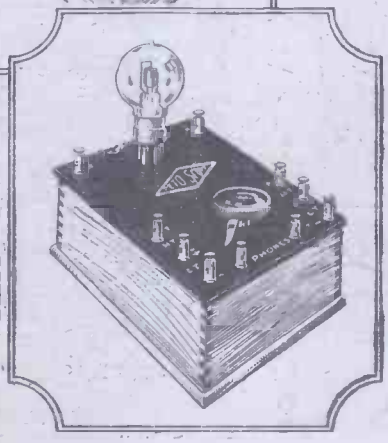


H.F. UNIT





DETECTOR UNIT



L.F. UNIT

No. 1 of a Series of interesting talks on Peto - Scott Units

The Tuner

—the first link in the chain

WHAT are the essentials of a good Tuner? Selectivity—ease and rapidity of handling—efficiency over a wide band of wave-lengths—compactness and portability—cheapness. This is the order in which we place the cardinal points of an efficient Tuner. Let us see how these requirements are met by the Peto-Scott Tuner.

Selectivity

In order to obtain selective tuning it is absolutely essential to have two inductively coupled circuits. In this way interference can be absolutely eliminated and much finer tuning obtained. Stations as near to one another as ten metres can be effectively separated and tuned out. *This can only be done on a two-circuit Tuner.*

PRICE LIST OF UNITS (in sets of parts for home construction)	
No. 1. Tuner Unit.....	27/6
No. 2. Condenser Unit...	42/-
No. 3. H.F. Amp. Unit...	13/6
No. 4. Detector Unit....	17/6
No. 5. L.F. Amp. Unit..	33/6
Cabinets for 1, 3, 4 and 5	3/6
For No. 2..	7/-

Postage 9d. per Unit extra, but paid over £2.

Ease and Rapidity of Handling

Unless carefully designed, a two-circuit tuner is sometimes a little more difficult at first for a novice to handle, therefore we have provided a rotary switch with two positions—"Stand by" and "Tune," which enables one circuit or two circuits to be used at will. For rapid searching for a wanted station use the "Stand by" position and an open circuit—thus there is only one condenser to tune. When the Station is found, throw in the other coil and *tune out* any interference from unwanted Stations.

Efficiency over a wide Band of Wave-lengths

This Tuner Unit uses plug-in coils. These may be of any form—basket coils for very short wave-lengths, and honeycomb coils up to 26,000 metres. Remember plug-in coils are cheap, and they avoid any dead-end effects. You only need to purchase those for the actual wave-lengths on which you intend to operate.

Compactness & Portability

This Tuner Unit is 7 inches by 5 inches and of standard depth. Compactness in Wireless promotes efficiency owing to the shortness of connecting wires. Long handles to the coil holders render accurate tuning easy and free from body capacity effects. A Series-parallel switch enables the condenser to be put in series or in parallel with the primary coil as desired.

Cheapness

In common with the remainder of these Units, the Tuner Unit is extraordinarily cheap. For the modest sum of 27s. 6d. a full set of parts, including a finished coil holder, is supplied, together with full wiring diagram and working instructions for assembling. The ebonite panel is drilled and tapped ready for immediate use.

If you are thinking of building your own Set, send 6d. for an Illustrated Booklet showing exactly how each Peto-Scott Unit is constructed. **6D.**

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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.

Bath Radio Club.

A meeting was held at the Red House, Bath, on April 11th. The proceedings were opened with several interesting announcements by the chairman. Primary amongst these was the intimation that a special Radio Auction Night has been fixed for May 11th, when members will be able to dispose of all their surplus wireless and electrical gear.

Mr. Leslie Bowen gave an admirable lecture on the principles of transmission.

Hon. sec., Geo. J. Barron Curtis, F.S.A.A., F.C.I.S., 6, Pierrepont Street, Bath.

The Fulham and Putney Radio Society.*

Before a well-attended meeting, held at our headquarters recently, Mr. Winnett gave a very interesting lecture on the "Crystal Detector Set." Mr. Winnett, who has had considerable experience on the subject, explained the theory of induction, and the operation and function of the crystal.

Hon. sec., J. Wright Dewhurst, 52, North End Road, West Kensington, London, W. 14.

Bournemouth and District Radio and Electrical Society.

A meeting of the above society was held on Friday, April 13th, when Mr. A. Harris, hon. sec. of the newly formed South Dorset Radio Club, lectured on "The Electronic Theory as Applied to Speech Reception."

Hon. Sec. Mr. A. Reynolds, Town Hall, Bournemouth.

Eastern Enfield Wireless and Experimental Society Wireless Exhibition.

The above society held a very successful wireless exhibition in St. James' Hall, Durants Road, Ponders End, recently

The exhibits were very fine. There were four aerials erected in the hall, from which exhibiters demonstrated, and which picked up the concerts broadcast from London.

One very well-decorated stand had on show practically every component part and various types of complete wireless instruments.

The society is undergoing complete reorganisation, and it is hoped that in the very near future a new meeting-place will be found.

Hon. sec., W. F. Ling, 234, Durants Road, Ponders End.

The North London Wireless Association.

The 123rd meeting of the association was held on Monday, March 26th.

On this occasion the committee arranged a most interesting series of lectures to be given in the near future, a full list of which will be issued shortly.

The functioning and methods of using a local oscillator were interestingly explained by Mr. Frank S. Angel.

Hon. sec., J. C. Lane, The Northern Polytechnic Institute, Holloway Road, N.

The Leicestershire Radio and Scientific Society.*

A meeting was held recently, when the president opened a discussion about broadcast receivers, and a very successful demonstration of broadcast music was given on a three-valve set, fitted with reaction sold under broadcast licence with a microphone amplifier and loud speaker kindly lent by Messrs. Rowe & Son, Ltd., of Leicester.

Hon. sec., J. R. Crawley, 269, Mere Road, Leicester.

Rawtenstall and District Radio Society.

A very interesting lecture was given at the weekly meeting held on Wednesday, April 4th, when Mr. Deavin, of the Dartford society, spoke on the earlier methods used in wireless. The speaker had on view two or three sets, including a very small crystal one on which he receives 2 L O at a distance of 50 miles. The whole set only measures 3 in. square by 3 in. deep.

Hon. sec., J. W. Butterworth, 11, Bank Street, Rawtenstall, Lancs.

The Swansea Radio Society.*

On Wednesday, April 4th, The Swansea and District Radio Experimental Society listened to a very interesting lecture given by Mr. D. W. Walters, of Gowerton, on transatlantic tests.

The lecturer was congratulated on being fifth in order of merit during the recent transatlantic tests, and the society feel honoured at having such a distinguished amateur among its members.

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

The Radio Society of Highgate.*

A lecture entitled "Designing a Receiving Set," was given on April 6th, by Mr. F. L. Hogg, who incidentally is to be congratulated on being the first British amateur to report having exchanged messages with an American amateur. The lecturer explained the necessity of common sense in designing a receiving set, as opposed to merely striving after an artistic effect in arranging the components on a panel. "The high-frequency circuits," he said, "should be kept as far apart from the low-frequency circuits as possible, and all leads should be short." The great advantages of the unit system of building an experimental set were explained, and special attention was directed to the arrangements of the terminals.

Hon. sec., J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

The Beckenham and District Radio Society.

A most interesting and informative meeting was held at the above society's headquarters on Thursday, April 5th. In a short lecture, Mr. Longley, of Wireless Equipment, Limited, gave a most instructional half hour, on his method of getting a high-tension voltage for transmission purposes where generators and electric light mains are non-existent.

Hon. sec., Mr. J. F. Butterfield, 10, The Close, Elmers End, Beckenham.

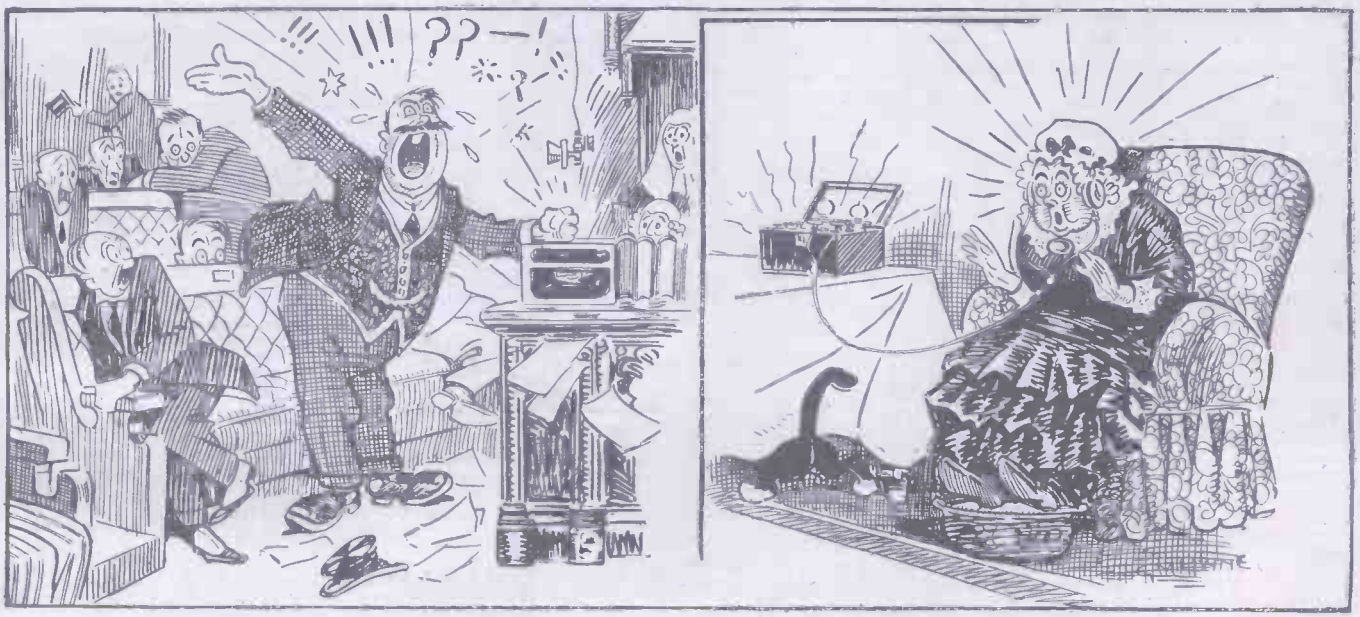
Leyton Radio Club.

A radio club has been formed in Leyton, and is to be known as The Leyton Radio Club. Meeting nights every Wednesday at 8.0 p.m., at the Church Army Social Centre, Goldsmith Road, Leyton. All interested in wireless in Leyton are cordially invited to join, membership fee 1s. per month.

Hon. sec., Capt. H. Thorley, C.A., 73, Goldsmith Road, Leyton, E.10

The Editor of "Popular Wireless" welcomes photographs of amateur sets from readers, or anything else of particular wireless interest. 10s. 6d. will be paid for each photograph used.

THE WOMEN'S HOUR VIA 2 L O!



RADIOTORIAL

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

The chairman of the Theatrical Committee—which is now up in arms against the British Broadcasting Co.—stated the other day that there is a London hotel where forty or fifty people, who would otherwise go out at night seeking a place of amusement, now sit and smoke while they listen-in to the Broadcasting Company's concerts. The theatrical manager of the committee cites this case, in all seriousness, as being representative of the effect of broadcasting on the theatres. Readers of POPULAR WIRELESS, who look at the question from a broadminded point of view, realise that is merely one case—or one of the aspects of the case—against broadcasting. The Broadcasting Company have recently received hundreds of letters from listeners-in stating that the recent wireless entertainment given by the Co-Optimists resulted in a general desire on their part—and on the part of their friends who listen-in—to visit the theatre at which the Co-Optimists were performing. In my own case, I candidly admit to feeling the same way. After listening to the Co-Optimists by wireless, I was very keen to see the actual show. This the theatre managers seem to have lost sight of.

Have the theatre managers such a poor opinion of their own productions that they are frightened that listeners-in will not want to visit the theatres? In a good many cases, I daresay this is so. But I feel sure that if individual theatre managers were left to their own devices, and were not bound down to the decision of their colleagues, quite fifty per cent. of them would be pleased to have their performances broadcast.

In America, there has never been the slightest objection on the part of theatre managers to the broadcasting of theatre productions. In fact, it has been welcomed with open arms, and with the full realisation that broadcasting offers one of the finest mediums for advertising.

It is to be regretted that theatre managers have taken such a narrow-minded view of the situation. But it is excellent news to hear from Lord Gainford that the Broadcasting Company are in no way daunted by the lack of enterprise shown by the theatrical people, and that they intend to have a wireless theatre of their own at their new Savoy premises, and that wireless "stars" will very shortly prove just as popular to listeners-in as those who adorn the footlights.

It is no use fighting against broadcasting. The theatres will have to produce better pieces which will bring audiences to their theatres, whether the latter possess listening-in sets or not. And, just as theatrical productions are candidly criticised in the daily press, so POPULAR WIRELESS will candidly criticise the Broadcasting Company's productions as well. While we offer, to the best of our ability, every help to the Broadcasting Company, we are not going to praise everything to the skies indiscriminately. Without malice, and with every possible fairness, we shall continue to ventilate our views concerning productions given by the Broadcasting Company, and I invite readers' co-operation in this matter. Constructive criticism is one of the most useful things in the world, and it will always be my endeavour to see that only constructive criticism appears in POPULAR WIRELESS.

THE EDITOR.

Questions Answered

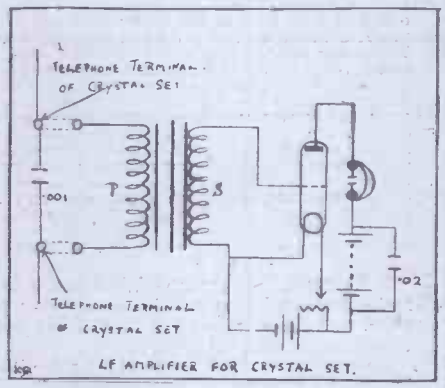
Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be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

Readers are requested to send the necessary postage for reply.

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.

"CRYST" (Tottenham).—Can you tell me how to add an L.F. amplifier to a crystal set?

This has often been explained in our Radiotorial columns, but you will be able to follow it quite clearly from the accompanying diagram. The two batteries should be about 4 or 6 volts (L.T.) and 30-60 volts (H.T.). The condenser across the



L.F. AMPLIFIER FOR CRYSTAL SET.

telephone terminals of the crystal set should be left on that set if it is already fitted, but if no telephone condenser is fitted on your crystal set, it would be advisable to add one as shown on the left of the diagram.

* * *

A. A. (Enfield) asks several questions regarding the erection of an aerial, employing a chimney stack at one end and a tree at the other to support it.

We have drawn a house similar to that indicated in your rough sketch in order to make the answers to your questions clearer. Erect the aerial between the chimney stack and tree as you suggest, employing at least two insulators at the tree end to reduce the possibility of leakage that might arise from the exuding of moisture from the leaves of the tree. See that the securing rope is sufficiently long to allow the aerial wire and insulators to well clear the leaves and

branches, making due provision for a possible extension in the growth of the latter. At the chimney stack end employ a securing rope of sufficient length to permit of the taking down of the lead-in wire from the extreme end of the horizontal wire so that the former can comfortably clear the edge of the roof. The available length, 65 feet, is ample for a single aerial, and will be quite suitable for broadcast reception. Obtain every available inch of height at either or both ends.

* * *

A. A. (Newton).—I intend making a crystal set as described in POPULAR WIRELESS, No. 39. There are several diagrams, and I have decided on the circuit marked "A." I am eighteen miles from Manchester, and wish to make a frame aerial to get that station. Please give me size of same. Also size and number of turns for inductance.

We are afraid that a frame aerial is not suitable for a crystal set at your distance from the broadcasting station. 120 turns of No. 20 enamelled wire on a former 6 in. long and 5 in. in diameter will do very well for the inductance. It will take up about 5 in. on the former, so start ½ in. from the end.

K. R. B. (Gloss.).—Could you kindly tell me, through your columns, where the wireless stations Haren and Königswusterhausen are?

Haren is in Hanover, Prussia, and Königswusterhausen is near Berlin.

* * *

J. C. (Cardiff).—Is it necessary for 'phones to be stamped B.B.C. as well as a receiver for use with a broadcasting licence?

Yes; your 'phones must be marked B.B.C. for use with this form of licence.

* * *

"SUPER" (Dulwich).—Please give me details for a frame aerial for use with an Armstrong super-regenerative circuit with a range of 300—1,000 metres, and whether loading coils can be used with such a circuit.

You have not grasped the principles under which this circuit operates, as it is only suitable for the reception of signals over a restricted band of short wave-lengths. The frame should be that which is normally suited for wave-lengths from 300 to 700 metres. No loading coil will be necessary.

* * *

"GRID" (Hong Kong) asks what length of No. 25 Eureka wire to use in a filament resistance, and for particulars of a telephone transformer.

Use four yards of resistance wire and wind in usual spiral form for the filament resistance. Details of 'phone transformer are as follows: Core of iron wire ½ in. diameter and 3 in. in length; primary winding, 3 oz. of No. 42, and secondary, 4 oz. of No. 34.

* * *

R. W. (Stockton Brook).—Do some accumulators discharge with a noise, because we have tried different accumulators and we hear a hissing noise from some of them?

Only if they are discharging too rapidly, and therefore unevenly, or if the cells are sulphated. You should examine the cells closely and also make sure that none of the plates are cracked.

* * *

"WAVE" (Brixton).—In your wave-length tables of POPULAR WIRELESS, No. 45, you give 680 metres as the maximum wave-length of a 4 in. diameter former wound with 100 turns of 22 enamelled wire. Surely this is incorrect, as the maximum wave-length of a 3½ in. former with the same number of turns and same wire is 700, according to the tables.

You are right. It should be 780 and not 680 metres.

* * *

L. N. (E.C.4).—Please will you tell me the capacity of a condenser with 59 plates 9 cm. in diameter using ⅛ in. spacing washers.

The capacity would be 0·0028 mfd. approx.

* * *

"VARIOMETER" (St. Albans).—How does a variometer function?

To understand fully how this instrument operates it is necessary to realise what happens when two coils, both carrying a varying current, are coupled together. If the coils are coupled closely they will have an electro-magnetic effect upon one another, and if the coupling is gradually loosened this effect is lessened, until a point is reached where the effect is zero. Now, the effect of coupling these coils is to increase the inductance of each, and if the coils are at the same time connected together in series, the total inductance of the two coils can be varied by varying the coupling between them. This is all that takes place in a variometer. Two coils, connected in series, are coupled together, the coupling being varied by rotating the inner coil so that its inductance either assists or opposes that of the outer coil. Thus roughly, we are able to vary the total inductance of the circuit from the sum of the two inductances to the difference between the two. It is, of course, known to you that a circuit can be tuned by either altering its inductance or capacity, and so by means of the variometer the inductance can be varied very critically simply by rotating one of the coils, and thus sharp tuning can be obtained without the necessity of a condenser.

* * *

E. B. T. (Harlow).—I am using a two-valve set and have been offered a Dutch valve for the detector panel. Is this type of valve efficient?

We do not advise the use of the valve as a detector on a multi-valve set, as it would necessitate the use of a separate H.T. battery or separate H.T. control. This is because the soft Dutch valve only requires about 20 volts on the anode, and it blue glows if any extra voltage is used. Further, if you are using reac-

(*Continued on page* 498.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 497.)

tion you will find it very difficult to control that type of valve owing to its softness. You will find that the valves oscillate and sizzle at the least provocation. On the whole we do not think the valve worth the trouble, and prefer a more stable and harder type of detector. After all, the Dutch valve is not such a wonderful detector as all that, and a good old type Ora will be found to be more satisfactory and to give louder results when reaction is employed.

* * *

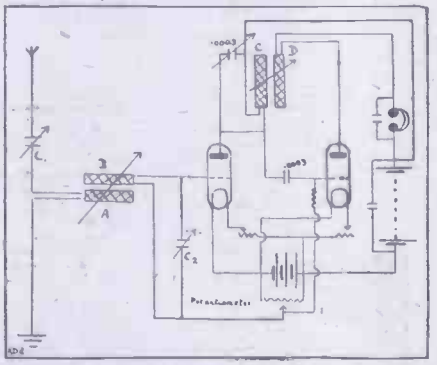
C. W. (Wembley).—Can an ordinary buzzer be used as an interrupter on a crystal set in order to enable the set to receive C.W. ?

Yes, but you must make sure that the buzzer has an adjusting screw whereby the speed of the make and break can be regulated. It is just as well to fix a couple of small arms on the buzzer, each arm being provided with a contact point and adjusting screw. These arms should be as light as possible. One, of course, is fixed to the buzzer itself and the other to the trembler, so that when the buzzer operates the arms vibrate, and the two contacts at the end form a make and break whose speed corresponds with that of the buzzer trembler. Any convenient material, as light as possible, can be used for the arms, and they should be as short as possible so as to enable them to work rapidly. The aerial is fixed to one side and the earth to the other, as is shown in the article on C.W. reception in our issue of April 7th. The buzzer make and break must be tuned in to receive the station, tuning being carried out while the set is in operation.

* * *

"REACTION" (Harrow).—What is the best method of employing reaction on a two-valve (H.F. and detector) set ? Should I use H.F. transformers or tuned anode ?

We prefer the tuned anode coil for the H.F. circuit, and the reaction from the detector plate is coupled to this coil. The circuit given will be found to be very efficient for telephony reception, especially on broadcasting wave-lengths. Each of the four coils is of the honeycomb or basket type, though the coil B can be dispensed with, the grid being taken direct to the aerial and the potentiometer to earth. It is advisable to use a potentiometer to control the grid of the H.F. valve, and thus keep the set from internal oscillation. The potentiometer



should have a value of about 300 ohms, and should be disconnected from the battery when the set is not in use, otherwise the charge in the accumulator will gradually leak away through the windings of the potentiometer. The condensers C1 and C2 are ·0005 and ·001 mfd respectively. The values of the coils vary according to the wave-length required, but for broadcasting A should be about 50 turns, B about 75 turns, C 75 or 100 turns, and D about 50 turns. Each pair can be mounted in two coil holders.

RECENT WIRELESS INVENTIONS.

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

Grant of the following Patents can be opposed and printed copies of the full specifications purchased.

193,150.—W. W. BURNHAM.—INDUCTANCES.—In a variable inductance comprising pivoted coils which are movable like the pages of a book, each moving coil is operated by a spindle parallel to the pivotal axis of the coil-holder through worm or toothed gearing. The spindle is long enough to avoid the hand coming close to the coils when operating them. Alternatively the movable coil may be mounted directly on the spindle or again several coils may be simultaneously operated by the same spindle.

190,070.— E. POLLOCK.— TRANSMITTING AND RECEIVING.—In a combined transmitting and receiving set valves are variously employed to prevent receiving taking place simultaneously with transmitting. One arrangement has a detecting diode valve shunting the high tension supply of the receiver circuit and being rendered conductive so as to short-circuit same when inductively energised by speech current variations in the microphone circuit. The circuits may be arranged so that one aerial may serve both for transmisson and reception.

194,298.—SOC. DRAULT ET RAULOT - LAPOINTE.—CONVERTING ALTERNATING CURRENTS.—The secondary winding of a transformer or other high tension alternating source is connected to a pair of contacts and to a point between two condensers. The other terminals of the condensers are connected to a second pair of contacts, and the four contacts co-operate in alternate pairs with a switching device rotated by a synchronous motion, whereby the condensers are alternately charged in the same direction by successive half-waves and discharge high tension unidirectional current suitable for X-ray work, etc.

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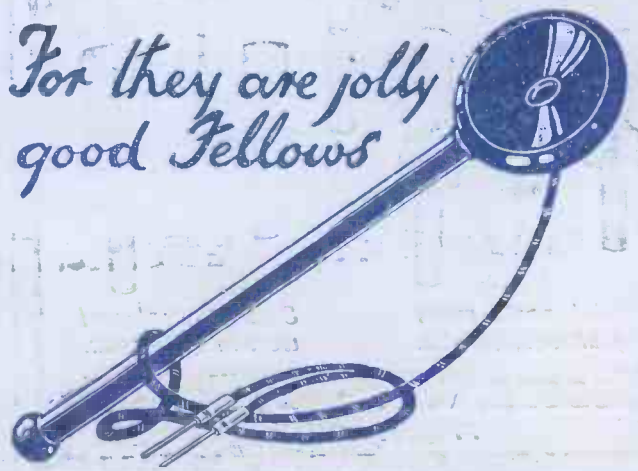

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R/R

POPULAR WIRELESS WEEKLY, May 19th, 1923. REGISTERED AT THE G.P.O. AS A NEWSPAPER

SYNOPSES OF BROADCAST OPERAS.

Popular Wireless

PRICE 3d.

No. 51. Vol. III. SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc. May 19th, 1923.

Princess Alice, Countess of Athlone, photographed in 2 L O's New Studio.

FEATURES IN THIS ISSUE.

More Pictorial Valve Circuits.
Substitute Valve Holder.
Transmitting Photos by Wireless.
Complete Single Valve Set.
Geary the Toreador.
High Speed Wireless.

And a long article on the Values of Tuning Coils and Condensers, by C. E. Field, B.Sc., compiler of the "Popular Wireless" Wave-length Tables.

POPULAR WIRELESS

May 19th, 1923. SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc. [Every Friday.

TOPICAL NOTES AND NEWS.

Music in an Aeroplane.

MR. P. D. ROBINS, who was piloting an aeroplane, announced that he was able to hear music from a broadcasting station whilst travelling at ninety miles an hour at a height of 1,200 ft., and the higher the machine rose, the clearer became the music. Each of the party in the aeroplane wore headphones, listening-in on a 4-valve set without aerial or earth, the instrument used was one of Burndept's ethophones.

* * *

Cardiff "In Clover."

I HAVE just received a long and interesting letter from Major Corbett-Smith, the versatile and energetic director of the Cardiff Broadcasting Station. He tells me that great things are contemplated in respect of broadcast programmes for the fortunate listeners-in in Wales. He writes:

"Our Sunday evening programme is always devoted to the best music, and we try also to invest each one with a particular interest. For instance, on May 6th we gave an all-Wagner programme with the items so arranged as to indicate the development of Wagner's creative touch.

"Another scheme which I have in mind is the production of Comic Operas. By way of an experimental start we are giving 'Dorothy' in ten days' time, and if successful, shall follow it up with 'Merrie England,' 'Tom Jones,' and other similar works. I propose also to perform my own opera, 'Elizabeth.' This is Grand Opera in one act, written originally for Madame Kirkby Lunn in the name part."

* * *

Wireless Picnics!

I SHOULD imagine that this summer there will be a good deal of outdoor "listening-in," and from all I hear from various of my readers, many amateurs are busy making portable sets. The fun of stringing an aerial up to a tree and the joy of listening-in in the open air should add greatly to the delight of *al fresco* parties.

* * *

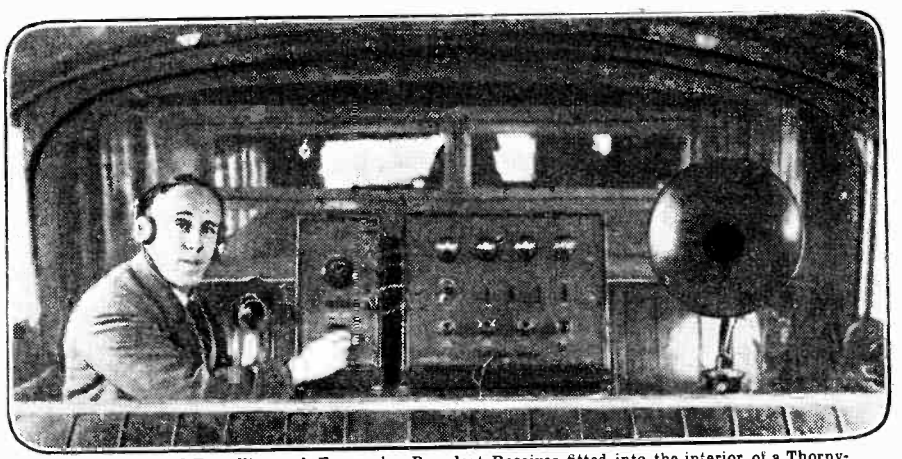
Wireless on Fishing Vessels.

THE latest addition to the development of the uses of wireless at sea is the fitting of English fishing vessels with radio apparatus. This is proving of considerable commercial value and the utility of the installation has been demonstrated in connection with the rescue of the crew of a sailing vessel by one of the trawlers recently fitted with wireless. This trawler not only rescued the crew of a sailing vessel just before it sank, but by means of its wireless equipment was able to inform the owners of the incident and the relatives of the rescued crew were immediately informed of their safety, and thus all anxiety was allayed.

* * *

Awards to Wireless Operators.

I HEAR that the three Marconi operators of the s.s. City of Valencia have each been presented by the German Government and the Hamburg-America line with a pair of valuable binoculars, with suitable inscriptions, as a mark of appreciation of the valuable services rendered by wireless at the foundering of the liner Hammonia, which was lost off the Spanish coast last September.



Comfortable Road Travelling. A Four-valve Burndept Receiver fitted into the interior of a Thornycroft Motor Coach.

* * *

A Modern Miracle.

AN interesting experiment on the powers of wireless telephony to assist deaf people to hear has been described to me by a correspondent from Edinburgh. In the presence of several witnesses, a little girl of twelve, who has been deaf from birth, was enabled to hear speech and music for the first time. She was able to hear clearly with headphones on a six-valve instrument: this in spite of the fact that several ear specialists have been able to give no hope whatever of her hearing sense being developed.

* * *

An Original Detector.

WIRELESS is becoming an expensive game. I am told that the latest craze is to use a diamond as a detector instead of the usual, and cheaper, crystals. Personally, I am going to try an orange with two knitting needles therein fixed. I have *heard* that it works.

* * *

New Direction Finder.

THE latest wireless direction-finder has just been installed on the Cunard liner Mauretania, which left Southampton for New York some days ago. By means of this device, I am told that if touch is secured with two or more land stations, the exact positions of the vessel is easily found by cross bearings.

* * *

Wireless Insurance.

SPECIAL insurance policies, available to all owners of wireless sets and aerial equipment, have now been drawn up by insurance companies. These cover the apparatus itself, both inside and outside the building, against risks not under the control of the insured, such as fire, lightning, burglary, theft, and also indemnify the owner against third party liability in connection with breakdown of aerials, masts, and poles.

An annual premium of 7s. 6d. covers loss or damage to the apparatus to the value of £50, and third party risks up to £500 for any one accident, including damage to property belonging to the insured.

* *

An Interesting Forecast.

IT seems that very shortly one will be able to sit comfortably at home and watch a performance taking place in a theatre miles away. A French expert tells me that recent tests have been remarkably successful, and that the time is approaching when theatres and concert halls will be provided with apparatus to broadcast not only the voice, but a faithful image of the scene on the stage or platform.

* * *

A New Insulator.

GREAT expectations are entertained regarding the production of insulating plates from the rich deposits of silicious earth at Jaellasjoe, in the vicinity of Oerkelljunga (Skaane). The deposits are estimated at 800,000 cubic metres, and as the material can be directly pressed into plates it will be possible to produce 1,000,000 square metres of plates annually for a long period.

(*Continued on page* 506.)

NOTES AND NEWS.

(Continued from page 505.)

Insect Wireless.

A FAMOUS scientist has suggested that by means of transmission through the direct current glow discharge, instead of the diaphragm transmitter, it will be possible to investigate how insects and animals communicate with each other, for there can be no doubt that they *do* communicate in a way quite unknown at present.

* * *

Shall We Hear Them?

ONE great entomologist states that insects speak to each other by electro-magnetic waves, while another declares that they speak by sounds far too shrill for the human ear to record, but it seems possible that we shall be able to pick up the sounds and reduce their frequency so that we might hear them.

* * *

A Correction.

WE regret to state that in the advertisement, in last week's issue, of a complete Receiving Station, offered by V. V. Bertram, the address was wrongly stated, and the price of the station was omitted. This should have appeared as "Complete Station £18 7s. 6d., and the address 412, Fulham Road, Walham Green, S.W.4."

In order to provide more space for Notes and News, and to permit of an extended broadcasting programme, the latter has been :: transferred to page 527. ::

* * *

"Stars" Made to Order.

THE B.B.C. intend to develop their own "stars" of vaudeville and opera, and so successfully make themselves independent of existing "stars" and theatrical productions, agencies, etc. How successful such a scheme can be is proved by the phenomenal rise to fame of Mr. Norman Long, who was comparatively unknown before broadcasting commenced.

* * *

Held Over.

OWING to a lack of space due to an extension in the Opera Synopses, "Geary the Toreador" will be held over until next week.

* * *

2 O M's New Rôle.

I HEAR that 2 O M, Mr. H. S. Walker, is taking on yet another rôle. He has promised to judge the home-made apparatus sent in for the competition taking place at "The Pavilion," Clapham Junction, during the "Wireless Week" that is to be held there commencing on May 28th.

* * *

King of Italy's Set.

I AM told that King Victor Emmanuel is setting the fashion for wireless in Italy. He is installing an all-British set.

* * *

British Sets Preferred.

THE Premier, Signor Mussolini, and Madame Tetrazzini are also enthusiastic supporters of radio, while the Postmaster-General in Rome takes a very keen interest in its development. It is significant that British sets are preferred.

Relay Stations.

IT now seems fairly certain that Sheffield and other large towns will be provided with relay stations. This will permit the humble crystal to reign in new territories.

* * *

Uncle "Cactus's" Flowers.

CALLING on "Uncle Caractacus" the other day I noticed his room was full of flowers. "I get simply inundated with them," he explained, "large bunches arriving every day from my nieces and nephews."

* * *

Atmospherics.

HAVE you been troubled with atmospherics lately? Many who have only taken up wireless during the past winter will find a new source of trouble in these disturbances. A fortune awaits the man who first invents a cheap and effective instrument to eliminate these unwelcome visitors.

* * *

New Broadcasting Station.

THE Southern Broadcasting Station will be erected in Bournemouth, and another station will probably be built either in Cork or Dublin.

* * *

Wireless on the River.

I SPENT "Bluebell Sunday" at Hampton Court, and was interested to see house-boats all along the reach to Kingston with aerials rising from many of the decks. Wireless seems to have completely captured the river and looks rather like ousting the gramophone.

* * *

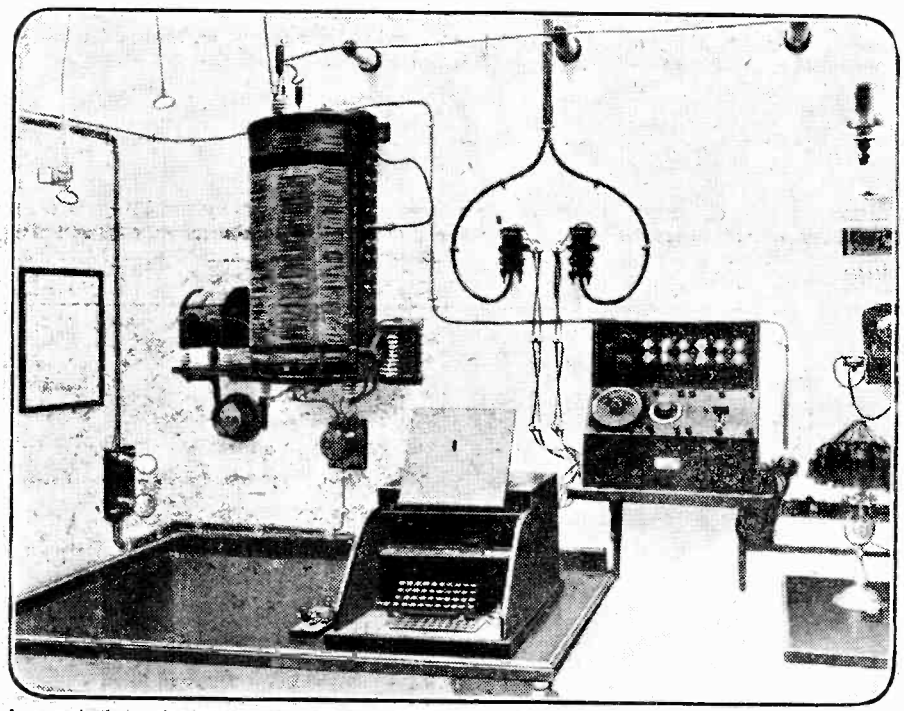
Mr. Norman Long.

MR. NORMAN LONG spoke very strongly at the Concert Artistes' Association. "I will not be bullied into either broadcasting or not broadcasting," he said. "There is a pistol being put at the artistes' heads, with a remark, 'If you do it you will be kicked out of the profession,' and I don't like that sort of thing." This seems to me to put the whole case in a nutshell.

* * *

"Georges Carpentier Speaking."

A FRENCH correspondent tells me of an interesting wireless thrill which happened at the Carpentier-Nilles fight. A gentleman was seen sitting in the front row at the ring-side, with a microphone instrument on his knee. When, after eight gruelling rounds, Nilles received "le knock-out," the ever ready Descamps dragged his weary protégé to the wireless expert and told him to talk into the receiver. Imagine the excitement of the army of listeners-in when they heard: "Georges Carpentier speaking. I have just beaten Nilles in eight rounds. I am very pleased with my victory."



A corner in the spacious wireless cabin of the s.s. Majestic, showing the Gell perforator and the Marconi Wireless direction-finder. The Gell perforator is used in connection with high-speed wireless transmission, which is regularly carried out by this giant White Star liner.

Wireless on Trams.

NEW YORK tram drivers are now being provided with receiving outfits to enable them to keep in touch with headquarters.

* * *

Cutting of Prices.

WE understand that the T.M.C. are taking strong action in all cases of price-cutting on their products.

This action is highly desirable, as there is no doubt that it is in the best interests of the public and the trade that a fair price having been fixed, it should be maintained by all concerned.

* * *

2 L O's Pigeons.

CAPT. LEWIS tells me that the instalments of the children's story, "The Fairy Dustman," will probably be sent from the Isle of Wight by pigeon carrier post. This is quite a bright idea and will do a lot towards keeping up the "fairy" illusion, but it is to be hoped that there will either be guards or less than 10 amps. on 2 L O's aerial during the arrival of the birds.

ARIEL.

SHORT STORIES OF THE OPERAS.

Commencing May 14th, the British National Opera Co. began their summer season at Covent Garden, and an arrangement has been made to broadcast certain operas from 2 L O. The following condensed stories of the operas will help listeners-in to follow the action of the various items, and will help them to visualise the acting on the stage. Owing to the fact that last-minute alterations in the time-table are possible, the stories of the operas are not arranged in the order they may be broadcast.—THE EDITOR.

LA BOHÈME.

A Romantic Opera in Four Acts, by GIACOMO PUCCINI.

SCENE: Paris. TIME: 1830.

CAST:

RUDOLPH, a poet.
SCHAUNARD, a musician.
MARCEL, a painter.
COLLINE, a philosopher.
BENOIT, a Landlord.
MIMI, a flower girl.
MUSETTA, a grisette.
PARPIGNOL, a toy vendor.
ALCINDORO, a wealthy Parisian.

ACT I. The four Bohemians, Rudolph, Schaunard, Marcel, and Colline are living happily together in a Parisian attic, though in a state of extreme poverty. The landlord arrives to claim his long overdue rent, but they manage to get rid of him. Rudolph is left alone and is visited by Mimi, the heroine, who comes to ask for a light for her candle. They exchange experiences, and decide to cast their lot together.

ACT II. The Bohemians are feasting and generally amusing themselves in the Latin Quarter, and we are introduced to Musetta, an old flame of Marcel's.

ACT III. Mimi and Rudolph have parted, and Mimi comes to find Marcel to ask him to persuade Rudolph to come back to her. She is suffering from consumption and is desperately unhappy. Rudolph and Mimi become reconciled, but Musetta and Marcel quarrel because of Marcel's jealousy.

ACT IV. The garret again. Marcel and Rudolph are at work, and on the arrival of the other two Bohemians they try to make merry. Musetta arrives with Mimi, who is dying, and they all try to help her, but it is too late. After singing snatches of their former love songs, Mimi dies in Rudolph's arms.

* * *

FAUST.

A Tragic Opera in Five Acts, by CHARLES GOUNOD.

SCENE: A German village.
TIME: The Eighteenth Century.

CAST:

FAUST, a philosopher.
MEPHISTOPHELES, the evil one.
VALENTIN, brother of Marguerite.
BRANDER, a student.
SIEBEL, a student.
MARGUERITE, a village girl.
MARTHA, her servant.

