

No. 32. 2 L O's "HELLO MAN."

POPULAR PW WIRELESS Weekly

3d

No. 32. Vol. 2.
Jan. 6, 1923.



H.R.H. The Prince of Wales listening to a Radio Concert at Devonshire House.

SPECIAL FEATURES.

Wired Wireless.
 How My Set Grew Up.
 How to Make a Micrometer Gauge.

Notes on the Sheffield Ether.
 An Accumulator Charging Board.
 A Visit to Croydon Wireless Station.

LONDON BROADCASTING RECEIVED 40 MILES AWAY ON A 50-FOOT INDOOR AERIAL

WITH OUR

G.P.O. Regd. **HESTAVOX II.** No. 2005.

2-Valve Broadcast Receiver.

Messrs. Tily and Brown, Ltd., 185-6, High Street, Guildford, and 7, Castle Street, Farnham, who have since accepted the Sole Agency for our Apparatus in the Guildford and Farnham Districts, sent us the following letter:

TILY & BROWN, LTD.,
185-186, High Street,
Guildford, and at
Farnham.
1/12/22

Gentlemen,—

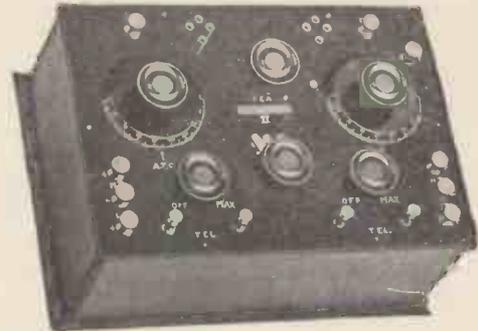
We feel that a word or two from us as to the performance of the Hestavox II is due to you. After exhaustive tests we find that the above set is excellent in all ways. Marconi House (2 L O), the Broadcasting Station covering this district (West Surrey) is picked up perfectly without any trouble both on usual 100 ft. outside Aerial and also on 50 ft. of wire indoors.

On occasions, other stations, 2 W P and 2 Z Y (Birmingham and Manchester) have been heard, but for a Broadcast Receiver your instrument is all that can be desired both as regards finish and performance.—

We remain, gentlemen,
Yours faithfully,
TILY & BROWN, LTD.,
pp. F. A. LOVE

READ THIS
LETTER
JUDGE ITS
MERITS FOR
YOURSELF

PRICE
(excluding accessories),
£12 - 7 - 6
(including all accessories),
£19 - 16 - 0



Among other Agents who are also demonstrating these sets, are:—

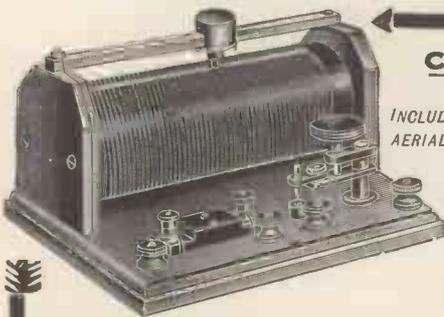
G. D. HINKS, Hardington, Yeovil. THE CELANDO CO., 87, Castle St., Reading.
C. FLEET, 13, Bessboro' Rd., Harrow-on-the-Hill. THE SUFFOLK WIRELESS SUPPLY,
4, Constable Rd., Nr. Felixstowe.

A NUMBER OF DISTRICT AGENCIES STILL OPEN. LOOSE LEAF CATALOGUES, Post free, 6d.

THE "HESTIA" ENGINEERING COMPANY,
32, Palmerston Road, Acton, London, W.3.

Showrooms open
9 a.m. — 6 p.m.
Telephone 1
Chiswick 586.

1 min. South Acton Sta. (N.L. or District Rlys.)



COMPLETE
FOR
INCLUDING
AERIAL AND
ONE
PAIR
OF
"MITCHELLPHONES."

50/-

Tested and
Guaranteed.

FOR LONDON, BIRMINGHAM, & MANCHESTER.

A Handsome Receiving Set, tuning up to 1,000 Metres, at a very sensible price that will appeal to intending purchasers.

Without doubt the finest value for the money, and is sold under our usual unconditional guarantee.

The price covers one pair of the famous Mitchellphones and aerial material for 100 feet, postage paid to your door. Immediate delivery can be effected, and you can easily instal the whole outfit by following the book, which is included, in time for your Christmas Holiday.

Dimensions:

9 ins. x 6 ins. x 5½ ins. high.

MITCHELLS ELECTRICAL AND WIRELESS Ltd., 188, Rye Lane, Peckham, S.E.15

POSTAL ADDRESS: McDermott Road, Peckham, London, S.E.15.
WEST END BRANCH: 2, Gerrard Place, London, W.1.

Read This:—
Unsolicited original can be inspected.

Surrey, Oct. 22, 1922.

Dear Sirs,
I am writing this to assure you of the efficiency of your Wireless Outfit. On Tuesday last I heard the Writtle Concert, although it is advertised to have only a 25 mile radius for speech.

I am
yours truly,
R.

BROWN'S



HEADPHONES

BRITISH
AND BEST

THE FINEST
HEADPHONES
PROCURABLE for

30/-

This price is for one pair of either 120 or 4000 ohm phones including cords of good quality.

Catalogue, post free, gives you details of our Wireless Headphones, Loud Speakers, and Amplifiers



Type F "Featherweight," Actual weight, including cords, is 6 oz. only

All our apparatus can be obtained of all Wireless Dealers.

S. G. BROWN, L^{TD.}

London Showrooms:

19, MORTIMER STREET, LONDON, W.1

Head Office and Works: Victoria Road, North Acton, W.3

NEXT WEEK.

"MY ORCHESTRA OF AUDIONS."

By Dr. LEE DE FOREST.

This is an article which will appeal to all. It is not unduly technical, and tells in an interesting manner some fascinating experiments made by the great scientist who perfected the modern valve.

Popular Wireless

TOPICAL NEWS AND NOTES.

NEXT WEEK.

THE MYSTERIOUS PLIODYNATRON.

A PAGE OF IDEAS FOR AMATEURS.

NOTES ON THE LONDON ETHER.

THE ELIMINATION OF "JAMMING."

SOME FAMOUS WIRELESS PATENTS.

Radio Sermons?

AN innovation in church concerts was made at St. Thomas's schoolroom, Hull, recently, when, with the aid of wireless, a large company heard some of the concert broadcasting by a British company.

Rev. G. J. Jordan, the vicar, expressed the hope that people would not stay away from church to hear broadcasting sermons.

Empire Press Union and-Radio.

A DEPUTATION representing the Empire Press Union will wait upon the Postmaster-General early in January to urge the necessity for a declaration of policy which will provide within a reasonable period an adequate system of wireless telegraphy for the British Empire. The deputation will be introduced by Viscount Burnham, president of the Empire Press Union.



Mr. McLellan, an engineer of the Marconi Co., who has been charged with the erection of the World's biggest wireless station in South Africa.

The City Accumulator Co.

I UNDERSTAND that the tender of the City Accumulator Co. for the purchase of the complete wireless stores and equipment of the Woolwich and Kidbrooke army and R.A.F. bases has been accepted by the Disposals Board. This must constitute a record deal in ex-service wireless apparatus.

The Newcastle Station.

WITH the object of opening a permanent establishment of the Marconi Wireless Telegraph Company in Newcastle, Captain G. Rolland Willans, manager of the Marconiphone Department, is at present visiting the city.

The company has opened temporary offices at 7, Collingwood Street, Newcastle, and Mr. E. G. Hake has been installed as district manager, the office being the centre for the four Northern Counties and North Yorkshire.

The aim of the depôt is to give full technical service and advice in order to ensure that the full benefit of broadcasting may be obtained by "listeners-in." The company

will be glad to give information to anybody who is interested in the development of wireless broadcasting, and who cares to write or call.

Newcastle is now transmitting every evening, from 6 to 10 p.m., on a wavelength of 400 metres.

Another Crystal Feat.

THE reception of the Birmingham broadcasted telephony in Bristol, a distance of 80 miles, on a crystal set certainly constitutes at least a minor record. Mr. H. J. Bartlett, who regularly accomplishes this feat, has sent me a few details of the set employed. His aerial is a 60 ft. twin with an average height of 36 feet. The inductance coil is wound with 120 turns of 26 S.W.G. and is tapped for rough and fine tuning to 22 studs. The crystal is silicon, and 8000 ohm phones are used. He employs a .0005 mfd. variable condenser in parallel with the coil to obtain fine tuning. Mr. Bartlett is to be congratulated upon the fact that he is evidently obtaining exceptional results with his set.

2 L O and Christmas.

I THINK most readers of POPULAR WIRELESS who listened-in to 2 L O over the Christmas holidays will agree that the programmes were first-rate.

Miss José Collins, Miss Edna Best, Mr. W. H. Berry, the Rev. J. A. Mayo, the Wireless Orchestra—were but a few of the attractions offered. The True Story of Father Christmas was probably the most thrilling thing any kiddie has ever listened to, especially when Mr. Burrows announced that the old gentleman had started off in his aeroplane with seven tons of toys!

Mr. Burrows—and Welcome!

"HERE'S Mr. Burrows!" cried a lady friend of mine the other night as the "Hello Man's" pleasant voice tickled the ether; and a local wit who was present murmured, "and welcome." Of course, it's a poor joke—but the poor chap meant well.

The Wireless Orchestra.

I WAS thinking the other night that the addition of a cornet to the Wireless Orchestra would make a great improvement. Excellent as the orchestra is, the effort would be even better still if a little more balance could be given to it by the sonority of a cornet.

Two Good Speakers.

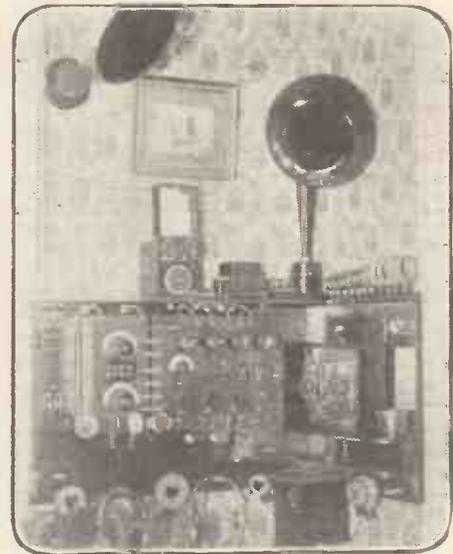
THE Reverend J. A. Mayo and Captain Towse, the blind V.C., are to be congratulated on possessing good radio voices. On a loud speaker they both came through

with great clarity. Both enunciated their words carefully, and not too quickly. The Reverend Mayo, especially, was excellently received.

Major Phillips at the Alhambra Theatre.

MAJOR RAYMOND PHILLIPS, I.O.M., who recently contributed a series of articles on Wireless Control to POPULAR WIRELESS, has been engaged by Sir Oswald Stoll to give a series of demonstrations at the Alhambra Theatre, London, for one week.

Major Phillips will introduce his famous wireless controlled airship as an aerial mail, as recently exhibited at the Radio Convention at the Central Hall. During its flight round the auditorium at each performance, numbered coupons will be released from the airship by wireless, and the holder of a winning coupon will be presented with a Broadcast receiver free of charge. Major Phillips will introduce several other radio novelties, and readers of POPULAR WIRELESS should not fail to see his fascinating experiments.



Mr A. E. Spiller's set, 23, Setton Park Rd., Ashley Down, Bristol.

Photos by Wireless.

A GREAT improvement in the method of transmitting photographs by wireless is announced by the "Daily Mail." Since 1908, Mr. T. Thorne Baker, a pioneer worker in radio-photography, has been experimenting with the end in view of perfecting photo transmission. Full details are not yet available, but it is stated that his improvements have revolutionised photo-transmission by wireless.

The Trans-Atlantic Tests.

THE Eiffel Tower recently gave out the latest results of the transatlantic wireless competition, showing that during the night of December 15th-16th the British amateurs far out-distanced the French wireless enthusiasts.

The total number of American calls recorded by French amateurs on the following night was 24. During the night of December 17th-18th 27 American amateurs were heard by one listener in Switzerland, and nine different French amateurs heard 41 Americans on December 18th-19th.

* * *

Bolshevik Broadcasting.

I HEAR that our old friend Trotsky has organised a broadcasting service in Russia. It is probable that the transmissions will be made from the Moscow station. I should be glad to hear from readers who pick up any broadcast messages from Bolshie land.

* * *

Wireless in Schools.

WIRELESS is the latest craze at our Public Schools, and all the headmasters are not disposed to regard it wholly as a boon and a blessing. Merchant Taylors' School contemplates a wireless installation, and Dr. Nairn is a little apprehensive lest this new form of communication should prove so attractive in its novelty to parents as to turn the school into an inquiry bureau.

He dreads mostly those parents who have shunned the telephone, but who are likely to make wireless an obsession. Dr. Nairn humorously suggests some such inquiries or instructions as "Did Jack take his handkerchief to school?" and "Please take care of Dick's vaccination arm."

"On these occasions," he observes, "I shall not be found listening-in."

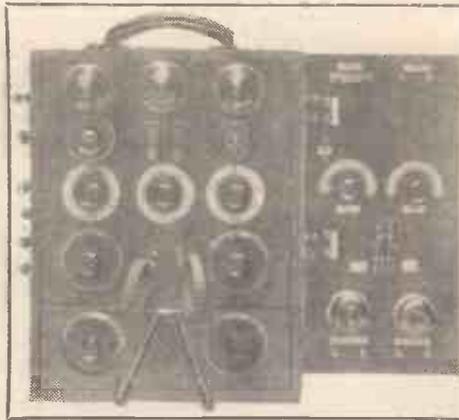
* * *

Senator Marconi and Broadcasting.

DURING a talk with a representative of POPULAR WIRELESS the other day, Senatore Marconi said that during his recent visit to America he became familiar with the programmes of several of the broadcasting stations now operating in the United States, and was impressed by the number and variety of items that could claim an educational value. It was true, he believed, that the demand for lectures was much keener amongst the American people than was the case in England; but he was satisfied that if the British Broadcasting Company developed a really attractive educational programme, the British public would welcome it, and it would probably become the mainstay of the development.

Senatore Marconi considered that variety, not merely in interests, but in time of transmission for educational items, should be kept well in mind in order that opportunity would be afforded for everyone to listen-in in turn.

He also considered that the programmes should be published many days in advance of their performance, in order that listeners-in might be given a fair opportunity of arranging their evenings in accordance with their tastes.



Home-made 3-Valve Portable Set by Mr. R. J. Pearson, 98, Grove Road, Walthamstow, E.17.

American Signals.

THERE seems to be a perfect epidemic of Trans-Atlantic reception.

Mr. J. Samuel, of Aberystwyth, has picked up American carols on an aerial 40 ft. long and only 30 ft. high; and Mr. T. B. Trott, of Plymouth, writes in to say that on the morning of December 23rd, using

five valves, he heard Newark's programme. But to cap it all I hear that Captain Round, of the Marconi Co., picked up an American concert on a 2 ft. frame aerial, using eight valves, and received such strong signals that they were audible on a loud speaker, and woke one of his children up in the next room! We are getting on!

* * *

The Old and the New.

THE old year departed as usual amid a clatter of church bells and the raucous hoots of train whistles and sirens. And at 11.55 the B.B.C. added their quota to the general din. 2 L O's chimes sounded the hour and then gave a life-like imitation of the local belfry in full swing. The peals came out excellently on a loud speaker, and the bagpipe solo must have been a joy to any Scotsman listening-in.

* * *

G E D the Austere.

IT seemed typical of the reigning spirit of the New Year period that Croydon the austere should unbend and devote the preceding Saturday afternoon to the broadcasting of New Year greetings to all and sundry of its regular communicants.

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.
Marconi House, London, Broadcasting Station	2 L O	369	Every evening, 5 to 5.45 p.m. 6.30 to 7; News at 7 and 9; Music from 7.30 to 10.30 p.m.
Newcastle Broadcasting Station	—	400	6-10 p.m. (approx.).
Manchester Broadcasting Station	2 Z Y	385	Every evening, 6 to 10 p.m. (News, vocal and instrumental music)
Birmingham (Witton) Broadcasting Station	5 I T	425	Every evening, 6.30 to 10 p.m. (News, Concerts, etc.).
Croydon	G E D	900	Throughout day to aeroplanes.
Writtle, Essex	2 M T	400	Tuesdays, 8 p.m. (Concert.)
Paris	F L	2,600	7.20 a.m., 11.15 a.m., 5.10 p.m. Also occasional telephony at 10.10 a.m. and 9.20 p.m.
Königswusterhausen	L P	2,800	Between 6 and 7 a.m., between 11 and 12.30, and between 4 and 5.30 p.m.
The Hague	P C G G	1,085	Sundays, 3 to 5 p.m. (Concert.)
Harcn	O P V H	900	Practically every 20 minutes past each hour from 11.20 to 4.20, giving messages to aeroplanes on the Brussels-Paris, Brussels-London, and Brussels-Amsterdam lines.
Radio-Electrique, Paris	—	1,565	Concerts at 8.45 p.m.
Brussels Meteorological Institute	O P O	1,500	Slow C.W. and Morse. Easy reading for amateurs.

Note.—See announcements in daily Press for last minute alterations in times of Broadcasting Programmes.

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

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

All times given are G.M.T.
An asterisk denotes transmissions made purely for experimental purposes.

2 L O's "HELLO MAN."

IN AN INTERVIEW WITH MICHAEL EGAN.

Thousands of people are familiar with the voice of Mr. Arthur Burrows, the popular announcer at the London Broadcasting station, Marconi House. In the interview with Mr. Michael Egan printed below, Mr. Burrows tells about the big future ahead for Broadcasting and the difficulties to be met with in catering for an audience of thousands.

PERSONALITY is a wonderful thing. Some people possess it in abundance, others not at all. The manner in which it is acquired, and the manner in which it is expressed are alike mysterious. So far as the individual is concerned, both its development and expression are unconscious processes. The moment they tend to become conscious the real personality begins to fade into a dim background of affectation.

Usually, when we decide that a certain person has a distinct personality, we gather our impression from a variety of sources. The colour and expression of the eyes, the contour of the face, the taste in dress, the method of gesture in conversation, the dominant characteristics of the voice, etc., all these factors, and a good many more, influence us—to a large extent unconsciously—in forming our judgment. Rarely do we gather any distinct impression of a personality from one characteristic alone.

Remarkable Ranges.

Yet that is exactly what several thousands of people have been doing during the past couple of months as they listened to the pleasant voice of the "Hello Man" at the London Broadcasting Station. In spite of the fact that *all* their information came to them from a single source, there is scarcely one of them who has not formed some definite conception of the character underlying that voice.

This is the thought that was passing through my mind the other afternoon as I made my way through a maze of corridors in Marconi House in search of Mr. Burrows, that being the "off-duty" name of the man whose voice has charmed so many ears of late.

I found Mr. Burrows busily engaged in dealing with a mass of correspondence, though this did not prevent him from giving me a good deal of his valuable time when I explained that I was in quest of some information on the subject of broadcasting for the readers of POPULAR WIRELESS.

In reply to my question as to how 2 L O's signals were being received in different parts of the country, Mr. Burrows surprised me with a list of outlying places from which excellent reports have been received. This last included the Shetland Islands, at which distant point readable signals had been received on a single valve! Another good record was established at Windermere, a spot which is well "sheltered" by neighbouring mountain ranges. In this instance a rectifying valve alone was employed.

"On the whole," said Mr. Burrows, "we seem to be getting a rather marked directional effect towards north. Incidentally, there have been some interesting 'freaks.' At Bridlington, for instance—which is practically due north, 185 miles away—our signals have been received on an ordinary crystal receiver. But I suspect that that

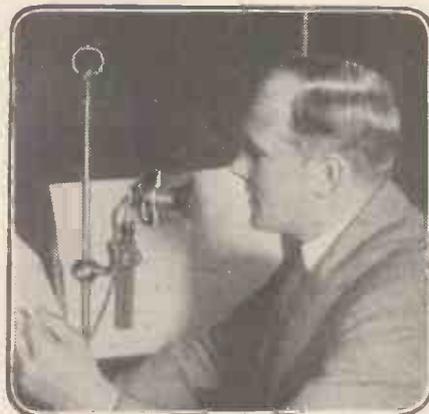
is a case of reception by re-radiation from a neighbouring aerial with which valves are employed."

This curious "freak" immediately suggested another matter to my mind.

"The problem of interference due to reaction is still a difficult one, I suppose?"

"It is, indeed," replied Mr. Burrows, in a serious tone. "If anything, it's becoming worse. Every day I receive numerous letters complaining of the use of reaction in different localities. If this doesn't stop, something serious will have to be done. It really is difficult to believe that people could show such indifference to a cause in which so many thousands of their fellow-beings are deeply interested. One careless or selfish amateur can spoil the amusement of a hundred others."

"Of course, reaction is not the only trouble," I put in. "There's the question



Mr. Arthur Burrows, 2 L O's Hello Man.

of amateur transmitting stations. I have in mind at the moment one particular transmitting gentleman who must be dearly in love with his own voice."

"Oh, yes, I know whom you mean. He's the person who completely spoiled our concert the other evening for thousands of people." Mr. Burrows held up a heavy bundle of letters as he spoke. "These letters are from some of those who suffered most from his interference. But he is not the only one. There are others. I'm sure they can't be aware of the trouble they are causing."

Not a "Beaver."

Whilst Mr. Burrows was speaking I could not help reflecting that many interesting impressions, as to his physical appearance, must have been formed by those who have been listening to his voice each evening for the past couple of months.

When the same kindly tones steal in out of the ether to bid one "Good-night" each evening of the week, one would have to be a very unimaginative person indeed to be able to

refrain from speculating as to the appearance of "the man behind the voice."

"People must be very curious to know what you are like," I said, noting the good-natured smile which my words brought to his genial face.

"Yes, some people certainly seem rather curious," he answered laughingly, glancing at another large pile of correspondence on his desk. "I must say they are very kind and solicitous about my well-being. My only regret is that I have not the time to answer personally all their kind inquiries and good wishes. Do please thank them all very sincerely for me. Their reports and remarks on the quality of reception, etc., have been very helpful indeed.

"I greatly appreciate the spirit the public has shown during these first trial weeks of broadcasting. One little chap, by the way," he added ruefully, "seems particularly anxious to know if I am bald. Perhaps it will ease his mind to know that, at any rate I'm not a 'beaver.'"

Before leaving Mr. Burrows, I asked him if we were to expect big developments in broadcasting before long.

Future Plans.

"Why, certainly," he said with real enthusiasm. "What we are doing now is only in the nature of an experiment compared to what we hope to achieve in the very near future. You see, it takes a little time to arrange a really first-rate programme suitable to all tastes, and that is one of our big problems. It isn't like running a newspaper, you know. A newspaper caters more or less for a particular clientele; we are out to cater for the whole community. Needless to say, that calls for a certain amount of preliminary experience."

At this point Mr. Burrows repeated once more his deep appreciation of the fine spirit shown by the general public in assisting to reduce this initial problem to a minimum.

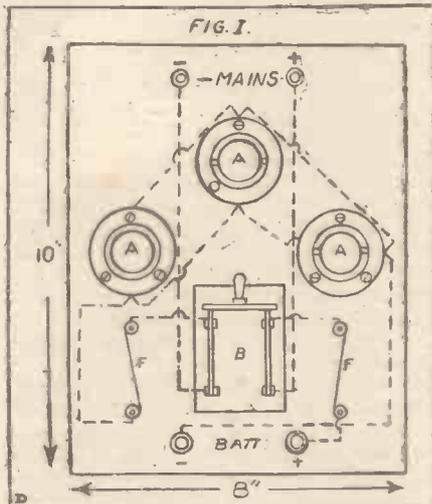
"But we are beginning to feel our way more surely now," he concluded, "and we have big schemes in view for the future. We shall be moving our studio shortly to a better equipped site not many hundreds of yards from this spot. The transmitting gear will remain here, and operations will be conducted by means of a 'remote control' system. Broadcast programmes of the future will contain a large element of an educational and instructive nature.

"These items will be rendered in popular form, and their highly informative character should make them of universal interest. I should also like to say that we are making a special point of ensuring that *nothing* shall be broadcasted which is in any way unsuitable for the minds of the children who form such a large percentage of our audiences. We leave it to parents, of course, to decide as to the advisability of allowing their children to listen-in to the news bulletins."

AN ACCUMULATOR CHARGING BOARD.

By "VOLTA."

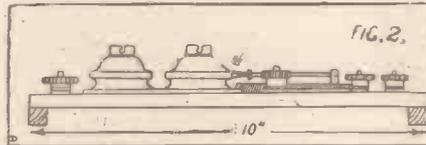
EVERY amateur who has a D.C. electric supply available should take full advantage of his good fortune by installing a small charging board. The initial expense is slight and the advantages many.



The batteries can be kept in excellent condition by frequently charging them at the

correct rate, which is an important factor regarding the life of an accumulator.

Figs. 1 and 2 are sketches (from which a deduction of the arrangement of parts is obtained) of a suitable board large enough to comply with the average amateur's needs.



C is a hard-wood board on which is mounted three ordinary flanged holders used for electric light, one D.P. single-way switch, and eight large size terminals. The fuses F F are made by fixing to the base two terminals about 2 in. apart and the fuse wire connected between.

The Lamps to Use.

The board can be used for any voltage up to 250 v. by using lamps the same voltage as the supply. The number of carbon filament lamps used and their candle power (c.p.) depends entirely on the charging rate of the accumulator. No ammeter is put in circuit as it is unnecessary, because the

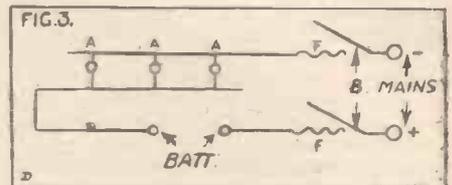
current can be easily calculated, knowing the voltage and c.p. of the lamps, and, once calculated, remains the same for that particular supply.

For example. (Carbon filament lamps take approximately $3\frac{1}{2}$ watts per c.p.). Assuming the voltage of supply is 200 and the c.p. 8, the current taken is found by applying the formula: $\text{Current} = \frac{\text{Watts}}{\text{Voltage}}$

$$C = \frac{8 \times 3\frac{1}{2}}{200} = .14 \text{ ampere}$$

A 16-c.p. lamp would take .28 ampere, a 32-c.p. lamp .56 ampere. According to the charging rate of the accumulator, one or more lamps are put in circuit. If the rate is 1.5 ampere, two 32-c.p. and one 25-c.p. lamps are fixed in the flanged holders.

The connections are shown by dotted lines, and from diagrammatical sketch (Fig. 3) they will be more clearly followed. Of course, when connecting batteries or renewing fuse the switch should be pulled out.



NEXT WEEK:

"MY ORCHESTRA OF AUDIONS,"

By Dr. LEE DE FOREST.

Don't miss this interesting article.
Order your copy of "P. W." NOW:

HOW MY SET GREW UP.

(Continued from page.)

galena, etc., were all improved by a potentiometer, but to treated galena it made no improvement. Treated galena exists in two forms. The first has exactly the same appearance as ordinary galena, and can only be obtained from dealers in France under the name of "Galène Specialement Selectionné pour la T.S.F." The other type has a granular structure, and is, I believe, artificial. It is sold by almost every dealer in England under different names, such as Permanite, Rectarite, Hertzite, Radiocite, etc.

Both forms are equally sensitive almost all over when a new surface is used, but after a few months' exposure to the atmosphere of towns, the colour of the surface changes from a silver to a grey, and sensitive points become rarer and rarer.

The best detector for this crystal is of the type in which the crystal is enclosed in a glass tube, while the "cat whisker" is mounted on a light rod which is a sliding fit in a hole through a ball-and-socket joint.

For preference, two detectors should be placed side by side with a switch, so that one can be set by comparison with the other. This absolutely removes the constant suspicion that the crystal has "lost its point," as one detector can always be compared with the other, and only the worst detector is adjusted to find a better point. If the moving part is kept small and light,

this type of detector can stand almost more vibration than a valve filament without losing its sensitivity. The set was once carried about $2\frac{1}{2}$ miles, and went $1\frac{1}{2}$ miles by tram. Both detectors were still O.K. when the set arrived back home. Another advantage of this crystal is that even the loudest X's, after several stages of H.F. amplification, do not make it insensitive.

On the day of Dame Melba's concert from Chelmsford, I acquired a valve and bought one dozen flashlamp cells for the H.T. I had no L.T., and so I had to receive the concert without the valve.

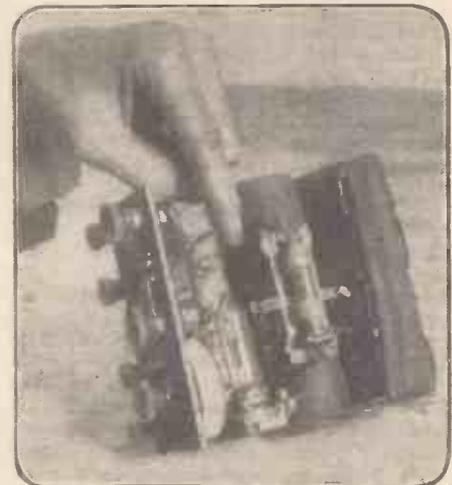
The first Amplifier.

Chelmsford was about 200 miles away from the place where I was staying. My aerial was of 36 S.W.G. wire 200 ft. long but only about 15 ft. high. Dame Melba was successfully received, even being audible with the earpiece a few inches from the ear. Flashlamp batteries were tried on L.T., but I could not get the filament bright enough. Later a 4-volt accumulator was obtained, and then experiments began.

I had a crystal set, a valve, H.T., L.T., and nothing else. To get amplification, I connected the valve input (grid and negative filament) to where the 'phones should be, and put the 'phones in the plate circuit, as shown in Fig. 2. The L.T. is left out for convenience.

In many crystal-valve circuits, a transformer is used between the crystal and note magnifying valve. The increased efficiency due to the step-up of the transformer is not so great as the decrease in efficiency when the blocking condenser is shunted by a conducting path such as that formed by the primary of a transformer.

When back home I invested in a second valve, which I used as an H.F. amplifier in the circuit (Fig. 3). From this diagram



A Miniature American Transmitter and Receiver. The set has a sending range of three-quarters of a mile.

it will be seen that either or both valves could be cut out, two H.T.'s being used.

One day I found that if the crystal and blocking condenser were interchanged, and a small condenser consisting of 6 ins. of twin-flex was connected between the second plate and the aerial, oscillations could be obtained. The condenser gave capacity reaction, and was later made variable. With this improvement the Dutch concert could be heard in early 1921. when it was using but 60 watts.

(To be concluded next week.)

HOW MY SET GREW UP.

By P. G. A. H. VOIGT, B.Sc.

PART I.

IT started about ten years ago, when I was such a little boy that I knew hardly anything about wireless, as a rough description of my first set will prove.

"The wireless cabin" consisted of a shelf, with a roof for the "instruments," situated in the fork of a tree in the garden. The double aerial consisted of flower wire (1s. reels), length 30 ft., height 16 ft., distance between wires 6 ins.

The "instruments" included a coherer, a receiver from a toy telephone, and a defunct pocket lamp battery, all connected in series with the two wires of the twin wire aerial. It is not necessary to say that I never heard a signal on this set.

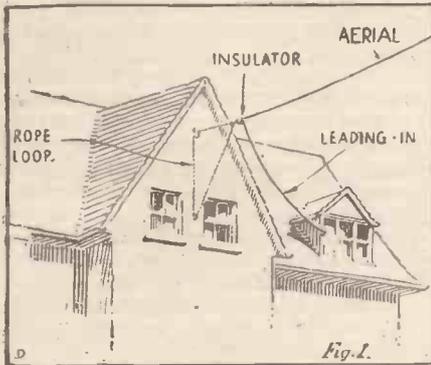


Fig. 1.

My next attempt began in April, 1914, when I managed to get my people to give me a receiving set, range 300 miles, price 17s. 6d. This set was of American origin, and contained a two-slide tuner, whose wave-length scale went up to 800 metres on a 100-ft. aerial, a very cheap silicon crystal detector, and a 75-ohm earpiece.

Early Results.

This set I installed in my workshop, which also contained the house cistern. This latter was used as the earth connection. The aerial was a twin wire 70 ft. long, from a balcony 24 ft high down to a tree in the garden 18 ft. high, distance between wires 3 ft. The "down lead" then went up through a window on the floor above, and was connected to a wire running from the workshop.

In spite of the fact that this wire was 50 ft. long and was stapled to the wall all the way, I heard three letters (too fast to read). By the time I had fetched up the family, the transmission (as usual) had stopped, and nothing more was heard.

When the war started I took down the aerial, and left it in the garden, expecting to put it up again in three weeks' time. Little did we think then that the war would

last over four years. Soon a G.P.O. official came along, put the set into a box, wound red tape round it, and put on a lead seal.

Every few weeks someone came to examine it and make sure that it had not been touched. Eventually it was taken away altogether.

When the war was over I intended to apply for my licence as soon as my apparatus was returned, but eventually I found that I would not get it back until I had a licence, so I applied for one, which arrived on November 19th, 1919.

Experiments with Earths.

On Peace Celebration Day I climbed into our attic and found a large quantity of dust. Next I chose a suitable spot as high as possible in the wall facing our garden, and with pokers, chisels, etc., dug out a hole. Through this hole a hook was then pushed, on the end of which was a pulley with a loop of rope through it. The lower end of the loop then hung near a window on the top floor. Behind the hook a strengthening plate was put, and the nut was screwed on. It has not been necessary to touch the pulley since it was put up.

As soon as the licence arrived the aerial was put up. It is a 100-ft. single-wire inverted L. The angle of the L is fixed through an insulator to the knot in the rope loop that passes through the pulley, as shown in Fig. 1. The angle is about 44 ft. from the ground. The "horizontal" part is about 80 ft. long, and its free end was at first 10 ft. from the ground. It has since been raised to 25 ft., but this did not appreciably affect its efficiency. The lead-in is about 20 ft. long. The set is situated by the window, where the lead-in enters the house.

As earth connections, two 1-in. iron pipes, about 6 ft. long, hammered into the ground a few feet apart, are used. It is much easier to hammer an iron pipe into the ground than dig a 6-ft. pit for the earth plate. As the set is situated on the top floor, about 34 ft. off the ground, the earth wire is about 40 ft. long.

Alternatively, I can use a water pipe or a gas pipe earth. On long-waves it makes

no difference which is used, or if they are all used together; on short waves they are nearly equal, but if more than one are used together, the efficiency decreases.

November 27th, 1919, the afternoon that my set arrived, I connected it in, and was pleased to receive a few Morse signals. Shortly after I examined the circuit, and found that the telephone was in parallel with the crystal, instead of being in parallel with the blocking condenser. After altering this connection, signals were considerably better.

In the earpiece there was room for many more turns of wire, so more turns were

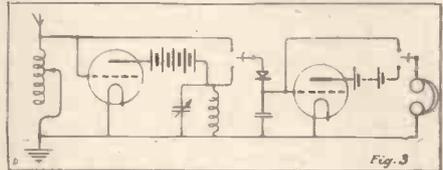


Fig. 3.

wound on, and signals further improved. Fortunately I was able to borrow an old pair of Sullivan 'phones, which were far better than the single earpiece on my set.

On December 31st, 1919, I bought my first pair of ex-Government A type 8,000 Brown's 'phones, which further improved signals.

Applied Potential.

One day, while experimenting with different earths, the 'phones were accidentally left on one earth while the set was on another. This caused an increase of signal strength which could not at first be accounted for. The increase was eventually found to be due to a slight difference of voltage between the two earths, which sent a current through the crystal and made it more sensitive. This was proved by reversing the connections to the detector, when the signals promptly became much weaker.

The next improvement to my set was a potentiometer. With silicon crystal, many stations came in with the potentiometer which could not be heard without it, but the best voltage was always very near zero.

Later I made many experiments to find the most sensitive crystal, and found treated galena to be the best. This is also the only crystal which is not improved by a potentiometer. Silicon, zincite bornite,

(Continued on page.)

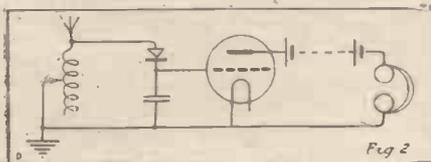
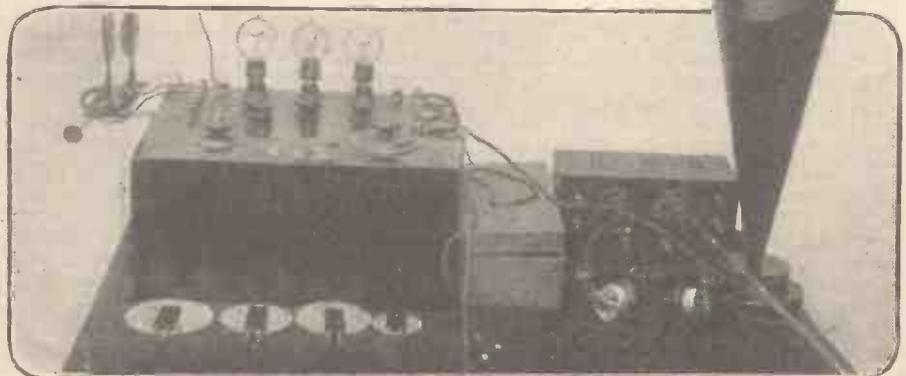


Fig. 2.



Mr. E. W. Simpson's three-valve home-made set, 233, Gipsy Road, London, S.E. 27.

THE MANCHESTER BROADCASTING STATION.

THE Metropolitan-Vickers Co. recently invited press representatives and others to inspect their Manchester station, and the offer was accepted by a party of guests interested in the development of broadcasting.

The Manchester station is situated in the research department of the works of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, which company is technically very closely associated with the pioneers of the movement, the Westinghouse Engineering and Manufacturing Co., of Pittsburg, U.S.A.

The party was conducted over the station by Mr. Fleming, one of the technical experts, and other officials, and showed in detail how the operations were carried out, and the research work they were still engaged upon.

The transmitting gear is housed in several departments situated close to each other. After inspecting the works the party was conveyed in motor buses to Hale, where the receiving stations are erected, where the testing work is undertaken, and where the visitors had the opportunity of hearing broadcast messages.

Nearing Perfection.

During the visit to the Trafford Park works Mr. Fleming presided over the luncheon proceedings, and in the course of his remarks he pointed out the great difficulties, which the public as yet did not fully appreciate, attending the development of broadcasting on a large scale such as they contemplated carrying on from those works.

The transmission of the human voice had to be done through the most delicate instruments, and as the public desired a message to be received without the slightest distortion it was necessary that the greatest care should be exercised in its transmission.

The company had a large staff working to overcome the difficulties which from time to time arise, and he thought they could claim that they were gradually solving the problems as judged by the results which they had achieved and which, he thought, were certainly very creditable, having regard to the short time they had been working.

The Metropolitan-Vickers Company has put on the market a complete line of apparatus, and is proceeding to market almost immediately larger sets for listening over a greater distance. In doing this the company has had at its disposal the whole of the experience and technical knowledge of the Westinghouse Company, and is, therefore, in a position to guarantee that the sets will give the results desired.

The experimental station at Hale has a power of 100 watts.

The Manchester station has been continually in operation during the last eight weeks, especially during election time when results were broadcast. Some indication of its activities may be derived from ex-

amination of the various items of entertainment already given at six p.m. and onwards every day, during which light stories of a humorous type are given, followed by songs or musical selections supplied by local artists of note, and stories, lectures, etc., etc., as well as dance music.

The stumbling block of previous transmissions, the intrusion of resonance into the reproduction of sound owing to the natural frequency of the microphone, have been overcome almost entirely, and sound comes with perfect clarity and gradation to the ear; the higher tones of the piano alternate more decisively with the lower, avoiding the earlier monotony, and the human voice fits in more and more harmoniously to its musical accompaniment.

Describing the Apparatus.

The power used for transmission is supplied by a small generator working from energy at 440 volts, 50 cycles, three-phase, obtained from the work's power house; this generator drives a triple set consisting of an induction motor, high tension generator and exciter.

Two of these sets are installed, one acting as a reserve brought immediately into action by throwing over a single switch from one side to the other.

The transmitter panel installed by the Radio Communication Company employs Mullard transmitting valves; the high tension direct current at 5,000 volts is fed

directly to the anodes of the valves and the filament of the transmitting valves heated from a 30-volt battery. An artificial aerial allows tests to be carried out without disturbing other users of the ether. The main aerial itself is of the cage type, suspended at 140 ft. between the top of the water tower and the highest point of the main works building; each cage has six wires supported by loops.

The power used in transmitting has increased continuously from 50 to 1,500 watts, in accordance with the greatly augmented capacity of the generating plant, and now the maximum power permissible is being used.

The most important part of the station from the entertainment point of view, and the most sensitive technically, is the studio, a spacious room adjoining the transmitting room. An extensive range of musical apparatus with attendant microphones supplies the entertainment broadcasted every evening.

Chief among these instruments are a Steinway grand piano with a Welte player attachment, a new Edison gramophone of the diamond disc type, and an Aeolian Vocalion Gradula cabinet gramophone. The studio is connected by multi-core cables, adaptable for microphone or other control circuits, to the transmitting room. The music, speech, or song sets into vibration the microphones placed on separate stands, and preliminary amplification of this sound in the studio is followed by further amplification in the transmitting room before the amplified currents are impressed on the aerial.

The studio is tastefully furnished and the walls are hung with heavy draperies as at 2 L O.

The visit to the station was voted a great success by all present, and all felt assured that Manchester will be well to the fore when continuous transmissions are given.

AN EXPLANATION FROM THE G.P.O.

FROM representations which have reached the Postmaster General, it appears that the conditions under which wireless receiving apparatus is licensed in connection with the broadcasting scheme are not fully understood.

As indicated in the broadcast receiving licence (which is now obtainable at any head or branch post office), apparatus used under this licence must bear the trademark of the British Broadcasting Company.

Terms of Membership.

This Company is an association of wireless manufacturers who have combined to erect stations for broadcast transmission under a licence from the Postmaster General extending for a period of two years, during which they have undertaken to maintain regular and satisfactory programmes of music and other matter.

Membership of the Company is open to any bona fide British manufacturer of wireless apparatus upon the purchase of at least one £1 share in the Company, and the lodging of a deposit of £50 as security for the proper performance of the conditions of membership. One of these conditions is the payment to the Company of a moderate

royalty on sets of apparatus sold by the manufacturer to the public, as a contribution towards the expense involved in the erection and maintenance of suitable transmitting stations and the maintenance of regular programmes.

Exceptions to B.B.C.

In view of these arrangements, which have been formulated both in the interests of the users of the receiving apparatus and of British manufacturers generally, the Postmaster General has agreed that sets used under the broadcast licences shall be limited to types submitted for approval by members of the Company, and that for a period of two years apparatus made only in this country shall be sold by them, with the exception of certain parts which, for the present, are confined to batteries, accumulators, and outside aerial equipment.

The trade-mark of the Broadcasting Company indicates that the apparatus is of a type approved by the Post Office as conforming to the technical requirements necessary to prevent interference. This approval does not, however, imply a guarantee of the efficiency or workmanship of any particular set.

WIRED WIRELESS EXPLAINED.

By SEXTON O'CONNOR.

"WIRED wireless" is in itself so paradoxical and puzzling an expression that it is not surprising to find a generally diffused doubt as to what precisely the term means, in spite of the references that are constantly being made to it in current wireless literature.

In order to dispose of one rather general misconception, it may be said at once that it is *not* correctly applied to the new method of reception wherein the wiring system of a domestic lighting installation replaces the more usual outside aerial.

Although clumsy in form, the term "wired wireless" is apt enough in meaning, and the value and importance of the principles it involves are at present fully realised only by the relatively small circle of telegraph and telephone engineers who are quietly but rapidly exploiting its possibilities.

Saving the "Landlines."

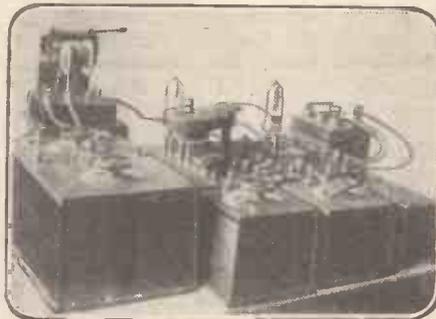
This new branch of radio science consists in the application of modern wireless methods to the older systems of line telegraphy and telephony (particularly the latter), and promises to endow those systems, threatened as they are by the advent of wireless, with a renewed lease of life, just as the invention of the incandescent gas mantle saved gas lighting from being utterly abandoned in favour of the electric lamp.

By the application of high-frequency oscillations and circuits, of the kind now rendered familiar by the development of the wireless art, to existing telephone lines, it is possible to make an ordinary two-line circuit carry simultaneously as many as sixteen distinct conversations, none of which interfere in the slightest degree with any other.

This at once revolutionises the whole problem of telephony, particularly in the case of long-distance trunk lines, where the cost involved in laying down a sufficient number of lines to carry the desired "traffic" has always proved prohibitive.

Secrecy and Economy.

"Wired wireless," then, will effectively remove both the expense and the delay which at present handicap the commercial use of long-distance telephony. Not only that, but by a judicious use of main lines with branch circuits for short-distance or suburban work it should reduce the cost of renting a private telephone to half or even a quarter of the present figure.



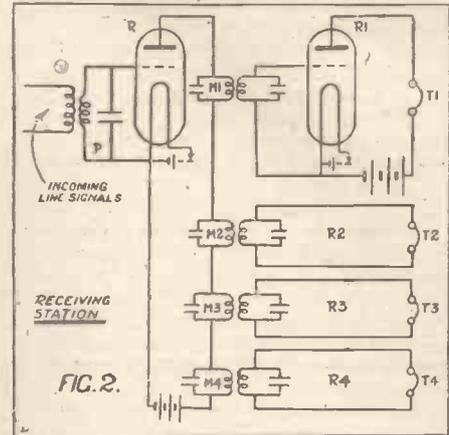
Mr. W. White's compact two-valve set, 1, Canterbury Road, Brixton, S.W. 9.

There are two important advantages that such an improved and cheapened "wired wireless" system would enjoy over any possible extension or development of wireless telephony in its present form. The first is secrecy. The second is economy in the electric power utilised in transmission.

As regards the first point, it is true that important developments are even now

taking place in the direction of perfecting secret systems of wireless telephony transmission. By utilising, for example, extremely short wave lengths, combined with clear-cut directional transmission, it is probable that a fair degree of success may soon be achieved. But we are a very long way from securing the degree of secrecy that is afforded by a line wire, or by "wired wireless."

So far as the power expended in signalling is concerned, the advantage undoubtedly lies with the line system, where the energy is strictly confined to the path of the conductor—practically without attenuation in



strength—instead of being radiated outwards in all directions—as in wireless—with only a small fraction ultimately utilised by the receiver.

According to the new method, a plurality of super-audible oscillations of different frequencies are impressed on the same line. These are individually modulated by the various microphones at the transmitting end; and, at the receiving end, are selectively separated by means of suitable high-frequency filter circuits, and are then rectified.

Each conversation reappears separately and distinctly in the telephones associated with the appropriate detector circuit. This will be made clearer by referring to the transmitting station shown in Fig. 1.

The Principles Involved.

A high-frequency "carrier wave" having a frequency of, say, one million cycles per second, is fed by a generator C (preferably an oscillating valve) to the grid-filament circuit K of an amplifying valve T.

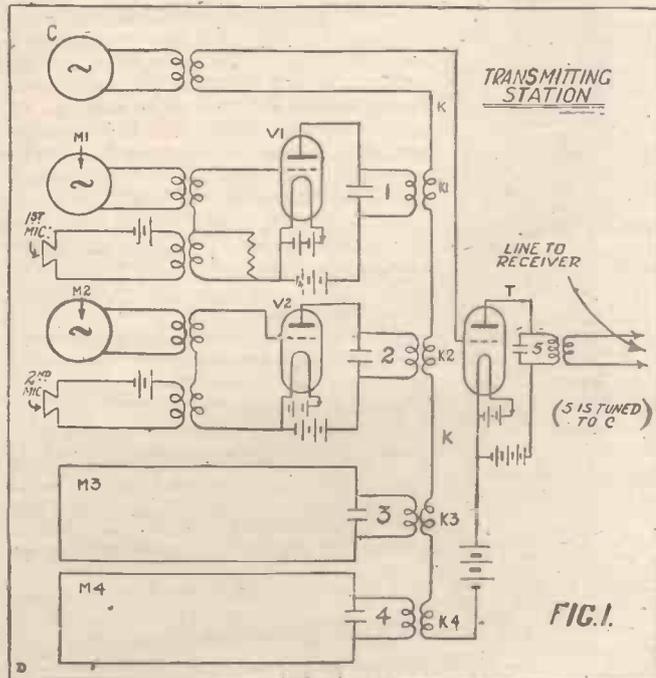
Linked to the same circuit at K1, K2, K3, and K4 are the separate speech-transmission sets M1, M2, M3, and M4. Each set consists of a valve oscillator M1 and a microphone MIC, both coupled to the input circuit of a modulating valve V1, the output of which is linked to the common circuit K.

The valve generator M1 is adjusted to have a frequency of, say, 30,000 cycles per second, whilst the generator M2 is set to 40,000, M3 to 50,000, and M4 to 60,000. Each of these frequencies is above the audible limit, and each is sufficiently distinct from any of the others to enable it to be separated out at the receiving end without giving rise to interference effects.

Considering the set M1, V1, the "secondary" carrier wave generated by the valve M1, and having a super-audible frequency of 30,000, is coupled to the grid circuit of the amplifier V1. At the same time speech-form variations from the first microphone are also applied to the grid of the amplifier, as shown in the figure.

The plate or output circuit I of this amplifier is tuned to the same frequency as the generator M, and will therefore

(Continued on next page.)



HOW TO MAKE A MICROMETER GAUGE.

By H. P. WARRAN, M.A., Ph.D., F.Inst.P.

THE wireless experimenter at home often finds it difficult to know the exact thickness of a thin sheet of mica or paper which he wants to use for making up a condenser of a definite capacity. He is also often in need of finding the gauge number or thickness of a sample of wire in his possession, and a glance through the questions and answers columns in wireless journals reveals the large number of experimenters in this difficulty. A simple micrometer gauge for the purpose can very easily be improvised, and with care built up into an instrument of great accuracy, at a very trifling cost.

A No. 0 B.A. screw (which has a pitch of 1 mm.) with its nut is required, though any good screw will do if its pitch is accurately known. The nut must be split through on one side and squeezed together a little if it has not a tight fit on the screw. It should then be worked up and down on the nut a few times, with a little oil to ease down any local irregularities on the threads, and to secure a smooth working of the nut on the screw without any shake or wobble.

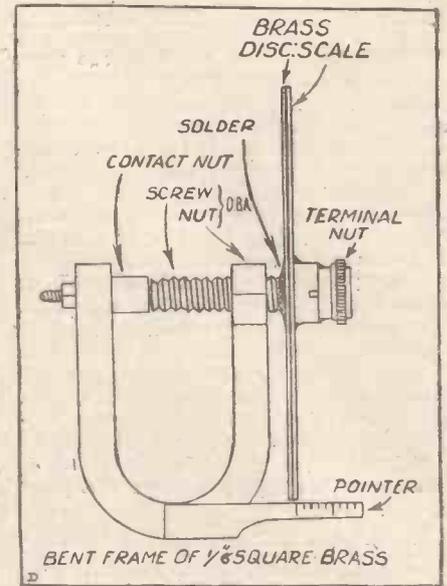
The knurled nut of an ordinary terminal is soldered on to the head of the screw for

the convenience of turning the screw gently. The frame for the gauge is easily made by bending a $\frac{1}{2}$ -in. square brass rod into a "U" shape after bringing it to a red heat in the fire, when it becomes quite pliable.

It is better to make one of the limbs of the "U" a centimetre longer than the other, and the separation between the limbs should not be more than two centimetres for the No. 0 B.A. screw. The B.A. nut is now soldered on top of the short limb in proper alignment, keeping the split side of the nut on top for purposes of tightening later on in case it works loose in course of time.

Marking the Scale.

On the longer limb a hole is bored in alignment with the B.A. nut, and through it is fitted a small contact stud that serves as the fixed jaw of the gauge towards which the screw tip advances as it is turned in the nut fixed to the frame. The tip of the screw as well as the surface of the contact stud are rubbed down flat over a fine file and polished with care to get the two surfaces in contact throughout, and to have this plane of contact normal to the axes of the screw.



The large graduated head for the screw on which the fractions of a turn are read is made out of a circular sheet 3 in. in diameter cut out of $\frac{3}{32}$ -in. sheet brass. It is soldered on to the head of the B.A. screw that passes through a 6-mm. hole bored through its centre, care being taken to get the screw quite normal to the plate.

The circular scale along the circumference of this disc can be formed in one of many ways. The circumference may simply be divided into 50 or 100 equal parts with a pair of dividers, and short lines ruled along these marks with the tip of a fine file, or a simple scale drawn on paper and then pasted on to the disc.

A neater job is to make the scale out of two semi-circular ivorine condenser scales after cutting off the ungraduated portions at either end, and these may be pasted on the disc to secure a uniform circular scale divided into 180 equal divisions along the circumference. In this case we can read up to 2° of rotation of the screw which corresponds to 1-180th of a turn which corresponds to movement of the screw head by 1-180th of a millimetre.

To Obtain Readings.

A pointer for the scale is formed by soldering a strip of brass to the U frame, as shown, and along it an approximate millimetre scale may also be scratched, though the latter elaboration is hardly necessary when the instrument is used largely to measure thicknesses that amount only to a small fraction of a millimetre.

In practice it is neither advisable nor necessary to make the zero of the circular scale coincide with the pointer when the jaws are in contact. The reading on the circular scale in this position and that when the object is interposed between the jaws are noted, and the difference between them gives the thickness of the specimen between the jaws with an accuracy sufficient for all practical purposes.

WIRED WIRELESS EXPLAINED.

(Continued from previous page.)

transfer to the coil K1 signal energy consisting of CW from the valve M1, having a frequency of 30,000, modulated by speech-variations from the microphone.

This signal energy is superimposed upon the "parent" carrier wave from the generator C, which, as before stated, has a frequency of 1,000,000 a second.

In precisely the same way the "secondary" carrier waves from the generators M2, M3, and M4, impressed with separate and distinct speech-frequencies from the associated microphones, may be simultaneously superimposed upon the parent carrier wave in the common circuit K.

Additional Carrier Waves.

As a further refinement, a second, third, or even fourth "parent" carrier wave may also be linked to the circuit K similarly to the generator C. These additional "parent" carriers may have frequencies of, say, 250,000, 500,000, and 750,000 respectively. Each "parent" carrier may again be modulated by four separate and distinct sub-frequencies, each in turn carrying an independent conversation.

The only necessary condition is that the sub-frequencies must be so chosen as not to lie too close to each other in frequency; but this is a comparatively simple matter in view of the big range of frequencies available—viz., from 30,000 to 1,000,000. It must be remembered that each sub-frequency must, in itself, be above audibility, and therefore the lower limit is taken at 30,000 cycles.

Reverting to the arrangement shown in

Fig. 1, the "parent" carrier and the four modulated "sub-carrier" waves are all applied to the grid of the amplifying valve T. All accordingly reappear in the plate circuit 5, which is tuned to the parent frequency of 1,000,000, and is coupled to the outgoing line-wires.

At the receiving end—shown in Fig. 2—the incoming line-wire is coupled to the grid circuit P of a detector valve R. The circuit P is tuned to the frequency of 1,000,000.

The output circuit of this valve will therefore contain the "envelope" of the carrier wave as modulated by all the applied frequencies, which are then selected or filtered out, in turn, by a series of tuned circuits, M1, M2, M3, M4, as shown.

The circuit M1 is set into oscillation by the modulated frequency of 30,000 coming from the microphone and transmitter M1 of Fig. 1. This particular frequency-component is absorbed by the circuit M1 of Fig. 2, which will, however, "reject" all other frequencies, leaving them to be picked out in turn by the similar circuits M2, M3, M4, tuned to the corresponding frequencies of the microphone sets at the transmitting end.

The circuits M1, etc., are linked, as shown, to the tuned grid circuits of separate amplifiers and detectors R1, etc. Each conversation is accordingly heard in the telephones T1 without interference from other simultaneous conversations, these latter being fed in like manner to the telephones T2, T3, and T4, through the associated amplifier and detector circuits R2, R3, and R4.

NEXT WEEK.

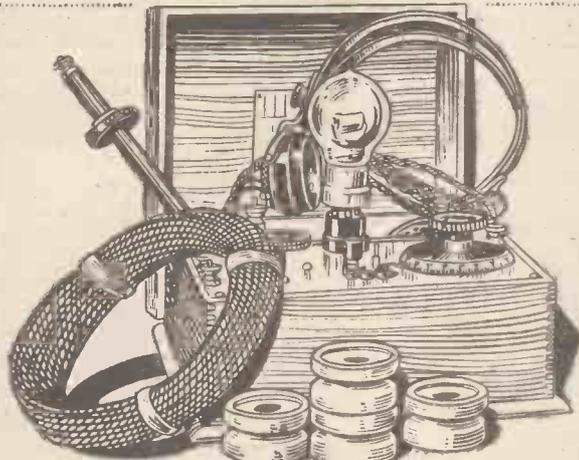
"My Orchestra of Audions"

By Dr. Leè De Forest.

Order Your Copy Now.

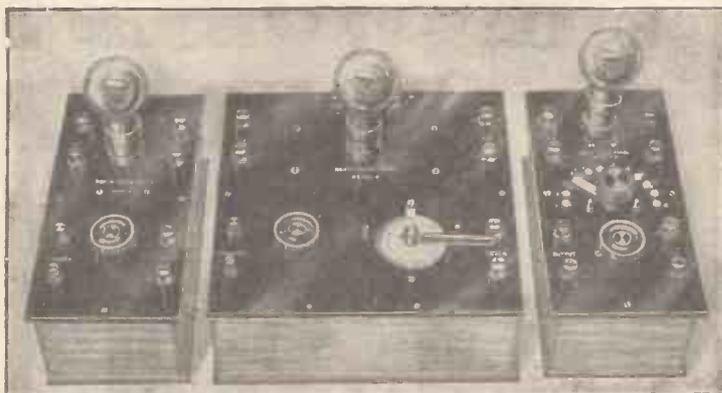
Good Things for Valve Enthusiasts from GAMAGES of HOLBORN

Valve or Crystal, Complete Set or Smallest Accessory, you cannot go wrong at GAMAGES. Stocks are so complete, prices for warranted apparatus so keen, and the firm's desire to help the Amateur so genuine, that it would seem almost folly to go elsewhere.