ACT I. Faust's Study. Faust, who has grown old and feels that life has no more joy in store for him, is about to end it with a dose of poison, but stops at the sound of Easter carols. Mephistopheles enters and promises to give him Marguerite, of whom Faust sees a vision, in exchange for his soul. Faust consents to the compact, and is changed into a young and handsome man.

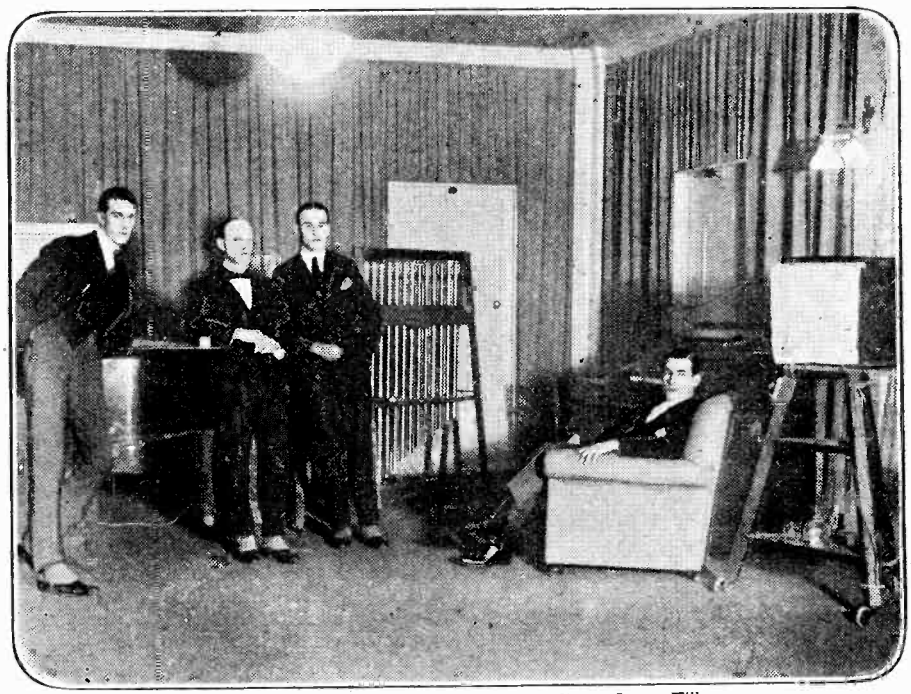
ACT II. A Square in the Village, where a festival is in progress. Valentin, who is going to the wars, leaves his sister in the care of Martha, and Siebel promises to be her champion. Mephistopheles now joins the throng, jests with Siebel about Marguerite, and Valentin, overhearing his remark, draws his sword. The Devil traces a circle of fire round himself, but slinks away when Valentin and his friends hold up their swords like crosses, and the festivities continue. Faust enters, offers his arm to Marguerite, but she repulses him.

ACT III. Marguerite's Garden. Siebel brings a bouquet for Marguerite, but the flowers fade until he dips them in holy water. Faust, aided by Mephistopheles, who gives Marguerite a casket of jewels, presses his suit, and Marguerite yields.

ACT IV. *Scene I.* The soldiers return victorious, among them Valentin, who learns of the betrayal of his sister. He crosses swords with Faust, who, aided by the Devil, gives Valentin his death-blow. With his last breath he curses Marguerite.

Scene II. Interior of the Church, where Marguerite goes to pray. Mephistopheles pursues her, and tells her that she is damned for ever.

ACT V. The Prison Cell, where Marguerite is awaiting judgment for the murder of her child. Faust appears and urges her to go with him. She refuses; the prison walls open, angels come from Heaven to rescue her, whilst the Devil, who owns Faust's soul for ever, takes him away to the infernal regions.



A view of the B.B.C.'s new London Studio at Savoy Hill.

THE VALKYRIE.

A Musical Drama in Three Acts, by RICHARD WAGNER.

SCENE: The Forests of Germany.
TIME: Antiquity.

CAST:

WOTAN, the mighty.
FRICKA, his spouse.
HUNDING, a warrior.
SIEGLINDE, his wife.
SIEGMUND, her brother.
BRÜNNHILDE, a Valkyr.
OTHER VALKYRIE.

The Valkyrie are a band of warrior maidens, created by Wotan to protect Valhalla, a paradise for warriors. Wotan

(*Continued on page* 508.)

SHORT STORIES OF THE OPERAS.

(Continued from page 507.)

has two children, Siegmund and Sieglinde, who have grown up in ignorance of each other.

ACT I. Shows us the Forest Hut of Hunding and his wife Sieglinde. Siegmund appears to ask for shelter, which they grant him. Siegmund and Sieglinde are irresistibly drawn together. She gives Hunding a sleeping draught and disappears with Siegmund into the forest.

ACT II. A Mountain Pass. Wotan has willed that his two earth children shall meet and marry, but his wife, Fricka, violently opposes his infringement of the marriage laws, and demands their punishment. Wotan summons his favourite Valkyr, Brünnhilde, and commands her to deliver Siegmund to his enemies. She pleads for him, but in vain. She meets the lovers, who are fleeing from Hunding, warns them, and finally resolves to shield them at all costs. Siegmund is killed by Hunding, who in turn falls by Wotan's spear. Brünnhilde flies from Wotan, terrified of his anger, taking Sieglinde with her.

ACT III. The Haunt of the Valkyries. Wotan appears before Brünnhilde, whose sisters have refused to help her. He consigns her to a fate worse than death—she is to be banished from Valhalla, to fall asleep and be claimed by the first passer-by who wakes her. Her entreaties, however, prevail upon Wotan to modify the decree, and he places her on a mountain peak hedged round by magic flames. The mortal intrepid enough to penetrate this almost inaccessible barrier would be considered worthy to claim her love.

* * *

AÏDA.

A Romantic Opera in Four Acts, by GIUSEPPE VERDI.

SCENE: Memphis and Thebes.
TIME: Rule of the Pharaohs.

CAST:

THE KING OF EGYPT.
AMNERIS, his daughter.
RHADAMES, a general.
RAMFIS, the high priest.
AMONASRO, the King of Ethiopia.
AÏDA, his daughter.

ACT I. The Egyptian King's Palace at Memphis. Ramfis tells Rhadames that it has been decreed that he shall lead the Egyptian army against their Ethiopian enemies. Rhadames is in love with Aïda, a beautiful slave, and realises that if he is victorious he can claim her for his bride. But Aïda knows that it is her father, the rival king, whom Rhadames will meet in battle.

Scene II. is the Temple of Ptah, the war god of Egypt, in which the consecration of the arms of Rhadames takes place.

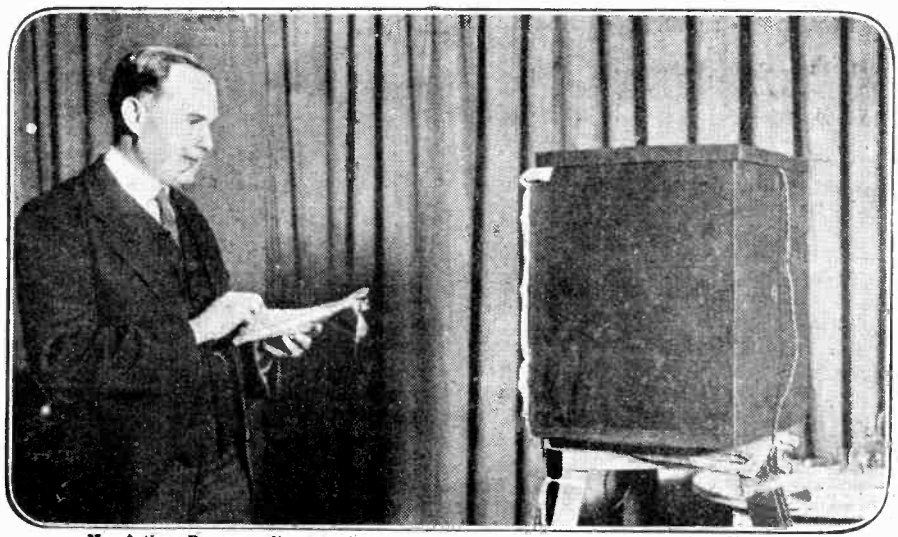
ACT II. *Scene I.* The apartments of Amneris, who is in love with Rhadames. She hears that he is returning victorious, and orders her maids to dress her in her finest clothes. She tricks Aïda into revealing her love for Rhadames.

In *Scene II.* we see Rhadames' triumphal return, with Aïda's father taken captive. Rhadames demands the release of the prisoners. The King grants his request, offers him his daughter's hand in marriage, and proclaims him heir to the Egyptian throne.

ACT III. A night scene on the Nile. Aïda goes to meet Rhadames for the last time, encounters her father, who urges Rhadames to ally himself with the Ethiopians and promises Aïda in marriage as a reward. Rhadames refuses, but Amneris comes from the temple, and, having overheard the conversation, denounces Rhadames, who gives himself up to the guards of Ramfis.

ACT IV. *Scene I.* Amneris now seeks to save Rhadames, but he will not give up Aïda.

Scene II. Rhadames is seen in the crypt of the Temple resigned to death.



Mr. Arthur Burrows, director of programmes, speaking into 2 L O's new microphone.

He is joined by Adïa, who comes to die with him. Together they sing farewell to life, and the curtain falls on Amneris, who is kneeling penitently in prayer, and the vaults close on the lovers.

* * *

PHŒBUS AND PAN.

A Satirical Opera in one act, by JOHANN SEBASTIAN BACH.

The story of the "Contest between Phœbus and Pan," founded on an old Greek myth, deals with the competition for the musical supremacy between the Phœbus, the god of the Lyre, and Pan, with his rustic pipe. The opera commences with choruses in six parts, and delightful ballet music is introduced. Mercurius presides over the contest, and Tmolus and King Midas are appointed judges. Tmolus claims the prize for Phœbus. Midas in a rollicking song declares his delight in Pan's untutored skill, and is presented with asses' ears whilst loudly declaiming that "*Pan's* a Master." Tmolus claims the prize for Phœbus, and the opera ends, as it began, with charming and melodious choruses.

THE MAGIC FLUTE.

A Fantastic Opera in Four Acts, by MOZART.

SCENE: Egypt.
TIME: Antiquity.

CAST:

SARASTRO, priest of Isis.
THE QUEEN OF NIGHT, a sorceress.
PAMINA, her daughter.
TAMINO, a prince.
PAPAGENO, his attendant.
PAPAGENA, the latter's sweetheart.
MONASTATOS, a Moor.

ACT I. A Forest, where Prince Tamino has lost his way and is being pursued by an enormous serpent. His cries bring three fairies to his aid, who slay the serpent. Papageno claims the honour for having killed the serpent, and the fairies seal his month with a padlock. The fairies show the Prince the portrait of a lovely maiden who is in the power of Sarastro at the Temple of Isis. The Prince is persuaded by her mother to try and rescue her, and sets off on the adventure with a magic flute given him to ward off danger, accompanied by Papageno, whose padlock is removed and replaced by a chime of bells.

ACT II. *Scene I.* The Palace of Sarastro. Monastatos has annoyed Pamina with his attentions, but is frightened by Papageno, who arrives to announce the coming of the Prince, and plans that Pamina shall escape with them.

Scene II. The Entrance to the Temple. Tamino approaches, and is at first refused admission. Sarastro enters, orders that the Moor shall be punished, but tells the Prince that he must prove himself worthy of Pamina's love by passing through the Ordeal of the Temple.

ACT III. *Scene I.* A Palm Grove, where the priests agree that Tamino and Pamina shall be united if the Prince can come successfully through the ordeals.

Scene II. A Courtyard. The first ordeal is that of silence. Tamino and Papageno must not utter a word, and

(Continued on page 511.)

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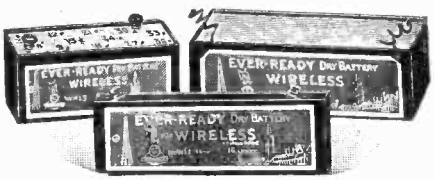

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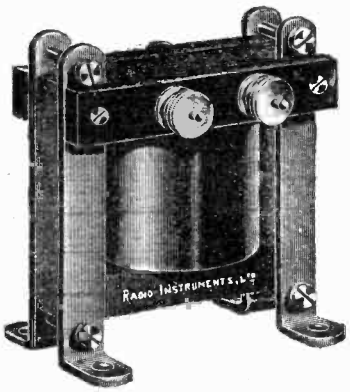

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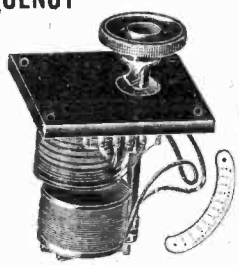

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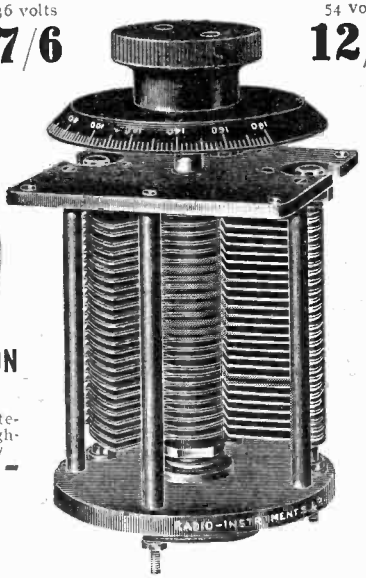

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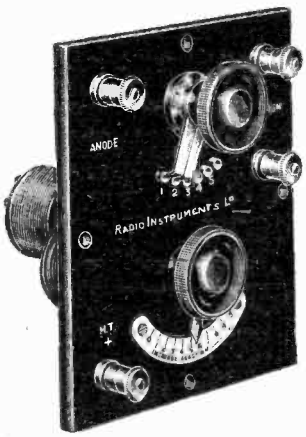

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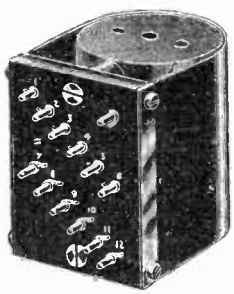

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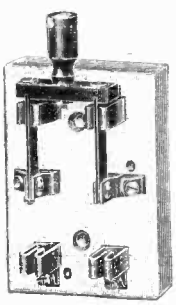

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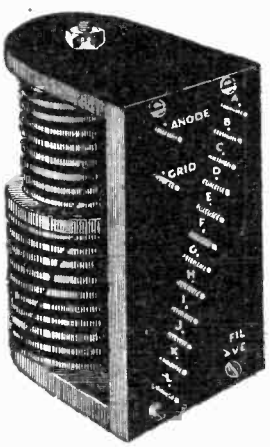

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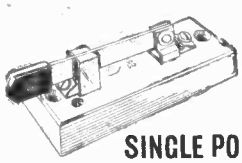

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SHORT STORIES OF THE OPERAS.

(Continued from page 508.)

they remain firm, though it is a great effort for Papageno.

Scene III. A Garden. The Moor tries to approach Pamina while she is sleeping, but is again frustrated by Sarastro.

Scene IV. A Corridor in the Temple. Papageno and Tamino are still under the ordeal of silence, which proves too much for Papageno. The Prince, however, remains silent, even when Pamina meets him. She is deeply hurt that he does not reply to her endearing remarks.

ACT IV. The Pyramids. The Prince is commanded to wander into the desert, and parts sadly from Pamina. Papageno feels that he, too, would like a wife of his own, and an old hag appears before him. Just as he is hastily running away, she changes into the young and beautiful Papagena, but Papageno has to prove his worth before he can win her.

Scene II. Pamina believes her Prince to be faithless, and is about to kill herself, but is prevented. Papageno is in despair over the loss of Papagena, but finds he can summon her by ringing his chime of bells.

Scene III. A Fiery Cavern. Tamino is seen undergoing the last of his ordeals. He is threatened by waterfalls and tongues of flames, but he calls to Pamina, they are reunited, and a few strains from the magic flute cause the remaining dangers to vanish.

Scene IV. The Temple of Isis. Sarastro welcomes the Prince and the maiden, and unites them, Papageno and Papagena are married, and the Queen of Night and Monastatos, the Moor, are vanquished.

* * *

HANSEL AND GRETEL.

A Fairy Opera in Three Acts, by HUMPERDINCK.

SCENE: A German forest.
TIME: The seventeenth century.

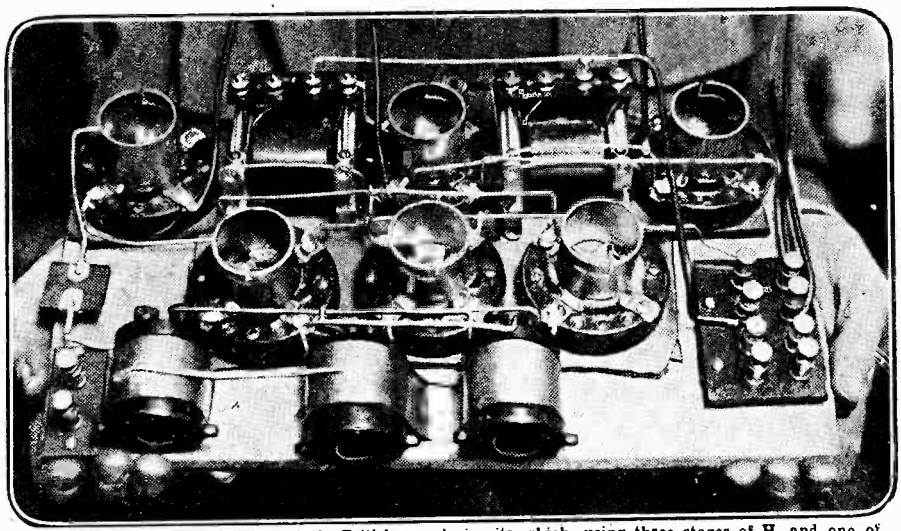
CAST:

PETER, a broom maker.
GERTRUDE, his wife.
HANSEL, his son.
GRETEL, his daughter.
THE CRUNCH WITCH.
THE SAND MAN.
THE DEW MAN.

ACT I. The Broom-maker's Cottage. Hansel and Gretel are so hungry that they lay aside the work their mother has given them, and dance about to forget their appetites. By way of punishment she turns them out into the wood, and they go to Ilsenstein, where the bad Crunch Witch lives. When the father comes home, he is alarmed by their disappearance, and he and his wife go post-haste in search of them.

ACT II. In the Forest. The children are afraid to return home, and sink down weary under a large tree, and the Sand Man comes and sprinkles his slumber sand in their eyes. Then in answer to their prayer, fourteen angels descend a staircase from Heaven and assume guard.

ACT III. The Witch's Gingerbread Hut. The next morning the children are aroused by the Dew Man, and they find themselves in front of the gingerbread hut, which they start to nibble. The witch comes out, captures them, locks Hansel up in a cage to fatten him, but Gretel, who is plump enough to be eaten, is made to bring water and fuel to prepare for the witch's feast. As she looks into the oven door, Hansel escapes from the cage, and they eat their fill of sweetmeats, and as the witch bakes, the oven cracks open, and a row of gingerbread children turn into real live children, and thank their deliverers for effecting their escape. The witch is baked into the form of a huge gingerbread loaf, then Peter and Gertrude enter, overjoyed to find their children safe. The opera ends in a general dance and merry-making.



An American adaption of one of the British naval circuits which, using three stages of H. and one of L.F. amplification, is claimed to receive telephony regularly across the Atlantic.

* * *

I PAGLIACCI.

Dramatic Opera in Two Acts, by LEONCAVALLO.

SCENE: Near Montalto, in Calabria.
TIME: August 15th, 1865.

CAST:

CANIO (Clown), chief of a troupe of strolling players.
NEDDA (Columbine), his wife.
TONIO (Taddeo), a player.
BEPPO (Harlequin).
SILVIO, a peasant.

The story of Pagliacci is almost completely told in the well-known Prologue which Tonio, in his player's garb, sings before the curtain.

IN ACT I. we are introduced to Canio, a travelling showman, and Nedda, his wife. Tonio, another member of the troupe, is in love with Nedda, but she rejects his suit as she is secretly in love with a villager named Silvio, whom she arranges to meet that night. Tonio discovers this, and warns Canio by way of revenge. Canio discovers Silvio and Nedda together, but fails to catch Silvio, and is persuaded by other members of the troupe to make peace with his wife.

ACT II. The show is about to begin, and we see a play which deals with a jealous husband who returns unexpectedly to find his wife (Nedda) with another man. Canio forgets that he is acting, the play reminds him so vividly of the treachery of his wife that his jealous rage gets the better of him, he seizes a knife and stabs her to the heart. Silvio rushes to help him, but Canio, recognising him, kills him instantly. The villagers take hold of Canio, who murmurs as he gazes at the bodies of his victims, "The play is over."

CAVALLERIA RUSTICANA.

Dramatic Opera in One Act, by MASCAGNI.

SCENE: A Village of Sicily.
TIME: The present.

CAST:

TURIDDU, a farmer.
LUCIA, his mother.
ALFIO, a carter.
LOLA, his wife.
SANTUZZA, a peasant girl.

A young farmer, Turiddu, is heard singing of his former love, Lola, "lovely as the spring's bright blooms," who married Alfio, a carter, whilst Turridu was away on active service with his regiment. Turiddu turns for consolation to a peasant girl, Santuzza, of whom, however, he quickly tires and he goes back to Lola.

The curtain rises on what appears to be a peaceful village scene. It is Easter, and the devout peasants are on their way to church. Santuzza meets Lola, tells her what has happened. Turiddu appears with Lola and treats Santuzza with cruel contempt. In despair she tells Alfio of his wife's conduct. After the church service, the villagers throng the square and drink and make merry together. Alfio appears, but refuses to drink, and challenges Turiddu to a duel, which is fought behind the scenes. There is a tense dramatic pause, and then messengers run in and the cries of the w announce the death of Turiddu. omen

A COMPLETE SINGLE VALVE SET.

By A. W. DRANSFIELD.

This set was actually constructed by the author, who obtained very excellent results on it. The diagrams are almost self-explanatory, and the amateur constructor should find little difficulty in building the set with but a few tools, a modest outlay, and the expenditure of but a few hours.

MANY amateurs that have made crystal sets and gained experience will now turn their minds to the construction of a valve set. The principal parts of a valve set in simple form consist of the following components: A tuner of which

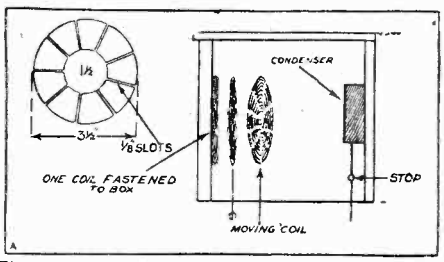


Fig. 1, showing the cardboard coil former and the arrangement of the tuning coils.

the size depends on the length of the wave it is desired to receive, and as this article is written for the reception of broadcasting, all dimensions, etc., will be for that purpose. The tuner will be of the pancake type, a very easily constructed form. Two pieces of card will be required about 3½ in.

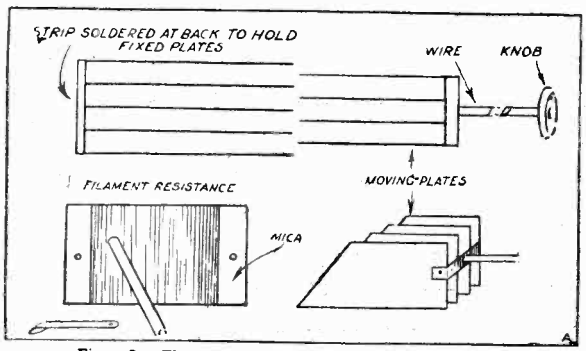


Fig. 2.—The variable condenser and filament resistance.

diameter (see Fig. 1). Mark a circle 1½ in. from the centre, then divide the circumference into 9 equal divisions (40 degrees) and cut towards the centre as far as the inner circle ⅛ in. slots to take the wire.

The Variable Condenser.

The wire will be d.c.c. 26 gauge. Start winding by leaving about 6 in. of wire for connections, and start at any slot, going down one slot, up the next, and down the next, and so on until on one side count up the spokes and layers of wire until you reach 24. This will give an approx. wave-length range of 600 to 800 metres, and so will pick up ship stations as well. The card should be well dried and paraffin waxed before winding. When the winding is finished warm the coil so as to allow the wire to get well set on to the card.

The next portion will be the variable condenser. This is not a very formidable undertaking, and will be of the sliding type, which is rather easier to construct than a rotary one. The metal used will be of thin sheet zinc, and 9 pieces will be required, 5 fixed and 4 moving plates, all the same size—4 in. by 3 in. The sliding blocks should be made of ebonite, and as small pieces are required they will not be expensive. The mounting of these plates will be better understood from the diagram (Fig. 2) than from any letterpress on the matter. A larger condenser made on the same lines, and put into the aerial circuit later, will greatly improve matters.

How To Use The Set.

A grid leak should be made and fastened on underneath the ebonite panel. This is made with copper foil and mica separators, only 4 pieces of foil, 1½ in. long and ⅝ in. wide, being utilised. The strips of foil are laid on the mica in such a manner that when they are assembled together there will be an overlap of foil of ¾ in., care being taken that they are placed together in such a way that the lugs project alternately first from one side and then the other (see Fig. 3). Now cut a piece of thin ebonite to cover the whole, in such a manner that two holes drilled in the ebonite to take the fastening down bolts will pass through the lugs. Before putting on the nuts, lay a strip of paper across the bolts, and scrape a little lead from a pencil all round the bolts so that the nuts when screwed home will make a good electrical contact. Then with a soft pencil join up the bolts from the lead scrapings with thick line. This will act as a grid leak and condenser in one unit (see Fig. 3).

The valve holder may be of the ordinary type, but the writer prefers the legs which are fitted into holes in the ebonite. The position of these holes may be easily obtained by pressing a valve on to a piece of blotting paper and, placing the paper on the ebonite, drilling through the dents made by the valve legs.

The other particulars are really better understood from the diagrams. The panel top may be marked carefully and filled with white jewellers' wax. A slight improvement may be made by having a set of terminals on the panel and appropriately marking them, so that the additions for experiments may be added without having to

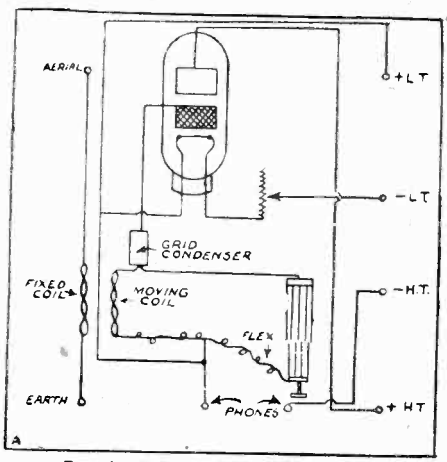


Fig. 4.—A simplified wiring diagram.

open the circuits to get a contact. It will be understood that this is the simplest form of valve receiver.

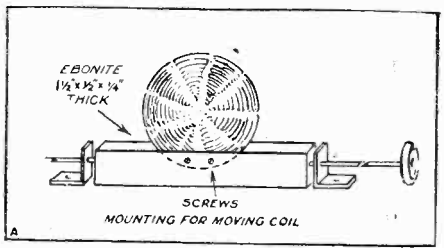


Fig. 5.—A simple method for mounting the moving coil.

The method of using the set is very simple. All that is required is to open the coils a little until a signal, or the concert, is heard, and then by using the condenser and the

(Continued on page 515.)

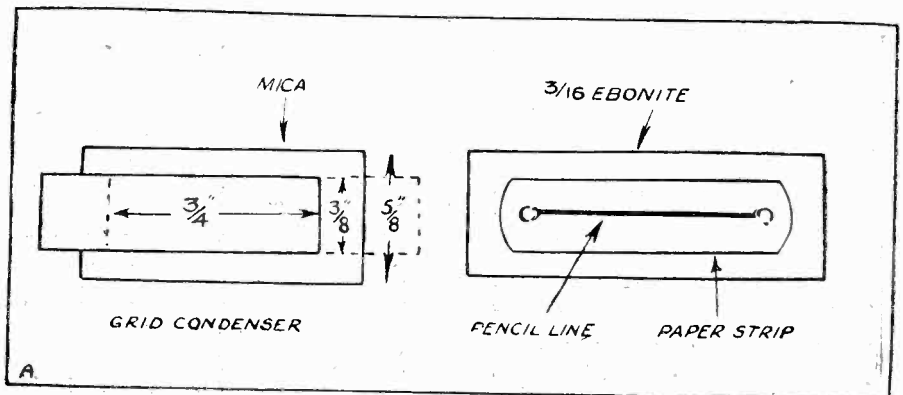


Fig. 3.—The grid leak and condenser.

ASSORTED TIPS

Quite a serviceable, and cheap, earthing switch can be made from an ordinary switch arm and a couple of contact studs mounted on a small piece of ebonite. The aerial down-lead goes to the switch arm, one of the studs to aerial terminal of the set, and the other to earth.

* * *

Very few valve sets have the glare of the filaments protected from the eyes, but if you are in the habit of listening-in for lengthy periods, it is advisable to arrange some covering. For the smaller type of valve, such as the "Ora" and "Xtraudion," quite a good cover can be made from empty inverted mantle boxes, although the "R" type will require larger ones. A pinhole would be sufficient to show that the valve was still burning satisfactorily.

* * *

Don't think that a higher plate voltage will always give you better signals. Some valves—such as those excellent little Dutch rectifiers—require very low plate voltage, and one step-up with the wander plug will often reduce the strength of the signals considerably.

* * *

If your variable condenser is not covered in to protect it from dust, it is a good plan to give the whole instrument a good "blow" with a cycle pump. Dust on the plates will make your condenser noisy in action, and a few "goes" with the pump will clean the plates quickly.

A COMPLETE SINGLE VALVE SET.

(*Continued from page* 512.)

variable inductance the best results will soon become apparent.

To give the instrument greater efficiency, a small resistance for the filament will be found an improvement, and a piece of thick flat mica wound with about 20 turns of

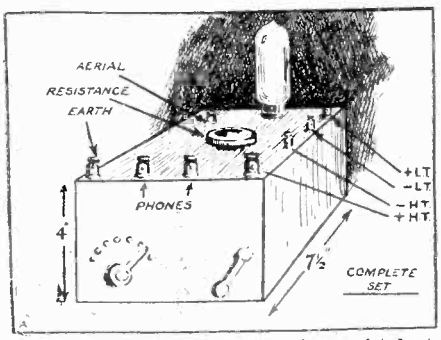
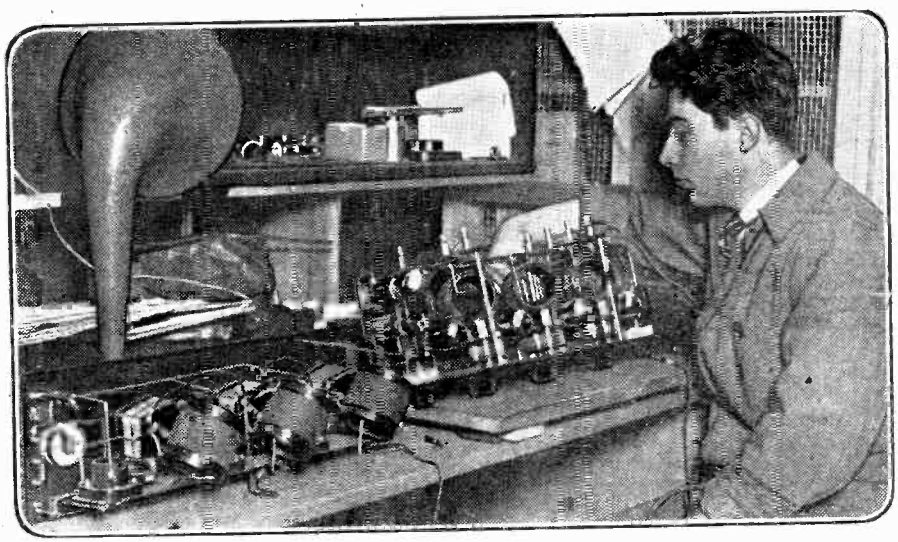


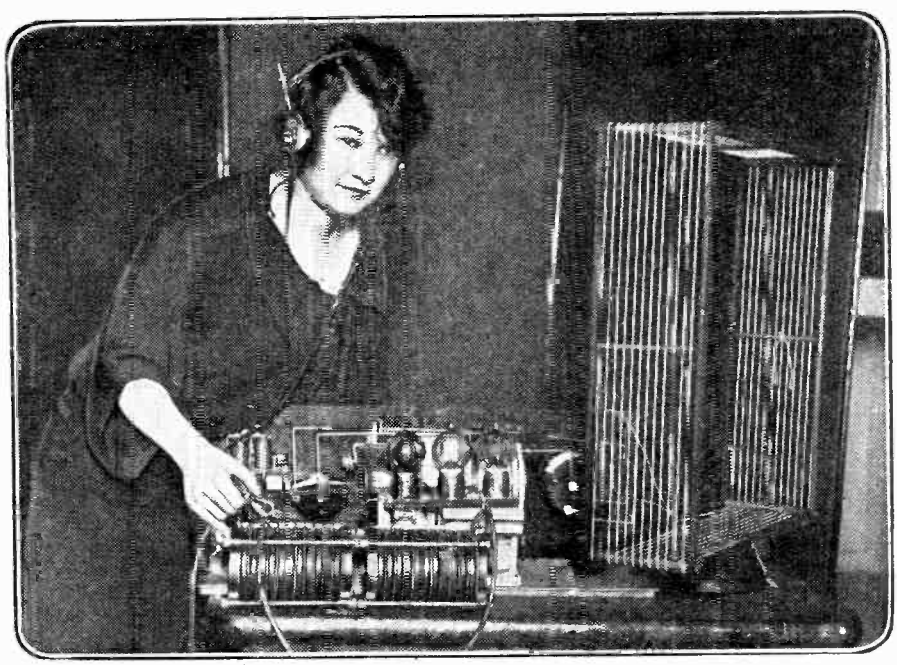
Fig. 6.—The general appearance of the completed set.

resistance wire should be screwed on the underside of the panel in a fashion similar to the grid condenser. Make the hole for the selector portion low enough to describe an arc across the whole of the resistance wire. This is shown in the diagram (Fig. 2).



The latest wireless product of America; the wonderful Neutrodyne Receiver, invented by Prof. Louis A. Hazeltin. The circuit embodies entirely new principles, and it is claimed that tremendous ranges are possible without even an aerial or earth attached. It is of non-radiating character, and employs two H.F. detectors and two L.F. valves. Dry batteries only are required. The above photograph shows the interior of the set.

The external appearance of the Neutrodyne Receiver. The dial on the extreme left controls all the amplifying valves, no potentiometer being used, while the next dial controls the aerial tuning adjustment. The third and fourth are "neutrostages," and the last the detector valve control.

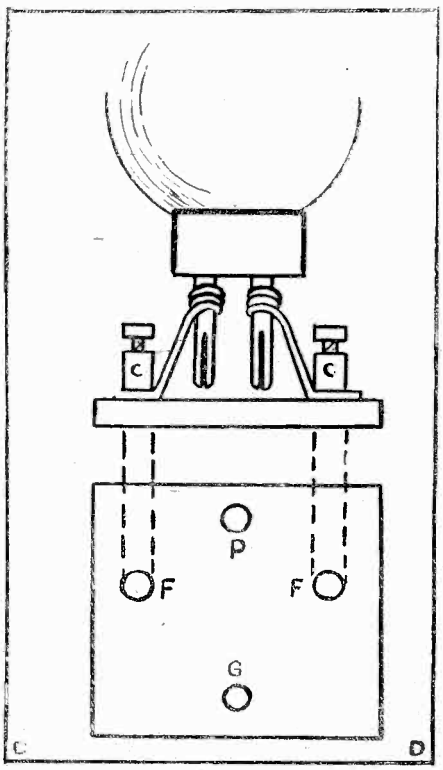


Miss Gladys Ward trying out the latest "super" set.

A SUBSTITUTE VALVE HOLDER.

This little device will prove extremely useful for those who do *NOT* confine themselves to one circuit.

IT is not always convenient for the experimenter when "trying out" various types of new circuits to connect up to the ordinary type of valve-holder in order to complete the wiring of the set. The connections to most valve-holders in the standard type of instrument are usually firmly soldered, or otherwise permanently connected, and everything in the nature of a permanent connection to the enthusiastic and genuine experimenter, is, to say the least of it, entirely undesirable. The device



shown in the illustration, therefore, may prove of interest to those restless spirits who are ever seeking to evolve something new in the way of wireless receiving circuits.

Mark Each Terminal.

A small baseboard of bakelite, ebonite, or even prepared wood, three or four inches square, four brass terminals, and about a foot of ordinary springy brass wire, are all the components that are necessary to construct this simple form of valve-holder.

The diagram is almost self-explanatory. The wire is divided into four equal lengths, one end of each length being turned into a small spiral of a suitable diameter, to support and make connection with the valve leg. A portable valve-holder ready for use is thus easily constructed, and can be placed in any required position and speedily connected in circuit by means of the terminals. Each terminal should be plainly marked as indicated, in order to make certain that the valve is placed properly in position.

Forms a Protection.

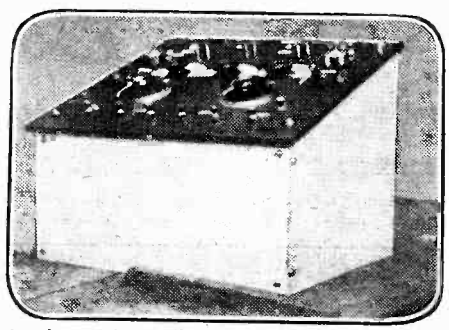
The filament circuit should be tested for continuity before connecting the high-tension battery, although perhaps this advice is unnecessary to the amateur who is likely to make use of this device, as it is probable that he has already experienced that by no means pleasant sensation which always attends the connecting of the plate battery across the filament of an expensive valve. This form of socket works well, provided the spirals make a sufficiently good connection with the valve legs, and the natural springiness of the wire acts as a buffer, and protects the valve against damage should the baseboard be heavily or carelessly placed down during operations.

CORRESPONDENCE.

The Editor, POPULAR WIRELESS.

Dear Sir,—As the advertising adviser to a large London firm dealing with wireless components, and specialising in sets of parts for home construction, I should be glad of this opportunity of replying to the letter signed "Olig" in your issue of April 28th.

In his letter the writer criticised misleading advertisements of wireless manufacturers, and I consider that the publication of his letter is likely to do the wireless industry—particularly as regards mail-order business—some considerable harm.



A valve receiver with an aluminium casing. Less capacity effects and more freedom from parasitic noises is claimed with the introducing of this metal.

It is my business to watch carefully all advertisements of wireless firms, and I cannot recall ever seeing one which appeared to deliberately misrepresent the article it purported to advertise. In my opinion, advertisements of wireless firms are honest, and the firms can be dealt with by anyone without fear of misrepresentation. Obviously, if the standard price for a transformer, for instance, is 21s., no amount of smooth-tongued salesmanship—either in print or in person—should convince an intending purchaser that one at 12s. 6d. would be equally as good.

Undoubtedly there have been some cases of advertisements which perhaps give only half the truth, but probably this is due to the fact that the advertisement writer does not understand his subject. At the present moment, of course, some advertising men are not quite *au fait* with the technicalities of wireless and can only speak and write in generalities.

Wireless enthusiasts living some distance from the nearest large town—and one of the great features of wireless is that it is such a wonderful companion to the lonely country dweller—need have no fear in dealing with *regular* advertisers in the columns of your paper, for obviously if a firm does not "deliver the goods" they cannot remain in business long.

Yours faithfully,
ERNEST R. GILBERT.
Gilbert Advertising, Ltd.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am writing to ask your readers, who have received United States Broadcasting Stations during the past six months, whether, as a general rule, the reception was clearer on a starlight or cloudy night and what seems to be the most ideal conditions for this long-distance reception.

I find the most ideal conditions to be a wet and cloudy night, and I may state that I have the greatest difficulty in receiving even W J Z, Newark, New Jersey, on a starlight night.

Do any other readers experience this?

Yours sincerely,
HENRY FIELD.
Baggrave Hall, Leicestershire.

The Editor, POPULAR WIRELESS.

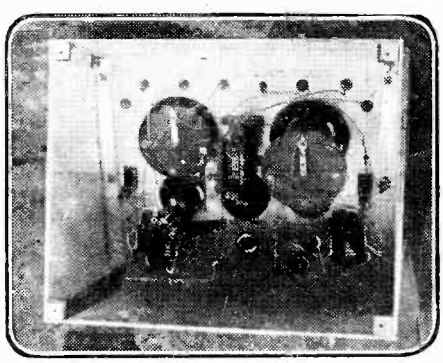
Dear Sir,—I read with interest the fact that Mr. P. Norris had received 2 L O at that great distance on a small crystal set.