SINGLE-VALVE BROADCAST RECEIVER IN MAHOGANY CABINET

Complete and self-contained. Fully licensed and passed by the Postmaster-General, Regd. No. 1043. The tuning Coil (tapped in three places) and Variable Condenser give a wave-length of 300 to 620 metres. Further stages of amplification can be added, and with low-frequency amplifiers a loud speaker can be effectively employed. This compact set will receive Telephony and Concerts 30 to 40 miles with surprising clarity. The Cabinet contains a section to hold 'phones and valve when not in use. The lid can then be placed on, keeping the set free from dust and preventing damage, etc. Price, including Royalties and complete with all accessories, **£13**.
Valve Panel alone, including Royalties, **£4 15s.**



"SONUS" 3-VALVE EXPERIMENTER'S SET

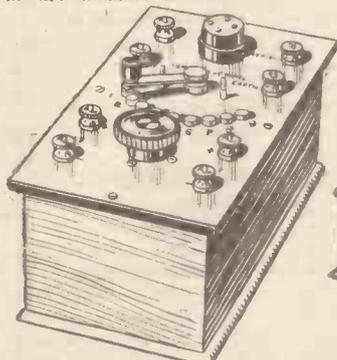
With this set it is possible to obtain really excellent results. The combination employed is, perhaps, the best known of any, namely, 1 High frequency Amplifying, 1 Detecting, and 1 Low frequency Amplifying. Long-distance work becomes a pleasure when this combination is employed, for in the construction of the panels the greatest care has been exercised in the selection of Transformers, etc., so that the familiar "howls" frequently met with may be eliminated as far as possible. The design of these panels is such that either a plain detector, 1 H.F., 1 Detecting—1 Detecting, 1 L.F., or all three together, may be used simply by strapping the panels together by means of brass strips. This set, when complete with H.T. battery, L.T. battery, 'phones, aerial wire, insulators, etc., **£22 15s.**

Write Now for our Wireless Catalogue Post free on request.

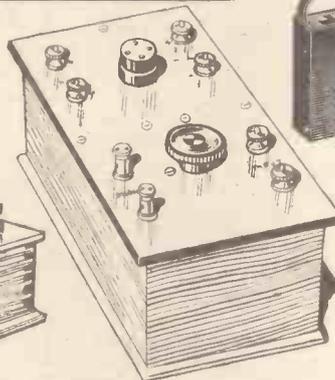
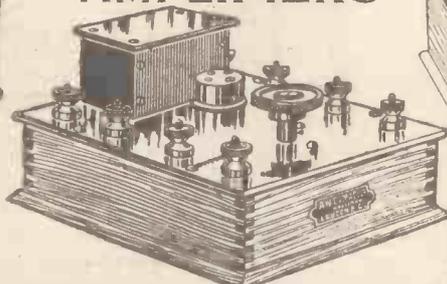
SPECIAL HIGH-TENSION BATTERIES



Well known for their great efficiency, long life, and general adaptability. They can be easily connected together to form a suitable H.T. Battery for valve work, or we can supply them ready mounted in our special battery boxes. We are now able to offer these batteries at the low price of **3/9**.
Size 9 in. x 3 in. x 1 in.



GAMAGE AMPLIFIERS



HIGH FREQUENCY

Fully adjustable, and most efficient. In mahogany box with ebonite top.

70/-

SINGLE STAGE

In polished mahogany with ebonite top, with ebonite container for Transformer. (Ratio 4 to 1.) Price

42/-

LOW FREQUENCY

Designed to give the maximum efficiency in amplification. Polished mahogany cabinet with ebonite top.

50/-

SPECIAL OFFERS OF ACCUMULATORS

All Quality in Stout Celluloid Cases by well-known makers. 6 volt 100 amp. Price **57/6**

We have an extremely good job line of 2 volt 20 amp. Accumulators in Glass Cases which we are offering at the very low price of **4/-**

GAMAGES "ACORN" ACCUMULATORS

Famous for efficiency, power and long life.	4 volts 20 amps. 20/-	4 volts 80 amps. 37/6
British made with first-grade plates and stout celluloid cases	2½ x 3½ x 6½ ins. 25/6	4½ x 5½ x 7 ins. 47/6
	4 volts 40 amps. 31/6	6 volts 60 amps. 55/-
	2½ x 5½ x 6½ ins. 31/6	6½ x 6½ x 7 ins. 55/-
	4 volts 60 amps. 31/6	6 volts 80 amps. 55/-
	4½ x 4½ x 7 ins. 31/6	8½ x 6½ x 7 ins. 55/-



HIGH-TENSION BATTERY BOXES



Improved design with baseboard and green baize bottom. Finished in polished mahogany with ebonite top. Designed to give total output of 105 volts varied in seven steps of 15 volts. Price, **29/6**.
Complete with Batteries, ready for use, **55/-**
Small size to take 60 volts, 4 tappings, **15/6**
container only
Complete with Batteries, ready for use, **31/-**

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

It Speaks for Itself—

and in no uncertain voice.

THE WORLD'S STANDARD LOUD SPEAKER.

AMPLION

WIRELESS
LOUD
SOUNDING
RECEIVERS
are supplied in
a series of

Ten Models

Suitable for
every service:

**The Home,
Laboratory**

and the
Concert Hall



At Prices

ranging from

£2 : 10 : 0

to

£15 : 15 : 0

**DAILY
DEMONSTRATIONS**

at the

**GRAHAM
SHOWROOMS**

The ALGRAPHONE SALON

25-26 Savile Row,
Regent Street, W.1

Phone : Regent 1075.

"MUSIC MASTER" HORN.

Type AR 13, 120 ohms £6 : 0 : 0

Type AR 15, 2,000 ohms £6 : 2 : 6

"GRAHAM" WIRELESS
PRODUCTIONS INCLUDE
"HIGH EFFICIENCY"
TELEPHONE HEADSETS
OF IMPROVED DESIGN
AND CONSTRUCTION.
THE "GRAHAM" IS THE
BEST HEAD GEAR MONEY
CAN BUY.

Full Particulars forwarded
upon request.
Ask for Folder P.W.

Patentees and Manufacturers:

ALFRED GRAHAM AND COMPANY

St. Andrew's Works, Crofton Park
LONDON - - - S.E. 4

Phone : Sydenham 952. Grams : Navalhada. Brock, London

SCOTLAND—

Mr. F. M. Milligan,
25, Renfrew Street,
GLASGOW.

IRELAND—

Mr. Alex. R. Munday,
41, Chichester Street,
BELFAST.

A VISIT TO CROYDON WIRELESS STATION.

By GORDON FRYER.

Vice-Chairman of the Hounslow and District Wireless Society.

A VERY interesting and instructive excursion was made recently by the Hounslow and District Wireless Society.

By kind permission of the authorities, ten members were allowed to visit the Wireless Station of the Croydon Aerodrome.

This station is familiar to all wireless amateurs, as the telephony from it to Lymph, Pulham, and the 'planes on the continental routes is a well-known sound to all.

It was a beautifully fine day, and several of our party went by car or motor-cycle, and one ardent enthusiast "push-biked" the odd 30 miles there and back; the remainder met at Victoria, and went by the 3 o'clock train.

Eventually, all were collected together, and under the leadership of our treasurer (our president and secretary being unavoidably absent), we obtained our "permit" from the Duty Office. A guide was appointed us and we first visited the transmitting apparatus shed.

The Receiving Apparatus.

It may here be not out of place to describe the general plan of the station.

The operator is stationed in a shed A, surrounding which is a directional receiving aerial, which leading directly into the hut is connected to the receiving panel.

About 150 yards from shed A is the transmitting apparatus shed B, being directly under the transmitting aerial. The operator in shed A can by means of a switch start the dynamos running in B, and speaks into his microphone, which is connected to the transmitting apparatus.

The directional aerial consists of 4 single wires at right angles to one another, each one forming 2 sides of a right-angled triangle, whose hypotenuse is an imaginary line drawn from the hut A vertically upwards for about 100 ft.

By means of this aerial, all signals will have two points of maximum audibility opposite to one another. In the case of Croydon one of these directions, namely, the north-westerly one, may be ignored in most cases, leaving a single directional bearing on to the station or 'plane being received. A pointer is revolved over a graduated scale, and when maximum strength of signal is received the bearing is read.

Upon a large map with corresponding degrees marked relative to Croydon, a line is taken from Croydon to the bearing required, and it is known that the sender is somewhere on that line. This is easily effected by a length of string tacked in on Croydon and extended to the required reading on a circle drawn with Croydon as a centre.

An exactly similar arrangement at Pulham, in Norfolk, gives another bearing, and at the intersection of the two is the required position of the sending station.

The receiving panel is made by the Marconi Co., and consists of 6 H.F., 1 D., and 2 L.F. valves, the 2nd L.F. valve being very rarely used. The inductances are not

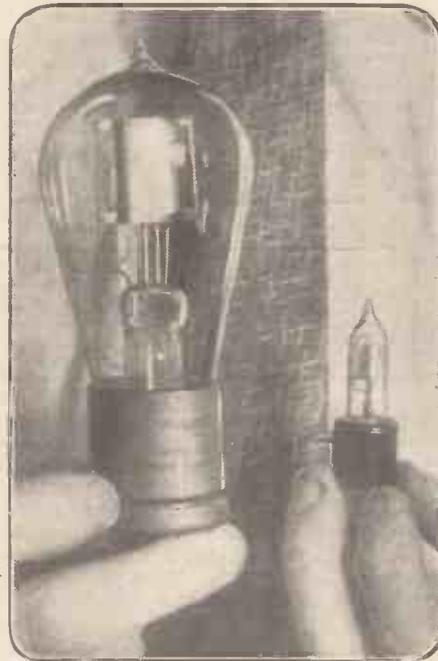
varied, all tuning being done by a small Vernier condenser or variometer giving a range of about 25 metres, and the direction-finding unit that I have mentioned already.

To the right of the panel is a separate heterodyne unit, which is used when speech cannot be heard in order to tune in the carrier-wave and obtain the position of the 'plane.

In the Transmitting Shed.

There is land connection to the transmitting apparatus shed, to the telephone exchange, and to the arrival and departure ground, to which news of the position of the 'planes en route is sent, and where, by means of a large map and figures of aeroplanes, the actual position of all 'planes in the air may be seen at a glance.

The transmitting apparatus consists of 3 distinct sets, the one in general use being



The smallest valve in the world. Signals are received by it quite loud and clear.

the largest, of 1½ kilowatts; there is one of 250 watts, and another of 100 watts. The large dynamos that generate the current are controlled by the operator in shed A. The large Marconi transmitting valves are used.

We first visited the transmitting apparatus shed and the various parts were described to us. While we were there, the operator in shed A started transmitting, and we saw the dynamos put into action, and by means of a pair of 'phones we could hear the operator speaking.

No hindrance was put upon our actions, and several of us donned the 'phones and heard the operator speaking.

After spending some 20 minutes here, our guide conducted us across to shed A.

The transmitting aerial consists of a double 4-wire cage aerial with a direction of N.W.—S.E.

On reaching shed A, the directional aerial proved a source of great interest. And now we are about to enter shed A.

But before doing so, let us pause awhile and analyse the emotion that filled us, if not shown outwardly, I am sure we felt inwardly.

We had all of us, since we had possessed a receiving set, been familiar with hearing a call such as this: "Hallo, Lymph. Croydon calling. I understand you to say that Ack Emma left Paris at 1345. Croydon changing over."

This station whose voice we knew so well we were about to enter, and beyond this, knowing the dread results of anyone jamming this all-powerful station, we wondered what we should behold on entering.

I had often pictured in my imagination an official in uniform, strict and severe, allowing no speech or freedom while guarding the ether between London, Paris, Brussels, and Amsterdam.

We entered a small room about 14 ft. square, and found sitting before the receiving panel, with its seven glowing lamps, a young operator, with coat off and shirt sleeves turned up, smoking a cigarette and extremely agreeable and affable. Three pairs of 'phones were connected in the circuit, and he invited us to listen to all that passed, and we all spent a most interesting half-hour here. It was curious to be actually next to the speaker himself, and hear the familiar "Hallo, Lymph. Croydon calling," etc.

We heard Pulham and Lymph speaking, but unfortunately just missed the speech from the Paris aeroplane which had just arrived.

Listening-in at G. E. D.

We listened-in expecting to pick up a 'plane that was on its way from Brussels, but a message came in through the Air Ministry to say that it had been forced to land at Ostend, and was not proceeding farther.

We had by now lost all our awe and dread of Croydon, and those of us with transmitting sets no doubt felt that a few words on 900 metres to our friend, with whom we had exchanged cigarettes, would not be objected to.

But we now had a rude awakening. "Hallo," said our friend, "there's an amateur calling himself 2 — on our wave-length. I'll have him in a minute." In less than 5 seconds he had his direction finder on him, and had got one bearing on to this unfortunate individual. Then the click of a switch, and, "Hallo, Pulham, there is an amateur calling himself 2 — on our wave-length. Please locate him." And within about 5 seconds another bearing from Pulham was taken.

We now thought that we had trespassed long enough upon our friend, and after thanking him for all the courtesy that had been extended to us we filed out. We had spent a most instructive and entertaining half-hour with our friend, but I don't think that any of us will dare to speak to him on 900 metres.

NOTES ON THE SHEFFIELD ETHER.

By 2IQ.

NOTE.—THE EDITOR WILL BE PLEASED TO PUBLISH REPORTS FROM READERS ON LOCAL TRANSMISSIONS IN THE PROVINCES.

FROM a transmitting point of view, Sheffield is in an ideal position, situated as it is in the extreme south of Yorkshire and bordering on the Derbyshire moors. With the nearest Admiralty station—Cleethorpes—70 miles away to the east, and Seaforth 60 miles due west, and with no stations north or south, the serious radio experimenter, providing he does not exceed the amount of power allotted to him, has nothing to fear as regards interfering with Government or Post Office transmissions.

Not many cities in England possess this great natural advantage, but, of course, there are drawbacks, and lots of them, the chief one being that on three sides, namely, north, east, and west, Sheffield is surrounded by high hills, and the greatest portion of the city is in the valley, well screened.

This, from a receiving standpoint, is, of course, very bad, but I venture to say that nowhere in the United Kingdom is more enthusiasm shown, nor better signals received, than here.

Those "Reactors" Again.

We possess a first-class wireless society, affiliated with the Radio Society of Great Britain, and having on its books somewhat over 200 members. Its club-room is situated at the Technical Department of the University, and is equipped with all the latest books and periodicals, as well as a large assortment of instruments. It was the first wireless society to arrange a dance to wireless music (two years ago) and to have its presidential address transmitted to over 600 people.

At the present moment there are seven transmitting licences in the city with the following call signals:—2ND, 2GJ, 2UM, 2DG, 2DH, 2DI, and 2IQ. Most of them work each evening, and transmissions are always well worth listening to.

The receiving licences at present issued to experimenters for Sheffield and district number 200 to 300.

On a quiet day the following amateurs have been heard by several of the stations in this district:—2AW, 2AZ, 2BG, 2DC, 2FN, 2FQ, 2GN, 2GU, 2IN, 2JP, 2LA, 2LG, 2LK, 2LV, 2PL, 2PS, 2QK, 2UG, 2VC, 2VQ, 2WD, 2KP, 2ZK, 5AG, 5BX, 5CW, 5CX, 2DU and 2KQ. There are several others, but at the present time I cannot find my old log-books. I will give them, however, in another article.

Of course, PCGG, 2LO, 2MT, Croydon, Brussels, and Amsterdam all come in very loud, and have on several occasions been received on a 2-ft. frame aerial.

With the exception of about half a dozen, the majority of the receiving sets are all low-frequency amplification, from 1 valve to 3, mostly home-made, and, from what I have seen of them, they all reflect great credit on their owners.

Our great trouble, which, I may say, is experienced in all large cities where there are a lot of amateurs, is the absence of the essentials governing the wireless reception of telephony, with the result that most of the telephony received is very badly heterodyned by people allowing their sets to oscillate. This is becoming worse each

evening, and it is fast becoming impossible to receive the broadcasting stations without the constant interruption of C.W. notes caused by these people swinging their condensers round when the set is oscillating.

One would not mind so much if they would keep still when they had tuned a station in, but they will keep trying to receive it better and so cause interference. This is a point I shall have more to say about at a future date. Whilst listening to Birmingham a few nights ago, on several occasions the station was completely blotted out by these people. Of course, it cannot go on, and the P.M.G. will have to take necessary steps to prevent it, otherwise the object of the Broadcasting Company will be completely defeated.

Stopping the "Super."

By the way, have any readers of POPULAR WIRELESS tried H.F. magnification, crystal rectification, and L.F. note magnification on broadcasting stations? I have just seen a set with this combination, and it gives excellent results (2 H.F., crystal, and 2 L.F.), everything beautifully quiet and speech and music very loud. Quite a number of people here are trying it.

I came across a case of a gentleman the other day, who shall be nameless, trying out his latest Armstrong super-circuit on

his outdoor aerial. Needless to say, he was soon found out and stopped, after causing much annoyance.

A little bird whispered to me that if I require any new filaments fitting to my ever-increasing stock of burned-out valves, it has been known to be done for 7s. 6d. each. Has the same little bird yet reached London?

Going One Better.

Have any readers noticed that when your friend visits your house to inspect your set he usually says that he gets signals much louder than you do, and proffers to take you round to show you? On arriving you are met with a mass of odd wires running all over the place, and after repeated attempts have been made a very faint station is heard. On remonstrating with him, he calmly tells you that he can't understand it (it was perfect this morning), and you go away feeling proud that your own set has not let you down.

Recently I tried the new Gecophone 2-valve broadcasting set. I had the pleasure of listening to Birmingham and Manchester on this set the other day, and for results it is one of the best I have heard of all the sets that are at present on the market, and I have tried several.

THE RADIO REUNION.

By HIGHAM BURLAC.

GEARY is a sociable soul, and loves "functions." I have been to his ping-pong parties, his bridge breakfasts, lotto luncheons, table-rapping teas, Dickens dinners and scance suppers. I went to oblige Mrs. Burlac, who gets next to Mrs. Geary, talking like a woman's encyclopedia, and leaves me to do all the ping-pong, bridge, etc. You know, reader.

But Geary's radio reunion was the limit. It was I who introduced him to wireless—brought him from absolute zero up to white heat by means of that radio dance I told you about. Yet to hear Geary talk you'd think he was Marconi's uncle, and had given that inventor a coherer to play with.

Well, when Geary had reached the stage where he, figuratively speaking, used to rob the baby's moneybox in order to buy valves, he roped us into his radio reunion. The Bogleys and the Wigfords and the Stickfords were asked, likewise the Baptist minister, and Miss Dooley, the dressmaker. I think he was nervous about yours truly, but Mrs. Geary wanted Mrs. Burlac, having got into difficulties with a jumper. So we went.

There was enough junk on view to furnish a Government dump. When Geary saw me eyeing four Leyden jars and a Wimshurst machine, which he had thrown in for effect, he blushed; positively the only time in his life. The look in his eye said, "You've

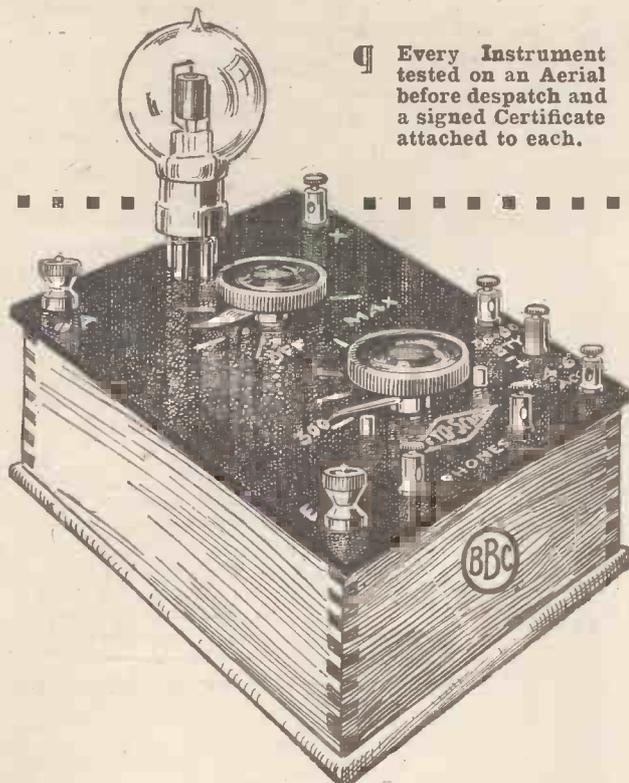
rumbled me, old top, but *have a heart*." So I had a tot of his "pre-war" to square the matter. The Bogleys and the Wigfords and the Stickfords behaved like putty images: I believe they thought it was to be conjuring—or a magic-lantern. Miss Dooley gushed, as usual, like Niagara, and tried to hook the Baptist minister, who dragged in a few phrases about the "marvels of science" and "the mysteries of Nature."

We all settled down to listen, while Geary fussed about, tightening terminals, and whizzing condensers round. Dead silence, broken only by "tut-tuts" from Geary, and Mrs. Stickford's asthmatic breathing. We grew restless after fifteen minutes of this, and began to make idiotic though would-be helpful suggestions. Geary swore the broadcasting station had probably broken down, but could not bring himself to summon me to his aid.

Mrs. Geary began to look moist. Mrs. Burlac whispered, "Higham, can't you help?" Geary, I remembered, was a man and a brother.

So I let go my hold of the aerial, which I had been pinching just where it entered through the lead-in insulator. I could easily have got all the credit for putting the show on its feet, but I let Geary have it.

But I would not have done so had I known that I had been sitting all the time on six spots of accumulator acid.



Every Instrument tested on an Aerial before despatch and a signed Certificate attached to each.

Registered N° 1045 Passed by P.M.C.
BROADCAST BABY

HERE'S just the Set you want to enable you to enjoy the splendid Concerts now being broadcast from four centres. An excellent Instrument, moderately priced—and simple to operate. One knob controls the whole of the tuning; there are no irritating adjustments to make. *Further valves can be added at any time*, so that at any future date you can add a Loud Speaker and enable everyone in the room to hear in comfort. In addition, by the aid of a special Loading Panel, to be attached to terminals A and E, its present wave-length limits can be increased to include the Paris, Hague and Berlin Concerts.

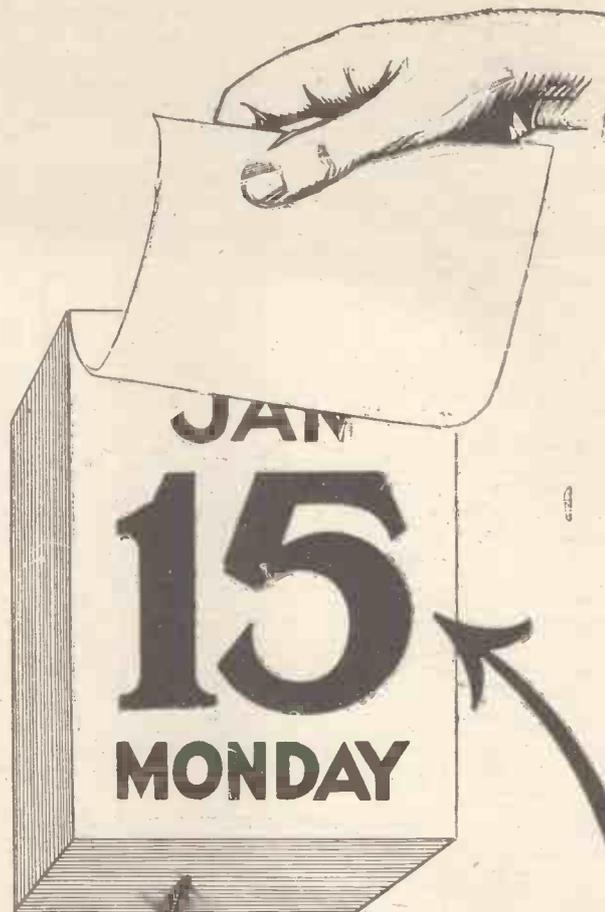
Exactly as illustration, but without Valve. Interior Components include superior Variometer, Grid condenser and leak, velvet Rheostat, etc. The whole only needing an accumulator, HT battery and phones to make a complete Receiving Station of high efficiency.

If for use with Broadcast Licence each instrument must be stamped B.B.C. at an extra cost of 32/6, being £1 for the Broadcasting Company, and 12/6 for the Marconi Company.

50/-

FULLY GUARANTEED.

The **PETO-SCOTT Co.**,
 Radio Headquarters,
 64, HIGH HOLBORN, W.C.



On this Date

will be published the first number of the brilliant new Radio Monthly

MODERN WIRELESS
 1/- NET.

Over 100 pages of interesting and authoritative articles by the best known British Radio Engineers. Edited by John Scott-Taggart, F.Inst.P., assisted by E. Redpath and Paul Tyers, its policy will be to instruct the novice in the building and operating of his Set and to keep the more experienced amateur *au fait* with the latest developments.

possess a good working knowledge you will be interested in the more advanced experimental work described in it.

Containing over 100 pages of illustrated and well-written articles, No. 1 will be one of the finest Wireless magazines ever published in this country.

Be sure you don't miss No. 1—it may be hard to get owing to the demand; if you are wise you'll order it in advance. Hand this form to a bookstall or newsagent.

If you know absolutely nothing about Radio you will find plenty to interest and instruct you—if you already

Please deliver reserve the first copy of **MODERN WIRELESS**, the new monthly published by **Radio Press Ltd.**, at **3, BOLT COURT, Fleet Street, E.C.**, on **Jan. 15.**

Name

Address

MAGNETISM & ELECTRICITY FOR HOME STUDY.

By
Harold E. Penrose.

6/-

Nett.
Postage 6d.

The Best Book for Amateurs.

A HEADMASTER'S OPINION.

"The lucid way in which the author puts the matter before the reader, the sequence followed (proceeding from the known to the unknown), the numerous analogies and associations with ordinary everyday things, and the excellent sketches and diagrams, together with test questions and summaries, make the work admirable for self study or as a book for school use."

The Wireless Press, Ltd.,
Dept. P.W.,
12-13, Henrietta St., Strand, London, W.C.2.

Exide

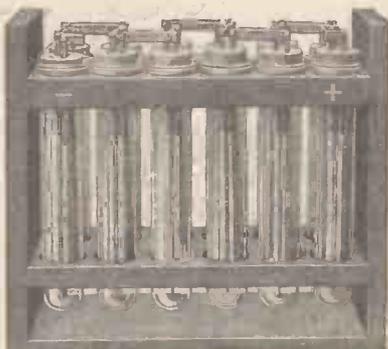
BATTERIES

H.T.

Batteries
for
Valve Sets

24v. 28v. 32v.

Type B.K.



Owing to the demand for these batteries, all orders will be dealt with in strict rotation. Prices approximately one shilling a volt.
:: Ask for Leaflet 4030 ::

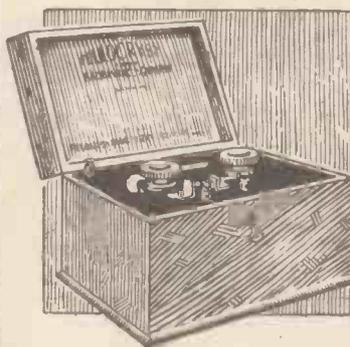
THE Chloride ELECTRICAL STORAGE
COMPANY LIMITED.

CLIFTON JUNCTION, | 219-229, SHAFTESBURY
NE. MANCHESTER. | AVENUE, W.C.2.
58, DALE END, BIRMINGHAM.

BROADCASTING



The FELLOCRYST SUPER



THIS is a high-grade Crystal Detector especially designed for receiving broadcasting, and complies with all regulations. Beautifully pure clear speech and music are received, and as many as three pairs of Fellows 4,000 ohms double headphones can be simultaneously used.

The "FELLOCRYST SUPER" is mounted in a highly polished oak cabinet and is sent out complete with 100 ft. coil of 7/22 stranded copper aerial wire, two shell insulators, and one pair 4,000 ohms double headphones, and is

British Made Throughout

PRICE COMPLETE - - £4:7:6 (Postage 3s. each)

Extra 4,000 ohms double headphones 21/- (Postage 1s.)

FELLOWS MAGNETO Co., Ltd.
LONDON, N.W.10.

Telephone:
WILLESDEN 1560-1

Telegrams:
"QUIXMAG," PHONE, LONDON.

*For they are
jolly good Fellows*

THE LIMITATION OF INTERFERENCE.

By BERNARD LAX.

THIS problem will afford plenty of scope for the amateur in the near future, and a useful method of limiting interference, using ordinary apparatus, will now be given.

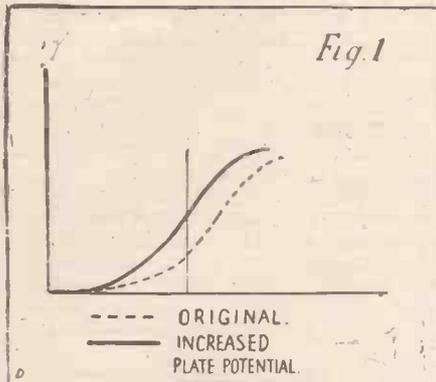
A high-frequency amplifying or detecting circuit should have a variable plate battery in order to obtain best results with the particular valve in use.

If the plate potential be increased when the circuit has been adjusted to its most sensitive state, more electrons will be absorbed in the plate and the valve will be working on a higher portion of the characteristic curve. This, of course, is equivalent to throwing the whole curve to the left. (See Fig. 1.)

The Filament Current.

An increase of filament temperature, when the valve has previously been adjusted to an efficient state, will cause the valve to work on a lower portion of the characteristic curve.

Increasing the filament current in two steps "a" and "b" (Fig. 2), in the case of



"a" the valve is working directly on the bend of the characteristic curve, with the result that signals will be slightly decreased in strength. The second step "b" results in considerably weakening signals.

Now, an increase of filament temperature in making the valve function on a lower part of the curve is equivalent to increasing the height of the curve or moving it to the right. The saturation value or amount of current which can flow from filament to plate is increased. This is due to the fact that the filament is emitting electrons at an increased rate at the greater temperature.

A combination of the two adjustments will produce a new curve which will be larger, with the working position requiring the same or about the same grid potentials to amplify or detect the incoming oscillations efficiently.

Variable H.T. Battery.

This adjustment is generally resorted to when a beat note heard in the telephone is rather "flat." The larger curve produced will accommodate the peaks of the beat note and its musical character will be restored.

It follows from the above that if the plate voltage and filament temperature be decreased below the normal adjustment, then a smaller curve will be produced. Let us suppose that an incoming signal be varying the current in the plate circuit from the bottom bend to the top bend of the curve. If the oscillating potentials or incoming signal-strengths applied to the grid be increased, it follows that no greater variation of plate current will result.

This, therefore, provides a method of limiting strong interfering signals. No variation of the ordinary receiver circuit is required, but it is essential that the plate and filament currents be adjustable.

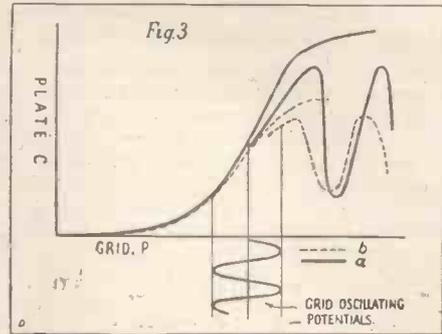
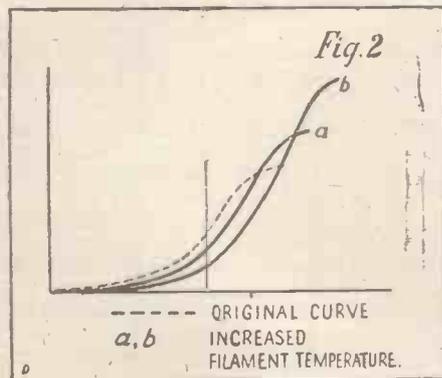
This is effected by a variable filament resistance and the plate battery being tapped off every cell or so. A decrease of plate voltage and filament current produces the smaller curve which is desired to make the valve function as a limiter.

The maximum strength of signal heard in the telephone is predetermined by the limits of the characteristic curve. Curves "a" and "b" (Fig. 3) are of the same value in different adjustments, the "b" curve being produced by a proportionate drop in plate voltage and filament current. It will be noticed that when the grid potentials produced by incoming oscillations are of the same value when the valve is functioning in the condition "a" or "b," the resultant plate current variation is not the same, "b" being much smaller.

Reading Through "Jamming."

Let us consider we are working on curve "b," and let "c" and "d" be the desired signals and interfering stronger signals respectively. It follows that, if "c" produces sufficient oscillating potentials on the grid to vary the plate current to its limits, "d" will not, although of stronger origin, produce stronger results in the telephone. This, therefore, is the required condition.

An interfering signal of greater intensity on the same wave-length can be decreased to the strength of the desired signal by carefully decreasing the filament current and plate potential until the strong signals drop to the strength of the desired signals. The desired signal may also drop slightly, but not to the extent the interfering signals lose in intensity. This is due to a slight decrease in the slope of the curve, the valve



then amplifying a little less. Economy at the same time is being effected in plate and filament current, a point which experimenters will always aim at.

In conclusion, although the above method outlined only limits strong interference down to the strength of the signals being read, as they are then on equal footing, reception is more easily accomplished.



A Bulky Loose Coupler of 12 years ago and a modern Vario-coupler of to-day.

"DEAR 2 L O."

THE following letter was addressed to the Broadcasting Station at Marconi House, London. It is one of the many hundreds received by 2 L O from enthusiastic juvenile listeners-in, and we are permitted to publish it in POPULAR WIRELESS by courtesy of the Broadcasting Department at Marconi House.

"Dear 2 L O,—

"I often listen-in to you on my daddy's wireless, and would like to speak to you if I could. I wonder what you all do in the intervals? Do you have cups of tea, or play games, or go and look at the shops and come back? Are you going to give us some nice carols?"

"Dear 2 L O, I hope you will have a merry Christmas.

"From a little listener-in,
"RENE BUCKLE."

HOW TO MAKE A D.F. STATION

By MICHAEL EGAN

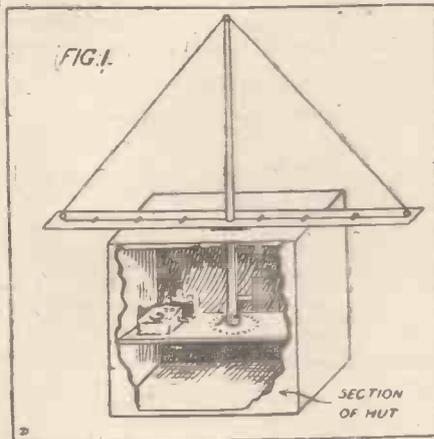
PART 7.

IN the foregoing articles we have considered in some detail the two main systems of direction-finding likely to be of most interest and use to the amateur. There are other ways, of course, of finding directions by wireless, but they are much more complicated than the simple "minimum" and "maximum" methods described in these articles.

It must not be imagined, however, that these minimum and maximum systems can be erected and manipulated successfully without any trouble on the part of the operator. Although the principles on which they work can easily be understood by anyone possessing a minimum of technical knowledge; at least an average amount of skill, patience, and intelligence are required in their operation if the best results are to be obtained.

Triangular Frame Aerial.

The most important factor in the ultimate success of any "home-made" wireless set is that of using the right material in the construction of its various parts. Experience is usually the best teacher in this matter. It is experience that gives many amateurs their first inkling of the fact that they are wasting



pounds on the purchase of elaborate material for some simple instrument which should really incur the expense of a few shillings.

Of course, it is much better to get material that is unnecessarily good than material that is unnecessarily bad! The former wastes some of your money; the latter wastes the whole of it. But it is still better to learn this fact by the good old method of being *told* it, rather than by the bad old method of being *shown* it by bitter experience.

In the case of direction-finding sets such as we have been considering, it is particularly advisable for the amateur to control his enthusiasm to possess the "ideal" set during his first attempts. This applies mainly to the maximum system, of course. In the minimum system, the only other item besides the amplifier and tuning condenser is the frame aerial. In the maximum

system the tuner switch-box (already described) plays an important part.

The aerial should be constructed with care from the outset. The frame itself should combine the maximum of strength and lightness. Also, the wires should be drawn tight, so as to allow no sagging or dipping. It must be borne in mind that the inductance of the aerial as a whole is affected by the distance of the turns from one another. This distance should, therefore, be kept constant. If, through stretching, the wires become slack, this should be rectified by re-winding the aerial.

As previously explained, the frame aerial need not necessarily be in the form of a rectangle, although this shape will probably prove the most convenient in the majority of cases. For working on the minimum method, a triangular aerial will also give very satisfactory results. It is particularly suitable under conditions which permit of it being used out of doors, e.g., on a flat, wooden roof.

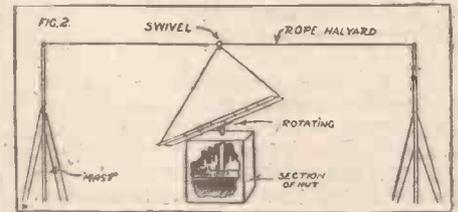
Fig. 1 shows how a triangular aerial could be erected on the roof of a wooden hut. On the operating bench, inside the hut, the base of a long, vertical pole rests in a loose-fitting cup. At about 9 inches above the point at which this pole protrudes through the roof a long crossbar is fitted. The top of the pole and the two extremities of the crossbar form the three corners of the triangle.

Constructional Details.

Preferably, the crossbar should be flat, so as to allow the aerial wires to be "cleated" down as they run along it. A few small rings at the top of the pole will serve to keep the wires in position there. Care should be taken to keep the hole in the roof (through which the pole enters) perfectly watertight. To assist this, the vertical pole should be grooved to take the aerial leads into the hut. A piece of "Pertinax" tubing, fitted to the base of the pole, will provide an efficient means of rotating the aerial system.

If sufficient space is available, another method of erecting a triangular aerial might be employed with success. This is illustrated in Fig. 2. The vertical pole protrudes only to a short distance above the roof of the hut, the crossbar being fixed on the top of it, at right angles. The apex of the triangular aerial is suspended by a swivel connection from a rope halyard stretched between two masts. The main advantage of this latter method lies in its stability and strength, which allow of a very large aerial being used.

With regard to the aeriels required for the maximum system, these should follow the lines already suggested with reference to the single indoor frame aeriels. The two frames should be fixed securely at right angles to each other. The greatest care should be taken to effect this; if they are fixed *approximately* at right angles, the results obtained will also be *approximately* accurate, which means they will be more or less useless for practical purposes.



Instead of trying to build one frame to carry both aeriels, it is best to make two separate single-aerial frames. One should be slightly shorter than the other, so as to allow it to be slipped inside, and fixed at right angles to the larger. They can both be the same breadth. So as to ensure a good, tight fit, the full height (i.e., including the thickness of the wood used) of the smaller frame should be equal to the internal height of the larger one.

Fixing the Frame.

Particular attention should be given to the question of insulation in the case of aeriels used for the maximum system. As the wires in one aerial run at right angles to those in the other, any kind of frictional contact between the two sets of wires is almost bound to result in a "short." For this reason the aeriels should be fixed so as to prevent any contact whatever. This will be effected automatically if the above suggestion is carried out.

At the base of the frame, where the extremities of the aeriels are joined to two sets of terminals, a good deal of "play" should be allowed in the leads that are taken from these terminals to the receiver. This is necessary in order to allow for the rotation of the aerial. About one foot of slack wire is usually sufficient. The remaining portion of the leads should be cleated down to the operating table at frequent intervals between the aerial and the receiver.

We have next to consider the problem of making a tuner switch-box. This need not be either a troublesome or costly instrument to make, although I have seen some elaborate contrivances which must have entailed five times more expense than was necessary. The next article will explain how to make a simple tuner switch-box, and will contain some final hints concerning the proper care of a direction-finding station.

(To be concluded next week.)

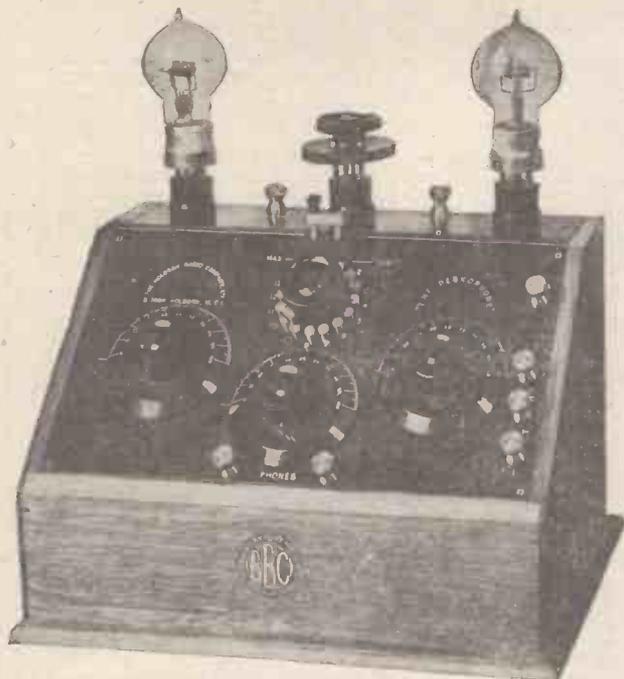
RADIO ASSOCIATION.

To Professor A. M. LOW, D.Sc., A.C.G.I.,
M.I.A.E., F.C.S., Hon. Treasurer.
RADIO ASSOCIATION,
44, Great Russell Street, W.C.1.

Dear Sir, Please enrol me as a Member of the
Radio Association, for which I enclose annual
subscription of 2s. 6d.

Name in full.....
(with Titles)
Address

A GOOD RESOLUTION for the New Year



THE DESKOPHONE TWO-VALVE SET.

The Deskophone two-valve set, tuner, high frequency amplifier, and detector. Complete with accessories as shown in illustration below of single valve set. Made under licence, etc., as below (P. O. No. 2020).

PRICE

£12 - 17 - 6

Royalties £3 - 0 - 0; R Type Valve 17/6 each extra.

THE DESKOPHONE SINGLE VALVE SET.

The Deskophone Single Valve Set, made in our own workshops to our own registered design, is the last word in wireless apparatus. Made as illustrated, it includes—Accumulator, H.T. Battery, Headphones, Aerial, Lead-in Wire, Insulators, and Coil. It has been passed by H.M.'s Postmaster General (No. 1019). Made under licence from the Marconi Coy., approved by the B.B.C. and fully stamped.

PRICE

£7 - 15 - 0

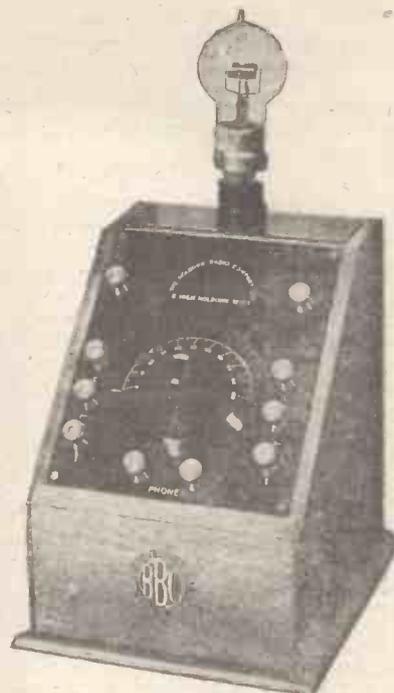
Royalties 32/6
R Type Valve 17/6 each extra.

"I will delay no longer. Knowing that Wireless Telephony has now reached the practical stage—knowing that I can get an efficient Receiving Set at a reasonable Price, I will investigate the Terms and Apparatus of The Holborn Radio Co., Ltd., at once. I shall call on them if I have time, or write if I have not, to-day."

CATALOGUE

Post Free.

TRADE SUPPLIED.



AMPLIFIER

This Low Frequency Amplifier can be used in conjunction with the single or two valve set. It considerably increases the volume of sound. Strongly recommended. Made under licence, etc., as above (P.O. No. 3042).

PRICE

£3 - 17 - 6

Royalties 22/6
R Type Valve 17/6 each extra.

THE
HOLBORN RADIO CO., LD.,
267 HIGH HOLBORN,
LONDON, W.C. 1.
Telephone: Chancery 8163.
Late of 8, High Holborn.



Tele. :—
HOP 134

IMPORTANT

We have opened very commodious premises at
54, GRACECHURCH STREET, LONDON, E.C.3
for the demonstration and sale of all types of
WIRELESS RECEIVING SETS and **"CLARITONE" LOUD SPEAKERS.**

Amateurs and Experimenters will be able to obtain every part required for any type of Set

INCLUDING—

Transformers, L.F. and H.F.
Headphones (all types, all resistances).
Condensers, variable and fixed (all capacities).
Vario-Couplers and Variometers.
Coil-Holders and Coils.
Anti-Capacity Switches (all types).
Rheostats (all types).
Radial Switches (5, 10, and 15-way).
Valves (M.O. and Mullard's).
Ebonite Valve Holders, Dials, Scales, other parts and in Sheet.

Brass W.O. and Telephone Type Terminals,
Nuts, Washers, Contact Studs, and all other parts.
Accumulators.
Dry Batteries.
Aerial Wire.
Insulators.
Hertzite and Galena Crystals.
Cotton and other Tubings (all colours).
Etc., etc.

PRICE LIST ON APPLICATION

PETTIGREW & MERRIMAN, LTD., 122-124, TOOLEY STREET, LONDON, S.E.1.

NOTE—54, Gracechurch Street is a few yards from Monument, Eastcheap, Bank, Cannon Street, and London Bridge.

HULLO!!! C.Q. WILL DAY CALLING

TO ANNOUNCE SOME RARE BARGAINS.

BEST FRENCH HEAD PHONES
8,000 ohms 27/6 per pair
SPLendid QUALITY BRITISH
HEAD PHONES, 4,000 ohms 26/- per pair
Single Head Phones, with Cord, 150
Ohms 6/- each
100 feet Stranded Copper Aerial Wire 3/3
Trench Buzzer Sets, complete with
Single Head Phone 10/6
Best Quality Filament Resistances . . 2/9 each, Postage 3d.
Switch Arms with Laminated Blades 1/- each, Postage 3d.
3-Way Coil Stand for Panel Mounting 15/- each, Postage 6d.
Best Ebonite Knobs with Brass Nut
inserted 2 B.A. 5d. each, Postage extra
Insulated Sleeving, all colours 5d. yard, Postage extra
Brass Terminals with Nut and Washer 1/6 doz., Postage 3d. doz.
Complete Set of Parts, including two Ebonite Plates, 4" x 4"
for making Best Quality Variable Condensers, '001, 9/- set;
'005, 7/- set; '0003, 5/- set. Set of Vernier Condenser Parts
without Ebonite, 1/9.

*These are only a few of our bargains. Do not fail to send
for our Price List giving the lowest prices for the best
quality goods. Postage on all goods extra.*

Write for our new January Catalogue, now ready.

We always Stock the Famous **HERTZITE CRYSTAL**
at 2/6 each, or mounted in Brass Cup 2/10, Postage 3d. extra.

WILL DAY, LTD.,

19, Lisle St., Leicester Sq., London, W.C.2.

Phone: Regent 4577. Telegrams: Titles, Westrand, London.

RELIANCE RADIO SERVICE CO.

THE "RELIANCE"
CRYSTAL RECEIVING CABINET.

Consisting of Ebonite Panel mounted in Oak Cabinet with lid; Tuning Coil and condenser, Patent Crystal Detector, totally enclosed in glass; 4,000 Ohms Double Headphones; 100 feet of Stranded Copper Wire; 2 Shell Insulators.

No further outlay, no batteries required. Each set has been tested and carries our guarantee, and we confidently assert that for the price it is the most compact and reliable that is obtainable.

PRICE COMPLETE

£3-5-0

INSTRUMENT ONLY

£1-12-6

We have also a complete range of Valve Sets in stock from £7 to £20. Call and inspect the famous FELLOPHONE 2-Valve and 4-Valve Receiving Sets, prices complete, £10 10s. to £17 10s. respectively. Also the FELLO-CRYST SUPER Crystal Receiving Set, price £4 7s. 6d. complete. All our sets are passed by the P.M.G. for reception of broadcasting. All sets open to inspection at our London address. Demonstrations given daily. Hours 10 a.m. to 6:30 p.m.

ILLUSTRATED CATALOGUE
POST FREE.



(P.O. Registered No. 277.)

RELIANCE RADIO SERVICE CO.,
283, St. John Street, Clerkenwell, London, E.C.1
PHONE: CLERKENWELL 4290.

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.

Woolwich Radio Society.*

A monthly meeting was held recently at the Woolwich Polytechnic, in a lecture-room kindly lent by the governors. There was a good attendance, including several visitors whom we were pleased to welcome.

Hon. sec., H. J. South, 42, Greenvale Road, Eltham, S.E. 9.

Rhyl and District Amateur Wireless Society.

At the meeting held recently a lecture was given by Dr. Goodwin on the subject of induction.

Hon. sec., C. Mitchell, 24, East Parade, Rhyl.

The Leeds and District Amateur Wireless Society.*

An instructional meeting was held at the Grammar School, Leeds, recently, a lecture entitled "Diagram Interpretation" being delivered by the hon. secretary. The lecturer explained the numerous difficulties that beset a beginner whose wireless circuit diagrams are concerned, and explained how these difficulties can be greatly reduced by strict standardisation of symbols.

Hon. sec., Mr. D. E. Pettigrew, 37, Mexborough Avenue, Chapeltown Road, Leeds.

Ilkley and District Wireless Society.*

A well-attended meeting of the above society was held at the Regent Cafe, Ilkley.

Mr. L. E. Overington lectured on the subject of "Electro Magnetic Induction."

Faraday's discovery of electro-magnetic induction by means of the iron ring experiment was described, and its development in the form of the transformer and induction coil. Self-induction, skin effect in conductors carrying H.F. current, permeability, hysteresis, and flux density were dealt with at full length.

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

The Radio Society of Tavistock.

The above society is in process of formation. Will any gentlemen who are interested in the science (either beginners or experts) kindly communicate with the hon. sec. (*pro tem.*), Mr. A. E. Graves, 2, Parkwood Road, Tavistock?

Hackney and District Radio Society.*

Recently an informal meeting of the above society was held at the new headquarters (the Y.M.C.A., Mare Street, Hackney, E. 8). The first unit of the society's wireless set was installed. A beautiful piece of work—made entirely by amateurs of the club—and well worthy of comparison with sets sold by dealers. It permits of the use of valve or crystal detection. Further units are in course of preparation. With the aid of a 3-valve Mk. III L.F. amplifier kindly lent by a member, telephony was very well received. It is worthy of note that the society's set is, as far as possible, being built without recourse to the ordinary funds, but by means of contributions in the form of money or apparatus.

Hon. sec., Mr. E. R. Walker, 48, Dagmar Road, Hackney, E.

The Fulham and Putney Radio Society.*

The society is moving its headquarters to Fulham House, Putney Bridge, which is the headquarters of the 47th (2nd London) Div. Signal Company, and the wireless room has been placed at the society's disposal on every evening each week by the commanding officer.

There is a very fine aerial fixed, and the room is equipped with 120-watt and 30-watt C.W. sets also a 20-watt spark set; and the society has a collection of apparatus of its own.

Hon. sec., J. Wright Dewhurst, 32, North End Road, West Kensington, London, W. 14.

Fulham and Chelsea Amateur Radio and Social Society.*

At a meeting held recently the hon. secretary gave a lecture on elementary inductance.

Hon. sec., Mr. R. Wood, 48, Hamble Street, Fulham, S.W. 6.

The Hornsey and District Wireless and Model Engineering Society.

At a meeting held recently Mr. H. J. Pugh gave a lengthy but interesting lecture on "Magnetism and Electricity" as applied to wireless.

Hon. sec., Mr. H. Davy, 134, Inderwick Road, Hornsey, N. 8.

Plymouth Wireless and Scientific Society.

At a meeting of the above, held recently at the Plymouth Chambers, experiments were carried out using the electric lighting mains as an aerial. The results obtained were only fair, and it was agreed that an outdoor aerial was to be preferred by far, when possible.

Hon. sec., G. H. Lock, 9, Ryder Road, Stoke, Devonport.

The Ilford and District Radio Society.*

Under the auspices of the above society a demonstration of wireless telephony was given at the Seven Kings Baptist Church recently. The demonstration was in aid of church funds and was very successful, telephony being received from Marconi House, 2 N and 2 J X.

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

Eastern Enfield Wireless and Experimental Society.

The weekly meeting of the above society was held recently at its headquarters, the Falcon Inn, South Street, Ponders End. New members are still required, and will be heartily welcomed at any of the society's Thursday evening meetings. A small library and certain articles of apparatus are now available for loan to any of the members.

Hon. sec., Arthur I. Dabbs, 315, High Road, Ponders End, N.

The Thames Valley Radio and Physical Association.

Meetings now take place every fortnight at the Hut—Wigan Institute (one minute from Mortlake station, L.S.W.R.), and interesting lectures are given each evening. Morse code is taught, and through the kindness of several members a 4-valve set will shortly be installed. Major-General Shaw and Dr. Mackintosh have just consented to become vice-presidents.

Hon. sec., Eric A. Rogers, 17, Leinster Avenue, East Sheen, S.W. 14.

Stockton and District Amateur Wireless Society.

The usual monthly meeting of this society was held on November 9th, 1922, in the Malleable Workmen's Institute, Norton Road, Stockton-on-Tees, with Mr. S. B. Butler in the chair. It was reported that an efficient receiving set was expected to be installed by the next general meeting. Great progress was reported as regards the increase of membership. The meeting was followed by a concert, in which many friends kindly rendered assistance.

The rest of the evening was spent with the concert and was a great success, ending about ten o'clock.

Hon. sec., W. F. Wood, 4, Berkeley Square, Norton-on-Tees.

The Darwen Wireless Society.

Due to the efforts of Mr. L. Nuttall and helpers, the Darwen Wireless Society has successfully been established. The mayor presided at the last meeting, and said in his official capacity as mayor of the town that he welcomed the society, which he was confident would be of benefit to Darwen. The mayor has very kindly subscribed a sum of five guineas, and a Blackburn gentleman has promised to present a four-valve set to the society when it obtains the club-room for which it has been negotiating. The list of members is constantly swelling, and now numbers over forty. Intending members can obtain all particulars from the hon. sec., Mr. T. H. Nather, 8, Hawkshaw Avenue, or the chairman, Mr. L. Nuttall, 17, Railway Road.

OMNIPHONE Wireless Service

VARIOMETERS—A complete tuner for waves 300-500 metres. Complete with engraved dial for panel-mounting, 15/6.

AERIAL EQUIPMENT—100 ft. 7-strand enam. copper wire, 3" shell" insulators, and ebonite leading-in tube, 6/6.

EBONITE—"A" grade, polished sheet, 3/16th inch thick, cut to any size required, at 1d. per superficial sq. inch.

All above post free. Send stamp for list.

OMNIPHONE WIRELESS CO.,
24, Warwick St., Regent St., London, W. 1.

LUNCH HOUR RAMBLE

STROLL ROUND TO
SPENCER'S STORES,

4-5, MASON'S AVENUE,
BASINGHALL STREET,
LONDON, E.C. 1.

CHEAPEST HOUSE IN CITY
FOR WIRELESS PARTS & SETS
PRICE LISTS FREE.

Beginners Guide to Wireless

Explains, in plain everyday language, everything beginners wish to know about wireless telegraphy. **HOW TO ERECT, CONNECT, AND MAKE** all the apparatus required for reception of telephony or morse, and full instructions and diagrams for making coils, tuners, and complete valve and crystal sets. 112 pages, price 1/-, post free.—SAXON RADIO CO. (Dept. 14), South Shore, Blackpool. 32-page cat. of wireless apparatus, 3d., post free.

WIRELESS INVENTORS

Patents and Trade Marks. Advice Hand-book and Cons. free.—B. T. KING, Regd. Patent Agent (G.B. & U.S.A.), 146a, Queen Victoria St., E.C.4. 'Phone: Central 682. 36 yrs. refs.

WIRELESS CONCERTS

are more fascinating if you understand the principles of Wireless Telephony.

Apply to Secretary

WIRELESS SCHOOL
179, Clapham Road, S.W. 9

CABINETS & CASES

IN POLISHED MAHOGANY OR TEAK.
QUOTATIONS PER RETURN.

J. LANCASTER & SON, LTD., 87, PARADE, BIRMINGHAM.



30 Seconds Suffices

To put up an efficient indoor aerial if you use

IND-AERIAL HOOKS.

They go on the picture-rail of any room, hall, passage, office, nursery, Showroom, etc. No nails or screws required. Can be taken

down again in a moment. They make your set portable. Varying lengths of aerial can be obtained by leading wire either round walls or across-room.

AERIAL IS SUPPORTED ONE FOOT FROM WALL

IND-AERIAL CO. (Dept. B),
47, Victoria St., London, S.W. 1.

PRICES.

2/9 each.

Four for

10/6

Post Free.

Send P.O.

to-day and

secure yours.

CUT THIS OUT

"Popular Wireless" PEN COUPON Value 2d. Send 7 of these coupons with only 2/9 direct to the Fleet Pen Co., 119 Fleet St., E.C.4. You will receive by return a splendid British-Made 14ct. Gold-Nibbed Fleet Fountain Pen, value 10/6 (fine, medium, or broad nib). If only 1 coupon is sent the price is 8/9. 2d. being allowed for each extra coupon up to 6. (Packet Clip, 4d.) Satisfaction guaranteed or cash returned. **Special New Offer.**—Your own name in gilt letters on either pen for 1/- extra. Lever Self-Filling Model with Safety Cap, 2/- extra.

R A D I O T O R I A L

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

Questions Answered

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have decided to reply individually by post. A weekly selection of questions will, however, be printed on this page, together with the answers, for the benefit of readers of POPULAR WIRELESS in general. Questions should be clearly and explicitly written, and should be numbered and written on one side of the paper only.

All questions to be addressed to: POPULAR WIRELESS, Queries Dept., Room 132, The Fleetway House, Farringdon Street, London, E.C.4. Readers are requested to send necessary postage for reply.

"VALVE" (London).—Is it possible for me to hear the Hague and Paris on one valve?

Yes: but in each case the reception will be very weak and probably the speech will be indistinguishable, except when the atmospheric conditions are very favourable for reception. We advise you to have two stages of amplification to be able to hear these stations clearly.

"QUERY" (Newcastle).—I saw a diagram of a crystal set in a paper the other day. It showed a battery in circuit with the crystal. Is this necessary?

The battery is only needed when the crystal to be employed is carborundum. Such crystals as galena, silicon, hertzite, etc., do not require a battery.

C. E. H. (Barnes).—In a previous issue of POPULAR WIRELESS you say that one valve has a range of 50 miles. On my single-valve set I hear 2 W P, P C G G, and 2 Z Y. Is this an unusual performance?

The 50-mile range is the average successful range, but there are many cases where this range is greatly exceeded. (2) The hum in the 'phones you mention is very likely due to the electric light mains. Try to keep all leads away from the parallel with any of the electric light wires. Screening your set with iron sheeting will very often remedy matters if the interference is very severe. A capacity earth instead of the usual type may also assist matters.

D. R. (South Coast).—I am troubled with "jamming" on my crystal set; is there anything I can do to stop, or lessen it?

If you are using a slider type of inductance, you will probably find a loose coupler a useful instrument. By loosening the coupling quite a considerable amount of the interference can be cut out. If the trouble still worries you, you can fall back upon the "balanced" crystal circuits recently described in POPULAR WIRELESS. This should have the desired effect.

"REACTION" (Southfields).—What is the difference between "magnetic coupling" and "capacity reaction" when dealing with reaction circuits?

Magnetic reaction is the name applied to the method of regeneration which employs a coil in the plate circuit of the valve. This coil reacts—electromagnetically—with another coil, usually the A.T.I. or secondary, which is connected to the grid of the same valve, or of an H.F. amplifying valve. "Capacity" reaction has the same effect—increasing incoming impulses—but instead of a coil, a condenser, usually variable, is placed in series with the plate of the valve. This condenser is connected electrically with the grid circuit of the valve, and reaction is carried out by means of static energy rather than electro-magnetic as in the case of the coil. It is usually found, however, that the coil type of reaction gives better results, and this is the type generally employed.