Perhaps you may be interested to know that I can tune in 2 L O quite distinctly, although I am one hundred and eighty-five miles from London, and my aerial is badly screened on all sides. Cardiff, at the distance of twenty miles, comes through very loudly. This is no freak, as I can do it almost any night.

The set I am using is a Gecophone No. 1 Variometer tuned crystal type. My aerial is a single wire one hundred feet long and about forty feet high. The earth connection is made to the heating apparatus about ten feet away.

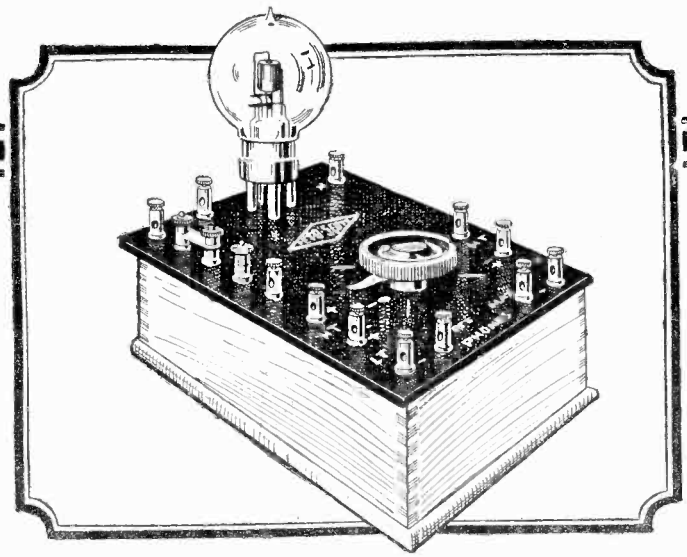
If this letter does not take up too much of your valuable space, I would be very pleased if you would publish it in one of the issues of your excellent paper, as I think it would interest other readers.

Yours faithfully,
H. E. LAKIN.
Derllwyn House,
Tondu, Glamorgan.



The interior view of the aluminium-cased valve receiver.

No. 2 of a series of interesting talks on Peto-Scott Units.



The Detector

—the heart of a Receiving Set

AN efficient Detector Valve is as essential to a Receiving Set as the balance wheel to a watch.

Without a good Detector Valve, a Receiving Set cannot be expected to give good results.

What does the Detector do?

When wireless waves are intercepted by your aerial, and your Set is tuned to receive them, they are oscillating at such a high frequency, that no telephone—or other similar instrument—could possibly be made to reproduce them. It is necessary, therefore, to detect—or rectify—them. This is effected by means of a grid leak and grid condenser acting in conjunction with the Valve. If these two have the correct value the frequency of these oscillations will at once be brought down from millions per second to thousands per second, and converted into audible sounds through the telephones. Note then, therefore, the immense importance of this Detector Valve Unit with its grid leak and grid condenser.

Almost any form of grid leak will give some sort of result, but only a Peto-Scott Grid Leak—tested and guaranteed permanent under all conditions—will give the results for which Peto-Scott Sets are famed.

If you are tired of spending money on unsatisfactory instruments, decide to take up the Peto-Scott standardised Radio Unit system and begin to get wonderful results right from the first Valve.

A Booklet, "Radio," price 6d., post free, describes the system fully, and shows how each Unit can be constructed at home.

PRICE LIST OF SETS OF PARTS.

Ready for home construction.

No. 1 Tuner Unit	27/6
No. 2 Condenser Unit	42/-
No. 3 H.F. Amp. Unit	13/6
No. 4 Detector Unit	17/6
No. 5 L.F. Amp. Unit	33/6

Mahogany Cabinets to fit Nos. 1, 3, 4 and 5, 3/6. To fit No. 2, 7/-.

Postage 9d. per unit extra, but paid on all orders over £2.

PETO-SCOTT Co., Ltd.,

Featherstone House,

64, HIGH HOLBORN, W.C.1.

Additional Demonstration Lounge:

99, HIGH HOLBORN W.C.1.

Read what an efficient Detector can do—

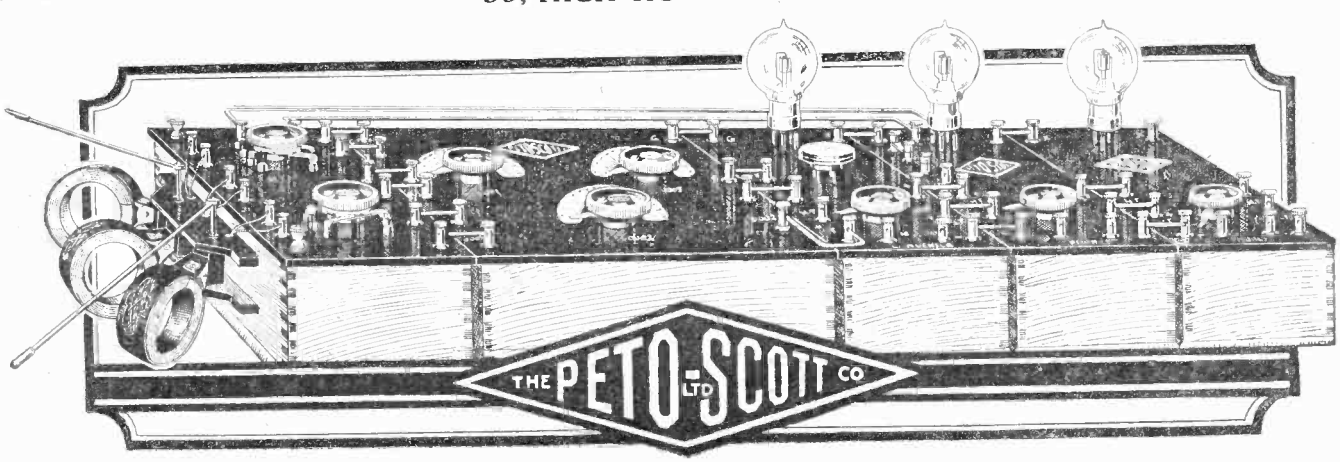
5, Leighs Fold, Green Lane, Patricroft.

Messrs. Peto-Scott, Ltd.

Dear Sirs,—No doubt you will be interested to know that the reception of the American Broadcasting stations W J X and W G Y on a single-valve home constructed set as described in my letter to "Popular Wireless" of March 17th issue, was made from a set of Peto-Scott (No. 4 unit) parts. To prove that this is not a case of "freak" reception, may I state that since that date I have received these stations eight times. I also get, apart from the above B.B.C. stations, the F.L., Radiola, Posts and Telegraphs (all French stations) telephony.

Wishing you the best of success with such an excellent panel.—Yours faithfully, J. H. Brittain.

P.S.—I am demonstrating my set before the Eccles and District Radio Society this week, and expect to pay a visit to the Manchester Wireless Society in a fortnight's time.



TRANSMITTING PHOTOGRAPHS BY WIRELESS.

By MICHAEL EGAN.

It is quite a general idea that the transmission of pictures by wireless involves extremely complicated and elaborate systems of "different currents and wave-lengths," but, as this article clearly shows, the principles that render this wonderful operation possible are really comparatively simple.

IT is probable that modern improvements in wireless telephony have awakened a deeper and more wide-spread public interest than has ever previously been awakened by the developments occurring in any other particular branch of science. There are numerous reasons to account for this extreme interest in wireless telephony, and at the base of all these reasons lies one dominant fact—the universal value and utility of the wireless telephone. So rapid has been the growth of interest in telephony, as manifested by the "characteristic curve" of public opinion, that the supreme importance of work that is being done in other fields of radio science has been somewhat disregarded. Among such work may be classed the research that is at present being conducted in connection with the transmission of photographs by wireless.

Preparing the Photograph.

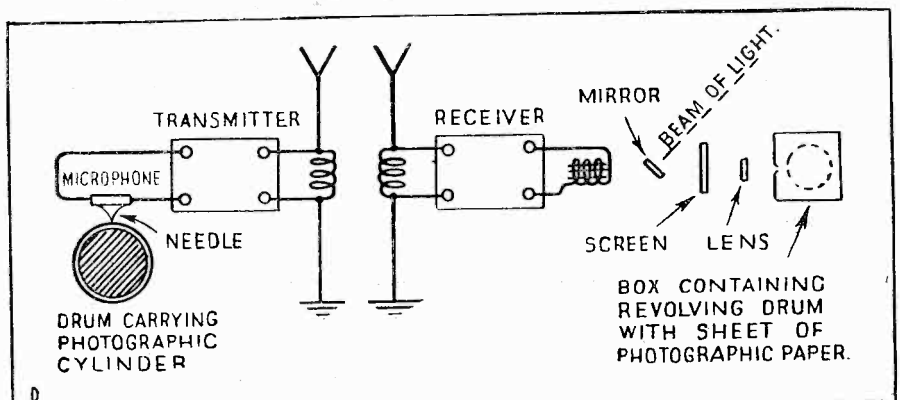
It is generally assumed that the principles underlying all systems of photographic transmission are of so abtruse a nature that they cannot be grasped with any degree of satisfaction by the ordinary amateur. Whilst this may be so—and, indeed, is necessarily so in connection with a large portion of the experimental work that is carried out in all departments of science—it is, nevertheless, an easy matter to give to the intelligent amateur an intelligent mind-picture of how a radio-photographic apparatus works. What follows is an account of a system of photographic transmission developed by a French scientist named Edouard Belin, and used by him to transmit a photograph of President Harding across the Atlantic on one occasion last year.

The photograph which it is desired to transmit is first prepared in a special manner. The process itself need not be considered here, it being sufficient to know that the photo is reproduced on a cylindrical drum, and that it is reproduced in relief. It can thus be resembled to one of the old-time phonographic cylinders with which many of us were wont to produce drawing-room atmospherics in the days gone by. The surface of the cylindrical photograph is "raised"—i.e. is made to consist of minute hills and valleys—in accordance with whatever variations in light and shade occur in the original photograph. The height of any point above the surface of the cylinder therefore indicates the amount of light or shade occurring at the corresponding point on the photograph.

Method of Transmission.

The cylinder is fitted to a revolving drum, which comprises part of the transmitter. A sensitive needle makes contact with the surface of the cylinder as it revolves, and the needle is in turn directly connected to a carbon granule microphone. This microphone works on exactly the same principle as those used in connection with ordinary wire, or wireless, telephony transmission. As the granules are contracted by pressure of the needle—resulting from contact with a high point on the cylinder surface—their electrical resistance is decreased, and, consequently, a larger current is permitted to flow. This increase in current strength in turn affects the radiation from the aerial.

So far as the methods used in telephonic and photographic transmission are concerned, the only important difference with which we need trouble ourselves is as follows. In telephony, the radiated energy is controlled in the first place by the vibrations of the human voice impinging on the diaphragm of a sensitive microphone; in photography—referring, of course, to this and kindred methods only—the original controlling factor is the sensitive needle passing over the raised surface of the cylindrical drum. As it moves over the surface of the cylinder with varying pressure, it alters the electrical resistance of the carbon granules in the microphone.



This diagram clearly illustrates the elements of the apparatus employed in the transmission and reception of photographs by wireless; its comparative simplicity will be apparent to even the veriest "tyro."

The Receiver.

So much for the transmitter, then; the different shades of light and dark on the original photograph are converted into variations in the carrier wave radiated from the transmitting aerial. This wave is picked up by the receiving aerial, from which it is passed through a coil of wire which comprises the winding of an electro-magnet. The variations in the transmitted wave are thus reproduced as variations in the magnetic field of this electro-magnet in the receiving station. At some distance from this electro-magnet a small mirror is suspended in such a manner that its movement in one plane is controlled by the impulses passing through the electro-magnet. (See accompanying diagram.)

In simpler terms, when a small variation occurs in the field of the electro-magnet, the mirror moves through a minute angle; similarly, when large variations in the electro-magnet are brought about by the received wave, the little mirror is deflected through proportionately larger angles.

Upon the reflecting surface of this mirror a beam of light is concentrated. This beam is reflected from the mirror on to a small screen, which is of such a nature that it offers a varying resistance to the passage of light through it. That is to say, at one end the screen is quite opaque, and at the other end quite transparent, the intervening part being composed of a substance that exhibits various degrees of transparency between these two extremes. As the mirror vibrates, it reflects the beam of light on to different points of the screen. The light that penetrates the screen will therefore be of a varying intensity. This varying light is now focused, through a lens, on a small aperture in a box, which contains a revolving drum carrying a sheet of sensitive photographic paper. Each variation in the received wave is thus utilised to focus a beam of light—of a particular intensity—on a sheet of photographic paper.

Reproducing the Picture.

When the transmission has taken place, the photographic paper is taken from its dark box and developed and fixed in the ordinary manner. Great care has to be taken, of course, to ensure that the rotation of the drum at the receiving station is synchronised with the rotation of the drum at the transmitting station.

What has been said above represents, of course, a bare outline of this very ingenious system of photographic transmission. Radio-photography is still in its infancy, as the phrase goes, but it must not be forgotten that it is already an older and more precocious child of science than was radio-telephony five or six years ago. And, as the rate of its development will depend directly on its value to humanity, we may look forward to some amazing achievements in this branch of science during the next few years.

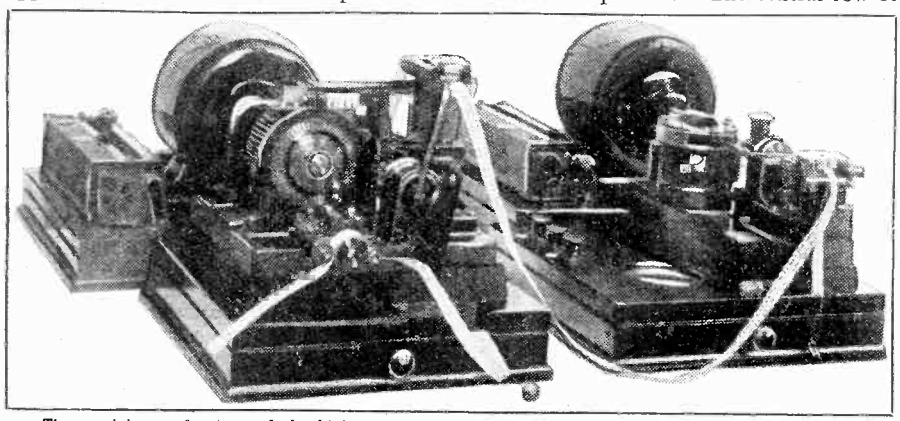
The value of an efficient system of radio-photography to modern life can scarcely be estimated; it can certainly not be over-estimated. Take, for example, the simple operation of affixing a signature to a document. What effect will it have on the business of the world when you can sit in your office in London and write your name with a wireless pen in Singapore? What chance will the criminal have who leaves the scene of his crime—in London, say—by one of the Great Northern expresses, and arrives in Glasgow in time to learn that his photograph had appeared in the "Glasgow Herald" some five hours before his arrival?

THE CREED TELEGRAPHIC APPARATUS.

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

High-speed wireless telegraphy is intensely interesting, and no doubt many readers will have heard the spasmodic "purr" of the large commercial stations that are continually transmitting at speeds varying up to 175 words a minute—faster than one can comfortably speak. The great White Star liner, the Majestic, has recently had high-speed wireless apparatus installed, and can communicate with land stations by this means up to a distance of 700 miles. This article clearly explains the working of such a system, and should prove of utmost interest to every amateur, especially those who have heard and puzzled over the prefix signal N W (Now Wheatstone), signifying the commencement of a high-speed transmission.

FOR reasons explained in other articles, big wireless transmitting and receiving stations are usually placed as near the sea coast as is conveniently possible, with the result that messages have to be despatched by overland wires from inland cities (and, conversely, telegraphed after receipt) by apparatus such as is used for ordinary rapid telegraphy. Since such apparatus is essential for the completion of



The receiving perforator and the high-speed printer. The latter is on the left of the photograph.

wireless telegraphic systems, a description of the latter would be incomplete without that of the part played by land wire instruments more or less common to all systems.

If an operator who lived in the early days of telegraphy could be resurrected now, his astonishment would surely be great—indeed, if modern telegraphic appliances were placed before him, he would be entirely at a loss how to use them. In his time, 20 words a minute, despatched and received by hand working, was about the limit of speed.

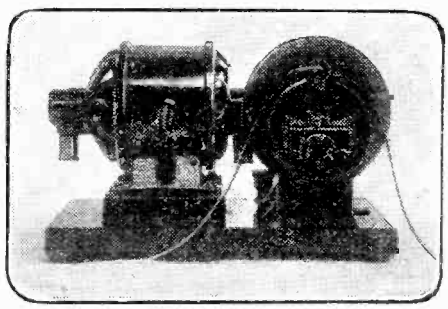
A Perforating "Typewriter."

At a later date, the invention of the Wheatstone transmitter rendered it possible to work at a speed of 300 words a minute, but such a speed necessitated the services of about two dozen operators at the sending and another two dozen at the receiving end, for all messages had to be deciphered and written out by hand.

In the latest type of Creed transmitter, the Wheatstone principle is retained, but its somewhat complicated mechanism is replaced by a simpler one with fewer wearing parts. It may be explained that a paper tape is first punched with the Morse code of dots and dashes on a keyboard perforator. This instrument has a keyboard lettered and numbered just like that of an ordinary typewriter. But when the operator depresses the keys, instead of letters and numbers being typed, the instrument automatically selects sets of punches, and perforates the tape with the Morse-code equivalents. A good operator will turn out about 40 to 45 words a minute.

An Automatic Contact.

The perforated tape is then passed on through the transmitter, over a pair of tiny rods called "peckers." The central row of closely spaced holes in the tape engage the teeth of a rotating star wheel which draws the tape through the instrument. The peckers are pressed gently against the underside of the tape by means of springs so that the two side rows of holes pass centrally over them. Whenever a hole passes over a pecker, the latter rises through it and, being connected by levers with the contact pins, make and break is automatically effected by the contact pins as they respond to the movements of the peckers. Thus the message is consigned to the transmitter, passed through a relay of a special adjust-



The transmitter.

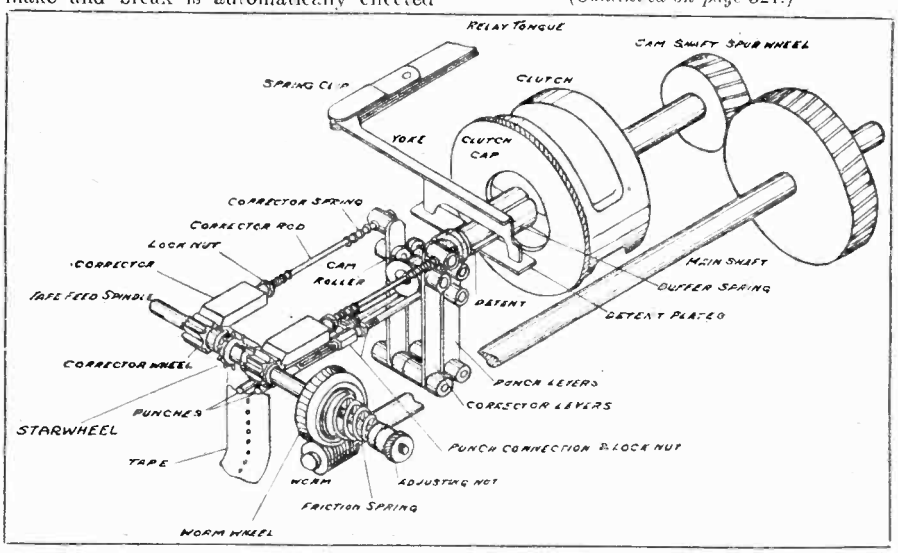
able type for correcting "bias," and in a flash reaches the wireless transmitting station at the rate of from 100 to 150, or even 175, words a minute.

Two Types of Relay.

It is not our purpose to deal with the wireless side of transmission and reception in this article, and we must therefore break our story here and take it up where the message, having been waylaid by the distant receiving station, is passed on to the receiving apparatus. Here it passes first through a line relay, and then through a power relay fitted on the same base plate as the receiver.

There are two principal types of relay. One of these is known as the "line relay,"

(*Continued on page* 521.)



This diagram shows clearly the essential working parts of the receiving perforator.

THE KENOTRON.

CONCURRENTLY with the development of the three-electrode valve as a generator, there arose the need for a source of high voltage direct current supply for application between its plate and filament. For certain powers a D.C. generator with revolving armature meets this need, but for higher voltages than such machines can deliver the kenotron was developed.

The one-way conductivity of valves has already been described in POPULAR WIRELESS and this description covers the kenotron.

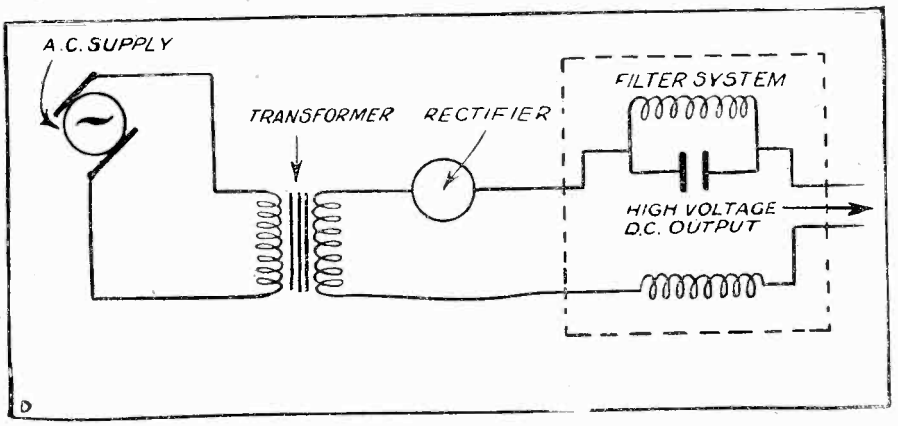
Thus it is easy to see that if a kenotron is connected in series with an alternating current supply it will act as an open circuit during alternate half-cycles, and will allow the current to pass only when its direction is from filament to plate.

Fifty per Cent. Efficiency.

The current derived from the kenotron under these circumstances will be in the form of pulses of direct current. In order to derive this direct current at high voltages, the A.C. supply is first transformed up to a voltage exceeding the value required, to compensate for the drop along the rectifier and any system of filters which may be employed. These filters are necessary for the smoothing out of the ripple in the D.C. output when the current is required to be constant, and consist in general of various combinations of condensers and choke coils. By using a number of rectifiers and phases, it is possible to produce a current with only a small percentage of intermittent current remaining in it.

Kenotrons are applicable not only to wireless circuits, but to any requiring a high voltage direct current, and have been made with a capacity of 30 kilowatts at 15,000 volts D.C.

Thermionic rectifiers, though noiseless in operation, and free from the moving parts and the drawbacks attendant upon chemical rectifiers, probably do not in efficiency exceed 50 per cent., but for amateur work form, with the subject of filters, an interesting study.



THE CREED HIGH-SPEED APPARATUS.

(*Continued from page* 520.)

used in connection with the magnification of signals received, and the other as the "power relay," for use with apparatus requiring power to operate it, such as the receiver and high-speed printer, the principle of working being the same in both cases.

The receiver (see diagram) is operated by an ⅛th h.p. electric motor mounted at one end of the instrument. An extension of the motor shaft operates, through worm gearing, a cross shaft at the other extreme end. This shaft drives, through a tiny friction clutch, a star wheel that engages the central holes in an otherwise blank paper tape, and draws the tape through the instrument.

The Perforator.

At an intermediate point, the motor shaft extension is geared to a parallel shaft which, through another friction clutch, drives a shaft in which cams are formed. Two punches, parallel with the shaft, terminate in sleeves that work in the cams, another pair of small rods terminating in another pair of sleeves. The last pair of rods is for controlling the speed of the paper tape, and stopping it whilst it is being punched, to prevent its being torn, and for synchronising or timing the punching with the signals as they are received.

The relay tongue (an extension of the armature of the power relay) is connected to a transverse yoke resting on a pair of "stop" or "detent" plates, one on each side of a "snail" or "detent" fixed to the clutch shaft. When the relay tongue moves in one direction, the detent plate arresting the "snail" moves with it, allowing the snail and the shaft to make a half-revolution when it is stopped by the other detent plate. The cams controlling the movement of the correcting and punching rods are so proportioned as to push the corrector rods forward at the right moment, and cause pawls or "correctors" to engage the teeth of a pair of corrector wheels on each side of the tape-feeding star wheel, and stop it, whilst the punches are forced forward and perforate the tape. Thus, for every movement of the armature, there is a half-turn of the snail and a corresponding movement of the correcting rods and punches. The two friction clutches slip when the shafts are stopped, thus permitting the motor to continue running.

From the foregoing description it will be seen that the function of the receiver is to punch a tape at the receiving station, which is a facsimile of the original tape punched by the keyboard perforator at the transmitting station.

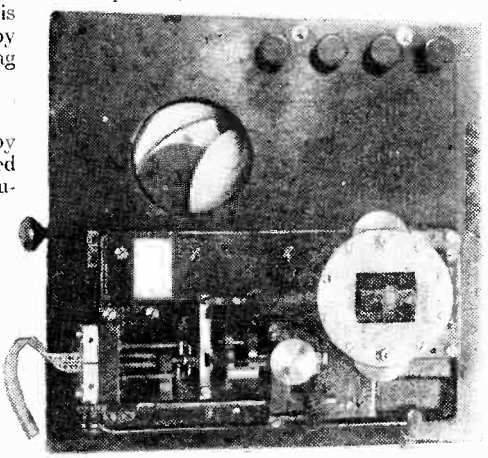
High Speeds Possible.

The paper tape punched and delivered by the receiver now passes on to the high-speed printer—a delightful but complicated instrument. In ordinary working, this machine turns out from 100 to 140 words a minute, but when occasion demands, a speed of 150 words may be attained. Higher speeds are not usually necessary; when they are, it is usual to employ two printers and divide the tape from the receivers between them, by which means a working speed of from 200 to 300 words a minute is possible. At the ordinary working speeds, vibration is scarcely perceptible, and the printing is wonderfully clear and distinct.

The Final Process.

As the perforated tape is fed into the printer, it passes over a series of ten pairs of small pins or "selectors." The two selectors of each pair are spaced exactly the same distance apart as are the holes in the tape corresponding to the Morse code. The selectors are pressed lightly against the underside of the tape, so that whilst on perforations are encountered nothing happens. But immediately a hole comes opposite a selector, the latter rises through it, and in so doing lifts the end of a horizontal "actuating" lever pivoted on a pin. The different combinations can thus print various letters.

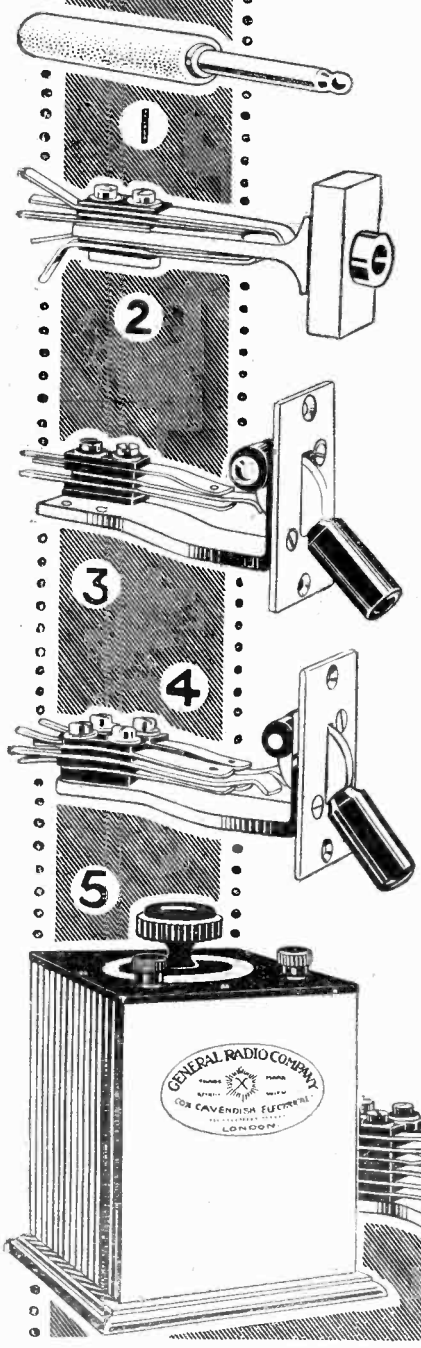
A great advantage of the Creed system is, not only that a message can be repeated over another telegraph line when desired simply by passing the same perforated tape through another transmitter, but it can also be used in conjunction with a syphon recorder or undulator by which the message is recorded in ink on another tape by a fine, trailing, syphon tube in line dot and dash corresponding to the Morse code.



The Creed Receiving Perforator.

The Creed can also be employed on practically any line, and for direct wireless relay communication. It is also extremely useful when similar messages to several different addresses are being dealt with, as the perforated tape can be run through the printer any number of times.

G.R.C. Parts.



G.R.C. Parts are produced with the same meticulous care as the famous G.R.C. Receiving Sets. From the stamping, turning, or moulding of the components and winding the various coils, through the assembling and finishing of the units to the final test, every operation is subjected to the most rigid inspection.

Although the G.R.C. Factory, employing 300 highly skilled hands, is pressed to its utmost capacity by the enormous demand for G.R.C. products, every single unit is carefully tested before shipment.

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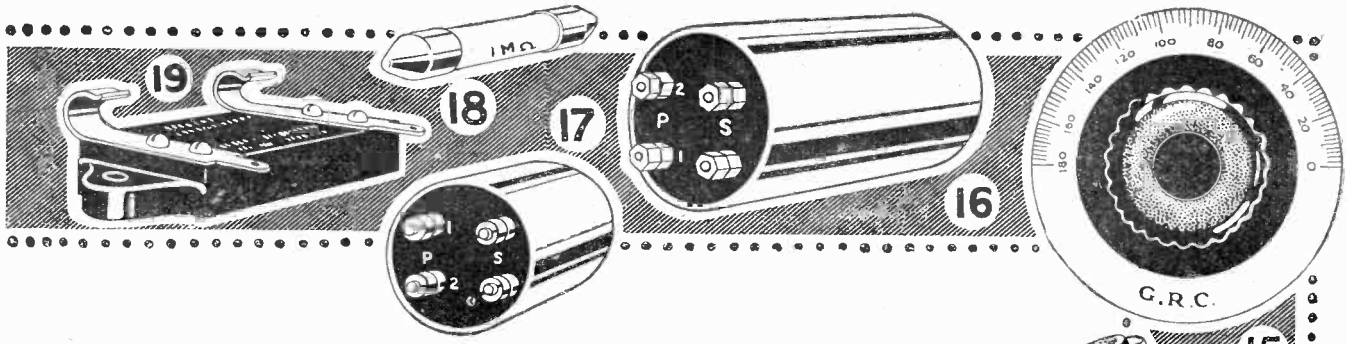
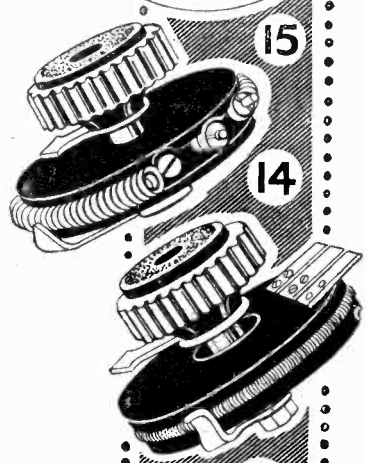
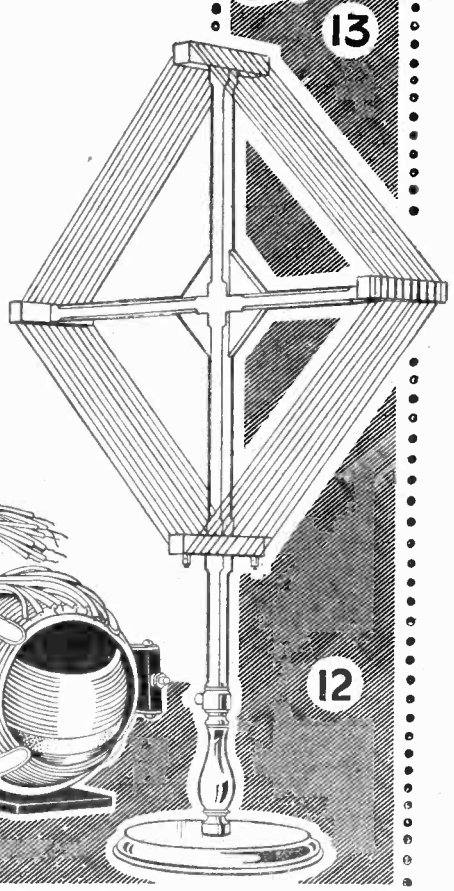
GENERAL RADIO COMPANY







No. 1. *G.R.C.* 111 ***Radiophone Plug.***

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No. 3. *G.R.C.* 115 ***Jack Switch*** *(Single pole—single throw).*

No. 4. *G.R.C.* 116 ***Jack Switch.*** *(Double pole—single throw).*

No. 5. *G.R.C.* 61 ***·0011 Variable Condenser in Case.***

No. 6. *G.R.C.* 117 ***Jack Switch*** *(Four pole—double throw).*

No. 7. *G.R.C.* 64 ***·0005 Lab. Variable Condenser.***

No. 8. *G.R.C.* 63 ***·0011 Lab. Variable Condenser.***

No. 9. *G.R.C.* 81 ***Variable R.F. Transformer.***

No. 10. *G.R.C.* 71 ***Variometer***

No. 11. *G.R.C.* 72 ***Vario-Coupler.***

No. 12. *G.R.C.* 104 ***Frame Aerial.***

No. 13. *G.R.C.* 91 ***Potentiometer.***

No. 14. *G.R.C.* 92 ***Filament Rheostat.***

No. 15. *G.R.C.* 122 ***Dial and Knob.***

No. 16. *G.R.C.* 83 ***Audioformer.***

No. 17. *G.R.C.* 82 ***Radioformer.***

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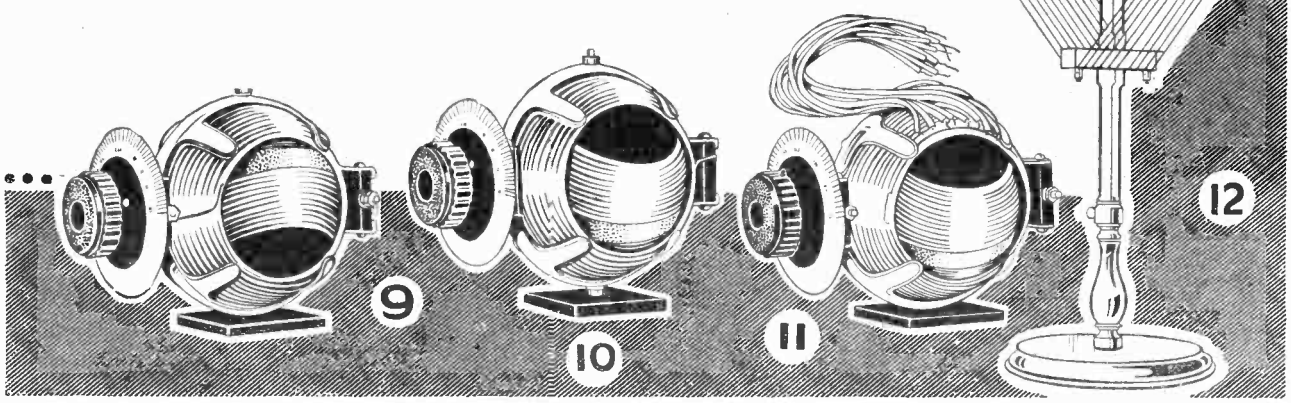


GENERAL RADIO COMPANY

MORE PICTORIAL VALVE CIRCUITS.

By O. J. R.

IN a recent issue of POPULAR WIRELESS, we described three different types of single valve receivers which, we said, were the best circuits for the newly graduated valve-set operator to try. This week we publish a similar article dealing with two-valve receivers in which is outlined three popular methods of arranging two valves in one unit. As time goes on we hope to proceed with three-valve and four-valve receivers until our late Crystal Fans ultimately become real valve experts.

We commence with a two-valve low-frequency amplifier or note magnifier suitable for use with a valve or crystal receiver. It will be remembered that the strength of the received signals, using a single valve L.F. amplifier, was $1 \times 5 = 5$. By adding another valve and transformer we get $5 \times 5 = 25$, so that the signals are now twenty-five times louder than they were originally. The signal strength is squared each time another valve is coupled to the next with a 5 to 1 step-up transformer.

Will Work Loud Speaker.

Thus if we have three valves we get $25 \times 5 = 125$, and so on. If an enthusiast is fortunate enough to reside in close proximity to the broadcasting station, say within a radius of 5 to 8 miles, then the two-valve L.F. amplifier shown in Diagram A will operate a loud speaker quite well, providing it is of a reputed make and that the receiver is as efficient as possible. The small fixed condensers C which are in shunt with the primary windings of the transformers may be of the Mansbridge type as shown or made up in the usual way. It is sometimes only necessary to provide one of these connected either to the first or second transformer, but this is a little matter best determined by first trying both and then disconnecting each in turn. This circuit is very simple to operate. If desired one of the filament rheostats may be dispensed with and the other made to control both valves.

To effect this alteration we will retain the rheostat nearest the accumulator, and take the other rheostat and three connecting wires out of the circuit. The wire then leading from the arm of the single rheostat to the lower valve filament leg is simply extended to the corresponding leg of the second valve and the O.S. of the second transformer joined to the O.S. of the first or to the negative accumulator lead, in any convenient position. The same remarks apply to any of the circuits shown. This is naturally the cheapest method, but for efficiency it is always advisable to provide a separate control for each filament.

The Tuner.

Providing one is within a reasonable distance of the broadcasting station the best way to arrange two valves as a complete receiver is to employ one as a detector and the other as a L.F. amplifier, as shown in Diagram B. This, of course, amounts to practically the same thing as the single valve receiver coupled to the single valve L.F. amplifier previously described, made up in one unit. The single slide inductance may be replaced by any other suitable tuning device, but it is always best when trying a new circuit to commence with a simple form of tuner and elaborate it, if necessary, after becoming acquainted with the other circuit adjustments. Experiments here will be chiefly confined to the grid leak and the 'phone condenser. Condensers of different

(*Continued on page 525.*)

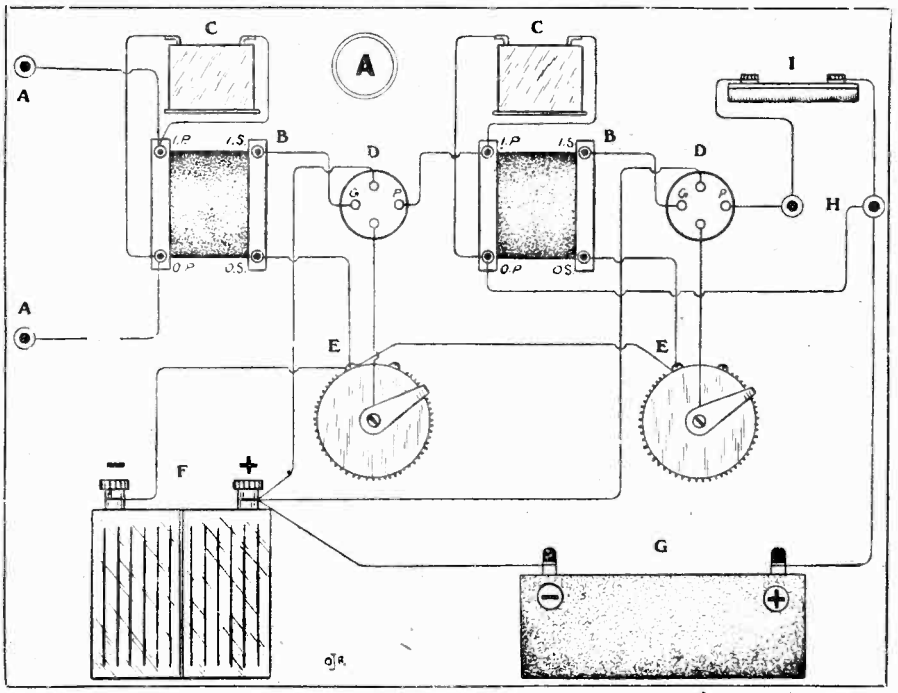


Diagram A: A two-valve low-frequency amplifier; A A, input from receiver 'phone terminals; B B low-frequency inter-valve transformers; C C, ·001 mfd. fixed condensers; D D, valves; E E, filament rheostats; F, accumulator; G, high-tension battery; H, telephone terminals; I, ·002 mfd. fixed condenser.