J. P. T. (Harpenden).—My one-valve set has been giving very good results until quite lately, when I have not been able to make it oscillate. The variation of the filament resistance does not seem to have much effect, and the valve will not oscillate, no matter how tight the reaction coupling is. Can you suggest anything?

Presuming, of course, that your accumulator is quite O.K. and that you have not altered the circuit in any way, the trouble is probably due to the H.T. battery. See that the voltage is quite sufficient; it is very likely that the cells are running down, and the substitution of fresh cells will probably cure the defect.

L. T. (Stevenage).—I have been using a French type of valve, but the filament has sagged somewhat, and is now touching the

grid. Of course the valve is useless, as the filament seems to be firmly stuck. Is there any way of freeing it?

As the valve is useless you can resort to fairly drastic measures in your efforts to free the filament. Give the valve several sharp blows on some fairly soft object—it sometimes happens that this will shake the filament off the grid. If you are successful, you should alter the position of the valve when in use so that the already sagging filament will be prevented from repeating the performance. Very often the sag can be cured and the filament straightened by using the valve the other way up—in your case pointing downwards.

"PUZZLED" (Reading).—I am troubled by a curious crackle when I am tuning in my valve set. I have looked to see if there are any loose connections, but I cannot find any. The crackle does not always occur, but I should very much like to know what it is.

If your connections are all quite tight and the filament resistance is making steady contact, the trouble is probably to be found in your variable condenser. Look carefully at each vane, and see that none of them touch. Very often a vane will touch another at just one position, while at other times it will not touch at all. You will probably find the condenser is the cause of your trouble.

W. J. Z. (Crewe).—I was listening in at about 1.30 a.m. the other morning and heard faint speech. On altering the wave-length slightly, however, the speech still remained, though it was very faint. I am near some telephone wires; do you think that these are the cause of the voices heard?

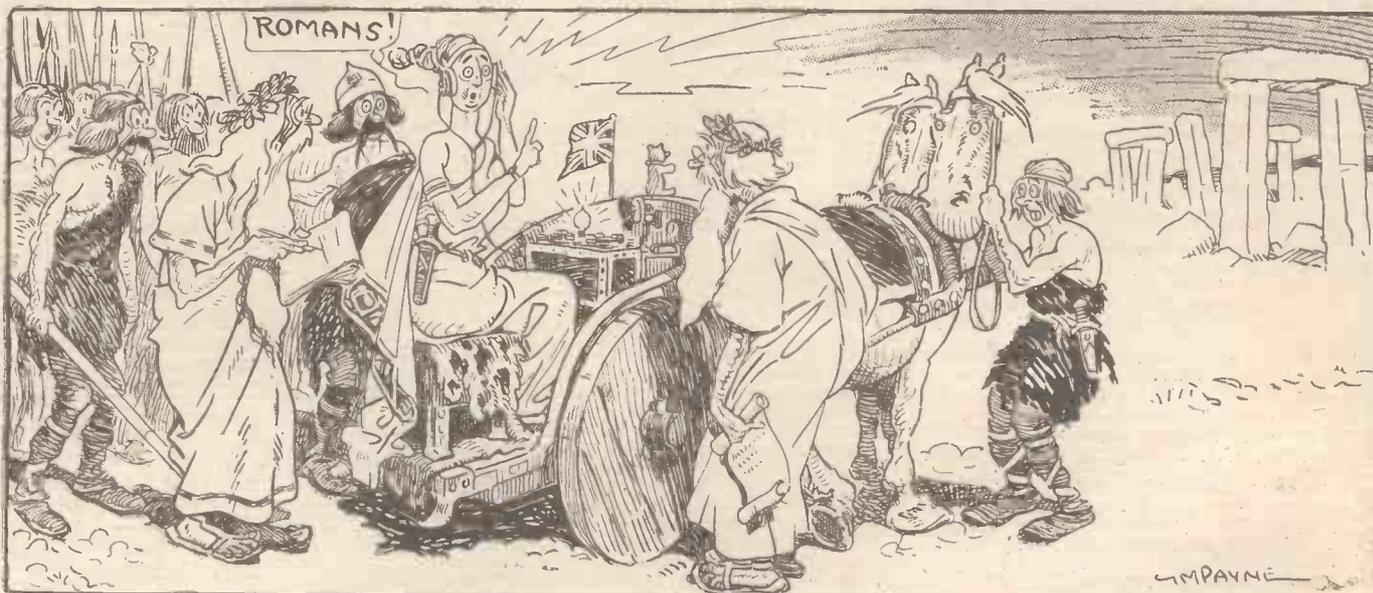
If your aerial is parallel to, and near telephone wires, there is no doubt that you could hear speech that was taking place over those wires. This is only possible over a short distance unless you employ a large number of amplifying valves. The reason for this phenomenon is, of course, fairly clear. The varying current flowing through the telephone wires will cause a varying electro-magnetic field round the wire. If your aerial is near enough to be cut by this magnetic field a similar current will be induced into your receiving circuits, and you will hear speech in your telephones.

"AERIAL" (Muswell Hill).—I have just decided to take up wireless, and as I have plenty of room for an aerial, would like to know which you consider best—a double or single one. How many insulators should I have?

You will probably find a single aerial about 30 feet high quite satisfactory, and it will be far easier to erect than a double one. Use at least two insulators at each end.

(Continued on page 746.)

WIRELESS IN HISTORY: THE FIRST S O S.



wireless - without an aerial

The "Ducon" does away with the Aerial. Plug one into an ordinary electric lamp holder or wall socket, connect to your wireless receiver, and you will receive the broadcasting perfectly.

The "Ducon" can be used with complete safety—each one is tested to 2,500 volts; *it consumes no current* and does not affect the electric light in any way.

The DUCON 10/-

is obtainable from leading wireless dealers, electrical contractors and stores, or direct from the makers.

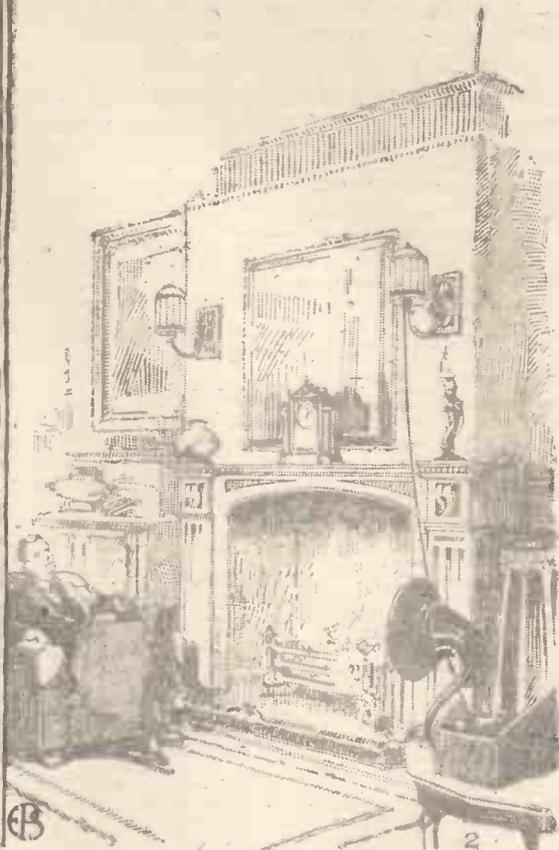
Over 50,000 in use.

Dealers not stocking are invited to write for trade terms.

The DUBILIER CONDENSER CO. (1921) LTD.
Ducon Works, Goldhawk Road, Shepherd's Bush, London.

Telephone: Hammersmith 2084.

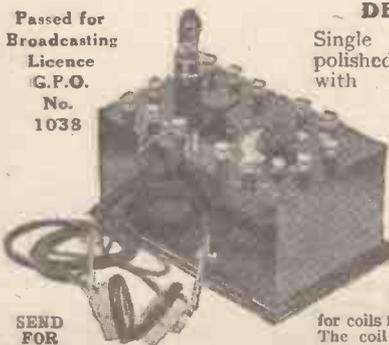
Telegrams: Hivoltecon, Phone, London



BROADCASTING RECEPTION SETS

One-Valve Set Complete for Working £7 : 10 : 0

Passed for
Broadcasting
Licence
G.P.O.
No.
1038



SEND FOR CATALOGUE AGENTS WANTED.

DESCRIPTION:

Single Valve, mounted on polished 1/4-in. Ebonite Panel with Variable Condenser, smooth acting resistance, grid leak and condenser and all terminals clearly engraved in white, in a Mahogany Polished Cabinet, 9 in by 5 in. by 5 in. £3 : 15 : 0

A TAPPED COIL for wave-lengths up to 900 metres with 2 terminals for coils for any higher wave-lengths. The coil is enclosed and the tappings are brought out to an 8-way switch mounted in the front of the cabinet.

ACCESSORIES INCLUDED:

- Siemen's 54 volt high-tension Battery with plugs for altering the voltage £0 : 15 : 0
 - 4 volt 50 amp. hour low tension Accumulator in case with carrying strap 1 : 4 : 0
 - One pair of Sensitive Head Phones of 4,000 ohms resistance 1 : 1 : 0
 - One Detecting Valve 0 : 15 : 0
- Total £7 : 10 : 0

Plus B.B.C. Royalties.

WIRELESS INSTALLATIONS LTD.

15, ALDRSGATE STREET, LONDON, E.C.

Satisfaction Guaranteed or money refunded.

The IDEAL SET for BEGINNERS

The Toy that's more than a Toy!



Post 32/6 Free

THE JUNIOR ASSEMBLY SET

Although sold at the price of a toy, this set has been designed by the makers of the well-known MULTUM-IN-PARVO Crystal Sets, as the boy's first real step in Wireless.

Clearly written instructions are given with each set, together with demonstration chart—failure is impossible—and many happy and instructive hours are assured.

All parts are of first-class quality, and the case is highly polished, solid mahogany. Only 'Phones and Aerial are needed to listen-in up to 10 miles.

We can supply our best quality 4,000 ohm 'Phones, especially suitable for this set, at 25/- per pair.



ASSOCIATED WITH CONSOLIDATED TRADING & MANUFACTURING CO., LTD., FULWOOD HOUSE, FULWOOD PLACE, HIGH HOLBORN, W.C.1. Call or Write for List.

HALL'S

PRICES THAT SPEAK FOR THEMSELVES!

BRITISH HEADPHONES

4,000 ohms. Very Light. Beautifully Finished. Stalloy Diaphragms. Complete with Cords. Adjustable Earpieces.

(Sold elsewhere almost exclusively at 35/-)

19/6 Postage 9d.

The well-known—
French "Brunet" Headphones
22/6 Postage 9d.

French "Sider" Headphones
21/- Postage 9d.

Every type of instrument and accessory for Mercury Condensers to Double Slider Tuners at ridiculously low prices can be seen at our showroom. Space naturally precludes complete list.

VARIABLE CONDENSERS:

Capacity	Parts Complete	Assembled for Panel Mounting
.001	7/-	15/-
.0075	5/9	12/9
.0005	5/-	11/6
.0003	3/3	9/-
.0002	2/3	7/-
.0001	2/-	5/-

Top and Bottom Circular Drilled Ebonite Plates, 1/6 extra. Vernier, 3/-

Intervalve Transformers, Ratio 4 to 1, finest manufacture 11/9; 5 to 1, 14/6

Crystal Sets "Royal Phone" Loud Speakers, 4,000 ohms resistance, ebonite horn, giving clarity of tone and freedom from distortion. each 30/-

Orders in strict rotation.

Aluminium Condenser Vanes, fixed and moving, 22/24 gauge pair 11d

Spacers, true to .001. Small, doz. 2d; large, doz. 2 1/2d

Ebonite Knobs, tapped 2 B.A. with brass nut—1st quality, 4d; 2nd quality 2d

Aerial Wire, 7/22 hard drawn copper, in 100 ft. lengths 2/8

Valve Legs, with nuts and washers, 1d each; doz. 9d

Two Coil Holders, solid ebonite mounted on mahogany 4/9

Three Coil Holders, solid ebonite, with long arms to avoid capacity effects 9/6

Crystal Detectors, adjustable in every way, turned brass on ebonite 2/6

Slider Rods, 12-in. or 13-in. 1-in. square brass, drilled both ends 4d

Engraved Ivorine Scales, 0-180°, round or square ends 4 1/2d

Filament Resistances, extraordinary value, velvet action 2/6

Switch Arms, complete with knob, collar, washers, bush nuts, etc. 1st quality, 1/6; 2nd quality 1/-

Valve Holders, turned ebonite, complete with nuts, 1/3; 2nd quality 9d

Crystal Cups. Plain 1d; one, two, or three screw 3d

Large Terminals, complete with nut and washer each 1d

Contact Studs, 1/2 in. by 1/2 in., or 3/8 in. by 1/2 in., complete with nut and washer. doz. 5d

Insulators, 2-in. reels—1d each; white egg, 3d; green egg, 4d; each green shell 3d

Brass Nuts, 2, 3, 4, 5, 6 B.A., doz. 3d. Washers, doz. 2d

Ebonite Sheets, 1/2, 3/4, 1, 1 1/4 lb. 3/6

Fixed Condensers, any capacity each 1/3

Grid Leak and Condensers combined each 3/6

Slider Plunger complete each 4d

Hertzite, 1/6. Boronite, Carborundum, Galena, etc. each 4d

Screwed Brass Lengths, 12-in. 2 or 4 B.A. each 3d

Inductances, wound 22/24 enamelled wire, each 3/6

Orders under 30/- kindly remit ample postage. Balances refunded if excess sent. Send for FREE Catalogue.

TRADE SUPPLIED HALL'S DISPATCH BY RETURN

'PHONE: REGENT 1282
71, Beak St., Regent St., London, W.1
Between Piccadilly Circus and Oxford Circus
Buses 3, 6, 12, 13, 15, 32, 51, 53, 59 and 88 pass

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 744.)

J. T. C. (Blackheath).—I notice that you always advise a water pipe for earth connection in preference to a gas pipe. Why is this? A gas pipe is usually far more handy.

If you use a water pipe you are sure of a good connection to earth. Moreover, this connection to earth is also obtained by means of the water the pipe contains, thus making a very good conductor, with very low resistance. In a gas pipe, however, the pipe is usually of iron—not so good a conductor as the lead water pipe—and the gas itself will not help in the conduction. Gas pipes, also, have cemented joints in them, which are liable to interfere with the flow of current to earth.

F. T. M. (Manchester).—I have a three-valve set and so far am unable to tune down to 2 Z Y, although with the same tuner and a crystal or single valve I can just get it in. Does the addition of extra valves affect the tuning?

Yes; to a certain extent the capacity and even inductance value of the set will be increased by the addition of stages of amplification. This is due primarily to the extra wiring involved, the capacity of the valves themselves, and the proximity to the A.T.I. of transformers, which must necessarily affect its inductance even although it may be inappreciable if considered alone. It is impossible to give you any definite method to reduce your wave-length range without details and diagram of your set before us.

"DISGUSTED" (Enfield).—I listened in the other night on a crystal set and could, by straining my ears, just hear faint strains of music. It was very nice, but has one always to hold one's breath when listening to wireless?

Not at all. You should listen in at Enfield for Marconi House on a three-valve set. You would then obtain a very opposite opinion as to the capabilities of wireless. It is all a question of the sensitivity of the set and the distance between that and the station from which it is receiving. We should recommend a single-valve set for comfortable "phone" reception in Enfield.

T. B. (Dorking).—Is it possible to use more than one pair of telephones on a crystal set without very considerably weakening the signals?

Yes; two pairs placed in series will not result in a very appreciable diminution of signal strength. A good tip to remember, which was mentioned in these columns some time ago and is perhaps worth repeating, is as follows: Separate crystal detectors with 'phones in series can be placed across the one inductance coil, care being taken to see that they tend to rectify in the same direction, otherwise it would result in a neutralisation. This will allow the introduction of a dozen pairs of 'phones, allowing one detector to two pairs, without noticeably showing a depreciation of the initial single detector signal strength.

"AMATEUR" (Liverpool).—What number Marconi valve can work from a dry cell for the filament, what current and voltage does it take, and how much plate voltage?

The L T 3; 1.8 volts 11 amp. on the filament, 30-50 on the plate.

G. S. A. (Lancashire).—I am making my own set, and would be pleased if you will answer a few questions: (1) Will a .001 mfd. condenser be suitable for a tuner, wound with 22 d.c.c. wire? (2) What is the wave-length of the above tuner 4 1/2 inches by 9 inches long? (3) Could I use slab coils for high wave-lengths? (4) What 'phones should I use for a two-valve set?

(1) Yes, though it is a little large. (2) The wave-length is roughly 200-1,600 metres using the above condenser. (3) Yes; these coils could be used for high wave-lengths, though they are unsuitable for low waves, owing to their high self-capacity. (4) Any good make of 'phone. About 4,000 ohms will be found quite O.K.

"WORRIED" (Kentish Town).—I have a one-valve set, and I used to hear the London amateurs regularly, but I never hear them now.

I can hear Marconi House very well, and occasionally Paris. Is there anything wrong with my set?

The reason why the amateurs have seemingly disappeared is that most of them have gone down to low wave-lengths for transmitting. Owing to the broadcast ing, 400 metres cannot be used during the evening. Listen in on 180-200 metres—especially Sunday mornings. You will hear plenty then.

"AERIAL" (Great Yarmouth).—I have been told that my aerial is "blind" for reception from the Hague, but quite O.K. for Birmingham. Personally, I am not certain if this is so, and would be obliged if you could tell me which way an aerial should point.

When deciding whether an aerial is "directional" for a certain station or not, the lead-in end should be taken as the head or pointer of the aerial. Thus, if your lead-in is at the end nearest the Hague, and the aerial goes straight in a direction away from that station, the aerial is then "directional" for best reception from the station.

B. T. P. (Cambridge).—I have a two-valve set (one L.F. amplification), and am thinking of adding another valve. At present I hear Marconi House and 2 W P, and of course Writtle, but they are not very loud. I should like to be able to hear Manchester and Paris. What valve do you recommend?

You should add an H.F. amplifier. This will enable you to detect signals which are coming from a fairly long distance away. Using this extra valve you should have no difficulty in hearing Paris or Manchester. For louder signals from stations you already hear fairly well, of course L.F. should be employed, but in your case we would recommend an H.F. amplifier.

"FED UP" (Hertfordshire).—I have just blown one of my valves, probably through the H.T. getting across the filament. Is there no safeguard that I can use to prevent this in the future?

Yes; you should have some fuse wire in between the H.T. battery and the valve panel. Any fuse wire that will blow at about 1 amp., or less, will be suitable. There are one or two firms which make a speciality of this type of wire. If you cannot obtain a proper fuse, you may find a short length of 48 S.W.G. copper will serve the purpose quite well.

"NO NAME" (Lyndhurst).—Please can you tell me how many turns of 28 S.W.G. enamelled wire I shall require to wind an inductance of 4 1/2 inches by 7 1/2 inches to tune to 4,000 metres? (2) How many turns are there per inch? (3) What would be my lowest wave-length?

Your former is too small to give you the range you require. You should increase the diameter to 6 inches and, if possible, the length to about 10 or 11 inches. You will need about 600 turns or so. (2) There are about 55 turns to the inch. (3) You will have difficulty in getting below 350 or 400 metres.

S. R. (Lewisham).—How can I calculate the resistance of any conductor?

The resistance of a conductor is, roughly, proportional to its length, and inversely proportional to its cross-sectional area. This is neglecting any heat effects. A formula giving the resistance of a conductor is $R = \frac{\rho L}{A}$. L is the length of the conductor in cms., A is the cross-sectional area of the conductor in cms.; and ρ is the specific resistance of the material, which is usually given at some definite temperature. R is the resistance in ohms.

"CRYSTAL" (Leigh-on-Sea).—I have a crystal set, using galena, and I find that I am constantly having to adjust the "catwhisker." If I leave the set for an hour or so the sensitive point seems to have shifted. Is this a common occurrence among crystal receivers?

Yes; the fact that the sensitive point is lost frequently is one of the disadvantages of crystal rectification. Galena especially is very apt to vary in sensitivity. When leaving a crystal it is best to lift the "catwhisker" off, or in any case to disconnect the aerial lead-in. This change of sensitivity is due to many things—heat, electric currents, atmospheric changes, damp, etc.—and cannot be avoided.

F. T. (Westbourne Park).—Is it advisable to clean the aerial occasionally? It seems to me that the oxide coating should be removed.

(Continued on page 748.)

ELECTRADIX RADIOS.

Immediate Delivery from our Huge Stocks.

Everything from a Recorder to an Earth Clip.

The best-equipped City depot.
COME AND SEE US.

9, Colonial Avenue is first opening on left in the Minories, near Aldgate Station, Metropolitan Railway.

LESLIE DIXON & CO. Tel.: Avenue 4186.
9, Colonial Avenue, London, E.1.

CRYSTAL SETS

Assembled and unassembled.

And all component parts.
Write for illustrated catalogue. Post free, 3d.

VALVE PANELS ON THE UNIT SYSTEM

Unassembled
Simple to build. Full instructions sent with each set. Ask for particulars.

P. H. BOYS & CO.

Electrical & Wireless Engineers,
187, GOSWELL ROAD, LONDON, E.C. 1.
Phone: Clerkenwell 4454.

ACCUMULATORS, etc. New and Guaranteed
4-Volt, 25-Amp. Celluloid, 11/3. Postage 1/-.
4-Volt, 40-Amp. 17/6 6-Volt, 40-Amp. 25/6
4 " 60 " 21/3 6 " 60 " 31/-
4 " 80 " 27/- 6 " 80 " 36/-
Packing, 1/6 extra. Packing, 2/- extra.
7/22 Aerial, 5/6 100 ft.; Mullard Ora Valves, 15/-;
15-V. Siemens H.T. Batteries, 4/-; Marconi R. Valves, 17/6; Accumulator Charging Board, 37/6;
Voltmeters, Watch pattern, 0/12 Volts, 6/-.
Cash with order. Goods despatched per return.
LOWKE & SONS, Ltd., Northampton.

PORTLAND'S

Parts by Post.
"EBONITE."

	s. d.	£ s. d.
8 x 1.....	7	7 6
4 x 4.....	13	9 6
7 x 5 1/2.....	28	12 10
10 x 6.....	39	3 0
17 x 5.....	53	1 3 0
		7lbs 1 3 0

Quarter, Mat, British.

Postage Free. Any size cut.
JAMES PORTLAND
39, Sinclair Road, Olympia, W.14.
Mr. Portland stocks
200 Wireless Parts

WIRELESS BARGAINS

Load Speakers, 10/6; Crystal Detectors, 3/-;
Phones, All British, 4,000 ohms, 21/- All
Post Free. Trade Supplied.
Illustrated Catalogue P, including list of stations,
6d. post free.

EONS WIRELESS SUPPLY CO.
115, FLEET ST., E.C.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 746)

Yes; the periodic cleaning of the aerial will probably result in better signal strength, though it is not worth the trouble unless you have your aerial arranged on pulleys and can easily lower it. More attention should be given to the insulators than the aerial itself, and these should always be kept clean. If soot is allowed to accumulate on the insulators, a conductive coating is very quickly formed, and a considerable amount of energy escapes from the aerial to earth along the surface of the insulators.

D. E. L. (Barking).—I have a crystal set, with one-valve amplification. At present I am using a biscuit tin as earth, buried about 3 feet 6 inches deep in fairly moist soil. There is a water tap some distance away from the biscuit tin, and about the same distance from the set as the tin is. Would it be any improvement to use both the tin and the water pipe as earths?

The two earths could be used to advantage, but a separate lead to each should not be employed, owing to capacity effects. Take a bare wire from your tin, underground if possible, to your water pipe. This will mean that the tin and the pipe are both in series with the set. This earth should prove very effective indeed.

L. I. (Oxford).—How many valves should I need to hear the Hague as well as the three English broadcasting stations?

For efficient reception you will need four valves, using one H.F. and two note magnifiers. It is doubtful, however, whether you will be able to use a loud speaker without employing another H.F. valve amplifier.

"ENQUIRER" (Bristol).—What do the letters E.M.U., E.S.U., and I.C.W. stand for?

Electro Magnetic Units, Electro Static Units, and Interrupted Continuous Wave.

N. E. F. (Chislehurst).—Can you give me the number of turns per inch it is possible to wind using 22, 24, 28 and 30 S.W.G. enamelled and D.S.C.?

Using 22 S.W.G. approximately 32 and 28, 24 S.W.G. 40 and 36, 28 S.W.G. 60 and 54, and 30 S.W.G. 70 and 65.

K. L. J. (Bedford).—What is the best way to use a lead roof as an earth?

The best way, strictly speaking, would be to have the set above the lead roof in order to employ it as an efficient earth. Therefore unless alternative earths are hopelessly out of the question, that method should be avoided. By the way, don't forget to keep the aerial as far above it or as far away from it as possible.

T. O. I. (London, E.).—I am just about two miles as the crow flies from Marconi House, so would it be possible to hear the music with a crystal set on an indoor aerial?

Quite possible, if due regard is paid to the direction of the aerial, i.e., lead in end pointing to 2 L.O. insula-

tion and earth. For this latter employ the usual water pipe or direct earth to a plate of metal in the ground. The latter, if it is in any way possible.

"PUZZLED" (Louth).—Is it possible that some of these "records" obtained by crystal and simple valve sets are due to reradiation from near at hand multi-valve sets?

Yes, it is quite possible that reradiation may contribute very greatly towards these "freak" results, but not in all cases, as it has been proved that in some no valve-sets were within many miles. This latter condition, however, will obtain in very few parts of the country at present.

J. H. H. (Wolverhampton).—I have seen in an American journal that ordinary electric light bulbs can be used as valves merely by fixing a rough grid and plate round the outside. Could not therefore the ordinary electric lights used for house lighting be employed for the purpose, and carry out their ordinary work as well?

Not at present, anyway, the greatest difficulty to overcome being that of interference from the main itself. You will be interested to learn that POPULAR WIRELESS is publishing an article very shortly on valves whose filaments can be lighted directly from 110 volt A.C. and D.C. mains.

P. T. E. (Wanstead).—Are those low current valves "soft"?

No. "Soft" valves generally function well on 20 or so volts, and will "blue" up if the H.T. is increased unduly above that, whereas the low temperature or low current valves generally require from 40-50 volts on the plate, and can therefore be placed in the "hard" category.

"SATISFIED" (Manor Park).—I have constructed and obtained successful results with the valve panel you gave in Number 26 of POPULAR WIRELESS, and now wish to add a low frequency amplifying panel. Can any make if I buy it complete be used?

We should suggest that you should construct the L.F. panel as well, although the L.F. transformer should be purchased complete. Mr. Hersey, who wrote the detector panel article referred to, has written two further articles describing the construction of both an H.F. and an L.F. panel to connect to the detector panel in the orthodox unit fashion. These will appear very shortly.

"REDÆR" (W.C. 2).—Referring to your article in POPULAR WIRELESS, No. 27, on freak sets, I shall be glad if you can give me the approximate number of turns used for the inductance.

About 50-80 turns will be found to be O.K. Tuning is done by means of the variable condenser. The wire you mention will be quite O.K.

"CRYSTALICE" (Manchester).—Can you please tell me if I need an experimental licence for a home-made crystal set?

You should write to the Secretary, G.P.O., for an experimental licence form. This should be filled in as far as possible, and then data given with the form saying that you want permission to use your set with a broadcasting licence. The full details of your set should be given. For further details, see the article on "Home-made Sets," in POPULAR WIRELESS, No. 31, December 30th.



USE Q 61 HEADPHONES

for best results. Perfect design, extremely light and comfortable. Immediate delivery from stock.
4,000 Ohms 21/- per pair.

Specially designed for Wireless Telephony. Receivers arranged in series, Aluminium Cases and fitted with extremely light and efficient Head Bands, and Twin Connecting Cords. Offered subject to being in stock on receipt of order.

Illustrated Wireless Catalogue now ready. Post Free 3d.

The JEARY Electrical Co. Ltd

8, LAMBETH HILL, & 97, Queen Victoria St., London, E.C. 4

HERE'S REAL RADIO SERVICE

QUALITY GOOD. PRICES RIGHT. DELIVERY PROMPT.

TELEPHONES, double headbands, 4,000 ohms.	£1-0-0
TELEPHONES, double headbands, 8,000 ohms.	£1-2-6
SINGLE EARPHONE, with cord and handle, 4,000 ohms.	11/0
CRYSTAL DETECTORS, mounted on coneite, ball & socket joint	2/6
WOUND INDUCTANCE, 12" x 4", wound with 22 enamel wire	3/6
BLOCKING CONDENSERS, any capacity	2/0
FILAMENT RESISTANCES (remarkable value)	2/6
INTERVALVE TRANSFORMERS, 5 to 1 ratio	from 14/0
BASKET COILS, set of seven	5/0
SLAR COILS, set of eight	7/6
TERMINALS	from, per doz. 1/0
POCKET LAMP BATTERIES, 4.5 volts, for H.T.	per doz. 5/0
AERIAL WIRE, 7/22 bare copper, 100 feet	3/3
AERIAL WIRE, 7/22 enamelled, 100 feet	4/6
AERIAL WIRE, 1/18 phosphor bronze, 100 feet	2/0
LEADING-IN CABLE, heavily rubber-covered	per yard 6d.
VARIOCOILERS, 150-500 (few only)	17/6

Silk, Cotton, and Enamel-covered Wire, Cardboard Cylinders, Accumulators, H.T. Batteries, Technical Books, etc., etc.

The **Waterloo Electric Co.,** 129, WATERLOO RD., LONDON, S.E.1
Telephone: Hop 5649. Send for Free Price List.



**Important Notice to all Wireless
Manufacturers, Retailers,
Experimenters and Amateurs.**

EX - GOVERNMENT WIRELESS APPARATUS

A few weeks ago, we advertised the purchase of a complete Government Wireless Depot and offered the same for re-sale at astonishingly low prices in accordance with our inevitable business rule to

SHARE OUR BARGAINS WITH OUR CUSTOMERS.

The immediate response to our advertisement resulted in our being absolutely "snowed under" with enquiries and orders from all over the country, and it was only through despatch staffs working night and day at full pressure that we were able to keep faith with our customers in respect of our promise to execute all orders

WITHIN 48 HOURS OF RECEIPT.

It was impossible to deal with the thousands of enquiries as expeditiously as we should have wished and we again take the opportunity of tendering our apologies to all those who unfortunately were kept waiting.

Moreover, we are returning cash to the extent of several hundreds of pounds daily to those who unfortunately were too late to avail themselves of the wonderful bargains we offered, for when once the stock of any particular line is disposed of

IT IS IMPOSSIBLE TO REPEAT AT ANY PRICE.

As an example, the Hand Generators and Galvanometers were all sold by Telegraphic Money Order within a few hours of our advertisement appearing. The public are aware that it is possible to deal in this way with a firm of repute making the unconditional offer, as we do, to forward

EVERY ARTICLE ON APPROVAL FOR 7 DAYS.

We hope in the near future to be able to repeat our bargain offers from time to time, and we invite the Wireless public to assist us so that we can more expeditiously deal with the demand as it arises.

By filling in the Form at the foot of this page

YOU WILL BE PLACED ON OUR MAILING LIST.

Immediately this Form is received, an envelope will be addressed in readiness and the moment we have a bargain to offer everyone on our mailing list will be informed simultaneously.

FILL UP THIS FORM NOW

and post to us immediately. ½d. stamp only required.

Messrs. THE CITY ACCUMULATOR CO.

Mail Order Dept., 79, Mark Lane, London, E.C.

Please include my name on your Mailing List. I am particularly interested in

.....

(Signed)

Full Postal Address

.....

POP. WIRELESS.

Date 19

Radio Head 'Phones

(Manufactured under Brown's Patent No. 134353/18 by Sole Licence)



No. R1238

To obtain the best results from your receiving set use high quality Head 'Phones.

The instrument illustrated is of the highest efficiency and has an unequalled popularity by reason of its sensitive and selective qualities.

Gives a comfortable fit to the ear of the user.

Write for leaflets Nos. 321 and 325.



MARCONI

STANDARD

To be obtained from all Dealers or direct from:

Sterling Telephone & Electric Co.,
TELEPHONE HOUSE, LTD.

210/212, Tottenham Court Road, London, W.1.

Telephone No.: 4144 Museum (7 lines). Telegrams: 'Cucumis, Wesdo, London.'

Works: **DAGENHAM, ESSEX.**

Branches: **MANCHESTER: 14, St. Peter's Square.**

CARDIFF: 8, Park Place.

NEWCASTLE-ON-TYNE: 9, Clavering Place.

We guarantee that all Broadcast Radio Apparatus sold by us conforms with the conditions of the Broadcaster's Licence issued by the Postmaster-General.

DON'T Let Violence in Advertising
Rush Your Judgment

FOR YOUR PROTECTION

INSIST on a comparative demonstration
before you purchase

It is all we ask to prove the demonstrable superiority in signal strength, purity of tone, simplicity in operation of

THE
Crystophone
REGISTERED

P.M.G. BROADCAST RECEIVERS

SOLD BY ALL LEADING STORES
AND WIRELESS AGENTS

All Crystophone Receivers are exclusively fitted with the

LATTIKONE TUNER

The ONLY Tuning Coil which actually builds up and strengthens the incoming signal current and thus enables us to claim a

50% INCREASE in Signal
Strength. Such is the reserve of power of

THE
Crystophone Type 33
REGISTERED (two valves)

that 4 Invisible wires stretched across the ceiling of ANY ROOM,

on ANY FLOOR,

in ANY HOUSE in
LONDON, BIRMINGHAM, MANCHESTER,
is sufficient for use with 6 pairs of head-
phones, while with a P.M.G. Aerial it is

Guaranteed for 100 Miles

PRICE £15 (INCLUDING
ALL ROYALTIES.)

Crystophone Crystal Receivers

with Lattikone Tuner,

PRICES from £3 10s. 0d.

Demonstrations Daily

ON BROADCASTING

FROM 4 TO 10 p.m.

WIRELESS SUPPLIES CO.,
64, Mortimer St., London, W.1.

'Phone: Museum 2672. 'Grams: "Adragonax, Wesdo, London."

All Applications for Advertisement Space in POPULAR WIRELESS to be made to JOHN H. LILE, Ltd. (Sole Agents), 4, Ludgate Circus, London, E.C.4. Phone: 10806 Central.

No. 33. AN ARTICLE BY Dr. LEE DE FOREST.

POPULAR WIRELESS

3d

Weekly

No. 33. Vol. 2.
Jan. 13, 1923.

*ullo Everybody!
2 L.O. Callings*

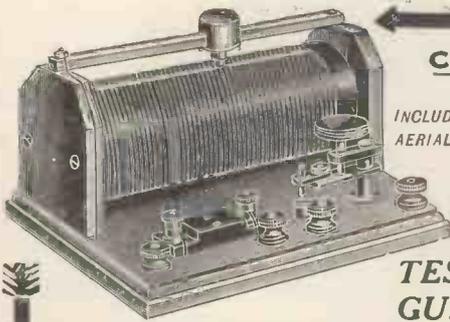


Marconi House, the temporary home of the London Broadcasting Station.

FEATURES IN THIS ISSUE.

The Amateur Wireless Association.
The Mysterious Pliodynatron.
Ideas for Amateurs.

The Value of High Resistance 'Phones.
How My Set Grew Up.
Famous Wireless Patents.



COMPLETE
FOR
INCLUDING
AERIAL AND
50/-
ONE
PAIR
OF
"MITCHELLPHONES."

**TESTED AND
GUARANTEED**

FOR LONDON, BIRMINGHAM, & MANCHESTER.

A Handsome Receiving Set, tuning up to 1,000 metres, at a very sensible price that will appeal to intending purchasers.

Without doubt the finest value for the money, and is sold under our usual unconditional guarantee.

The price covers one pair of the famous Mitchellphones and aerial material for 100 feet, postage paid to your door. Immediate delivery can be effected, and you can easily instal the whole outfit by following the book, which is included.

Dimensions:

9 ins. x 6 ins. x 5½ ins. high.

MITCHELLS ELECTRICAL AND WIRELESS Ltd., 188, Rye Lane, Peckham, S.E.15

POSTAL ADDRESS: McDermott Road, Peckham, London, S.E.15.
WEST END BRANCH: 2, Gerrard Place, London, W.1.

Read This:—
Unsolicited testimonial original can be inspected.
Surrey, Oct. 22, 1922.
Dear Sirs,
I am writing this to assure you of the efficiency of your Wireless Outfit. On Tuesday last I heard the Writtle Concert, although it is advertised to have only a 25 mile radius for speech.
I am, Yours truly,
R.---

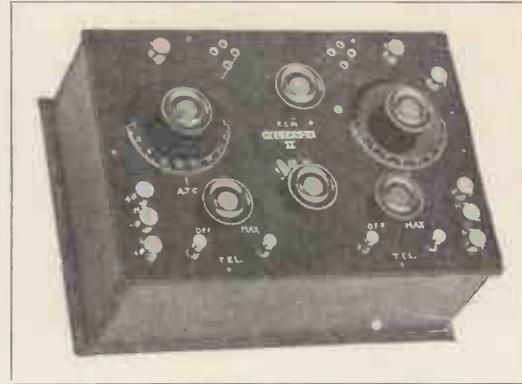
? WHY ?

Has the

G.P.O. Reg. **"HESTAVOX II"** No 2005.

2-Valve Receiver

Established itself as the ideal set for Broadcast Reception?



WE WILL TELL YOU.

Because it is of perfect design and finish, will receive the Broadcast Transmissions from distances up to 150 miles, is easily built into a multi-valve set one valve at a time as required, and is moderately priced at

£12 : 7 : 6 (exclusive of accessories)

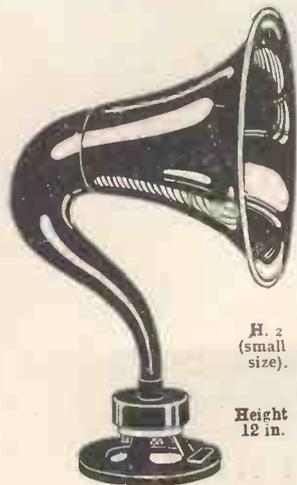
Write for Name and Address of our Nearest Agent. Some District Agencies still open. CATALOGUE (Post Free) 6d.

The "HESTIA" ENGINEERING COMPANY,
32, PALMERSTON ROAD,
1 min. South Acton Stn. ACTON, LONDON, W.3.
(N.L. and District Rlys.)

Showrooms open
9 a.m. — 6 p.m.
Telephone:
Chiswick 580

**The "BROWN"
LOUD SPEAKERS**

with new improved
Curved Horns



THE requisites of a Loud Speaker are pure tone, clear articulation, and good volume of sound. The BROWN Loud Speaker possesses all these qualities in a marked degree. Type H. 2 has been designed to meet home requirements, both as to volume of sound and price.

PRICES

H. 2 (Small), Low Resistance. 120 ohms, height 12 in. £3 0 0

H. 1 (Large), Low Resistance. 120 ohms, height 21 in. £6 5 0
High Resistances for either size, 2/6 to 5/-extra.

THE BROWN MICROPHONE AMPLIFIER.

This amplifier gives a magnification much greater than that obtained from a two-valve amplifier.

Prices

Low Resistance (120 ohms input) £6 0 0
High Resistance (2,000 ohms input) £6 2 6

All our apparatus can be obtained from all wireless dealers.

Sole Manufacturers:

S. G. BROWN, Ltd.,

London Showrooms:

19, MORTIMER STREET, LONDON, W.1.
Head Office and Works: Victoria Road, North Acton, W.3.

Use a Note Magnifier!

The Wates Unit System of Note Magnifiers enables you to build up your set, step by step, until your reception will be as perfect as with a larger and more expensive receiving set.

These Note Magnifiers are recommended to the Amateur who is not in the position to instal a larger set in the initial stages. The surprising amplification obtained after fitting even one unit will justify the small cost. The panel is enclosed in a highly polished mahogany case, and costs but

£3 10 0

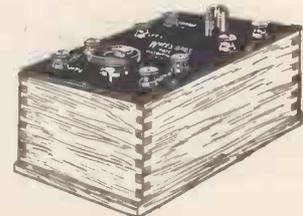
including all Royalties and Taxes.

TWO-VALVE AMPLIFIER IN ONE UNIT

£6 0 0

Send for particulars of this and our list of Broadcasting Receiving Sets (Crystal and Valve), or call at our Showrooms—they will interest you. We also manufacture and supply all component parts.

- Filament Resistances...3/9
- "Ideal" Valve Accumulators in cases.
- 4-Volt 50 amp. 24/- (Carriage 2/-)
- 6-Volt 50 amp. 35/- (Carriage 3/-)
- Variable Condensers (of various capacities) ... From 6/-
- Fixed Condensers ... 2/6
- 3-Coil Holder, complete Unit for use with Standard Coils ... 20/-



Wates Bros. 13/14, Great Queen Street, KINGSWAY, LONDON, W.C.

Phone: Gerrard 576.

Telegrams: Zywateseng, Westcent.

NEXT WEEK
THE PROGRESS OF BROADCASTING
 By Sir William Noble
PETER PAN BY WIRELESS
 (An Interview with Miss Edna Bést)
THE NEWCASTLE BROADCASTING STATION

Popular Wireless

TOPICAL NEWS AND NOTES.

NEXT WEEK
HOW TO MAKE AN H.F. AMPLIFIER
A PAGE OF IDEAS FOR AMATEURS
A COMPACT AND NOVEL RECEIVER
WIRELESS STAGE "STUNTS"
 By Major Raymond PHILLIPS, I.O.M.

Going Some!

MR. R. E. JAMES writes to me from Manchester to the effect that he is obtaining extraordinary results with one valve and a frame aerial. He can bring in the Manchester broadcasting station from a distance of six miles on a loud speaker and obtain comfortable telephone signals from Birmingham, while Marconi House and Paris are easily audible. He also states that he can hear the American telephony very faintly, but —?

An Everyday Affair.

INVARIABLE reception of 2 LO and 2 MT on one valve in Glasgow is, according to Mr. T. A. Robertson, the performer of that commendable feat, quite simple. His apparatus is simplicity itself, consisting merely of a valve panel and a small tuning coil with a reaction. The tuning coil con-



A New Photograph of Mr. Arthur Burrows

sists of 70 turns of 24 S.W.G. on a 3-in. former, and the reaction, a former of 2 in. diameter and 4 in. long, wound with 26 S.W.G. No variable condensers are used.

Hardly "Freak."

THE number of amateurs who report that they have heard the American broadcasting is steadily increasing. Two stations in Inverness—one using an indoor aerial and four valves—have heard W J Z (Newark), while the same station has been heard in Leicestershire, Warwickshire, and as far east as Norwich.

In one case the receiving station only consisted of two valves, one detector and one L.F. amplifier.

These successes, coincident as they are with fair weather conditions, can hardly be put down as freak reception. Probably in

the near future we shall be able to hear the Americans almost as well as our own stations.

Aircraft and Radio.

LECTURING on "Wireless and Aircraft" before the Chelmsford Engineering Society, Capt. P. P. Eekersley emphasised the importance of communication between aircraft and the ground and also between different machines. Quite recently a machine at Croydon lost one of the wheels from its under-carriage, on leaving the ground. The pilot was warned of this by wireless and was able to make a good landing on his one remaining wheel by tilting his machine. For communication with aircraft, the telephone was used rather than Morse code, mainly because the pilot had plenty to think about without having to translate Morse at the same time. The pilot had the receivers close to his ears inside his helmet, and this was found to exclude the noise of his machine quite effectively.

Progress in Norway.

THE Norwegian Radio Company, the Norwegian Marconi Company, and the Norsk Telegram Bureau have submitted to the Government a request for a concession to build and carry on a broadcasting telephone system from stations in Norway.

It is said that the companies intend to form a joint broadcasting telephone company for the purpose of building sending stations in Christiania, and subsequently at Bergen and Trondhjem, each with a radius of one hundred miles for the regular transmission of concerts. Receiving apparatus, for hire by subscribers at an annual fee, will be placed under the control of the telegraph board.

The companies have also requested the Government for leave to build a large radio-telephone station in Christiania in order to broadcast Press exchange news and weather forecasts over the whole of Southern Norway. The radio-telegraph is intended to be used for long distances, such as Trondhjem and the North Cape.—"The Times."

America on a 2-foot Frame!

THE other interesting fact about Captain Round's Christmas Eve-Christmas Morning vigil is that there was no mere "pig's whisper," but a loud speaker in full blast. Now one needs quite a respectable volume of sound to make a loud speaker shout about the house, so that although eight valves were at work the result is really surprising, and should

give a fine fillip to amateur endeavour. I may mention, for the benefit of those who wish to repeat the experiment, that the wave-length on which WGY was sending was about midway between those of the Manchester (385 metres) and Birmingham (425 metres) Broadcasting Stations, and that the signals were heard before 2.0 a.m. (Greenwich).—Extract from an article by Mr. E. Blake, A.M.I.E.E., in the "Daily Mail."

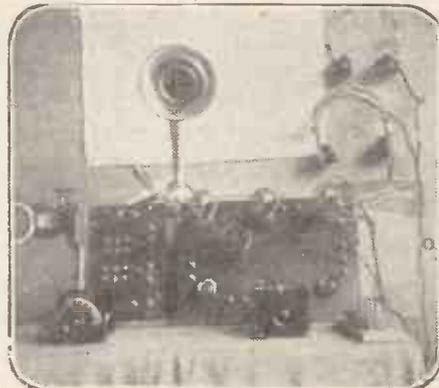
The Trans-Atlantic Tests.

ASERIES of experiments in Trans-Atlantic wireless telegraphy, under unusually economical conditions, has just been completed in South London by members of the Radio Society of Great Britain.

The experiments were held on ten successive days, from December 22nd. They were carried out with an apparatus installed by experimenters in a building at the base of the chimney on the premises of the County of London Electric Supply Company, at Wandsworth. The aerial consisted of six wires on a hoop five feet in diameter, fitted to the chimney, 170 feet high. The maximum wave-length used throughout the ten days was two hundred metres, and the maximum power one kilowatt and a half.

The call number of the station was 5 WS, and this, with groups of code letters belonging to the code of the Radio League of America, was sent out during two periods of fifteen minutes each, between midnight and 4 a.m., every day. Replies from the American amateurs, through their league, relayed by the Carnarvon station, were received at Wandsworth to all the transmissions except those of the first day, and these replies were confirmed by telegram.

(Continued on next page.)

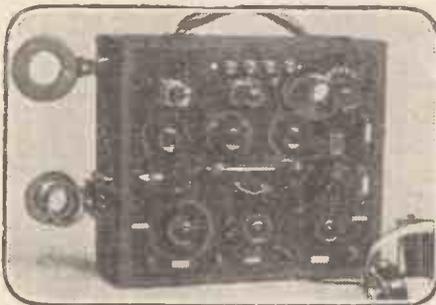


Mr. L. Tyers' Set, 12, Manor Road, Smethwick, Birmingham

Further Tests in View.

MR. L. McMICHAEL, the secretary of the Radio Society of Great Britain, claimed that these successful experiments were unique achievement for British amateurs. Their importance could best be appreciated by bearing in mind that our big official and commercial stations, when communicating with America and other distant countries, used wave-lengths of from 15,000 to 30,000 metres, and power from 250 to 350 kilowatts. The aerials, too, in such cases, were tremendous structures, with a complicated system of wires.

The society's recent tests, carried out under atmospheric conditions that were by no means satisfactory, would cause many experts to consider whether the great expense represented by existing high-power stations was altogether necessary. He thought the tests had impressed the authorities, who had been inclined to doubt their usefulness ever since the society first contemplated making them, nearly a year ago, and it might be that drastic revisions



Mr. J. G. W. Thompson's set, 8, Frith St., Edinburgh.

of the Empire wireless schemes would come under consideration.

At the end of this year the committee of his society hoped to make experiments in economical Transatlantic wireless telephony.

What We May Expect.

"IN five years' time, if certain expectations are realised, it will be possible for anyone in any part of the country to sit down at his own fireside—among the Grampians, in Wessex, or in the West-end of London—and listen, it may be, to 'question time' at the House of Commons, a speech by the Prime Minister, an act from an opera at Covent Garden, a scene from a new play at one of the theatres, or a concert at the Albert Hall. In the opinion of wireless experts, there is no question as to the practicability of such a scheme. Technically, it is all a matter of linking up the Houses of Parliament and the other places to the broadcasting station by means of land lines. A representative of 'The Times' was informed recently that the laying of these land lines had already been under consideration by the British Broadcasting Company. Before anything of the kind can become an established practice, however, the wireless authorities recognise that there are serious difficulties to be met."

(From "The Times.")

Big Changes Coming.

"THE Times" goes on to say that: "A serious effort will be made at every station to improve the standard of the programme. It is largely owing

to the kindness of the artists that the present programmes are being carried on. The services of the performers have mostly been given for nothing. In the next twelve months every station will have its own wireless orchestra of ten or fifteen performers. On the literary side an attempt will be made to reach a wider constituency. 'What we aim at is to have a speech from the Prime Minister, say, on the night he takes office, or a talk by Donoghue on the night he wins the Derby,' stated a Broadcasting official. 'On such occasions it would be possible to push up the power of the London station and give the speech to the whole country. I do not think it is unreasonable to suggest that by 1924 the Prime Minister or the Archbishop of Canterbury or the representative of any other party or creed will be able to reach at one time an audience of one million people.'

Why?

CAN any reader tell me why it is that every time a fellow hears music faintly and no call sign, the Editor gets inundated with letters reporting reception of New York broadcasting? And why we all get that nasty twinge when Mr. Burrows says scathing things about reaction fiends in our own particular neighbourhood? And why it pours with rain on the very day one decides to overhaul the aerial?

A New Magazine.

MR. SCOTT-TAGGART tells me that his new wireless magazine, "Modern Wireless" (price one shilling net), will be on sale on January 15th. I feel sure all keen wireless men are looking forward to the first issue of this magazine, for under the control of Mr. Scott-Taggart it is bound to be well worth its price.

Various.

DR. W. H. ECCLES has accepted the Presidency of the Radio Society of Great Britain in succession to Admiral Sir Henry B. Jackson.

I shall be pleased to receive the opinions of readers on the broadcasting of the Opera from Covent Garden, via 2 L O.

Mr. William Le Queux, M.I.R.E., is now enjoying a well-earned holiday in Switzerland. Recently I hear Mr. Le Queux had a very narrow escape while skiing. He was flung into a deep drift and not until some hours later were his cries for help heard.

Mr. Percival Marshall's exhibition at the Horticultural Hall has been a great success. A full report of the various wireless exhibits will be given in our next issue.

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.
Marconi House, London, Broadcasting Station	2 L O	369	Usually every evening, 5 to 5.45 p.m.; 7 and 9.30 News; 7.15 Orchestra; 8.25 to 10.30 Music.
Newcastle Broadcasting Station	5 N O	400	6-10 p.m. (approx.).
Manchester Broadcasting Station	2 Z Y	385	Every evening, usually from 4.30 to 10 p.m.
Birmingham (Witton) Broadcasting Station	5 I T	425	Every evening, usually from 6.30 to 10 p.m. (News, Concerts, etc.).
Croydon	G E D	900	Throughout day to aeroplanes.
Writtle, Essex	2 M T	400	Tuesdays, 8 p.m. (Concert.)
Paris	F L	2,600	7.20 a.m., 11.15 a.m., 5.10 p.m. Also occasional telephony at 10.10 a.m. from 5.20 to 7 p.m.
Königswusterhausen	L P	2,800	Between 6 and 7 a.m., between 11 and 12.30, and between 4 and 5.30 p.m.
The Hague	P C G G	1,085	Sundays, 3 to 5 p.m. (Concert.)
Haren	O P V H	900	Practically every 20 minutes past each hour from 11.20 to 4.20, giving messages to aeroplanes on the Brussels - Paris, Brussels-London, and Brussels-Amsterdam lines. Concerts at 8.45 p.m.
Radio-Electrique, Paris	—	1,565	

Note.—See announcements in daily Press for last minute alterations in times of Broadcasting Programmes.

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

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

All times given are G.M.T.

MY ORCHESTRA OF AUDIONS.

THE AUTHOR OF THIS ARTICLE IS A RADIO SCIENTIST OF WORLD-WIDE REPUTE. THE "MAN WHO PUT THE GRID IN THE VALVE"—AS THE AMERICANS REFER TO DR. DE FOREST—HAS GIVEN IN THE FOLLOWING ARTICLE SOME INTERESTING NOTES ON A NEW AND WONDERFUL INSTRUMENT. HE EXPLAINS HOW EXTRAORDINARILY BEAUTIFUL MUSICAL TONES ARE CREATED BY THE VARIATION OF INDUCTANCE OR CAPACITY IN THE VALVE CIRCUIT, AND EVERY AMATEUR WHO HAS BEEN PLAGUED BY "HOWLING" WILL RECOGNISE THE RAW MATERIAL FROM WHICH DR. DE FOREST'S "ORCHESTRA OF AUDIONS" IS BUILT.—EDITOR.

By LEE DE FOREST, Ph.D.



Dr. Lee De Forest

THE undeveloped talents of the audion tube are undoubtedly numerous. One might let his imagination roam at will among its possibilities and never touch upon more than a small fraction of the applications some day to be discovered; many of them, doubtless, by the thousands of radio amateurs who are now free to pursue this still adventurous search.

There is one phase of audion, application in which I have always had a deep personal interest. This application does not lie in the field of practical utility, but in the world of art and imagination, in the province of music.

A Wonderful Discovery

For, in addition to its many other magic feats, the audion may be used to produce musical harmonies far more beautiful than those of any musical instrument yet devised.

Music from the audion! That is the theme which I suggest to those who are interested in the undeveloped possibilities of the vacuum tube.

The audion serves not only as a detector, an amplifier and a high-frequency generator, together with a score or two of other uses in electrical engineering: it will serve also as a musical instrument, an instrument of astounding possibilities.

It is quite possible, I believe, that the musical audion, when fully developed and perfected, will revolutionise altogether the production of music. It will supersede our organs and pianos, even perhaps our

symphony orchestras, just as these have superseded the musical instruments of ancient times, the lyre, the tambor, and the Pipes of Pan.

This musical phase of audion possibilities is not a new idea, though it is one long awaiting development. Back in 1915, following the use of the audion in the record-breaking radio telephone demonstration from Arlington to Honolulu, I made an announcement of what was then the promise of an early use of this magic tube as a producer of music. I pointed out that the tube was a device capable of producing musical notes of rare beauty and great range; an entirely new music of surpassing volume and harmony.

It was while developing the audion as a wireless telephone detector, and as an amplifier to be used on long-distance telephone lines, that I made the discovery of audion music. I found that when the

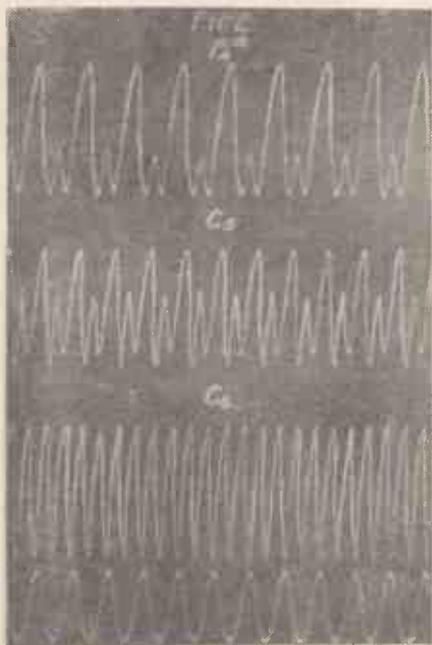
circuits of an audion tube were adjusted in a certain way, so that electrical oscillations were produced, I could hear a clear musical note in the connected telephone receiver. The quality of this note was exceptionally beautiful. After later experiments I found I could change this quality of tone so as to produce a great variety of sounds—imitating, for example, the flute, the oboe, the cornet or stringed instruments. I could also produce other sounds which, while pleasing to the ear, were quite unlike the tones emitted by any of the musical instruments with which we are familiar.

Ethereal Tones.

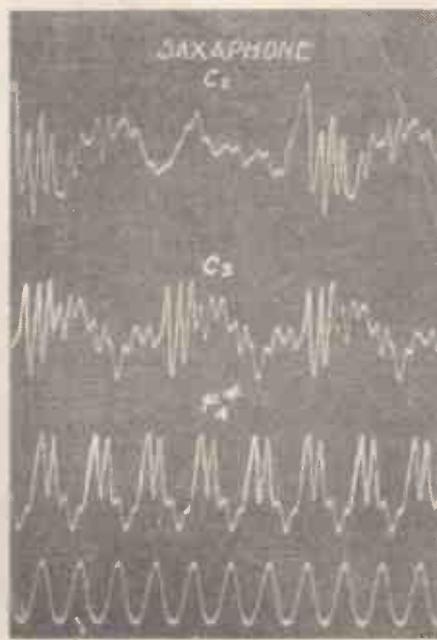
The pitch of the note could be regulated, I found, by changing the capacity or the inductance of the circuit, this being accomplished easily by means of a sliding contact on the inductance coil or by turning the knob of the condenser. I found, indeed, that I could change the pitch of the note by merely touching my finger to certain parts of the circuit, and by so doing I was able to obtain many weird and beautiful sound effects. Another method of varying the pitch was by means of a black lead pencil mark drawn on a piece of paper or a slate and connected across certain parts of the circuit.

Everyone is familiar with the peculiar plaintive notes produced by the Hawaiian guitar when the player slides a piece of steel along a string previously set in vibra-

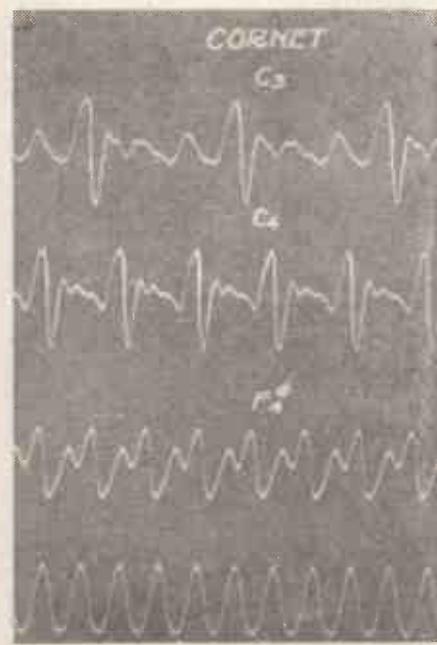
(Continued on next page.)



This oscillograph photo of the notes of a fife shows (at the bottom) a pure sine wave of 100 cycles a second. The second wave from the bottom shows the highest note of the fife, which has practically no harmonics. The presence of harmonics is clearly shown in the two upper waves.



The tones of the saxophone—the instrument richest in harmonics. Compare the record of harmonics (illustrated by the frequencies in the three upper waves that record the three different notes of the saxophone) with the pure sine wave at the bottom.



Portrait of three notes of a cornet. Note the first harmonic (one octave below the fundamental) in the second wave from the bottom (above the pure sine wave). In the next record above are numerous harmonics which are further increased in the top wave.

MY ORCHESTRA OF AUDIONS.