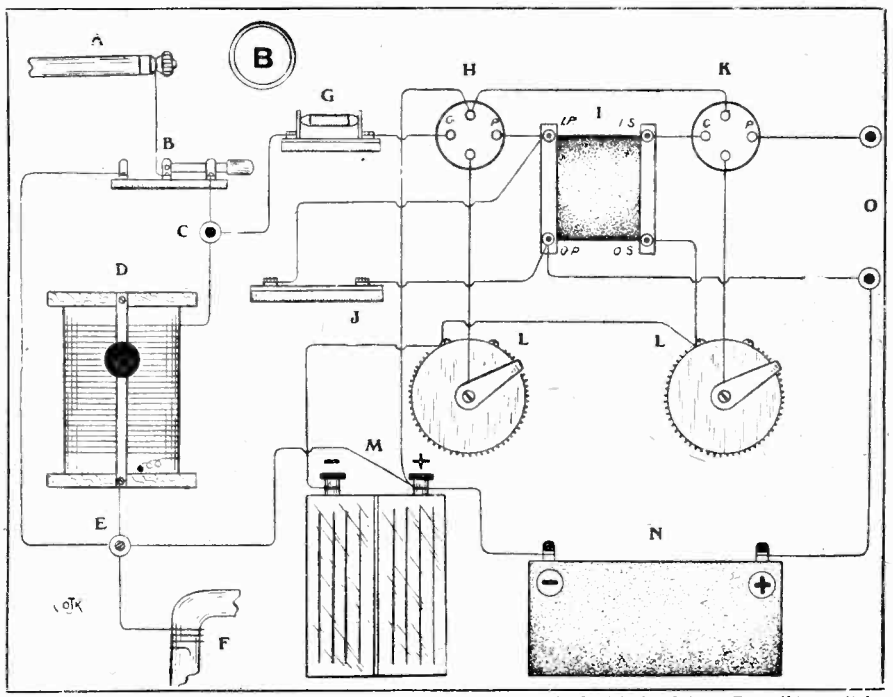
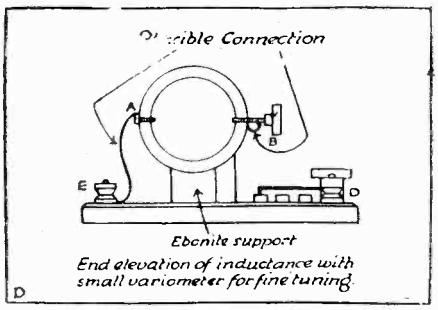


Diagram B: First valve as rectifier, second as L.F. amplifier; A, aerial lead-in insulator; B, earthing switch; C, aerial terminal; D, tuning inductance; E, earth terminal; F, earth; G, grid leak and condenser; H, detector valve; I, low-frequency inter-valve transformer; J, ·001 mfd. fixed condenser; K, L.F. amplifying valve; L, filament rheostats; M, accumulator or low-tension battery; N, high-tension battery; O, telephone terminals.

FINE TUNING.

FINE tuning is absolutely essential for good results for both the most primitive to the most elaborate wireless receivers. The variable condenser is most commonly used for this purpose, and it usually takes the form of the moving plate



End elevation of inductance with small variometer for fine tuning.

air-dielectric type. The wireless enthusiast usually finds difficulty in constructing this type of condenser and abandons the condenser made with two test-tubes as being most inefficient.

The following device was found to be an excellent method for obtaining fine tuning, and it is, moreover, very simple in construction.

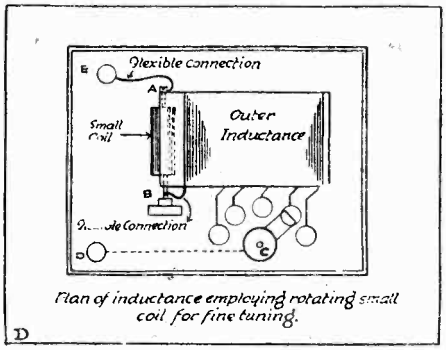
It consists essentially of a small coil connected in series with an ordinary hollow solenoid inductance, and mounted inside it in such a way that it can be rotated upon a diametrical axis. In fact the device is a small variometer used in conjunction with another inductance.

For the broadcast wave-lengths wind 75 turns of 26 S.W.G. double cotton covered wire on a hollow 2 in. cardboard former, taking tappings at every 15 turns.

The former should be 3½ in. long, and a space of ¾ in. should be left before the winding commences. Next construct a second coil of 10 turns of the same wire on a 1½ in. former, leaving a space of $\frac{3}{16}$ in. between the fifth and sixth turns.

Useful for Any Coil.

Pivot this coil inside the larger inductance by means of a small screw (A), and a screw with ebonite knob (B). Solder the free ends of the small coil to A and B. By means of short pieces of flexible wire connect B to the near end of the outer inductance, and A to a terminal (E) mounted on the base. The five tappings should be taken to five contact studs mounted on the baseboard, and connect the switch arm (C) to a second terminal (D). Incidentally copper rivets make excellent contact studs.



Plan of inductance employing rotating small coil for fine tuning.

It will be noticed that this small coil for fine tuning may be fitted to any solenoid inductance and not necessarily to an inductance made for the purpose.

MORE PICTORIAL VALVE CIRCUITS.

(*Continued from page 524.*)

values should be tried across the 'phone terminals and then across the plate 'phone terminal and the negative side of the high-tension battery.

High-Frequency Amplification.

If the reader is unfortunate enough to be "out in the cold" as far as reasonable distance is concerned, then the best way for him to arrange the two valves is to employ the first as a high-frequency amplifier and the second as a detector or rectifier, as shown in Diagram C. The valves are here shown coupled by means of a plug-in type of air core transformer, this being considered the most satisfactory method of coupling consistent with general utility and ease of manipulation. These transformers are wound to cover specified wave-lengths and mechanically arranged to engage an ordinary valve-holder so as to be readily interchangeable. The most usual arrangement of the winding is *in* and *out* primary to the grid and plate legs, and *in* and *out* secondary to the filament legs. See I, Diagram C. The tuning arrangement of this circuit may, of course, be modified at will. If the two honeycomb coils are used, a ·0003 mfd. variable condenser (not shown) should be connected in shunt with the secondary coil D. The connecting wires for this would conveniently lead from the terminals on the coil holder or from the grid of the first valve and the positive L.T. terminal. The other variable condenser may be tried in series with the primary coil C instead of shunt as shown. This alteration will reduce the wave-length range of the coil. Disconnect the left-hand side of the condenser from the earth terminal F, and the top of the coil from the aerial terminal B. Do not interfere with the lead from the right-hand side of the condenser to the aerial terminal, but connect another lead from the other side to the top of the coil.

A double pole double throw or "two-way" switch is often employed to effect a quick change over from series to parallel and vice versa, and the wiring of this was shown in a previous article. The small earthing switch as shown at B, Diagram B, may conveniently be included in either of the circuits.

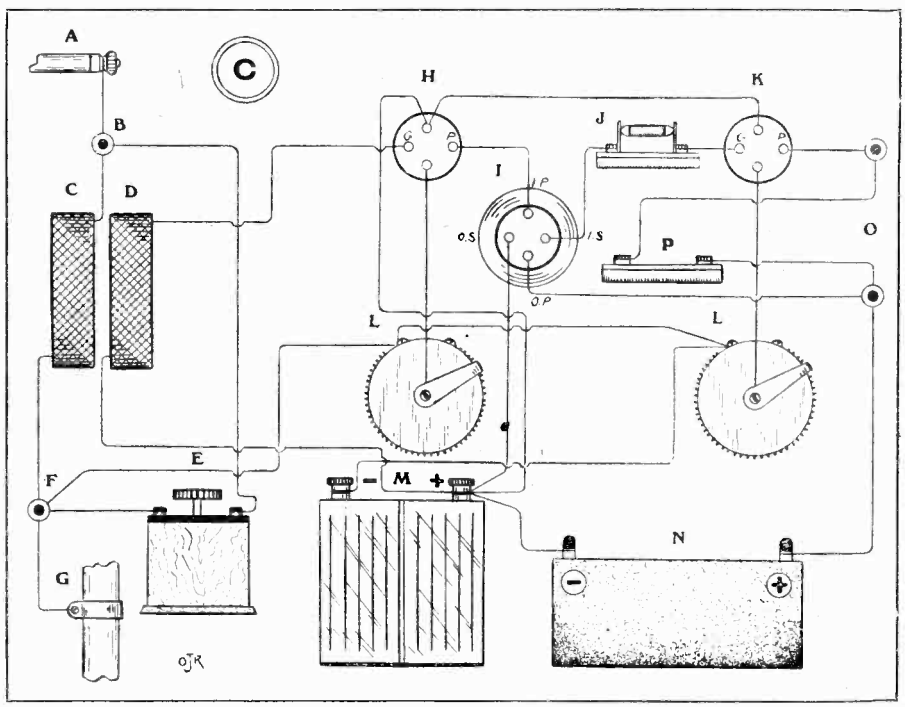


Diagram C: First valve as high-frequency amplifier, second as rectifier; A, aerial lead-in; B, aerial terminal; C, primary tuning coil; D, secondary tuning coil; E, ·0003 mfd. variable condenser; F, earth terminal; G, earth; H, H.F. amplifying valve; I, plug in type high-frequency transformer; J, grid leak and condenser; K, detector valve; L, filament rheostats; M, accumulator; N, high-tension battery; O, 'phone terminals.

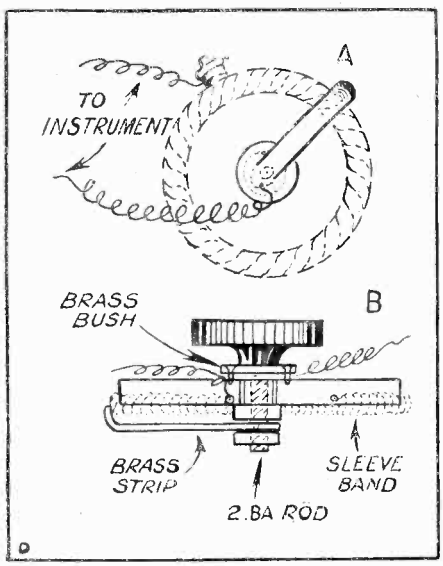
AN IMPROVISED FILAMENT RESISTANCE.

THE first article to obtain is a spring sleeve band. The bands are made of steel wire, tightly coiled. Next obtain a piece of dry wood, four inches square; on this should be marked a circle of four inches diameter. The wood should then be cut away to this circle with a sharp chisel, and finished with glass-paper.

A hole, large enough to take a small brass bush, as sold by all wireless dealers, should next be drilled in the centre of this wood.

The wood must then be impregnated with paraffin wax, and put by until it is cold.

The metal collar should now be taken off the sleeve band, and the band stretched so as to separate the individual turns of wire slightly; it should then be fixed round the edge of the wood, with the edge of the band slightly protruding above the surface, and



fixed in position with a few brads spaced round the edge, one end being attached to a small terminal and the other secured to the wood.

Care should be taken that the individual turns do not touch their neighbours.

A piece of brass $\frac{3}{8}$-in. wide by $2\frac{1}{2}$ in. long should be cut, and a hole drilled in one end large enough to take a 2 B.A. rod.

Next cut a piece of 2 B.A. rod $1\frac{1}{2}$ in. long; on to this screw an ebonite knob. Screw the brass bush to the wood, with two small wood screws, pass the 2 B.A. rod through this, screw a nut on to the rod until it will just rotate in the bush.

Total Cost—9d.

Then slip on the strip of brass and screw on another nut until it grips the strip tightly. It will then be found that the brass strip just makes a light contact with the edge of the spring; if it does not quite touch, bend the strip down until contact is made.

The resistance can be fixed to an instrument panel by drilling two holes in the wood and attaching with two nuts and bolts.

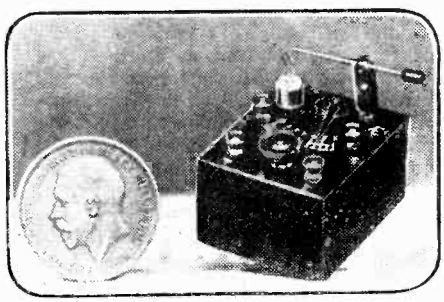
When wiring up, attach one wire to the terminal and the other wire to the brass collar.

If carefully made, the resistance, although larger than the bought article, will be found to be smooth and reliable in action, and the use of the sleeve band will get over the difficulty experienced in obtaining Eureka resistance wire of sufficient springiness to prevent dragging the turns together when adjusting filament brilliancy.

The total cost should be about ninepence.

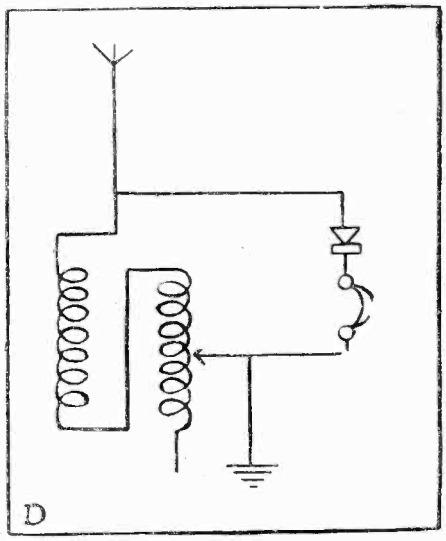
SMALL BUT EFFICIENT.

WE have received for test a wonderful crystal set from one of our readers. The set, while being perfectly efficient and of the highest finish, stands no higher than a penny piece, as can be seen by the accompanying photograph. Everything is hand made, even to the terminals. It is mounted in a highly-polished ebonite case, truly an excellent piece of amateur



The diminutive receiving set mentioned in this article, showing its size in comparison with a penny.

workmanship. The set is variometer tuned with perfect micrometer adjustment, tuning, of course, being restricted to the broadcasting wave-lengths, but, nevertheless, giving excellent results over these bands. The coils were of the minutest possible size, and great patience must have been exercised in winding them. We tested the set on a small outside aerial and results, from the London Broadcasting Station about a mile away, were far beyond our expectation, the music coming in very loudly. For telephony the midget set has an effective range of about ten miles, while for Morse the range would be nearer a hundred miles. Telephony, of course, can be received over greater distances under very good conditions. This is certainly the smallest set we have seen, since it is entirely self contained, and while we have seen sets practically as small the finish has not been of the same class.

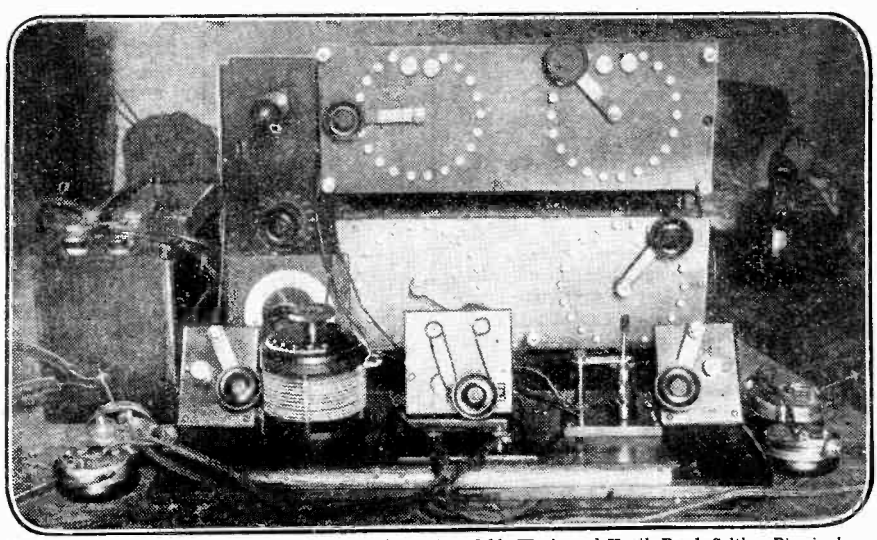


The circuit is very simple, as can be seen by the diagram above.

Many people use the plug-in telephones and find that provision has been made for only two pairs of 'phones on their sets. The following is a quick way of overcoming the difficulty of adding a third pair. The plugs usually have a grub screw in the side to grip the tags of each 'phone lead. Remove these grub screws and insert ordinary telephone terminals of the same thread, usually 4 B.A., into each hole, and connect the leads of the third pair to these.

* * *

A hand drill taking $\frac{1}{8}$-in. and $\frac{1}{4}$-in. drills should always be kept at hand, as it will come in useful for making clean-cut holes in ebonite panels, wood, or metal.



The efficient receiving set assembled by Mr. C. V. Carpenter, of 11, Washwood Heath Road, Saltley, Birmingham.

THE BRITISH BROADCASTING STATIONS.

WIRELESS BROADCASTING PROGRAMME.

Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.
London	2 L O	11.30–12.30	Music	369	Every week day.
"	"	5 p.m.	Women's "Hour"	"	"
"	"	5.30–6.15 p.m.	Children's Stories	"	"
"	"	7 and 9.45 p.m.	News	"	"
"	"	8–10.30 p.m.	Music and various	"	"
"	"	8.30–10.30 p.m.	News and music	"	Sundays.
Newcastle	5 N O	11.30–12.30 p.m.	Music	400	Every week day.
"	"	Usually 5.0–10 p.m.	Music, News, etc.	"	" "
"	"	8.30–10 p.m.	Music and News	"	Sundays.
Manchester	2 Z Y	11.30–12.30	Music	385	Every week day.
"	"	Usually 5.0–10 p.m.	Music, News, etc.	"	" "
"	"	8.30–10 p.m.	Music and News	"	Sundays.
Birmingham	5 I T	11.30–12.30	Music	425	Every week day.
"	"	Usually 5.30–10 p.m.	Music, News, etc.	"	" "
"	"	8.30–10 p.m.	Music and News	"	Sundays.
Glasgow	5 S C	11.30–12.30	Music	415	Every week day.
"	"	Usually 5.30–10 p.m.	Music, News, etc.	"	" "
"	"	8.30–10 p.m.	Music	"	Sundays.
Cardiff	5 W A	11.30–12.30	Music	353	Every week day.
"	"	Usually 5.0–10 p.m.	Music, News, etc.	"	" "
"	"	8.30–10 p.m.	Music and News	"	Sundays.
Croydon	G E D	Throughout day	Aeroplane Traffic	900	

NOTE.—All times are B.S.T.

FORTHCOMING EVENTS FROM THE LONDON BROADCASTING STATION (2 L O).

SUNDAY, 20th inst.—The Prince of Wales, Earl Haig, and Marshal Foch will speak from the Queen's Hall to the British Empire League. All the broadcasting stations throughout the country will be connected with landlines for the purpose of broadcasting these speeches.

THURSDAY, 24th inst. (Empire Day).—Rt. Hon. Lord Islington, G.C.M.G., D.S.O., P.C., address at 8 p.m. Rt. Hon. Earl Meath, P.C., G.B.E., address at 9 p.m.

FRIDAY, 25th inst.—H. E. Blain, Esq., C.B.E. Chairman of the London Safety First Council, address on "Safety First," at 9 p.m.

Extracts from the following Operas, as performed by the British National Opera Co., will be relayed from Covent Garden and transmitted from 2 L O on the dates mentioned: 19th inst., "Faust"; 21st inst., "Aida"; 23rd inst., "Magic Flute"; 26th inst., "Phœbus and Pan"; 30th inst., "Hänsel and Gretel"; June 1st, "La Bohème": June 2nd, "Cavalleria Rusticana" and "Pagliacci." In "La Bohème" it is hoped that Madame Melba will sing.

NOTE.—See notes and news page for later details or alterations, if any, to hand.

THE CONTINENTAL BROADCASTING STATIONS.

Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.
BELGIUM					
Brussels (1)	Brussels	12 noon	Weather report	1100	Working days.
		4.50 p.m.	Aeroplane traffic	1100	When necessary
		6 p.m.	Concert	1300	Sunday, Tuesday and Thursday.
HOLLAND					
The Hague	P C G G	3–5 p.m.	Concert	1050	Sunday.
		8.40–9.40 p.m.	Concert	1050	Monday & Thursday
The Hague (Laboratorium Heussen)	P C U U	7.45–10 p.m.	Concert	1050	Tuesday.
		9.40–10.40 a.m.		1050	Sunday.
The Hague (Velthuyzen)	P C K K	8.40–11.40 p.m.	Various	1050	Friday.
Ymuiden (Middelraad)	P C M M	8.40–11.40 p.m.	Concert	1050	Saturday.
Amsterdam	P A 5	8.10–11.10 p.m.	Concert and News	1050	Wednesday.
FRANCE					
Levallois-Perret (Radiola)	S F R	2–3 p.m.	Music	1780	Sunday.
		5 p.m.	Stock Exchange News	1780	Every day.
		5.15–6.15 p.m.	Instrumental music	1780	Every day.
		8.45 p.m.	General News	1780	Every day.
		9–10.30 p.m.	Vocal and instrumental concert	1780	Every day.
Paris (2) (Eiffel Tower)	F L	6.40 a.m.	Weather Forecast	2600	Every day.
		11.15 a.m.	Weather Forecast	2600	Every day.
		3.30 p.m.	Stock Exchange News	2600	Every day.
		6.20 p.m.	Weather Forecast, Concert	2600	Every day.
		10.10 p.m.	Weather Forecast	2600	Every day.
École Supérieure des P.T.T. Radio-Riviera (Nice)		7.45–10 p.m.	Radio Concerts	450	Tuesday, Thursday,
		2.30–7.30 p.m.	Radio Conferences	450	Saturday.
		11 a.m.	News, Concert. tzigane	460	Every day.
		5–6 p.m.	News, instrumental Concert	460	Every day.
		9–10 p.m.	Latest News, Concert.	460	Every day.
GERMANY, CZECHO-SLOVAKIA, AND SWITZERLAND					
Berlin (Königswusterhausen)	L P	6–7	Financial News, etc.	2800	Every day.
		11-12.30			
		4–5.30 p.m.	Financial News, etc.	2800	Every day.
Prague	P R G	7–11 a.m. and 3 p.m.	Weather News, General News	1800	Every day.
		9–2 p.m. and 9 p.m.	Concert	4500	
Geneva	H B	6–7 p.m.	Concert	1200	Every day.

(1) If, at the indicated times, a station has to receive or transmit service communications, the weather transmission will take place after these communications. Tuesday: Operatic selection on the gramophone. Thursday: Various on gramophone. Sundays: Various by artistes.

(2) Special concerts given during the evening are announced in the course of the preceding transmissions.

(3) All times are G.M.T., not B.S.T. in the Continental section only.

THE VALUES OF TUNING COILS AND CONDENSERS.

By C. E. FIELD, B.Sc.

This article, specially written for "Popular Wireless," covers many constructional details more or less inadequately dealt with by the majority of wireless textbooks. Constructional details of apparatus intended for specific purposes can easily be found, but the most voluminous of works on the subject seem to miss many of the essential points dealt with by Mr. Field.

FOR the amateur who is constructing his own receiving set, a knowledge of the values required for his tuning coils and condensers is of primary importance.

We will consider first the aerial tuning coil. Generally speaking, amateurs will find that the single layer cylindrical coil is the most satisfactory, as it is simple to construct, and when fitted with a slider adjustment, permits of very close tuning. For short-wave reception, No. 22 S.W.G. enamelled wire will be found most suitable, while for long-wave work No. 24, 26, or 28 may be required in order to prevent the dimensions of the coil from becoming too great. The thicker wire is, of course, to be preferred where possible.

Number of Turns Required.

Using No. 22 wire, the following will suffice for the reception of broadcasting: 60 turns on a 3½ in. diameter former, 70 turns on a 3 in. former, or 80 turns on a 2½ in. former, while 80, 90, or 110 turns on formers of 4, 3½, or 3 in. diameter respectively would bring in ships' signals. For the reception of the Dutch concerts, 110, 130, 150, or 170 turns on 6, 5, 4½, or 4 in. diameter formers make convenient windings.

Signals on wave-lengths up to 3,000 metres (these, of course, include Paris telephony) could be received on the following windings: 420, 470, or 530 turns of No. 24 wire, on diameters of 6, 5½, or 5 inches respectively; 380, 420, 480, or 520 turns of No. 26 wire, on diameters of 6, 5½, 5, or 4½ inches; or, on the same formers, about 50 turns fewer in each case of No. 28 wire.

For wave-lengths much above 3,000 metres, the single layer coil becomes unwieldy and inefficient, and the amateur is recommended to buy honeycomb coils of some reputable make.

Loose Coupler Coils.

If he contemplates constructing these for himself, he should make a fairly comprehensive series of coils, each one being wound with an ample margin of turns, and finally adjusted to the required wave-length by actual tests on the set with which it is to be used.

For long wave-lengths, a honeycomb coil with a winding of rectangular section requires fewer turns than a single-layer coil of the same diameter, whilst on broadcasting wave-lengths the number of turns required are nearly the same.

If a loose coupler is employed, the secondary winding may have the same number of turns as the primary; but if the A.T.C. and the A.T.I. are connected in parallel, more turns will be required on the secondary. A good plan is to make the secondary coil to slide inside the primary, and compensate for the smaller diameter; and for the inductance and capacity of the aerial, by winding it for the same length as the primary, with wire of one or two sizes smaller.

In all tuning coils no pains should be spared to make the adjustments as fine, or the values as exact, as possible, in order to reduce to a minimum the additional capacity required for tuning.

Three Classes of Condensers.

Condensers in a receiving circuit fall into three classes.

First, those required for tuning purposes; secondly, those required for filtering out high-frequency and low-frequency currents; and thirdly, those required for temporarily storing electrical energy.

In the first class, the most important condenser is the aerial tuning condenser, placed in series or in parallel with the aerial tuning coil. From considerations of efficiency, this condenser should be as small as possible, but for tuning-in, a large condenser is much more convenient.

Perhaps the most useful maximum value is ·001 mfd., a capacity of ·0015 mfd. being sometimes preferable for use with long-wave honeycomb coils, while ·0005 mfd. will generally suffice in conjunction with a small diameter coil fitted with slider adjustment. The same values are suitable for use in parallel with the secondary winding of a loose coupler.

Small tuning condensers are often connected across the primary windings of high-frequency intervalve transformers, and across the terminals of reaction coils and anode tuning coils. For these a maximum capacity of ·0003 or ·0004 mfd. is sufficient.

Moving Vane Type.

Assuming that these condensers are constructed in the usual way, with semicircular metal vanes separated by spacing washers of, say, ⅛ inch thickness, a capacity of ·0005 mfd. will be given by 30 plates of 3 in. diameter, 23 plates of 3½ in. diameter, or 18 plates of 4 in. diameter. The number of plates required for other values, except in the case of condensers containing only two or three plates, is very nearly proportional to the capacities, so that a capacity of ·001 mfd. would be given by 36 plates of 4 inch diameter. These numbers refer to all the plates, both fixed and moving, and the figures given assume the use of No. 20 S.W.G. sheet metal. The use of No. 16 S.W.G. metal would make the values half as large again for the same numbers of plates and thickness of spacing washers.

The second class of condensers, used for separating high-frequency and low-frequency currents, are generally referred to as "by-pass" or "by-path" condensers, because they provide an alternative path through which high-frequency currents can flow, but which offer a high resistance to the passage of low-frequency currents.

Such condensers are used in parallel with the primary windings of low-frequency intervalve transformers, or with iron-core intervalve choke coils or across the telephone receiver terminals, and are especially necessary when the output current from a detector or low-frequency valve has to pass through a reaction coil on its way to the high-tension battery.

A by-pass condenser may be roughly likened to a strainer which is required to separate sago grains from peas. If the strainer has too fine a mesh, neither the sago grains nor the peas can pass through it, whilst if the mesh is too coarse both will pass through together. Between these extremes a great many different meshes may be employed.

In the case of the by-pass condenser, a very small capacity will not only block the passage of low-frequency currents, but will also offer a very high resistance to high-frequency currents, whilst too large a capacity will let both types of current through. The correct values, however, are not at all critical, and in general it is as well to err on the side of too large a capacity. Values varying from ·001 to ·005 mfd. are quite satisfactory.

Various Fixed Condensers.

These condensers are generally constructed of sheets of metal foil and waxed paper. Using ordinary cartridge drawing paper, 120 square cm. of active area of metal foil will give a capacity of ·001 mfd., this area, of course, being split up among several sheets, according to the dimensions required for the condenser. Thus, 10 sheets, each having an area of overlap 3 cm. by 4 cm. could be employed. For other values, the area, or number of sheets, will vary in direct proportion to the capacity required.

The third class of condensers used in receiving circuits are known as "reservoir" condensers. A reservoir condenser is connected across the terminals of the high-tension battery, in order to prevent variations in the plate voltage and current of the valves, the condenser acting as a kind of shock absorber to any irregularities in the output of the battery.

Scope for Experiments.

The capacity of a reservoir condenser may be anything from ·001 mfd. up to a quarter, or even half a mfd. If the capacity is made too large, however, the condenser becomes inconveniently big, and the insulation resistance between its terminals becomes low.

There is one more very important condenser which stands in a class by itself, for it really operates both as a reservoir condenser and a by-pass condenser of very small capacity. This is the grid condenser, which should have a capacity of from ·0002 to ·0003 mfd.

A capacity of ·0002 mfd. would be provided by 24 square cm. of active area of waxed cartridge paper, cut into smaller sheets as required, and interleaved with metal foil.

There is still much to be learned about the best values of condensers for different purposes, and amateurs can do useful work by experimenting in this direction.

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.

Exeter and District Wireless Society.

A very interesting and instructive lecture was delivered by Mr. Smitham recently before the Exeter and District Wireless Society, at their headquarters, 31, Longbrook Street, Exeter.

The subject dealt with was that of Induction Coils as applied to the reception of short wave-lengths.

The lecturer made it abundantly clear why the construction of the coil played such an important part for the purposes of reception, as by lessening the self-capacity of the windings, a larger range of wave-lengths could be brought under control.

Every amateur knows the importance of eliminating self-capacity, but the reason why it should prove such an obstacle to successful working is often obscure to him.

The subject was so well handled that all derived great benefit from it, also from the many lucid diagrams that supported the explanations.

The various coils were dealt with in the following order: Single layer, pile wound, slab, basket, honeycomb, Burndept, duolateral, and also a coil specially designed by the lecturer.

Hon. Sec., F. S. Valentine, 10, College Avenue, Exeter.

Hackney and District Radio Society.*

A meeting of this society took place at the Y.M.C.A., Mare Street, Hackney, E.8., on Thursday, April 26th, and was presided over by Mr. H. A. Epton. The chairman reported that he had, in the company of the secretary, paid a visit to the studio of 2 L O, where he had been received most kindly by the various officials. He spent a pleasant and interesting evening in the studio, operating and receiving rooms.

The lecture of the evening was given by Mr. F. G. Francis, B.Sc., a member of the society, who had previously given several lectures. Mr. Francis' subject this evening was "The Characteristic Curves of Valves." The lecture commenced with a brief explanation of the use of graphs, explaining how these were applied to the pictorial representation of damped, continuous, and modulated continuous waves. The processes of amplification and rectification were explained, and the operation of a valve in these respects, gone into by the aid of graphs showing characteristic curves of waves.

The lecturer then proceeded to take the characteristic curves of a French "R" valve and a Cossor C.V.C. valve, the latter kindly lent by Messrs. Negretti and Zambra. These curves being constructed, some explanation was given as to the relative merits of the two valves, both as detectors and amplifiers. A short explanation was given as to the use of valves as note magnifiers.

That the lecture was an interesting one was proved by the large number of questions put to the lecturer, all of which were answered to satisfaction. Mr. Francis kindly promised a further lecture shortly on the Dual Amplification Circuit.

The chairman announced that, by the kind permission of the owners, a party of members were to be allowed to visit the S.S. Patricia, lying in Millwall Dock, on the following Wednesday, for the purpose of inspecting the radio equipment; also that a visit was being arranged on a Sunday afternoon to the Croydon Aerodrome.

Hon. Sec., C. C. Phillips, 247, Evering Road, E.5. (Letters only.)

Peckham Wireless and Experimental Association.

The Wireless and Experimental Association gave a most successful demonstration at the Central Hall, Peckham, on Thursday, April 26th.

The fact that a special programme was being broadcasted in honour of the marriage of the Duke of York, enabled Mr. P. Voigt, B.Sc., a member, to give the audience a higher standard of programme than usual; but the great achievement of that gifted demonstrator was that of filling the hall with an ample volume of melody, using only a crystal detector and one valve employing dual amplification, and the four Amplion loud speakers, kindly lent by Messrs. Graham, of Brockley, did the rest.

The exhibition of members' home-constructed apparatus fully proved the contention that we are an experimental association, and that the experimental licence is the only one which can suit our case.

Hon. Sec., Geo. Sutton, A.M.I.E.E., 18, Melford Road, S.E.22.

North London Wireless Association.

At the 126th meeting of the association, on April 23rd, Mr. F. S. Angel gave his seventh paper on the elementary principles of wireless.

After giving a brief outline of the valve—past and present—a full explanation was made upon the action and course of the electrons from filament to plate. Various curves were drawn, showing the correct point for obtaining maximum results, and the method used for retarding saturation point.

The potentiometer was shown in circuit with the grid, and the manner in which it was used for assisting the passage of electrons to the plates when the grid became too negative to function correctly.

In closing a most interesting and instructive lecture, Mr. Angel added that he thought it would be a great benefit to users of valves if the various makes were sold accompanied by their characteristic curve.

Full particulars of membership from:

Hon. Sec., J. C. Lane, Northern Polytechnic Institute, Holloway Road, N.

* * *

North Middlesex Wireless Club.

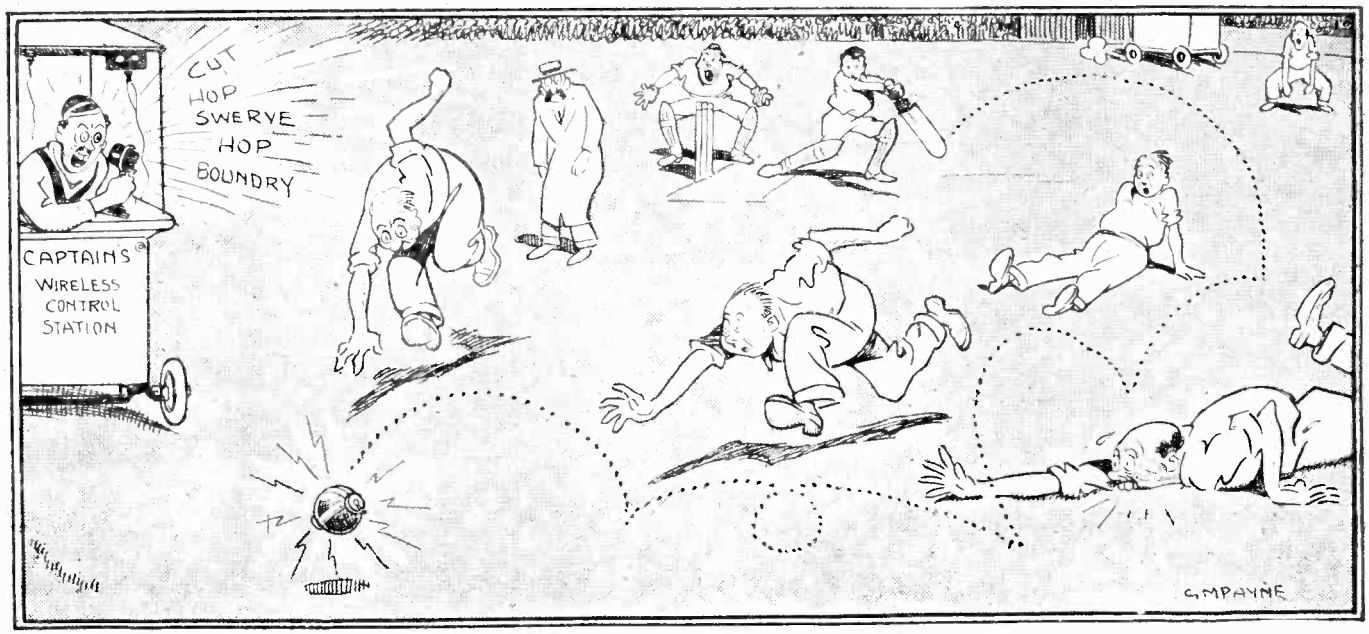
The 112th meeting of the above club was held at Shaftesbury Hall, Bowes Park, N., on April 4th. The chair was taken by Mr. M. F. Symons, who introduced the lecturer for the evening—Mr. W. Gartland.

The members present enjoyed a very instructive and interesting account of Mr. Gartland's experiments with high-frequency amplification. The lecturer pointed out that experimenters living in London who wished to hear the provincial broadcasting stations were compelled to adopt some means of tuning out the London Broadcasting Station—no easy matter. The most effective way of increasing the selectivity of receiving apparatus is undoubtedly, in Mr. Gartland's opinion, the use of high-frequency amplification. He described various circuits he had himself used, and discussed their relative merits. Dual amplification, as a means of increasing signal strength, was also mentioned.

Following the lecture, Mr. L. C. Holton answered various questions which had been placed in the club question box at the last meeting. This question box promises to be a very popular institution among the members.

Hon. Sec., Mr. H. A. Green, 100, Pellatt Grove, Wood Green, N.22.

BRIGHTER CRICKET; THE WIRELESS CONTROLLED BALL.



RADIOTORIAL

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

Controversy seems to spring up with every new phase in the advancement of science, but it seems to me that wireless broadcasting is getting rather more than its fair share. There is no need to recapitulate with regard to the series of obstacles that have arisen, and which hedge round the actions of the B.B.C. like so many barb-headed spears, but I do not doubt for one moment that broadcasting has come to stay, and that eventually it will successfully surmount all its difficulties and occupy its rightful position. Broadcasting, is comparatively speaking, a new thing, and everybody knows the fate of anything that happens to be new. Remember the motor-car and its "red flag" restrictions, and, farther back, Arkwright's great invention and the welcome given to it by the world at large. Broadcasting is going through that inevitable stage of its existence where prejudice and opposition, backed up by existing interests that have, colloquially, "got the wind up," is doing its utmost to kill the usurper at its birth. Of course, one can no more hope to stop the march of progressive science than Canute could ever have hoped to stop the tide coming in. Anyway, he might, and probably did, HOPE to do so, but history records the result.

Several interesting alterations have been made in the arrangement of the items in this week's POPULAR WIRELESS. Greater space is devoted to Notes and News, and the broadcasting programmes have been greatly extended. It remains to be seen whether or not this meets with the approval of readers, and I would welcome criticism in this respect. The stories of the operas are briefly given, together with other interesting details. This will allow readers to clearly follow the sense of such extracts that are broadcast, and should prove a very useful and popular feature.

THE EDITOR.

Questions Answered

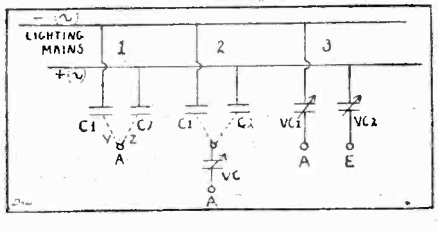
Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be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

Readers are requested to send the necessary postage for reply.

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.

B. E. (London, W.) asks several questions regarding the use of lighting mains for the reception of wireless signals.

The usual method is to employ two fixed condensers of some ·02 mfd. capacity, C1 and C2, in series with each pole of the main and connected together through fuses X and Z to the terminal A as shown at (1) in the accompanying diagram. A is the aerial terminal, whilst the usual earth is employed. This method is adopted in the "Ducon," which is a patented device. A variable condenser can be usefully placed in series as shown at (2). A third method



involving the use of two variable condensers of fairly high capacity and illustrated at (3) in the diagram uses one wire as the aerial and the other as the earth.

* * *

"Valve Crystal" (St. Albans).—In the case of a valve crystal circuit can I use variometers throughout? The circuit would be the ordinary one valve (H.F.) and treated galena crystal. Is this type of valve circuit O.K.?

Yes, you could use variometers quite well, though we prefer the ordinary basket or honeycomb coil tuned by condensers. The reason for this is that in the case of these coils reaction can be easily accomplished by coupling the anode coil to the A.T.I. In the case of the variometers this reaction cannot be carried out unless small loading coils are placed in series with the variometers in each circuit, the loading coils being coupled together. You will find that the H.F. valve and crystal combination will give very good results, and 2 L O should come in loudly.