(Continued from previous page.)

tion. Much the same effect can be obtained with the musical audion by varying gradually the pitch of its note. Other effects include the shrill warble of birds, staccato drumbeats, heavy organ peals and notes closely simulating those of the familiar orchestral instruments. Even in our preliminary experiments we succeeded in producing new tones, tones far more ethereal and beautiful than any now at the command of musicians.



Of the thirty instruments of the modern orchestra, the lowest pitch is that of the tuba (32.7 vibrations a second), and the highest is that of the piccolo (4,752 vibrations a second). Radio-frequency currents in general use range from 30,000 to 1,500,000 vibrations a second; the highest audible vibrations range up to 40,000.

The reason why these effects were possible will be clear at once to radio engineers. Musical tones are simply air vibrations or oscillations that have frequencies within the audible range. That is, they have what we call "audio frequencies." On the other hand, the electric oscillations in a vacuum tube, for example in a tube which is being used as a generator of oscillating current or as a transmitter for continuous wave radio work, are much more rapid than the oscillations of sound. They have higher frequencies or what we call "radio frequencies." All this is familiar.

But vacuum tubes can be made to oscillate not only at the high radio frequencies, but also at the much slower audio frequencies. This, indeed, is just what the tube does when it goes wrong temporarily and howls into the telephones of a radio receiving set. It is oscillating at a comparatively low frequency, a frequency within the audible range.

Synthetic Music.

All that we have to do to bring this about artificially is to arrange a partial feed-back circuit containing the proper inductances and capacities to produce just the frequency—that is, the tone—which we wish. The electric oscillation thus produced, being already of audio frequency, requires merely to be fed into a telephone or loud speaker in order to give us ordinary sounds in the form of a musical tone.

The note of an organ pipe is produced by the oscillation of the air-column inside the pipe. The note of an audion tube is produced by an electric oscillation in the tube circuits. To change the pitch of an organ pipe one changes its length, thus altering the frequency of the oscillations of the air-column. To change the pitch of the musical audion one changes the inductance or the capacity, thus altering the frequency of the electric oscillations. Either an organ pipe or a musical audion circuit may be built or adjusted to give out a tone of any desired pitch.

My next step in the development of the musical audion was to arrange a scale similar to that of a series of organ pipes. In this audion organ, however, we used switches in place of the ordinary organ keys. By pressing certain switches we cut in or out of the circuit more or less of inductance or of capacity, thus changing the frequency of the oscillations in the tube and controlling the pitch of the note emitted from the telephone receiver.

To give volume to the music we connected a number of loud-speaking horns in place of the telephone receiver. With these horns distributed in different parts of the laboratory, or grouped together in one place, we secured many novel effects in the way of our synthetic music.

The bulbs used in these experiments were three inches in diameter or less. We used one bulb for each octave of the musical scale. By an arrangement of switches in place of keys, we could produce from this one bulb, by pressing the right switch, any of the notes of that octave. Another bulb was used for the next octave, and so on. The output

of all these bulbs was fed into one set of telephone receivers or loud speakers, so that the total energy emitted in the form of sound was that of all the circuits in action at any one time. It included all of the notes being sounded by the tubes, just as orchestral music includes all of the notes being sounded at one time by all of the instruments which are playing.

Earlier Experiments.

These experiments of mine were carried out six or seven years ago. There had been, however, some still earlier attempts to produce electrical music in other ways, not using the audion. Notable among these were the experiments of the Cahil Company with what was called the "tellharmonian."

This instrument was a huge plant consisting of a large number of alternating current generators of the inductor type. Each of these generators produced a current of a certain definite number of alternations a second, and each was tuned to the frequency of one of the notes of the musical scale. There was a different generator for each note, just as a piano has a different string for each note.

The currents from these generators were controlled by a keyboard similar to that of an organ and were combined thus into a single, highly-complex musical current which was transmitted over the telephone wires to theatres, hotels and homes, where loud-speaking horns poured this new electrical music into the air. There were imitations of the organ, the clarinet and other instruments, and mingled with these were strains of a quality entirely novel to musicians.

Tonal Resources.

In comparison with the tellharmonian, the musical audion has the advantages of greater flexibility and ease of control as well as of simplicity. As a source of musical tones an audion is equivalent to—indeed it is superior to—the alternating current generator, but at a small fraction of the cost, bulk and weight. The necessary parts of an audion organ might be contained in the cabinet of an ordinary talking machine and with a control the size of a typewriter keyboard. With the audion organ there are no pipes or strings to require great bulk, and yet it will produce music ample to fill a large auditorium.

(Continued on next page.)



MY ORCHESTRA OF AUDIONS.

(Continued from previous page.)

The greatest advantage of the audion organ lies, however, in the increased tonal resources which it puts at the service of the musical composer. Musical tones differ among themselves in three qualities: pitch, loudness and quality. The pitch is simply a matter of frequency; the greater the frequency, the higher the pitch. Loudness explains itself; tones may be either very strong and loud, or very faint—or anything in between. Both of these two characteristics of a tone are fully controllable in the audion organ; pitch, as I have explained, by varying the frequency of the electric oscillation, loudness by varying the input of energy with a resistance or in any other convenient way.

Explaining "Overtones."

But the third characteristic of tones, the tone quality, the audion organ also permits us to control; and it is this, I imagine, which will be of the most interest to the professional musician.

The differences in the sound of the various musical instruments are due almost altogether to differences in the quality of their tone. Middle C of the piano has a pitch or frequency of 262 vibrations a second. This same note played on a violin or on a clarinet or on a French horn has exactly the same frequency, 262 a second. Yet the notes from these different instruments do not sound alike. You can tell easily that one of the notes is from the piano, another from the French horn. What are the differences?

They lie in the tonal quality, and this tonal quality is a matter of what are called "overtones." A pure musical tone is a simple and regular vibration. It is represented by a pure sine-wave curve, like the curve of a perfectly regular alternating current.

Incidentally, such an absolutely pure tone cannot be produced by any ordinary musical instrument and only with great difficulty by the human voice. All ordinary musical tones contain certain overtones superposed on the pure tones. These overtones are tones of higher pitch, that is, of higher frequency, which are sounded at the same time as the pure tone and blend more or less completely with it. The overtones produce little bumps and hollows, little kinks, in the sine-wave of the pure tone. Or they displace the maxima and minima of the wave, so that the original sine-wave is no

longer exactly even and symmetrical. In electrical language they "distort the wave of the sound."

Regulating Tone Quality.

This distortion is what produces tone quality. A piano-note has a certain fundamental tone, a pure symmetrical sine-wave, corresponding to the pitch of the note. It also has certain overtones, corresponding to vibration of the piano string in parts, in halves or thirds or quarters. It has certain other overtones, corresponding to parts of the sounding-board or to other strings. The actual tone is the sum and combination of all these tones. The overtones distort the sine-wave of the pure tone. They give it its quality, so that you recognise it as a piano tone. If your ear is very good you may be able even to recognise it as a tone from a certain individual piano or from a piano of a certain make.

Similarly with other instruments, each one has its own set of overtones which it imparts to its fundamental tone. Each one has its own tone quality. To some extent this quality can be controlled by the musician, as when a violinist changes his tone quality by varying his bowing, or when a horn player sticks his fist into the bell of his instrument in order to get the so-called "stopped" quality into his tone.

Now all of these variations of tone quality are obtainable—and controllable—with the audion organ. The musical audion may be adjusted so that its primary tone is absolutely pure, a perfect sine-wave. Or this

primary tone may be altered merely by distorting the electric circuits, so as to cause any desired change in the quality of the sound. It may be made to counterfeit the piano, the violin, the 'cello or the horn, or may be distorted into any sort of sound—musical or grotesque.

Furthermore, the note of the audion tube is controllable in pitch with extraordinary precision. It may be altered not only in steps of a full tone (as in most instruments), but by half tones or quarter tones or even lesser fractions. It may be played so as to be always precisely in tune, an advantage which it shares only with the violin and other bowed strings and with the slide trombone. All other instruments, among ordinary ones at least, have a fixed series of notes. Only these notes can be played, and the musician can alter the pitch of these, while playing, only slightly, if at all.

Mechanical Limitations.

On the piano, for example, D sharp and E flat are the same tone, produced from the same string. Every musician knows that this is not quite as it should be. D sharp and E flat ought to differ a little in pitch. One or the other should be used depending upon the exact harmony desired. But to insert both in the piano would require too many strings and keys. One note, about half way between the two, must serve for both. The entire piano keyboard is a compromise between musical desirability and mechanical necessities. Its scale is not, it cannot be, exactly perfect.

Other instruments have similar imperfections. Their scales are never quite perfect. Their harmonies are always a trifle untrue. Only the violin and its lower-pitched analogues, the viola, the 'cello and the double bass; the slide trombone; the human voice—and the audion tube—can be made to produce absolutely true tones, absolutely perfect harmonies. ●

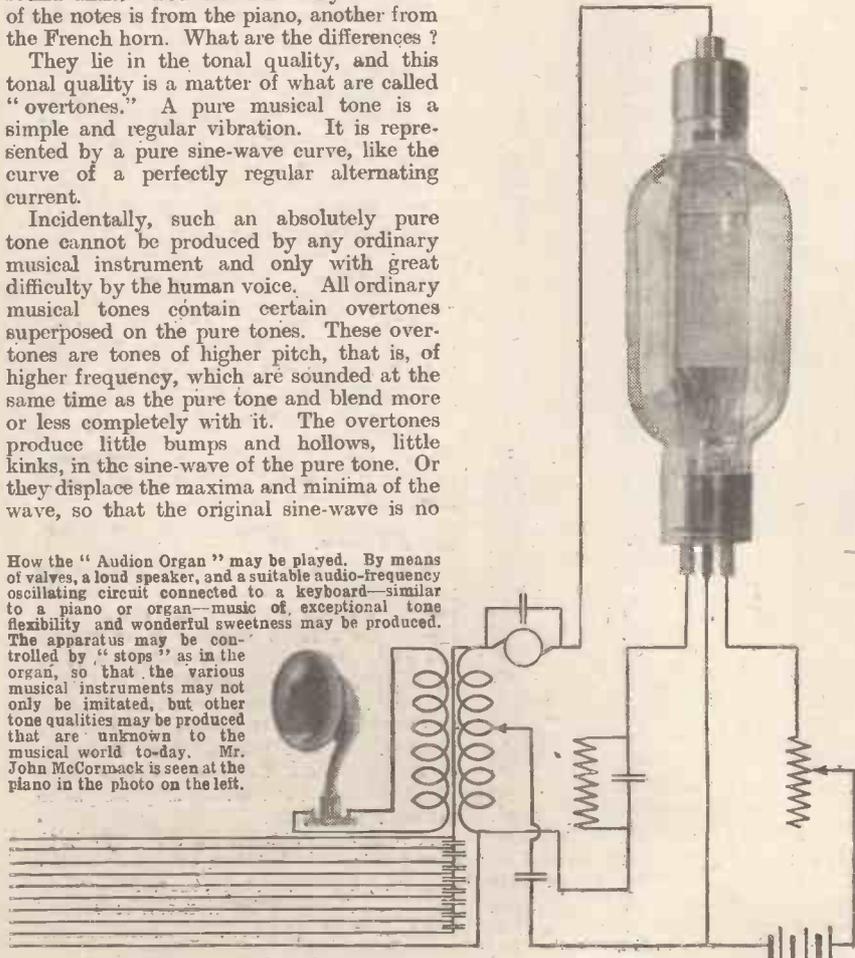
In precision of control, for both pitch and tonal quality, the audion tube equals or surpasses all other instruments. It has, as the musicians say, great flexibility, a flexibility exceeding even that of the full orchestra.

The Orchestral Scale.

The modern symphony orchestra contains 25 to 30 kinds of instruments. Allowing for the possible different ways of playing some of these instruments, the composer has at his service perhaps one hundred different kinds of tonal quality. His available pitch range is from the highest D of the piccolo, at 4,752 vibrations a second, to the lowest C of the multiple-valved tuba, at 32.7 vibrations a second. He can widen this pitch range a few notes if he has an organ for very low tones or if his violinists can play the six or seven possible harmonics which range above the piccolo. But his available range of tone quality and his available range of pitch do not fully coincide. He cannot play high notes of bass-horn quality nor low notes that sound like the piccolo or flute. The flexibility of the orchestra, its resources of tone colour, or expression or emotional portrayal, while very great in comparison with the piano or with any other single instrument, is still far from being as complete as is possible in theory.

(Continued on next page.)

How the "Audion Organ" may be played. By means of valves, a loud speaker, and a suitable audio-frequency oscillating circuit connected to a keyboard—similar to a piano or organ—music of exceptional tone flexibility and wonderful sweetness may be produced. The apparatus may be controlled by "stops" as in the organ, so that the various musical instruments may not only be imitated, but other tone qualities may be produced that are unknown to the musical world to-day. Mr. John McCormack is seen at the piano in the photo on the left.



MY ORCHESTRA OF AUDIONS.

(Continued from previous page.)

The whole history of instrumental music may be regarded, by the way, as a more or less successful effort by musicians to widen the flexibility of their instruments, to increase the sum-total of their tonal resources. The original instruments of primitive man appear to have been two, the single pipe or whistle and the drum. To these the ancients added a third fundamental instrument, the stretched string or lyre. These three possessed a very small range of pitch and a still smaller range of tonal quality.

Pipes of Pan.

It was the effort to increase this range that led to modern instruments. Out of the pipe grew first the notched or holed pipe, which could play several notes, and which survives in the modern flute. Then came the combination of several pipes fastened together in a row. These could play not only a note for each pipe, but the quality could be varied by using narrower and wider pipes, or by making them out of different materials. Hence the Pipes of Pan, or syrinx; and out of these there came, by direct and traceable descent, the modern organ.

The primitive stringed instrument, the lyre, developed even more widely in the direction of greater flexibility. Pitch range was attained by the device of changing the string length with a moving finger, as in the modern violins. A marvellous increase in range of tonal quality followed the invention of the bowed or scraped string to replace the original plucked string.

Even the drum followed suit in the search for greater flexibility. We have now

the tuned drum, or kettledrum, the various tone qualities of small drum, base drum, and tambourine, and, in addition, the triangle, cymbal, and others, which are really only kinds of drums made out of metal, and made thus in order that the tone quality might be different, that the composer's available range of quality might be widened still a little farther.

Is It Perfection?

Finally, we have the modern orchestra, its available musical resources so wide that they would have been totally inconceivable, I suppose, to a musician of ancient Greece or Rome, even perhaps to the religious choristers of only two or three centuries ago.

Is this the final step? Has the orchestra as wide a range of pitch and tone quality as we will ever be able to attain?

I think not. I believe that the musical audion will soon be able to widen greatly even the great flexibility of the orchestra. Audion tubes can play notes of any pitch; even, if necessary, notes several octaves above the piccolo or the violin harmonics. And they can play all of these notes high or low, with any desired tonal quality; with the quality of horn or oboe or 'cello, or with new qualities not yet known or used.

An Audion Organ.

What a resource for the composer! What possibilities of new orchestration, of undreamed of harmonies and melodies, tone colours, and emotional effects!

Of course, we must not expect that the development of the audion organ will be entirely free from practical difficulties. At least two of these difficulties can be foreseen already. One is that of arranging a tube circuit which will be perfectly stable, so that the tone of the tube will not vary until adjusted.

The second difficulty is the devising of a precise, rapid, and dependable system of control, an equivalent of the keys and valve mechanisms of the ordinary organ. Mere switches and condenser knobs are neither precise enough nor quick enough.

At the moment these practical obstacles look pretty serious. But obstacles have a way of disappearing as we approach them more closely, especially where the audion tube is concerned. Probably obstacles to the development of the audion organ will be no exception.

In all my work with the audion—and I can imagine no device in the wide range of practical physics which has greater fascination

than this little bulb—I have found no phase of its possibilities quite so interesting as this one of the production of musical tones. Certainly the idea of producing beautiful tone effects by such an entirely new method, unknown to our great composers, offers to musicians an alluring field for their genius.

In the audion we shall have an instrument suitable for home entertainment as well as for furnishing music to a big auditorium. And music thus produced may be taken up again by the audion, this time for broadcasting, and finally received by the countless other audions of receiving sets throughout the world. The musical audion, the radio transmitting audion, and the receiving audion, each one doing its share towards the enrichment of life!

AMMETERS AND VOLTMETERS.

By GEORGE SUTTON, A.M.I.E.E.

THE writer once heard a story about an electrical student who was given an ammeter and a voltmeter to connect up to a circuit, and was found later in a state of mental puzzlement. He said that he had connected them in series and nothing had happened. Then he connected them in parallel, and one of them had gone click, and the other seemed to be doing something. Then he took off the covers and stirred up their "innards" with his pipe stem, but that did not seem to make them any more lively.

A True Story.

We were reminded to-day of the story, when we went into a dealer's shop where the man was puzzling how to connect up a 0-45 ammeter. He did not like to put the shunt across the meter because it would short-circuit it. Fortunately, he had not a "live" circuit to try it in series. Most small ammeters which will be used by wireless men are made without external shunts, but the principle of their use is the same.

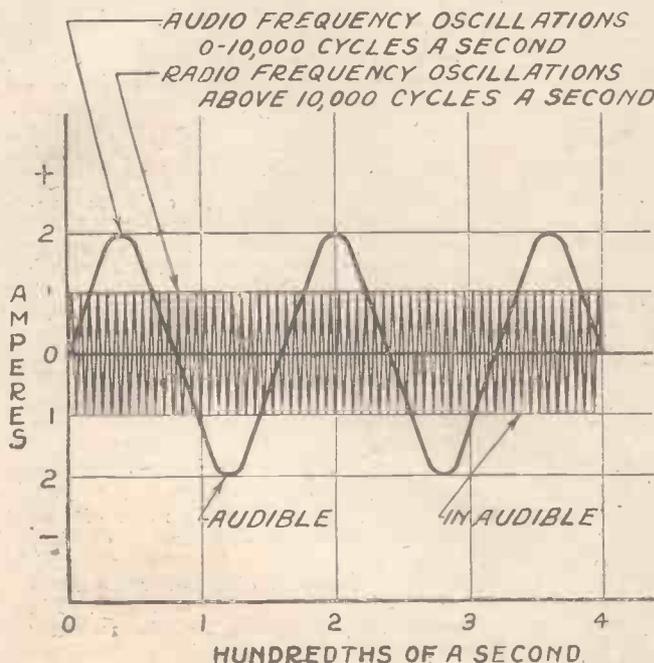
Another memory of the writer's is of a Government store, issuing an ammeter and a shunt, when demanded, as ordered by regulations, and ignoring the superfluous consideration of whether both parts bore the same number. This was discovered when the testing department were brought to book for passing inaccurate instruments into stock.

The Difference.

It should be borne in mind that an ammeter measures the current in amperes passing through a circuit, and cannot do so unless the current actually flows through the ammeter, so it is put directly into the circuit, or, as electricians say, "in series."

If the ammeter has an external "shunt," this is put in series so that the current flows through it. The reading portion is then connected across the ends of this shunt, being calibrated to read the amperes passing through the shunt.

A voltmeter registers the difference in the pressure in volts between any two points in a circuit, as, for instance, the terminals of a battery. If this distinction can be borne in mind, it may save some good instruments from being ruined.



Vibrations that we can hear—and those that we cannot. The diagram shows two alternating current waves. One is of a frequency that we can hear, and one is of a frequency that oscillates so fast that the human ear cannot detect it. The latter is used in radio work, and is usually produced by the valve. The valve may also be used to produce the audio-frequency oscillations which are used by Dr. De Forest for the production of the wonderful new music described in this article.

GET IT at GAMAGES

You can only save a few shillings by buying "cheap" apparatus of uncertain origin, but you can save endless trouble by buying all your needs from Gamages. Here every single purchase can be relied

upon. Experiments and research in the Gamage broadcasting Station maintains their lead in design. Behind all is the Gamage reputation for Quality and Value—second to none in the World.

REDUCED PRICES FOR ALL WIRELESS GOODS DURING SALE NOW PROCEEDING

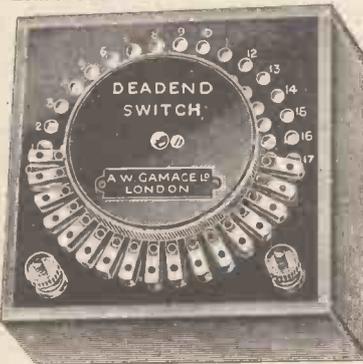
GAMAGE SWITCHES



SIX-STUD SWITCH

Mounted on ebonite base, as illustration. First-class instrument finish. London made. Price

11/6



DEAD-END SWITCH

Eliminates detrimental effects of "dead ends" on that part of a coil not in use when a section of same has been tapped off. The coil is then tapped off in sections, and requisite number put in for tuning: by means of rotary arms, and thus disconnecting remaining part of coil. Size 5½ x 5½. Price

27/6

High-Class SWITCH



3/9

Pure Copper SWITCHES

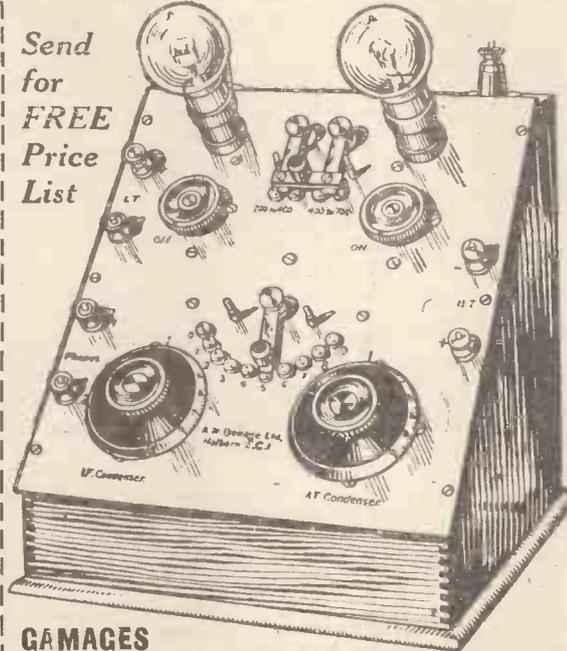
Mounted on Porcelain bases. Single Pole, double-throw switch

4/6

Double Pole, ditto, 6/6.
Double Pole, single-throw, 5/6
Similar Type on Ebonite Bases, giving better insulation, 6/6
Single Pole, double-throw
Double Pole, ditto, 9/-
Post 6d.



Send for FREE Price List



GAMAGES TWO-VALVE BROADCAST RECEIVING SET

Fully licensed and passed by the Postmaster-General. Regd. No. 2022. Designed to meet the requirements of the more advanced enthusiast. The combination is one H.F. and one Detecting Valve with an adjustable H.F. Transformer in two stages. The tuning inductances are contained in the cabinet and are varied by means of a nine-stud switch. The whole is mounted in sloping panel cabinet of polished mahogany. The complete set comprises Panel as above, Accumulator, H.T. Batteries, Phones, Aerial Wire, Insulators, Lead-in Tube, Switch—everything necessary to erect a high-grade and most efficient Receiving Set. Price, Carriage Paid

£20



GAMAGES CRYSTAL RECEIVING SET

Fully licensed by Postmaster-General. Regd. No. 226. Tuning coil wound with best quality wire, and tapped in four places. This, when used in conjunction with the Variable Condenser, which is of the best possible workmanship, gives a good variation of tuning. The crystal detector, designed to prevent dust from deteriorating the sensitivity of the crystal, contains our famous "Permanent" Crystal, which has given such excellent results. The task of finding a sensitive spot on the crystal is minimised by means of a buzzer. Will receive Telephony for 30 miles, and signals from Spark stations using a wave-length of 300-500 metres for 150 to 200 miles. Complete in polished mahogany cabinet, with instruments mounted on polished Ebonite; Phones, Aerial Wire and Insulators ready for use. Price

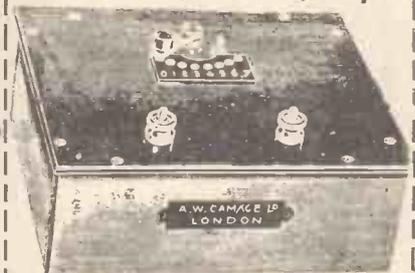
£4-19-6

TERMINAL PANEL



For connecting 'phones and batteries in a valve circuit and wherever it is essential to have good connections at difficult junctions. Professionals, as well as amateurs, will appreciate the advantages of this little panel. Subsurface wiring. Beautifully finished in matt ebonite ¼ in. thick. Sizes 5½ in. x 2½ in. x 1½ in. Price

12/-



HIGH-TENSION BATTERY BOX

Improved design with base board and green baize bottom. Finished in polished mahogany with ebonite top. Designed to give total output of 105 volts varied in seven steps of 15 volts. Price, container only, Complete with Batteries, ready for use, 55/- Small size to take 60 volts, 4 tap-pings, container only Complete with Batteries, ready for use, 31/- Batteries, 3/9 per unit of 15 volts.

29/6

15/6

"SONUS" UNIT VALVE PANEL

For the experimenter. Designed to obviate the use of several separate parts in valve receiving set. Comprises Valve Holder, Filament Resistance, Grid Condenser and Leak, Phone Condenser, and necessary terminals for connections with positions clearly engraved. Finished in polished mahogany and ebonite with heavy brass Terminals. Price

35/-

WAVE CHANGE PANEL

Designed to facilitate the change over from short to long wave-lengths. A half turn of the centre knob changes wave-length from short to long.

Handsomely finished with ebonite panel, set in polished mahogany container, as shown. Size 4½ in. x 4½ in. x 2½ in. Price

17/6



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

PITMAN'S

RADIO YEAR BOOK

1923.

An indispensable Reference Book for everyone interested in Amateur

THE YEAR BOOK

Radio Receiving

THE YEAR BOOK

contains amongst many other useful articles the following :

- Map showing proposed Broadcasting Stations.
- Post Office Broadcasting Conditions.
- Lists of Amateur and Official Stations.
- How to Pick Up Time Signals.
- The Wireless Societies.
- Inventors' Guide.
- Morse Code.

1/6 Net.

contains in addition to useful data, articles of general interest by the highest authorities, such as :

- Alan A. Campbell Swinton, F.R.S.
- Prof. G. W. O. Howe, D.Sc., M.I.E.E.
- E. H. Shaughnessy, M.I.E.E., M.I.Rad.E.
- Leslie McMichael, M.I.Rad.E.
- Sir Wm. Noble.
- N. P. Hinton, B.Sc.
- J. Swinburne, F.R.S.

In short :

The Radio Year Book

forms a complete guide for all who possess or are about to purchase a Receiving Set, and for those who manufacture or supply Radio Apparatus.

WORTH READING.

The Year Book contains nearly 150 pages of useful information. It may be the means of doubling the value of your receiving set. The cost is nominal ; the value is phenomenal. Order a copy to-day.

OF ALL BOOKSELLERS, SIR ISAAC PITMAN & SONS, LTD., Parker Street, Kingsway, London, W.C.2. OR FROM :

Poor 'Phones mar the Programme



RECEIVING broadcast music through bad 'phones is like trying to read F L telephony on a crystal—the results are the same—very poor. Fit Ericsson 'Phones—and listen. Hear the sigs. come through like a flute. No metallic sounds or distortion. Mark how the natural tone of voice and instrument is preserved.

A user writes: "I am fortunate enough to possess a pair of your 'phones." Light and comfortable, well-balanced and delicately accurate withal, robust in construction, Ericsson 'Phones connect up as the ideal 'phones for your receiver.

Write to-night for free illustrated list.

2,000 ohms. pair 31s.
4,000 ohms. pair 32s.
All resistances in stock.

BRITISH L.M. ERICSSON MANUFACTURING Co., Ltd. International Buildings, 67/73, Kingsway, W.C.2.

Ericsson

"The Services use them."

Telephones

CHANGE OF ADDRESS

Owing to increase in business

Radio COMPONENTS LTD.

have removed to larger and more convenient premises at

19, RATHBONE PLACE, W.1
(19 doors from Oxford Street, and 3 mins. from Tottenham Court Road Tube).

Telephone: Museum 5261.
Telegs: Radponents, Westcent, London.

THE CHEAPEST 2-VALVE SET

£9-0-0, complete with HEAD- PHONES, ACCUMULATOR, Etc. B.B.C. recharge extra £3-0-0.

INTERVALVE TRANSFORMERS
Cash returned if not satisfactory. 20/- each.

21/- Complete HEAD- PHONES 4,000 ohms.

British make throughout.

BRITISH CENTRAL ELECTRICAL CO., LTD.,
6 & 8, ROSEBERY AVENUE, LONDON, E.C.1.



IDEAS FOR THE AMATEUR.

CYCLE RIM "SPREADERS."

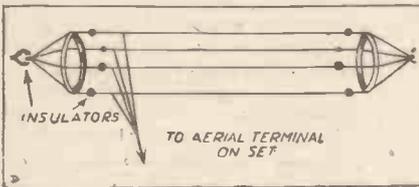
THERE are many ambitious amateurs who, either tired of, or dissatisfied with, the ordinary single or double wire aerial, aspire to the more pretentious type of cage aerial.

While the arrangement has been used in the past primarily for transmission, there is no reason why it should not be utilised to obtain excellent reception; and it is possible that the difficulty of constructing efficient "spreaders" has played a large part in deterring the amateur from attempting its construction.

Good Insulators Required.

A simple way of overcoming the difficulty in question is to procure some old bicycle wheel rims, which are admirably suited for the purpose, and which are of sufficiently large diameter to ensure a good spacing of the wires, provided that only a reasonable number are employed.

Before the aerial is raised into position, the rims should be heavily varnished or shellacked. The insulators should be of the best variety obtainable. For long aeriels it may be found necessary to use more than two "hoops," or rims, as shown



in the illustration, and a fairly good rule is to employ one hoop to every 20 or 25 feet of aerial wire.

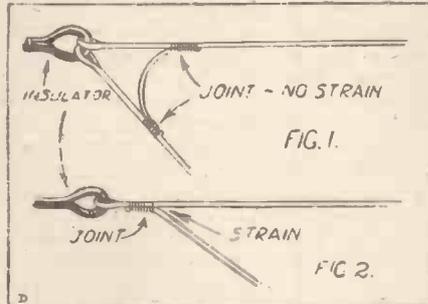
The down leads should be carefully connected, a thoroughly reliable and firm joint being made in every case. Where the down leads are "bunched," as at A in the drawing, the joint, in addition to being soldered, should also be bound with copper wire.

A USEFUL BOOK.

WIRELESS HANDBOOK AND DIARY. Edited by Paul D. Tyers. (Radio Press, Ltd., London, 2s. 6d.) This useful and, we might almost say, indispensable little book is in every way a credit to its authoritative publishers. Letts' diaries are universally acknowledged as THE diaries and therefore the Radio Press has adopted the wise course of prefacing one of the handy pocket-size "Letts," with 40 pages of informative wireless data and diagrams which is entirely in addition to the usual comprehensive information on such general matters as postal regulations, sporting, and gardening notes, etc.

"DOWN LEAD" STRAIN.

A GOOD method of connecting the "downlead" of the "L" type of aerial to the horizontal wire or wires is shown in the illustration at Fig. 1. The strain on the actual joints is negligible, but the wires should be thoroughly cleaned, soldered, and bound in the usual manner.



If this is done, it will provide added security, as should either wire break loose from the insulator, the aerial would still be retained in position, although the strain would then be applied to one of the two joints.

Worth the Trouble.

It may be argued that under normal conditions there is no need to impose any strain on the downlead. This is not correct, however, as in any case, if the two wires be jointed, as at Fig. 2, the joint will at least have to stand the strain imposed upon it by the weight of the wire forming the downlead.

The downlead, also, unless strained to a certain extent, will tend to form itself into a spiral, which is not only unsightly, but to some extent inefficient.

A free, swinging downlead of this type would, in addition, exert heavy strain upon the joint, and tend to pull away from the horizontal aerial wires if subjected to the buffetings of a winter gale. It would, in any event, most certainly weaken the connection, if it did not break loose altogether.

The first method has much to recommend it, and is well worth the small amount of trouble entailed by its installation.

AN INSULATING HINT.

WHEN constructing a wireless set the amateur should be exceedingly careful to see that all wires and other conductors are insulated one from the other. Bad effects are often caused through neglect of this very important point.

Some little time ago the writer built a four-valve set, and experienced intermittent rustling and scratching noises when the instrument was working. Every wire was carefully examined for bad joints, the leads to the terminals also received particular attention, but still the noises continued.

After exhaustive search, in which an old telephone receiver played an important part, it was discovered that surface leakage was taking place, the current from the high-tension battery crossing from the filament pin of each valve socket to the anode pin, and thus completing the circuit.

Breaking Surface Film.

Each socket was removed from the ebonite base, and diagonal saw-cuts made between grid filament and anode pins on both top and bottom of the sockets. Sulphur, which has the property of breaking up surface moisture film, was then melted in a spoon before the fire and run into the slots.

On returning the sockets to their base, the leads were soldered on to the pins, and, as a further precaution, sulphur was also poured round the latter. The results were excellent, and, using five valves, the writer has absolute silence on his instrument.



A Handsome Cabinet Set. Sent in by M. P. Taylor, 367, Soho Road, Birmingham.

THE AMATEUR WIRELESS ASSOCIATION.

By GEORGE SUTTON, A.M.I.E.E.

THE amateur of to-day is the professional of to-morrow, and the professor of the day after, so that the seed bed of the whole wireless plantation is the amateur wireless association.

This being so, it becomes necessary to consider the tillage of this garden, whose buds open out into the gorgeous flowers of imaginative foresight, the delectable fruits of ripe experience, and the germinative seeds of further achievement.

Getting to Work.

Few hobbies or amateur preoccupations possess the suitability to become the connecting link between persons of widely different temperament and social standing as the study of wireless. Not many pursuits have so universal an appeal to the imagination or are so easy of comprehension by so large a number of devotees. The wonder is, therefore, not that so many wireless societies exist, but that there are not a very great many more. It is merely diffidence on the part of those capable of gathering up together those of their friends who have a common taste with them, coupled with the very English trait of being generally unwilling to break new ground, and if my remarks lead to the inauguration of only one new wireless club I shall feel that I have not laboured in vain.

First of all it is necessary to get together, and many a preliminary meeting has been held at street corners. You cannot very well elect a chairman *pro forma* there, however, but any room, with not too much furniture in it will do for talking purposes.

You will probably have no difficulty in electing a chairman for the preliminary meeting; someone always seems to be at hand to drift into that position more or less naturally, and as a matter of course.

Choosing Capable Officers.

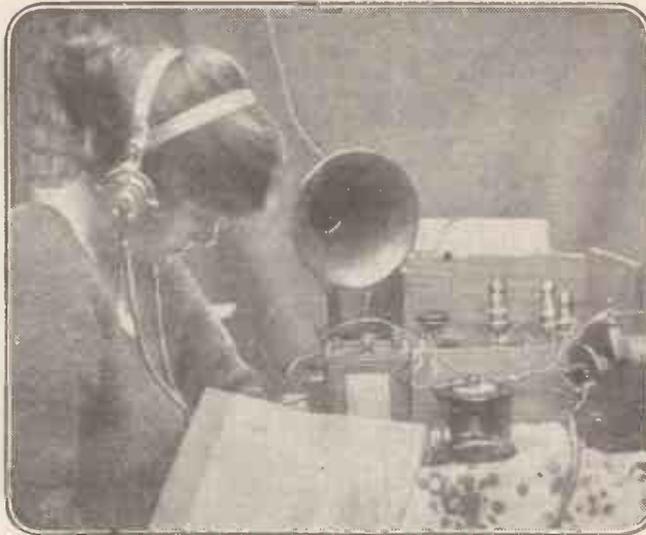
A chairman is a distinct necessity, and if any progress is to be made even from the first, he must know and apply the general rules observed when a few people meet together for a discussion. A meeting having a chairman who can't or won't "chair" is like the headless body of an eel: there may be plenty of life and movement, but if you get anywhere it is quite by accident. Caution should be observed in confirming the appointment, as the subsequent discovery that your chairman is incompetent for his job may lead to quite distressing incidents. There is no need, even when you have found what you consider to be the ideal chairman, to study his feelings in any way, because the born chairman has

no feelings; they would only get in his way and prevent his perfect functioning. If he is the right man he will see to it that transgressors of the written and unwritten laws of debate shall have all the feeling necessary to make them subside.

I have mentioned the chairman first because he comes first, but an officer of much greater importance than he is the secretary. It would be impossible to overrate the influence which the secretary has upon the association.

It will take colour from his views; it will prosper as he interprets and makes provision for the needs of the members. In no other connection can the scriptural injunction be more closely applied, "He who would be great among you, let him be your minister," for the secretary is servant to all, and if the most retiring member does not instinctively feel that the secretary is *his* secretary, the mark of perfect organisation has been missed.

It may be objected that these are mere platitudes, but I plead in extenuation that



Mr. R. G. Wooler's set, 91, Londonderry Road, Stockton-on-Tees, Co. Durham.

should a promising association be brought to grief by unsuitable officers, the clock is set back in that neighbourhood for a long time before things can again be considered as normal, and the possibility presents itself of starting all over again. The time thus lost is a definite and direct loss to the whole amateur wireless community.

We will assume that the association is formed and the right kind of officers duly elected, and it now becomes the burden of well-wishers how to run the show, not only to keep it level, but continually to progress. As the late C. H. Spurgeon once said of the man on a bicycle, you must either go on or go off. A constant stream of new members is absolutely essential if you are not to lose ground.

If your secretary has not the instincts of the journalist, search out one of your members who has, and make him your publicity officer. The local Press will greedily absorb all the "right kind of stuff" you can let them have, and our science is so romantic

that it would be a pity not to attempt to shed the beam of the pure light of science in the darkness of your neighbourhood. The technical Press also is eager to learn all you are doing, only the recital must be short, crisp, and sweet.

As regards the agenda for your meetings, there is little difficulty in getting first-class men to lecture to a good society, but this sort of thing should be done sparingly. It will probably be found that the best lecturer makes a telling appeal to only about half of his audience. He cannot be aware of the receptivity or the assimilability of his listeners, and he will be talking over the heads of some the while he is talking "baby stuff" to others. You will have difficulty in finding a better means of providing entertaining and instructive stuff than that gathered on your own floor by an agenda committee.

Studying the Members.

Take your time, and elect good men to represent five grades of members in your society—one for the elementary, one for the intermediate, and another for the advanced. The other two are again intermediate between the first and the second, and the second and the third. It is the sole business of this committee to canvass their constituents and keep the society advised of their wants and wishes. The secretary will very soon learn what are the capabilities of his members, and while some members are quite hopeless in proving their point mathematically, these same people may be whales for practical work and have an almost intuitive sense of what to do with tools. Nor will it always be the member who is most eloquent who is also most edifying and informative, for the halting tongue may be able to convey some priceless hints on working refractory materials.

It would be very injudicious also to try to lead a member who had exclusive information to betray his trust, even apart from the point that it was not playing the game. The temptation to extract advance or exclusive information must be sternly repressed, for the very presence of such a member indicates that he has an interest in the society, and will be as communicative as it is permitted him to be. It should rather be the secretary's care to give such members warning that the publication of matter at the society's meetings jeopardises his chance of obtaining exclusive property in the ideas by means of patent rights or registration.

Rules and Regulations.

Many rules, like pie-crust, are made to be broken, and a new society should be sparing in the number and scope of the rules it adopts. In a science such as ours, which is ever moving forward from success to success by long and rapid strides, the rules governing the society should be elastic and easily capable of amendment; but such amendment must be effected at a special general meeting convened for the purpose, and of which due notice must be given. Rules should not be enacted to trap or terrify the members into infringing them, or be at all invidious. We may paraphrase a

(Continued on page 761.)

LET EXPERTS TEACH YOU THE WAY TO SUCCEED

There is no royal road to success, but this is undoubtedly the easiest way. Both of these books are written in plain, simple language by a number of the cleverest craftsmen and engineers of the day and illustrated by thousands of photographs and diagrams. Wireless enthusiasts are particularly well catered for and can become thoroughly proficient at their hobby. Hundreds of other things are taught, too, from which good money can be saved and made.

The book that has helped thousands
—Let it help you—

THE AMATEUR MECHANIC

Tells you and shows you in simple language, and by over 6,000 photographs and diagrams, how to do 400 valuable jobs. There is no need to study or gain experience; you can start right off from the word "go!" and do almost any job, from mending or making a pair of boots or repairing a burst waterpipe, to redecorating a house or fixing up a powerful wireless set. The latter is the subject of some especially up-to-date and interesting articles, and the letter we quote on this page will tell of its wonderful success, etc., etc.

WIRELESS SUBJECTS TAUGHT

CONDUCTION AND INDUCTION SYSTEMS—RADIATION SYSTEMS—TUNING AND RESONANCE—OSCILLATORY CIRCUITS—THE MARCONI COHERER—A SIMPLE ANALOGY—TRANSMITTING—RECEIVING—THE CRYSTAL DETECTOR—FOUR TYPES OF TRANSMITTING APPARATUS—THE THERMIONIC VALVE—RECEIVING CONTINUOUS WAVES—LOGICAL SEQUENCE OF THE INFORMATION—AERIALS—THE SINGLE-WIRE AERIAL—THE T TYPE AERIAL—THE TWIN-WIRE AERIAL—THE EARTH CONNECTION—WAVE-LENGTH OF AERIAL—MAKING A LONG-DISTANCE CRYSTAL RECEIVING APPARATUS—GENERAL DESCRIPTION—CAPABILITIES OF THE APPARATUS—SPECIFICATION—THE TUBULAR CONDENSER—THE VARIABLE CONDENSER—THE CRYSTAL DETECTOR—CONNECTING UP COMPLETE SET—WORKING THE SET—MAKING A COMPLETE VALVE PANEL—GRID CONDENSER—FILAMENT RHEOSTAT—RESERVOIR CONDENSER—WIRELESS TELEPHONY—THE TRANSMITTING STATION—THE RECEIVING STATION—GENERAL ADVICE—LIST OF CHIEF STATIONS.

OTHER JOBS YOU CAN DO

How to Build Your Own Sheds, Outhouses, Poultry Houses, etc.—How to Cure Damp Walls, Leaky Roofs, and Smoky Chimneys—How to Make Garden Frames, Garden Furniture, and Garden Paths—How to Mend Windows, and to Make, Mend, and Strengthen Locks and Bolts—To Clean, Overhaul, and Repair Motors and Motor-Cycles—To Install Wireless Telegraphy, Electric Light, etc.—To Work in every kind of Metal—To Etch on Brass—To Write on Glass—To Make Hectographs—To Build a Boat, a Canoe, a Canvas Canoe, etc.—To Paint and Paper a Room—To Sole and Heal and Patch Boots and Shoes—To Make a Pair of Hand-sewn Boots, etc., etc.

A FREE BOOKLET TO TELL YOU ALL ABOUT IT.

Mr. E. J. BARNARD, Welling, Kent, writes: "I think I ought to tell you how much I value 'The Amateur Mechanic.' It has proved of great assistance in a variety of jobs, and especially as to the article on WIRELESS TELEGRAPHY. I constructed an instrument entirely according to the instructions, and was rewarded with success on the first trial. Sunday last was, for me, a red-letter day, as I succeeded, with the same instrument, in picking up the telephonic message from London to Geneva at 9.40 a.m. Considering that my aerial is only 42 feet long and 18 feet high, I think these are grounds for self-congratulation. I may add that until I became interested in the article in 'Amateur Mechanic' I had not the slightest elementary knowledge of Wireless Telegraphy."

To THE WAVERLEY BOOK CO., Ltd.,
(P.Wi.E. Dept.),
96, Farringdon Street, London, E.C.4.

Please send me, without charge, your Free Illustrated Booklet, containing all particulars as to contents, authors, etc., of "THE AMATEUR MECHANIC"; also information as to your offer to send the Complete Work for a merely nominal first payment, the balance to be paid over a few small monthly payments, beginning thirty days after delivery.

Name.....
(Send this form in unsealed envelope with halfpenny stamp.)
Address.....
P.Wi.E. 1923.

From this work you can learn
all about electricity and wireless
from "A" to "Z."

ELECTRICAL ENGINEERING

By H. H. Simmons, M.I.E.E. & A. H. Avery, A.M.I.E.E.
with over 1,000 illustrations.

SOME OF THE CHAPTERS

What Electricity is and some Account of its Discovery—Electrification by Friction—"Electrics"—The Attraction of oppositely Electrified Bodies and the Repulsion of similarly Electrified Bodies—The Atomic Constitution of Electricity—The Electron Theory as a sound Working Hypothesis—The Electric Current—E.M.F. Current and Resistance—Work, Energy, and Power—Condensers—When a Condenser is said to have Unit Capacity—The Effect of Dimensions—Materials—Metals and Impurities—Effect of Temperature—Alloys—Electrolytes—Insulators (Wood, Cotton, Silk, Paper, Indiarubber, and Guttapercha, Vulcanised Fibre, Asbestos, Vulcanised Indiarubber, Ebonite, Vulcanite or Hard Rubber, Glass, Porcelain, Mica), Oils, Fats, Gums (a List is appended giving the Resistant Strength of other Insulating Materials; this Information is Priceless to the Practical Worker)—What "a Law" means—Ohm's Law—Resistances in Series and in Parallel—Cells in Parallel and Series—Potential and Potential Differences—Fall of Potential—Application of Ohm's Law—Simple and Complex Circuits—What the Voltaic Cell is—The Cell as a Furnace—Consumption of Fuel—Chemical Action in a Cell—The Element—Local Action—Polarisation—E.M.F. and Resistance of Cells—Qualifications of a Good Battery. Classification of Cells: The Grove Cell—The Bichromate Cell—Fuller's Bichromate.

THESE CHAPTERS REPLACE YEARS OF STUDY

To gain the knowledge and experience this book gives would in the ordinary way take years and cost much money. Send off the coupon and find how to save all that.

THIS FREE BOOKLET

comes on receipt of the coupon. It shows you many of the illustrations and some specimen pages from the work itself. There is no cost or obligation attached to it, so

SEND FOR IT
TO-DAY!

No charge nor obligation to order anything
TO THE WAVERLEY BOOK CO., LTD.,
(P.Wi.N. Dept.)
96, Farringdon Street, London, E.C.4

Please send me, without charge or obligation to order, FREE Descriptive Booklet on your new work, "ELECTRICAL ENGINEERING," with particulars as to "Waverley" terms of payment after delivery by small monthly payments should I decide to order the work.

Name.....
(Send this form or a post card.)
Address.....
P.Wi.N. 1923.

Tele. :—
HOP 134

IMPORTANT

We have opened very commodious premises at
54, GRACECHURCH STREET, LONDON, E.C.3
for the demonstration and sale of all types of
WIRELESS RECEIVING SETS and "CLARITONE" LOUD SPEAKERS.

Amateurs and Experimenters will be able to obtain every part required for any type of Set

INCLUDING—

Transformers, L.F. and H.F.
Headphones (all types, all resistances).
Condensers, variable and fixed (all capacities).
Vario-Couplers and Variometers.
Coil-Holders and Coils.
Anti-Capacity Switches (all types).
Rheostats (all types).
Radial Switches (5, 10, and 15-way).
Valves (M.O. and Mullard's).
Ebonite Valve Holders, Dials, Scales, other parts and in Sheet.

Brass W.O. and Telephone Type Terminals,
Nuts, Washers, Contact Studs, and all other parts.
Accumulators.
Dry Batteries.
Aerial Wire.
Insulators.
Hertzite and Galena Crystals.
Cotton and other Tubings (all colours).
Etc., etc.

PRICE LIST ON APPLICATION

PETTIGREW & MERRIMAN, LTD., 122-124, TOOLEY STREET, LONDON, S.E.1.

NOTE—54, Gracechurch Street is a few yards from Monument, Eastcheap, Bank, Cannon Street, and London Bridge.

HULLO!!! C.Q. WILL DAY CALLING

TO ANNOUNCE SOME RARE BARGAINS.

BRITISH MADE HEAD PHONES,
150 ohms **18/6** per pair
SPLENDID QUALITY BRITISH
MADE HEAD PHONES, 4,000 ohms .. **26/-** per pair
BEST FRENCH HEAD PHONES,
REAL SOLID COMFORT, 4,000
ohms **21/-** per pair
BEST FRENCH HEAD PHONES,
8,000 ohms **27/6** per pair
Single Head Phones with cord, 150
ohms **6/-** each
100 feet 7 Stranded Copper Aerial Wire .. **2/6** per coil
Trench Buzzer Sets, complete with
Morse Tapping Key and Head
Phone **10/6** each, postage 1/6
Best Quality Filament Resistance .. **2/9** each, postage 3d.
3-Way Coil Stand for Panel Mounting .. **15/-** each, postage 6d.
Insulated Sleeving, all colours, 1½ mm. **5d.** per yard
Brass Terminals with Nut and Washer **1/6** doz.
Bobbin Type Insulators **1/-** doz., postage 9d.
Porcelain Shell Type Insulators, 5d. each. Sheet Ebonite,
Grade A, cut to any size., Every Requisite in Stock for Wireless.
TRADE SUPPLIED.

These are only a few of our bargains. Do not fail to send for our Price List giving the lowest prices for the best quality goods. Postage on all goods extra.

Write for our new January Catalogue, now ready.

We always Stock the Famous HERTZITE CRYSTAL
at 2/6 each, or mounted in Brass Cup 2/10, Postage 3d. extra.

WILL DAY, LTD.,

19, Lisle St., Leicester Sq., London, W.C.2.
Phone: Regent 4577. Telegrams: Titles, Westrand, London.

RELIANCE RADIO SERVICE CO.

THE "RELIANCE"

CRYSTAL RECEIVING CABINET.

P.O. Reg. No. 277.

Consisting of Ebonite Panel in Oak Case, with lid. Tuning Coil, 900 metre wave-length, .001 Condenser, Patent Crystal Detector, Silicon or Hertzite Crystal, Spring in small chuck, ball joint action with Variable Pressure, the whole totally enclosed in glass tube, thus eliminating dust and damp.

Accessories include 1 Pair Fellows 4,000 ohms Double Headphones, 100 feet Stranded Copper Wire, and 4 Insulators.

No further outlay. A guaranteed range of 20 miles for broadcasted concerts and will take 2 Pairs of Double Headphones with perfect clearness. Each Set tested and fully guaranteed and we confidently assert that for the price it is the most reliable yet offered to the Public and it is manufactured by one of the oldest firms in the trade.

Price Complete. Post Paid.

£3-7-6

Instrument Only. Postage 1s.

£1-18-6

We have also a complete range of Valve Sets in stock from £7 to £24. Call and inspect the famous Fellophone 2 and 4 Valve Sets. Prices £10 10s. and £17 10s. respectively. Also the Fellocrystal Super Crystal Set. Price £4 7s. 6d. Demonstrations given daily. Call and get satisfaction, no fancy prices but honest value for money. Hours 10 a.m. to 7 p.m.



Illustrated Catalogue Post Free.

RELIANCE RADIO SERVICE CO.,
233, St. John Street, Clerkenwell, London, E.C.1
PHONE: CLERKENWELL, 4290.

THE AMATEUR WIRELESS ASSOCIATION.

(Continued from page 758.)

common saying and read it: "Happy is the society which has no rules."

Rules, however, are necessary for a platform from which can be enforced law and order, and an appeal to an unwritten law is always a poor sort of thing. No general set of rules can apply to all cases; for instance, rules differentiating between full members and associate members are necessary enough in such a society as the Wireless Society of London, but would be ridiculous in a little country village or a rural district.

Hold a special general meeting for the purpose, and invite every member present to suggest a rule or a subject or purpose for a rule, and then let the committee go over them all as one goes over one's belongings before going on a walking tour and delete all that can be done without. Then call another special general meeting and say what you have done and why you did it. The sense of the members will then have been taken as to how they think the club should be run, and the executive will not have to bother overmuch to enforce obedience, nor the printer to print unnecessary rules.

Unless you have real business to transact, do not worry your committee to turn up at a lot of extra meetings. Good committee-men are generally those with many other interests, and they will be inclined to grudge the time spent at a meeting which does not commend itself to them as necessary. At the same time a committee is a real necessity, for if the officers of the club take too much upon themselves they are the people to point it out and to clamour to share the responsibility.

Royal Presidents.

One rule must relate to the hour and night of meeting, and this, like the place of meeting, should be invariable. It will not even make amends for a movable night and time if the members were able to be circularised for each meeting, for the circulars would be bound to arrive after the members had made other arrangements. Far better to hold a weekly meeting at an invariable hour and trust to your agenda committee to provide a bone to pick.

A treasurer with a banking account is a very useful officer to be able to call upon in time of need, and, although it is generally a badly run society if it gets into debt, there is nothing like a good healthy debt on a club to get members to pull together to wipe it off.

New candidates for membership should always have to run the gauntlet in some way. If they only have to ask in order to receive full membership, they will not value the privileges so highly as if they had to prove their fitness in some way. It should always be possible for members to ballot against a candidate, and in any case an intimation to the secretary or a member of the committee that such a candidate is not a desirable acquisition will lead to fuller investigation. Investigation should then always be made, as there is a possibility of spite or purely personal dislike.

The member's subscriptions, which should

be the life-blood of any society, need not be at all heavy, either in amount or incidence. If you ask for a guinea per annum, payable in advance, you may probably attract a nice select little crowd who will expect to get their full guinea's-worth. If, instead, you fix, we will say, an entrance fee of sixpence and a monthly subscription of 1s. 6d., the youngest desirable member will feel that he can afford this, and by the end of the year you will not be far short of your guinea per member. Do not dun members who perhaps have been unable to turn up regularly for arrears of subscriptions. Introduce a registration or country membership fee of 1s. per annum to keep them in touch till such time as they are able to resume full attendance and a full monthly subscription.

One officer whom you desire should honour your society by accepting the presidency of it, should also be chosen with great care. Do not make the mistake of aiming too low. If you can get Royalty, so much the better for your purpose. Don't think that your society is not fit for such associations. Believe, and know, that you are perfectly worthy, as you may possibly have to persuade your great person to this effect, and you will not convince him if you have not previously convinced yourself.

"Tapping" the Authorities.

Don't make a regrettable rule that no person may occupy the presidential position for more than one or two years in succession. Suppose the highest gentleman in the land had graciously consented to accept the presidency of your society, and was quite willing to remain in that capacity for another year or two, how embarrassing it would be to have to depute someone to explain that your rules would not permit you to retain his services.

If you are really an earnest, hard-working society, there are few great men who would not feel it an honour to accept the presidency and head the club note-paper with their names and titles. Don't make the mistake either, if he helps the club funds with a substantial donation, of making a bold announcement of the fact, unless you have ascertained that it is his desire that it should be done. If such is his wish, you will have one reason at least to question the wisdom of the selecting committee.

Your president will probably not wish to turn up at all your meetings, but he should be advised of them all, and a tactful secretary, or even the publicity officer, could contrive to make him feel that he had not accepted your invitation in vain, merely to become an ornamental nonentity.

Many occasions may arise when you will wish to make a public impression. For instance, we will suppose that the club desires to hold an open-air meeting in the summer in one of your public parks, and, with the permission of the Postmaster-General, to use a kite aerial for reception in a part of such park as is ordinarily closed to the kite-flying public. The secretary's application on ordinary note-paper might procure the necessary local permission, but on properly headed club note-paper, bearing the name, we will say, of the lord of the manor as your president, would make it a certainty, even if your local council were labourites to a man.

The Amateur Wireless Association, which,

with Hamlet, thinks that the times are out of joint, and that it was born to set them right, will probably also experience other aspects of a "cruel spite."

There was quite an amount of talk, on both sides of the Atlantic, recently on the matter of amateurs policing the ether; indeed, it is feared that a misunderstood communication by the writer to a conference convened by the Wireless Society of London, suggesting the sweeping of the snow off one's own doorstep, may have contributed to the noise that was made on the subject.

Aims and Ambitions.

The Post Office Authorities, acting on behalf of the Government, and controlling amateur wireless activities, will doubtless welcome assistance in keeping the ether sweet and clean, but they may reasonably fear that the zeal of the amateur society member, untempered with discretion, would be provocative rather than alleviative.

If we succeed in gathering into our societies all who are interested in the science, we shall not have any unattached and irresponsible experimenters who, not knowing when their single valve is radiating, are rendering reception impossible with the fine seven-valve set of the man ten miles away.

Much of the success of the individual wireless club will depend on the aims and expectations of the members comprising it. If they have started a club in order to acquire joint ownership in a communal receiving set, they will probably soon get what they want, and just as soon get tired of the toy, which will be in someone else's hands just when they want to play with it, or, even more likely, be found completely out of order. But if they desire to acquire their own personal set, and learn how to use it, they deserve a more lasting pleasure, and in all probability will achieve it.

The field in which we have now been wandering together is so vast that we cannot expect to have done more than to pick a few—flowers, I hope they are—leaving many rare blossoms for others to discover and to pluck.



Mr. J. Pitman, of "The Rest," Caldecote, Cambridge, and his set. Mr. Pitman has been confined to bed for many months, and finds Radio a great pastime.

It Speaks for Itself—

and in no uncertain voice.

THE WORLD'S STANDARD LOUD SPEAKER.

AMPLION

WIRELESS
LOUD
SOUNDING
RECEIVERS
are supplied in
a series of

Ten Models

Suitable for
every service:

**The Home,
Laboratory
and the
Concert Hall**



At Prices

ranging from
£2 : 10 : 0

to

£15 : 15 : 0

DAILY
DEMONSTRATIONS

at the

**GRAHAM
SHOWROOMS**

The ALGRAPHONE SALON

25-26 Savile Row,
Regent Street, W.1

Phone : Regent 1075.

"MUSIC MASTER" HORN.

Type AR 13, 120 ohms £6 : 0 : 0

Type AR 15, 2,000 ohms £6 : 2 : 6

"GRAHAM" WIRELESS
PRODUCTIONS INCLUDE
"HIGH EFFICIENCY"
TELEPHONE HEADSETS
OF IMPROVED DESIGN
AND CONSTRUCTION.
THE "GRAHAM" IS THE
BEST HEAD GEAR MONEY
CAN BUY.

Full Particulars forwarded
upon request.
Ask for Folder P.W.

Patentees and Manufacturers:

**ALFRED GRAHAM
AND COMPANY**

St. Andrew's Works, Crofton Park
LONDON - - - S.E. 4

Phone : Sydenham 952. Grams : Navalhada, Brock, London

SCOTLAND—

Mr. F. M. Milligan,
25, Renfrew Street,
GLASGOW

IRELAND—

Mr. Alex. R. Munday,
41, Chichester Street,
BELFAST.

HOW MY SET GREW UP

By P. G. A. H. VOIGT, B.Sc.

PART II (Conclusion).

At the beginning of 1921 the set was a two-valve set, one H.F. (tuned plate circuit), crystal detector, and one L.F. with capacity reaction when both valves were used. The set then passed through many stages while I was experimenting with various circuits in which one valve could do the work of two and amplify the H.F. currents and the telephone currents simultaneously.

In June, 1920, I introduced a loud speaker. The trumpet was salvaged from a scrap heap and a "T" tube added. A section of this tube is shown in Fig. 2. To convert the headphones into a loud speaker, all that is necessary is to take the 'phones off one's head and slip them on to the tube.

The next stage introduced a 10 in. basket coil. This coil has about 1,000 turns of 34 or 36 S.W.G. wire, and took exactly

was so loud that the neighbours started dancing on their lawn.

For my holiday in August, 1922, I took with me a 3-valve and crystal set, two of the valves being used for dual amplification. A wooden box with the strap contained a 60-volt H.T. accumulator of a new type, whose capacity is $\frac{1}{2}$ (actual) ampere hours. The writer hopes to put this type of accumulator on the market soon at the price of 10s. per 30-volt group. The current on short circuit is about 15 amps., and for safety a fuse such as 48 S.W.G. Eureka or a flash lamp bulb should be used.

Some Results Obtained.

The set was fitted with switches so that the second or third valve or both could be cut out when not required.

A double slide potentiometer was used

the coal cellar 7 ft. below ground level. The Eiffel Tower telephony received on this frame was audible in the loud speaker using three valves.

The normal aerial in Brighton went round the ceiling, which was 8 feet square, and had a 3 feet down lead. Total length of aerial wire was therefore 35 feet. The electric bells were used as earth connection.

Using only one valve as dual amplifier and a crystal detector, I received on this aerial the following telephony stations—Croydon F L on 2,600 metres, 2 L O, 2 M T, 2 F Q, F L harmonic on 1,300 metres, and P C G G using up to three valves. Many amateurs were heard, but I could only get the call signs of six of them. Unfortunately many amateurs were using shorter waves than I expected, and consequently they were not received.

I heard many more telephony transmissions, but could not get the calls because of interference, weakness and distortion, or because in some cases call letters were not given at all. There were very few amateurs who repeated their calls, giving the long distance listeners a chance to discover from whom they were receiving.

In conclusion, I would like to say that more amateurs using valves should use them as amplifiers, and let a crystal do the detecting (especially now that reaction has been practically forbidden), because the crystal detector is a more sensitive detector of weak telephony than the valve.

Fig. 1 gives a one-valve dual amplification circuit with crystal detection, which can be highly recommended. Using a one-valve dual amplification and crystal circuit of this description, I have received P C G G's music on a 4-foot frame with 17 turns.

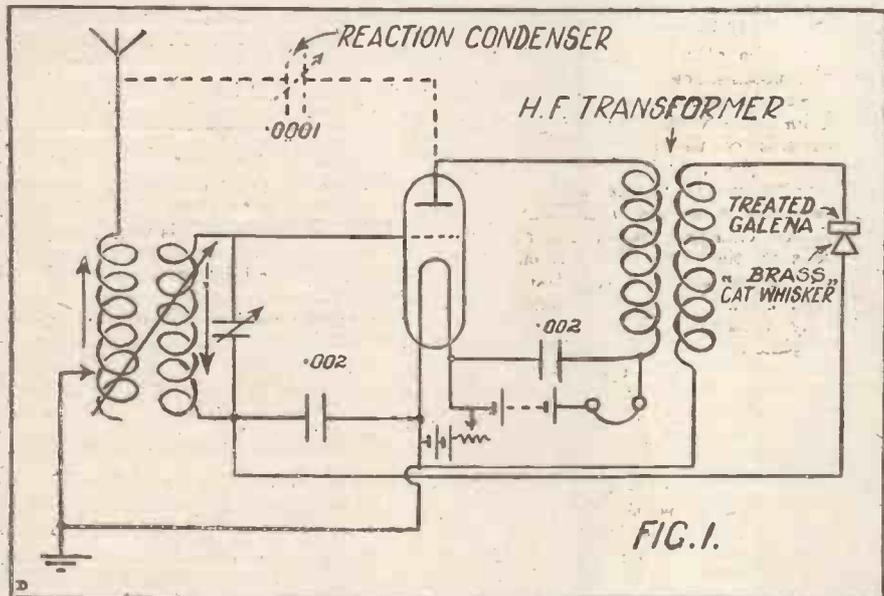


FIG. 1.

half an hour to wind with a home-made basket coil winder, having 15 spokes. This coil tunes the 100 ft. single wire aerial to 13,000 metres without a condenser. The set was mounted on a 3-ply tea chest fitted with partitions and covered with tinfoil for screening. The screening was not found to make any difference to the working of the set. At that time two valves were used for dual amplification, and a crystal for detection.

An Original H.T. Unit.

In order to make the set portable it was later mounted on a half-imperial drawing board. A third valve was added at the same time to act as a note magnifier. This valve was normally not in circuit, but was used more for demonstration purposes.

With the two valves, P C G G comes through well in the loud speaker, and with three valves it can be heard 100 yards from the loud speaker. On one occasion 2 F Q (about two miles away) was working, and it

for controlling the voltage of the 1st and 2nd grids.

There were two crystal detectors which were set by comparison with one another, instead of, as in the case of a single detector, being set by comparison with what is thought the strength of the signal should be. Treated galena was the crystal used. This crystal is less efficient than a valve detector with loud signals, but it is more efficient with weak telephony and spark. In this way the detector itself has a limiting action which prevents strong signals from becoming excessively loud.

The set in Brighton received speech and music from Marconi House, 2 L O, without aerial or earth, the tuning coil acting as a tiny frame aerial, outside diameter 5 in., inside 2 in., with 30 turns. By twisting the whole set round, it could be used for direction finding, and on 2 L O it gave an error of only five degrees.

P C G G's speech and music could be received on a 4-foot 5-turn frame aerial in

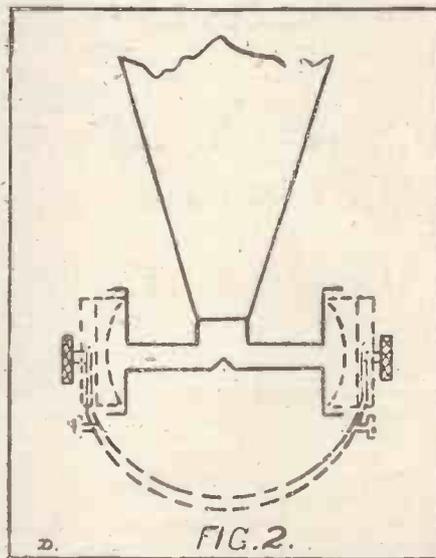


FIG. 2.

HAVE YOU IDEAS?

WE PAY WELL for short, bright, instructional articles, not exceeding five hundred words in length.

Send along your ideas to—

"POPULAR WIRELESS," and let other readers share them.

THE MYSTERIOUS PLIODYNATRON.

By SEXTON O'CONNOR.

THE name pliodynatron is formed by a combination of the words plotron and dynatron. Plotron is the technical term generally applied in America to a highly-exhausted or "hard" three-electrode tube, as distinct from the earlier "audion," or soft valve, which contained residual air or gas. Dynatron is the name similarly used to cover any form of thermionic power generator or "electron dynamo."

A pliodynatron is, therefore, a hard thermionic generator of electric oscillations, comprising control electrodes similar to the grid of the ordinary three-electrode tube.

Whilst possessing many features in common with the older type of valve, it is fundamentally different in operation. In order to cause the ordinary valve to generate power, it is necessary to employ some form of retroactive coupling. In

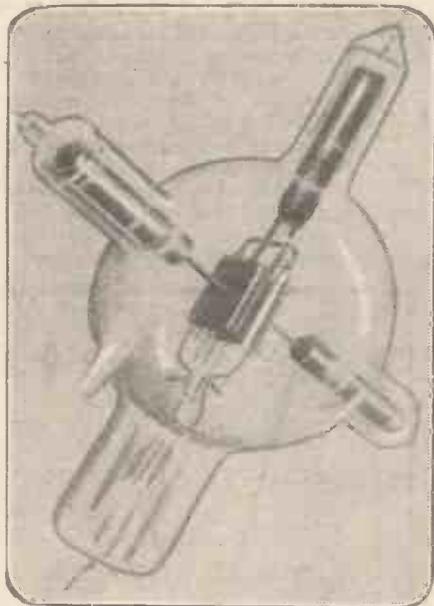


Fig. 1. The Pliodynatron.

other words, the input and output circuits must be so linked together that they mutually react or boost each other until the valve is set into continuous oscillation.

On the other hand, in the case of the pliodynatron, power is generated by causing the stream of electrons emitted by the filament to strike with great velocity against a special fourth electrode or plate inserted inside the tube.

How It Works.

As a result of such collisions, "secondary" electrons are emitted from the plate itself. These form a second electron stream which is caused to flow in the opposite direction to the normal stream from the filament, and in this way a rapid alternation of current is created in the external circuit associated with the plate.

A photograph of the pliodynatron is shown in Fig. 1, whilst Fig. 2 represents diagrammatically the different elements contained within the tube, together with

the associated circuits when the device is being used as a telephony transmitter.

It will be seen from Fig. 2 that there are four electrodes. The first, F, is the ordinary glowing filament or cathode. Wound closely about the filament is a second electrode or grid, G, associated in the ordinary way with the secondary of a microphone transformer, the other end of which is joined to the filament.

The third electrode, called the anode, consists of another spiral of wire, A, which is permanently connected to the positive end of a high-tension battery, M. The fourth electrode or plate is marked P, and is likewise connected through a tuned circuit, L, C, to the positive end of a high-tension source, N.

The steady voltage applied to the anode, A, from the battery, M, is about 100 volts, whilst the plate, P, when the tube is oscillating, carries a mean voltage of approximately the same value.

Under the attraction of the very high positive potential of the anode, the electrons from the glowing filament are urged forward with immense velocity. Passing between the spirals of the anode, A, they strike against the plate, P, with such force that they knock off clouds of "secondary" electrons.

These, in turn, are attracted by the positively charged anode, A, and flow towards it, thereby forming a current in the opposite direction to the original electron stream from the filament. By suitably adjusting the initial potentials of the plate and anode, a continual reversal of current can be set up in the external circuit joining the plate to the anode, the frequency of which is controlled by means of the variable condenser, C.

Replaces Two Valves.

The aerial, X, is therefore constantly energised through the inductance, L, by the oscillations set up in the plate-anode circuit, and these oscillations are, in turn, radiated outwards through the ether as continuous waves of steady amplitude.

When, however, the microphone, Q, is spoken into, current variations corresponding to the speech are created, and are transferred by the transformer, Q', into corresponding potential changes which are applied to the grid, G. As the latter is wound closely around the filament it exercises a very sensitive control upon the electron stream at its source, in a similar manner to the grid action of the ordinary three-electrode valve.

The density of the electron stream passing forward to strike against the plate, P, is thus regulated in accordance with the current changes occurring in the microphone circuit. The electron stream in turn controls the amplitude of the current available to generate the oscillations in the tuned circuit, L, C, and the energy radiated from the aerial therefore reflects in its varying amplitude the original speech frequencies imposed upon the microphone.

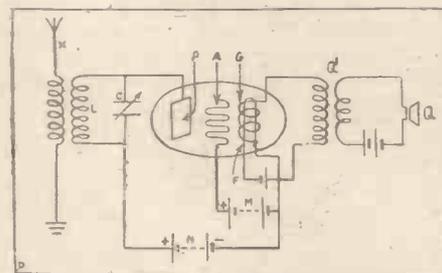


Fig. 2

In the circuit just described the single pliodynatron tube fulfils the combined function of the separate power valve and control valve at present used in ordinary systems of wireless telephony transmission.

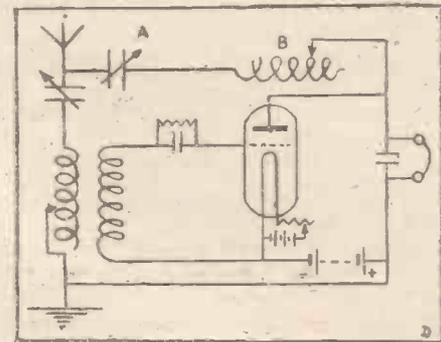
TO ELIMINATE "JAMMING."

A CIRCUIT for use in areas where the ether is "congested," and where any device that will eliminate most of the "interference" is welcome, is shown in the accompanying diagram.

By careful adjustment of the aerial tuning inductance and aerial tuning condenser, the station which it is desired to receive is first "tuned in" in the ordinary manner.

The "Rejecting" Circuit.

The theory by which the interfering station is "tuned out" is as follows. The set is a "two-circuit" arrangement, a tapping being taken direct from the aerial to a single circuit tuner consisting of a second



variable condenser (A), and a variable inductance (B) in series, which in turn is taken to the plate connection of the valve, and thence to earth via the telephone circuit.

When the station which is jamming is "tuned" on to this circuit by means of the variable condenser and inductance, the received signals will take this path to earth, and as they are not rectified by the valve, will be inaudible in the telephones.

Something really new



Don't risk missing No. 1 next Monday

If you don't place your order in advance, or at least be early on the scene, you may have difficulty in getting your copy—the whole edition of 20,000 copies having already been sold to the trade. Read the list of contents of this splendid 100-page Radio Magazine and you will understand why there will be such a keen demand for this issue.

Some of its Contents :

The Transmission of Wireless Waves, by Sir Oliver Lodge
Receiving Radio Signals from Electric Mains, by P. R. Coursey.
Valve Receivers employing Crystal Detectors, by John Scott-Taggart.
How to make a 4,000-mile Receiver, by L. Vizard.

- Northolt.
- A Two-Valve Broadcast Receiver.
- An Experimental Station at Gerrards Cross.
- Dual Amplification.
- A Simple Winder for Wave-wound Coils.
- The Dynatron.
- Charging Accumulators at Home.
- The Sine Wave.
- A Great Wireless Invention used in the Imperial Chain.
- A Conducting Cement.
- The Sinking of the S.S. Hammonia.
- A Simple Wireless Telephone Transmitter.
- The Outlines of Wireless.
- Double Reaction—a New Development.
- An Amateur Wireless Society and how to conduct it
- Directional Wireless.
- Patents of the Month.
- Experimental Licences.
- A Page for the Absolute Beginner.
- How to Make a Simple Broadcast Receiver using a Crystal Detector.
- The World's Land Stations.
- Choosing a Broadcast Receiver.
- Wireless Operators and their Careers.
- Recent Additions to our List of Experimental Call-signs.
- Map of European Wireless Stations.
- The Construction of a Valve Panel.
- How to Make a Note-amplifying Panel.
- Methods of Fixing Windings and Inductances.
- A Simply-made Grid-leak.
- Times of Regular Transmissions.
- Greenwich Time by Wireless.
- How I heard the American Concerts

The absolute novice as well as the experienced amateur will both find many articles of interest in every number of MODERN WIRELESS. Edited by John Scott-Taggart, F.Inst. P., the eminent authority on Thermionic Valves, assisted by Paul D. Tyers and E. Redpath, and published by

Radio Press, Ltd.,
Devereux Court, STRAND, W.C.2.

14 NET

Hand this Order to your Newsagent to-day.

I deliver the first copy of MODERN WIRELESS, the new monthly published by Radio Press, Ltd., a 3, BOLT COURT, Fleet Street, E.C., on Jan. 15.

Name
Address

THE NEWCASTLE BROADCASTING STATION.

(BY OUR REPRESENTATIVE IN NEWCASTLE.)

THIS station (call sign 5 N O), the third provincial station to come into operation under the Broadcasting Scheme, is situated on the premises of the Co-operative Wholesale Society, in Blandford Street, West Newcastle. The aerial of the station, as can be seen from the photograph, is a four wire "sausage," and is supported by a chimney 170 ft. in height. (The chimney belongs also to the C.W.S. Co.)

The aerial slopes down at an angle of about 30° from the vertical to the roof of the transmitting-room, which is situated on the ground floor, some 150 ft. from the base of the chimney.

The Power Units.

Power for the station is, at present, supplied solely by the mains of the Electric Supply Co. at 240 volts. D.C. This is taken to two switchboards, one of which controls the motor alternator, and the other, which is a charging board, for charging the accumulator battery of 40 volts, 330 ampere hour capacity. This battery supplies the filament current for the oscillator panel, the amplifier panel, and the modulator panel.

The power unit consists of three machines coupled together on a common base plate; they are the motor, the alternator, and the exciting machine for the field windings of the alternator. The A.C. current thus generated passes to the first of the four panels, which is composed of the step-up transformer, two rectifying valves, smoothing condensers and choke, also a D.C. voltmeter, and a milli-ammeter.

The filaments of this pair of valves are supplied with A.C. at low voltage from a small step-down transformer, connected to the alternator mains. The alternator mains are also fed direct to a second transformer (which is a step-up). The two ends of the secondary winding are connected to the plates of the two rectifying valves, and a centre tapping from the winding becoming the H.T. negative, and the filaments the H.T. positive. A centre tapping on the secondary of the filament current transformer becoming the earth of the system.

The H.T. Side.

The rectified H.T. current is then passed through the smoothing condensers and the choke, through a milli-ammeter, and on to the second panel. The voltmeter across the H.T. leads serves two purposes; one to show the H.T. voltage, and also to act as a leak across the smoothing condensers, when the transmitter is idle, thus preventing a dangerous charge remaining therein.

The second panel has the sole duty of generating an oscillating current at radio frequency. The circuits, in principle, are similar to those of an "independent heterodyne." The filament current in this case coming from the accumulator battery and the H.T. from the last panel.

The radio frequency output is then passed to the third panel which functions as a radio frequency power amplifier. H.T. and L.T. supply is from the same

source as the last panel. There are two amplifying valves, and the plate circuit of the second is connected to the aerial. The tuning of these circuits controls the wave-length. In the H.T. lead of this circuit is connected an iron cored choke.

Distant Microphone Control.

The fourth panel is the modulation panel. It consists of two valves, the grid of the first being controlled through a transformer, by the low frequency speech current variations, from the microphone circuits. The plate circuit is coupled to the second valve where the variations are further amplified. The H.T. circuit of the second valve is connected to the iron cored choke in the plate circuit of the Amplifier Panel. And the variation in the H.T. supply passing through this choke varies the amplitude of the wave emitted by the transmitter.

The first transmission from this station took place on Friday, Dec. 22nd, and transmissions have been continued regularly since then, with further slight improvements.

The first concerts were given from a temporary concert room on the premises of the C.W.S. However, the permanent room became available on Dec. 29th. These are at 24, Eldon Square, Newcastle, and are between three-quarters of a mile and a mile from the transmitter, the two being connected together by line telephone for the transmission of the music, etc.

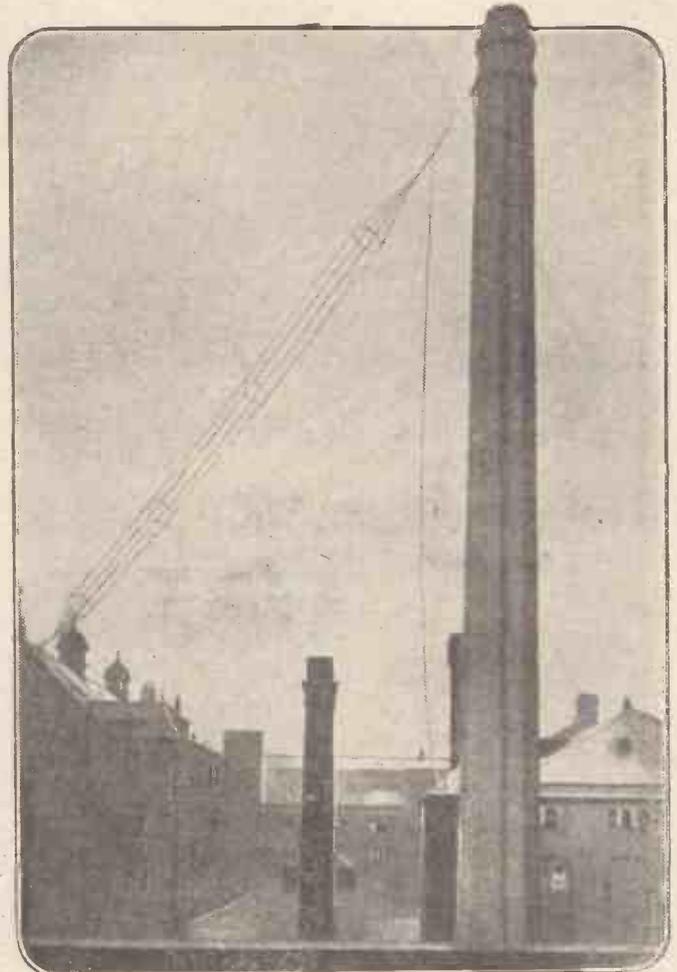
As no regular artistes were engaged, the vocal and instrumental selections being rendered at present are given by the members of the Amateur Dramatic Society, and judging by the multitude of reports they have succeeded in giving great satisfaction to a widely spread audience.

Transmissions at present start at 6.30 each evening. The call sign is 5 N O, and the wave-length 400 metres.

NOTE:—This article has been inserted at the last minute before going to Press, in place of "Famous Wireless Patents," which will appear next week.—The Editor.

BOOK REVIEWS.

The Radio Amateur's Handbook. By A. Frederick Collins (George A. Harrap & Co., Ltd., London, 7s. 6d.). This book, written by one of the earliest pioneers of wireless telephony, is one of the most interesting works on the subject that we have read. Large type and detailed diagrams, practically all of which are entirely self-explanatory, and an appendix containing much useful data, including a useful list of "don'ts," all contribute to form a very complete outline of wireless telegraphy and telephony transmission and reception. The only point that might call for a very slight adverse criticism is the

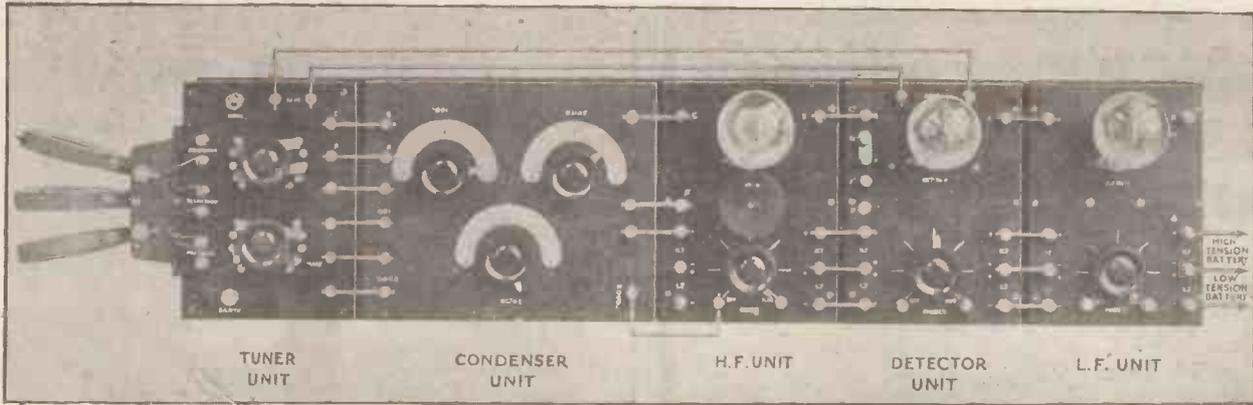


The Aerial at the Newcastle Broadcasting Station.

fact that the chapters on regeneration do not include that permissible and useful form of interval reaction that dodges the official ban on aerial energisation.

HAVE YOU IDEAS?

If so, write them up in the form of short bright articles and send them along to **POPULAR WIRELESS**. We pay well for contributions of this description, if accepted.



Use a stage or two of H.F. and a Frame Aerial

— you'll get the long-distance Stations just as well but with less interference and without atmospherics.

The man who cannot erect an outside Aerial or who wants to move his Set from room to room, need not despair. A good Frame Aerial of the type illustrated will give clear telephony when used with sufficient H.F. amplification from all Stations within a wide area.

Further, because it is directional, it cuts out a lot of interference from nearby

Stations together with most of the atmospherics.

The Petto-Scott standardised Unit System provides the only sensible way of adding just as many stages of H.F. amplification as you may need at the least possible expense. Our illustrated Booklet, "Radio," describes the whole System and shows how each Unit is built up—price 6d., post free.

PRICE LIST OF SETS OF PARTS.

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

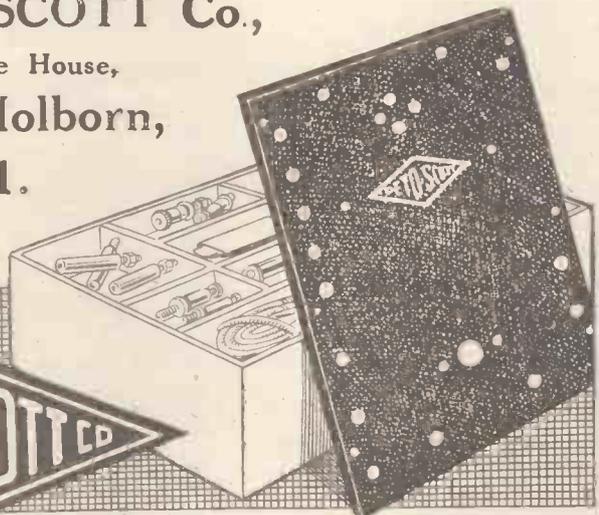
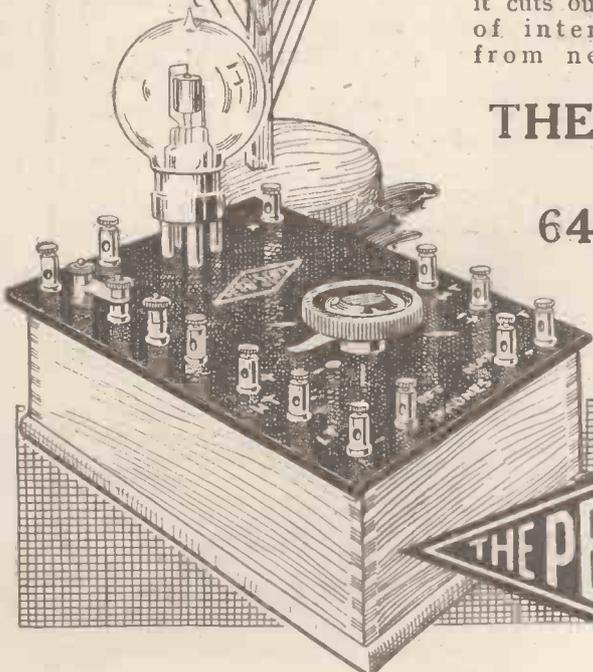
Mahogany Cabinets to fit Nos. 1, 3, 4, and 5, 3/6. To fit No. 2, 7/-.
Postage 9d. per unit extra, but paid on all orders over £2.

THE PETTO-SCOTT Co.,

Featherstone House,

64, High Holborn,

W.C. 1.



MARSHALL AD

DON'T Let Violence in Advertising
Rush Your Judgment
FOR YOUR PROTECTION

INSIST on a comparative demonstration
before you purchase

It is all we ask to prove the demonstrable
superiority in signal strength, purity of tone,
simplicity in operation of

THE
Crystophone
REGISTERED

P.M.G. BROADCAST RECEIVERS

SOLD BY ALL LEADING STORES
AND WIRELESS AGENTS

All Crystophone Receivers are exclusively fitted with the

LATTIKONE TUNER

The ONLY Tuning Coil which actually builds up and
strengthens the incoming signal current and thus enables
us to claim a

50% INCREASE in Signal
Strength. Such is the reserve of power of

THE
Crystophone Type 33
REGISTERED (two valves)

that 4 Invisible wires stretched across the
ceiling of ANY ROOM,
on ANY FLOOR,

in ANY HOUSE in
LONDON, BIRMINGHAM, MANCHESTER,
is sufficient for use with 6 pairs of head-
phones, while with a P.M.G. Aerial it is

Guaranteed for 100 Miles

PRICE £15 (INCLUDING ALL ROYALTIES.)
Crystophone Crystal Receivers

with Lattikone Tuner,
PRICES from £3 10s. 0d.

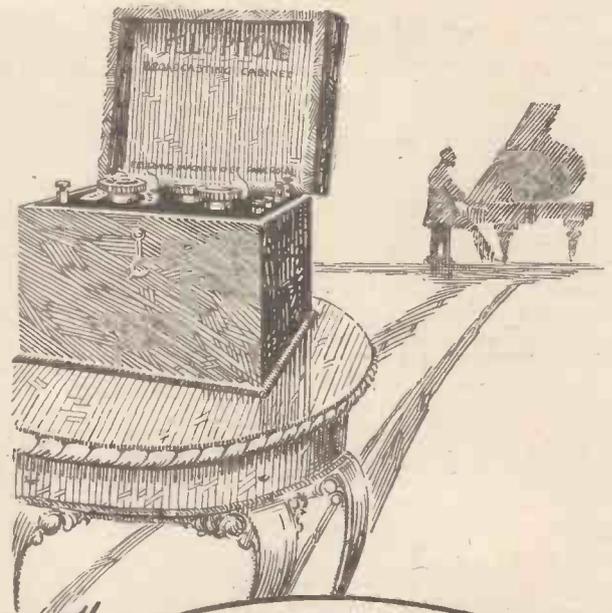
Demonstrations Daily

From 5 to 10 p.m.

**THE CRYSTOPHONE
MANUFACTURING Co., Ltd.,**

16, WELLS STREET, OXFORD STREET,
LONDON, W.1.

TELEPHONE: MUSEUM 1664.



The
FELLOPHONE

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 head-
phones, but without valves.

British Made Throughout.

Made under Marconi Licence and approved by the BBC and
Postmaster-General.

PRICE COMPLETE (without valves),

£12 (inclusive of all taxes). Carriage 2/-

EXTRA FOR 2 VALVES, 30/.

EXTRA FOR ADDITIONAL FELLOWS

DOUBLE HEADPHONES, 21 6 (Postage, 1/-)

FELLOWS MAGNETO Co., Ltd.
LONDON, N.W.10.

Telephone:
WILLESDEN 1560-1.

Telegrams:
"QUINMAG." "PHONE, LONDON

EB

8A3

*For they are
jolly good Fellows*

HOW TO MAKE A D.F. STATION.

By MICHAEL EGAN

PART 8 (Conclusion).

BEFORE attempting to make a tuner switch-box for use in connection with the maximum system of direction-finding, it is advisable first to make a thorough study of the circuits involved. To the experienced amateur this may seem superfluous advice, but there will be many to whom it will prove a very timely practical hint. Over-enthusiasm is accountable for a good many false starts on a comparatively simple job; in fact, the measure of one's enthusiasm is very frequently the measure of one's capacity for making a mess of things.

The Tuner Switch-box.

When setting out to make an instrument which involves the combination of a number of separate parts in one complete system, the sensible thing to do is first to study the circuits on paper, until you are thoroughly conversant with the various connections and leads that will be employed. Visualise the kind of instrument you wish to construct and, as you scrutinise the circuits on the paper before you, make a note of what leads will be short, what ones will be long, what pairs of terminals had better be placed close together, what wires can be eliminated altogether, etc.

Having done that, it is a good plan to sketch the kind of thing you are aiming at on another piece of paper. The next step is to assemble all the parts loosely in the position in which you propose to fix them. This gives you an opportunity of seeing what the completed object will look like, and of making whatever alterations you like before any mischief is done. Then, after deciding in what order you will fix and connect up the various parts—go ahead.

Although we have made ourselves familiar with the idea of a tuner switch-box used in connection with the maximum method of direction-finding, it is not necessary that this instrument should actually take the form of a "box." If it is desirable to make it as small and compact as possible, then the box form will certainly be the most convenient. But there is no reason why the various instruments comprising it should not be mounted on an ordinary baseboard.

In fact, for many beginners this method will have a lot to recommend it. In the first place, it is easier to make; secondly, it permits of easy access in the event of a "fault" arising. Also, by reason of everything being open and exposed to view, the operator will become more and more familiar with the circuits with which he is dealing.

The instruments required for a simple tuner switch-board are two small, flat, pancake inductances, two double-pole throw

over switches, and six terminals. If good insulated wire be used throughout for making the connections, and if the terminals be mounted in insulated collars, an ordinary piece of deal wood (about 12 in. square) should serve quite efficiently as a baseboard. The base of the double-pole switches (as purchased from any manufacturer) will be of ebonite or porcelain, or some other insulating material. There is no need, therefore, for the baseboard itself to be of

ser and balance coil are at the top, the two switches below. This places the switches within easy reach of the operator—the change-over switch on the left, the reversing switch on the right. Once the balance coil has been adjusted to balance a particular aerial, it need never be touched again so long as that aerial is in use.

Some Practical Suggestions.

It is a good plan to enclose the balance coil in a little oblong box, with a handle (which carries the movable half of the coil) protruding from one side. This saves the coil from the wear-and-tear to which it would be subjected if left exposed.

Such a switch-board as we have described will enable quite satisfactory results to be obtained with a maximum direction-finding system. Perhaps the least "ideal" item on it will be the reversing switch. It will be found—with experience—that the time taken to reverse this switch is an important factor in the operation of the system as a whole. The quicker it can be thrown over from one position to the other the better. For this reason an ordinary double-pole switch will leave something to be desired, since it takes an appreciable amount of time to release the knife-edge from one set of sockets and swing it over to the other.

The real fault of such a switch lies in the fact that it is somewhat uncomfortable to operate, rather than that it tends to inefficiency. A much more convenient kind of reversing switch would be a small rotary contact switch, which required a minimum amount of transverse motion to change it from one position to another. But such a switch would be much more difficult to make, and much more expensive to buy, than a double-pole switch.

With regard to the fitting of the compass card to maximum systems, this is performed in exactly the same manner as has already been described in connection with minimum systems. Also, it is advisable to use at least three amplifying valves with either system.

Keep your aerial and apparatus as far as possible from any other wiring systems that may be in the neighbourhood, and make it a rule to dust and clean all instruments at frequent and regular intervals. A little care in this respect will repay you tenfold. And when anything goes wrong, don't just try to guess the fault by testing various instruments haphazardly.

Aim at devising a system of fault-tracing, so that, when something does actually go wrong, you will be able to trace the cause of the trouble in the shortest possible time. In the long run this is not only the best way of achieving satisfactory results—experience shows that it is the *only way*.



Mr. G. F. Doyle's fine home-made set, 12, Cumberland Terrace, Finsbury Park, N. 4.

ehonite. A coating of shellac on the deal wood will be an additional safeguard.

The pancake coils may be wound concentrically or fanwise, or in any other manner that will secure big inductance value with small size.

One of the coils should be fixed firmly on the board, whilst the other should be made capable of being moved over the fixed one. The movable coil should also be reversible, so as to permit of the two coils being opposed to one another if necessary. In this way the inductance of the balance coil can be adjusted over a wide scale of values. This means that the same balance coil can usually be made to "balance" aerials of very different size. This is a useful fact for the experimenting amateur to know.

We can also, of course, instal our aerial-tuning condenser on the board. The conden-

- AT -

HALL'S

PRICES THAT SPEAK FOR THEMSELVES!

BRITISH HEADPHONES

4,000 ohms. Very Light. Beautifully Finished. Stalloy Diaphragms. Complete with Cords. Adjustable Earpieces.

(Sold elsewhere almost exclusively at 25/-)
19/6 Postage 9d.

The well-known—

French "Brunet" Headphones
22/6 Postage 9d.

French "Sidep" Headphones
21/- Postage 9d.

GUARANTEED GOODS DISPATCH BY RETURN

VARIABLE CONDENSERS:

Capacity	Parts Complete	Assembled for Panel Mounting	
.001	7/-	12/-	
.0075	5/-	12/-	
.003	5/-	10/6	
.0003	3/3	7/6	
.0002	2/3	6/-	
.0001	2/-	4/9	
Top and Bottom Circular Drilled Ebonite Plates, 1/6 extra, Vernier, 3/-			
Interval Transformers, Ratio 4 to 1, finest manufacture .. 11/9; 5 to 1, 14/6			
Crystal Sets .. from 15/- to 23			
"Royal Phone" Loud Speakers, 4,000 ohms resistance, ebonite horn, giving clarity of tone and freedom from distortion. each 30/-			
Orders in strict rotation.			
Aluminium Condenser Vanes, fixed and moving, 22/24 gauge .. pair 11d			
Spacers, true to .001. Small, doz. 2d; large, doz. 3d			
Ebonite Knobs, tapped 2 B.A. with brass nut—1st quality, 4d; 2nd quality 2d			
Aerial Wire, 7/22 hard drawn copper, in 100 ft. lengths 2/9			
Valve Legs, with nuts and washers, 1d each; doz. 9d			
Two Coil Holders, solid ebonite mounted on mahogany 4/9			
Three Coil Holders, solid ebonite, with long arms to avoid capacity effects 9/6			
Crystal Detectors, adjustable in every way 7/3			
Do. enclosed in glass case 4/6			
Engraved Ivorine Seals, 0-150, round or square ends 41d			
Filament Resistances, extraordinary value, velvet action 2/6 and 3/6			
Switch Arms, complete with knob, collar, washers, bush nuts, etc. 1st quality, 1/6; 2nd quality 1/-			
Valve Holders, turned ebonite, complete with nuts, 1/3; 2nd quality 9d			
Crystal Caps. Plain 1d; one, two, or three screw 3d			
Large Terminals, complete with nut and washer 1d			
Basket Coils, set of 7 5/-			
Contact Studs, 1/2 in. by 1/4 in., complete with nut and washer doz. 6d			
Insulators, 2-in. reels—1d each; white egg, 3d; green egg, 4d; green shell each 4d			
Brass Nuts, 2, 3, 4, 5, 6 B.A., doz. 3d. Washers, doz. 2d			
Ebonite Sheets, 1/2, 1, 1 1/2 lb. 3/9			
Fixed Condensers, any capacity each 1/3			
Grid Leak and Condensers combined each 3/6			
Slider Plunger complete each 5d			
Slider Rods, 12-in. or 13-in. 1/4-in. square brass, drilled both ends 4d			
Hertzite, 1/6. Boronite, Carborundum, Galena 4d			
Screwed Brass Lengths, 12-in. 2 or 4 B.A. each 3d			
Inductances, wound 22/24 enamelled wire, each 3/6			
Orders under 30/- kindly remit ample postage. Balance refunded if excess sent.			
SEND FOR FREE CATALOGUE.			

TRADE SUPPLIED **HALL'S** DISPATCH BY RETURN

PHONE: REGENT 1282
71, Beak St., Regent St., London, W.1
Between Piccadilly Circus and Oxford Circus
Buses 3, 6, 12, 13, 15, 32, 51, 53, 59 and 88 pass

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 Burnham, Highbridge and District Wireless Society.

Since our last report, weekly meetings have been held, and the technical education authorities have granted the use of a room at the Technical Institute, Burnham-on-Sea, for the holding of these meetings. Papers have been given and considerable progress made, while the buzzer class has helped members forward with their Morse. Single-valve Armstrong super-circuit was demonstrated, and a visit paid to the home station of the hon. sec., when a full muster of members turned up.

Hon. sec., L. Lott, 52, High Street, Burnham-on-Sea.

Tottenham Wireless Society.*

A meeting of the above society was held on Wednesday, November 22nd, at Bruce Grove Schools, Spurling Road.

The chairman opened the meeting with the usual buzzer practice, after which a very interesting lecture on "Aerials" was given by Mr. Hall. The lecturer fully explained how to make a substantial mast, also how to erect it correctly, after which he went into the smaller but important details.

A two-valve set was presented to the society by Mr. Kaine-Fish, for which he was accorded a hearty vote of thanks from the society. Business was next discussed, after which several new members were enrolled.

Hon. sec., Mr. R. A. Barker, 22, Broadwater Road, Bruce Grove, N.17.

Ramsgate, Broadstairs and District Wireless Society.*

At a recent meeting Mr. F. Harrison gave a very entertaining and practical lecture on "Valves," kindly bringing various types to illustrate his lecture, which was followed with the keenest interest, many questions being put to the lecturer, who was accorded a hearty vote of thanks. The next weekly lecture was given by Mr. P. F. Weeks, M.B.E., who chose, for the benefit of the younger members, "A Simple Crystal Set and Its Construction," and brought one of his own sets for the members to examine, a most ingenious piece of apparatus composed of "odds and ends." Many useful hints were picked up by the members, who tendered their thanks in the accustomed manner.

The next meeting was quite an innovation for the members, a "question night" being held, members bringing any questions they wished answered, and the answer was given by a member present. Much interest was displayed and another will be held shortly. The society are now in the course of erecting the first wireless set for the society, the apparatus chosen being a two-valve set to be constructed. The society regret to announce the death of two of their vice-presidents, Mr. W. G. Riddle and Mr. Charles F. Grossmith (a member of the well-known family of entertainers).

The society have now permanent headquarters at the Y.M.C.A., Ramsgate, where they will meet every Tuesday.

At a committee meeting held on December 4th, Mr. W. Ford Wells, of "Wykeham," Broadstairs, was elected as a vice-president.

Joint hon. secs., Mr. F. Harrison, "Rochester Cottage," St. Lawrence (Ramsgate); Mr. F. C. Marshall, 6, Ramsgate Road, Broadstairs (Broadstairs and district).



HANG IT!

Hang this up-to-date and very complete directory of wireless telephone and telegraph call-signs, from your table. Over 12,000 call-signs of amateurs, ships and land stations. As indispensable to a "listener-in" as a telephone directory is to a subscriber.

Price 2/6 net.

Obtainable through the usual channels or direct (post free 2/8) from

Radio Press Ltd. DEVEREUX COURT,
Publishers of Authoritative Strand, LONDON, W.C.2.
Wireless Literature.

WIRES, SCREWS, TERMINALS

DIRECT FROM MANUFACTURERS

7/22 COPPER WIRE, 3/3 per 100 ft.

SEND ENQUIRIES TO—

BORO' SUPPLY,

Tyrwhitt Rd., Lewisham High Rd., S.E.4.

FOR THE EXPERIMENTER.

Microphones, W.E. Solid back	15/-
Microphones, Inset type	5/-
Receivers, 150 ohm P.O. watch pattern with hooks and cords	5/-
Condensers, 2 M.F., Mansbridge	1/3
Double headphones, French, 4,000 ohms, extremely sensitive, by "Brunet"	22/6
Buzzers, ex-Army	2d.
Variable resistances, reading 0 to 80 ohms, with radial arms	2/6 & 3/6
Telephone jacks	4/6
Dewar switches, six spring	1/-
12wlv	1/9
Ebonite sheet, 1/2 in. matt surface, cut to size, per square in.	3/6

Cabinets in teak, oak, or mahogany, hand-polished to requirements. Large stocks of ex-Govt. and new Wireless Apparatus.

**W. H. AGAR, Walrod Street,
Mitcham Lane, Streatham, S.W.16.**

WIRELESS INVENTORS

Patents and Trade Marks. Advice Hand-book and Cons. free.—B. T. KING, Regd. Patent Agent (G.B. & U.S.A.), 146a, Queen Victoria St., E.C.4. Phone: Central 682. 36 yrs. refs.

THE BEST BOOK ON

WIRELESS FOR AMATEURS

How to make and use a Wireless Valve Receiver Set, By E. K. Spiegelhalter. This book has been specially written for Amateurs in Wireless. Clear Constructional details accompanied by 24 very practical Illustrations are given, which will enable the operator to build his own set economically and to work it successfully when made.

Price 2/- net. Send P.O. for a copy.
E.&F. N. SPON, Ltd., 57, Haymarket, London, S.W.1.

SPECIAL OFFER of POLES for AERIAL MASTS

PRICE 7/6 each or: 2 for 13/6. 3 for 19/6. 4 for 25/-.

Each pole an 18-ft. selected Fir of 4-in. butt. Lengths for extending height, or for spreaders, 3d. per ft. Masts can be prepared (peeled and treated with preservative) at 1/6, and extra lengths at 6d. each extra.

CARRIAGE PAID anywhere in England; elsewhere 1/- per pole extra.

COLEMAN & SONS, 7, CRANFIELD, BLETCHLEY

RADIOTORIAL

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

In this issue of POPULAR WIRELESS my readers have the opportunity of enjoying a special article from the pen of Dr. Lee De Forest, one of the foremost authorities on valves in the world.

Dr. De Forest is known in America—and for that matter in every country where wireless men foregather—as “the man who put the grid in the valve.”

Great as his work on the perfection of the valve has been, Dr. De Forest is also the inventor of many other famous wireless improvements, and in his article, “My Orchestra of Andions,” he tells of some very fascinating experiments.

POPULAR WIRELESS has now a goodly list of famous contributors. There is, of course, a reason for this; but being modest, I will say no more.

Since number one made its appearance POPULAR WIRELESS has published articles by the following scientists: Sir Oliver Lodge, Dr. J. A. Fleming, Sir William Noble, Dr. Irving Langmuir, Professor Low, Mr. John Scott-Taggart, Mr. P. J. Risdon, Mr. E. Blake, Mr. William Le Queux, Sir J. Kenneth D. Mackenzie, Mr. Philip E. Coursey, and many others.

And I can assure my readers that many more splendid articles—not too technical to be understood by the average amateur—will continue to make POPULAR WIRELESS the best weekly wireless paper published.

THE EDITOR.

Questions Answered

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have decided to reply individually by post. A weekly selection of questions will, however, be printed on this page, together with the answers, for the benefit of readers of POPULAR WIRELESS in general. Questions should be clearly and explicitly written, and should be numbered and written on one side of the paper only.

All questions to be addressed to: POPULAR WIRELESS, Queries Dept., Room 132, The Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send necessary postage for reply.

“DOUBTFUL” (London, N.W.)—I have two bichromate cells, giving about 4 volts. Will these be suitable for the filament current of a valve set?

No, the current delivered is by no means steady enough for the purpose. You must use accumulators, or else employ low-temperature valves, such as types L.T.1 and L.T.3. These only take a very little current, and could be run off dry cells.

“REACTANCE” (no address)—asks what part of the apparatus causes “reactance,” and how it can be eliminated.

“Reactance” is a term used in denoting an electro-magnetic effect caused by coupling the plate of a valve to either its own grid circuit or to that of another valve. The effect is to increase the incoming oscillations. Unfortunately, if the reaction takes place on the grid of the first valve—i.e., on the aerial circuit—there is great danger of causing radiation through too tight a coupling being used, and its resultant interference with local receiving stations. If a H.F. valve is used the reactance, from plate of detecting valve, can be coupled to the transformer (H.F.) and thus eliminate any chance of energising the aerial and causing radiation. In single valve sets, however, and in L.F. valve amplifying sets, the reaction coil should be cut out altogether if there is the slightest chance of its causing radiation.

D. P. B. (Brighton)—Can I use the electric light mains for charging my accumulators? The mains are 200 volts, and I believe are D.C. How many lamps should I have to give the correct charging rate?

You should certainly be able to charge your accumulators from the mains. Assuming that the cells have a charging rate of about 2 amps., you will find that four carbon lamps will give about the required amperage. The lamps should be of the 32 candle-power type.

F. R. G. (Sunningdale)—I have a four-valve set and am being continually jammed by spark stations when I am listening to the British broadcasting. Can I do anything to prevent it? Please can you tell me who the following are: FFB, GBU, OSM, CBY?

As you are using H.F. amplification you will find it difficult to eliminate jamming unless you employ a frame aerial. There will be an article in POPULAR WIRELESS shortly on the “Elimination of Jamming.” The stations are: Boulogne-sur-Mer (coast station), SS. Ulysses, Constantinople (coast station), and SS. Orompello, respectively.

A. B. C. (Nottingham)—All the time that I was listening-in last night I was troubled by a continual crackle in the ‘phones. I was using a three-valve set. Can you help me find the cause of this interference?

Assuming that your accumulator is neither run down nor overcharged—in either case you might get this crackle—it is probable that your filament resistances are not making continuous good contact. This would cause minute fluctuations in the L.T. current and therefore the crackle in the ‘phones. If your connections are all quite tight and you find that the resistances are making good steady contact, you should examine the H.T. battery. Possibly one of the cells in this battery has run down and thus, by its high resistance, it is causing unsteady H.T. voltage. This would give rise to the crackle you experienced.

P. D. (Hornsey)—I have a crystal set on which I get quite good results, but would like to increase its range if possible. What would you advise me to do?

If you wish to continue the use of crystal rectification you should add valve amplifiers to your existing set. One or more H.F. valves will increase your range, while L.F. amplification would make your present signals louder. We suggest that you follow out the circuit shown in our issue of November 25th, under the heading of “My Receiving Station,” by “Crystor.”

“PUZZLED” (Salisbury)—I have a 4-volt 20-amp. accumulator, but find it is insufficient for three valves. Can I add another of the same voltage and capacity in parallel so as to increase the total amperage?

This is not to be recommended, as, unless the two accumulators are charged to exactly the same voltage, one will tend to discharge through the other one. This is liable to cause variations in the voltage applied to the valves, and would thus give rise to noises in the ‘phones. We would suggest that you sell your present accumulator and buy a 6-volt 60-amp., or something of that order. Don’t forget that with the 6-volt battery you must have filament resistances in series with your valves.

W. H. M. (Manchester)—I have just erected an aerial of the double type, using 140 ft. of wire, and the height is 30 ft. Does this infringe the P.M.G.’s regulations? (2) I have a one-valve B.B.C. set; what range has this, please? (3) Can I get a licence for a crystal and valve set, all home-made? It does not contain reaction.

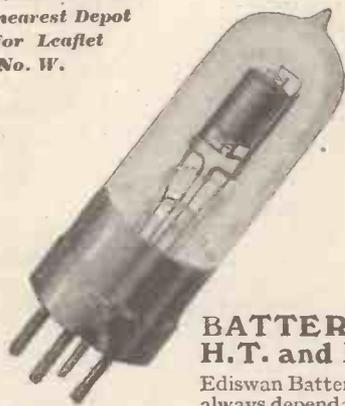
The aerial is not in accordance with the regulations. It should be 100 feet total height and length. That is, the height added to the length or span from the set to the further insulators or spreader should not exceed 100 feet. This, of course, is inclusive of the length of the lead-in, but has no bearing on the number

(Continued on page 773.)

WIRELESS IN HISTORY: CLEOPATRA HOLDS A RADIO TEA.



If your usual dealer is unable to supply write to our nearest Depot for Leaflet No. W.



BATTERIES H.T. and L.T.

Ediswan Batteries are always dependable for efficiency and service. Always insist on "Ediswan" products when buying Accumulators or Dry Batteries.

The Ideal Valve for Reception

IS THE

EDISWAN "AR"

Manufactured by a firm with over forty years' experience in lamp-making, Ediswan Receiving Valves represent the best of their class. Robust in construction, silent and economical in working, the "AR" Valve is equally suitable for the experimenter as well as for Broadcast reception.

Price 15/- each.

THE EDISON SWAN ELECTRIC COMPANY LTD.,
123/5, Queen Victoria Street, E.C.4.

BRANCHES : Aberdeen, Belfast, Bristol, Birmingham, Brighton, Cardiff, Dublin, Dundee, Edinburgh, Glasgow, Hull, Leeds, Leicester, Liverpool, Manchester, Newcastle-on-Tyne, Nottingham, Sheffield, Southampton, Swansea.



39

ESTABLISHED 1905

DOUBLE HEAD PHONES

(4,000 Ohms).

Double Plate Magnets,
Duralium Headbands,
Replaceable Coils,

£1-0-0

(Postage 9d)



SINGLE EAR PHONES

(2,000 Ohms).

Special New Year Offer.

7/6 EACH.

(Postage 4d.)

MADE BY—
TURNOCK'S TELEPHONE WORKS,
41, High St., Aston, Birmingham.

SEIZING THE OPPORTUNITY
GUARANTEED VALUE.

Only by Manufacturing in very large quantities are we enabled to offer these "Wireless" articles at the exceptionally attractive prices.

CRYSTAL DETECTORS Post free 2/4 each
(Beautiful workmanship and finish)

ALL FIXED CAPACITY CONDENSERS Post free 1/2 each
(From 0.0003 to 0.001. Very efficient).

HEADPHONES, 4000 Ohms. Post free 21/- pair
We always hold large stocks of every Wireless Accessory and everything electrical.

Our high standard is always guaranteed and Money will be gladly returned if entire satisfaction is not obtained.

We Are! Wireless and Electrical Experts! and will gladly and freely help you if you will write and tell us of your difficulties.

THE BELGRAVIA ELECTRICAL CO.,

111, Wilton Road, Victoria, S.W.1. Telephone: VICTORIA 1120

A NEW WIRELESS INSTRUMENT

THE "WHISPER-PHONE" RELAY (PROV. PATENT.)

Magnifies Crystal-Set Wireless Reception from 3 to 5 times and Valve-set Reception from 5 to 12 times. The Equivalent of Two Valves.

The most original and surprisingly simple Wireless Amplifying Apparatus yet invented.

No delicate adjustments necessary. Instantly ready for use.



A small 3-Volts Pocket Lamp Battery only required to work it.

SEND 3d. STAMPS FOR FULLY ILLUSTRATED LISTS.

Let your Friends hear your Crystal-set or Valve-Reception. The "Whisper-Phone" Wireless Relay: A Highly Efficient DEAF-PHONE, and a Marvellously Sensitive DETE CTAPHONE.

CHAS ADOLPH, SUPER-MICROPHONES, Etc.,
12, Leverington Street Works, King Square, LONDON, E.C.1.

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 773.)

"NOVICE" (Brighton).—What are the lowest and highest wave-lengths one is likely to hear stations working on?

The amateur stations can be heard down to 150 metres, while the large station at Bordeaux in France (L.Y.) transmits on 23,400 metres. It is as well to remember, however, that all the stations working on wave-lengths above that of Nauen, 3,900 metres, which are audible or fairly easily audible in this country, are employing the continuous wave system. This allows them to be brought in very easily on harmonic tuning, so that unless you are going to specialise in long-range Morse reception it is quite unnecessary to have a tuner to tune up to the twenty thousand metre adjustments.

H. G. (Balham).—Can a coherer be used for the reception of telephony, and if so would the local battery used allow sufficient amplification to use a loud speaker over short ranges?

No; the coherer can only be employed for the reception of Morse signals consisting of unmodulated impulses over short distances. Except for control purposes, the instrument is not as efficient as the simpler crystal detector.

"AMPLIFIER" (Hampstead).—I have a two-valve set, one L.F., and have also two Mullard valves; one of the old type and one which is a little broader than the first. Is there any difference between them?

You will find that the older type of valve—the thinner one—will be best as a detector, while the newer and broader valve should be used as an amplifier.

"QUERY" (Herts).—I have a crystal set which gives very good results, but the other evening I thought I heard a valve oscillating while Marconi House was transmitting. Is this possible with a crystal? I always thought a crystal could not receive C.W.

It is quite possible that you heard a local valve oscillating, provided Marconi House was being received by you at the same time. In this case the oscillations from the valve would heterodyne with the carrier wave of the broadcasting station, and thus form a series of notes audible in a crystal set.

"TRANSFORMER" (Southampton).—I have burnt out my L.F. transformer primary. Can I use the rest of the instrument in any way?

The secondary can still be used as a choke coil, directly coupling up the plate of the valve to the grid of the second valve. One end of the winding goes to the H.T. positive, while the other end goes to the plate of one valve and to the grid of the next valve. A small condenser should be placed in series with the grid, and a leak from the grid should be taken to the earthed pole of the L.T. battery.

L. T. M. (Mill Hill).—I have great difficulty in tuning out 2LO when listening for Birmingham on a three-valve 2-L.F. set. Would a three-coil tuner be advantageous?

Yes; a three-coil tuner will certainly assist matters, but fine tuning will have to be obtained to satisfactorily cut out the station when you are so near to it. You will find that an H.F. valve—preferably of the tubed anode type—will assist greatly, and owing to its high degree of selectivity you should be able to tune Marconi House practically right out. An H.F. valve will greatly assist in the reception of long-distance stations.

"OTTO" (Eltham).—What should I hear with a crystal set that includes an inductance of 4½ in. diameter wound with 60 turns of 22 S.W.G., 30 ft. high aerial, and what variable condenser should I use?

You should, if the aerial is fairly directional and you obtain fine tuning and crystal adjustments, hear the broadcasting from Marconi House. Your coil is of very efficient dimensions for the purpose, and used with a .0005 mfd. variable condenser in parallel for tuning purposes, should give quite useful results.

"STILL LISTENING" (London), complains that he is unable to obtain results from a single-valve set on a frame aerial.

Unless you are within two or three miles of Marconi House, it is not very probable that you will do so. The introduction of a grid leak and condenser on the

(Continued on page 776).

SECTIONS

1. Crystal Detector Circuits
2. Single-Valve Circuits
3. Two-Valve Circuits
4. Three-Valve Circuits
5. Four-Valve Circuits
6. Five-Valve Circuits
7. Local Oscillators for Heterodyne Reception of CW
8. Valve Transmitter and Radio Phone Circuits

2/6 or 2/8 post free from Publishers.

THE use of Reaction gives almost the additional strength of another Valve, but carelessly used it is a source of great annoyance to all other receiving stations within two or three miles. Therefore the P.M.G. has rightly banned all reaction coupled to Aerial circuits on broadcast wave-lengths.

No need to cut it out altogether though, for in this new book by John Scott Taggart—that eminent authority on Thermionic Valves—several circuits are shown for the first time which permit the fullest use of Reaction which cannot cause oscillation in the Aerial circuit.

If you are not now using reaction, get this book and see how easily you can alter your wiring to obtain that maximum of efficiency so essential if you are to pick up those long distance broadcasting Stations.

Every diagram is clearly drawn, all condenser values are given—further, you have the assurance that every circuit has been tried and tested, that they are not mere "paper circuits." You'll need this book to understand your Set better. Get it to-day.

—to get the best results you must know how your Set works.

Expert knowledge will make your Set twice as sensitive. Know how it works and you can easily correct any faults and tune it up to a high state of efficiency. The requisite knowledge for this can be gained from books issued by the Radio Press. Here are some of them—all can be relied upon for dependable information. From all Booksellers or direct from the Publishers.

- CONSTRUCTION OF WIRELESS APPARATUS.** Shows how to make every component necessary without the aid of special tools. 1/6
- WIRELESS VALVES SIMPLY EXPLAINED.** Over 130 pages of sound explanation telling exactly how the Valve works and how to get the best results from it. 2/6
- RADIO PRESS DIRECTORY.** 20,000 Call signs with names of Stations (commercial and amateur). 2/6
- WIRELESS FOR ALL.** Read this before buying your Set. Tells you exactly what Radio is and the Set you'll need. 6d.
- SIMPLIFIED WIRELESS.** A practical Book showing how to build Crystal Sets, and explaining full theory of Radio in everyday language. 1/-

Radio Press, Ltd
PUBLISHERS OF AUTHORITY WIRELESS LITERATURE
DEVEREUX COURT, STRAND, W.C.2.



BARGAINS

Crystal Detectors	2/8
Valve Holders (ebonite)	1/-
Fixed Condensers	1/6
Reel Insulators	2d.
Egg Insulators	5d.
Laminated Switch Arms	1/10
Terminals	1d.
Aerial Wire, stranded 150 ft.	4/6
Contact Studs	doz. 5d.
Valve Legs	1d.
Crystal Cups (3 screws)	4d.
Valve Pins	1d.
Spade Terminals	1d.
Condenser Vanes	doz. 1/-
Filament Resistances	2/10
Lead-in Tubes, 8 in.	1/6
12 in.	1/9
Slide Rods, with terminal	6d.
Large Spacers	doz. 4d.
Small Spacers	doz. 3d.
Loud Speakers	10/6
Interval Transformers	13/6
Phones, 4,000 ohms	21/-

Send Ample Postage.

Illustrated Catalogue, including List of Stations, Post Free, 6d.

EONS WIRELESS SUPPLY CO.,
115, FLEET ST., E.C.4.

(Next "Daily Express" Offices.)

ELECTRADIX RADIOS.

Immediate Delivery from our Huge Stocks.

Everything from a Recorder to an Earth Clip.

The best-equipped City depot. COME AND SEE US.

9, Colonial Avenue is first opening on left in the Minories, near Aldgate Station, Metropolitan Railway.

LESLIE DIXON & CO. Tel. Avenue 4136.
9, Colonial Avenue, London, E.1.