* * *

A. C. (Burnham).—Can bichromate batteries be used for lighting the filaments of valves? What are tonic train signals?

Unless they are of the type known as dull emitters, when primary cells can be used quite well, bichromate batteries cannot be used for your valves, as the voltage falls rapidly with the comparatively large current required for the purpose. Tonic train signals are C.W. signals interrupted by a buzzer or break at the transmitting station.

* * *

L. N. (Bristol).—Is a grid leak an improvement in the Armstrong super-regenerative circuit?

It is not necessary in the three-valve circuit. Two small dry cells should be inserted into each valve circuit with the negative terminals connected to the grids. In the case of the one-valve "super," a grid leak can be used quite well, but you will find it needs only about ½ to ¾ of a megohm instead of the usual 2 megohms.

* * *

"Former" (Hounslow).—How much, and of what gauge wire, and what size former tubes shall I require to make a loose coupled tuner to tune between 300–4,000 metres? I want to use it with two variable condensers, one blocking condenser, 4,000 ohms 'phones, a P.M.G. aerial and crystal detector. What capacity should the condenser have?

There is not much spark transmission on wavelengths as high as 4,000 metres, so it will not be necessary for your set to tune as high as this. The primary should be wound on a former 4 in. by 8 in. long, using 24 D.S.C. wire, and the secondary on a former 3 in. by 6 in. long, wound with 28 D.C.C. both tapped off at intervals. The two variable condensers should be ·001 mfd. and ·0005 mfd. and the telephone condenser ·001 mfd. This will allow you to tune to 3,000 metres or so.

* * *

"Frame" (Ipswich).—I cannot possibly arrange an outdoor aerial, and wish to get the Hague on a frame aerial. Please give size for frame and number of valves.

The aerial should have sides of 5 ft., with about ten turns spaced ¼ in. apart. You will need at least six valves to get anything like good results.

* * *

"Electra" (Wargrave).—Which is generally best, 100 ft. single aerial or 70 ft. double aerial? What are the objections to bringing down the lead for a considerable distance indoors? Which are the most efficient for crystal reception, honeycomb, pancake, or single layer coils?

There is not any appreciable difference between the two, though for low wave-lengths the single aerial will probably give slightly better results. The chief objection is the extra resistance, while there is also increased risk of leakage. If the lead-in runs near the walls there will also be a great deal of loss of energy due to capacity effects and the resultant damping of the signals. We prefer single layer coils for crystal reception.

(*Continued on page* 534.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 532.)

A. B. V. (Blackpool).—I have a quantity of red fibre that I believe is an insulator, will this do for a panel?

Your details as to the fibre are not very clear, but we would advise you to use ebonite. Most fibres, even those that are vulcanised, are liable to leak, owing to the fact that water readily condenses on them. In addition to this the finished effect is not so neat as when ebonite is used, and fibre panels are very liable to warp and swell.

* * *

D. R. (Amesbury).—How can double reaction be accomplished on a two-valve set?

We presume, of course, that the two valves are used as H.F. and detector respectively. The method of double reaction is best used in conjunction with honeycomb or basket coils, and a tuned anode rather than a transformer. Instead of mounting the tuned anode coil away from the aerial tuning, it is mounted on one side of a three-valve holder, the aerial coil on the other side and the reaction coil in the centre. It is best to tune in the set with reaction on the anode, the aerial coil being as loosely coupled to the reaction as possible. Then, when best results are obtained, gradually bring the aerial coil nearer the reaction coil, and alter the tuned anode coils coupling slightly until loudest signals are heard. Needless to say, this form of reaction should not be used during broadcasting hours, as, the reaction being coupled to the aerial, the set will be liable to oscillate and cause interference. During those hours the reaction upon the tuned anode can be employed, while the aerial coil is kept as far away as possible.

* * *

C. W. (Reading).—How is C.W. transmitted?

By means of an arc or valves instead of the former spark discharge, and this causes a continuous wave to be emitted from the transmitting aerial. In order to break this up into signals, a very general method used is to change the wave-length every time the transmitting key is depressed. Thus, by the careful tuning of the receiving station the normal continuous wave, or spacing wave, as it is called, can be tuned out, and only the new wave on a slightly different wave-length is then audible, so that the dashes and dots of the Morse code are easily distinguished. The buzzer of a crystal set can be made to interrupt the waves at a regular frequency, and so when the frequency of the incoming waves changes, as it does when the key is depressed and the wave-length altered, this variation is audible in the 'phones of the crystal set.

* * *

"COUPLER" (Reading).—Please give me details of a loose coupler for use as reaction to tune from 180-400 metres with a .0005 mfd. variable condenser.

Put the condenser in series in the aerial circuit. Use an outer former of 3 in. diameter by 3 in. of winding of No. 22 D.C.C. for the aerial circuit with five tappings. Reaction inductance may be 2 in. diameter by 1 in., wound with No. 28 D.C.C.

* * *

E. M. (Slough).—I am using a crystal set, and I do not hear amateurs as well as 2 L O, even though they are nearer. Why is this? Who is 5 B Q?

The amateurs transmit on a much lower power than 2 L O. They are only allowed a power not exceeding 10 watts by the P.M.G., while 2 L O's power is 1½ kilowatts. 5 B Q belongs to Mr. D. Douet, and is situated at Putney.

APOLOGY

In our advertisement in the issue of the "Popular Wireless" dated 14th April, 1928, we advertised for sale B.T.H. French Headphones. We have to admit and express our regret that such description is false, such headphones not being made by the British Thomson-Houston Co., Ltd. (whose registered office is at Crown House, Aldwych, W.C.2), and we withdraw any further sale of headphones under the above name or description.

THE CENTRAL RADIO CO., 6, Little Russell St., London, W.C.1,

EDISWAN VALVES

Noiseless

Sensitive

Robust

There is no better valve for wireless work than the Ediswan Type A.R. It is silent working, sensitive, and essentially strong. It gives high amplification, is very compact, and extremely economical in current consumption.

This Valve—made by the makers of the world-famous Ediswan Electric lamps—has been specially designed for operation on low plate voltages and is particularly recommended for amateur work.

We have had very considerable experience in the development and manufacture of the Thermionic Valve. The first experiments in connection with the investigation of the "Edison Effect," on which the working of a valve depends, were carried out at our Ponders End Works by Prof. J. A. Fleming, who was then in our employ.

PRICE 15s.

DESCRIPTIVE LEAFLETS FREE ON REQUEST.

Also manufacturers of complete Receiving Sets, Accessories, and H.T. and L.T. Batteries.

Ask your usual Dealer, and if unable to supply send us a post card with his name and address.

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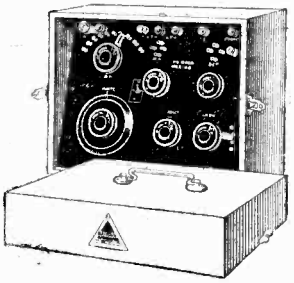
Super 2-Valve Set

Versatility & Portability

Wherever you go music is appreciated. Take our Super Two-Valve Set on your holidays and picnics. In any part of England you can then have the choice of at least two Broadcast Concerts. Light in weight, compact, portable and fully approved by the P.M.G.



TEST. In addition to the various technical tests each Set is tested at our Works 20 miles east of 2 L O to hear Birmingham, Manchester and Newcastle (250 miles), while a little time spent in fine tuning will generally eliminate Birmingham and bring in Glasgow with perfect clearness.

Price

£12 : 10 : 0

B.B.C. Fees 35/- extra.

2-Valve Bureau Set

This is another of our efficient, well designed instruments for use in Broadcast areas.

Price £6 : 10 : 0

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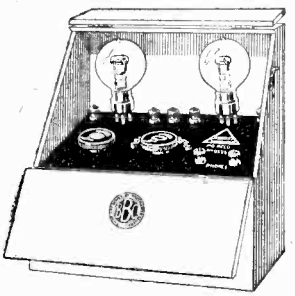

Send 3 stamps for our Catalogue which gives details of Sets for all purposes, units for Experimenters and components for home construction.

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BASKET INDUCTANCES, 150—4,000 metres, with 8 Circuits and Calibrations (post 3d.), set of 6, 2/6; set of 7	3 6
'PHONE LEADS, good quality ..... per set	2 6
L.F. TRANSFORMERS, 1-1, 3-1, 5-1 ratio, exceptional quality (post 6d.) ..... each	14 6
TUNING STANDS for Honeycomb or Duo-lateral Coils (post 6d.), 3-Coil Stand, 7/6; 2-Coil Stand	5 6
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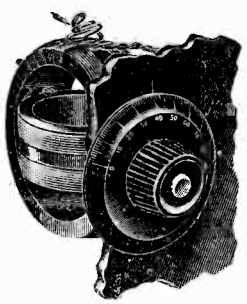
SYSTOFLEX SLEEVING, 1 mm., 4d. per yd.; 1½ mm., per yd.	5d.
¼-in. sq. **BRASS RODS**, 13 in., drilled ..... per length	4d.
SLIDERS, complete with plunger ..... each	5d.
47 **S.W.G. D.S.C. wire**, sufficient to wind one H.R. Ear-piece per bobbin	1/-
Ex-ARMY SINGLE EAR-PIECES, 150 w. (post 4d.) ..... each	2 9

SCIENTIFIC SUPPLY STORES,

126, NEWINGTON CAUSEWAY, LONDON, S.E.1

'Phone: Hop 4177.



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SOLVE YOUR TUNING PROBLEMS

A Complete Tuner for the Broadcast Wave-lengths, tuning the average standard aerial between 300 and 525 metres. Specially designed for low self-capacity, and is infinitely more efficient than "Slider" or tapped coil. Suitable for valve or crystal sets. May be used in series with fixed coils for longer waves. Easily Fitted.

OMNIPHONE WIRELESS CO.,

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Regent Street, LONDON, W. 1.

Phone REGENT 3335.—20 *Yards from Regent Street, between Robinson & Cleavers and Maison Lewis.*

RECENT WIRELESS INVENTIONS.

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

Grant of the following Patents can be opposed and printed copies of the full specifications purchased.

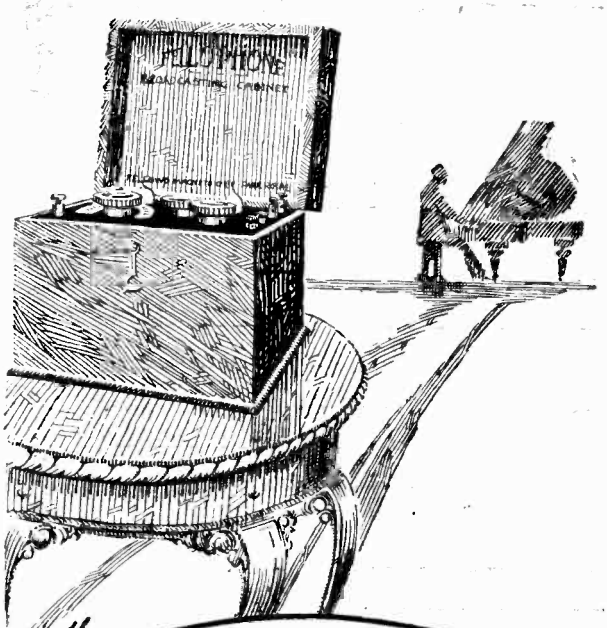
194,279.—BRITISH THOMSON-HOUSTON CO., LTD.—VALVES.—The desired tension is placed upon the cathode during manufacture by sealing its leading-in wires into a pair of re-entrant tubes rigidly held apart by arms which also serve as supports for the anode and grid. The arms may be secured to the tubes by clamping rings or sleeves, or by sealing, and in the latter case the tension upon the filament may be adjusted by deformation of the arms or by a spring mounting. The tubes are finally sealed into the container.

194,362.—LORENZ AKT.-GES.—TRANSMITTING APPARATUS.—In transmitting systems having an amplifying valve controlled microphonically, and having its plate current transferred to the aerial through an iron-cored transformer which acts as a modulator, the flux in the iron core is adjusted to give the best results. This can be done by varying the current through an auxiliary winding, which current may be supplied from a separate battery. Alternatively, instead of using an auxiliary winding the magnetising current may be fed through choke coils to the H.F. winding, or the flux may be varied by raising the plate voltage by applying an adjustable positive voltage to the grid.

194,356.—W. DORNIG.—AERIALS.—Circular horizontal loop aerials are half a wave-length in diameter, and tuning condensers may be distributed equally around the loop. For simultaneously receiving or transmitting waves of different lengths, aerials corresponding to the various wave-lengths may be arranged concentrically. A rectangular aerial may receive or transmit waves of two different lengths equal to twice the distance between the opposite pairs of sides, and can be used directionally.

194,459.—P. G. A. H. VOIGT.—RECEIVING SETS.—Simultaneous high and low frequency amplification is obtained by back-coupling the output of an L.F. amplifier to the grid of an H.F. amplifier, suitable condensers being used to by-pass H.F. currents.

194,595.—S. G. FROST.—VALVES.—During exhaustion a heating current is passed through a fuse and one or more of the electrodes on a special support, the fuse being afterwards blown by increasing the current.



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2-VALVE RECEIVING CABINET

A high-grade instrument at a very low price. This set has been especially designed for receiving broadcasting, and complies with all the Postmaster-General's regulations. It can be used either for listening-in with headphones or with a loud speaker.

Additional interest and use is secured because it will receive all amateur transmitting stations within a range of 20 miles. The "Fellophone" is mounted in a handsome oak cabinet, and is sent out complete with H.T. battery, 6 volt accumulator, 100 ft. aerial, 2 shell insulators, and one pair of Fellows 4000 ohms double headphones, but without valves.

British Made Throughout.

Made under Marconi Licence and approved by the BBC and Postmaster-General.

PRICE COMPLETE £12 inclusive of all taxes
without valves. **Carriage - - - 2/-**
EXTRA FOR 2 VALVES - - - 30/-
EXTRA FOR ADDITIONAL FELLOWS DOUBLE HEADPHONES, 21/6 (Postage, 1/-)

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REVOPHONE

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R.F.

POPULAR WIRELESS WEEKLY, May 26th, 1923. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

FURTHER PICTORIAL VALVE DIAGRAMS.

Popular Wireless

PRICE 3d.

No. 52. Vol. III. SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.Sc. May 26th, 1923.

José Collins Broadcasting
— a song —
from 2 L O's new studio.

FEATURES IN THIS ISSUE.

Choice of Loud Speakers.
Adjustment Signals.
Rejector Circuits.
A Lead-in Device.
Page of Practical Ideas.
Lightning and the Wireless Aerial.
The B.B.C.'s Reply to Critics.
Experimenter's Crystal Detector.

POPULAR WIRELESS

May 26th, 1923. SCIENTIFIC ADVISER, SIR OLIVER LODGE, F.R.S., D.Sc. [Every Friday

TOPICAL NOTES AND NEWS.

Our New Companion.

ON May 29th our new companion journal "Wireless Review and Science Weekly" will be on sale, price 3d., and I strongly advise all readers of P.W. to get a copy. This new journal is truly a lavish production. Number 1 has articles by Senatore Marconi, Sir Oliver Lodge (who is also Scientific Adviser-in-Chief), Dr. N. W. McLachlan, P. J. Risdon, E. Blake, and other famous men.

* * *

£1,000 in Prizes.

ANOTHER great attraction is the offer of £1,000 in prizes to readers. £500 is offered for an Ideal Broadcasting Programme, and £500 for certain experimental developments, full details of which are given in number one of "Wireless Review and Science Weekly."

* * *

"W.R." and "P.W."

"WIRELESS Review and Science Weekly" is a companion paper to P.W. Space will not always permit this paper to print long articles, however fascinating, by the world's greatest authorities, as P.W. is essentially a popular paper designed to meet the requirements of a very large public.

But in our new companion paper you will find specialised articles. In future issues will appear articles by Dr. J. A. Fleming, Professor J. Arthur Thomson, Dr. Lee De Forest, Sir William Noble, and many other famous men. Every reader of P.W. will miss a great treat if he fails to purchase a copy of "Wireless Review and Science Weekly." Together with P.W. it will supply all possible information. You will need no other wireless papers. The initials "W.R." and "P.W." represent the essentials of Wireless literature.

* * *

Too Heavily Blanketed.

THERE has been much discussion with regard to 2 L O's transmission lately among those discerning amateurs who delight in "dissecting" transmissions, and personally I am also inclined to think that 2 L O's new studio is too heavily "blanketed." "Resonance" is present in all concert rooms and that "standing in the centre of a field" arrangement can be too perfect to allow the broadcast results to sound quite natural, I fancy.

* * *

Wireless Creeps In.

A WOMAN in a provincial police-court declared that the wireless waves came through the gaspipes, burnt her hair, and threw her out of bed.

* * *

Two Classes of Amateurs.

THE Advisory Committee of the Post Office have examined many of the applications for experimental licences, and have divided them into two classes:

1. Actual experimenters.
2. Those who wish to listen-in.

Mr. Stanton Jefferies, musical director to the B.B.C., holds an audition of aspirants for broadcasting fame.

Experimental licences will be issued to the first category at once, and will not be held up pending the report of the Select Committee.

* * *

Wireless Telephone Service.

THE King of Denmark has opened a public wireless telephone service between Denmark and the Island of Bornholm, in the Baltic. The service is the first of its kind in Europe, connections being possible with any ordinary telephone.

* * *

Two Great Inventors.

SOME years ago William Dubilier went to a lecture given by Marconi. He was so impressed that at the conclusion of the lecture he went round to see the great Italian.

"Is there anything I can do for the cause of wireless?" said Dubilier to Marconi.

"Yes," replied Marconi. "You can carry my bag."

* * *

The Poetry of Wireless.

WHEN will our spring poets become topical and introduce wireless into their ballads. Wireless contains many beautiful analogies—they only want finding.

"Her eyes are as bright as the lighted filament of a valve, her lips as red as a copper pyrites crystal; her cheeks are as rosy as a positive pole, while her hair is finer than 50-gauge copper." I have waited for it, but it hasn't come; now I have tried it I know why.

* * *

2 G M Comes Back.

THE other evening, after a very long silence, I heard that worthy amateur, 2 G M, "ether shaking." He commenced with a feeble communication on spark and then by degrees, through very pathetic C.W., burst into quite good telephony. Apparently not satisfied, he increased his modulation until his overloaded "carrier" began to resemble a rough sea at Bournemouth.

* * *

An Involuntary Conclusion.

FINALLY, he made the trite remark, "I think I am over-modulated," and a peculiar crackling gurgle signified "closing down." I observed that the ether was allowed to rest after this outburst, and concluded that the "closing down" was occasioned through causes mechanical.

* * *

Something Really Useful.

BY the way, I hear that 2 G M is working on something new in the way of valves where radio active salts are used instead of a heated filament to provide an electron stream. It seems that he has, or is attempting to obtain, a more intense activity by purely chemical means. Let us hope that he succeeds, and thus solves the battery question.

(*Continued on page 542.*)

NOTES AND NEWS.

(*Continued from page 541.*)

How's the Valve?

I MET him one evening gazing meditatively into the entrance of the Savoy. I greeted him with the remark, "Hallo, 2 G M! How's the valve?"

"All right; but I wish she'd hurry up," was the enlightening reply.

* * *

2 L O's New Director.

I UNDERSTAND that Mr. Percy Pitt has now left the British National Opera Co., but is dividing his activities between it and the B.B.C. He is in charge of new productions, and is, for instance, choosing the extracts of the operas that are being broadcast. The B.B.C. are to be congratulated upon their good fortune in obtaining his services.

Mr. Percy Pitt.

* * *

Is It Worth It?

I HAVE a friend who possesses a very nice crystal set, and who appeared to be perfectly satisfied with his results—until he listened-in on a five-valve set the other evening. That's all; but the moral is that louder signals mean louder statics and ——is it worth it? Work it out, remembering that summer is coming. (Note.—Statics are much more plentiful during the summer months.)

* * *

A Jentle Pun.

ON the train the other morning I met an acquaintance who having lately been elected chairman of the local board, has the honoured letters J.P. after his name. He is an ardent wireless enthusiast, and so, after congratulating him, I told him he should now be in a position to deal with the "Jamming Problem."

"Just Possible," he replied. Rotten, wasn't it?

* * *

The Group Test.

I SPENT a very enjoyable hour the other Sunday listening to Captain Eckersley conducting from 2 L O a group test of simultaneous broadcasting, with all the stations linked with landlines. Captain P. P. E. testing is as funny, or even funnier than many "pukka" entertainers. He makes a test interesting to listen to.

* * *

"Now Come on, Glasgow."

GLASGOW, for some reason, seemed rather slow in reporting results, and the worthy captain raised laughter even among his worthy but more solemn companions in the studio, when he adopted his screamingly funny "naughty, naughty" attitude.

* *

An Impromptu Item.

IT was not Captain P. P., however, that was responsible for the "Grenadier Guards" joke, but "Uncle Rex," I think. "Now, just a moment," said the latter, "and the Grenadier Guards' band will render a selection as they march by." The following silence was broken by the faint "toot-toot" of a passing motor. 2 L O's doors must have been thrown open for this interesting item—otherwise, what about the "blanketing."

FUTURE EVENTS

The following list will give some indication of the nature of the items contracted for by the B.B.C., but the broadcasting programme should be watched in case of rearrangement of dates.

London Broadcasting Station.

SUNDAY, MAY 27TH.
9 p.m. The Rev. Hutton, Congregational Church.

MONDAY, MAY 28TH.
7.30-9. Shakespeare.

Mr. A. W. Barber, of 47, Salisbury Road, Norwich, operating the set that he has constructed.

WEDNESDAY, MAY 30TH.
"Hansel and Gretel."

THURSDAY, MAY 31ST.
Miss Ellen Terry.

FRIDAY, JUNE 1ST.
"La Bohème."

SATURDAY, JUNE 2ND.
"Cavalleria Rusticana," "Pagliacci."

SUNDAY, JUNE 10TH.
9 p.m. Rev. W. P. Cartwright, London City Mission.

SUNDAY, JUNE 24TH.
9 p.m. Rev. G. H. Mitchell, F.R.G.S., Chaplain, East London Seamen's Mission.

SUNDAY, JULY 8TH.
Dean of Manchester.

WEDNESDAY, OCTOBER 17TH.
C. W. J. Unwin, "Sweet Peas."

GRENADIER GUARDS BAND.
Friday, June 8th; Friday, July 6th; Friday, August 14th; Friday, September 7th; Friday, October 26th; Friday, December 14th.

IRISH GUARDS BAND.
Tuesday, June 26th; Tuesday, August 7th; Friday, August 21st; Friday November 2nd; Friday, December 21st.

ROYAL AIR FORCE BAND.
Sunday, July 1st.

Birmingham Broadcasting Station.

FRIDAY, JULY 20TH. Irish Guards Band.

Manchester Broadcasting Station.

MONDAY, JULY 2ND.
Grenadier Guards Band.

FRIDAY, AUGUST 3RD.
Irish Guards Band.

Cardiff Broadcasting Station.

TUESDAY, JULY 3RD.
Grenadier Guards Band.

FRIDAY, AUGUST 10TH.
Irish Guards Band.

MONDAY, OCTOBER 1ST.
Grenadier Guards Band.

Newcastle Broadcasting Station.

FRIDAY, MAY 31ST.
Grenadier Guards Band.

FRIDAY, AUGUST 17TH.
Irish Guards Band.

Shakespearian Nights.

CAPT. LEWIS says that he is arranging a series of "Shakespeare Nights" which will take place fortnightly. The first play to be broadcast is "Twelfth Night."

* * *

Wireless Concert Programme.

ON page 544 will be found the cast and story of "Twelfth Night," which will be broadcast from 2 L O on the 28th inst. This will enable listeners-in to follow the transmission more easily. It will form the wireless concert programme for that item.

* * *

Radio Exhibition

MR. CECIL MOYLAN, manager of the "Electric Pavilion," Clapham Junction, tells me that so many exhibitors have sent in their applications in connection with the "Wireless Week" that the proposal to hold the exhibition in the Pavilion has been abandoned. Instead, the hall of Messrs. Arding & Hobbs, Ltd., Clapham Junction, has been obtained and will be open for a fortnight from May 19th.

ARIEL.

THE BROADCASTING CONTROVERSY.

Reply by B.B.C. to Recent Charges.

CERTAIN sections of the entertainment industry and their supporters would have you believe that a deadly blow has been dealt to the British Broadcasting Company. If such a blow has been made, it has failed to reach us.

The British Broadcasting Company will keep faith with its many thousands of listeners-in, and will continue to provide ever-improving programmes of entertainment. Here are some facts, as distinct from the fears upon which the opponents of broadcasting are building their fabric.

The theatrical managers have suggested that they cannot allow the British Broadcasting Company to steal their entertainments, and a cartoon, appearing in a weekly journal, pictures the Broadcasting Company as a little boy crawling beneath the tent walls of a circus. The same managers suggest that, as the result of broadcasting, the theatrical industry has suffered and will suffer injury.

Extraordinary Possibilities.

The facts are that in every instance where a theatrical play has been broadcast, the suggestion that the Broadcasting Company should do this has originated with the theatrical interests themselves.

As the result of the broadcasting of a pantomime and three musical plays, we possess some twenty-eight foolscap pages of summarised letters, bearing names and addresses of persons who have booked seats for these plays, and in one instance up to twenty-one stalls for a single production. In these letters alone we have evidence that between 2,000 and 3,000 seats have been booked by listeners-in, and it is impossible for us to judge how many other seats have been booked by persons who have not troubled to write and acquaint us of the fact. We do know that amongst those who have written are persons who have not been to a theatre for ten years.

The entertainment industry seems to have the mistaken belief that broadcasting exists for entertainment purposes only. This is not the case. The nightly talks now radiated from London and the other stations are proving intensely popular and indicate the extraordinary possibilities of broadcast telephony in the provision of information which can enlarge human outlook and increase enjoyment of life. The British Broadcasting Company has already arranged that in many departments of human interest the greatest authorities of the day will talk; a form of activity that so far has never been attempted by the entertainment industry, despite its national value.

Gramophone Industry Friendly.

Another step in the campaign against British broadcasting was the publication of a suggestion that the gramophone industry had forbidden artistes who are accustomed to making records to take part in broadcast concerts. We have pleasure in stating that this is not the case, that the Gramophone (His Master's Voice) Company, the Columbia Company, and Aeolian Company are all friendly towards us and have never refused permission for their artistes to broadcast, and that the manufacturers of the Edison-Bell and Winner Records state that they would be willing to do anything in their power likely to assist the British Broadcasting Company. This company states that the progress of broadcasting should undoubtedly stimulate business in many directions and reduce to a very great extent the unemployment in the country.

With regard to the concert artistes, the British Broadcasting Company officials met the Concert Artists Association at St. George's Hall on Sunday last, when the manager of this company offered to meet a committee of the Concert Artists Association with a view to establishing a minimum rate for artistes.

At the same time certain agents and agencies, whether working independently or under pressure from elsewhere, are straining every nerve to prevent bands and artistes with which they are associated from broadcasting, even though in many instances the artistes themselves would like to do so. In the case of a number of leading bands, these have decided to broadcast, despite losses of contracts threatened in other directions.

The public undoubtedly realise by now that the present campaign is taking the form of an attempted denial to them of certain entertainment, which by the march of science they are entitled to, and is being given in America, the United States, Canada, France and other countries.

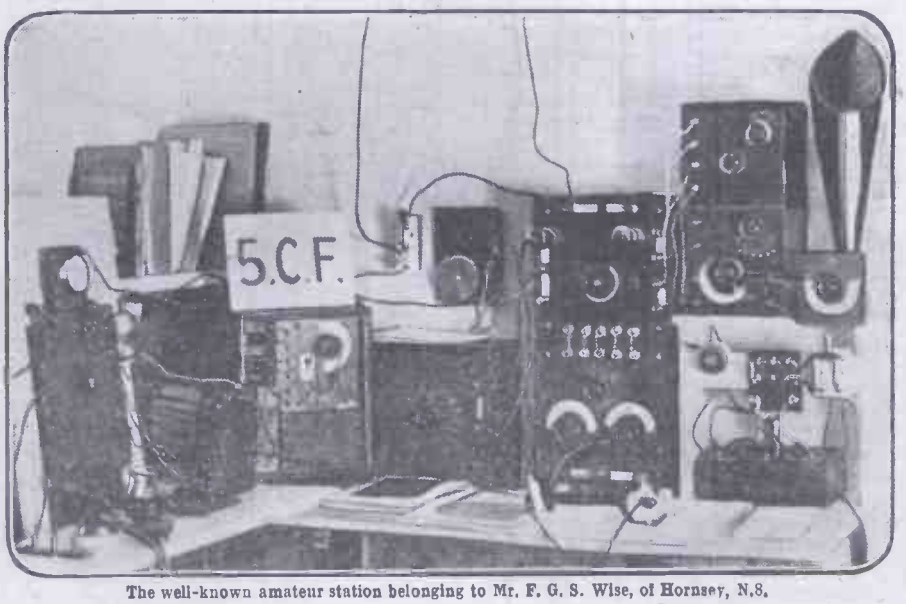
Auditions at 2 L O.

Happily there are many able artistes who have indicated to us that they will not submit to the treatment proposed, and there are also a number of enlightened persons in the entertainment world who are not sympathetic to the methods at present being employed with a view to crippling us.

These argue that where a man has talents, and a fair offer is made for the use of these talents, no third party should be allowed to forbid the enjoyment of these talents by the general public. The services of these people will still be available for broadcasting. At the London station alone, no less than 72 artistes were given auditions in one day, and the average for the last three or four weeks has been over 250 artistes per week.

"Still a Free Country."

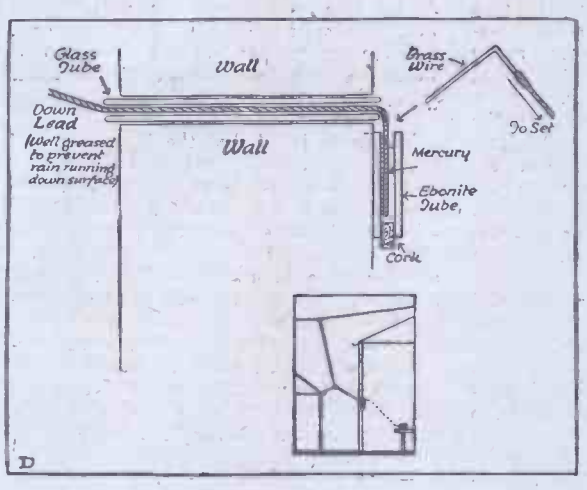
We are satisfied that the British love of fair play has not disappeared, and feel that our immediate duty is to reassure everyone that we are going forward with redoubled energy. We are erecting two new stations, one immediately in Bournemouth, and another at a later date in the North of Scotland. We are also enlarging our contracts with big military bands, and organising groups of players of our own for the production of British dramatic masterpieces. We are leaving no stones unturned to prove that even in the development of a new industry, Britain *is still a free country.*



The well-known amateur station belonging to Mr. F. G. S. Wise, of Hornsey, N.8.

A LEAD-IN DEVICE.

DIFFICULTY is often experienced in bringing the lead-in wire direct to the set without a break and terminal connection. A common method is to use a



piece of ebonite tube fitted through a hole in wall or window-frame and containing a threaded brass rod with screw-up caps at each end. The down-lead is soldered to the outside cap, but soldering a connection to the inside one is out of the question, unless flex is used, which may be neatly coiled up on the wall when not in use. For a wireless "den" this is ideal, but for a drawing-room it is both unsightly and unpopular with housemaids and other wielders of duster and brush. Terminals and plug and socket joints enable a detachable wire to be used from wall to set, but are productive of resistance losses, especially after time has dimmed their brightness with corrosion, or when inexperienced hands fail to make "all tight."

As Efficient as Soldering.

A perfect all-metal joint between lead-in wire and set, enabling the indoor part of the lead-in to be removed when not wanted, is obtained by a simple adaption of the "mercury cup" contact used in the "Pohl" type of commutator. A short piece of glass tubing of just sufficient bore to allow the lead-in wire to pass through it is sufficient insulation if fitted through wood. On the inside the wire is cut off about an inch and a half long, well cleaned, preferably with hydrochloric acid, and bent downwards to fit into a short piece of ebonite tube with the bottom end corked, containing mercury.

To affix the tube necessitates no holes or screws—simply a piece of linen 1½ in. by 2½ in., some thread and thick shellac varnish. To the end of the connecting wire running to the aerial terminal of the set is soldered a right-angle bend of stout brass wire. This is cleaned and "tinned" by rubbing with mercury and may be dipped into or removed from the mercury cup in an instant. The resulting contact is as efficient as a soldered join, and since mercury does not oxidise in air, the amalgamated end of the detachable wire will remain bright and clean, if not handled. By making several connecting wires of different lengths and similar arrangements with the earth-lead, the instrument may be moved from room to room.

It must be remembered, however, that the extension earth or aerial leads must be arranged in accordance with the demands of efficiency in respect of insulation, etc.

The earth lead should always be short and of very low electrical resistance, but does not necessarily need insulating. Separate earth leads for different rooms are sometimes possible.

The aerial lead should be highly insulated and should take the shortest and straightest line to the set that is possible. Finally, don't sacrifice too much efficiency for the sake of convenience.

THE STORY OF TWELFTH NIGHT.

A Comedy, by William Shakespeare.

To be Broadcast from 2 L O on Monday, 28th inst.

Scene: A City in Illyria and the sea-coast near it.

CHARACTERS.

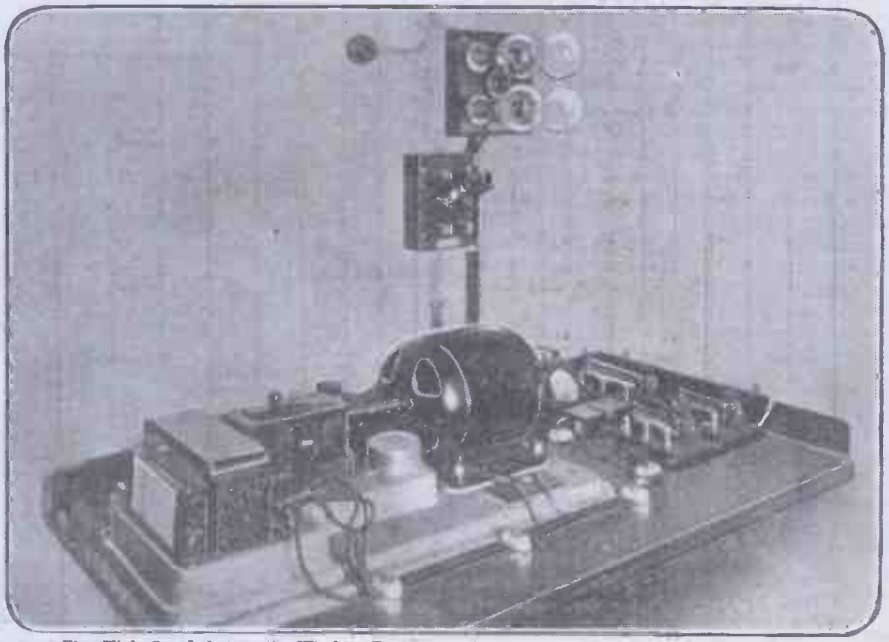
ORSINO, DUKE OF ILLYRIA	Gerald Lawrence.
SIR ANDREW AGUE-CHEEK	Nigel Playfair.
SIR TOBY BELCH	Henry Caine.
MALVOLIO	Herbert Waring.
ANTONIO, CLOWN, FABIAN	George Hayes.
VIOLA, SEBASTIAN	Cathleen Nesbit.
OLIVIA	Enid Rose.
MARIE	Mabel Tate.
PROLOGUE	Cecil Lewis.
VOICE FOR LYRICS	Philip Wilson.

Sebastian and Viola, twin brother and sister, who were so much alike as to be almost indistinguishable, were shipwrecked on the Isle of Illyria, owned by the Duke Orsino, who was in love with Olivia, a rich countess. Olivia, however, had abjured the sight and company of men for seven years, on account of the death of her brother, whom she dearly loved. Viola was rescued, but they could not find her brother, and, whilst lamenting his loss, she heard the story of Olivia and Orsino, and decided to enter the service of Orsino, disguised as a page, Cesario.

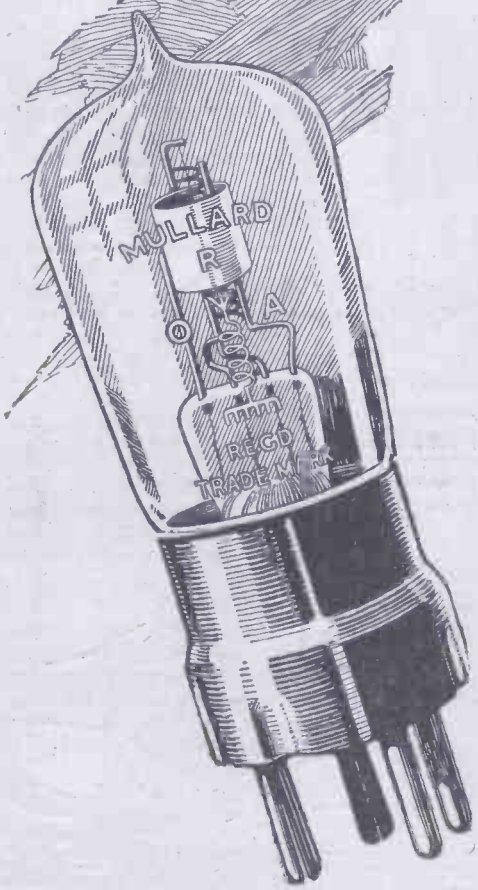
Looking exactly like her brother, Sebastian, she served the duke faithfully and became his confidant, but found herself falling in love with him. He told her of his passion for Olivia, and solicited her services to plead his suit. The fair countess lost her heart to the young Cesario, who naturally rejected her declarations of love with contempt.

Later, Sebastian appeared on the scene just in time to save Cesario from fighting a duel with a former admirer of Olivia's. Olivia mistook Sebastian for Cesario, continued her wooing, and found to her joyful surprise that Sebastian, although inwardly puzzled, encouraged her, and they married within a few hours of their meeting.

When all the errors caused by this extraordinary likeness between the brother and sister had been cleared up, Olivia showed no dislike to the exchange, and Orsino turned his attentions to Viola, whose beauty, even in boy's clothes, had always attracted him; and so, from page-boy and friend, she becomes "Orsino's mistress and his fancy's queen."



The High Speed Automatic Wireless Transmitter in the wireless cabin of the s/s Majestic.



"Numberless as the gay motes that people the sunbeams"

THE power of the microscope discloses the wonders of the infinitely small.

The power of the valve produces enchanting music from the myriads of negligible currents that flock through space.

Choose your valve with the same care as you would a microscope.

THAT MEANS A

MULLARD.

Advt. of the Mullard Radio Valve Co., Ltd., London, S.W.12.

FURTHER PICTORIAL VALVE DIAGRAMS.

By OSWALD J. RANKIN.

THE three pictorial diagrams shown represent the three most popular methods of arranging three valves in one unit. The first diagram shows how to connect up the valves to form a three-stage low-frequency amplifier or note magnifier; in the second diagram the first valve is arranged as a detector and the second and third valves as low-frequency amplifiers, and the third diagram shows what is probably the best three-valve circuit in general use, viz., one valve H.F., one valve rectifying, and one valve L.F.

The Deciding Factor.

Here we have three different circuits each employing three valves. Unfortunately, there is no such thing as a general circuit suitable for all, since X might live practically next door to the broadcasting station, while Y is 40 miles and Z 90 miles away. X, Y and Z must, therefore, each select the circuit most likely to suit them. We should feel sorry for Z if he owned a crystal set and built up the three-valve amplifier in the hopes of picking up the broadcast telephony, and we should think X rather foolish to adopt the arrangement shown in Diagram C, for he would merely be trying to "guild the lily." In fact, X should really keep out of the picture altogether, unless he is installing a loud speaker. The circuit shown in Diagram C is the best one for Z, and we will leave Y to find out for himself which of the two circuits B and C is most likely to suit him, although we would recommend circuit B.

A beginner should not be guided by the results others get. It should be remembered that some are more privileged than others concerning the use of reaction, etc. These circuits are all non-reacting and may be used for the reception of the broadcasting without fear of causing interference by re-radiation. However, if it is desired to use reaction without fear of becoming a criminal this may be employed in circuit C, if coupled to the high-frequency transformer. For particulars of this the reader is referred to an excellent article on the subject appearing in POPULAR WIRELESS, No. 44.