That book you want

On Wireless, or any Technical subject. Foyles have it, or will quickly obtain it, 1,000,000 vols. (Second-hand and New) on every conceivable subject in stock.

Write for Catalogue 120 (free) mentioning requirements.

FOYLES, 121, Charing Cross Rd., London.

AERIALS

MADE IN THREE SECTIONS 16 FT. HIGH, WITH METAL JOINTS AND FITTINGS COMPLETE.

CAN BE FIXED IN ANY POSITION.

These masts were purchased from the Government, are new, and could not be made to-day for £2.

My Price 15/- each

S. H. RAWLINGS,
9, Victoria Street, London, S.W. 1.

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 775.)

grid of the valve, and a '001 mid. fixed condenser across the telephones and H.T. to act as a "bypass," would help towards the possibility of doing so, but a stage or two of H.F. amplification is very advisable for frame aerial work.

"POP WIRE READER" (London, W.).—My landlord has asked me whether there is any danger attached to the erection of a wireless aerial, even though I am using an earthing switch?

Not if you connect the switch correctly. As you have it at present the series condenser is left in direct series with the earth lead, even although the earthing switch is closed. You should arrange the circuit so that the aerial has a direct metallic path to earth when the set is not in use. It will then be perfectly safe; in fact, owing to the aerial acting as a lightning conductor, it will even provide additional safety to the house.

"BOY READER" (Blackburn).—Is any licence required for an indoor aerial? Yes, a licence is necessary.

G. W. (no address).—What is the capacity required for the variable condenser of the secondary of a loose coupler and a fixed condenser for the 'phones?

'001 mfd. in each case. What is the gauge of the enclosed wire, its nature and resistance per 1,000 yards?

It is 36 single-silk-covered S.W.G., with a resistance of 520.9 ohms per 1,000 yards.

"CAPACITY" (Bristol).—How many foils, each one square inch in size, using '002 in. mica as a dielectric, will be required for a '001 mfd. variable condenser?

One on each terminal will suffice.

"AERIAL" (Newport).—Will I be able to obtain results on a single-valve set with telegraph wires running across my aerial 10 ft. above at right angles?

You will experience little or no interference, although the wires will cause a slight absorption and reflection, and thereby reduce your signal strength to a certain extent. If you intend to extend your set at any future date, employ H.F. amplification in preference to L.F.

J. M. (no address).—Does the introduction of a loud speaker affect the wave-length at all? Not to any appreciable extent, anyway, as the loud speaker is placed in the detector and not the tuning circuit.

"AMATEUR" (Wimbledon).—Is a valve amplifier better than a microphone amplifier for loud-speaker work?

Yes, because most types of microphonic relays although generally speaking more economical, are very susceptible to mechanical vibration.

"PUZZLED" (Ripley).—I have five basket coils, 20, 25, 33, 38, 50 turns; what coils should I use for A.T.I. to hear Birmingham, London, and Manchester broadcasting?

A great deal depends upon the variable condenser employed. If you are using a '0005 mfd. condenser, 2 L.O. should come in on coil 20 with the condenser in parallel, Birmingham on coil 25, and Manchester on coil 20. The other coils will enable you to tune up to about 800 or 900 metres, using the same condenser.

WIRELESS FOR ALL
JOHN SCOTT THOMAS

SIMPLIFIED WIRELESS
JOHN SCOTT

No. 1. The most fascinating story of the age told in simple non-technical style. Price 6d. (7d. post free).

No. 2. The sequel to the story, with full instructional and constructional details. Price 1/- (1/1½ post free).

From all Newsagents or in two days from **Radio Press, Ltd.**, Devereux Court, Strand, LONDON, W.C.2.

PICK UP AMERICA

if you can, on your outdoor aerial, but hook up an indoor aerial on

IND-AERIAL HOOKS

and let the family get the broadcasting. They go on the picture-rail and support aerial one foot from the wall. Results will charm you!

P.O. for 10/6 brings four post free.

IND-AERIAL CO. (Dept. B), 47 Victoria St., S.W. 1

ACCUMULATORS, etc. New and Guaranteed

4-Volt, 25-Amp. Celluloid, 11/3.	Postage 1/-.
4-Volt, 40-Amp. 17/6	6-Volt, 40-Amp. 25/6
4 " 60 " 21/3	6 " 60 " 31/-
4 " 80 " 27/-	6 " 80 " 35/-

Packing, 1/6 extra. Packing, 2/- extra.

7/22 Aerial, 5/6 100 ft.; Mullard Ora Valves, 15/-; 15-V. Siemens H.T. Batteries, 4/-; Marconi B. Valves, 17/6; Accumulator Charging Board, 37/6; Voltmeters, Watch pattern, 0/12; Volts, 6/-.

Cash with order. Goods despatched per return.

LOWKE & SONS, Ltd., Northampton.

WIRELESS CONCERTS

are more fascinating if you understand the principles of Wireless Telephony.

Apply to Secretary

WIRELESS SCHOOL
179, Clapham Road, S.W. 9

CABINETS & CASES
IN POLISHED MAHOGANY OR TEAK.
QUOTATIONS PER RETURN.

J. LANCASTER & SON, LTD., 87, PARADE, BIRMINGHAM

PORTLAND'S Parts by Post. "EBONITE."

8 x 1.....	s. d. 7	12 x 10 ..	s. d. 7 6
4 x 4.....	1 3	17½ x 8½ ..	9 6
7 x 5½.....	2 8	18 x 18 ..	12 10
10 x 6.....	3 9	36 x 18 ..	1 3 0
17 x 5.....	5 3	7lbs.....	1 3 0

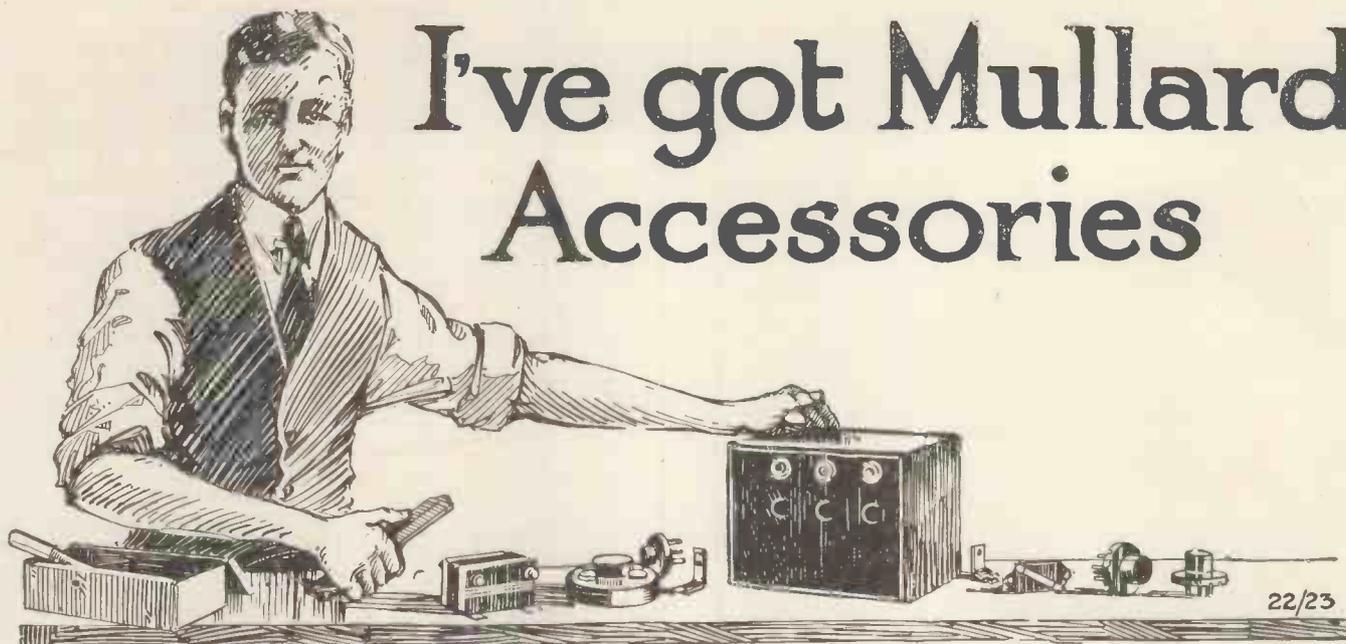
Quarter, Mat, British.
Postage Free. Any size cut.

JAMES PORTLAND,
39, Sinclair Road, Olympia, W.14.
Mr. Portland stocks
200 Wireless Parts

MATERIALS, TOOLS, & WORKSHOP SUNDRIES

OUR 1923 LIST of above (64 pages) is now ready. Wireless experimenters cannot afford to be without a copy. SENT POST FREE on receipt of Post Card.

GEORGE ADAMS (DEPT. P.W.), 255-6, HIGH HOLBORN, LONDON, W.C.1.



The wireless components with a world-wide reputation of many years standing. They will ensure your getting a set which looks well, works well and speaks well.

For receiving vocal and instrumental items you must have

MULLARD "ORA" VALVES

to get the best results

Oscillates **R**ectifies **A**mplifies

Specially recommended where good amplification is required.

The "Ora" Valve requires about 3.8 volts on the filament and 30 volts or over between the anode and filament for efficient results.

Standard Price **15/-** each

IMPORTANT NOTICE.

The great demand for Mullard "ORA" Valves and other accessories has compelled us to open much larger works. A greatly increased output is now available.

The Mullard "R" Valve

is now reduced in price from 22/6 to 17/6.

Mullard Radio Valve Co. Ltd.

45, Nightingale Lane, Balham, S.W. 12

Contractors to H.M. Admiralty

War Office, Royal Air Force & Post Office.

Telephone: 1068 Codes: ABC (5th Ed) Telegrams: Radiovalve, Bentley's Wandscom, London.



Please send me post free	
Quantity.	Description.
.....	Telephone Head Sets (Type A, 21/-; Type B, 25/-)
.....	"ORA" Valves - 15/- each
.....	Grid A Resistances - 3/-
.....	Anode A or B Resistances - 2/6
.....	BA Combined Resistances - 5/6
.....	Valve Bases with Terminals - 5/-
.....	Valve Sockets - 1/3
.....	Terminal Clips - 9d. per pair

I enclose (Cheque, Money Order, P.O.) value to cover the cost.

Name and Address.....
 To the MULLARD RADIO VALVE CO., LTD.,
 45, Nightingale Lane, Balham, S.W. 12.

Name of usual Wireless Dealer.....

SEND THIS TO-DAY.



Place An Order For Your
**BROADCASTING
INSTRUMENTS
NOW!**

If you are Expecting Perfect Reception You MUST Use R.F.H. RECEIVING INSTRUMENTS, R.F.H. 'PHONES, THE MAGNAVOX LOUD SPEAKER
(For which we are factors and retail agents.)

WE manufacture our own Components, Coils, Condensers, Resistances, Switches, Cabinets, etc., which not only enables us to ensure perfect Workmanship and Materials, but enables us to give quick delivery, and to offer guaranteed high quality Radio Goods at the lowest possible price.

ALL R.F.H. Receiving Instruments are made to fulfil the conditions laid down, and are accepted and passed by the Postmaster General for Broadcasting Reception, and are made under licence. Prices range from 5 gns. to 100 gns. Exceptionally fine sets are purchasable from us or our agents at prices varying from 12 gns. to 35 gns., according to number of valves, etc., etc.

FOR super-excellence in reception and simplicity in operation, you must get an R.F.H. 2, 3, or 4 Valve Radio Set.

IMMEDIATE DELIVERY.

Write to us for particulars.
LISTS FREE.

BUYING AGENTS WANTED IN ALL TOWNS
ROGERS, FOSTER & HOWELL
LTD.
Edward Rd., Balsall Heath,
BIRMINGHAM.

**R. F. H.
RADIO
SETS**

AMPLIONS

THE MASTER LOUD SPEAKER
for POWER and TONE
ALL MODELS IN STOCK—ALWAYS
DEMONSTRATIONS EVERY EVENING 5 to 8.30
TRADE SUPPLIED at full discounts

Crystor

COWL INSULATORS
(PROV. PATENT)

THE ABSOLUTE ESSENTIAL OF A
PERFECT AERIAL



**AERIAL
INSULATORS**
Price 1/9 each.

Crystor Aerial Outfit

SINGLE-WIRE AERIAL, containing 2 Crystor Cowl Aerial Insulators, 1 Crystor Cowl Lead-In (vertical or horizontal), 100 ft. Best Quality stranded copper Aerial Wire, 100 ft. Best Hemp Rope, and one pulley block, packed in box. Price complete, 18/6
Postage 1/6 extra.

Horizontal Wall or Window
LEAD-IN 6/6

Vertical Roof
LEAD-IN 6/-

**STOCKED by all leading stores and
Wireless Agents EVERYWHERE**

I was recommended by Mr. — (a well-known amateur) to fit your Cowl Insulators to my aerial . . . the effect was extraordinary; it was just as if I had switched in another valve . . . I received signals I had never heard before . . . S. D. (Ealing).

BECAUSE

Crystor Cowl Insulators are
THE ONLY WAY TO GUARANTEE
100% Efficiency from AERIAL

SOLE DISTRIBUTING AGENTS:

WIRELESS AGENCIES LD.,
64, Mortimer St., London, W.1.

'Phone: Museum 2872.
'Grams: 'Adragonax, Wesdo, London.'

All Applications for Advertisement Space in POPULAR WIRELESS to be made to JOHN H. LILE, Ltd. (Sole Agents), 4, Ludgate Circus, London, E.C.4. Phone: 13306 Central.

SPECIAL WIRELESS MAP (27" x 20") FREE INSIDE
TOGETHER WITH A FOUR-PAGE DIRECTORY OF AMATEUR STATIONS WITH CALL SIGNS AND ALL DETAILS

POPULAR WIRELESS

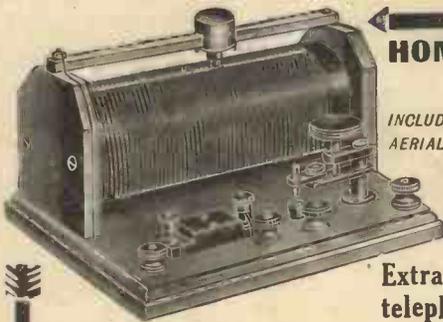
3d
Weekly

No. 34. Vol. 2.
Jan. 20, 1923.



HOSPITAL PATIENTS LISTEN TO GRAND OPERA BY WIRELESS.

FOUR - PAGE SUPPLEMENT FOR BEGINNERS
(COMMENCES IN THIS ISSUE)



HOME JUNIOR SET

INCLUDING AERIAL AND ONE PAIR OF "MITCHELLPHONES."

57/6

Extra pair of telephones **25/-**

Now approved and stamped **B.B.C.** TESTED AND GUARANTEED.

FOR LONDON, BIRMINGHAM, & MANCHESTER.
A Handsome Receiving Set, tuning up to 1,000 metres, at a very sensible price that will appeal to intending purchasers.

Without doubt the finest value for the money, and is sold under our usual unconditional guarantee.

The price covers one pair of the famous Mitchellphones and aerial material for 100 feet, postage paid to your door. Immediate delivery can be effected, and you can easily instal the whole outfit by following the book, which is included.

Dimensions:

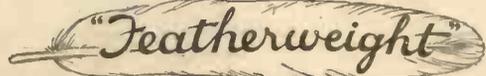
9 ins. x 6 ins. x 5½ ins. high.

MITCHELLS ELECTRICAL AND WIRELESS Ltd., 188, Rye Lane, Peckham, S.E.15

POSTAL ADDRESS: McDermott Road, Peckham, London, S.E.15.
WEST END BRANCH: 2, Gerrard Place, London, W.1.

Read This:—
Unsolicited testimonial original can be inspected.
Surrey, Oct. 22, 1922.
Dear Sirs, I am writing this to assure you of the efficiency of your Wireless Outfit. On Tuesday last I heard the Writtle Concert, although it is advertised to have only a 25 mile radius for speech.
I am, Yours truly,
R.

BROWN'S



HEADPHONES

BRITISH AND BEST

THE FINEST HEADPHONES PROCURABLE for

30/-

This price is for one pair of either 120 or 400 ohm phones including cords of good quality.

Catalogue, post free, gives you details of our Wireless Headphones, Loud Speakers, and Amplifiers



Type F "Featherweight." Actual weight, including cords, is 6 oz. only

Obtainable from All Wireless Dealers.

S. G. BROWN, L^{TD.}

London Showrooms (Retail only):

19, MORTIMER STREET, LONDON, W.1.
Head Office & Works (Trade Only): -Victoria Road, North Acton, W.8.

? WHY ?

Has the

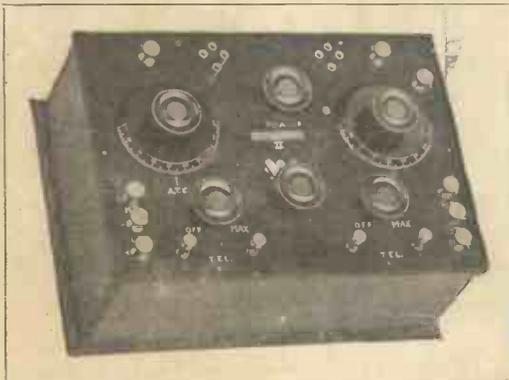
"HESTAVOX II"

G.P.O. Reg.

No. 2005.

2-Valve Receiver

Established itself as the ideal set for Broadcast Reception?



WE WILL TELL YOU.

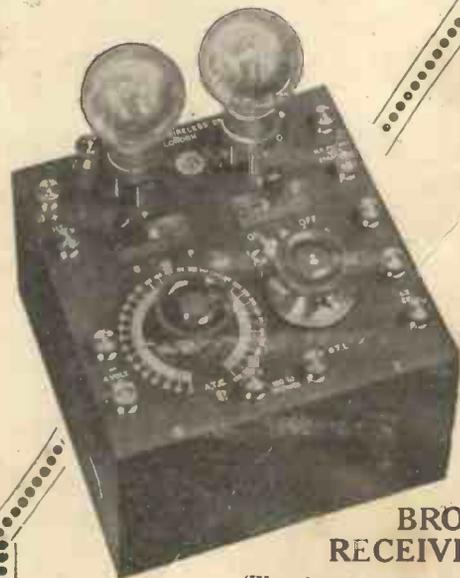
Because it is of perfect design and finish, will receive the Broadcast Transmissions from distances up to 150 miles, is easily built into a multi-valve set one valve at a time as required, and is moderately priced at

£12 : 7 : 6 (exclusive of accessories)

Write for Name and Address of our Nearest Agent. Some District Agencies still open. CATALOGUE (Post Free) 6d.

The "HESTIA" ENGINEERING COMPANY,
32, PALMERSTON ROAD,
1 min. South Acton Stn. ACTON, LONDON, W.3.
(N.L. and District Rlys.)

Showrooms open
9 a.m. — 6 p.m.
Telephone:
Chiswick 586



ALL TINGEY Broadcast Receivers bear the B.B.C. Stamp.

ALL TINGEY Valve apparatus is duly licensed under Marconi's Patents for Amateur use in Great Britain

TWO-VALVE BROADCAST RECEIVING SET

(Wave length 300 to 2,800 metres)

PRICE (as illustrated, less valves, including Broadcasting fees) **15 Gns.**

Illustrated Catalogue of 1, 2, 3, 4, and 5 valve Broadcast Receivers and experimental Unit System, with all accessories, Price 6d post free.

Offices and Showrooms:

92, Queen Street, Hammersmith, London, W.6.

Telegrams—"Tingoldar," London.

Phone—Hammersmith 1916.

TINGEY WIRELESS LTD.

NEXT WEEK.
SECOND INSTALMENT OF BEGINNERS' SUPPLEMENT.
WHAT TYPE OF SET TO BUY.
 This article will clearly explain how much you need spend for various wireless sets, and exactly what you will need if you are a certain distance from a broadcasting station.

Popular Wireless

TOPICAL NEWS AND NOTES.

NEXT WEEK.
"THE FUTURE OF BROADCASTING IN THE HOME."
 An interview with Senatore Marconi, who gives his views on the possibilities of broadcasting. (Special to POPULAR WIRELESS.)
"OPENING TO OPERA WIRELESS."
 London Ronald's opinion on broadcast music.

The First Radio Opera.

ALL those who listened-in to the first opera broadcasted by wireless in this country, must have felt a little surprised at the amazing success of the venture. The chatter of the audience, the "tuning-up" of the orchestra, the rap of the conductor's baton—the whole affair was a most delightful novelty.

An Orchestra Next?

WHEN you come to think of it, it is rather astonishing how well the voices in the first and succeeding operas broadcasted.

On the stage the various artistes were not only singing but acting as well; they moved about continually, turned their heads away from the microphones, and assumed all sorts of attitudes, yet the variation in the strength of their voices was not sufficient to render signals at all inaudible in my telephones.

Excellent as the results were, I feel sure that if the Queen's Hall orchestra are broadcast in the same way, the result will be better still, for the players retain their position throughout the programme.

That Rushing Noise.

THE rushing noise heard during the transmission of opera from Covent Garden via Marconi House will, doubtless, be put down to "landline" noises. As a matter of fact, it is caused by the amplifiers—which are of special design with a secretive inaccessibility—situated underneath the stage at Covent Garden. The circuits employed are of novel description; and special transformers are used for them in the actual wireless transmitting-room.

Better and Better.

I HEAR from a very authoritative source that 2 L O expects to be able to spring a surprise on the radio world shortly in respect of an entirely new type of microphone. Veritably it will be adding "super" to quality. The "voice" number "one" and "voice" number "two" tests recently carried out gave me the first blue. Ladies can change their names but seldom their personality. Did anyone else spot it?

To Be Exact.

2 L O is able to regulate the wave-length of its transmissions to the extent that accuracy is obtainable to a quarter of a metre. At the time of writing 2 L O's wave-length is exactly 373½ metres—truly a micrometric adjustment!

WIRELESS IN THE HOME

By the Editor.

With this number of POPULAR WIRELESS is included a New Supplement for the absolute beginner, and a specially prepared Map of the radio stations in this country.

The new recruits to the ranks of wireless enthusiasts will find amusement and instruction not only in listening to the official broadcasting stations, but also in listening to amateur transmitting stations. Amateurs now work chiefly on an adjustment of 180 metres, but some may be heard on 400 metres.

Since broadcasting began the popularity of wireless has increased by leaps and bounds, so that at the time of writing these words it is estimated that there are 60,000 licensees in London alone. It is hard to say how many there are in the whole country, but 100,000 would be a moderate estimate.

The new amateur, once he has heard a broadcast concert on his set, naturally becomes all the keener. He wants to know the why's and wherefore's of wireless; how he can improve his set, and perhaps obtain an experimental licence.

POPULAR WIRELESS is at his service. No trouble is too great for us so long as we can be of assistance to our readers, and if there are any little problems—never mind how trivial—that are puzzling you, write in to POPULAR WIRELESS, and we will solve your difficulties for you by post—free of charge.

Special arrangements have been made by the staff of this paper in order to advise and assist readers who are anxious to purchase wireless sets. For details, see our Radio-topical Page.

If you want to have a receiver of your own but feel diffident about buying one without advice, just drop a line to the "Queries Department" of POPULAR WIRELESS, and we will assist you to our utmost.

The British Broadcasting Company has already given us a taste of its fare, and very excellent fare it is, too. The broadcasting of opera from Covent Garden by wireless was an innovation that took the country by storm; and the results have more than justified the experiment of bringing opera into thousands of homes by radio. So urge your friends to buy a receiver and enjoy the broadcasting. The more the merrier.

Wireless Control

GREAT interest was evinced by the youngsters—and their parents—in the wireless controlled model train exhibited by Major Raymond Phillips on the Bassett-Lowke stand at the recent Model Engineer Exhibition at the Royal Horticultural Hall, London. Regular readers of POPULAR WIRELESS must have felt quite superior in their knowledge of "how it works," owing to the series of articles constructionally detailing the set that Major Phillips wrote specially for POPULAR WIRELESS.

A New Address.

I UNDERSTAND that owing to a considerable increase in business, Messrs. Radio Components, Ltd., have moved to larger and more convenient premises at 19, Rathbone Place, W.1. (3 minutes from Tottenham Court Road Tube Station).

Opera for Manchester.

IT is probable that when the opera company visits Manchester the same arrangements will be made as in London to broadcast the operas each evening. In the case of Manchester, however, the land line will be six miles long, as the Manchester station is some way from the theatre where the operas will be given.

For Traders and Manufacturers.

I AM advised that an association has recently been formed under the title of "The National Association of Radio Manufacturers," and that it comprises in its membership the principal British producers of radio apparatus.

The association has been brought into being for the purpose of preventing those chaotic conditions which inevitably arise in a new industry if the solution of all problems is left to individual effort.

It is interesting to note that the Radio Section of the "Daily Mail" Ideal Home Exhibition to be held at Olympia from March 1st to 24th (inclusive) will be under the control of the association. The arrangements include the acquisition of a theatre at Olympia capable of seating 1,000 people, in which radio demonstrations will be organised by the association throughout the period of the exhibition.

Messrs. Derbyshire & Co., Chartered Accountants, of 4, Southampton Row, London, W.C.1., are acting as secretaries to the newly formed organisation, and will be pleased to furnish further particulars to any duly qualified British manufacturers who would like to consider the question of membership.

A One-valve Set.

THE reception of the American broadcasting stations in England has been accomplished on a single-valve set that would appear to be quite authentic. I am emphasising the fact in an endeavour to decrease the "record-breaking" correspondence which I am receiving on this subject.

Have a Try.

TO go one better would demand a crystal set to accomplish the feat, but I really expect that somebody will go "that one," but, please, when doing so send the fullest possible details. I would like to possess such a set myself!

Speeding Up.

CAPTAIN LEWIS, the deputy director of programmes of the Broadcasting Company, has been personally conducting a series of experiments in voice transmission from Marconi House. Perhaps it has been noticed that he has, during the children's stories and news, been varying the quality and speed of articulation. He hopes to be able to considerably "speed-up" the transmission of such items.

The New Craze.

THE craze for wireless is spreading now more rapidly than ever. People are indeed going wireless mad and are forgetting their work. One business man has complained to Marconi House that wireless has been responsible for his wife neglecting her household duties. "At half-past five each evening," he wrote, "instead of my wife preparing the evening meal she sits down to 'listen-in.'" Perhaps before long we shall hear of wireless divorces.

The Latest.

I HEAR the B.B.C. are endeavouring to arrange for the transmission of "The Last Waltz" from the Gaiety Theatre. They have also other musical comedies in mind.

Doubtless we shall be pleasantly surprised before very long.



Sounding the Chimes at Marconi House.

Sunday Service.

THE decision of the B.B.C. not to transmit on Sundays during the hours of public worship will, I think, meet with universal approval. It has, however, taken the point out of Talbot O'Farrell's joke. Briefly, it is that Scotsmen are missing church and enjoying the service at home by wireless—and missing the collection. Even Scotch folk have been heard to laugh at this.

Some Applause.

ONE would have thought that to listen to the whole of "Faust" by radio would be a bit too much; but last Saturday I switched on at 7.15, and kept the loud speaker working until the curtain fell at 11.10. Mr. Robert Radford's voice was as clear and strong as a bell, and the applause—well, it was about as much as my Magnavox could carry!



Even public houses are taking up wireless—a counter attraction to 30 under proof!

"Siegfried" by Wireless.

ON the night Wagner's opera "Siegfried" was broadcast I took a Marconi portable set round to the home of Sir Landon Ronald, the famous conductor and composer. Sir Landon was delighted with the results and—but in next week's P.W. he himself will give his opinion of wireless music.

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.
Marconi House, London, Broadcasting Station	2LO	369	Usually every evening, 5 to 5.45 p.m.; 7 and 9.30 News; 7.15 Orchestra; 8.25 to 10.30 Music.
Newcastle Broadcasting Station	5NO	400	6-10 p.m. (approx.).
Manchester Broadcasting Station	2ZY	385	Every evening, usually from 4.30 to 10 p.m.
Birmingham (Witton) Broadcasting Station	5IT	425	Every evening, usually from 6.30 to 10 p.m. (News, Concerts, etc.).
Croydon	GED	900	Throughout day to aeroplanes.
Writtle, Essex	2MT	400	Tuesdays, 8 p.m. (Concert.)
Paris	FL	2,600	11.15 a.m. Weather report; 6.20-7 p.m. Weather report and Concert; 10.10 Weather report.
Königswusterhausen	LP	2,800	Between 6 and 7 a.m., between 11 and 12.30, and between 4 and 5.30 p.m.
The Hague	PCGG	1,085	Sundays, 3 to 5 p.m. (Concert.)
Haren	OPVH	900	Practically every 20 minutes past each hour from 11.20 to 4.20, giving messages to aeroplanes on the Brussels - Paris, Brussels-London, and Brussels-Amsterdam lines.
Radio-Electrique, Paris	—	1,565	5.5 p.m. News Items; 5.15 to 6.10 Concert; 8.45 p.m. News Items; 9 to 10 p.m. Concert.

Note.—See announcements in daily Press for last minute alterations in times of Broadcasting Programmes.

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

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

All times given are G.M.T.

MUSIC BY WIRELESS.

By MARK HAMBOURG.

In the following article Mr. Mark Hambourg, the famous pianist, gives his opinion on the broadcasting of music by wireless. Mr. Hambourg listened-in to the grand opera transmitted from Covent Garden, via 2 L O, the other evening, and in the next column will be found an account of how a special demonstration set was fixed at Mr. Hambourg's house, and his candid opinion of the broadcast opera.—EDITOR.

IN a recent number of this journal, Mr. George Bernard Shaw suggested that broadcasting might prove of educational value if Sir Johnstone Forbes-Robertson were to recite good English to "listeners-in" for half an hour each day. As a rider Mr. Shaw added the belief that this would prove a "startling novelty" to most of the subscribers.

From the musical point of view there is no doubt but that broadcasting will, if conducted on the right lines, prove of great educational value; thousands of people, to whom Bach, Beethoven, and Mozart are only names, will learn to appreciate the difference between good and bad music; they will listen (in time) with infinite pleasure to the "Moonlight Sonata" in preference to "That Coal-Black Mammy of Mine"; and although—to borrow Mr. Shaw's own words—good music may prove a "startling novelty" at first, I believe a vast number of "listeners-in" will quickly learn to love it.

But on the other hand the musician has got to weigh the pros and cons of broadcasting very carefully. Is it going to pay him to be "exploited by wireless"? Will it induce people to attend his concerts? Personally, I think it will; for, as the love of good music is acquired, people who have hitherto not attended concerts will want to enjoy the pleasure of listening to those where first-class artists perform.

Bach Depositing Foxtrots.

To my mind this wireless broadcasting will undoubtedly prove a great educational factor in our lives. Whenever I see in the papers that a new pianist is to give a recital, I say to myself:

"All the better; the more musicians there are, the better for all of us, because our public will grow larger and larger, and good music will be more and more appreciated."

When listening to wireless music I think one of the most remarkable things about it is the fact that the actuality of the player is so distinctly conveyed to the vast, unseen audience. And the musician himself cannot but feel impressed by, and a little thrilled at, the knowledge that his music is being heard, perhaps, over hundreds of square miles—while the listener, even if familiarity has dulled the thrill and wonder of it a little, cannot fail to appreciate the fact that he is listening to an actual performance; that every note of the piece to which he is listening is being conveyed to him at such a speed that it reaches his ears at practically the same time as it reaches the ears of the musician himself.

It is this sense of individuality, and the appreciation of the actuality of the player, that will help to make wireless music popular. The musical education of the public by



MR. MARK HAMBOURG.

wireless cannot fail, providing those responsible for the programmes see to it that the right music is broadcasted by the right people.

Judicious selections from the great composers would help tremendously towards the musical education of a vast public. In time people will become as keen on the merits and demerits of Bach as they are now on the merits and demerits of the latest ballroom fox-trot.

BROADCASTING OPERA.

Mr. HAMBOURG "Listens-In."

By ARIEL.

WHEN it was announced by our good friends at 2 L O that Mozart's opera, "The Magic Flute," was to be broadcast by wireless on the evening of January 8th, I asked Mr. Mark Hambourg, the famous pianist, if he would care to "listen-in," and give POPULAR WIRELESS his opinion of the B.B.C.'s initial effort to broadcast opera.

Mr. Hambourg very kindly consented, and so I made arrangements accordingly.

Through the courtesy of the Marconi Company, I borrowed a six-valve portable receiver.

The set is contained in an ordinary suit case, with a loop aerial wound round the lid. Beyond two potentiometers for valve control there are no switches, or knobs to fiddle with, the frame aerial being fitted for 2 L O's wave-length.

Before the day fixed for the broadcasting of opera, I had tested this set out fairly exhaustively. I had taken a taxi ride with it, and heard the 7 o'clock news message from 2 L O perfectly. I took it into a Tube; but although signals came through, the local interference was, of course, very bad. Good signals, in fact, can be picked up on this extraordinarily amazing little set within a radius of about 20 miles of London. And no, outside aerial or earth, ye proud owners of chimney-pot masts and gaspipe earths.

Wonderful! Wonderful!

I arrived at Mr. Hambourg's house in Regent's Park at about 8 o'clock, and a few minutes later had arranged the set on a chair in his drawing-room, and handed Mr. and Mrs. Hambourg, their two daughters, and Lord Muir Mackenzie (who was also present) the telephone headpieces.

For a minute or so I felt rather chilly, because the only sound in the 'phones was a slight hiss. Mr. Hambourg looked at me a little quizzically, but just as I felt I should have to make an explanation along came 2 L O's cheery call, announcing we were now to be switched over to Covent Garden.

And then, quite clearly, we heard the chatter of the audience, the whimpering of the violins tuning up, and the joyous piping of the flutes and oboes and the throaty gurgle of the brass instruments. A sharp, sudden tap (the conductor's baton!), and the orchestra ceased their wailing, and a second later the overture to the opera came clearly to our ears.

Mr. Hambourg sat entranced. Every now and then, as he heard some favourite passage, he would beat time with his finger in sheer delighted amazement, and when the overture ceased and the sound of clapping reached our ears, he cried aloud:

"Wonderful! Wonderful!"

And, hardened wireless sinner that I am, his enthusiasm made me realise all over again the astounding perfection to which broadcasting has been brought in such a short space of time.

Concentrated Magic.

At dinner Mr. Hambourg had the portable set close by him on a chair, and so enjoyed his meal all the more to the charm of Mozart's opera.

"You know," said Mr. Hambourg, "if you'd brought this wireless set out two hundred years ago you'd have been burnt at the stake. Here am I, listening to an opera being picked up by an instrument in a suit case; no outside wires, no connections. Why, it's absurd!"

And Mr. Hambourg became quite excited as he stared at the portable receiver and the six twinkling little valves—a veritable box of concentrated magic. Mr. Hambourg was especially interested in noting how the various instruments in the orchestra broadcasted. He was especially charmed by the purity of the tones of the flute and clarinet. And when I left, Mr. Hambourg declared himself delighted and amazed at the clarity of the orchestral music and "human" feeling of the voices of the opera artistes.

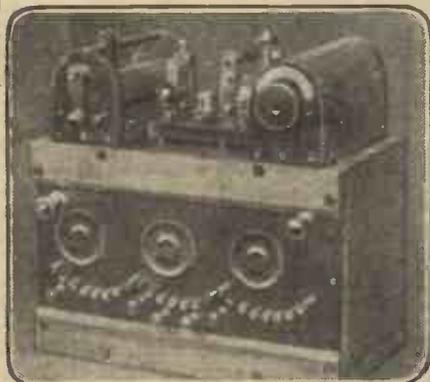
And I took Marconi's amazing box of tricks back home, glad to think that one of our great artistes had formed such a high opinion of the initial effort of the Broadcasting Company in transmitting grand opera by wireless.

THE ADVANTAGES OF HIGH-RESISTANCE 'PHONES.

THE beginner is frequently puzzled as to the reason why he is always advised to use high-resistance 'phones, instead of the cheaper low-resistance variety, either in a crystal set or when placed in series with the plate circuit of a valve.

The reason is comparatively simple. The telephone is an energy-operated device. The more power that can be applied to vibrate the diaphragms in the ear-piece the louder will be the resulting signals.

The energy utilised to vibrate the diaphragm is in the form of a magnetic field, created by the electric current flowing through the coils of the ear-piece. But the strength of this magnetic field depends upon two factors: (a) the actual strength of the



Home-made Crystal Set, by M. K. Holden, 165, Manchester Road, Mossley, near Birmingham

current, and (b) the number of turns of wire in the ear-piece coils. In other words, the magnetic field produced by the varying current depends upon ampere turns.

In the case of a single valve receiver, the current flowing through the telephone coils for a given grid potential will be inversely proportional to the total resistance of the plate circuit as a whole. The resistance in question is almost wholly made up of (R) the resistance of the internal plate-filament path of the valve and (r) the resistance of the ear-piece coils in the telephone.

The Useful Factor.

Taking the high-tension as 50 volts, and ignoring impedance effects, the steady plate current will be equal to $\frac{50}{R+r}$. The resistance R of the valve may be taken approximately as 58,000 ohms.

Now, if two telephones are compared, one say of 2,000 ohms resistance, and the other of 8,000 ohms, the current in one case will be $\frac{50}{60,000}$ or 0.96 milliamps., whilst in the other case it will be $\frac{50}{68,000}$ or 0.86 milliamps.

Assuming for the sake of simplicity that the same thickness of wire is used in both types of ear-piece, the number of turns in the high-resistance 'phones will be four times that of the other.

So that the relative strengths of the magnetic pull upon the ear-piece diaphragms in the two cases will be as 4×0.86 is to 0.96—or roughly three and a half to one. The signal strength will be in the same proportion.

To put it in a nutshell the loss in current owing to the extra resistance introduced into the circuit by an 8,000 ohm pair of telephones is more than compensated by the extra number of turns of wire that are made available, the actual magnetic energy applied to the diaphragm depending not upon the current alone, but upon the ampere turns.

Exactly the same reasoning applies to a crystal circuit, and it may be shown mathematically that maximum efficiency is attained when the telephone resistance is made equal to half the total resistance of the circuit. Considerations of size and expense however limit the winding of such 'phones to the practical maximum of 8,000 ohms now in general use.

NOTES ON THE LONDON ETHER

By 2 G M

WE were speaking to one of the great unlicensed the other day. "Do you mean to say," said he, "that standing here in the Strand wireless waves from Marconi House will pass right through me on their way to Charing Cross?" We informed him that they certainly would, and moreover were he to swallow a small receiving set, he would, with the aid of an X-ray and a "shimmy" for adjusting purposes, be able to "soothe his savage breast" from within.

Thunder from 2 O N.

But what ignorance—what a pusillanimous outlook! Fancy restricting 2 L O's "harmonic dodger" to a run down the Strand to Charing Cross! Fancy not even crediting 2 L O's musically modulated wave with sufficient intelligence to take the 6.10 to Chislehurst!

The sooner the "man in the street" (hot to mention that one in the Strand) realises that the London ether quivers regularly every evening with the tuneful melodies provided by 2 L O, and that both City and Suburbia can enjoy same with but the assistance of a crystal set and a 10s. licence, the sooner will he realise the beauty of the words of Moore, "And music too—heard far off, so far as to seem like the faint, exquisite music of a dream." That is until valve by valve he reaches six valves and a loud-speaker when all the neighbours will curse the power of his "gramophone."

Will that amateur who described 2 G M as a "low-lying station," at 11.10 a.m., 10th inst., please supply us with his identification number, as we wish to point out that his geography requires revision. Another station that must be at least temporarily nearer to Heaven than the majority, is doubtless 2 L P, who we understand has actually obtained successful results with an Armstrong super-regenerative circuit. Verily a triumph.

2 O N renews his activities at opportune hours with a diaphragm splitting note on 180 metres. With all due respect, our impression of 2 O N the other night was what might be expected from the coupling of the battered megaphone of a Mediterranean pilot to a stentorphone with a split diaphragm. Developments must be expected.

Seasonal Greetings,

2 O N must have discovered a radium spring or some potent source of atomic energy in his garden. We wonder if he remembers what Shakespeare said in the year 1602 regarding wireless telephony transmissions? The actual words were, if we remember aright, "Give us a taste of your quality, not power," but then we happen to be very close to this particular amateur lightning producer.

Talking about wireless and the noble bards, we wonder if Wordsworth was referring to 2 K T when he dejectedly exclaimed, "They should take who have power," because we heard 2 K T the other night pushing out his worst and flattest C.W. wave during 2 L O's transmission. We had written that "2 K T drops his fiddle and 'comes back' very creditably on 180 metres," but we must add that that remark must now be accepted with discretion, because his C.W. caused quite a lot of "—amming" upon that occasion.

He only possesses one gramophone record, we believe, so it would be useless for him to add an alternative attraction on 180 metres for the multitudinous "takers." Anyway, we hope 2 K T will never have the "pleasure" of hearing "The broken melody" from 2 L O.

Taking everything into consideration, we think it would be as well for 2 K T to pick up his fiddle again, at any rate, during broadcasting hours.

2 H Y really should not call his fellow electron pushers "Priceless old beans." It isn't done. It is almost as bad as "5 Pip Pip" with his "Closing down now, so smash smash, old valve."

2 L O has gathered together a splendid little drove of melody manufacturers who will creditably go down to posterity as the first British Wireless Orchestra. Also 2 L O's transmission leaves very little to be desired, and soon, no doubt, their youthful microphones will grow out of those delicate little lips.

The Radio New Year programme broadcast over that memorable 11.55 p.m. to 12.12 p.m. period from 2 L O was excellent. We believe feelings of trepidation were audibly expressed by just a few as to the possibility of the "reservoir" of that noble wind instrument, the bagpipes, which energetically performed upon that auspicious occasion, coming into fatal contact with a sharp end of 2 L O's famous "broke lead." That, of course, was all rot; and, anyway, the ever resourceful Mr. Burrows would have immediately been at hand with a small portion of stamp edging.

Shortly after 2 L O had gone to roost the night, or rather morning, the ether commenced to tear itself to pieces with "Happy New Year, Old Man!" from a horde of diminutive broadcasting stations classified officially as "10 watters." Sentiment was excellent in all cases, transmission excellent in a few cases, fair in many, but in the case of the rest—well, "Happy New Year, Old Man!"

WIRELESS STAGE "STUNTS."

By MAJOR RAYMOND PHILLIPS, I.O.M., late Member of the Inter-Allied Commission of Control.

IT is probably not generally known that wireless has for many years played an important part in connection with various stage stunts, more particularly those arranged to create an atmosphere of mystery. Many so-called spiritualistic manifestations have been effected by means of concealed wireless apparatus, and in big spectacular stage productions, remarkable and ingenious engineering feats are sometimes involved.

Interesting effects can be produced by means of what is technically known as the inductive method of transmission and reception. The latter functions on the same principle as the inductive phenomena between the primary and secondary windings of an ordinary induction coil. Two coils are used (each one separate from the other), one for transmitting, and the other for receiving. This method could scarcely be called wireless in the strict sense of the term, although there are no connecting wires between the transmitting and receiving coils and apparatus.

Those readers who wish to try the experiment can easily do so, as the transmitting coil may simply consist of 25 turns of double silk-covered copper wire, No. 18 gauge, wound in a circle 4 feet 6 inches diameter. A simple method for winding is to drive wire nails in an old door, or in a wall (if the landlord does not object), in a circle of the diameter specified, and lead the turns over the nails.

When the required number of turns have been wound, it will be necessary to wrap the coil with insulating tape, leaving say 12 inches of the terminal wires free for connecting in series with an ordinary telephone transmitter or microphone and battery.

The Talking Kettle.

The receiving coil can be wound 3 feet diameter with 70 turns of No. 20 gauge double silk-covered copper wire, and completed the same as the transmitting coil, except that it will only be necessary to connect an ordinary telephone receiver to this coil. A battery is not required.

If the transmitting coil with its microphone and battery is placed in one room, and the receiving coil with its telephone receiver placed in another room (the planes of both coils being parallel to one another), words spoken in the microphone will be distinctly heard in the telephone receiver attached to the receiving coil.

It will be understood that the transmitting and receiving coils can be made in various sizes according to the gauge of copper wire used, so that the experiment can be performed in such a manner as to completely mystify an audience.

For instance, a receiving coil might be neatly attached to a lady's skirt, and the terminal wires and telephone receivers connected therewith completely concealed.

With the introduction of a little trickery the lady would be in a position to reply to apparently impossible questions, as a confederate would, of course, communicate with her through the medium of a trans-

mitting coil, microphone, and battery connected therewith, but also concealed.

Many years ago a papier mâché kettle was introduced. It contained a receiving coil and telephone receiver. Speech could be heard emitting from the spout of the kettle when a confederate spoke into the microphone attached to a transmitting coil, the latter of course being concealed.

Illuminated Fairies.

The device caused a sensation at the time, many people believing that communication with "spirits" had actually been established, as the kettle could be carried about a room, and turned upside down. The receiving coil and telephone receiver were of course concealed (the kettle being provided with a false bottom), so that the interior could be examined with impunity.

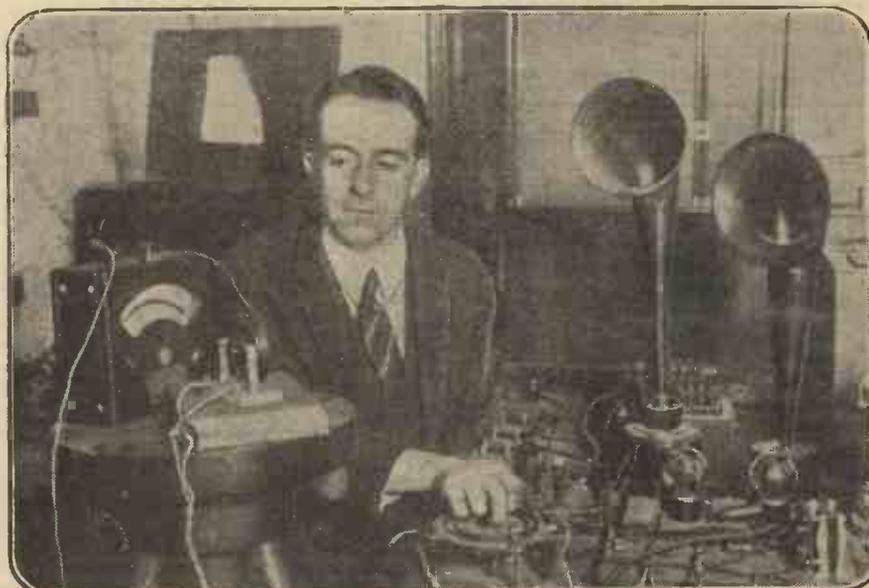
overlooked that the principal difficulty is to produce a demonstration which will entertain, amuse, and interest an audience.

As I have on many occasions been asked what led me to introduce so many novelties on a Music Hall stage, I will conclude this article by giving a brief account of the events which led to my first appearance at the London Hippodrome.

The Wireless Airship.

In 1906, when wireless, telepathy, and aviation were practically in their infancy, I commenced experimenting with the wireless control of mechanism, and subsequently succeeded in constructing a piece of apparatus which gave promising results.

After further experiments during 1907 to 1910, I constructed a wireless controlled airship, and wrote a letter to Mr. (now Sir)



Testing Loud Speakers by means of an instrument that photographs defects. The slightest "fault" is shown

With modern radio telephony, it is obvious that in future it will be possible to produce astounding effects.

A stunt I introduced in 1912 involved the genuine wireless control of lighting miniature electric lamps attached to the dresses of lady dancers. The feat presented some difficulties, as the source of power had to be provided from non-spillable types of accumulators.

The coherer, relays, and selector were contained in a neat box, the latter being attached to the back of a dress. The antenna at first consisted of two aluminium rods neatly bent to a suitable shape, but afterwards were arranged to represent wings, so that the dancers appeared as fairies.

With a stage suitably lighted, the effect was brilliant, as the dancers' dresses appeared to be enveloped in flames. From the foregoing remarks it will be apparent that the scope for wireless stage stunts is practically unlimited, but it must not be

Oswald Stoll, asking if he could see his way to allow me to conduct "rehearsal" flights with my airship during the daytime in one of the theatres under his control. I received a reply by return granting the facilities asked for, and subsequently in reply to my telegram announcing that "rehearsals" were completed, I was asked to give a trial demonstration at the London Hippodrome on Friday evening, April 29th, 1910, between the performances at that theatre.

After the demonstration I was instructed to appear at the London Hippodrome on the following Monday, May 2nd, 1910, and thus for the first time in the history of the world, an airship was wirelessly controlled by me before an audience in a Music Hall. In my previous articles in POPULAR WIRELESS I have referred to many other demonstrations with apparatus which I have designed and constructed.

I shall shortly introduce further novelties which I hope to refer to at some future date.

HOW TO MAKE AN H.F. AMPLIFIER.

By H. G. HERSEY.

(Member of the Wireless and Experimental Association.)

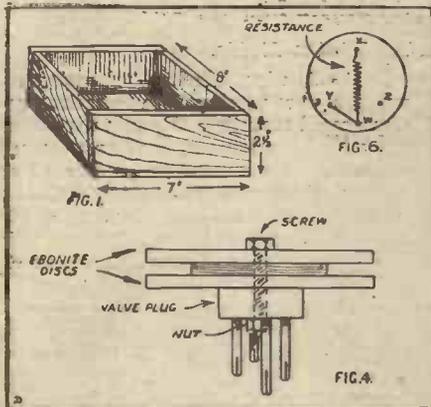
WITH broadcasting an established fact we find ourselves working hard with the object of tuning up our sets not only to a wave-length but to the highest point of efficiency. It is now that we realise what a valuable asset to the apparatus reaction used to be; without it we find our single valve reduced to the level of a mere

we are ready to commence assembling the various components. The circles A and B represent the positions to be taken up by the two valve holders, the former for our valve and the latter to hold High Frequency Transformers of the 4-pin plug in type. The method of mounting these valve holders will be best solved by the reader, for there are so many patterns available, each having its particular arrangement for mounting.

H T + and C. The building of these transformers calls for no special skill or ability.

The reader should collect as many old valve bases as possible. (The local dealer will often provide these for a small sum.) It is the 4-pin plug we require as a means to mount our transformer upon.

A sheet of ebonite $\frac{1}{8}$ in. thickness should be purchased, its size depending upon the number of transformers we desire to construct. The ebonite is cut into discs by means of a fret saw, and three discs clamped to a 4-pin plug make an ideal former in which to wind

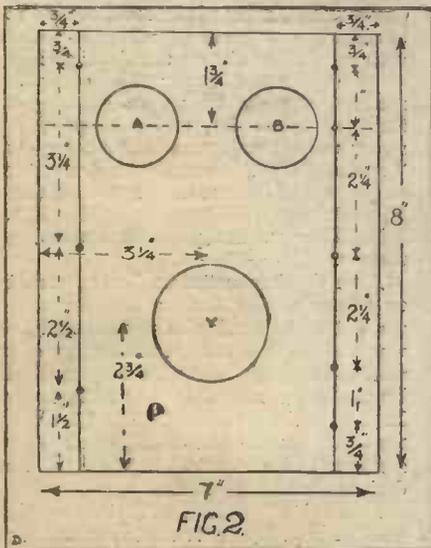


crystal, and costing no small sum for its extravagance in the way of filament current.

It is the object of this article to offer a few practical details towards the construction of a high frequency panel, this to be placed in front of our detecting valve, and to serve one or two important functions, such as amplifying the weakest of radio frequencies, thus giving our detecting valve something tangible to work with and resulting in an increase to the range of reception, also it will afford a ready means of introducing reaction in such a way as to conform to the Postmaster's requirements.

The Base and Panel.

A sheet of ebonite is purchased, 8 in. by 7 in. by $\frac{1}{8}$ in., and a base is made up from some hard wood to mount the ebonite upon. This base is shown in Fig. 1. The ebonite should next be marked out as in Fig. 2, and



The filament resistance is another factor calling for consideration; should the reader purchase an ex-Army filament resistance as with the detector panel, a method of mounting the same is shown in POPULAR WIRELESS, No. 26, page 569. If any other pattern is at hand undoubtedly the reader will soon see a way and means of attaching the same to his panel in the position Y.

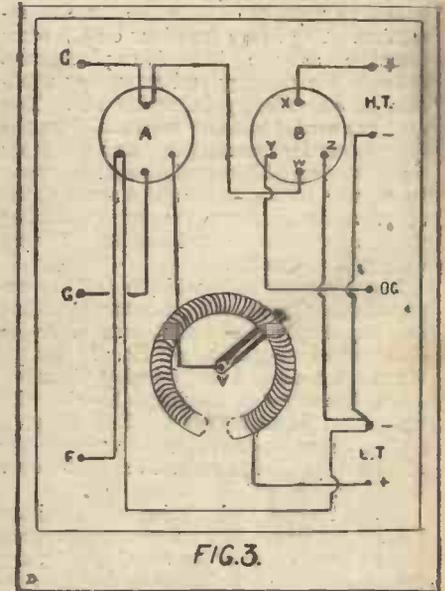
The panel having been previously drilled along the sides for the 8 terminals, according to their size, also the holes for the wood screws around the edges, is now ready for the terminals and wiring.

Wiring and Connections.

The wire used should be of about No. 20 S.W.G. and well insulated, preferably systoflex or rubber covered. Commencing with the filament circuit a lead is taken from L T + terminal to the filament resistance, another from the resistance centre to the right hand side socket of valve holder A, a second connection is taken from L T - terminal to left hand filament socket.

The filament circuit complete can now be tested with a valve in position, its brilliancy being adjustable by the filament resistance. Having proceeded so far successfully we can commence wiring the various H F circuits. The F terminal is connected to the left hand filament socket, and the G terminal is connected to grid socket. The input side of the valve is complete, and we can now deal with the plate circuit.

From the H T + terminal a lead is taken to valve holder B, socket X, Fig. 3. From socket W another is taken to the plate of the valve holder A, and also extended to terminal C. It is now observed that the plate current is broken between the points X, W-. It is here that we are to insert the primary coil of our transformer, resulting in a tuned anode circuit.



our wires. A transformer to cover the broadcasting wave-lengths is made up as follows:

Two discs of ebonite are cut each 2 $\frac{1}{4}$ in. diameter, a third disc is cut 1 $\frac{1}{4}$ in. diameter; a hole is now drilled through the centre of each to take a small brass screw and nut, the length of screws to be $\frac{1}{8}$ in. (a contact stud answers this purpose well). The valve plug is next taken, and a hole is drilled through its centre between the 4 pins, and the discs and plug should be assembled as in Fig. 4.

Test for Continuity.

A small hole should now be pierced through the bottom flange opposite the anode pin, and $\frac{1}{8}$ in. from the circumference. A short-length of No. 26 or 28 enamelled wire is passed through this hole to protrude beyond the flanges, and the inside end of the primary winding should be soldered to this, the joint being pulled in to the centre of the transformer with the outside end. We now wind on 80 turns of No. 38 S.W.G. D.S.C. wire for our preliminary winding. The depth of winding should be gauged and a hole pierced through the bottom flange opposite the grid pin.

To complete the secondary circuit a lead is taken from the socket Y to the terminal O G (output to grid). The secondary winding of transformer is to be placed between points Y Z, and as the connection from Z must go to the filament of the detecting valve it can be conveniently taken to the L T - terminal of this panel. It now remains to connect H T - and L T - together and the wiring is complete. The panel can now be screwed to its base and paped flush with the woodwork, the latter being treated to varnish or polish to taste.

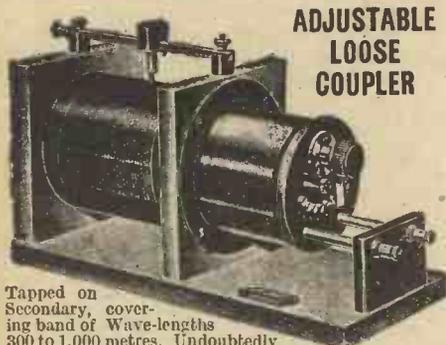
A number of high frequency transformers will be required to cover all wave-lengths, each having its particular range, which can be increased by placing a variable condenser across its primary, i.e., between terminals

A length of 26 enamelled wire is inserted and a connection made, the joint being insulated with paper and pulled to the coil.

(Continued on page 785.)

Complete Clearance of Wireless Oddments at **GAMAGES SALE**

This is a unique opportunity for you to secure **Genuine Bargains in Wireless Apparatus.** Gamages have large surplus stocks on hand which must be cleared, and in order to do this speedily, prices are cut to the lowest possible level. The goods offered are in every way new and perfect, being regular stocks, and you can order with every confidence of satisfaction being given, or your money returned in full.



ADJUSTABLE LOOSE COUPLER

Tapped on Secondary, covering band of Wave-lengths 300 to 1,000 metres. Undoubtedly the most efficient for shorter wave-lengths, especially with Crystal receivers

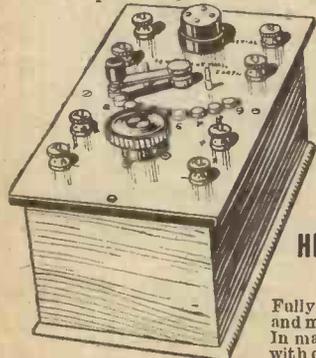
SALE PRICE 37/6

Cast Aluminium END HOOKS

For Aerial spreading. Secured by means of a screw.

2/6

Per pair



Best Quality CRYSTALS

Fine large specimens each

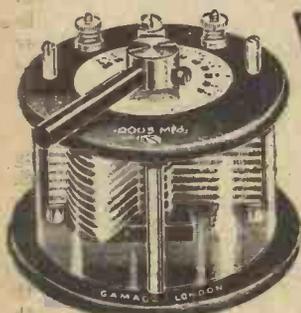
Bornite	1/-
Copper Pyrites	1/-
Carborundum	1/-
Silicon	1/-
Tellurium	1/6
Permanite	2/6
Zincite	2/6

HIGH FREQUENCY AMPLIFIERS

Fully adjustable, and most efficient. In mahogany box with ebonite top.

70/-

VARIABLE CONDENSERS



"SONUS" UNIT VALVE PANEL

When used with necessary batteries will convert crystal set into valve receiver. Comprises Valve Holder, Filament Resistance, Grid Condenser and Leak, Phone Condenser, and necessary terminals for connections

heavy brass terminals. **SALE PRICE 27/6**

Paraday House Calibration. These condensers are the best obtainable, with positions clearly engraved. Of the best workmanship, electrically and mechanically perfect. No. 1.—As illustrated. Circular, with polished ebonite top and base, celluloid container and engraved ivory scale, .00045 capacity. **SALE PRICE 19/9**

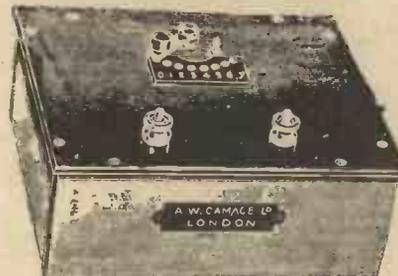
.0003 capacity. As above but with out-long arm. **SALE PRICE 17/9**



Special Purchase of "LUCAS" SIGNALLING OUTFITS

For Day or Night Signalling. Projects a very powerful straight beam of light that makes signalling readable at a distance of three miles in daylight. Three colour discs—Ruby, Green and Yellow—and reducing screen supplied for night use. Outfit consists of wooden carrying case with leather shoulder strap, containing lamp fitted with cable and two-pin plug, ball-jointed helio, tripod adapter, tube sight, steel earth spike, three spare bulbs, box of spare parts, tapping key and instruction book. Every Scout Troop should have one of these Ex-Government Sets. Offered at **15/9**

Carriage Extra. 12-volt Batteries for above 7/- each.