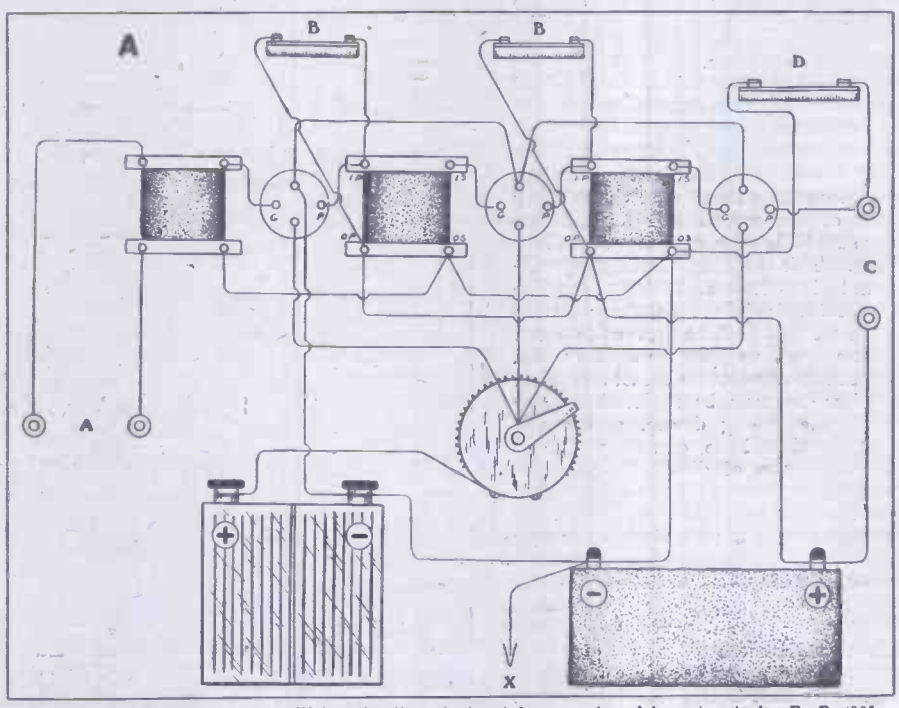
When Using Loud Speakers.

Diagram A is purely a note-magnifying circuit. In this case the single rheostat controlling all three valves will be found quite satisfactory providing the resistance spiral is made from fairly stout wire capable of carrying the 1½ amperes of current without heating. The ratio of note magnification will be: 5 × 5 × 5=125. This means that if a crystal receiver is used the signals will now be approximately 125 times louder than originally.

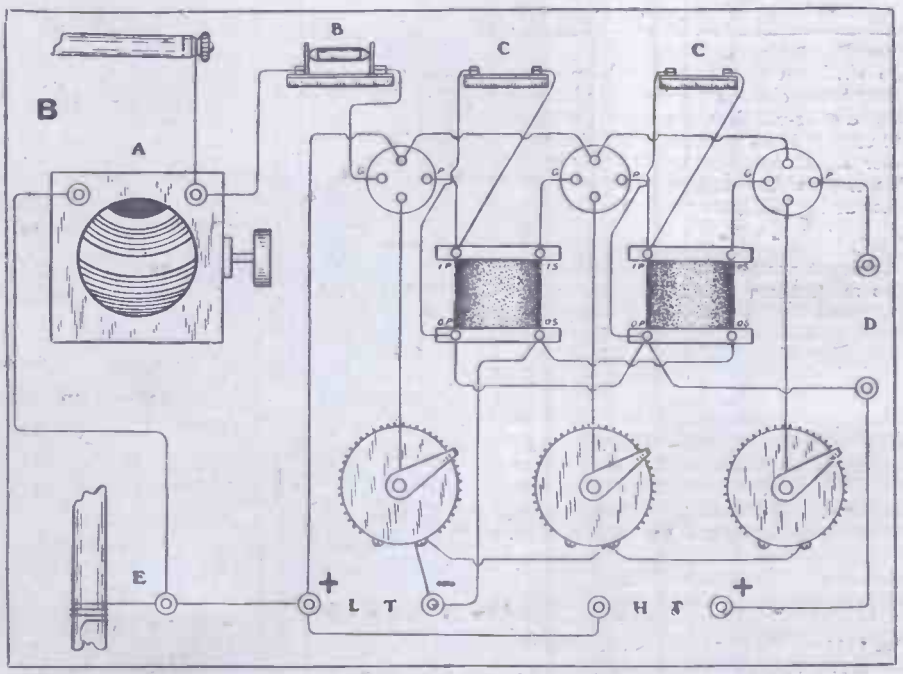
It is a mistake to regard a loud speaker as a magical piece of apparatus made to connect to any old set for the purpose of making the signals louder. At its best, it is no more than a more or less sensitive earpiece with a horn attachment, so that it will be obvious that if we expect it to function satisfactorily before we have amplified our signals sufficiently, we shall be disappointed. It is not the loud speaker but the power behind it that counts. If signals can be heard distinctly when the 'phones are held some distance away from the operator then one can reasonably expect the set to operate a loud speaker. This simple test should be carried out before making the investment.

Makers of loud speakers cannot be held responsible for the inefficient working of the receiver. Broadly speaking, three

(*Continued on page* 548.)



A three-valve low-frequency amplifying circuit. A, input from receiver 'phone terminals; B, B, ·001 mfd. fixed condensers connected in shunt with primary windings of second and third transformers; C, output to H.R. 'phones, or H.R. loud speaker; D, ·01 mfd. fixed condenser in shunt with 'phones and H.T. battery; X, earthing lead.



First valve rectifying, second and third valves L.F. amplifying.—A, variometer; B, grid leak and condenser; C, C, ·001 mfd. fixed condensers in shunt with primary windings of L.F. transformers; D, output to headphones; E, earth.

FURTHER PICTORIAL VALVE DIAGRAMS.

(*Continued from page 547.*)

stages of low-frequency amplification will be required for the present type of commercial loud speaker, which, in the writer's opinion, is yet a long way from being perfect. In most cases crystal rectification is preferable to valve rectification. A well-adjusted crystal will give clear signals without distortion, and should there be any distortion, loud speakers have an uncanny habit of amplifying this in preference to the telephony or music.

Advantage of Variometers.

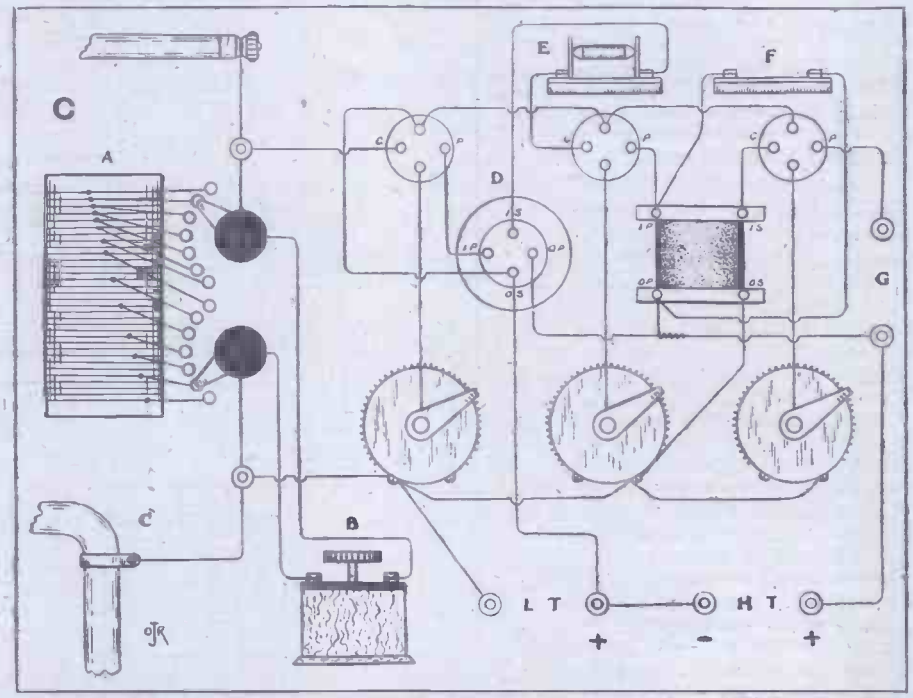
Diagram A is a good all-round loud speaker circuit. The connections of the 'phone condenser should be carefully noted, and it is important that the capacity of this should not be smaller than ·01 mfd. The fixed condensers in shunt with the primary windings of the second and third transformers should have a capacity of ·001 or ·002 mfd. This is a circuit having separate high and low-tension batteries. The negative H.T. is joined to the negative L.T., and earthed at X to prevent howling.

Diagram B is a very simple circuit which can be recommended for broadcast reception. The variometer may be replaced by any other suitable tuning device, and a few experiments should be carried out with 'phone condensers of different capacities. The variometer possesses a distinct advantage over any other type of tuner. If the amount of winding is approximately correct it permits very sharp tuning and no variable condenser is required. When we consider the loss of efficiency by "damping" caused by the capacity of a variable condenser, we can appreciate the utility of this little instrument. It can also be used in place of a variable condenser, but as it comprises two coils in series it naturally follows that when used for this purpose it must be connected in series and never in shunt. If all three valves are of the same make it is a good plan to change them about to determine which one will function best as the rectifier.

Separate Rheostats Advisable.

Under normal conditions, it would be difficult to think of a more satisfactory method of arranging the three valves than that shown in Diagram C. The H.F. valve is here shown coupled to the rectifying valve by means of a plug-in transformer, but this arrangement may be modified to suit individual tastes and various degrees of advancement. The provision of a separate filament rheostat for each valve is of great importance, since each valve is employed in its own exclusive circuit. Similarly, a few experiments should be carried out with separate values of high-tension current.

We will now leave the reader to study these three-valve circuits, and in the near future we propose to deal with a trio of four-valve circuits.



First valve H.F., second valve rectifying, third valve L.F.—A, tuning inductance (any suitable type); B, 003. mfd. variable condenser; C, earth; D, H.F. transformer; E, grid leak and condenser; F, ·001 mfd. fixed condenser; G, output to headphones.

USEFUL WRINKLES.

The platinum wire from the stem of an old burnt-out electric light bulb makes a very good cat's-whisker. Wind the wire round a nail to give it a spiral form and the cat's-whisker is then complete. This is an improvement on the ordinary copper cat's-whisker as the platinum does not oxidise.

* * *

To prevent your aerial ropes from rotting and to make them thoroughly waterproof, it is a good tip to work tallow into them thoroughly and thus save the expense of specially prepared rope.

* * *

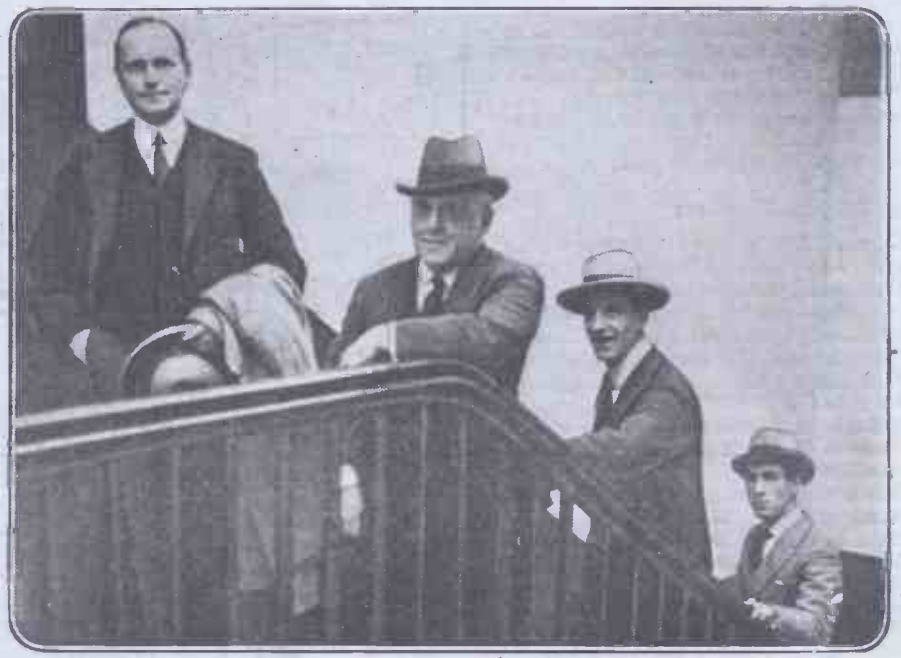
A cheap and quite efficient variable condenser can be made in the following way. Make an ordinary fixed condenser and leave a tab jutting out on one side from every metal sheet. Connect a telephone terminal to each tab and by running a steel knitting-needle through these terminals the capacity of the condenser can be varied.

* * *

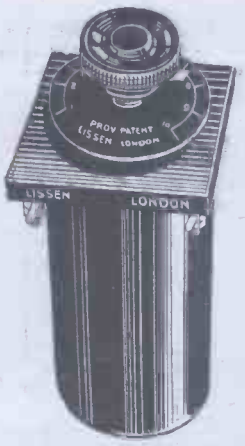
When soldering zinc plates, remember that zinc is a very soft metal and will run if you get the iron too hot.

Fuses are the safety valves of electrical apparatus.

Dry batteries should not be stored in damp or warm places.



The uncles of 2 L O take a "breather" as they climb up the many stairs to the new studio.



The Speed of Ether Waves

How the

LISSEN REACTANCE (P. Patent) Method Amplifies Feeble Signals

186,000 MILES A SECOND—THAT IS THE SPEED AT WHICH RADIO SIGNALS TRAVEL. The greater the distance they travel, naturally, the weaker they become. But radio signals never come to an end. Every signal sent out disturbs the ether, and may be picked up if the receiving apparatus is sensitive enough.

LISSEN REACTANCE (P. PATENT) METHOD BUILDS UP WAVE ENERGY.

The feeble impulses of distant signals can be amplified by using the LISSEN REACTANCE (P. PATENT) method, which will **BUILD UP WAVE ENERGY before passing it on to the Detector Valve.** The LISSEN REACTANCE method is high-frequency amplification achieved in its most efficient form. Every receiver should have at least one stage of LISSEN REACTANCE.

NEW LISSEN REGENERATIVE REACTANCE (P. PATENT).
ONE KNOB CONTROLS TUNING AND REACTION.

This is the new unit on which we have worked for many months. It is super-sensitive, and makes every receiver capable of spanning great distances. Embodies fully **variable non-radiating reaction.** NO SWINGING COIL IS USED. SELF-TUNED. May be used without a variable condenser, but owing to the sharp tuning possible we recommend a new LISSEN Vernier to be shunted across. (This is barely 1 in. in diameter. Lissen one hole fixing, price 12/6.)

AMATEURS—Go to your dealer and ask for LISSEN RADIO FREQUENCY. If your dealer cannot show you, send direct to factory. Anything wanted sent post free, or any information furnished. After purchase, whether direct or through dealer, we are always happy to assist amateurs.
DEALER—Your customers are interested in LISSEN Apparatus. Please order through factor or send direct. Few days ahead, if possible.

RANGE 150 to 4,000 metres. Complete, **£2 : 12 : 6**

Regeneration over the whole range.

Internally connected switch operates over contacts that in effect provide nearly 20 tappings, making tuning very selective. **LISSEN ONE HOLE FIXING,** easily fixed on any panel or side of case. Length 4⅝ in., diameter 2¾ in., dial 2½ in. Blue print and instructions sent.

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(P. PATENT)
STILL TO BE USED.

150 to 600 metres (6 tappings giving effect of 12). Complete **27/6**

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1 *stage H.F.*—use **EITHER** the **LISSEN REACTANCE** or the **LISSEN REGENERATIVE REACTANCE.**

2 *stages H.F.*—use one **LISSEN REACTANCE** and one **LISSEN REGENERATIVE REACTANCE,** or two **LISSEN REACTANCES** as the most efficient alternative.

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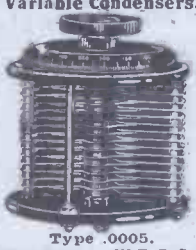

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Assembled complete for Panel Mounting (or can be used as separate unit).

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Capacity	No. of Plates.	Price
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These Condensers enclosed in superior Mahogany Case or Dust- proof Celluloid Mounting. Add 7/6 to above prices.

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	ass.	
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.0005	10/-	4/9
.0003	7/6	3/6
.0002	6/6	2/9
.0001	5/6	2/3
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W.B.C. Leading-in Tubes: 12 in., 1/4; 6 in.	1/-
W.B.C. Wound Inductance Tubes: 12 x 4, 3/3; 6 x 3½, 2/3; 5 x 4	2/-

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TELEPHONE RECEIVERS.

By J. H. REYNER, B.Sc.

Even the most advanced amateur will find this article interesting to read, while it is quite within the comprehension of the beginner.

THE telephone receiver is one of the most important components of a wireless equipment. With a crystal set a good telephone will make all the difference between success and failure. It follows, therefore, that a thorough understanding of the principles involved will be of great value in assisting the amateur to choose his telephones from a number of instruments on the market, ranging in price from 16s. to 50s., or more.

The essential principle of a telephone is as follows: The currents to be detected are

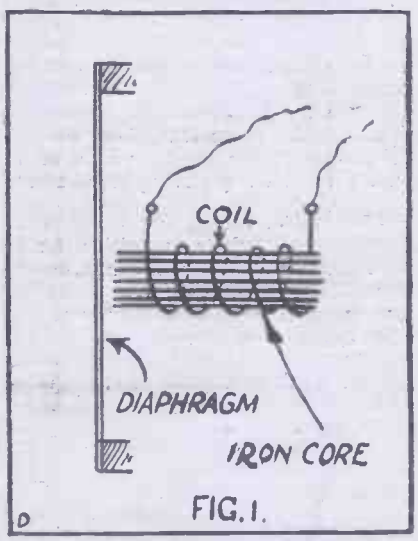

FIG. 1.

passed round the windings of an electro-magnet which is placed in juxtaposition to a diaphragm of soft iron or iron alloy (Fig. 1). These varying currents attract the diaphragm with varying pulls, which cause sound waves to be set up, these in turn affecting the ear-drum.

"Resonance" must be Avoided.

Such a crude arrangement, however, would be totally unresponsive to the feeble currents dealt with in wireless work, and certain modifications are necessary. If the exact relation between the current in the windings and the pull on the diaphragm is investigated, it is found that if the diaphragm is subjected to a permanent magnetic pull, and the received currents are arranged to make this force slightly greater or less, a much more sensitive arrangement is obtained, the sensitivity depending on the intensity of this permanent magnetic field.

A hard steel permanent magnet is therefore employed, suitably shaped to fit inside the case of the receiver, and fitted with special pole-pieces, over which the windings are fitted. The diaphragm rests on the rim of the case and across the top of the pole-pieces (Fig. 2). In the ideal case the diaphragm is just clear of the pole-pieces, so being perfectly free to move, and yet still in a strong magnetic field.

The next point to be considered is the diaphragm. Any piece of iron in a varying magnetic field absorbs some of the energy in the field and converts it into heat. To reduce this loss of energy the diaphragm is made of some alloy of iron having less tendency to absorb the energy, and yet just as satisfactory as regards magnetic properties. Such a material is "stalloy," an alloy of iron and a smaller percentage of silicon.

Again, the diaphragm is made as light as possible consistent with sufficient mechanical rigidity, and is tightly clamped at the edges to prevent it from moving other than under the influence of the currents in the windings. The system, moreover, has to be carefully designed to avoid "resonant" notes—i.e. the diaphragm may tend to vibrate of its own accord at some definite frequency, so that every time this note is reproduced by the telephone it is greatly exaggerated.

The "Reed" Type.

In the Brown Reed type of telephone, a highly sensitive instrument, the diaphragm is made of very thin aluminium, supported at the sides by gold-beater's skin, thus providing a very light mechanism indeed. The centre is clamped to an iron reed which is under the influence of the magnetic system. As the pole-pieces are adjustable, as previously described, it will readily be understood that this is one of the most sensitive receivers on the market. The system, however, has a distinct resonant frequency which is a disadvantage in wireless telephony, although it may be distinctly useful when receiving Morse signals.

The coils round which the current is passed may be wound with many turns of fine wire (high resistance) or fewer turns of thicker wire (low resistance). Where the telephone is to be inserted direct in a crystal or valve circuit the high-resistance pattern should be employed, since the current involved is very small but at a relatively high pressure. The low resistance type being wound with thicker wire, is more robust, but involves the use of a telephone transformer, which transforms the small relatively high-voltage current into a larger current at a reduced pressure of which the low-resistance telephone is able to take full advantage.

There are other types of telephone receivers, such as the Baldwin telephone, which achieve the same results by different

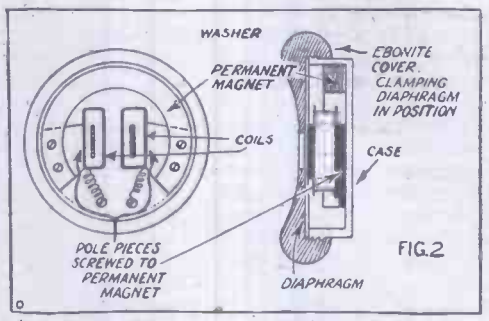

FIG. 2

means, but practically all the telephones on the market at the moment are of the type described above.

It will be seen, therefore, that there are two essential characteristics, from the point of view of sensitivity.

Loss of Energy.

(*a*) A strong permanent magnetic field, obtained by the use of good quality steel or steel alloy.

(*b*) Accurate machining of the parts so that the diaphragm is as near as possible to pole-pieces. In some makes of telephone, the pole-pieces are adjustable relatively to the diaphragm by means of a small screw, so that the most sensitive position may readily be obtained.

It is estimated that even the best telephones only convert about 1/1000th part of the energy they receive into sound waves, and that the movement of the diaphragm is of the order of 3/100,000,000ths inch. It is obvious, therefore, that attention to detail is all important, and the reason for the great differences in price becomes apparent.

Mr. H. Bennett, of Fernside Lodge, Hollybush Hill, E. 11, and the neat receiving set that he has constructed.

THE 2 L O CONCERTS.

A Criticism by CECIL COOK.

Mr. Cook has for some years been actively connected with the organisation of the Queen's Hall concerts, whilst during the Great War he held the position of controller of the Government Department that dealt with the Garrison Theatres and Cinemas. He is also a composer of some note, the music of "The Willow Pattern" being one of his best-known compositions. He is therefore able to write with authority on the subject of musical broadcast items.

THE criticisms which are being levelled by the London Press generally at the 2 L O Broadcast Concerts are only another proof of the impossibility of pleasing everyone. One critic considers them "high-brow," another looks upon them almost with contempt and demands music similar to that given at Queen's Hall. A third condemns the programmes as uninteresting and poorly performed, yet another declares the music to be chiefly by nonentities, while a London daily would like to abolish forthwith the entire organisation that has been set up and amiably offers to provide, free of charge and, presumably, for all time, concerts far more interesting and varied than those to which so many thousands listen each night. The purpose of this little article is not to argue on the fairness or unfairness of the above criticisms, but, rather, to help people to realise some of the difficulties in such an undertaking and to offer one or two, perhaps, useful suggestions.

Wide Appeal Required.

Criticism, especially in art, is mainly a matter of personal opinion, and is frequently made, if not without personal knowledge, at all events without practical experience of the subject. As one, however, who has had large experience in organising and drawing up the programmes of some of the most important concerts in London, who during part of the war and after was in sole charge of all the official entertainments for soldiers in this country, and who, lately, was responsible for the musical side of the production of "Polly" at the Kingsway Theatre, and conducted for some weeks many of its earliest performances in conjunction with Mr. Eugene Goossens, the present writer may perhaps claim the privilege of putting forward some of his views on the subject.

The number of listeners-in to 2 L O must amount to tens of thousands, and one notes that the farther one gets into the suburbs and outskirts of London the more the number of aerials increases—erected, be it said, mostly on medium-size and small houses. On the edge of a market garden between Hounslow and Twickenham may be seen an aerial leading into a small cottage, probably occupied by one of the farm labourers, whilst in a small village on the borders of Surrey and Hampshire, some miles from a station, I have come across a five-valve set in a tiny inn. Therefore the B.B.C. have to make a wide appeal in their entertainments and to study all classes.

A Source of Anxiety.

They cannot cater only for the musical enthusiast, who, it is sorrowful to confess, as a class is very limited in number, which is proved by the fact that high-class vocal concerts seldom pay and orchestral concerts practically never. Would the Royal Philharmonic Concerts take place were it not for guarantors? Look where grand opera has landed one well-known impresario! The very popular Promenade and Symphony Concerts must always be a source of anxiety to those who have to foot the bill. How many attend, or even have heard of, the Chamber Concerts which have taken place for years at South Place, Finsbury, where the best instrumental quartettes and trios are heard, as well as high-class vocal music? Here one finds the real music lover. It is almost an education in itself to go there.

An Art In Itself.

The cost of good concerts is almost prohibitive. A singer who decides to give a recital at one of the lesser halls has to venture round about £80 on the undertaking, an amount which takes a lot of getting back, and I have in mind a small orchestra of 16, including conductor, which, for no more than four hours' work a day, costs £125 per week to keep going.

Now, having indicated very shortly and inadequately some of the difficulties of the position, it will probably be admitted that the B.B.C. deserve credit for what they have already accomplished. But, at the same time, there remain other grounds for criticism, and these lie mainly in the way the programmes are presented. With such names as Wagner, Brahms, Beethoven, Mozart, Liszt, Gounod, Tschaikowsky, Rachmaninoff, Grieg, Elgar, and many another, in the programmes, it cannot be said that there is a lack of good music, but the fact is that the composition of a good and interesting musical programme is a difficult matter. It is so difficult that it is almost impossible to maintain a constant level of excellence—especially when it has to be done every night. It is almost an art in itself, and needs taste, judgment, style, variety, and contrast.

Lacking in Contrast.

The items require to be chosen with great discrimination and discretion, and it is here that, in my opinion, the Broadcast Concerts fail lamentably. No attempt at choice seems to be made. Whatever comes along is put in, and that this is so is shown by the irritating repetition of items, even in the same programme. Hence they are frequently dull and uninteresting. Further, singers are put on to perform three or four songs in succession which are frequently all heavy and lacking in contrast. There might be something to say for such a plan if a singer appeared only once, but they invariably make a second appearance later in the evening. It is the same with the orchestra. Surely the better course would be to variegate the concert with vocal, instrumental and humorous and other items, suitably arranged, instead of putting them in casual groups.

It would be a good plan, also, to arrange various classes of programme. For instance, say, every other evening, the concerts might be of a popular nature, with light and bright music and songs; other evenings might be devoted to music of a more serious nature. Occasionally there might be, even, a programme confined to the music of one of the great masters, with, perhaps, a short address on incidents in the life of that particular composer. But always, and in every case, care and discrimination are needed in the choice of items. As to lectures generally, if they are considered necessary, the subject matter needs to be carefully chosen.

It must be great fun for those who possess loud speakers to dance to wireless, so we must leave that part of the programme without criticism. But, to the musician, the ordinary run of rag-time and jazz tune is atrocious, with certain exceptions, such as "The Kitten on the Keys," which, in its class, is a superlatively clever piece of music.

Operas and Plays.

There is not much to say, either, for or against the broadcasting of plays, as the last word remains with the theatrical managers, and if they do not acquiesce there will be no more listening-in to plays. Generally speaking, I am inclined to think that more is lost than gained by the transmission of plays by wireless. So much depends on personality, movement, light and colour. Like humour, dialogue needs to be very pointed to hit the mark after being dispatched through space.

Grand opera, yes, by all means, if possible. One can enjoy opera with closed eyes. The dramatic action usually moves slowly, but, for purposes of wireless transmission, the orchestral accompaniment, which is usually of equal importance as the vocal part, needs to be given as much prominence as the voice.

One last word, and this has reference to the artiste. If report be true, and I cannot doubt the source of my information, the B.B.C. are offering entirely inadequate fees to singers and instrumentalists for their concerts. The labourer is worthy of his hire, and it is not fair to ask artistes who have spent a lot of money on their professional education to forego their just rewards. It is their living and often a very hard living. In the early days of broadcasting many singers were glad to give their services practically for expenses owing to the novelty of the thing, but if the B.B.C. desire to keep a high standard and to obtain good talent they will have to pay artistes fair and adequate remuneration for their work.

DO YOU EXPERIMENT?

If you do then probably you have at some time or another constructed some piece of apparatus or obtained results worthy of chronicling and passing on to other amateurs. Popular Wireless pays well for short bright articles of this nature if accepted for publication. Drawings and diagrams can be rough but should be clear in detail.

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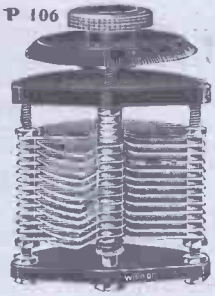
P 106



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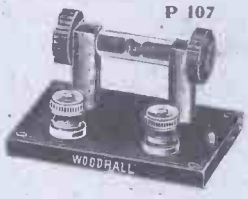

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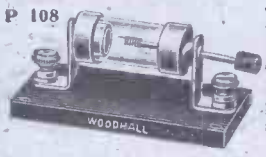

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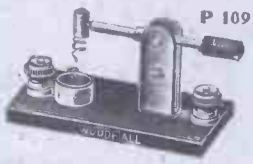

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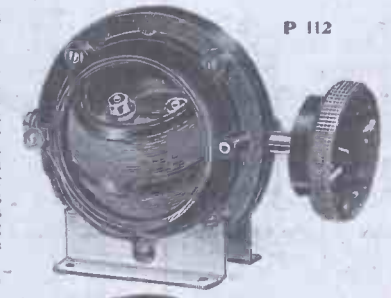
Postage 1/3 extra. Brackets movable for panel or table mounting.

P 112



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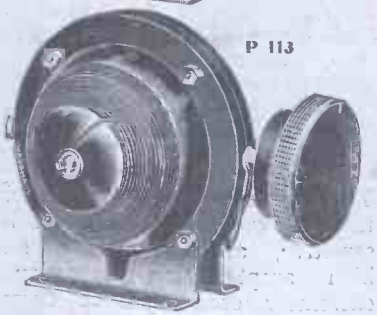
P 113



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A real *instrument*, of unique design, approved for broadcast reception. Unlike most sets, this outfit has tuner exposed. The A.T.I. consists of the Woodhall Variometer P112 (above) and the detector, dustproof, is of the Perikon type. The tuning is extremely selective, and every part is highly efficient. Heavily nickel-plated fittings, on Radion Mahoganite panel, in highly polished case with dust cover. Price, without accessories, but including B.B.C. Royalty 65/-
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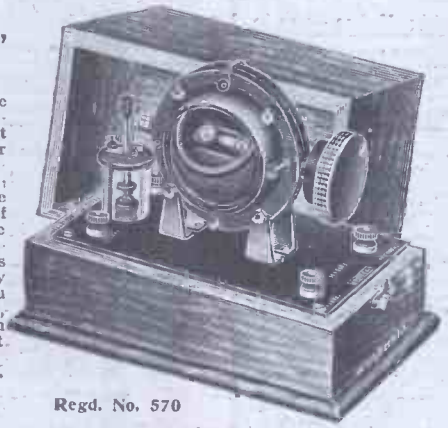

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9ct. Gold Cat's whisker	4½d.	Grid Leak (2 m.) ..	1/2	Lead-in Tubes, 8 in.	1/8
		Knob and Dial, 3 in	2/-	Aerial Wire, 100 ft., 7/25, Phosphor-Bronze	3/-

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AN EXPERIMENTER'S CRYSTAL DETECTOR.

THE standard patterns of crystal detector as stocked by the numerous wireless stores are not particularly suited to the serious experimenter in the fields of crystal rectification. It is often necessary, in the course of one's experiments, for a rapid change of crystal to be made in order that comparative results with similar signals may be obtained. To do this with the general run of detectors involves the withdrawal of sundry pins and nuts of particularly small and elusive dimensions, which is by no means a rapid and easy method.

It was with the idea of eliminating this trouble that the writer evolved the detector to be described. It is not claimed that the general design is new; in fact, the actual detector was constructed partly with fittings from a purchased detector. The diagram (Fig. 1) should give a general idea of the construction, and the following notes should explain its advantages.

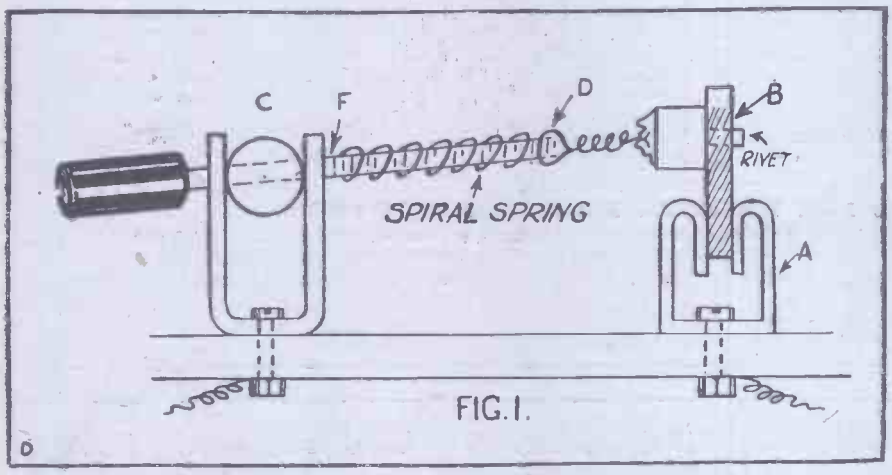


FIG. 1.

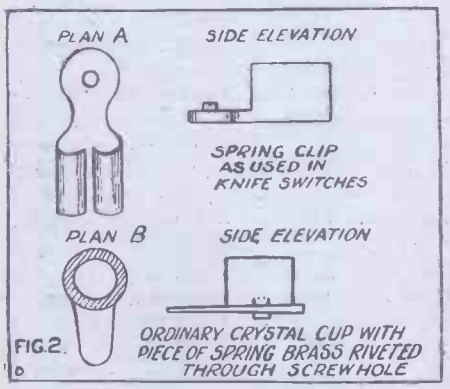


FIG. 2.

The whole portion shown at C, in Fig. 1, can be obtained by dismantling a standard detector. If any difficulty is found in obtaining the spring clips in which the cups fit, they can be readily made from a piece of stiff spring brass or copper in the manner indicated by Fig. 3.

If a number of crystal cups are mounted with the flat strip to fit the clip, and fitted with different crystals, such as copper pyrites, galena, bornite, silicon, etc., it will be seen that a change can be effected in a second by pulling one cup out of the clip and pressing another in its place.

An Alternative Method

If it is desired at some time to adapt the detector to double combinations, the pip D (Fig. 1) holding the fine wire whisker is removed, and a crystal cup with a hole in the bottom, tapped the same as rod F and fitted with a zincite crystal, may be screwed on in place of D (see Fig. 4).

As an alternative to the spring clip for holding the crystal cup, a single valve socket may be substituted, and an old valve leg soldered on to the cup used to plug same in and out. If there is any difficulty

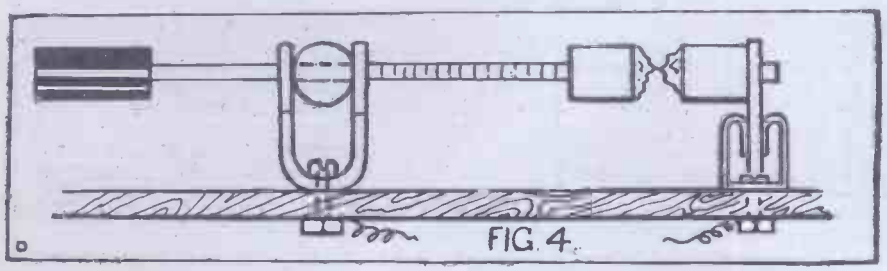
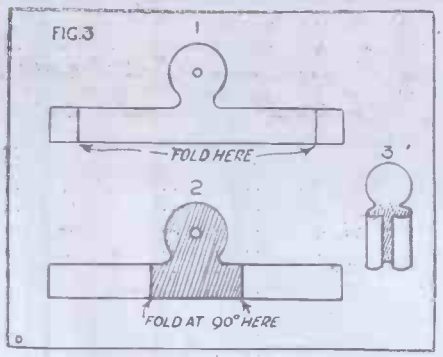


FIG. 4.



in obtaining a valve leg, a piece of brass rod of the same diameter as the hole in valve socket may be used, providing a longitudinal saw cut be made in it in order that a tight fit may be assured by opening out the cut with a knife (Fig. 5).

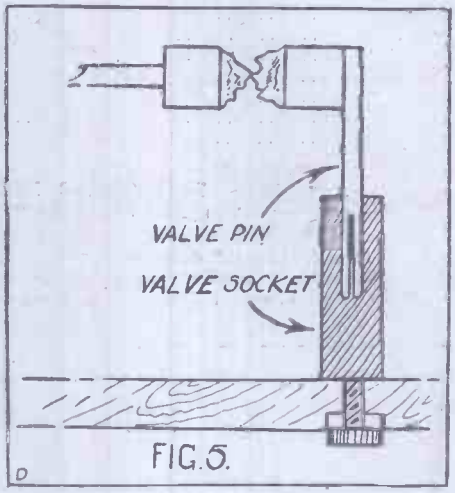
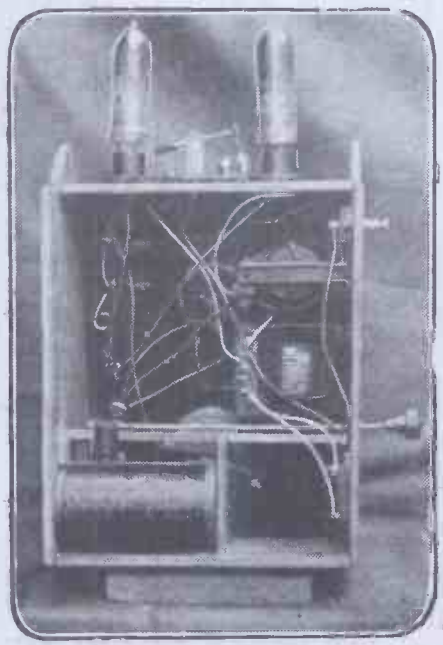


FIG. 5.

This detector though "home-made," and a little unconventional in design, will be found to give results quite as satisfactory as those obtained from the more expensive pieces of apparatus. As a finishing touch the brass portions of the instrument could be lacquered.



This photograph shows the wiring of a neat crystal and 2 L F set constructed by Mr. H. Parker, 72, Hennon Street, Bolton.

THE BRITISH BROADCASTING STATIONS.

WIRELESS BROADCASTING PROGRAMME.

Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.
London	2 L O	11.30–12.30	Music	369	Every week day.
"	"	5 p.m.	Women's "Hour"	"	"
"	"	5.30–6.15 p.m.	Children's Stories	"	"
"	"	7 and 9.45 p.m.	News	"	"
"	"	8–10.30 p.m.	Music and various	"	"
"	"	8.30–10.30 p.m.	News and music	"	Sundays.
Newcastle	5 N O	11.30–12.30 p.m.	Music	400	Every week day.
"	"	Usually 5.0–10 p.m.	Music, News, etc.	"	"
"	"	8.30–10 p.m.	Music and News	"	Sundays.
Manchester	2 Z Y	11.30–12.30	Music	385	Every week day.
"	"	Usually 5.0–10 p.m.	Music, News, etc.	"	"
"	"	8.30–10 p.m.	Music and News	"	Sundays.
Birmingham	5 I T	11.30–12.30	Music	425	Every week day.
"	"	Usually 5.30–10 p.m.	Music, News, etc.	"	"
"	"	8.30–10 p.m.	Music and News	"	Sundays.
Glasgow	5 S C	11.30–12.30	Music	415	Every week day.
"	"	Usually 5.30–10 p.m.	Music, News, etc.	"	"
"	"	8.30–10 p.m.	Music	"	Sundays.
Cardiff	5 W A	11.30–12.30	Music	353	Every week day.
"	"	Usually 5.0–10 p.m.	Music, News, etc.	"	"
"	"	8.30–10 p.m.	Music and News	"	Sundays.
Croydon	G E D	Throughout day	Aeroplane Traffic	900	

NOTE.—All times are B.S.T.

FORTHCOMING EVENTS FROM THE LONDON BROADCASTING STATION (2 L O).

FRIDAY, 25th inst.—H. E. Blain, Esq., C.B.E. Chairman of the London Safety First Council, address on "Safety First," at 9 p.m.
Extracts from the following Operas, as performed by the British National Opera Co., will be relayed from Covent Garden and transmitted from 2 L O on the dates mentioned: 26th inst., "Phœbus and Pan"; 30th inst., "Hansel and Gretel"; June 1st, "La Bohème"; June 2nd, "Cavalleria Rusticana" and "Pagliacci."
In "La Bohème" it is hoped that Madame Melba will sing.

NOTE.—See notes and news page for later details or alterations, if any, to hand.

THE CONTINENTAL BROADCASTING STATIONS.

Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.
BELGIUM					
Brussels (1)	Brussels	12 noon	Weather report	1100	Working days.
		4.50 p.m.	Aeroplane traffic	1100	When necessary
		6 p.m.	Concert	1300	Sunday, Tuesday and Thursday.
HOLLAND					
The Hague	P C G G	3–5 p.m.	Concert	1050	Sunday.
		8.40–9.40 p.m.	Concert	1050	Monday & Thursday
The Hague (Laboratorium Heussen)	P C U U	7.45–10 p.m.	Concert	1050	Tuesday.
		9.40–10.40 a.m.		1050	Sunday.
The Hague (Velthuyzen)	P C K K	8.40–11.40 p.m.	Various	1050	Friday.
Ymuiden (Middelraad)	P C M M	8.40–11.40 p.m.	Concert	1050	Saturday.
Amsterdam	P A 5	8.10–11.10 p.m.	Concert and News	1050	Wednesday.
FRANCE					
Levallois-Perret (Radiola)	S F R	2–3 p.m.	Music	1780	Sunday.
		5 p.m.	Stock Exchange News	1780	Every day.
		5.15–6.15 p.m.	Instrumental music	1780	Every day.
		8.45 p.m.	General News	1780	Every day.
		9–10.30 p.m.	Vocal and instrumental concert	1780	Every day.
Paris (2) (Eiffel Tower)	F L	6.40 a.m.	Weather Forecast	2600	Every day.
		11.15 a.m.	Weather Forecast	2600	Every day.
		3.30 p.m.	Stock Exchange News	2600	Every day.
		6.20 p.m.	Weather Forecast, Concert	2600	Every day.
		10.10 p.m.	Weather Forecast	2600	Every day.
École Supérieure des P.T.T.		7.45–10 p.m.	Radio Concerts	450	Tuesday, Thursday,
Radio-Riviera (Nice)		2.30–7.30 p.m.	Radio Conferences	450	Saturday.
		11 a.m.	News, Concert, tzigane	460	Every day.
		5-6 p.m.	News, instrumental Concert	460	Every day.
		9–10 p.m.	Latest News, Concert.	460	Every day.
GERMANY, CZECHO-SLOVAKIA, AND SWITZERLAND					
Berlin (Königswusterhausen)	L P	6–7	Financial News, etc.	2800	Every day.
		11-12.30			
		4–5.30 p.m.	Financial News, etc.	2800	Every day.
Prague	P R G	7–11 a.m. and 3 p.m.	Weather News, General News	1800	Every day.
		9–2 p.m. and 9 p.m.	Concert	4500	
Geneva	H B	6–7 p.m.	Concert	1200	Every day.

(1) If, at the indicated times, a station has to receive or transmit service communications, the weather transmission will take place after these communications. Tuesday: Operatic selection on the gramophone. Thursday: Various on gramophone. Sundays: Various by artistes.

(2) Special concerts given during the evening are announced in the course of the preceding transmissions.

NOTE.—All times are G.M.T., not B.S.T. in the Continental section only.

LIGHTNING AND THE WIRELESS AERIAL.

By H. W. GAMBRELL (Hon. Sec., Rugby & Dist. Branch of Radio Association).

THE attitude of the insurance companies and the wireless man's dread of lightning, tend to mark the wireless aerial as a curse and danger to humanity, whereas if a little thought be given to the matter, this ofttimes unsightly erection is a blessing in disguise.

Ariel's remarks in POPULAR WIRELESS of April 28th are perfectly logical; in fact, Maxwell—what a name for the wireless man to conjure with—actually proposed covering houses with a *network* of wires as a protection against lightning.

The question of conduction of lightning does not, however, effect the point at issue. What I am actually concerned with is the elimination by neutralisation of the well known electrical phenomena. It is the old story of prevention being better than cure.

Those of my readers who have investigated the action of points in electrostatics will remember that if a point be attached to the surface of a charged body, such body will discharge through that point, and the discharge will be of the same potential, negative or positive, as the charged body.

In 1749 Franklin said: "May not the knowledge of this power of points be of use to mankind in preserving houses, churches, etc., from the stroke of lightning by directing us to fix on the highest points of these edifices upright rods of iron made sharp as a needle." Now, good reader, you may think that the uprights rod of iron with needle-like points is the pivotal feature of my quotation, but you are wrong. It is the one word "highest" which draws my attention. It is that word that I concatenate with the wireless aerial.

Practically all aerial masts go to a good height. Those who do not are not worth considering (mine is one of the latter). Let us therefore follow the advice of Franklin, and place earthed spikes on our masts.

Prevention of Lightning.

We will now consider the action of atmospheric electricity. A cloud by some means gathers a positive charge; in accordance with the laws of induction it induces a negative charge on the earth's surface, and when the potential difference between these bodies is sufficient to overcome the specific inductive capacity of the dielectric air, we get a discharge known as lightning. If, however, we erect our aerial mast with its earth connected point, the charge induced on the earth's surface will issue from the point as a negative stream, resulting in the partial or complete neutralisation of the cloud charge, thus eliminating the possibility of lightning.

It is obvious that the more of these oppositional erections the better, and taking into consideration the number of aerials now erected, it should, by the introduction of pointed conductors, be possible to overcome lightning altogether, or at least curb its ferocity.

Four Points Worth Noting.

The following, by Professor S. P. Thomson, may be of assistance to those who consider my suggestion worth materialisation:

1. All parts of the lightning conductor should be of one and the same metal, avoiding points as far as possible (except, of course, at the top), and with as few sharp bends and corners as may be.
2. The use of copper for lightning rods is a needless extravagance. Iron is far better. Ribbon is slightly better than round rod, but ordinary galvanised iron telegraph wire is good enough.
3. A good deep, wet earth should be provided, independent of gas or water pipes, to which the conductor should be led down. If any part of the conductor goes near a gas or water pipe it is better to connect them metallically than to leave them apart.
4. In ordinary buildings the conductor should be insulated away from the walls so as to lessen liability of lateral discharge to metal stoves, and things inside the house.

CONVERTING FORD COILS.

The dismantled materials contained in the condenser and, on the right, a finished grid condenser.

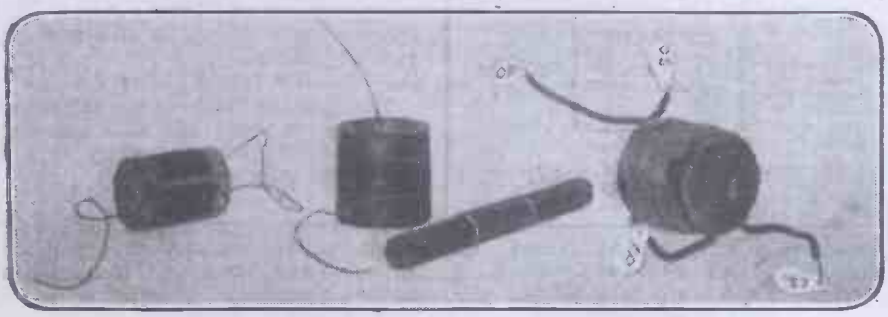
THE coil should be taken to pieces very carefully, and will be found to contain a large capacity condenser made up of two long rolls of excellent tinfoil, sandwiched between fine quality paraffined paper. Sufficient material is contained in a Ford condenser to make up a large number of fixed condensers suitable for wireless work, and they can be very easily constructed, as shown in the accompanying photograph, which portrays the material used and a finished grid condenser.

It will be noticed that two pieces of foil, 1½ in. wide, are cut off to the desired length, which allows ½ in. for connections. The paraffined paper is cut slightly longer than the foil and 2 in. wide. It is then folded up the centre, and the foil placed in the fold. The prepared sheets are next staggered so that the ½ in. foil projects on either side, and the whole is folded up into a flat, compact roll, when the foil can be bent back and clamped at each end with thin brass or copper lugs.

The induction coil consists of a bundle of iron wires, 5 in. long, covered with a layer of insulating material on which is wound a single layer of fairly heavy gauge wires, which forms the primary circuit. The secondary circuit is divided into two separate coils of fine-gauge wire, placed side by side, each measuring 1½ in. long by 1⅝ in. diameter. Each layer of wire is insulated from the next by a sheet of paraffined paper, and the whole is embedded in a black, waxy substance which can be used in place of Chatterton's compound.

The primary circuit should be carefully withdrawn and the primary winding removed. The layer of insulating material should also be removed, except for 1½ in. in the centre. The secondary coils should be parted; one coil should have about one-fifth of the winding removed from the inside, and the other coil worked down from the outside until one-fifth of the winding remains and it will slide inside the other coil.

Lengths of flex should be soldered to the starting and finishing ends of wire on each coil, and marked for reference when connecting — IP, OP, IS, and OS. It is finally assembled by placing the two super-imposed coils on the bundle of iron wire, which is then divided and folded back over the coils to close the magnetic field, and the whole wrapped in insulating tape and connected up, when it will be found to function well as a low-frequency inter-valve transformer.



The two prepared coils, the bundle of iron wires, and the finished transformer.

BROADCASTING AND THE THEATRES.

By PHYLLIS DARE.

I HAVE been asked to give readers of POPULAR WIRELESS my opinions as to the relative positions of the theatres and the Broadcasting Company, and whether I think the antagonism, if I may call it such, that has sprung up between theatre-land and that company is really as bitter as has been made out.

Miss Phyllis Dare.

In the first place, I am sure that the theatre managers are not in any way acting spitefully towards the new interest that has come before the public—wireless telephony and broadcasting—but they have a very real doubt as to whether the proposal to broadcast the plays and musical comedies is going to assist in, or be adverse to, the future position of the stage. I think the doubt is a very natural one, and there appear to me to be several points both for and against the broadcasting of the various productions.

Two Points of View.

In the first place, I am inclined to think that the broadcasting of one act or so of any piece will be a very useful aid to the theatre concerned, inasmuch as those who have enjoyed the excerpt will assuredly wish to see the whole piece. That is all very well as long as the transmission of the act is good; but what if it should be poor? In the case of the broadcasting of a portion of any play, I think that the management should be allowed to choose the excerpt to be broadcast, so that a truly representative impression should be given to the thousands who listen to it.

So far the balance is on the side of the broadcaster, so let us look at a point against the transmission of theatre productions.

The novelty of wireless has still a great hold on the imaginations of the public, and I rather think that the majority of them would stay in during the evening to hear the broadcasting instead of going out to the theatres and other places of amusement. This is, of course, talking of the people in and around London, and to these the broadcasting of a show in its entirety would probably mean that they would not stir from their comfortable fireside in order to see the play when once they had heard it over the wireless. It was the same with the electrophone, which made a slight difference to the theatres, though in the case of wireless the listeners-in would not be able to switch on to a theatre every night, or even choose their plays.

An Additional Attraction.

I believe that the act of the "Lady of the Rose" that was transmitted the other night was heard perfectly, and, as far as I know, the result was not at all detrimental to Daly's, but rather attracted a number of people to come and see the piece. How the ordinary plays and drama would be affected it is hard to say, for, of course, the musical productions have a far better chance of being broadcast with success than have the pieces where only the spoken word is employed.

Finally, though my mind is not thoroughly made up on the point, I am inclined to think that, judiciously used, broadcasting will prove a useful advertisement for the theatres rather than a serious rival. I believe that this would be especially the case where people who live in the country are concerned, for if they have heard the plays by means of wireless, they will, on their visits to London, probably come along to the theatres in order to see the plays for themselves.

REJECTOR CIRCUITS

WHILE experimenting with rejector circuits with the object of eliminating the local broadcasting station whilst listening to a more distant station, it was found to be possible, by a suitable arrangement of circuits, to receive two broadcasting stations simultaneously on one aerial, each station's signals being received independently in a different pair of 'phones. The following is a brief description of the method adopted.

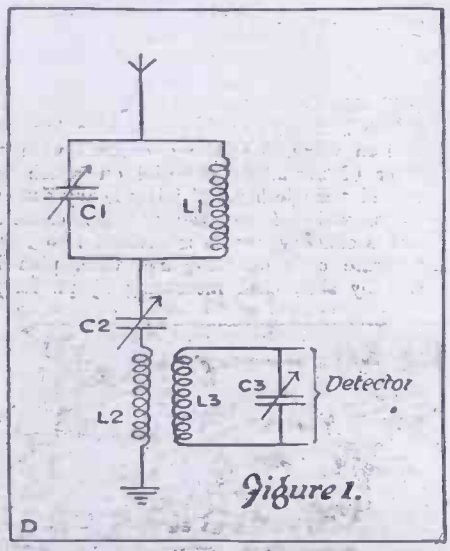


Figure 1.

Two Receivers Used.

Fig. 1 shows an ordinary receiving circuit with a rejector circuit added. L2 C2 and L3 C3 are tuned in the usual manner to the required station, while L1 C1 is tuned to the wave-length of the interfering station. Now if the secondary of a second receiver be coupled to L1 as in Fig. 2, and tuned to the same wave-length as L1 C1, the two stations can be received one by each receiver. Thus

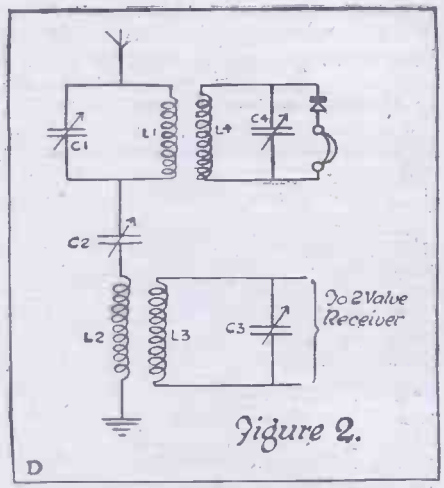


Figure 2.

at 3½ miles from 2 L O and using one aerial it is possible to receive that station on a crystal detector, and at the same time 5 I T on a 2-valve receiver, both stations giving good telephony and neither interfering with the other, except, of course, that there is a certain amount of loss of strength as compared with what would be obtained if only one station were being received.

CATALOGUES, Etc.

STOCKTON BUN have sent us their new pamphlet dealing with the T.M.C. complete sets. In the first few pages they include some remarks of interest to those who have not yet installed a set. They also give details of the "Triumph" accumulator charging set.

* * *

We have received a pamphlet from the General Electric Co. It is not generally known that they have brought out a new four-valve cabinet set with which excellent results have been obtained. A loud speaker can be operated with a frame aerial up to a distance of ten miles. America has often been heard on their two valve-set.

* * *

A. H. Hunt, Ltd., are the manufacturers of the A.H.H. combined wander plug, valve protector and battery tester. They are also the manfacturers of a new type variable grid leak.

* * *

The Economic Electric's new catalogue is profusely illustrated and deals with high-class complete sets and every type of component and accessory.

* * *

The manufacturers of the Victor Wireless apparatus have sent us a catalogue dealing with their complete sets and accessories, all of the highest efficiency and finish.

ADJUSTMENT SIGNALS.

Every amateur should make himself acquainted with the details of the transmissions dealt with in this article, as they form invaluable indications of the true tuning, sensitivity, etc., of receiving stations.

Callibration Wave Transmissions

Time.	Station.	Call.	Wave Length.	System.	Remarks.
0750	Air Ministry	G F A	900 ..	C.W. ..	
0800	Air Ministry	G F A	1,680 ..	C.W. ..	
0845	Air Ministry	G F A	1,680 ..	C.W. ..	
1007	Paris	L O ..	6,500 ..	C.W. ..	1st, 10th, and 20th of month.
1020	Paris	L O ..	8,000 ..	C.W. ..	1st, 10th and 20th of month.
1035	Paris	L O ..	1,680 ..	C.W. ..	1st, 10th and 20th of month.
1800	Paris	F L ..	5,000 ..	C.W. ..	3 minute dash 1st and 15th of each month.
1810	Paris	F L ..	7,000 ..	C.W. ..	3 minute dash 1st and 15th of each month.
1820	Lyons	Y N ..	10,000 ..	C.W. ..	3 minute dash 1st and 15th of each month.
1830	Lyons	Y N ..	15,000 ..	C.W. ..	3 minute dash 1st and 15th of each month.

The above table will prove of utmost value to the experimenter. By means of noting the adjustments necessary a very fair system of complete callibration over quite useful ranges can be obtained. Adjustments should either be carried out on a separate heterodyne wave-meter, or on the closed circuit of the set. Readings over very comprehensive ranges can be obtained by noting the positions indicated by the harmonics of these transmissions in the following manner. Harmonics are invariably exact multiples of the fundamental wave-length. Thus the first harmonic of a 1,000 metre wave would be 500 metres, the second 250 and so on. From these noted points of adjustment the "between" readings can very easily be obtained.

Without changing the coil the condenser reading provides an excellent method of mathematically determining any unknown wave-length if the reading of a callibrated wave or harmonic is at hand. The system is quite accurate for all condenser readings between 40 degrees and 175 degrees.

The simple rule is that taking the unknown wave-length as x and the known as y, the condenser reading of x as a, and y as b

$$\sqrt{y} : \sqrt{x} :: \sqrt{b} : \sqrt{a}$$

Therefore, suppose a 10,000 metre callibration wave is tuned in on a closed circuit with a condenser reading of 100. The square root of this reading—i.e., 10, will be to the square root of any other reading between 40 and 175 as the square root of 10,000 is to the square root of the wave-length indicated by any other such reading. For instance, a reading of 49 would indicate a wave-length of 4,900 metres.

U.R.S.I.—

These letters, preceding a long dash of some two minutes or so duration, and transmitted by some of the larger stations, have no doubt caused some considerable speculation among amateurs not acquainted with the meaning of these signals. These cryptic messages are intended to indicate that the stations transmitting them are employing carefully approximated powers of radiation. This enables observations to be made as to such phenomena as "fading," "blind spots," local absorption, night effects, topographical variations, etc. Amateurs will find great scope for experiment in these fields and may discover the key to problems that are as yet more or less unsolvable by even the leading scientists. For this reason, and as a matter of general interest, a few details of the transmission of U.R.S.I. signals are appended.

Station	Time of U.R.S.I. Transmission G.M.T.	Wave-length in metres.	Approximate Radiation Height	Approximate Current in Aerial.
Eiffel Tower ..	10.35 p.m. ..	2,600	85 metres ..	85 amps.
Nantes ..	2.15 ,, ..	9,000	135 ,, ..	180 ,,
Bordeaux ..	7.55 ,, ..	23,400	170 ,, ..	480 ,,
Rome	4.0 ,, ..	10,500	120 ,, ..	100 ,,

CATALOGUES, BOOKS, ETC.

WE have received a catalogue from Mitchell's Electrical and Wireless, Ltd., in which they illustrate their high-class apparatus, both complete sets and components. Perhaps the two most interesting illustrations are of the "Lokap" winding machine and of their new filament regulator which goes by the same name. With the winding machine amateurs can wind coils to any given wave-length, while they claim many special features for the filament resistance. Their unit system is also worthy of note.

* * *

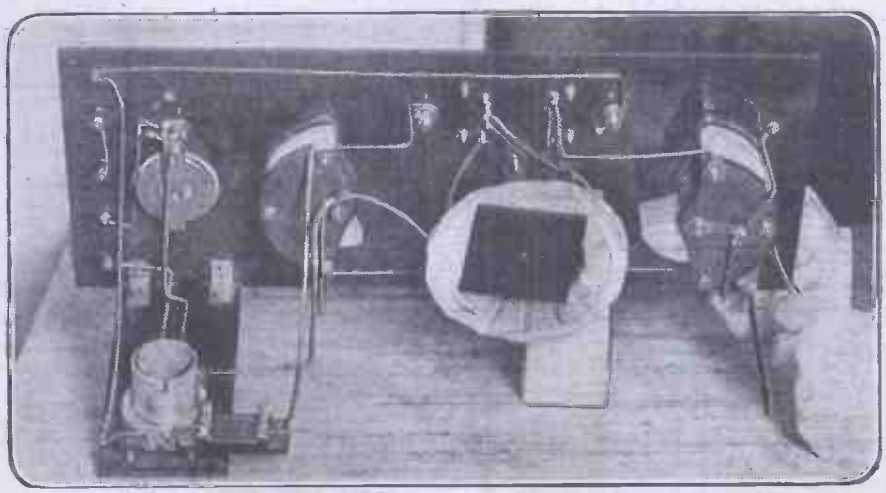
The Electrical Apparatus Co., Ltd., have issued an interesting leaflet of their complete sets, both crystal and valve. All sets are of the highest workmanship and efficiency, from the crystal to the multi-valve set. The sets are, of course, approved by the P.M.G. and stamped B.B.C.

* * *

A catalogue to suit those wishing to buy a complete set, or the amateur wishing to make his own set, has been forwarded to us by the "Fellows Magneto Co., Ltd." The apparatus is high-class and well finished. It is interesting to note that their service department extends to testing any amateur set free of charge, and advising on same, providing it is sent carriage paid.

* * *

The Sterling Telephone and Electric Co. have put on the market a single hand receiver. The instrument case is of aluminium with swivel and trunnion movement which, together with the smooth and well-finished ear-cap, ensures a perfectly comfortable fit to the ear. The instrument provides a convenient means of reception, avoiding disarrangement of the hair, and is specially suitable for ladies.

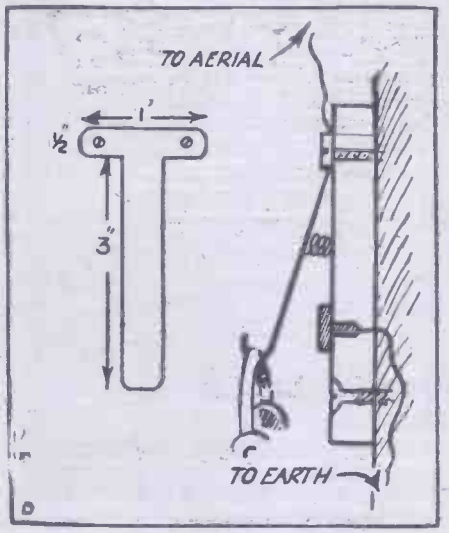


The above photograph is a "close-up" of the wiring of a Reinartz Tuner. This type of set is one of the most popular used in America at the moment, although, of course, "Supers" of all kinds abound.

SOME PRACTICAL IDEAS.

AN "EARTHING" 'PHONE HOOK.

A PIECE of ebonite, about 4 inches by 3 inches, is drilled and countersunk to receive two 1-inch wood screws. A piece of strong springy brass is cut to the shape shown in the figure the ends rounded and then bent up to form a

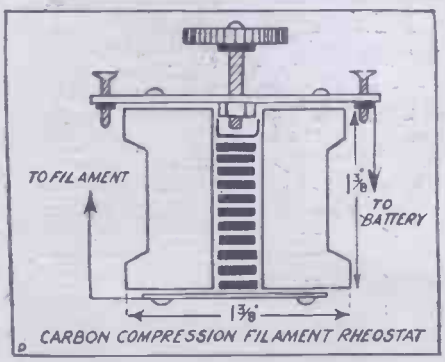


hook. This is screwed on to the ebonite, with a wire from the lead-in soldered on behind.

Beneath the hook is fixed a small flat-topped rivet of aluminium or some similar metal, and when the 'phones are placed on the hook, they press the spring down, and, if the rivet is connected to earth, they "earth" the aerial, and so protect the set from damaging atmospherics.

A CARBON COMPRESSION FILAMENT RHEOSTAT.

THIS rheostat of unusual design, provides smoother control of the filament current than the conventional wire-wound variety, and is easily made from



scrap at almost no cost. It is also quite noiseless in operation.

An ordinary cotton reel acts as container for the resistance element, which consists of eighteen little "pills" about ⅛ in. thick and ¼ in. diameter, cut from a carbon rod from a discarded high-tension battery. These may easily be cut without breakage with a short length of broken hacksaw blade attached to some sort of handle, and are subsequently smoothed on a piece of fine sandpaper.

Close up one end of the reel with a piece of thin, springy brass (such as that from an old electric-light bulb), 1 in. by ½ in., attached with two small screws. Put in the carbons, which must be quite a loose fit in the hole, and on top of these place, upside down, a brass cap obtained from the same source. This is for the adjusting screw to work against, otherwise it will grind up the top carbon pill.

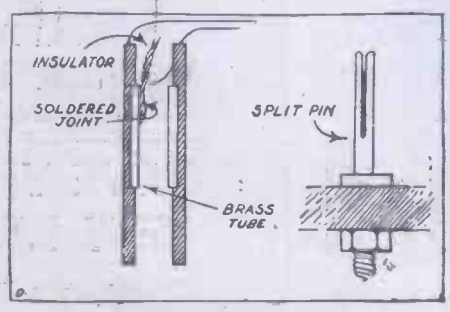
Fine Adjustment Possible.

The other end piece is of thick brass, 2¼ in. by ½ in., having a hole drilled in the middle to pass the adjusting screw, two for fixing the strip to the reel, and another two near the ends to take screws and nuts for attaching the rheostat behind the panel. A nut is soldered on the underside of this strip, over the centre hole, to suit the adjusting screw, which may be a ¼-in. Whitworth, 1¼ in. long. Any sort of knob about 1 in. in diameter will complete the instrument.

I would specially commend this rheostat to the attention of those who use a soft detector tube.

VALVE PROTECTION.

MANY valves have been burnt out either by sheer bad luck or through the gross carelessness or stupidity of one's friends or relations. (This is the usual way of putting it, I believe.) Anyhow, a device which renders it practically impossible to connect the H.T. leads to anything but the H.T. terminals should be universally welcome.



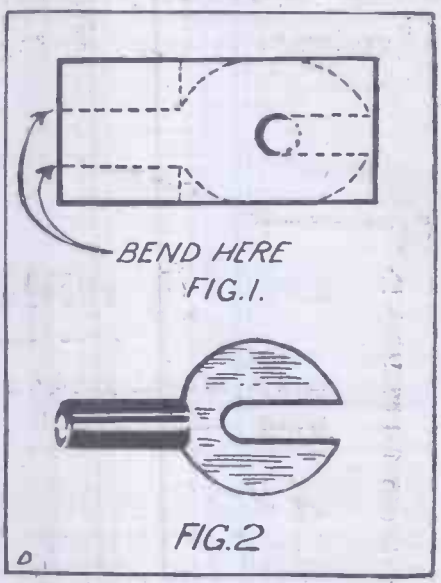
One such device is as follows:

The H.T. terminals consist of split brass pins, whilst the H.T. leads end in short pieces of brass tube which are a good sliding fit over the pins, and are protected by a piece of ebonite tube. The sketch will make this quite clear. It would be very difficult to make connection between the inner brass tube and any ordinary type of terminal, and the effort to do so would draw attention to the fact that something was wrong.

HOW TO MAKE SPADE TERMINALS.

TAKE a piece of sheet brass, about 22 S.W.G. Cut off pieces, 1 in. by ½ in., drill or punch $\frac{3}{16}$ in. hole, ⅜ in. from one end, in centre of each piece, and cut into it with pair of snips, as shown in Fig. 1. Next, cut with snips ⅜ in. from the other end, $\frac{5}{32}$ in. deep, and make another cut that forms the V (dotted lines in Fig. 1).

The nose of the spade terminal can then be trimmed off (dotted lines, Fig. 1), or



left square, as preferred. Next, bend up halves that are to hold wire, so that they are at right angles, leaving a trough for the wire.

The fixing is quite simple. Allow enough wire so that when one half is bent over there is enough wire to bend back, then bend other half over it, so forming a locking device. A piece of insulating tape can be bound round the connection, if preferred, which adds a finish to it.

A FEW TIPS.

To produce a mellow tone in the headphones, the following tip proves very successful. Carefully remove the original diaphragm from the 'phones and cut a piece of mica of the same size. Across the centre of the mica lay a small, perfectly flat piece of tin, and use this for the new diaphragm. This idea should not be tried when the signals are not fairly loud.

* * *

The following is an effective and simple way of testing the efficiency of telephones. Having placed the 'phones on the head, put the metal connection of one lead between the teeth, holding the other lead in the hand by the flex. Take a piece of metal—such as a pair of steel scissors—and gently rub the free tag. On doing this, a scraping sound will be heard in the 'phones if they are O.K.

NOTES ON THE CHOICE OF A LOUD SPEAKER.

By J. F. STANLEY, B.Sc., A.C.G.I.

This article deals with some points that should be very carefully considered by all intending purchasers of loud speakers. A good loud speaker can be quite moderately good, but a bad one can be worse than the most primitive phonograph.

IT is a well-known fact that a certain amount of distortion always takes place when reproducing speech on a loud speaker, and that the degree of distortion increases as the amplification is increased. Some loud speakers distort much more than others, and anyone contemplating buying such an instrument should insist on being given a demonstration before the final purchase is made. There are various sources of distortion in loud speakers, and these may be classed as those due to the actual reproducing mechanism and those due to the horn or trumpet.

There are also other causes of distortion, such as those due to the amplifier used, and those due to the acoustic properties of the room or hall in which the loud speaker is installed, but since these factors are external to the loud speaker itself we need not dwell on them in these notes.

Tests for Distortion.

Let us consider for a moment the distortion produced by the actual reproducing mechanism of the loud speaker. The source of the trouble here lies in the diaphragm, or in the reed in certain types of instrument. In the writer's opinion the reed type of loud speaker is far more sensitive than the diaphragm type, but the distortion produced by loud signals is also slightly more marked.

For the reproduction of C.W. Morse signals the reed type scores every time, but for telephony the writer recommends the diaphragm type. Furthermore, the diaphragm should preferably be a good deal larger and thicker than an ordinary telephone diaphragm, since in this case the natural period of vibration of the diaphragm will be well below the normal speech frequency.

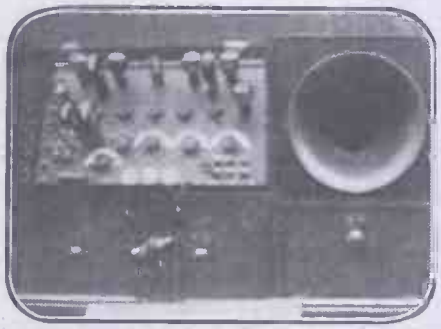
This is an important point, and the cause of the "tinny" sound produced by some loud speakers is due to the fact that the natural frequency of the diaphragm corresponds very nearly with the frequency of the sound being reproduced.

When this is the case resonance effects are set up which, though sometimes useful when receiving signals of a constant pitch, are very unpleasant in the reception of speech and music.

Another blatant source of distortion occurs in the trumpet of the loud speaker, and the following test is very useful when choosing an instrument. Remove the trumpet from the "works" of the loud speaker, and press the narrow end of the horn against your lips. Then try to spit down the horn, just as though you were trying to play that awful instrument of torture, the bugle. Then one of the three following things will probably happen, viz.:

(*a*) A loud, deep note like the bellowing of a cow will be produced; (*b*) a fairly high-pitched note, corresponding to, say, "middle C" on the piano, will be heard; or (*c*) no sound at all will come forth. If the latter case results, then the horn is a good one, as far as freedom from distortion is concerned, because we now know that the horn has no natural frequency of its own within the range of audibility.

If a loud, deep note is heard, as in case *a*, then the horn can be considered satisfactory from a distortion point of view, because the natural frequency of the instrument is considerably lower than the average speech frequency. Certain resonance effects may be heard when reproducing the bass notes of an orchestral item, or when a very bass voiced singer is filling the night with music, and the cares that infest the day—sorry, Uncle Arthur!—but these notes will be very rarely met, and need not be worried about. If result



The efficient and compact receiving set assembled by Mr. L. H. Hirst, 227, Quarmby Rd., Quarmby, Huddersfield, Yorks.

b is obtained, thank the salesman very much, but do not buy the loud speaker. The resonance effects will be very serious.

A good non-curved horn should always give the result *c*, and therefore, if you are thinking of buying a loud speaker, the writer suggests that you get one with a straight horn, if possible. Why is it, then, that so many instruments are provided with curved horns? The reason is simply that in order to produce a large volume of sound a large horn must be used, and if the horn were made straight it would probably be three or four feet long. This would be very cumbersome, so that in order to make the loud speaker more compact, this long horn is bent round into the curved shape so familiar to us all.

But it is in the process of bending the horn that the distortion trouble tries to creep in, and the final shape of the trumpet, therefore, requires to be carefully designed. If the curved horn, when blown into as described above, gives no sound at all, or only a very bass note, then you can buy the thing in safety. In the cheaper varieties of loud speakers, however, the note emitted sometimes has a moderately high pitch, as in *b*, and, as already stated, this type should be avoided.

Eight Valves for 2 L O.

In conclusion, remember that loud speakers, like the proverbial bricklayer, do not like to be overworked. DO NOT USE MORE AMPLIFICATION THAN IS ABSOLUTELY NECESSARY. The writer once heard a loud speaker trying to reproduce 2 L O ten or fifteen miles away with the aid of eight valves! How the B.B.C. has survived the advertisement is quite beyond comprehension. But perhaps the audience did not realise that it was 2 L O with which they were being deafened. The sound was very much like being inside a large and busy workshop. Remember, therefore, if you buy a small loud speaker, do not expect it to do the work of a large one. If you buy a large one, do not expect it to do the work of a stentorphone, and if you buy a stentorphone, heaven help you!

A CINEMA "WIRELESS WEEK."

THE cinemas have not been backward in recognising the immense part that broadcasting and all branches of wireless play in the interest of the public. Radio plays have been filmed where practically everything is done by wireless, loud-speakers have been installed in other picture houses, but the purely educational and scientific side has been neglected up to the present.

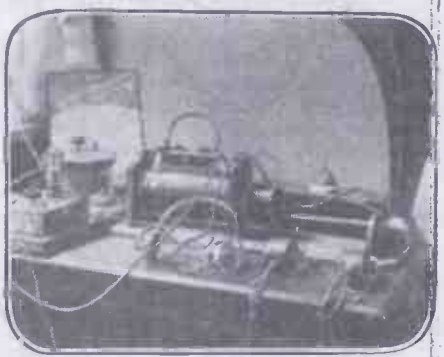
A new line has now been struck by Mr. Cecil Hoylan, manager of the Pavilion (2 X L), Clapham Junction, who has arranged a wireless week to commence on Monday May 28th. Non-technical pictures are to be shown, dealing with the methods employed in broadcasting wireless telephony, and a competition for the best piece of home-made apparatus is to be held. The apparatus may take any form and no fees or conditions of entry are demanded, other than that the exhibitor must be a bona-fide amateur. The exhibits will be divided into two classes, according to the ages of the competitors. Mr. H. S. Walker, owner of the well-known station 2 O M, and Major Stevens, both of Wireless Equipments, Ltd., have kindly consented to act as judges.

Radio Exhibition.

The great climax, however, is reached on Sunday, June 3rd, when a special afternoon's entertainment, consisting of an entire programme of wireless pictures, kindly lent by Messrs. Gaumont, Ltd., Goldwyn, Ltd., and the Marconi Wireless Telegraph Co., Ltd., will be held. The entertainment is open to all, admission being by invitation, and tea will be served, to cover which a nominal charge of 6d. per head is being made.

Further attractions will be found during the "wireless week," in an exhibition of all the latest apparatus and radio novelties to be shown in the grand vestibule.

This special week should prove of great interest to our readers, who will find many useful tips besides greatly advancing their knowledge of wireless. It is a chance that should certainly not be missed.



A South African amateur's set. This neat little set was constructed by Mr. B. C. Biram, of 15, Banskia Road, Rosebank, Cape Town.

THE ART OF MISCHA LEON.

By "ARIEL"

All those who heard this great tenor recently broadcast from 2 L O will enjoy reading the following delightfully intimate details of Mischa Leon "behind valves."

IF anyone has a "broadcasting voice" that person is Mr. Mischa Leon, the famous operatic tenor from the Grand Opera, Paris. I had heard him "on the wireless," and was so amazed at the quality and fullness with which his notes came through that I determined to go to the broadcasting studio when he was singing and "compare voices," as it were.

Accordingly the other evening found me in the "Chamber of Horrors" once more, though it held no horrors for the famous tenor. It was appallingly hot, and there did not seem to be room to breathe. In the centre of the floor, as usual, was the microphone, in front of which Mr. Mischa Leon was standing, while all round were grouped the members of the orchestra, conducted from a corner—apparently the only available space—by Mr. Jefferies.

Mr. Mischa Leon.

A rap of the baton, and then the orchestra burst out with the Preislied from "Meistersinger." I listened carefully. "Now," I thought, "I shall be able to find out how much of the quality of the voice is lost on its journey through the ether." But I was to be agreeably surprised. For when Mr. Mischa Leon commenced to sing I realised at once what a perfect medium is wireless telephony. The voice to which I was listening was in no way different from that which I had heard previously via the ether.

As I watched Mr. Mischa Leon throwing his whole soul into the wonderful piece of music he was singing, I realised why it was that he is considered to have a perfect broadcasting voice.

He sings regardless of the microphone and its unresponsive coldness; no longer is he just a singer singing a song, but he lives the part he is portraying, and microphone and ether combined cannot take away the personality from his voice.

"I love singing in this studio," Mr. Mischa Leon said to me afterwards. "The wonder of it all inspires me. To-night, for instance, my voice is being heard in Berlin, Madrid, and by a friend of mine out on the Atlantic on his way to America.

"I have just returned from Prague," he continued, "where I have been singing 'Carmen,' and if any of those who have heard me out there have receiving sets they will be able to hear portions of the operas over again as I sing them here in London. It is very wonderful that the voice should be reproduced so exactly over such great distances."

Wonderful Modulation.

Going along to the transmission room we were greeted with smiling faces everywhere, and congratulations were poured upon Mr. Mischa Leon for his success.

Inside the room, among the many instruments, is a large indicator which in effect registers the strength of the music that is being broadcast, and this instrument had suddenly jumped when Mr. Mischa Leon commenced to sing, till it registered his voice as being about six times as powerful as the orchestra!

"The sudden jump rather surprised us," said the engineer-in-charge of the transmitting room, "and I had to modify things a little as the effect would have been overwhelming when heard in the 'phones of listeners-in."

"I did not think I was singing as loudly as all that," laughed Mr. Mischa Leon.

"It's not the loudness so much as the fact that you have what we call a 'broadcasting voice,'" was the reply.

WIRE "KINKS."

WHEN cleaning off the covering of copper wire, whether silk, cotton, or enamel covered, refrain from using a knife wherever possible. If the covering is lightly rubbed with a piece of glass-paper, it will come off quite easily. A knife is liable to make a nick in the copper, and so weaken it that the wire will break off if bent at all.

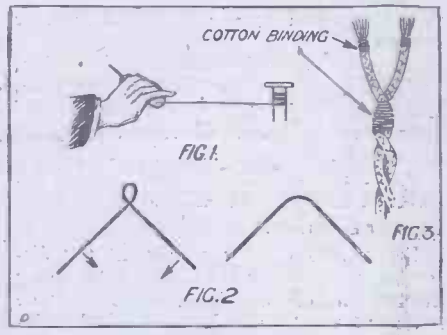
Dealing with Flex.

When small quantities of wire are bought, it is often rather kinky. To straighten this out as good as new, fix one end of the wire round a nail firmly, catch hold of the wire with a piece of soft rag, so that it passes through the hand, as in Fig. 1. Put a gentle pressure on the wire, and draw the rag along it; this will remove any ordinary kinks in the wire, and make it as good as new.

Where there is a bad kink in the wire, do not pull it out, but try to bend the wrie back to its proper position. Hold the kink gently with a pair of flat-nosed pliers, and bend the wire back in the direction of the arrows, as in Fig. 2.

Always remember that copper wire is rather brittle when twisted badly, and handle it carefully.

Flexible wires, such as telephone leads and lighting flex, also call for care in handling. In the case of baring flex, remove the outer cotton or silk covering and the rubber sheath first. A pair of small scissors are best for this job. Then unwind the inside cotton covering, and the whole number of the flex wires are intact. If a



knife is used, very often a number of strands are cut away. In a wireman's exam. the number of strands are counted by the inspectors to see if any have been cut off.

A Hint on Soldering.

When a piece of flex has been bared, the outer cotton or silk covering tends to fray out. To prevent this bind it for about half an inch with cotton. This will also strengthen the lead at the joint. Another good tip is to bind the leads with cotton where they meet in the case of twin flex or telephone leads. (See Fig. 3.) This will prevent the flex untwisting.