HIGH TENSION BATTERY BOX

Improved design with base board and green baize bottom. Finished in polished mahogany with ebonite top. Designed to give total output of 105 volts varied in seven steps of 15 volts. **SALE PRICE, container only 19/9**

Small size to take 60 volts, 4 tappings, container only. **SALE PRICE 14/9**

SPECIAL HIGH-TENSION BATTERIES



Well known for their great efficiency, long life, and general adaptability. They can be easily connected together to form a suitable H.T. Battery for valve work, or we can supply them ready mounted in our special battery boxes. We are now able to offer these batteries at the low **SALE PRICE of 2/2½**

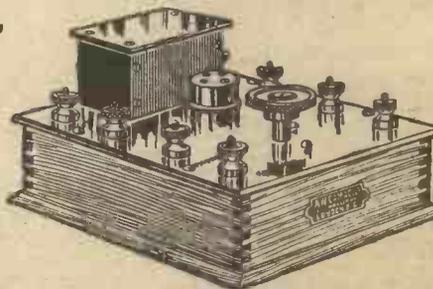
Size 9 in. x 3 in. x 2 in.

THE "PARLIPHONE" LOUD SPEAKER

(Prov. Patent No. 21967) NO METAL USED IN ITS CONSTRUCTION. EQUAL IN EFFICIENCY TO THOSE THREE TIMES THE PRICE.

Horn and stand moulded in one solid piece of Ebonite. Contains no receiver, but the interior is screwed and made to receive a Brown's Patent Standard Receiver. Thus by simply unscrewing one ear-piece from Head-phones and inserting in the "Parliphone" an efficient Loud Speaker is obtained at a small cost. The remaining ear-piece can still be utilised for tuning in the ordinary way. As no metal is used in its construction, the objectionable metallic "ring" so common to most Loud Speakers is entirely obviated, the result being a rich mellow note without the slightest distortion.

PRICE 32/6 Packing and Postage, 1s. 3d. extra.



THIS AMPLIFIER WILL IMPROVE YOUR CRYSTAL SET TO A SURPRISING DEGREE

This single-stage Amplifier, finished in polished mahogany with ebonite top, and ebonite container for the transformer, forms a handsome and efficient instrument.

The transformer used is of a 4 to 1 ratio. This amplifier will considerably increase volume of sound, thus making Telephony and Signals normally weak a pleasure to listen to. Price

Extras: Valve, 15/- High-Tension Battery, 15/- Low-Tension Battery, 25/6 **42/-** Post free.

Write for a Copy of Gamages New **WIRELESS CATALOGUE** Post free on request

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

It Speaks for Itself—
and in no uncertain voice.
THE WORLD'S STANDARD
LOUD SPEAKER.

AMPLION

WIRELESS
LOUD
SOUNDING
RECEIVERS
are supplied in
a series of

Ten Models

Suitable for
every service:

The Home,
Laboratory
and the
Concert Hall



At Prices
ranging from
£2 : 10 : 0
to
£15 : 15 : 0

**DAILY
DEMONSTRATIONS**

at the

**GRAHAM
SHOWROOMS**

The ALGRAPHONE SALON

25-26 Savile Row,
Regent Street, W.1

'Phone : Regent 1073.

"MUSIC MASTER" HORN.

Type AR 13, 120 ohms £6 : 0 : 0

Type AR 15, 2,000 ohms £6 : 2 : 6

"GRAHAM" WIRELESS
PRODUCTIONS INCLUDE
"HIGH EFFICIENCY"
TELEPHONE HEADSETS
OF IMPROVED DESIGN
AND CONSTRUCTION.
THE "GRAHAM" IS THE
BEST HEAD GEAR MONEY
CAN BUY.

Full Particulars forwarded
upon request.
Ask for Folder P.W.

Patentees and Manufacturers:

**ALFRED GRAHAM
AND COMPANY**
St. Andrew's Works, Crofton Park
LONDON - - - S.E. 4

'Phone : Sydenham 952. 'Grams : Navalhada, Brock, London

SCOTLAND—

Mr. F. M. Milligan,
25, Renfrew Street,
GLASGOW.

IRELAND—

Mr. Alex. R. Munday,
41, Chichester Street,
BELFAST.

HOW TO MAKE AN H.F. AMPLIFIER.

(Continued from page 782.)

The coil should be tested for continuity, and all being well should be bound carefully with cotton until covered up. A few small pieces of paraffin wax should now be placed upon the cotton, and a hot wire placed near the wax will cause the latter to melt and be absorbed by the cotton, thus sealing the primary winding and well insulating it from the secondary.

Winding H. F. Transformers.

The transformer should now be held out in front with the pins pointing toward you, the anode pin uppermost and grid beneath. The left hand side filament pin is to be used for inside secondary. A hole should be pierced and a length of 26 wire inserted as with the primary. Ninety turns should be wound on, care being taken to ensure that the winding is in the same direction as the primary. This completed, the ends should be soldered to their respective pins.

The secondary should now be bound with black cotton and waxed, the finished article presenting a neat appearance. The following data will be of great assistance to readers desiring to construct a number of transformers.

The figures given have been ascertained by the trial and error method, also without the aid of a variable condenser across their primary windings. A certain amount of latitude must be allowed these figures, the results varying according to many factors, such as tightness of windings and insulation factors.

No. of turns.	Inside flange diameter.	Outside flange diameter.	W/L
30	1 1/4 in.	2 in.	190/240
45	1 1/2 in.	2 1/4 in.	240/300
80	1 3/4 in.	2 3/4 in.	300/400
240	1 3/4 in.	3 in.	550/750
340	1 3/4 in.	3 1/4 in.	950/1200
900*	1 3/4 in.	3 1/2 in.	2500/3500

* Width of winding 3/8 in.

The use of a variable condenser between terminals C and H T + will considerably increase the range of coils. It should not

exceed .0002 for the lower wave-lengths, and .0005 for the higher wave-lengths, otherwise in the first instance tuning will be too critical, and in the latter the absorption too great.

The panels should be externally connected as in Fig. 5. The terminal F on the detector panel can be ignored. If a small coil be connected across the terminals R 1 and 2 of detecting panel and coupled back to the H F transformer in use, a beat frequency can be set up for the reception of C.W. signals, and if this coupling is loosened slightly to render the valves just off the oscillation point regeneration is effected for telephony without distortion, and should the set oscillate there will be no re-radiation in the aerial to cause annoyance to your neighbouring wireless friends.

On Long Wave-lengths.

Should the circuits oscillate without reaction when the primary of transformer is tuned closely with a condenser, a slight positive potential to the grid of the amplifying valve will put matters right. On the longer wave-lengths the reader may find the winding of coils tedious, and should he desire to use resistance capacity amplification it is only necessary to mount a suitable resistance upon a 4-pin plug between the anode and grid pins.

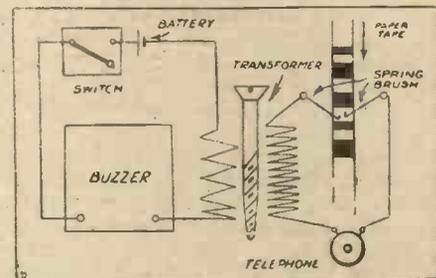
The grid pin and the filament pin, which will occupy socket Y, should be connected together, see Fig. 6. With this component it will be necessary to make one small alteration to the detecting panel by taking the grid leak lead off the terminal lettered G, and connecting the lead to the terminal F. This alteration will not effect the efficiency of the set with the transformers, but is most essential for the resistance component if used, the reason being that the grid of the detecting valve would otherwise be connected direct through the leak and the amplifying resistance to the H T + supply.

WIRELESS PHOTOS.
POPULAR WIRELESS will pay 10s. 6d. for every amateur photograph published in this paper. If you have a good print of your set, send it along at once.

A SIMPLE AUTOMATIC TRANSMITTER.

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

THE pleasures of listening in are never realised to the full extent until one is able to follow the numerous messages in Morse going on all the time. To those who have not yet acquired the art of Morse reception, an automatic transmitter, designed on the lines recently suggested by C. R. Palmer in the December 9th issue of POPULAR WIRELESS cannot but be of the greatest use. But those who have been trying similar ideas, for the purpose would have noticed that the process of perforating the tape with a knife, as suggested, is neither speedy nor satisfac-



tory. Even though this difficulty can be overcome by using a pair of paper-punching pliers, it is not simple enough to suit the average experimenter.

Marking the Tape.

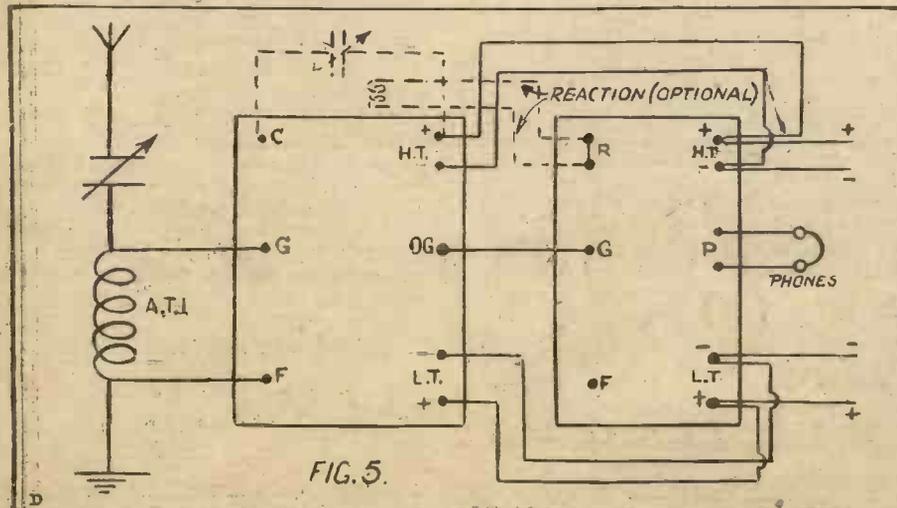
A very simple plan is to mark these dots and dashes on the paper tape, using one of the conducting paints of aluminium or gold that can be had for a trifling sum. Or they may simply be drawn across the tape (not along its length) as a wide patch with a soft pencil, using the following rules for the relative dimensions of dots, dashes, and spacing of the Continental code generally used.

1. A dash is equal to the length of three dots.
2. A space between two elements of a letter is equal to one dot.
3. A space between letters in a word is equal to one dash.
4. A space between words in a sentence is equal to two dashes.

In general a width of about 1/4 in. is quite ample for a dot, and a sample of such a tape is shown in the diagram.

This simplified way of marking the tape is possible since in this design the current for actuating the buzzer has not to pass through this marking on the paper. From the diagram of connections it would be clear that the buzzer is working all the time, and that the signal circuit is coupled to it through a simple step-up transformer. The primary of the transformer is in series with the buzzer, while the secondary is in series with the telephone and a pair of contact brushes made out of a pair of springy brass wires, and mounted separated from each other by about 1/4 in. These brushes press on the paper tape, and as a signal-mark passes beneath them it closes the secondary cir-

(Continued on next page.)



THE WONDERFUL MICROPHONE.

By L. B. POWELL.

AMONG the thousands of people who spend their evenings listening to the broadcasting from London, Manchester, and Birmingham now, it is doubtful if there are many who know that these wonderful entertainments from space would not have been possible without a certain little instrument, to the perfection of which a number of scientists devoted their skill long before wireless was heard of. It is the microphone, which was used by the pioneers of ordinary telephone communication in the latter half of the last century.

The First Steps.

These men probably did not dream of the marvellous use to which it would be put seventy years later, yet by their efforts they contributed something of immense value to the science which enables man to fling his voice, the music of orchestras, and the chiming of clocks across thousands of miles of space.

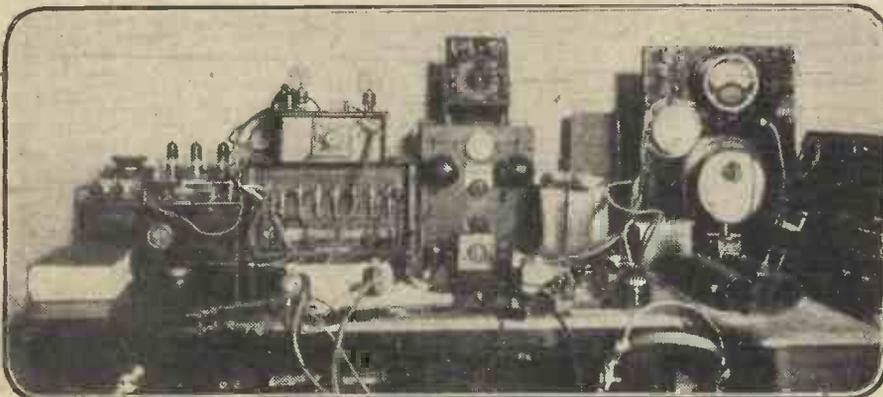
For the microphone transforms sound waves into wireless waves, and it does so in

concert is being transmitted, several microphones are placed in various parts of the room, so that an evenly balanced volume of sound is ensured.

Experiments with Jam-jars.

It was while experimenting with a microphone fifty years ago that David Edward Hughes, an American electrician, experienced phenomena which was probably the first actual "demonstration" of wireless communication. He found that the microphone was sensitive to what he called "sudden electrical impulses" proceeding from electrical machinery when in motion. One day he set an instrument working in his window, and took the microphone, with a battery attached, down the street. He was astounded to find the sounds still audible at a distance of a quarter of a mile.

The real significance of this incident was missed by many eminent scientists at the time, but it was a tiny hint of the wonders that were to follow, and marked the beginning of a period of research by many men,



Transmitting and Receiving Set at Station 2JP, Mr. Michael Ellison's amateur station near Malton, Yorkshire.

a very delicate and sensitive manner. In the early experiments it was found that a piece of parchment, or very thin metal, stretched over a frame, would vibrate when waves of sound struck it, in just the same way as the diaphragm of the human ear does. But the problem, in dealing with electricity, was how to superimpose these vibrations on the current pulses travelling along the wire.

Granules Replace Powder.

One way of doing this was to make the diaphragm the lid of a small box filled with powdered carbon, through which the current passed, and to this a mouthpiece was attached. The carbon, like every other conductor of electricity, offered a certain amount of resistance to the current, and this was varied each time a sound wave struck the diaphragm, by the particles jumping at each vibration. In this way the sound was carried to the receiving end, where the vibrations were reproduced, more or less accurately, in another diaphragm.

In microphones to-day carbon granules instead of powder are used with much better results. Sometimes, when a wireless

who adopted many different methods. Hughes himself made some important experiments afterwards. He was a remarkable man, for some of his tests were made with simple articles that lay near at hand, and jam jars, knitting pins, tins, and bits of string and cardboard formed part of the equipment of his laboratory. He died in 1900, just when Marconi's achievements were causing amazement in the scientific world.



Home-made set by Mr. S. H. Southard, 65, Whitistile Road, Brentford.

A SIMPLE AUTOMATIC TRANSMITTER.

(Continued from previous page).

cuit through the telephone, which gives a buzz as the signal.

The simple coupling transformer is easily made out of an empty cotton reel. An iron screw passing through its centre hole fixes it to the base-board, and forms the core as well. Four layers of about No. 24 double cotton-covered wire forms the primary winding, and twelve layers of No. 34 or 36 D.C.C. forms the secondary winding. A few layers of paper wound over the primary forms a useful insulation between primary and secondary, and the finished transformer may with advantage be given a bath in melted paraffin-wax before fixing it to the base-board with the screw.

High Speeds.

The use of a small electric motor for moving the tape past the brushes is apt to prove inconvenient for the average amateur who wants to save all his battery current for the valves. Such an elaboration becomes necessary only when one wants to practise reception at high speeds, for which uniformity of motion of the tape is essential. For the average experimenter starting to learn the code, the tape may simply be drawn past the brushes by hand, and at a later stage more conveniently wound on to a second reel fitted with a handle for rotating it.

CORRESPONDENCE.

To the Editor, POPULAR WIRELESS.

Dear Sir,—Perhaps it will interest you to hear that on the night of 27th-28th December I heard 2LO very distinctly. I was using a loose coupled tuner with a four-electrode valve as amplifier, and had two pairs of telephones connected. At times signals were so strong as to be readable a foot away from the phones, and all the time they were wonderfully clear. The following night I again heard him and also 2ZY and 2WP. The signals of the latter station were naturally not so strong as those of 2LO, but, if anything they were more distinct.

At 1.10 a.m. (G.M.T.) to-day, I heard music on a wave-length of 360 metres, but could not get any call sign. Can you give me any idea as to whom it may be? My H.T. battery was not functioning properly, but I hope for better luck to-night. The aerial is 40 ft. high and 80 ft. long, is badly screened, and is pointing due north and south. I am a regular reader of POPULAR WIRELESS, so if you have any comments to pass on this letter, I will look for them in that very useful journal.

Wishing you and your paper the best of luck in the New Year.

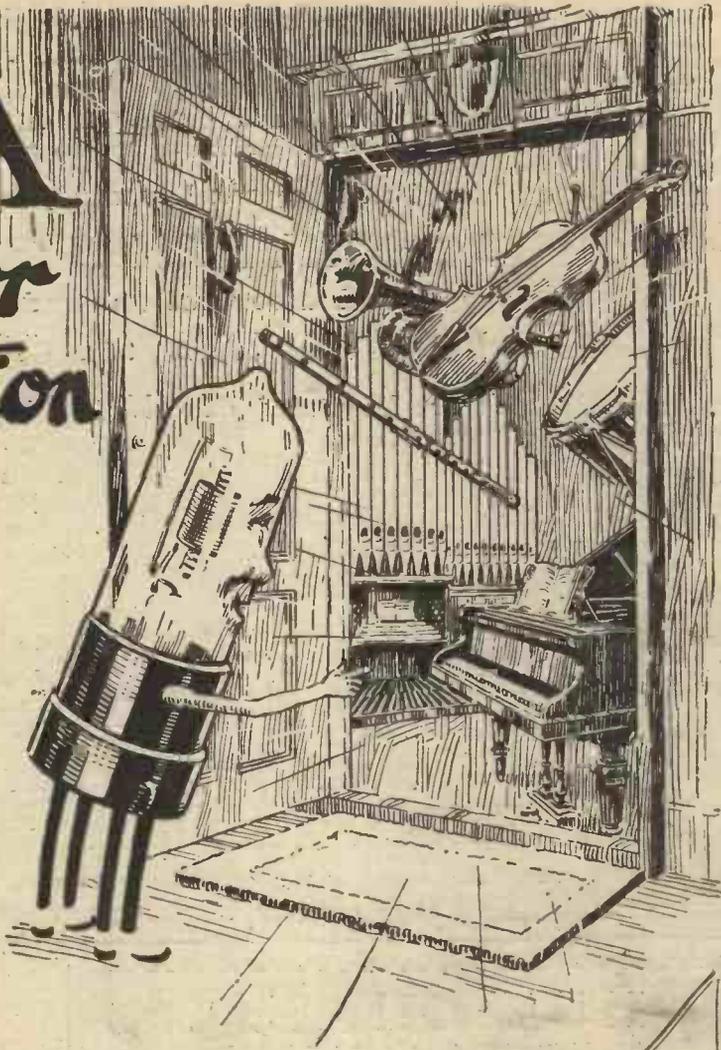
I am, yours sincerely,

A. H. G.

(Söderhamm, N. Sweden).

ORA

The Valve for perfect reception



A CONVINCING STATEMENT.

The International Meteorological Expedition operating in North West Perth, W. Australia, and using a portable wireless equipment, consisting of a 3-valve receiver with small portable aerial, received quite easily the time signals from all the high power stations in the world. They reported very satisfactory results despite the fact that conditions were very unfavourable indeed. Needless to say, Mullard "ORA" valves were used. The admirable manner in which these valves sustained several trans-shipments, submersion in water during landing, and severe rough handling generally, is the subject of a very interesting letter sent to us recently by Mr. John Wishaw of Mount Lawley, Western Australia.

For receiving vocal and instrumental items you must have

MULLARD "ORA" VALVES

to get the best results.

Oscillates Rectifies Amplifies

Specially recommended where good amplification is required.

The "Ora" Valve requires about 3·8 volts on the filament and 30 volts or over between the anode and filament for efficient results.

Standard Price : : **15/-** each.

The MULLARD "R" Valve

is now reduced in price from 22/6 to 17/6.

Mullard Radio Valve Co. Ltd.

(DEPARTMENT P.W.)

45, Nightingale Lane, Balham, S.W. 12

Contractors to H.M. Admiralty

War Office, Royal Air Force & Post Office.

Telephone: Battersea 1068
 Codes: ABC (5th Ed) Bentley's
 Telegrams: Radiovalve, Wandscom, London.



Name and Address.....
 To the MULLARD RADIO VALVE CO., LTD.,
 45, Nightingale Lane, Balham, S.W. 12.

Please send me, post free

Quantity	Description	Price
.....	Telephone Head Sets	Type B, 25/-
.....	ORA Valves	15/- each
.....	Grid A Resistances	3/-
.....	Anode A or B Resistances	3/-
.....	BA Condensers 0003 mfd.	2/6
.....	Combined Resistance and Condenser	5/6
.....	Valve Bases with Terminals	5/-
.....	Valve Sockets	1/8
.....	Terminal Clips	9d. per pair

I enclose (Cheque, Money Order, P.O.) value P.W. (20.1.23.)
 to cover the cost.

Name of usual Wireless Dealer.....

SEND THIS T-O-D-A-Y

Tele. :-
HOP 134

IMPORTANT

We have opened very commodious premises at
54, GRACECHURCH STREET, LONDON, E.C.3
for the demonstration and sale of all types of
WIRELESS RECEIVING SETS and "**CLARITONE**" **LOUD SPEAKERS.**
Amateurs and Experimenters will be able to obtain every part required for any type of Set

INCLUDING—

Transformers, L.F. and H.F.
Headphones (all types, all resistances).
Condensers, variable and fixed (all capacities).
Vario-Couplers and Variometers.
Coil-Holders and Coils.
Anti-Capacity Switches (all types).
Rheostats (all types).
Radial Switches (5, 10, and 15-way).
Valves (M.O. and Mullard's).
Ebonite Valve Holders, Dials, Scales, other parts and in Sheet.

Brass W.O. and Telephone Type Terminals,
Nuts, Washers, Contact Studs, and all other parts:
Accumulators.
Dry Batteries.
Aerial Wire.
Insulators.
Hertzite and Galena Crystals.
Cotton and other Tubings (all colours).
Etc., etc.

PRICE LIST FREE ON APPLICATION

PETTIGREW & MERRIMAN, LTD., 122-124, TOOLEY STREET, LONDON, S.E.1.

NOTE—54, Gracechurch Street is a few yards from Monument, Eastcheap, Bank, Cannon Street, and London Bridge.

HULLO!!! C.Q.

WILL DAY CALLING

TO ANNOUNCE SOME RARE BARGAINS.

BRITISH MADE HEAD PHONES,
150 ohms 18/6 per pair
SPLENDID QUALITY BRITISH
MADE HEAD PHONES, 4,000 ohms .. 26/- per pair
BEST FRENCH HEAD PHONES,
REAL SOLID COMFORT, 4,000
ohms 21/- per pair
BEST FRENCH HEAD PHONES,
8,000 ohms 27/6 per pair
Single Head Phones with cord, 150
ohms 6/- each
100 feet 7 Stranded Copper Aerial Wire .. 2/6 per coil
Trench Buzzer Sets, complete with
Morse Tapping Key and Head
Phone 10/6 each, postage 1/6
Best Quality Filament Resistance .. 2/9 each, postage 3d.
3-Way Coil Stand for Panel Mounting .. 15/- each, postage 6d.
Insulated Sleeving, all colours, 1½ mm. 5d. per yard
Brass Terminals with Nut and Washer 1/6 doz.
Bobbin Type Insulators 1/- doz., postage 9d.
Porcelain Shell Type Insulators, .. 5d. each.
Sheet Ebonite, Grade A, cut to any size.
Every Requisite in Stock for Wireless. **TRADE SUPPLIED.**
*These are only a few of our bargains. Do not fail to send
for our Price List giving the lowest prices for the best
quality goods. Postage on all goods extra.
Write for our new January Catalogue, now ready.*

We always Stock the Famous **HERTZITE CRYSTAL**
at 2/6 each, or mounted in Brass Cup 2/10, Postage 3d. extra.

WILL DAY, LTD.,

19, Lisle St., Leicester Sq., London, W.C.2.

Phone: Regent 4577. Telegrams: Titles, Westrand, London.

THE OSCILLATION VALVE

The Elementary Principles
of its Application to
Wireless Telegraphy

By
R. O. BANGAY.

Price 6/- nett

Post Free 6/6

The increasingly important part played by the Valve in all Modern Wireless Installations makes it essential that all those interested in Wireless Communication should have at least an elementary knowledge of its action and the principles underlying its various uses.

Mr. Bangay's clear and simple way of imparting information makes this book one of particular value to experimenting amateurs.

CONTENTS.—General consideration of Wireless Telegraph Receivers. The Oscillation Valve. The Fleming Valve. The Three-Electrode Valve. The application of the Oscillation Valve to Receivers. The Valve as a Magnifier. The Valve as a High-Frequency Magnifier. Reaction between Sheath Circuit and Grid Circuit of Valve. The Application of the Three-Electrode Valve to Transmitters. The Theory of the Soft Valve.

The Wireless Press, Ltd., Dept. P.W.

THE PIONEER HOUSE FOR WIRELESS PUBLICATIONS
12-13, Henrietta Street, Strand, London, W.C. 2.

HOW OPERA IS BROADCAST

By K. D. R.

THE Royal Opera House, Covent Garden, has seen a great change during the last week. The average theatre-goer would probably not notice the slightest difference, the auditorium looks the same; it seats the same number of people, but the keen observer would notice, projecting slightly above the footlights, four small discs.

What have they to do with it? Everything. It is those discs—or microphones, as they are properly termed—that have revolutionised Grand Opera. Wireless telephony has once again proved its boundless possibilities in the way of providing entertainment, and the British Broadcasting Company is to be congratulated upon the success of its latest venture—broadcast opera.

The Microphones

I had the privilege of representing POPULAR WIRELESS at Covent Garden, and at Marconi House, on the second night, when the selections from the opera "Hansel and Gretel" were broadcast.

At Covent Garden there are four microphones, connected in parallel, placed just above the footlights. They are of a special type, slightly less sensitive than those used in ordinary broadcasting, owing to the desire to cut out all the bad qualities that are liable to creep in on certain notes during the musical items.

These microphones have double faces, so as to be equally sensitive to sounds from the stage and from the orchestra pit. Underneath the stage are amplifiers, to which the microphones are connected, the amplifiers being connected by a specially laid cable to a transformer in the transmission room at Marconi House. There is also a telephone line from the prompter's box in the wings of the stage to the operators at 2 L O.

From the Opera House Mr. Jeffries, musical director and manager of the London broadcasting station, phones to the transmission room that the orchestra is about to commence the overture; power is switched on, the opening bars of the music crash out, and the broadcast opera commences.

Stand By!

Every note of the music can be heard over miles of country. Each instrument can be picked out, and at the end of the overture a great rushing sound, as of a sea breaking against the rocks, announces the applause of the audience in the theatre.

But the most wonderful part of the organisation is shown later on. Let us have a look at what is happening at 2 L O.

In the transmission room is an ebonite panel with two rows of switches, a telephone of ordinary type, and a pair of head 'phones. The telephone communicates with Mr. Jeffries at Covent Garden, and the switches connect the microphone in the footlights to special transformers in circuit with the transmitting valves. The headphones are connected to the microphones, and thus enable the transmitting staff to hear whether they are operating correctly.

The overture is being sent out to the thousands of listeners all over the country, when suddenly Captain Lewis, who is deputy director of programmes, and is in charge of the studio arrangements at Marconi House, receives a message from Covent Garden that the overture is nearly over—three more minutes only. Quickly he arranges the artists in the studio, and everything is put in readiness to begin the usual concert from 2 L O, as soon as the first portion of the opera is finished.

He grasps the switches in the transmission room. "Stand by!" he calls to the opera-

tors; then, "Over!" The opera music ceases, three switches fly back, a warning light in the studio lights up, and the announcer gives out the title of the first item.

Item follows item, until the time approaches when another scene from the opera is to be broadcast—the witch scene in "Hansel and Gretel."

Captain Lewis flies to the telephone and rings up the Opera House. "Hallo, Jeffries! How much more?" "Three minutes!" comes the reply. The studio is warned to be ready to close down the item now being broadcast. "Two minutes," comes from Mr. Jeffries.

"Close down," calls Captain Lewis to the studio; the artistes stop, and the switches connecting the studio to the transmitter are opened. Captain Lewis picks up a microphone in the transmitting-room: "Hallo, hallo, 2 L O calling. Stand by for the witches scene from the opera 'Hansel and Gretel,'" he announces.

"One minute," comes from the theatre. The operators stand by. The microphones from Covent Garden are switched in, and the power valves temporarily switched off. "Over!" calls Capt. Lewis; the switches are closed, the valves light up, and the next part of the opera is flashed through space.

The last notes die away. "Over!" and out comes the switch connecting the microphones at the Opera House, another switch connects up the studio and the transmitters, the little light in the studio shows "ready," and once more the concert goes on its way through the ether.

It is, indeed, a wonderful piece of organisation, and the technical staff and all who are responsible for its working are to be congratulated.

Discussing the matter of reports received on the transmission, Captain Lewis said: "I have hundreds of letters and cards from all parts of the South of England, reporting on the reception of the opera. Of course, a few give adverse criticisms, but the majority of my correspondents were delighted with the clearness of reception."

Wireless in History: Nero Listens-in while Rome Burns.



SOME FAMOUS WIRELESS PATENTS.

By A BARRISTER-AT-LAW.

THE birth of Wireless as a commercial proposition dates from the Marconi patent, No. 12039, filed on the 2nd of June, 1896, which describes the first use of a tuned insulated conductor (or antenna) in combination with a Hertzian transmitter, one end of the sparking appliance being connected to earth and the other to the elevated antenna.

Curiously enough, Popoff had previously used an extended conductor, or aerial, for reception, but this alone could have no appreciable effect in extending the possible range of signalling, so long as transmission was limited to the very small wave-lengths obtainable from a bare spark-oscillator.

Marconi's addition of a tuned aerial introduced the era of long-wave transmission, and marks an epoch in the history of wireless. In the first official trials in 1896, wireless signals were successfully transmitted over a range of two miles. The next year this was increased to thirty-four miles, and four years later signals were being successfully received from Poldhu over a distance of some two thousand miles.

Developing the Valve.

Before these results could be achieved, however, another remarkable invention had intervened. This was protected by the famous "four sevens" patent filed by Marconi on April 26th, 1900, in which for the first time a closed tuned circuit is coupled to a similarly-tuned open aerial circuit at the transmitting and receiving ends.

In the inventor's own words: "This arrangement enabled much more energy to be imparted to the radiator than heretofore, the closed circuit of the primary being a good conservator, and the open circuit of the secondary a good radiator of wave energy."

The next most important wireless patents, in historical order, are probably those relating to the first valve-detectors.

The original British patent for the two-electrode valve was filed by Professor Fleming on November 16th, 1904, No. 24850. About the same time Professor Lee de Forest, in America, was experimenting in the use of gas-filled bulbs for detecting radio-signals, and had filed several American patent applications to protect the results of his investigations. In one of these he claimed to have forestalled Professor Fleming, and very extensive litigation ensued between the two parties before their respective rights to priority could be determined.

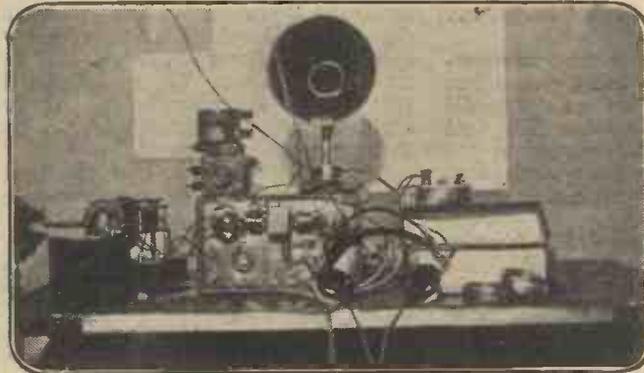
Finally the American Courts held that de Forest's patents were intended to protect a device in which the detecting action took place by a process depending upon the conduction of an electric current through a gas-filled bulb by the effect of heat, whereas in Fleming's valve the action was entirely different—namely, a discharge of electricity (by means of the electron-flow between the filament and plate) through what was practically a perfect vacuum. Without actually stating that the de Forest patent was invalid because the description given in his

specification was not sufficiently full and clear, the Courts hinted that this was so, and gave judgment in Fleming's favour.

Meanwhile de Forest had made some distinct improvements on the valve as originally invented by Fleming. In one instance he added a boosting or power battery to the plate circuit, so as to increase the signal strength; whilst, later, he added a third electrode or grid, thus evolving the modern form of three-electrode valve or amplifier.

Nevertheless, in view of the decision previously referred to, the Courts held that both these modifications were merely improvements upon Fleming's master patent, and could therefore only be made and held under license from him.

Following the extended use of the two and three electrode valves as detectors and amplifiers, the time came when it was found



Mr. Charles H. Hollis's set, 78a, High Street, Poole, Dorset.

that they could also be made to serve as generators of continuous oscillations.

This discovery was of vital importance. Not only did it provide a more compact and economical form of high-frequency generator than any then known for the transmission of continuous-wave and tonic-train signals, but it opened up new fields of possibility in the shape of portable and comparatively inexpensive telephone transmitters. This application proved of particular value in making it possible to design wireless-telephony and long-range C.W. signalling sets for use in aircraft, where the question of weight is of primary importance.

Introduction of Reaction.

Apart from the increased demand thus created for valves for transmission work, it must also be remembered that, with the extension of the use of C.W. signalling, they found a further wide sphere of usefulness in heterodyne reception.

Having regard to all these facts, it is not, perhaps, surprising to find inventors treading very closely upon each other's heels in the struggle to claim priority for so vital an improvement.

The first mention of a valve capable of producing oscillations is apparently made in a patent, No. 13630, filed on June 12th,

1913, in the name of the Marconi Company and Chas. S. Franklin. The inventors, in their specification, state that they make "the circuit in which the magnified oscillations occur (plate circuit) react on the circuit in which the oscillations to be magnified occur (grid circuit) by coupling these circuits, either electrostatically or electromagnetically, to a certain degree."

It is further pointed out that by so coupling the circuits the system may be caused to produce continuous oscillations, and that this effect may be utilised to receive C.W. signals by the interference method (heterodyne).

In a somewhat later patent, filed on December 9th, 1913, by the Marconi Company and Henry J. Round, a specific claim is made to a valve in which the plate circuit is tuned to a frequency slightly different from that of the received waves, in order to secure heterodyne reception of continuous-wave signals by the use of a single valve.

Meanwhile the well-known American inventor, E. H. Armstrong (of super-regenerator fame) had been working on the same subject, and late in the year 1914 he filed a patent application claiming under the International Convention a priority date corresponding to that on which he first filed the corresponding specification in America, namely, December 18th, 1913.

In this application Armstrong claims a thermionic receiver of wireless signals in which the receiving circuit (grid) is linked to the detector circuit (plate) by a combined electrostatic and inductive coupling, in order to facilitate the transfer of the energy of the high-frequency oscillations from the plate or wing circuit to the grid circuit.

British Priority Claim.

In the course of this specification Armstrong makes reference to a previous American patent application, dated October 29th, 1913, in which a claim is made to the use of an audion, or three-electrode valve, for both amplifying and detecting wireless signals.

A British application was, in fact, made to cover this earlier American patent so late as July, 1920. For this application the inventor claims the early priority date of October 29th, 1913, under the provisions of certain War Emergency legislation framed in order to meet the case of inventors who found themselves unable by reasons arising from the state of war to attend to the formalities of filing patents, etc., in strict accordance with the statutory dates.

PETER PAN BY WIRELESS.

"Popular Wireless" interviews Miss Edna Best, this year's Peter Pan, who recently spoke to listeners-in at 2 L O.

"HALLO! Hallo! Hallo! Peter Pan will now speak to the children."

Thus was announced the never-dying favourite of all the pantomime seasons when he spoke by wireless on Boxing Night to the children listeners-in all over the country.

Not only the children listened eagerly to the short speech that followed, but thousands of grown-ups strained their ears to catch every word, and hundreds of loud-speakers were ringing with the clear boyish tones.



Miss Edna Best.

I, too, listened-in to Peter Pan, whose part this year is being taken by Miss Edna Best, and I doubt if I have ever heard a clearer, better delivered, or more perfectly modulated speech by wireless since the commencement of broadcasting. Unfortunately, it was all too short. There was a pause, and then Mr. Burrows's voice announcing regretfully that Peter Pan had vanished.

"It was Ghastly."

I determined to find out where he had gone and what were his feelings as he spoke to his invisible listeners over miles and miles of country. After a long search I found him at last in London, just as he had always appeared to us each Christmas, with his brown suit and fair hair, and I asked him what he thought of this further addition to life's pleasures—broadcasting—and how he liked his new experience of performing before such a vast but unseen audience.

"It was simply ghastly!" he said; "I felt awful. I was speaking into a small instrument, and wondering all the time how my words were sounding out there over all those miles of space. I wondered whether anyone was listening at all, or whether all my listeners had turned away in disgust.

"You see," he went on, "I couldn't tell at all how it was sounding, and when I stood up to speak it seemed so useless—not a soul to be seen, and a dead silence over everything. There was no stage, no audience, nothing but a small mouthpiece to speak into, and that awful stillness, and those heavily curtained walls all round.

"If I could have had some sort of receiver over my head, and heard my words as they were presumably being heard by my listeners, I should not have felt so unnerved; but to speak to hundreds of people—invisible—without the slightest idea of what they thought of it or how it sounded—it was ghastly! You see, I had not even their faces to go by—nothing but empty space—ugh!" And he shuddered at the recollection.

Captain Hook Ahoy!

I assured Peter that his voice came through beautifully clearly and that I had heard every word perfectly.

"So you have a receiving set," he said. "It must be awfully jolly to be able to sit at home and listen to the music and songs that are sent out each night. Wireless must be very fascinating and exceedingly interesting. But it is awful speaking at the transmitting-end, though," he added.

"Oh, yes, we had a rehearsal earlier in the day, and I was told how to stand and more or less what to expect, but it is a very peculiar sensation, and quite paralysing at first.

"I should very much like to have a wireless set," Peter continued. "Of course it's too late now, but I hope to have one of my own in my next Christmas stocking."

Then he added suddenly: "I must fly now—that Captain Hook wants watching"—and was gone. He had vanished as mysteriously and rapidly as he did from Marconi House on Boxing Night, but I hope we shall hear him again in the near future.

THE BRITISH BROADCASTING COMPANY.

THE details are to hand of the British Broadcasting Company, Limited, which was registered as a public company on December 15th, with a nominal capital of £100,000, in 100,000 Cumulative Ordinary shares of £1 each. The said shares confer on the holders thereof the right to receive out of the profits of the company a fixed cumulative dividend at 7½ per cent. per annum on the amounts paid up or credited as paid up thereon, but not to any further or other participation in profits.

The objects of the company are:—To acquire from H.M. Postmaster-General a

licence, in such form and subject to such terms and conditions as he may from time to time prescribe, for the erection, establishment and operation within the United Kingdom of Great Britain and within Ireland of stations as a public utility service, for the "broadcasting" supply to the public, by means of wireless telephony and/or wireless telegraphy of news, information, concerts, lectures, educational matter, speeches, weather reports, theatrical entertainments, and any other matter which for the time being may be permitted by or within the scope of the said licence; to equip and instal the said stations with all requisite or convenient plant and machinery, and to carry on (only so far as may be necessary or convenient for the furtherance of the objects of the company) the business of ironfounders, mechanical and electrical engineers, brass founders, metal workers, tool makers, wood workers, builders, etc.

Allotment of Shares.

The shares may be allotted or disposed of as the board may determine, provided that the board shall not without the previous written approval of H.M. Postmaster-General for the time being, allot more than 60,006 shares in the initial capital to the following six companies or their nominees, viz.:

Marconi's Wireless Telegraph Company, Limited.

Metropolitan-Vickers Electrical Company, Limited.

Radio Communication Company, Limited.

British Thomson-Houston Company, Limited.

General Electric Company, Limited.

Western Electric Company, Limited,

and that the board shall, up to a total of 39,994 shares, issue to applicants, being bona fide British manufacturers of wireless apparatus other than the above six companies, the full amount of shares (not exceeding 10,000 to any one such applicant) for which such applicants may apply.

The First Directors

Godfrey Chas. Isaacs, Marconi House, W.C. 2, director of Marconi companies.

John Gray, Crown House, Aldwych, W.C. 2, director of Shielton, Limited, Corbel, Limited, and the Hotpoint Electric Appliance Company, Limited.

Henry M. Pease, Norfolk House, W.C., managing director of Western Electric Company, Limited.

Sir William Noble, Magnet House, Kingsway, W.C., director of General Electric Company, Limited, and Walker-Western Company, Limited.

Major Basil Binyon, 34-5, Norfolk Street, W.C. 2, managing director of Radio Communication Company, Limited, and director of Mullard Radio Valve Company, Limited, C. F. Elwell, Limited, Radio Press, Limited, and London Radio College, Limited.

Archibald McKinsley, 4, Central Buildings, The Broadway, S.W., Metropolitan-Vickers Electrical Export Company, Limited, Cosmos Lamp Works, Limited, and Vickers, Australia, Limited.

Lord Gainford, Headlam Hall, Gainford, Durham.

The remuneration of directors is to be £200 each per annum (£500 for the chairman), free of income tax. The registered office is at 15, Savoy Street, W.C. 2.

A RADIO DIVINING ROD.

By A. H. DALY.

IT is quite possible that the day of the water divining-rod is past, and a new wireless invention will take its place. The divining-rod, as most people know, is a twig which, when carried by a person skilled in the art of water divining, will quiver and become agitated when that person is over a spring of water, even if this spring is some distance below the ground.

But the wireless substitute for this divining-rod will not only locate water, but also coal and other minerals, such as gold and silver; and, unlike the divining-rod, does not depend upon the vagaries of the "spirit world" for its successful functioning; but upon the scientific and well-known refractive properties of wireless waves.

The apparatus for water divining consists of a special type of powerful wireless transmitter and sensitive receiver. The transmitter radiates what is called a wireless beam—that is, the waves, by means of metal reflectors, are radiated in one particular direction, like the directive beam of a wireless lighthouse.

The receiver is similar in many respects to the usual wireless receiver, having direction-finding properties, but, in addition, has extremely sensitive instruments which operate a galvanometer. This galvanometer may be said to take the place of the pair of telephones used in ordinary wireless reception.

When it is necessary to find water in areas seemingly devoid of that liquid, two holes are dug in the ground a fixed distance apart. In one hole is placed the transmitter, in such a manner that the wireless beam will be radiated in the direction of the other hole, in which is placed the receiver.

When the transmitter is in operation, a large percentage of the beam, or wireless waves, passes through the earth in the direction of the receiver—for, although the earth is a conductor of electricity to a certain extent, and therefore tends to reflect or repel the waves, a certain amount of them will penetrate it for a considerable distance if they are powerful enough and sufficiently concentrated.

The Reflected Wave.

These waves, on being picked by the receiver in the other hole, do not affect the galvanometer, but are passed on to earth. This is done by a rejecting instrument similar to the old type of wireless rejector, which aimed at diverting atmospherics to earth to prevent interference with reception; but whereas the old rejector did not do what it was supposed to, this one does, and thus ordinary wireless waves from the transmitter have no effect on the galvanometer needle.

Imagine, however, that there is a spring of water situated somewhere between the two holes. (This water need not necessarily be situated in a direct line between the two holes, but can be some distance below or to the right or left of the transmitter, for the water will still come under the influence of the radiated waves, as the beam covers a considerable area.)

What will be the effect of this water on the radiated wireless waves?

In the first place, some of the waves will miss the water altogether, and on striking the receiver will pass through to earth without affecting the galvanometer. Other waves from the transmitter will strike the spring of water and be reflected back the way they came, for conductors such as water reflect wireless waves; so these waves will not reach the receiver at all.

A third portion of the waves, however, will also strike the water, but at such an angle that, instead of being reflected back, they will be refracted or bent out of their original course, and will pass on and enter the receiver. It is these bent or refracted waves which make water divining by wireless possible, for they act on the receiver and auxiliary instruments in such a way that the galvanometer is excited and the needle registers a current. Thus the operator at the receiving end knows that water is present between the two holes.

If no water is discovered between these two holes another hole is dug, in which is placed the receiver. The transmitter is left in its original hole, and the wireless beam re-focused on this new hole. In this way a considerable area of ground can be surveyed with minimum trouble.

Locating Coal.

When locating new veins of coal or ore in existing mines, the transmitter is placed upon a truck and wheeled along one gallery, while the receiver is placed upon another truck and wheeled along a second gallery which is as nearly as possible parallel to the first gallery. At certain fixed points readings are taken, and if a movement of the galvanometer needle is observed, it is a sign that coal or ore is present.

It should be mentioned that electromagnetic waves are not refracted by all minerals in the same manner. The degree of refraction varies, and by means of this variation it is possible to ascertain whether it is water, coal, or ore which is deflecting

the waves from their proper course. This method of using the apparatus has been tried very successfully in potassium mines for locating the source of water which is tending to flood the mines.

Another way of using this apparatus, which is at present being tested, is in connection with a range of hills. The transmitter is placed in the valley on one side of the range and the receiver in the valley on the other side. In this way it is thought that it will be possible to ascertain what mineral deposit there is in the range of hills, although it should be mentioned that, up to the present, this arrangement has not been very successful, owing to the difficulty of getting sufficient of the beam to penetrate through the hills instead of taking the easier path over the summit.

Prospecting Simplified.

Although this apparatus is purely in its experimental stage, when we come to think of the amount of time and trouble, to say nothing of disappointment, which is the lot of those who look for the necessities of life, such as coal and water, or those more exciting minerals, gold and silver, it is possible to appreciate the vast and far-reaching importance which this new wireless invention will have on the whole world once it is made practicable for everyday use.

RADIO ASSOCIATION.

To Professor A. M. LOW, D.Sc., A.C.G.I.,
M.I.A.E., F.C.S., Hon. Treasurer.

RADIO ASSOCIATION,
44, Great Russell Street, W.C.1.

Dear Sir, Please enrol me as a Member of the
Radio Association, for which I enclose annual
subscription of 5s.

Name in full.....
(with Titles)

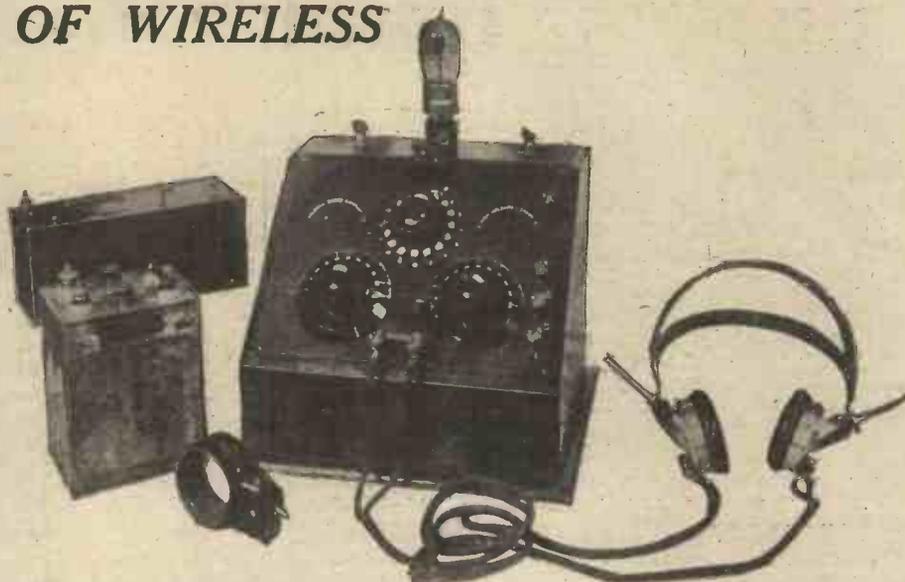
Address



A high-speed ink recorder of radio signals. It can record 200 words a minute.

THE LURE OF WIRELESS

There is a strange fascination about Wireless. To "listen-in" to a voice speaking or singing many miles away is to wonder at the marvels of science. As a serious study, as a regular hobby, or simply as an amusement, Wireless is rapidly assuming a leading place in the social life of this country. Get in touch with us if you would know more about Wireless. Expert advice given free.



CATALOGUE

Post Free.

TRADE SUPPLIED.

THE DESKPHONE SINGLE VALVE SET.

(Regd. Design No. 594025.)

The Deskphone Single Valve Set, made in our own workshops to our own registered design, is the last word in wireless apparatus. Made as illustrated, it includes—Accumulator, H.T. Battery, Headphones, Aerial, Lead-in Wire, Insulators, and Coil. It has been passed by H.M.'s Postmaster General (No. 1019). Made under licence from the Marconi Coy., approved by the B.B.C. and fully stamped.

Price - £7 - 15 - 0

Royalties 32/6 R Type Valve 17/6 each extra;

Set without accessories £4 - 5 - 0



AMPLIFIER

This Low Frequency Amplifier can be used in conjunction with the single or two-valve set. It considerably increases the volume of sound. Strongly recommended. Made under licence, etc., as above (P.O. No. 3042).

PRICE

£3 - 17 - 6

Royalties 22/6

R Type Valve 17/6 each extra.

THE DESKPHONE TWO-VALVE SET.

The Deskphone two-valve set, tuner, high frequency amplifier, and detector. Complete with accessories as shown in illustration above of single valve set. Made under licence, etc., as above (P.O. No. 2020).

PRICE

£12 - 17 - 6

Royalties £3 - 0 - 0 ;
R Type Valve 17/6 each extra.

Set without accessories

£9 - 17 - 6



THE HOLBORN RADIO CO., LTD.,

267, High Holborn, London, W.C. 1.

(Late of 8, High Holborn)

Telephone: Chancery 8163.

RADOLIONS

P.M.G. BROADCAST RECEIVERS

Of **QUALITY** and **TONE**

2, 3, 4 and 5 Valves

AMPLIONS

THE MASTER LOUD SPEAKER

for **POWER** and **TONE**

ALL MODELS IN STOCK—ALWAYS

DEMONSTRATIONS EVERY EVENING
5 to 8.30

TRADE SUPPLIED at full discounts

Crystor

COWL INSULATORS

(PROV. PATENT)

THE ABSOLUTE ESSENTIAL OF
A PERFECT AERIAL



Crystor Aerial Outfit

SINGLE-WIRE AERIAL, containing
2 Crystor Cowl Aerial Insulators, 1 Crystor
Cowl Lead-In (vertical or horizontal), 100 ft.
Best Quality stranded copper Aerial Wire,
100 ft. Best Hemp Rope, and one pulley
block, packed in box. Price complete, **18/6**
Postage 1/6 extra.

Horizontal Wall or
Window
LEAD-IN 6/6

Vertical Roof
LEAD-IN 6/-

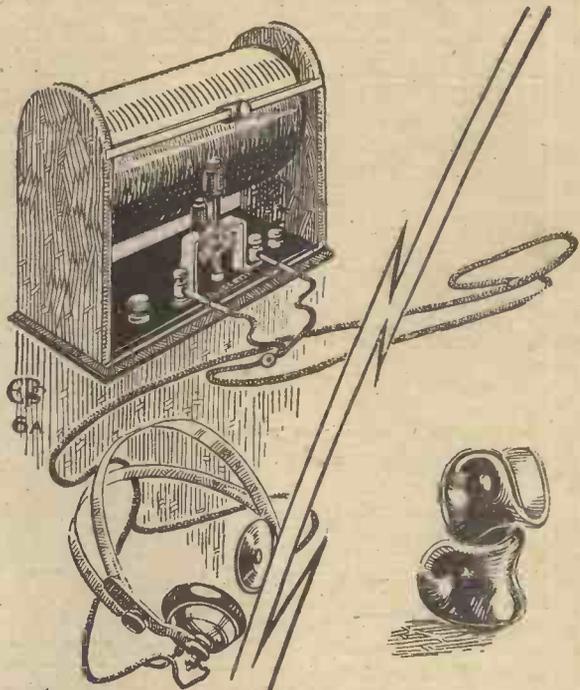
STOCKED by all leading stores and
Wireless Agents EVERYWHERE

I was recommended by Mr. — (a well-known
amateur) to fit your Cowl Insulators to my aerial
the effect was extraordinary; it was just as
if I had switched in another valve . . . I received
signals I had never heard before . . .
S. D. (Ealing).

SOLE DISTRIBUTING AGENTS:

WIRELESS AGENCIES Ltd.,
64, Mortimer St., London, W.1.

'Phone : Museum 2672.
'Grams : 'Adragonax, Wesdo, London.'



The FELLOCRYST

This is an excellent crystal
receiving set, which gives very
good results on all wave lengths
from 300 to 1,500 metres, and
is suitable for receiving broad-
casting from ships and long
distance stations.

The adjustments are simple
and easily made, and the silicon
crystal detector well maintains
its sensitive state.

No batteries are required.

The set is sent out complete and includes 100 ft.
coil of 7/22 stranded copper aerial wire, 2 shell
insulators and one pair 4,000 ohms double
headphones.

Every set is tested and guaranteed to receiving
broadcasting up to 15 to 20 miles, and Morse
signals from much greater distance.

The "FELLOCRYST" is British Made throughout.
Under Marconi License and Approved by the B.B.C.,
and Postmaster General.

PRICE Complete £3 : 15 : 6
Inclusive of all taxes. Postage 1/6 extra.

Extra 4,000 ohms double headphones . . . 21/6
Inclusive of all taxes. Postage 1/-

FELLOWS MAGNETO Co., Ltd.
LONDON, N.W.10.

Telephone : WILLESDEN 1560-1. Telegrams : "QUIXMAG," PHONE, LONDON

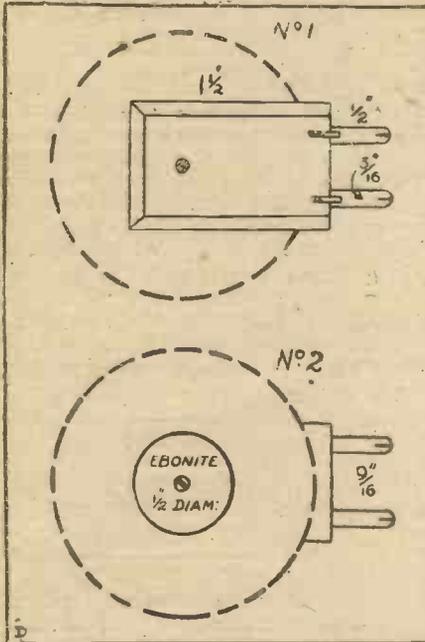
*For they are
jolly good Fellows*

A PAGE OF IDEAS FOR AMATEURS.

MOUNTING BASKET COILS.

MOST amateurs are aware of the difficulty of mounting basket, or pancake coils, as they are sometimes called. This type of coil is supposed to be the most efficient inductance in use at present, and would certainly be more generally used and more in favour—but for the difficulty in mounting.

The sketch shows the method I have used for mounting them to fit a standard two-pin tuning-stand. The construction



is within the scope of most amateurs, and does not require many tools, and the cost is very little.

The materials required are some sheet ebonite about $\frac{3}{8}$ in. thick, a few small screws about 6 B.A., 6 in. of $\frac{3}{16}$ in. brass rod, and a cycle spoke 15 gauge; the latter is threaded 6 in. down. A cycle shop will supply the spoke and thread it for a few pence.

The ebonite is cut into strips 1 in. wide, and then cut into lengths to suit the coil to be mounted; each coil will require a different length. For a coil 2 in. in diameter a length $1\frac{1}{2}$ in. wide will be required. Two holes are drilled in one end $\frac{3}{16}$ in. apart and threaded, using a length of the spoke filed with flats to form a tap.

The brass rod is next cut into $\frac{3}{8}$ in. lengths, and a small hole drilled in one end; a short piece (about $\frac{1}{4}$ in.) of spoke is cut off and soldered in the piece of brass, leaving a short length protruding to screw into the ebonite (see Sketch No. 1). If the threaded end is first dipped into shellac, it will make a firm joint in the ebonite.

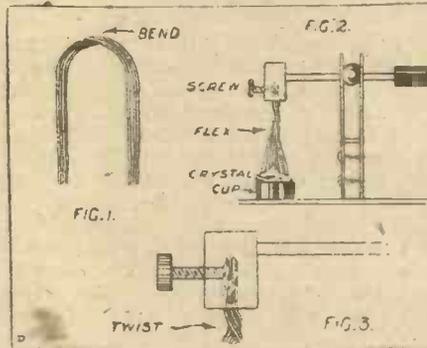
The edges of the latter are now bevelled, and a hole is drilled about $1\frac{1}{2}$ in. from the end, and tapped to suit the screws intended to be used. Pieces of ebonite are then cut

A MULTI-CONTACT DETECTOR.

PROCURER about $1\frac{1}{2}$ inches of ordinary wire flex, and separate about 12 of the fine wire strands. Double these over, as in Fig. 1, and push up into the position usually occupied by the cat's-whisker, and screw up firmly. Fig. 2.

Now twist the flex as in Fig. 3, in order to give the flex stability, and with the finger open the loose ends to form a brush, after neatly cutting level with a pair of scissors.

This method will find several sensitive spots immediately, and owing to the flexi-



bility of the wires, can be made to press firmly or lightly, according to the type of crystal used.

The spare flex not in use can be put aside ready to replace the one already made. Give the strands a rope-like twist so that they will not come apart.

OLD DRY BATTERIES.

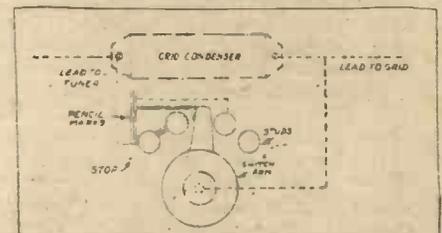
OLD dry batteries can often be transformed into quite useful wet ones. All that you have to do is to dissect the battery until you come to the zinc cells. A few holes are bored through this zinc cylinder—small holes—and also two or three through the top coating of pitch or whatever substance is used to seal the battery. The holes through the zinc should go well into the battery until the powdered carbon and manganese oxide is reached. The cells are now placed into vessels containing sal-ammoniac and water, and a complete Leclanché battery is formed. Of course, the liquid should not cover the cells, but should not quite reach to the top of the zinc cylinders.

off slightly larger than the hole in the centre of coil, and a hole drilled in the centre; the ebonite is filed round and bevelled. This can be done quite easily, using a hand-drill, and mounting the ebonite on a small screw and fixing in the drill chuck. If a file is held on the ebonite, and the drill turned, quite a good circle can be made.

AN ADJUSTABLE GRID LEAK.

AS a wireless experimenter, I should like to explain the method adopted by myself of varying the grid leak. Having become annoyed at the far too frequent use of pencil and rubber, as a means of varying my grid leak when using different circuits, I decided that I should arrange some means whereby I could reduce, add, shorten, or cut out my leak altogether at a moment's notice.