Very often the wires in flex are dirty, and it is difficult to solder them. In this case, untwist the wires from their usual twist and twist them in the opposite direction. This will bring the clean inside wires to the outside, and make a much better soldering job. Never use soldering spirits; use either resin or fluxite.

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GEARY THE TOREADOR.

By HIGHAM BURLAC.

The exploits of the inimitable Geary, exclusively chronicled from time to time in "Popular Wireless," are intended merely to amuse, and if there is a moral to each of these episodes it is just that there can be amusing and lighter phases of wireless without introducing prejudiced derision.

THE popularity of that amiable ass Geary —I think I mentioned before that I love him like a brother—was at high-water mark during his presidency of the local radio club, but it certainly overflowed like a spring tide after the club's first annual outing, complete with four courting couples and the inevitable fair one of uncertain age but quenchless hopes.

We got no further afield in this episode than the famous great sward known for miles around here as One Tree Four Acres, a four-acre field with one tree in one of the acres. Geary had never been nearer to Spain than picking up E G C's weather report or eating those infernal onions, "to keep away the catarrh," as he says. Gosh! When he breathes on an ohm it has no more power of resistance than a mho. Of course, there was that Spanish girl at Ramsgate who—but there!

Well, there was Geary on a push-bike, with apparatus dangling from him like Santa Claus. There was Mrs. Burlac, Mrs. Geary, and Miss Geary, in a pony-cart with a picnic basket, and I on a motor-cycle, with young Bill Geary making intermittent contact with the pillion. Bless my soul, how that boy's jaws did rattle—just like the tapper-back on a coherer. I may mention that I was invited merely because I loaned the club a few trifles such as the pony-cart, the portable frame aerial, the portable receiver, and a crate of beer. Geary is nothing if he is not generous, and I believe he said I was welcome. The other radio bugs hopped on a 'bus, and passed us *en route*. They made rude remarks about Geary pacing the pony—that is, all except the lovebirds, who were assembled in series, in banks of two, beamed over by She of the 45 years.

"Oxo" In Possession.

We arrived at One Tree Four Acres without incident of note, the monotony of the journey being broken only by the dull thud of young Geary hitting the earth every time I took a corner. That boy's inductance was higher than I expected. I'll say this much for Geary, he balanced himself, the frame aerial, and the accumulators on that bicycle like a juggler, and toted his load uncomplainly. He told me afterwards that he calculated he had developed 239 kilowatts power during the run, and only the jingling of the beer bottles in the crate kept him going.

We found the 'bus party staring sadly at the Bull. Four Acres was now populated by one tree and one bull, though the latter seemed to think the tree was *de trop*. He was a rip snorter, a regular Oxo of a brute, and blew through his nostrils in a most truculent fashion, taking practice gallops at the tree like a pugilist doing shadow fighting.

As became a president, Geary at once took charge—by falling off his bicycle. He did not allow for the inertia of the accumulators, and put on the brake a little too abruptly. This gesture cheered us up splendidly. Then he wiped his *pince-nez* and inspected Oxo.

"Calm yourselves, ladies," he said, "it's only a bull."

"Well, if that's all, nip over the fence and put up the aerial," I suggested.

"All in good time, my dear fellow. Suppose we camp here for a snack first. We've a good hour before broadcasting begins. Go and feed the pony, Burlac, and then open the beer. Sit down, ladies."

Geary Enters the "Ring."

As usual, I did all the donkey-work, while Geary made the girls rock with laughter at my expense. We ate and drank amidst the inevitable pleasant concomitants of a meal *al fresco*; I refer to stray dogs, small boys, ants, grasshoppers, and nettles. The bull meditated, the lovebirds cooed softly, and all Nature smiled, with the possible exception of the ants, who were too busy using their faces (if any) with a more piquant effect.

As Geary's nourishment proceeded so his courage rose. By the time he had reached the bottle and a half mark he was daring me to slap the bull on the sternpost, and, finishing the second bottle, he bet me I would not tie a knot in the beggar's rudder. After the third bottle he got over the fence, waved a sandwich at the bull, and called it a broken-winded ruminant. The ladies were delighted and admiring, and chorussed, "Oh, *Mister* Gee-aree!" Oxo went on with his ruminating without even changing his stance.

We set up the aerial and receiver just on Oxo's side of the fence, and disposed ourselves comfortably on the grass, while Geary fussed over the connections.

(Note: A small quantity of British bottled beer mixed with the accumulator acid for "topping" purposes did not appear adversely to affect the well-known chemical action which takes place during the discharge of the battery. There was nothing else to be done. There was no other water within a mile.)

Of course, Geary had forgotten to bring the valves. He is the sort of ass who goes fishing and forgets the bait, the flask, and the matches. Luckily there was an emergency crystal circuit available, but the frame aerial had very little use for it.

A Preliminary Skirmish.

"We must hoist an open aerial," remarked Geary brightly, looking round for applause, while the rest of us looked round for something on which to hoist it. But Four Acres was as flat as a billiard table. With the exception of Oxo, Geary, and that One Tree, there was not a signal excrescence on the face of the earth, and the One Tree was apparently the property of Oxo just then.

"There's a nice tree, Geary," I said. "Show us how they hook up tree aerials in America."

This reference to his recent trip brought Geary smartly up to the mark.

"By the Great Horn Spoon, I'll take a stab at it!" he exclaimed. "Watch my smoke! No walking porterhouse can put it over Aloysius P. Geary. Gimme the wire!"

Vain were the girls' pleadings, vain the grip of Mrs. Geary on his coat-tail. With the wire coiled round him, the intrepid fellow crept towards One Tree.

"Mr. Burlac," quavered his wife, "Aloysius can never climb that tree."

"I think he can," I assured her. "He has every encouragement to do so—or will have," I added, for Oxo was coming out of his trance.

When Geary got within twenty feet of the tree, Oxo took a preliminary breather through his nostrils and stamped a bit, as who should say, "Awake, thou sleeper!" This made Geary pause, and I didn't blame him. Bulls are very downright in their customs. Presently our hero crept forward again, Oxo still quiescent, until he stood at last under the shadow of One Tree. Then Oxo felt that the proprieties had been overstepped, and he turned round, for Geary had instinctively kept aft, and glared at the hapless president, with slightly lowered head. Geary ran astern with both engines (forgive this nautical language, but I have just been to Margate on the "Eagle"), and Oxo snorted once, twice, and again. Geary got One Tree between himself and his bovine friend just as the latter arrived at about sixteen knots.

"Oxo" Vanquished.

Then the dance began. Talk about Maud Allan! Talk about electrons! Geary and Oxo gyrated round One Tree fit to make Sir J. J. Thomson do his calculations all over again. Mrs. Geary's lamentations and the sight of the disconsolate club moved me to action, and as a counter attraction I advanced into the firing-line, and threw all the empty bottles at Oxo. Oxo stopped to sniff at them, and Geary went up the tree like a squirrel. But Oxo was an experienced unit of cattle, and had seen bottles before; but he had never before seen a Geary, so he advanced to the foot of One Tree, and made his dispositions for a siege.

But as despair descended on us, behold Geary drawing from his breast-pocket a shining instrument, behold him bending from his leafy bower, behold Oxo ramping at him. And then, lo, with a bellow of dismay, Oxo was bolting to the most remote acre of Four Acres.

Geary affixed the aerial, using a beer bottle for an insulator. Geary returned to the bosom of his club—and then discovered the valves in his overcoat pocket. Now did you ever hear of such an ass?

The wireless picnic was a huge success. Oxo sulked all the time, even when the loud-speaker got into its stride, and was never the same companionable bull again.

Geary had nearly shifted one of Oxo's eyeballs from its bedplate with a blast from his bicycle pump. As I said, Geary is a born ass, but can be relied upon in an emergency. Guess there's a Geary in every wireless club.

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 Leeds and District Amateur Wireless Society.*

The 33rd general meeting was held on April 20th, at the Woodhouse Lane United Methodist Church School, Leeds, under the chairmanship of the president, A. M. Bage, Esq. At this meeting, Mr. H. F. Yardly, M.I.R.E., was elected a vice-president of the society, and G. P. Kendall, Esq., B.Sc., was elected the first honorary member of the society, in recognition of greatly appreciated services he has rendered continuously to the society since its inauguration in January, 1921. Mr. Yardley read a letter from Capt. Eckersley of the B.B.Co., Ltd., relative to the proposed broadcast relay station at Sheffield. Mr. A. F. Carter, A.M.I.E.E., at the invitation of the committee, accepted the vacant position in their number, and will forthwith act as committee member. The headquarters of the society were transferred from the Grammar School to the above address, all further meetings of the society to be held at the new address in accordance with the syllabus. Mr. T. Brown Thomson lectured upon "Detectors, Ancient and Modern." The lecturer examined practically every type of detector that had up to the present had any following in the radio world. The coherer and magnetic detectors were described after the Hertz "spark ball" detecting device had been analysed. The electrolytic and thermal detectors were then considered, the crystal detecting circuit being then discussed. The thermionic or valve detector was the next type put before the meeting, Mr. Thomson concluding his remarks with a statement to the effect that he intended to endeavour to solve the loud-speaker problem by free use of his sciatic nerve, as suggested by the frog's-leg detector. The discussion which followed was heartily supported, the magnetic and electrolytic detectors receiving close attention.

Hon. sec., D. E. Pottigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

The Radio Society of Highgate.*

The fifth lecture of a special series of elementary lectures on the theory of wireless reception was given on Friday, April 27th, by Mr. H. Andrewes, B.Sc., A.C.G.I. Mr. Andrewes said that a single-valve set without reaction was very little better than a crystal, and in many cases such a set is sheer waste of good "juice." If reaction or regeneration is used, however, the valve becomes a very much more sensitive detector than a crystal. The theory of reaction was fully dealt with, and an explanation given of how a valve can be used for the reception of continuous waves. The cause of and cure for "howling" was explained, and brief mention was made of how reaction is made use of in the Armstrong super-regenerative receiver. Wavemeters and separate heterodynes were then described, and the method of using and calibrating such instruments was given.

Hon. sec., J. F. Stanley, B.Sc., A.C.G.I., F.R.A., 49, Cholmeley Park, Highgate, N.6.

Walton-on-Thames and District Amateur Radio Society.

At a meeting of the newly-formed Walton and District Radio Society, held at the Council Rooms, Walton-on-Thames, at which Mr. F. W. Chambers presided, a highly interesting and successful lecture was given by the well-known radio expert, Mr. Oswold J. Carpenter, A.M.I.R.E. Mr. Carpenter, who is the chief research engineer of the Marconi Scientific Instruments, Ltd., explained to an appreciative audience the principles of the science of radio telegraphy and telephony in such lucid and simple language that even the most non-technical of his hearers must have obtained such a clear grasp of the subject as will assist them greatly in its study from a more scientific aspect. The lecturer demonstrated his remarks by lantern slides and the reception of selections from the 2 L O broadcasting programme on a five-valve receiving set brought down by him for the purpose.

Membership of the society is open to ladies, of whom a large number were present at the lecture.

Hon. sec., Mr. S. W. Blanchflower, "Norwood," Churchfield Road, Walton-on-Thames.

Bethnal Green and District Radio Society.

A meeting of the above society was held at the Men's Institute, Wolverley Street, Bethnal Green Road, E.2, on Tuesday, April 17th.

Mr. J. H. Reeves, M.A., delivered a lecture on "Amplification by Valves." After describing most clearly the action of a valve, the lecturer went on to give some very valuable hints on the design and construction of home-made sets.

He emphasised the importance of choosing the right valve for the grid leak, and suggested a leak consisting of two terminals on ebonite, joined by a pencil-line which could be adjusted while the set was in operation, by the application of a lead pencil. He sketched a simple valve panel where the wiring was so arranged as to have as few crossings as possible, thus securing the maximum of efficiency. Mr. Reeves then discussed in detail the best methods of H.F. amplification.

A vote of thanks to Mr. Reeves was carried with great enthusiasm.

Hon. sec., Mr. S. A. Dennison, Men's Institute, Bethnal Green Road, E.2.

The Redhill and Reigate Radio Society.

On Thursday, April 19th, Mr. H. G. White, A.M.I.E.E., gave an interesting lecture on "An Experimenter's Ideal Unit System," to a large and attentive gathering of members. The speaker described a unit system of his own design which enables comparative tests to be made of all the various methods of aerial tuning circuits and intervalve couplings, without altering the internal circuits of the instruments, and without the usual complications of change-over switches, etc. He also discussed the various combinations of circuits obtainable, together with remarks upon their relative degree of selectivity and sensitiveness.

At the close of the lecture various questions were asked and dealt with by the lecturer.

Hon. sec., Mr. Chas. W. Johnson, 111, Station Road, Redhill.

The Stoke-on-Trent Wireless and Experimental Society.*

An interesting discussion on "Reaction, Its Use and Abuse," opened by Messrs F. J. Goodson, B.Sc., and F. T. Jones, took place at a meeting of the Stoke-on-Trent Wireless and Experimental Society on May 10th. Mr. Goodson first dealt with re-radiation, what it is, and how it is caused, and Mr. Jones dealt with its detection and prevention.

To detect re-radiation, touch the aerial terminal with a damp finger, and if this produces a twang, or a more or less musical note in the 'phones, it shows that the set is re-radiating. If only a click is produced, this is due to capacity effects, and not to re-radiation. The best method of detecting re-radiation is to employ another receiving set some distance away.

Several members disagreed with Mr. Jones as to the non-radiating properties of the tuned anode circuit, and instances were cited in which such circuits were found to be re-radiating seriously, although the reaction coil was coupled to the anode coil, and the aerial coil was separated from the reaction coil be several feet.

Hon. sec., F. J. Goodson, B Sc., G.I.Mech.E., Tontine Square, Hanley.

The Kensington Radio Society.*

At the May meeting of the above society Mr. W. J. Henderson gave a lecture on the various types of "B.B.C." one, two, and three-valve receivers. After the main differences had been explained he demonstrated the instruments on the club aerials. The contrasts between the single-valve detector followed by low-frequency magnification and the more sensitive but more intricate arrangement of one high-frequency amplifier followed by detector and low-frequency magnifier, were most instructive. Several members joined in the discussion concerning the effects of self-capacity and self-oscillation in such circuits, and the various methods to control them.

At the next meeting Mr. Voight will lecture on Dual Amplification Circuits and Crystal Rectifiers.

The secretary will welcome all wishing to become members.

Hon. sec., Mr. J. Murchie, 2, Sterndale Road, W.14.

South Shields and District Radio Club.*

On Friday, April 20th, a lecture on "Directive Transmission and Reception and Their Value" was delivered by Mr. R. Oliver.

Proceeding from a brief description of the usual forms of inverted "L" and "T" type aerials, which, he stated, were only slightly directional, the lecturer went on to describe aerial systems of stations such as Leafield, Cairo, etc., which were true types of directional aerials, in which little added capacity or inductance were inserted, the aerial itself being of the required wave-length. Mr. Oliver incidentally mentioned that the familiar method of explaining the radiation from an aerial by comparison with the dropping of a stone into a pond was not, in the case of ordinary aerials, correct, and that radiation from such aerials was always partly directional. The lecturer then proceeded to describe methods of duplex working, and their advantages both with regard to non-interference with nearby stations, and operation in conjunction with particular stations.

Hon. sec., Mr. J. A. Smith, 66, Salmon Street, South Shields.

Hackney and District Radio Society.*

On Thursday, May 10th, a special lecture was delivered to the society, at its headquarters at the Y.M.C.A., Mare Street, Hackney, by L. L. Robinson, Esq., M.Inst.C.E., M.I.E.E., M.I.Mech.E., who is Chief Electrical Engineer for the Borough of Hackney. The meeting was presided over by the Mayor of Hackney, the president of the society.

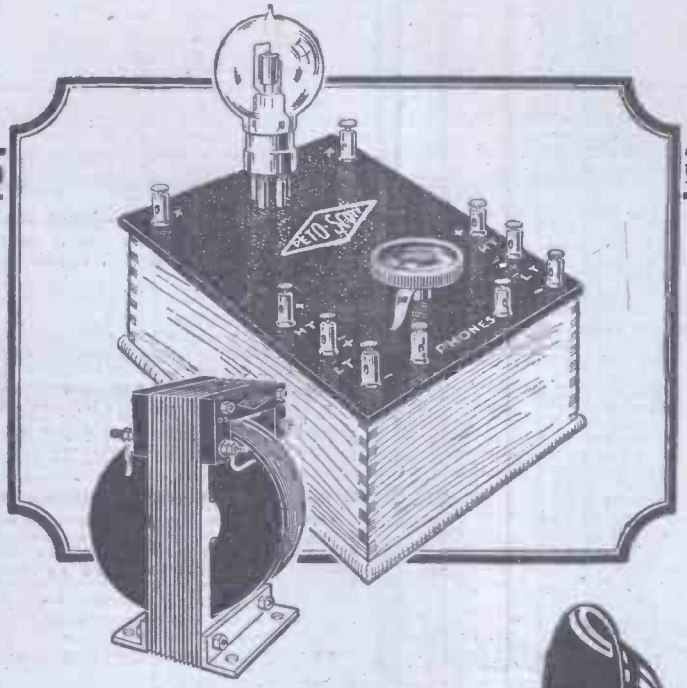
Mr. Robinson spoke on "Electric Currents, Minute and Large," and stated that it was rather interesting to consider the difference between the sort of current he had to deal with in his daily life and the currents used in radio. His electricity depot sent out A.C. at a frequency of 50 cycles per second, so that the wave-length of his current was equal to 6,000,000 metres, compared with wave-lengths of 369 metres sent out by 2 L O, 2,600 metres by Paris, and up to 30,000 by the great commercial stations.

Mr. Robinson went on to deal with the phenomenal and physical principles of the currents used, with especial reference to wireless, a subject in which he had only recently become keenly intersted, and to which a great deal of his spare time was now devoted.

After his lecture he replied to quite a number of questions, and the meeting closed with a very hearty vote of thanks to him and to the Mayor.

Hon. Sec., C. C. Phillips, 247, Evering Road, E.5.

No. 3 of a series of interesting talks on Peto-Scott Units.



The L.F. Amplifier

—converts whispers into living voices

THE real test of any Receiving Set comes when it is put to work a Loud Speaker. Here the Low Frequency Amplifying portion of it comes into full play, and upon the efficiency of its design depends not only the quantity but the *quality* of its tone.

Remember that more than half the distortion noticeable when a Loud Speaker is used comes from the Set itself, and not from the Loud Speaker.

This distortion can be brought about in two ways. Firstly, by placing the Transformers too closely together. In the Peto-Scott Unit System this is impossible, owing to the actual position of the Transformers within the Units. Secondly, by the design of the L.F. Transformers themselves.

The Transformer used in every Peto-Scott L.F. Unit is the well-known and well-proved MAX-AMP. This Transformer—sturdily constructed of the finest materials and wound on closed Stalloy laminated core—is a masterpiece of efficiency. While others are wound with a minimum of wire to save expense, the MAX-AMP carries the greatest number of turns it is possible to use and still retain the correct scientific ratio.

Remember these two points: each MAX-AMP is guaranteed to withstand 500 volts between windings, and each one is actually tested on a working circuit before being passed for issue.

The Unit shown above is No. 5 of the series—the remainder being shown below. If you would know more of this cleverly designed System of Radio Units—the only method whereby the man of moderate means can commence with one Valve and add others at the minimum of expense—send 6d. for a copy of "Radio," a 24-page Booklet describing the whole System and showing exactly how each Unit can be built at home.

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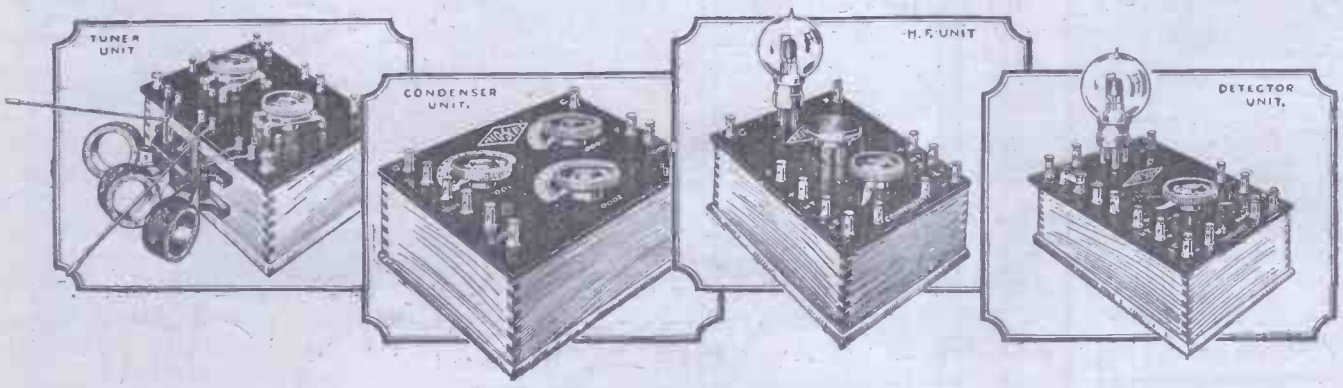


RADIOTORIAL.

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

On May 29th our new companion paper, "Wireless Review and Science Weekly," will be on sale, price 3d.

For some time past I have felt sure that a "companion" to "Popular Wireless" would be welcome, as it is impossible to treat very exhaustively in "Popular Wireless" all the numerous and fascinating wireless and science articles sent in for publication. The inclusion of popular science in the new paper will, I hope, please readers. There is certainly an immense scope in this direction, and the new paper will take advantage of it.

Sir Oliver Lodge will act as Scientific Adviser-in-Chief. And in Number One there will be a host of fine articles, besides the offer of £1,000 in prizes. I sincerely hope all constant readers of "Popular Wireless" will purchase a copy of our new companion. My endeavour has been to make "Wireless Review" and "Popular Wireless" THE TWO indispensable radio papers. A copy of each paper constitutes a complete survey of wireless progress week by week, and you will not need any other wireless paper.

THE EDITOR.

Questions Answered

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

Readers are requested to send the necessary postage for reply.

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.

"QUERY" (Hackney).—What is the velocity of wireless waves? How many watts make one horse-power? What do you mean by a coupling?

The velocity of wireless waves is 186,000 miles per second. There are 746 watts to one horse-power. A coupling is a magnetic or electrostatic connection between two circuits for the purpose of transferring energy from one circuit to the other.

* * *

F. N. (High Wycombe).—What is my maximum wave-length with 200 turns on a former 4½ in. diameter, using 24 gauge wire? Shall I be able to get London broadcasting from here on one valve?

Your maximum wave-length is 1,490 metres. A table giving wave-lengths of single-layer tuning coils wound with enamelled wire was given in P.W. No. 45. You are not likely to bring in 2 L O well without reaction at this range. An H.F. amplifier with inter-valve reaction would very greatly increase your range of reception

* * *

D. E. Y. (Clapham).—I often see the letters E.M.F. in print. What do they mean?

E.M.F. stands for electro-motive force. It is the force which is necessary to produce an electric current, and upon the value of which depends the amount of current (measured in amperes) flowing in any particular circuit. The electro-motive force is measured in volts.

* * *

G. B. C. (Wandsworth).—In a valve receiving circuit with reactance and a certain plate voltage I understand that the local oscillation generated must have a definite strength. Can these local oscillations be increased in strength up to a certain limit, and what benefit or otherwise would result?

For self-heterodyne reception the reaction coupling must be properly proportioned. If the local oscillations are too strong they will wipe out the incoming oscillations altogether. By arranging a variable reaction coupling the signal strength can be adjusted up to a maximum.

* * *

"SHIPS" (Southampton).—What size frame aerial do I need to receive the Morse signals sent out by ships? What are the call signals of the Aquitania, Mauretania, Celtic?

Use ten turns of No. 24 D.C.C. on a 4 ft. frame. The call letters of the Aquitania are M S V, the Mauretania M G D, and the Celtic M L C. You will find that the frame will have to be rotated before the maximum results can be obtained, owing to its directional properties.

* * *

J. E. J. (Southampton).—Does the use of a reaction coil increase the wave-length range of an A.T.I.? Is it correct that transformer coupled circuits are more satisfactory than resistance coupled valve circuits for short waves?

The use of a reaction coil will increase the wave-length range of an A.T.I. by virtue of the mutual inductance that will exist between the two coils, but as the coupling between the coils will be, or at least should be, fairly loose, the increase will not be very great.

The transformer coupled circuits are more satisfactory on the lower wave-lengths. Resistance coupling will give very good results on the higher waves, though the transformer type can be used for any wave-length if desired, providing the transformer is suitable. Different windings are required for different ranges of wave-lengths, unless an aperiodic transformer is employed.

* * *

W. W. S. (Enfield).—I intend using my low resistance 'phones (150) with a transformer, and as I have only got a crystal set I am not sure if this is practicable. Please give me number of turns, etc., for the transformer.

The 'phones will work quite well with the transformer. The core must be of soft iron about ½ in. by 3 in. For the primary winding you will need about 15,000 turns of 42 or 44 s.w.g. and for the secondary 1,800 turns of 38 s.w.g. It is a very tedious undertaking, however, and we do not advise an amateur to try it, unless he feels sure he can wind the coils evenly, as a great deal depends upon the efficiency of the windings.

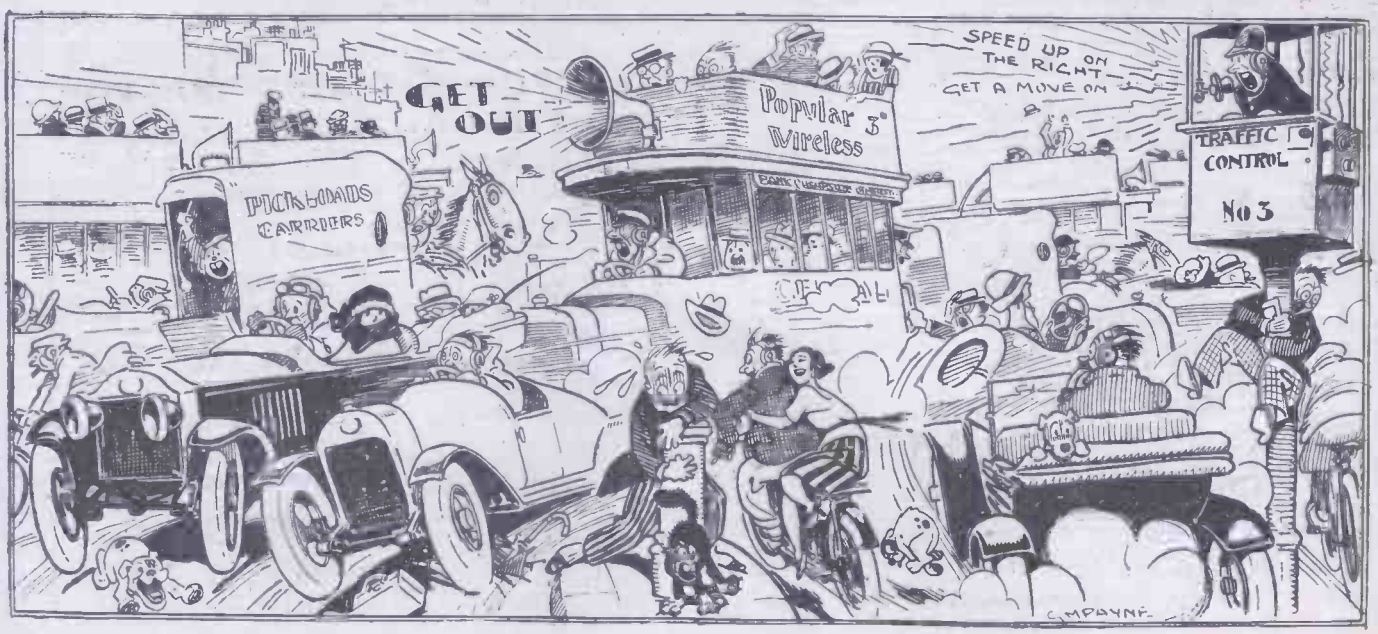
* * *

T. C. L. (Loughborough).—Why is it that the zinc dissolves away in a Daniell cell unless it is amalgamated, even though no current is flowing?

The cause of this dissolving of the zinc is due to what is known as local action. The zinc used is usually of the commercial type and very often contains a comparatively large percentage of impurities, mostly iron and arsenic in very small particles all over the surface of the zinc. Now if there is a small particle of iron on the surface of the zinc and this comes into direct contact with the acid in the solution the iron will act as one "plate" of a primary battery, while the zinc is the other plate. Thus a difference of potential will be set up and a current will flow from the zinc through the acid to the iron. This will mean that the zinc will gradually be eaten into and will eventually dissolve away. If this kind of action is taking place all over the zinc it will not be long before the whole zinc sheet has dissolved, and the plate would have to be renewed. To prevent this

(*Continued on page 572.*)

WIRELESS SPEEDING UP THE TRAFFIC IN THE STRAND.



RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 570.)

local action the zinc is amalgamated with mercury, which forms a coating over the zinc but not over the iron, so that the iron is separated from the rest of the plate and will quickly disappear when the cell is put into operation. The action of the current upon the zinc will of course gradually dissolve it, but the mercury will then unite with the next layer of zinc and so keep it amalgamated and prevent any local action taking place. It is by this means that the zinc is kept from dissolving when the cell is not in use.

* * *

"Fan" (West Ealing).—What is the best way to find the capacity of a variable condenser without the use of any really complicated formula? I should be obliged if you would work out an example.

The capacity of a condenser per square centimetre of effective plate area = 0·0000000884 mfd. for a plate spacing of one millimetre. Hence to find the capacity of any condenser, this figure should be multiplied by the plate area in square centimetres, and divided by the plate spacing expressed in millimetres and fractions of a millimetre. Thus, for example, the capacity of a variable condenser having a plate area of 1,000 sq. centimetres and a spacing betweeen the plates of half a millimetre

$$= \frac{0{\cdot}0000000884 \times 1000 \text{ mfd.}}{\frac{1}{2}}$$

$$= 0{\cdot}001768 \text{ mfd.}$$

* * *

L. N. (Great Missenden).—Am I likely to get Paris and Nauen time signals on a crystal set, if I have a suitably wound inductance? Do they send the signals very quickly, and is a knowledge of the code necessary to understand these signals? Paris sends out at 10.45, I believe, and Nauen at 11.55 morning and night. Is this correct? How are they sent? I am using Hertzite.

You should get Paris time signals all right, but it is doubtful whether you will manage Nauen. The signals are sent very slowly, and if you know the difference between a dash and a dot, you should understand them easily. The times you give are O K, but they are Greenwich Mean Time and not British Summer Time. From Paris the signals begin at 10.43 when "Wait" is signalled, – . – . . . several times in succession. At 10.44 "19 dashes" followed by a "dot" at 10.45 exactly. After a minute's pause at 10.46 "14 D's" – . . are sent with another "dot" at 10.47. Another minute's pause, commencing at 10.48 "11 6's" – . . . . followed by a "dot" again at exactly 10.49. This concludes the signal, and is finished up with the call sign "FL" and "End of Work" . . . – . –. The signal is somewhat similar at Nauen, but starts at 11.55 with the letter "V" . . . – in succession. At 11.56 call – . – . –, followed by the call sign "POZ." Commencing at 11.57 seven "x's" – . . – followed by three dashes," the last dash being at 11.58, then five "N's" – . followed by three "dashes," the last at 11.59, then five "G's," ending with three more dashes, the last at 12.00.

* * *

D. C. M. (Essex).—I have direct current lighting, and wish to charge my accumulator off the mains, regulating the charging rate by the insertion of lamps between the accumulator and the mains. How do I find out how many lamps I need?

In the first place, the current required depends upon the charging rate of your accumulator, and this is regulated by the insertion of suitable lamps or "banks" of lamps in series with the mains, so that only the required current shall pass. In order to find out what arrangement of lamps is necessary, you must pick on the lamp you are going to use, and then work out how much current it will pass. For instance, the best lamp to use is the carbon filament type, because this class of lamp passes more current than the metal filament type. You want to choose a lamp of the same voltage as your mains, and rated at about 32 candle-power. The current that this lamp will pass is determined by the following formula.

V A (watts supplied) = c.p. times rating for this type of lamp. In this case the lamp will rate from 3·5 to 4 watts per c.p., so that V A = 32 × 4 = 128 watts.

Now the current that this lamp will pass is found by

$$\text{A (amperes)} = \frac{\text{V A}}{\text{V}} \quad \text{where V} = \text{volts.} = \text{voltage of mains.}$$

$$\therefore \text{A} = \frac{\text{V A}}{\text{V}} = \frac{128}{220} = \text{·56 amp.}$$

Now we find that one lamp passes ·56 amp. and for the sake of example, let us say we wish to charge at a 3 amp. rate. One lamp in series with the mains will only give us ·56, and if we place two together in series with one another, we shall have still less, so that evidently we must arrange the lamps in parallel so that though each lamp only passes ·56 amp., the whole "bank" will pass somewhere about 3 amp. Two in parallel will give ·56 × 2 = 1·12 amp.: but we need nearly 3 times that amount. Five lamps will give us ·56 × 5 = 2·80 amp. which is just below the maximum charging rate of our accumulator. It is better to be below the given rate than above it, and so if we use 5 lamps in parallel with one another, but the "bank," or collection of them in series with the accumulator and the mains, we shall be able to charge the battery at a convenient and safe rate. The formula given above holds good for any kind of carbon lamp and any voltage of D.C. main, provided that the lamp and main voltages are the same or thereabouts, and that the wattage of the lamp is taken as 4 watts per c.p.

* * *

C. V. (Bradford).—Why, with tapped anode reactance, is it often possible to get best results when the switch arm is making contact with two studs at once? How can I eliminate a humming noise caused by near-by electrical machinery?

With a tapped anode reactance which is self-tuned, the natural period of the winding is not usually the same as that of the signal. Moving the switch arm so that two studs are touched simultaneously brings the wave-length of the coil more nearly equal to that of the signal. If the coil were tuned with a variable condenser, it would not be found that better results were obtainable by bridging two studs. (2) It is a difficult matter to stop these noises. Try shielding the set, and make the earth lead as short as possible, and see that it makes good contact with the ground. Failing this, try a capacity earth. A frame aerial also minimises this trouble.

* * *

"Koyl" (Southgate).—If I double the number of turns of wire on my coil, do I double the wave-length range?

You more than double your wave-length as the inductance of a coil is proportional to the square of the number of turns. By doubling the number the magnetic field is doubled, and this latter will, when the circuit is stopped or started, cut the windings, which are twice as many as before and thus generate four times the electro-motive force, because the E.M.F. is directly proportional to the turns and the strength of the magnetic field. It must be understood that this is an opposing E.M.F. generally termed "back E.M.F." It will not mean that the wave-length range is quadrupled as the induction and capacity of the aerial must be taken into calculation.

* * *

"Micro" (Brixton).—How do you find the capacity of fixed condensers?

The capacity of fixed condensers is determined by the formula:

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

when K represents the capacity of the condenser in mfd., a the effective area of one set of plates in square centimetres, t the distance between plates, and k the specific inductive capacity of the dielectric between them. In the case of air k = 1: for paraffin paper k = 2: for mica k = approximately 5, depending on quality. This formula is reasonably accurate for all ordinary forms of condensers used in wireless receiving circuits—i.e. condensers in which the thickness of the dielectric t is small compared with the area of the plates. In such cases the effective area A used in the above formula is the total area of one set of plates which is opposed by plates connected to the other terminal of condenser.

* * *

"Super" (Tottenham).—With reference to the super-crystal set in Popular Wireless No. 38, I have constructed the set, but am at a loss to discover what the terminals sec. (for VT) are for. Also where does the other connection of the variable condenser go?

The terminals sec. (VT) are for the addition of a detector valve, thus cutting out the crystal if wanted. If the valve is not used, no leads are taken from these terminals. The other terminal of the variable condenser goes to the side of the crystal detector connected to the secondary coil.

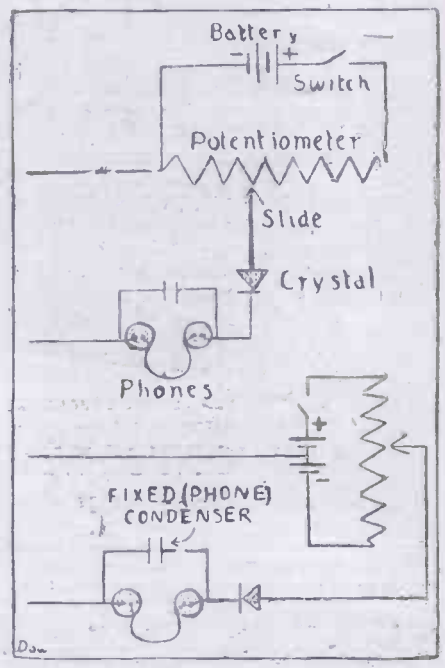
* * *

S. N. (Bridlington).—My accumulators often stand idle for some time, and I should like to know if this harms them at all.

If the cell is out of use it should be given a charge at least once every two months. Charging should be continued until all the cells have gassed freely for about five hours. The plates should be kept covered with liquid by topping up with water when required. Should the battery be put away for a long time, it is advisable to empty out the acid and leave the cells dry. Before doing this the cells should be charged fully, and then the acid emptied out and the cells rinsed out well with clean water and left to dry. When putting the battery into use again, it should be filled up with acid of specific gravity 1·25, and given a long charge, which should be continued until the cells have gassed for about six hours.

* * *

"Potens" (Banbury).—I am at present using Hertzite, but intend changing this for carborundum. Is a potentiometer necessary, and how is this fixed?



See diagram above. Two methods are shown, the lower allowing for a variation of potential through the detector in either direction. We prefer this latter arrangement in spite of the fact that two batteries are needed, as it prevents any necessity for changing leads over. When the set is not in use, the switch must be set open, otherwise the battery will slowly run down. The potentiometer should have a resistance of about 400 ohms, and the battery can be of the ordinary flash-lamp type—viz., 4½ volts. A steel contact should be used.

* * *

"Kapasity" (Wycombe).—I have been told that if I wished to decrease the wave-length of my aerial I should connect a condenser of small capacity in series with it, and also that the smaller the condenser the more decrease in wave-length will be obtained. Is this all correct?

This is quite correct. You probably know that a capacity in a series decreases the capacity of the aerial, and also that to add a condenser in series with another condenser will decrease the capacity of the circuit. This is shown, and the actual values obtained can be worked out by the formula

$$\frac{1}{\text{K}} = \frac{1}{\text{K}_1} + \frac{1}{\text{K}_2} + \frac{1}{\text{K}_3} + \frac{1}{\text{K}_4} + \text{etc.}$$

where K is the resultant capacity and K_1, K_2, etc., are the respective capacities of the various condensers connected in series. For the sake of argument, suppose that the capacity of your aerial is 2 mfd.—although really it is much less—and that you are adding a capacity of 3 mfd. in series with it. The resultant K is found by the above formula; so we have $\frac{1}{\text{K}} = \frac{1}{2} + \frac{1}{3} = \frac{5}{6}$; therefore $\text{K} = \frac{6}{5} = 1\frac{1}{5}$ mfd., which is less than that of the original aerial. But if we add a smaller capacity to the aerial we shall find the capacity of the aerial is still further reduced. Using a capacity of 1 mfd. we have $\text{K} = \frac{1}{2} + \frac{1}{1} = \frac{3}{2}$ so that $\text{K} = \frac{2}{3}$, which is less than 1½. Thus it is seen that the smaller the capacity in series with another capacity, the smaller is the resultant capacity. Now, if we decrease the capacity of an aerial we decrease its wave-length, so therefore, by adding a small capacity we decrease the wave-length of the aerial by a larger amount than if we added a large capacity in series with the aerial.

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RECENT WIRELESS INVENTIONS.

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

Grant of the following Patents can be opposed and printed copies of the full specifications purchased.

194,763. — **J. MARSCHALL.**— **ALARMS.**— An interesting application of the thermionic valve is its use in this patent to operate a fire or burglar alarm. The grid is connected through a high-tension battery to a safe, and the filament is earthed. The anode circuit includes a relay for operating an alarm. On a rise of temperature, or on a burglar approaching or touching the safe, the capacity or resistance of the grid circuit is altered, thereby reducing the anode current and allowing the relay to operate, thus sounding the alarm.

194,883.—**C. S. GOODE.**—**VALVES.**— In a valve having three vertical parallel electrodes, means such as a magnet are rotatably mounted upon the bulb so as to provide an adjustable magnetic field for controlling the current in the valve. A horse-shoe magnet may be pivoted on the pip of the bulb, the ends being level with the middle of the electrode.

N/R

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N/R