I managed this in the following manner. Finding a suitable space on my panel, I made five holes to take a stud each, and another below, to take a switch arm. From the grid condenser on the tuner side I took a lead to the first tapping, and another lead from the switch arm to the grid side of the condenser. From the first stud to the second I made a thick, heavy pencil-mark—on the back of the panel, of course, taking care that it made good contact with the underside of the studs' washers. Then from



the first again to the third, I made a slightly lighter pencil-mark, and from the first to the fourth studs a lighter one still. The fifth stud I left by itself. A larger number of studs may, of course, be used, thus giving a greater range of variation to the leak.

When the grid leak is shortened by having the switch arm on the first stud, the condenser also becomes shortened, thus making a direct lead from the tuner to the grid. On the other hand, if the switch arm is on the last stud, the leak is cut out altogether, leaving the condenser only.

* * *

No wireless set looks really smart unless all the brass work is lacquered. This, of course, excludes the under parts of terminals, etc., where contact must be good—in this case no lacquer is employed. It is best when lacquering to put on a thin coat while the brass is cold, and then to warm it up until the lacquer melts. This is then cooled and the process repeated, the result being a very fine smooth surface.

HAVE YOU IDEAS ?

Send along your wireless notions to **POPULAR WIRELESS**. If accepted they will be paid for at our usual rates. Articles should not exceed 500 words.

THE PROGRESS OF BROADCASTING.

By **SIR WILLIAM NOBLE.**
Chairman of the B.B.C. Committee.

THE British Broadcasting Company has now been launched; a chairman and six of the directors have been appointed. The chairman is Lord Gainford, whose excellent record in public work is a guarantee that the affairs of the new company will be conducted in a broadminded and business-like manner. The six directors so far appointed are Mr. Godfrey Isaacs, representing the Marconi Company; Mr. Archibald McKinstry, the Metropolitan-Vickers Company; Mr. John Gray, the British Thomson-Houston Company; Sir William Noble, the General Electric Company; Major Binyon, the Radio Communication Company; and Mr. H. M. Pease, the Western Electric Company. At the first statutory meeting to be held shortly, two more directors will be appointed by the firms in the company other than the six companies named.

Well Under Way

The registered offices of the company are at 15, Savoy Street, in premises belonging to the Institution of Electrical Engineers—a suitable home for such a company.

For the principal posts, the company has been fortunate in securing the services of able gentlemen, and these officers will now have the conduct of the business of the company.

Broadcasting stations have already been opened in London, Birmingham, Manchester and Newcastle-on-Tyne, and the initial steps have been taken for procuring premises for the installation of plant at the remaining our centres, viz., Plymouth, Cardiff, Glasgow and Aberdeen.

Preparing the Programmes.

The programmes at all the stations will be under the central control of the Director of Programmes. There will be two features in the programmes common to all the stations, namely, the broadcasting of the weather reports of the Air Ministry, and a synopsis of the world's news supplied by the four Press agencies, otherwise the programmes will vary with the locality of the station. What is suitable for London listeners-in may not be suitable for the Glasgow clientele, and what suits Wales may not suit Newcastle. Local conditions will play a large part in determining the character of the programmes. Every effort will be made to provide good programmes. The

officers concerned with the provision of programmes will be ever on the alert to introduce new and novel features. Any suggestions made by listeners-in through your journal will receive careful consideration.

Some Tricky Points

There have been certain criticisms levelled at the committee, which has been in charge of the inauguration of a broadcasting service for this country, for the delay which has taken place in launching the scheme. The committee appreciated this feeling, but with the knowledge of the facts they were satisfied the time taken was fully justified by the results.

The committee had to reconcile many divergent interests in order to arrive at the desideratum of one broadcasting company for the whole country; it had to prepare the Articles of Association, and the Agreement between the company and its constituent members, and these documents had to receive the sanction of the Postmaster-General. The Post Office had to prepare a licence for the company, and this licence had to be considered in detail by the committee. Whilst the committee secured the pooling of all patents for transmission, they had to consider and agree to a licence from the Marconi Company for the receiving sets. Many other subsidiary points arose, and the committee had to deal with all these.

As chairman of the committee I can assure readers of POPULAR WIRELESS that there has been no undue delay in dealing with the work preliminary to the formation of the company.

"The Big Six."

There have been hints made that the committee had been secretive and had unduly considered the interests of the "Big Six" Companies. Such is not the case, as was testified publicly by Mr. Phillips of the Burndebt Company, who represented on the committee the firms other than the six companies already named.

It should be remembered that the committee was appointed at a public meeting of manufacturers; and that the so-called "Big Six" guarantee the capital of £100,000 and any more money required to run the scheme successfully.

(Concluded at foot of next column).

SOME SATIRICAL ANSWERS.

By **H. T. LEED.**

"RADIOAC" (Bats Belfry).—The scratchings and cuts on your mahogany panel are not due to the depredations of the Radio Bug. Radio Bugs are essentially American, and provided you understand that language, you should consult an American dictionary to obtain a true definition of the term.

"EARTHPLATE" (Eyon-under-Rosebush).—The "grounds" to which you refer are in no way connected with coffee or tea. You state that the dictionary gives the meaning of this word as: "Grounds—House for sale, standing in own." We think from this that you must have consulted the wrong authority, and would advise you to try another book.

This word is of American origin—see reply to "Radioac."

Go To America!

"RADIOGONIOMETER (Frame).—(1) We are surprised that with a *nom de plume* like yours, you do not realise that the bulb mentioned is not for planting, either in flower-pots or garden beds. Your surmise that, when in bloom, it is used for hiding the position of the earth-plate is incorrect.

(2) There is more reason in your query concerning the expression, "VAKOOUM TOOB"; this is purely an American phrase—see reply to "Radioac."

"WIRELESS EXPERT" (Pye Square).—The expression $C^2 + 8^9 - II$

$$9^2 \div C^7 \times III$$

$$(6 + 2^3) \times 10^{17}$$

is equivalent to the ordinary formula,
 $M \times 9 - 4^5 - (8 \times 7)$

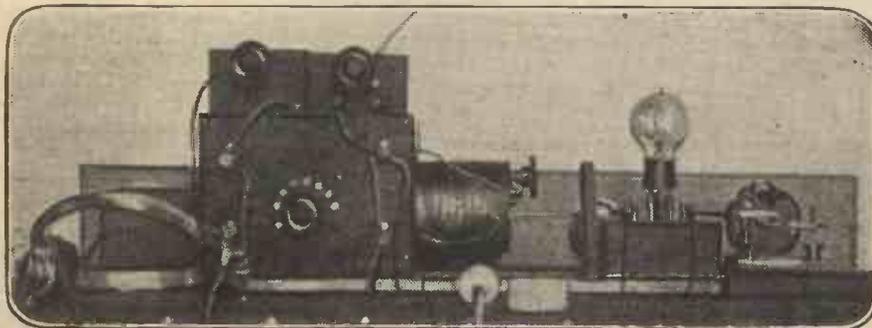
$$K^8 \times 2^{10} \div 6 + \frac{8^2}{76^2}$$

where $K = 2$ condensers in series and one in parallel, and where $M =$ grid leaks.

It is, of course, easily seen that to obtain the correct answer, which is the same in both cases, you merely divide the reciprocals by 2^2 . The formula you give is not very well known in this country, being an American calculation—see reply to "Radioac."

"Interested" (Catford).—Yes, it is essential that the whisker should be detached (*i.e.*, plucked) from the cat before the best results can be expected from your crystal set. For correct definition of "cat whisker"—see "Radioac."

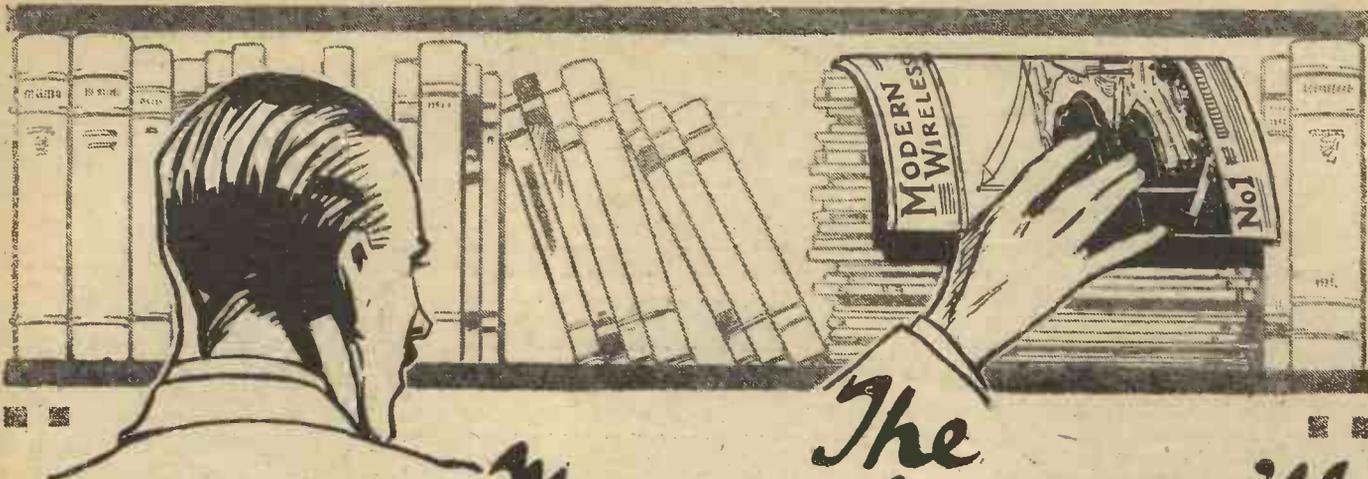
"HUMOURIST" (Broadrib).—It is apparent, from your remarks concerning a "tickler coil" that you are not familiar with—Oh, go to America!



Home-made set by Mr. S. Larkin, 23, Macching Road, Newhaven, Sussex.

Already some interference with broadcasting is being experienced from inexpert amateurs, and the directors of the B.B.C. would be glad if as few amateurs as possible would carry out experiments during the broadcasting hours, 5 p.m. to 11 p.m.

The management hope to provide such high grade programmes that all those with wireless sets will be listening-in instead of experimenting during the hours when the broadcasting stations are in operation.



The Magazine you'll need for reference — so be sure you don't miss N°1

CONTENTS OF No. 1.

1. "Northolt." The First Published Description of the New Government Wireless Station. By E. H. SHAUGHNESSY, O.B.E., M.I.E.E., Chief of the Wireless Section of the General Post Office.
2. "Receiving Radio Signals from Electric Lighting Wires." By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.
3. "The Transmission of Wireless Waves." By SIR OLIVER LODGE, D.Sc., F.R.S.
4. "A 4,000-mile Receiver." (Constructional Article.) By L. VIZARD.
5. "A Two Valve Broadcast Receiver." (Constructional Article.)
6. "Valve Receivers Employing Crystal Detectors." By JOHN SCOTT-TAGGART, F.Inst.P.
7. "An Experimental Station at Gerrards Cross."
8. "Dual Amplification." By P. G. A. H. VOIGT, B.Sc.
9. "A Simple Winder for Wave-wound Coils."
10. "The Dynatron." By PAUL D. TYERS.
11. "Charging Accumulators at Home."
12. "The Sine Wave." By GEO. SUTTON, A.M.I.E.E.
13. "A Great New Wireless Invention." (A hitherto unpublished account of the receiving system used on the Imperial Wireless Chain.)
14. "A Conducting Cement."
15. "The Sinking of the s.s. 'Hammonia.'" (A personal narrative by a wireless operator concerned.) By A. E. HUNTER.
16. "A Simple Wireless Telephone Transmitter." (A practical article.)
17. "The Outlines of Wireless." (An article for beginners.) By Lt.-Col. C. G. CHETWODE-CRAWLEY, R.M.A., M.I.E.E.
18. "Double Reaction—A New Development." (This is the first published account of an entirely new and effective type of valve circuit.)
19. "An Amateur Wireless Society and How to Conduct It." By F. HOPE-JONES, M.I.E.E., Chairman of the Radio Society of Great Britain.
20. "Directional Wireless." (The first of an important series of articles.) By J. ROBINSON, M.B.E., Ph.D., M.Sc.
21. "How to Make a Simple Broadcast Receiver Using a Crystal Detector." (A constructional article giving full details.)
22. "Digest of Current Radio Literature."
23. "The World's Land Stations: Their Calls and Wave-lengths."
24. "Choosing a Broadcast Receiver." (A valuable guide to all who propose to buy a radio set.) By MICHAEL EGAN.
25. "Wireless Operators and their Careers."
26. "2 XB."
27. "Recent Additions to Our List of Experimental Call-Signs." (A very useful supplement to the Radio Press Wireless Directory.)
28. "Map of European Wireless Stations." (This map also gives the call-signs.)
29. "The Construction of a Valve Panel."
30. "How to Make a Note-amplifying Panel."
31. "A Vernier Condenser and Its Construction."
32. "A Home-made Telephone Transformer"
33. "Methods of Fixing Windings and Inductances."
34. "A Simply-made Grid-leak."
35. "Times of Regular Transmissions." (A thoroughly checked list of stations, their calls and times of working.)
36. "Greenwich Time by Wireless." (Full details of the time-signal programmes.)
37. "How I Heard the American Concert." By J. H. RIDLEY, who was the first in this country to receive American broadcasting.
38. "Patents of the Month." (A résumé of recent inventions.)
39. "Experimental Licences." By E. REDPATH. (A long and most complete article on experimental licences and how to obtain them.)
40. "Book Reviews."
41. "With the Manufacturers."
42. "A Page for the Absolute Beginner." (A condensed account of wireless for those who are just starting, with some sound advice to the beginner.)

HOW can I charge my Accumulator at home? Instead of buying Coils can I wind my own? How can I receive louder speech and music?

The answer to these and scores of many other similar questions will be found in No. 1 of the new monthly "Modern Wireless." If you don't need the information at the moment you are quite likely to want it later—therefore, if you are wise, you will keep every number handy for ready reference.

But be sure that you start with No. 1, so that your files will be complete.

Every month "Modern Wireless" will consist of over 100 pages (in No. 1 there are 112 pp.) of informative and dependable articles from the pens of the best-known Radio engineers and experimenters. If you wish to keep abreast of the wonderful developments that are daily taking place—you must take care not to miss a single issue.

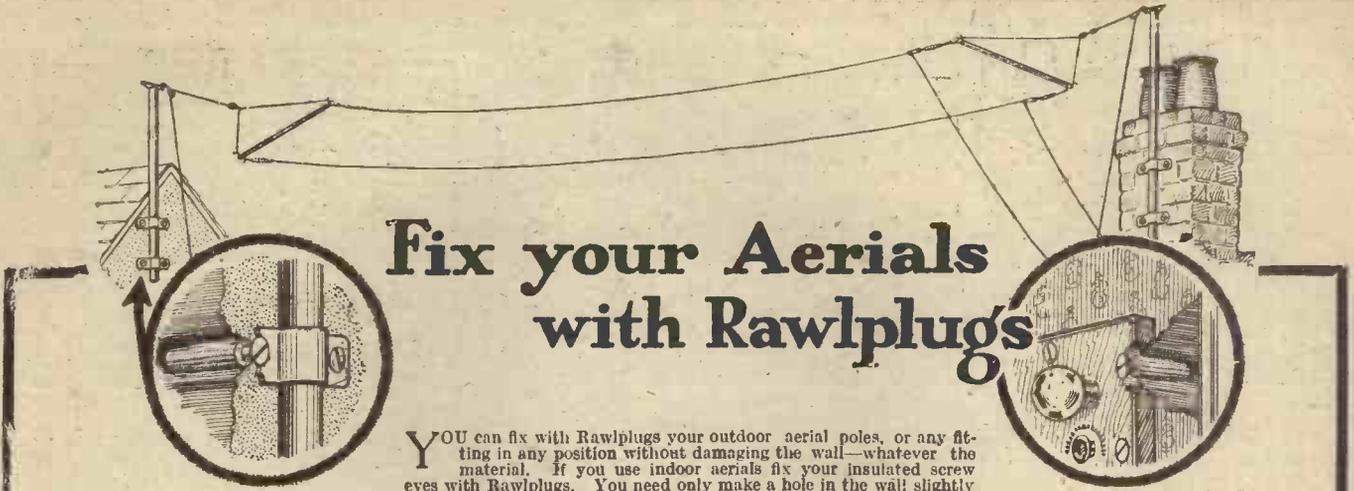
MODERN WIRELESS

Edited by John Scott-Taggart, F. Inst. P., assisted by E. Redpath and Paul D. Tyers, and published on the 15th of every month.

Sold by all Booksellers and Newsagents and published by

1/- Radio Press, Ltd
PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
DEVEREUX COURT, STRAND, W.C.2.

MARSHALL AD.



Fix your Aerials with Rawlplugs

YOU can fix with Rawlplugs your outdoor aerial poles, or any fitting in any position without damaging the wall—whatever the material. If you use indoor aerials fix your insulated screw eyes with Rawlplugs. You need only make a hole in the wall slightly larger than the diameter of the screw to be used, but the grip of Rawlplugs ensures a satisfactory job without any damage to the material.

For any job connected with Wireless where you use a screw in brick, plaster, stone, marble, ebonite, tile, etc., always use Rawlplugs.

Rawlplugs are made in all sizes to suit any standard size screw. (Nos. 3-20.)

Obtainable of all Ironmongers, Electricians, or Stores.

HOUSEHOLD OUTFIT
50 Rawlplugs No. 8 assorted lengths, a Rawlplug Toolholder and one Bit. A supply of round head and countersunk screws and screw eyes, screw hooks, cup hooks, square hooks, etc., and 3/6 full instructions.

RAWLPLUGS



WALL PLUGS

MECHANICS' OUTFIT
100 Rawlplugs No. 8 assorted lengths. A special Rawlplug Toolholder and two Bits. A supply of round head and countersunk screws and screw eyes, screw hooks, cup hooks, square hooks, etc., 5/6 and full instructions.

THE RAWLPLUG CO., LTD.,
GLOUCESTER HOUSE, CROMWELL RD., LONDON, S.W. 7

"SSH!—PCGG is through!"



IT'S waste of time trying to tune continental or distant stations through inferior 'phones. Perhaps you've reconditioned headpieces. Often as not they're pure "junk." And however expensive and selective your set may be, "dud" 'phones won't pick out weak signals.

Fit Ericsson 'Phones. The Services use them—for their never-failing sensitivity and ability to stand up to the hardest test. The Admiralty adopted them as standard in 1909, the R.A.F. in 1917. Easy to the head, robust in construction, delicate and sensitive in operation.

Write to-night for free illustrated list
The BRITISH L.M. ERICSSON MANUFACTURING CO., LTD.,
International Buildings,
67/73, Kingsway, W.C.2.

Ericsson

Telephones

2,000 ohms, price 31/-; 4,000 ohms, price 32/-. All resistances in stock.

"The Services use them."

RELIANCE RADIO SERVICE CO.

THE "RELIANCE" CRYSTAL RECEIVING CABINET.

P.O. Reg. No. 277.

Consisting of Ebonite Panel in Oak Case, with lid, Tuning Coil, 900 metre wave-length, .001 Condenser, Patent Crystal Detector, Silicon or Hertzite Crystal, Spring in small chuck, ball joint action with Variable Pressure, the whole totally enclosed in glass tube, thus eliminating dust and damp.

Accessories include 1 Pair Fellows 4,000 ohms Double Headphones, 100 feet Stranded Copper Wire, and 4 Insulators.

No further outlay. A guaranteed range of 20 miles for broadcasted concerts and will take 2 Pairs of Double Headphones with perfect clearness. Each Set tested and fully guaranteed and we confidently assert that for the price it is the most reliable yet offered to the Public and it is manufactured by one of the oldest firms in the trade.

Price Complete. Post Paid.
£ 3 - 7 - 6

Instrument Only. Postage 1s.
£ 1 - 18 - 6

We have also a complete range of Valve Sets in stock from £7 to £24. Call and inspect the famous Fellophone 2 and 4 Valve Sets, Prices £10 10s. and £17 10s. respectively. Also the Fellocryst Super Crystal Set. Price £4 7s. 6d. Demonstrations given daily. Call and get satisfaction, no fancy prices but honest value for money. Hours 10 a.m. to 7 p.m.



Illustrated Catalogue Post Free.

RELIANCE RADIO SERVICE CO.,
283, St. John Street, Clerkenwell, London, E.C.1
PHONE: CLERKENWELL, 4290.

WIRELESS CLUB REPORTS.

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

South Shields and District Radio Club.

The eighth meeting of the club was held recently in the Liberal Club Buildings, Ocean Road, South Shields, which premises have been secured as temporary headquarters.

A new aerial has recently been erected, and this was tried out on a four-valve Burndept set, in conjunction with a Brown's microphone relay and loud speaker. Among the telephony stations heard were the new Broadcasting Stations at London and Manchester, and the experimental station of the Chase Radio Company, Newcastle, from which latter an enjoyable concert was received.

A two-valve resistance coupled set, of home construction, was next demonstrated by a member, and the London Broadcasting Station received. Considering the low wave-length of the station, this was considered quite an achievement for a resistance coupled set.

Hon. sec., Mr. J. A. Smith, 66, Salmon Street, South Shields.

Working Men's College Wireless Club, Crown-dale Road, N.W.

The above club held its Second Annual Wireless and X-Ray Exhibition recently. We wish to thank Mr. Burnham (2 F Q), Blackheath, for his kindness in transmitting a concert to us that evening, which was received very well, except when the X-Ray coil was in action, which interrupted reception slightly.

Hon. sec., A. Fryatt.

Glasgow and District Radio Club.*

A highly successful exhibition was held by the club in the McLellan Galleries, Sauchiehall Street, recently. The exhibition was opened at twelve noon, and a steady stream of visitors were being admitted. The special features were the large trade show, all the latest in wireless being exhibited by about twenty firms, the local firms being very prominent. The club members' show was also fairly large, all types of ancient and modern apparatus being on view, and the workmanship of some was of high order.

Hon. sec., W. Yuill, 93, Holm Street, Glasgow.

Portadown Radio Association.

The inaugural meeting of above association has been held. The following office bearers were elected: President, W. M. Clow, Esq., J.P.; Hon. sec., Mr. W. A. Hayes; Joint treasurers, Capt. G. Lutton, H. McCallum, Esq., B.A.; Committee, Messrs. W. J. Warren, M.A., C. Spence, W. Sprott, W. J. Parks, T. Leake, J. Richardson, J. Greer.

Hon. sec., W. A. Hayes, Moyallon, Portadown.

Northern Radio Society.

Recently a meeting was called at Church Schools, Meanwood, and Mr. Bull was elected chairman. He then pointed out the advantages afforded the amateur in forming a radio society in this district, and it was decided unanimously to form same. An election of officers then took place, and W. H. Turner, Esq., was elected president of the society.

Temp. hon. sec., C. V. Stoad, 29, Shalebroke View, Chapeltown, Leeds.

The Finchley and District Wireless Society.*

The above society recently gave a demonstration at a bazaar, when musical transmissions were picked up from 5 CP, 2 W-P, 2 MT and Marconi House (2 L O). Although there was a great deal of noise from a "fair" that was held overhead and from a band at the other end of a hall, the transmissions were heard quite clearly from a Brown's Loud Speaker.

Hon. sec., Mr. A. E. Field, 28, Holmwood Gardens, Finchley, N.3. Phone, Finchley 1667.

Bromley Radio and Experimental Society.*

At a meeting of the society held recently at headquarters Mr. Allen demonstrated and explained his five-valve receiving set. The H.F.

valves arranged with tuned anode circuit, and he showed with diagrams the functioning of this and other parts of the apparatus. Telephony and music specially transmitted by 2 L O were afterwards successfully and clearly received on a loud speaker.

Hon. sec., J. F. Croome, 26, Wendover Road, Bromley, Kent.

The Ilford and District Radio Society.*

Mr. A. E. Gregory again delivered his lecture on the "Elementary Principles of the Valve," at a recent meeting.

Explaining briefly the electron theory and the emission of electrons from heated bodies, the lecturer proceeded to the theory of the two-electrode valve and its application as a detector. Next, the controlling effects on the electron stream, obtained by the insertion of the "grid," were shown and the increase in efficiency and range of application pointed out.

Characteristic curves and the method of obtaining them were fully dealt with, and the lecturer emphasised the importance of choosing a suitable portion of the curve to work on for different requirements.

The grid condenser and leak method of rectification were clearly explained by the aid of several diagrams.

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

North London Wireless Association.

At the association's meeting held recently, Mr. Hill gave a lecture on the Telephone System, External Working. Mr. Hill explained very clearly the system of distribution employed from the 800 pair cables leaving the exchange to the single pair for each line of the consumer. Although the subject dealt with was not strictly "Radio," it proved of great interest to the members, dealing as it did with an application of electricity with which we are all familiar.

Hon. sec., Mr. V. J. Hinkley, Northern Polytechnic, Holloway, N.1.

Walthamstow Amateur Radio Society.

At a recent meeting the society's three-valve set and loud speaker were used to demonstrate broadcasting reception. Very good results were obtained, the set working splendidly under the direction of Mr. Webb.

Hon. sec., R. H. Cook, 49, Ulverston Road, Walthamstow, E.17.

Streatham Radio Society, Streatham Hill College.

A weekly "informal" meeting was held at the Society's headquarters recently. Mr. Bevan Swift, A.M.I.E.E., gave the first of a series of lectures specially arranged for the younger amateur. Some of the more experienced, however, received an excellent "brushing up" on the lesser complicated fundamentals of Radio laws, such as the relation of wave-length to frequency, etc.

Hon. sec., S. C. Newton, A.M.I.E.E., "Comp-ton," Pendenis Road, S.W.16.

Whitnash Radio Society.

The above society has been formed, and those interested who reside in the district are invited to join. A four-valve receiving set, with loud speaker, has been installed in the new St. Margaret's Hall.

Hon. sec., Robert R. Hall, The Gardens, Whitnash, Leamington.

Manx Radio Society.

Wireless amateurs who know the Isle of Man, and they must be many, will be interested to learn that the above society was inaugurated at a meeting held at 19, Hawarden Avenue, Douglas, at which there was a most gratifying attendance. The following officers were elected: chairman, Mr. H. Colebourn; sec., Mr. J. P. Johnson; committee, Messrs. Vick, Gelling, Downward, Axon, Craine, and Hinton.

BARGAINS

Crystal Detectors	2/8
Valve Holders (ebonite)	1/-
Fixed Condensers	1/6
Reel Insulators	2d.
Egg Insulators	3jd.
Laminated Switch Arms	1/10
Terminals	1d.
Aerial Wire, stranded 150 ft.	4/6
Contact Studs	doz. 5d.
Valve Legs	1d.
Crystal Cups (3 screws)	4d.
Valve Pins	1d.
Spade Terminals	1d.
Condenser Vanes	doz. 1/-
Filament Resistances	2/10
Lead-in Tubes, 8 in.	1/6
" " " 12 in.	1/9
Slide Rods, with terminal	6d.

Large Spacers	doz. 4d.
Small Spacers	doz. 3d.
Loud Speakers	10/6
Intervolve Transformers	13/6
Phones, 4,000 ohms	21/-

Send Ample Postage.

Illustrated Catalogue, including List of Stations, Post Free, 6d.

EONS WIRELESS SUPPLY CO.,
115, FLEET ST., E.C.4.

(Next "Daily Express" Offices.)

ARMY TYPE TRANSFORMERS

The "Army" pattern is universally acknowledged to be the best. This Transformer (designed during the War) was extensively used in Government wireless sets.

Intervolve Transformers. Price 21/- (Audio or Radio Frequency)

Valve to Phone Transformers. Price 18/6

G. DAVENPORT & CO., LTD.,
99/105, Clerkenwell Road, E.O.1.

CABINETS & CASES

IN POLISHED MAHOAGANY OR TEAK.

QUOTATIONS PER RETURN.

J. LANCASTER & SON, LTD., 67, PARADE, BIRMINGHAM

ELECTRADIX RADIOS.

Immediate Delivery from our Huge Stocks.

Everything from a Recorder to an Earth Clip.

The best-equipped City depot.

COME AND SEE US.

9, Colonial Avenue is first opening on left in the Minories, near Aldgate Station, Metropolitan Railway.

LESLIE DIXON & CO. Tel. Avenue 4106.
9, Colonial Avenue, London, E.1.

"I CAN ALWAYS GET AMERICAN BROADCASTING, USING YOUR 3 VALVE."

Absolutely complete £16-10s. Carriage 5/-.

(Diagrams parts, valves, batteries, etc.)

HINKS' WIRELESS DEPT., HARDINGTON, YEOVIL.

TO THE TRADE.

Ebonite—Copper Wire, Bare & Covered—Aerials—Sleeving, &c.

Wireless Supplies. Prompt Delivery.

Cables & Electrical Supplies, Mica House, Offord St., Caledonian Rd., London, N.1. Telephone: North 805

CUT THIS OUT

"Popular Wireless" PEN COUPON value 20. Send 7 of these coupons with only 2/9 direct to the Fleet Pen Co., 119 Fleet St., E.O.4. You will receive by return a splendid British-Made No. 1 Gold-Nibbed Fleet Fountain Pen, value 10/6 (fine, medium, or broad nib). If only 1 coupon is sent the price is 8/9, 2d. being allowed for each extra coupon up to 6. (Pocket Clip, 4d.) Satisfaction guaranteed or cash returned. Special New Offer—Your own name in gilt letters on either pen for 1/- extra. Filling Model with Safety Cap, 2/- extra.

RADIOTORIAL

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

I wonder how many of my readers realise the significance of the latest accomplishment of the British Broadcasting Company, namely, the adaptation of landline microphonic reproduction to transmission by wireless telephony.

This has made possible the broadcasting of Grand Opera straight from Covent Garden to the sets of thousands of Listeners-in. Whether or not you stop to consider (the bare scientific side of this achievement, all of you will appreciate the fact that you are now able to enjoy a complete entertainment, as given in the leading opera house in the land, without leaving the comfortable warmth of your firesides.

THE EDITOR.

Questions Answered

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have decided to reply individually by post. A weekly selection of questions will, however, be printed on this page, together with the answers, for the benefit of readers of POPULAR WIRELESS in general. Questions should be clearly and explicitly written, and should be numbered and written on one side of the paper only.

All questions to be addressed to: POPULAR WIRELESS, Queries Dept., Room 132, The Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send necessary postage for reply.

W. E. (Kent).—Why is it that on my one-valve set I can hear Birmingham quite well, but Marconi House is very poor?

In all probability your set will not tune down to 300 metres successfully. Try a smaller coil as the A.T.I. and also try putting your condenser in series with the aerial and coil.

T. R. (Norwich).—My telephones have become very rusty, especially at the edges of the diaphragm. What is the best method of removing this?

The rusty parts should be carefully rubbed with a rag saturated in machine oil or with vaseline on it. In the case of the diaphragm, these should be placed on a perfectly level surface before the rubbing process is commenced, or you may injure them. Telephones should be frequently examined to see that rust is not forming.

"AMATEUR" asks for advice as to which licence he should apply for to cover his home-made crystal set.

You should apply to the Secretary, G.P.O., for an experimental licence form. This should be filled in as far as possible, and returned to the G.P.O., with the fee and full particulars of the set. It is just as well to ask for permission to use the set with an ordinary broadcasting licence if you feel sure you have no chance of obtaining a full experimenter's licence. With regard to the aerial, you should take full advantage of the limits allowed by the P.M.G. Do not forget that the 100 ft. allowed includes the height, the lead-in, and the total span of aerial from insulator to insulator. The number of wires used is immaterial.

D. W. (Rhondda).—What loading coil should I use for a crystal set, to tune up to 2,600 metres from 600 metres? (2) Would an electric light attachment be of use as an aerial arrangement for Cardiff broadcast reception?

A coil of about 400 turns of 24 S.W.G. enamelled wire, on a 5 in. by 11 in. former, should be ample. This should be tapped to studs so that fine tuning can be obtained. This coil will take you well above the Paris wave-length. (2) This type of aerial would be useless on a crystal set over the distance you propose to use it. You will need a good-sized outdoor aerial.

J. P. T. (Stockport).—I have a condenser of .0002 mfd.; can I use this as a grid condenser? If so, what should be the resistance of my leak? The condenser should be quite O.K. as a grid condenser, using a leak of 1 megohm.

"PIPER" (Dundee).—I am using a five-valve set that includes two high and two low frequency amplifiers. I am troubled with interference from some A.C. power mains. Would this be decreased without loss of signal strength by adding one high-frequency stage and cutting out one low-frequency stage?

The addition of another H.F. circuit would certainly help to filter out such interference; but, although it would also increase your possible range of reception, signals would not, generally speaking, be as loud, owing to the decrease in the stages of note magnification.

V. B. (Westcliff-on-Sea).—I am aware that it is a very near neighbour who is causing considerable interference in this district by

badly handling his valve set. What steps should I take to prevent him doing it?

The best plan would be to call on him and amicably point out the annoyance that he is causing. If he is not tractable, and you are certain as to the identity of the offender, then you should communicate with the nearest wireless society, who would willingly take the matter up and endeavour to lessen what is becoming a general nuisance in some localities.

"VARIOMETER" (Norwood).—I am building a one-valve set for broadcast wave-lengths; can I use a variometer instead of a coil and condenser?

Yes; a variometer will give quite good results, especially on the low wave-lengths. For waves of 200-600 metres you should use about 35 turns of 22 on the primary and about 36 on the secondary. The dimensions of the formers should be about 5 1/2 in. long by 4 in. diameter for primary, and about 3 in. long by 2 1/2 in. diameter for the secondary. The windings are connected in series.

K. D. R. (St. Albans).—I have decided to use a tuned anode type of H.F. amplifier; can I use basket coils for the coupling?

We presume you mean the type of coupling using a single coil—tuned—and connecting the plate of the valve to the grid of the detecting valve direct through a condenser. Yes; the use of basket coils will give quite good results. Plug-in coils would perhaps be best, but you can also join a set of coils—up to 1,500 metres or so—in series and tune by means of a rotary switch and a .0002 mfd. variable condenser. You will find the tuning very critical.

"TROUBLED" (Hatfield).—I am troubled by "spitting" noises all the time I am listening-in on a three-valve set. How can I cure this?

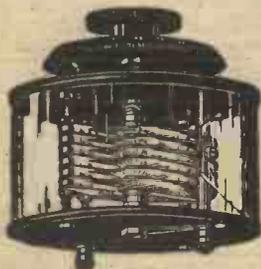
Probably the noises are due to one or more of the following causes: (1) The H.T. battery may have a faulty cell in it, or may be loosely connected. Test cells with a voltmeter and cut out the faulty one. (2) L.T. may be loosely connected or the accumulator over-charged. (3) There may be a break in some wire—possibly the telephone leads. Test carefully for a break on all connections—especially loose filament resistance contact, telephone leads, L.T. and H.T. battery connections. A larger condenser across the H.T. battery may cure the trouble if it is due to a poor H.T. battery. Use a .05 condenser.

P. D. M. (Elstree).—I have two sets, a crystal and a one-valve, and I wish for louder signals. What ought I to add to each set for louder signals from London, and to be able to receive Birmingham?

For louder signals from 2 L.O. on the crystal add H.F.; in the case of the valve add L.F. for louder signals. To be able to hear Birmingham, however, you should use H.F. amplification on the valve. The reason why H.F. should be used for the crystal is that the range is rather far for crystal reception, and it is better in this case to amplify the incoming signals rather than the rectified signals, which would be the case if L.F. were used.

(Continued on page 802.)

NOT CATCH LINES BUT EXTRACTS FROM OUR PRICE LISTS (3d. POST FREE).



VARIABLE CONDENSERS

Approx. Capacity in Mfds.	No. of Vanes.	Parts ready to assemble for panel mounting.	Price assembled for panel mounting.
.001	57	13/-	16/-
.0075	43	10/-	13/-
.0005	29	9/-	12/-
.0003	19	8/-	10/6
.0002	13	7/-	9/-
.0001	7	5/6	7/6
.00005	3	—	5/-

Ivoryine Scale and Pointer, 1/- extra.
Ebonite Dial, 1/6 extra.
Sufficient Celluloid, 1/- extra.



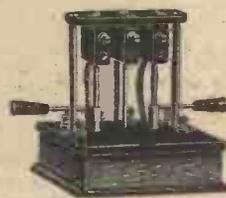
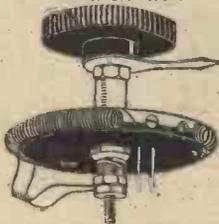
104/5 FIXED CONDENSERS.

A superior condenser made with best ebonite, copper foil and pure mica.

.0001 to .0005 .. 2/- each.
.001 to .002 .. 2/3 ..
.003 to .004 .. 2/6 ..

104/10 FILAMENT RHEOSTAT.

For Panel Mounting.
A much superior Rheostat to those usually offered and has been much improved upon since this illustration was made. 3/6 each.

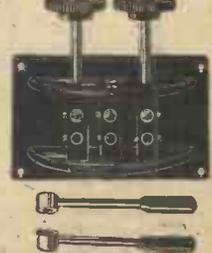


3-COIL TABLE STANDS WITH DIALS.

A beautiful piece of apparatus, 25/- each.

THREE COIL STAND FOR PANEL MOUNTING. 12/6 each.

EXTENSION HANDLES. 2/- per pair.



J. L. Cartwright & Co.

(Dept. P.), 24, LONDON ROAD, MANCHESTER

Works: BERRY STREET.

'Phone: CENTRAL 4209. 'Grams: Pladuram, Manchester.
Business Hours: 9 a.m. to 6 p.m., except Fridays, 9 a.m. to 3 p.m. Saturdays, 9 a.m. to 1 p.m.

SPECIAL TERMS TO THE TRADE.

Wholesale Agents for Scotland:
J. CORSTON SINCLAIR & CO., 47, Waterloo St., Glasgow.

The Cottage
Greenford Green
South Harrow

Telephone: G Harrow 793

January 6th 1923

Hears The Peto-Scott Co
64 High Holborn, W.C.1.

Dear Sirs

No doubt you will be pleased to hear my personal experiences with the "Broadcast Major" which I obtained from you a few days ago on behalf of a friend

Having had considerable experience in the design of Radio Instruments -- my present set being the fourth I have constructed -- I was certainly rather sceptical as to the results likely to be obtained with such a simple tuning arrangement as incorporated in the "Broadcast Major."

After a thorough trial, however, during which I received the London Broadcasting Station with perfect clearness and at excellent strength on as many as five pairs of head-phones at once, I wish to offer you my hearty congratulations.

You have certainly been able to manufacture an excellent two-Valve Set at a very moderate figure. I need hardly state that my friend, on whose behalf I purchased the instrument, is equally pleased with it, and is nightly receiving the excellent Concert from ZLO at his home some 20 miles from London.

Wishing you every success,
Yours truly,
P. M. G.



An Excellent 2 Valve Set

5 pairs of phones at once

Ready for immediate use — nothing more to buy

BEFORE introducing this Set, we have put it to exhaustive tests, and are now satisfied that for simplicity of operation, clearness, purity, and volume of tone, it is absolutely without a rival. If you are situated within 25 to 30 miles from any of the four Broadcasting stations—London, Birmingham, Manchester, and Newcastle—you cannot purchase a better instrument, although you may be asked to pay very much more.

Remember every instrument is tested on our own Aerial before being issued, and bears a certificate to that effect; further, every Instrument carries our full guarantee of complete satisfaction after a seven days' trial in your own home or money willingly refunded.

The BROADCAST MAJOR

(Passed by P.M.G.)

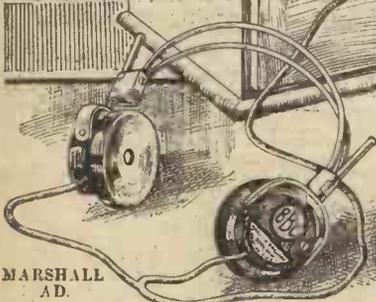
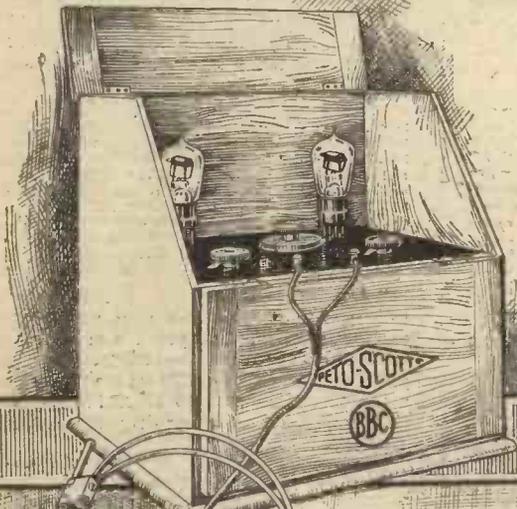
Cabinet made from solid mahogany, hand polished throughout and fitted with hinged top and drop-down front.

The tuning is controlled by one rotating dial and is very selective on all wave lengths between 350-550 metres—the Concert Wave lengths. Two filament rheostats are provided for regulating the filaments of the two valves. The L.F. Transformer is the MAX-AMP—our own design and manufacture. Included with the Set is an accumulator (6 volt 40 amp. hours), an H. T. Battery (60 volts), both of best British manufacture, and a pair of Western Electric Head-Phones. A complete Aerial outfit, including 150 feet of Aerial wire, together with necessary insulators, is supplied with the Set without extra charge. With the exception of the Valves, which owing to risk of breakage should be purchased locally, nothing more is required.

When this Set is required for use with Broadcast Licence a B.B.C. royalty of 35s. must be paid at time of purchase. The royalty of 25s. due to the Marconi Co. is being paid by us.

£9-9-0

Valves 15s. each extra.



THE PETO-SCOTT CO.,

Featherstone House,

64, HIGH HOLBORN, W.C.1.

AERIAL EQUIPMENT
 Consisting of 100 ft. 7-stranded en-
 amelled copper wire, strong yet
 flexible, 3 "shell" type porcelain
 insulators, light in weight and highly
 efficient, and ebonite leading-in tube,
 suitable for fitting in window frame.
 The complete outfit,
Price 6/6, post paid.
All accessories. List free.
The OMNIPHONE WIRELESS
 24, WARWICK STREET, CO.,
 REGENT ST., LONDON, W.1.
 20 yards front Regent Street, between
 Maison Lewis and Robinson & Cleaver's.
 Phone: REGENT 3335.

REY'S
 (The Well-Known Motor Cycle House).
 Send your enquiries for all makes of
WIRELESS INSTRUMENTS.
 Your old instrument taken in part payment,
CRYSTAL SETS from £3:10:0
173, GL. PORTLAND ST., LONDON.
 Phone: 1257 Langham.

WIRELESS INVENTORS.
 Patents and Trade Marks. Advice Hand-book
 and Cons. free.—B. T. KING, Regd. Patent
 Agent (G.B. & U.S.A.), 146a, Queen Victoria
 St., E.C.4. Phone: Central 682. 36 yrs. refs.

PORTLAND'S
Parts by Post.
"EBONITE."

	s.	d.		s.	d.
8 x 1.....	7		12 x 10 ..	7	6
4 x 4.....	13		17½ x 8½ ..	9	6
7 x 5½.....	28		18 x 18 ..	12	10
10 x 6.....	39		36 x 18 ..	1	3
17 x 5.....	53		7lbs.....	1	3

Quarter, Mat, British.
 Postage Free. Any size cut.
JAMES PORTLAND,
 39, Sinclair Road, Olympia, W.14.
 Mr. Portland stocks
 200 Wireless Parts

RADIOTORIAL
QUESTIONS AND ANSWERS.

(Continued from page 800.)

F. H. V. (Sidmouth).—On my inductance coil which has two sliders I notice that the sliders make contact with more than one turn of wire at a time. Surely that is wrong?

It would be very difficult, practically impossible in fact, to construct the coil so that the sliders make contact with but one turn. It is that point that prevents the slider inductance coil assuming the efficiency of one that has unit tappings as there will always be on the former, small closed circuits consisting of the shorter turns, which will tend to reduce the efficiency of the coil.

L. N. H. (Edinburgh).—Would a single thread of a spider's web joined from my aerial to the tree stop me receiving signals? Lately I have had a lot of trouble with my set and have tried every possible thing, but still obtain signals only in short periods.

No, it is not probable that such a fine thread as that would cause complete failure even in wet weather when a fine film of moisture would collect on its very small surface. It would take quite a fair-sized web fairly heavily covered with moisture to cause very appreciable loss in efficiency. Possibly you have your aerial too close to that tree you mention. It should be kept well clear of the leaves and branches, although we are more of opinion that the fault exists in your set. Send along a diagram and full details and possibly we can locate it for you.

"PRIZESTAR" (Exeter).—Referring to your wired wireless article is it possible the ordinary wireless waves tend to follow telephone wires and railways and thus cause some of these "2 M T on one valve" freak results?

No, that is not at all probable, because in the ordinary course of events metallic conductors would tend to reflect wireless waves and not attract them.

B. F. M. (London, E.).—I have broken off and lost the small spiral of wire that was used to press against the crystal on my broadcast set. The crystal is greyish black in colour and was purchased from Gammages. Can you tell me what the wire is and how to fix on another piece?

Most probably it was German silver and in any case that metal will serve the purpose. Obtain three or four inches of this, 34 gauge, and form a little

spiral by winding it on a nail of suitable size. Carefully "tin" one end and fix it to the brass arm with a small spot of soft solder.

A. P. (Oldham).—I am making that accumulator high tension unit described in POPULAR WIRELESS. Is the red lead put in the tubes in powder form?

No, in the form of a thick paste. The red lead in powder form is mixed with dilute sulphuric acid.

How many holes should be pierced in the tubes?

Providing they are very small holes the greater the number the better.

W. Y. (Manchester).—Why should it be advisable to put extra 'phones in series on a set instead of in parallel. Surely by placing them in series the resistance is increased and therefore current decreased?

Yes, but the resistance is not doubled. Whereas by placing them in parallel only half the current flowing in the circuit can pass through each pair of telephones, assuming them to be of similar resistance, by placing them in series there will be less current flowing through each than would flow through one, but not half for the following reason: Current equals voltage divided by resistance, but the latter factor must include the resistance of the crystal or valve which may be 10,000 ohms. It is obvious that by increasing the resistance by the addition of another pair of telephones, say 4,000 ohms, there will be less current, but to bring the current down to a half the additional resistance required would be 14,000 ohms—one pair of 'phones plus the resistance of the detector. Thus three additional 'phones could be placed in series and give the same signal strength as but one additional pair placed in parallel.

C. C. (Scarborough).—What form of circuit would you advise me to adopt using two valves with view to receiving the broadcasting?

A tuned circuit coupled H.F. stage and detecting would prove the most suitable for that purpose. Although it would require some little experience in handling before the best results were obtained. It might be as well to commence with the usual H.F. transformer coupled circuit as even that will require fairly critical tuning.

B. N. T. (London, S.).—Can you tell me how many persons hold receiving licences in London?

The exact figures are not to hand, but the number exceeds 60,000.

"OSCILLATOR" (Tottenham).—Am I causing disturbance merely by using reaction, or is it only when my set "howls" audibly in the 'phones?

If reaction is employed carefully and judiciously, no interference will be caused. You must keep well clear of the oscillating point—as far away as possible so that during reception there is no possibility of mechanical vibration or proximity of your person (capacity effect) causing your set to oscillate. The latter condition is not always audible and you should acquaint yourself with the methods of determining the state. When spark stations come in with a rough note and telephony is distorted, or when a slight rushing noise is heard in the 'phones and a damp finger on the aerial terminal of the set cause a distinct click in the 'phones, you are energising your aerial and possibly causing interference. That is the condition you must avoid. If you cannot do so during the course of the transmissions, then you should dispense with reaction altogether.

"AMATEUR" (Manchester).—I have been told that to receive C W it is necessary to employ reaction, and yet I can hear C W stations on my set while broadcasting is on, and it very often jams. My set is a single valve without reaction and no twisted leads, etc., that might cause a capacity regeneration. Why is it?

No doubt it is due to the C W stations heterodyning with the carrier wave of the broadcasting station or the weak oscillation of a nearby amateur carelessly using reaction. Such heterodyne harmonics can be frequently heard very faintly on most valve sets, but are not generally strong enough to cause interference. Being so near to a broadcasting station you should discover quite a margin for tuning out such interference without losing at least 2 ZY as you will find the parasitic C W fairly sharp in tuning.

N. R. (Norwich) has assembled a two-valve set on one panel, and asks whether the pencil

(Continued on page 804.)

Expert knowledge will make your Set twice as sensitive.

Know how it works and you can easily correct any faults and tune it up to a high state of efficiency. The requisite knowledge for this can be gained from books issued by the Radio Press. Here are some of them—all can be relied upon for dependable information. From all Booksellers or direct from the Publishers.

Radio Press, Ltd
 PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
 DEVEREUX COURT, STRAND, W.C.2.

- CONSTRUCTION OF WIRELESS APPARATUS.** Shows how to make every component necessary without the aid of special tools. 1/6
- WIRELESS VALVES SIMPLY EXPLAINED.** Over 130 pages of sound explanation telling exactly how the Valve works and how to get the best results from it. 2/6
- RADIO PRESS DIRECTORY.** 20,000 Call signs with names of Stations—(commercial and amateur). 2/6
- WIRELESS FOR ALL.** Read this before buying your Set. Tells you exactly what Radio is and the Set you'll need. 6d.
- SIMPLIFIED WIRELESS.** A practical Book showing how to build Crystal Sets, and explaining full theory of Radio in everyday language. 1/-



MARSHALL AD.

wireless - without an aerial

The "Ducon" does away with the Aerial. Plug one into an ordinary electric lamp holder or wall socket, connect to your wireless receiver, and you will receive the broadcasting perfectly.

The "Ducon" can be used with complete safety—each one is tested to 2,500 volts; **it consumes no current** and does not affect the electric light in any way.

The DUCON 10/-

is obtainable from leading wireless dealers, electrical contractors and stores, or direct from the makers.

Over 50,000 in use.

Dealers not yet stocking are invited to write for trade terms.

The Dubilier Condenser Co. (1921) Ltd.
Ducon Works, Goldhawk Road, Shepherd's Bush, London.

Telephones:
Hammersmith 1084.

Telegrams: Hivoltcon,
Phone, London



"We reply by return."

COMPARE THESE PRICES

Aerial Wire, 7/22 s, Stranded Copper, per 100 ft. ...	4/6
Aerial Wire, 7/22 s, Stranded Enamelled, per 100 ft. ...	5/0
Aerial Insulators, Egg Pattern, Porcelain, each ...	4d.
Aerial Pulleys, Aluminium, each ...	1/6
Switch Arms, Rotary Pattern, 1 1/2 in. Radius, each ...	2/8
Switch Studs, per doz. ...	10d.
Terminals, 4BA., per doz. ...	1/6
Ebonite Knobs, 1 1/2 in. diameter, each ...	6d.
Buzzers, each ...	2/6
Filament Resistances, Panel Pattern, Complete ...	2/6
Crystal Detector, Single Cup, Ball & Socket joint ...	2/8
Crystal Detector, Double Cup, Suitable for Zincite, Boronite, etc. ...	3/6
Crystal Cups, with three fixing screws, each ...	6d.
Crystals, All kinds, per packet ...	6d.
Brass Screwed Rod, 4 BA., per foot ...	4d.
Brass Screwed Rod, 2 BA., per foot ...	5d.
Inductance Sliders to fit 1/2 in. square rod ...	9d.
Brass Square Rod, 1/2 in., per foot ...	6d.
Brass Round Rod, 1/2 in., per foot ...	6d.
Brass Round Rod, 3/16 in., per foot ...	5d.
Brass Round Rod, 1/8 in., per foot ...	3d.
Brass Strip, 1/2 in. x 1/8 in., per foot ...	6d.
Copper Foil, 12 in. x 4 in., per piece ...	3d.
Leading in Tubes, 5 in., Ebonite with Terminals ...	2/-
Voltmeter, 0-15 v., Best Quality Instruments ...	7/6
H.T. Units, all makes, 15 v. ...	3/6
Accumulators, 4 v., 40 amps. ...	22/6
Accumulators, 6 v., 40 amps. ...	40/-
Variable Condensers, .0005 mfd., in Transparent Case ...	21/-
Mansbridge Condensers, 2 mfd., each ...	10d.

Postage paid on all orders above 7/6 in. value.

We guarantee ALL our goods.

ELECTRICAL SUPPLY STORES

(R. PALMER.)

5, ALBERT TERRACE, King Cross, HALIFAX.

Complete lists post free.

Exide

BATTERIES

H.T.

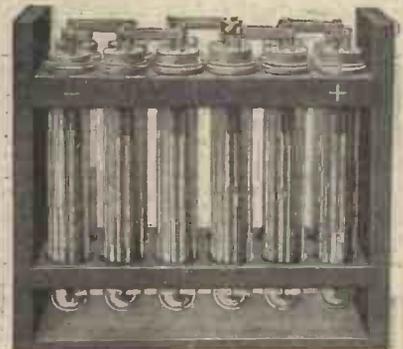
Batteries

for

Valve Sets

24v. 28v. 32v.

Type B.K.



Owing to the demand for these batteries, all orders will be dealt with in strict rotation. Prices approximately one shilling a volt.

:: Ask for Leaflet 4030 ::

THE Chloride ELECTRICAL STORAGE COMPANY LIMITED.

CLIFTON JUNCTION, | 219-229, SHAFESBURY
Nr. MANCHESTER. | AVENUE, W.C.2.
58, DALE END, BIRMINGHAM.

POST ORDERS OUR SPECIALITY

Satisfaction Guaranteed or Money Refunded.

PRICE LIST SENT POST FREE.

AERIAL WIRE 100 ft. 7/22 Copper 2/9
 HERTZITE CRYSTAL DETECTOR, Complete 3/9
 BASKET COILS, seven in set. 4/9
 CRYSTAL RECEIVING SET Entirely Enclosed in Mahogany Cabinet. B.B.C. Royalty paid. Fully tested and guaranteed. Carriage paid. 32/6
 HEADPHONES, Accumulators, Resistances, Insulators, Vanes, Terminals, Ebonite parts, Condensers, or anything Wireless.

Carriage paid on 29/- orders.

DE-LUXE COMMODITIES,
 151A, OXFORD STREET, LONDON, W.

JUST PUBLISHED.

The "READY" METHOD OF MEMORISING MORSE.

Whole Alphabet can be memorised permanently in **5 MINUTES**

Price 6d., or by Post 6d.

R. F. ROBERTS, 3, George Street, Croydon.
 Wholesale: Percival Marshall & Co., 66, Farringdon St., E.C.

CRYSTALS FOR CRYSTAL SETS

6d., 1/-, and 2/6 boxes—assorted.

Postage, 2d.

J. W. COX,
 CHEMIST, "CRYSTAL SPECIALIST"
 732, Stratford Road, Birmingham.



WIRELESS MASTS
 29 ft., 29/6; 35 ft., 35/-; 45 ft., 45/-; 50 ft., 50/-
 Complete with necessary Iron Fittings, Stay Lugs, etc., for IMMEDIATE ERECTION.
 Will save you endless trouble. Don't be misled by offers of odd, unpainted, or inferior thin steel poles without fittings.
 Bamboo Spreaders. Guy Wires, Strainers.
 Actual Manufacturers: (List particulars, 3d.)
 THE AMATEUR WIRELESS SERVICE,
 Dept. 5 P.W., 33, Elms Road, Aldershot.

ACCUMULATORS, etc. New and Guaranteed

4-Volt, 25-Amp. Celluloid, 11/3.	Postage 1/-.
4-Volt, 40-Amp. 17/6	6-Volt, 40-Amp. 25/8
4 " 60 " 21/3	6 " 80 " 31/-
4 " 80 " 27/-	6 " 80 " 36/-

Packing, 1/6 extra. Packing, 2/- extra.
 7/22 Aerial, 5/6 100 ft.; Mullard Ora Valves, 15/-
 15-V. Siemens H.T. Batteries, 4/-; Marconi R. Valves, 17/6; Accumulator Charging Board, 37/6;
 Voltmeters, Watch pattern, 0/12 Volts, 6/-
 Cash with order. Goods despatched per return.
LOWKE & SONS, Ltd., Northampton.

Beginners Guide to Wireless

Explains, in plain everyday language, everything beginners wish to know about wireless telegraphy.
HOW TO ERECT, CONNECT, AND MAKE all the apparatus required for reception of telephony or morse, and full instructions and diagrams for making coils, tuners, and complete valve and crystal sets. 112 pages, price 1/-, post free.—**SAXON RADIO CO.** (Dept. 14), South Shore, Blackpool. 32-page cat. of wireless apparatus, 2d., post free.

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 802)

lines with which he marked out the under side of the ebonite will cause trouble?

Yes, unless very carefully removed they certainly will cause leakage. It will be well worth while to take down the set for the purpose of erasing them carefully.

R. U. L. (Broxbourne).—How much current is lost in the charging and discharging of accumulators?

Generally about 25 per cent.

"AMATEUR" (Northampton).—What is the use of the change-over switch in the loose coupler given in No. 23 of POPULAR WIRELESS?

To allow the telephones and crystal to be placed across either the primary or secondary coil. Thus it is possible to tune in the signals on the primary coil and condenser and then switch over and complete the tuning by adjusting the secondary circuit and coupling knowing that the signals have reached at least the primary circuit. Without such a switch the tuning in to stations on a two circuit receiver is very difficult and requires a fair amount of experience. The difficulty is greater with crystal sets of that type owing to the fact that there is the crystal adjustment to consider. A buzzer is also almost a necessity in this case.

L. T. M. (Oxford).—When listening-in on low wave-lengths, I frequently hear the carrier waves of some stations, but cannot hear their speech. Why is this?

It is quite likely that you are too far away to be able to pick up the speech though the more pronounced carrier wave can be heard. Another reason may be that your set has not a very well-defined oscillation point, and this would mean, in the case of these distant stations, that as soon as you commenced to loosen the reaction coupling, you lost the carrier wave before your valves had really ceased to oscillate. To hear weak telephony it is often necessary that the valves have to be just off the oscillation point, and if this point is not well defined you will be unable to reach that adjustment.

S. E. B. (Doncaster).—While listening-in to the broadcasting the other night, the sounds gradually died away, so that I could only just hear them. I switched off for a few minutes and then tried again, when the same thing happened after a time. Why is this?

Very probably your accumulator is running down, you should test it with a voltmeter or hydrometer. The reading on the voltmeter should not be less than 1.8 per cell. In the case of the hydrometer it should not drop below 1.85. Remember that the voltmeter reading should be taken while the accumulator is actually on discharge. If your L.T. battery is O.K., the trouble may be due to a faulty, or unsuitable grid leak. Try the results of working with different values of leaks.

"HIGH TENSION" (Watford).—I have been troubled recently with a great deal of crackling noises in my set; is it likely to be either of my

batteries? I cannot find any loose connections.

Most likely it is due to the H.T. battery. Test this with a voltmeter and cut out any defective cells. In testing, the voltmeter should be connected across each section of the battery which is probably divided into 3 or 6 volt sections. If any section is found to have dropped in voltage below 2 volts, in the case of the 3-volt sections, or below 4 volts in the case of the 6-volt sections, cut this portion of the battery out, short circuit it by means of a piece of wire, connected from the plug of the best good cell to the plug of the next cell whose voltage is still O.K.

P. S. (Lewisham).—I have raised my aerial by about 10 feet, but the results do not appear to be so good as before. Why is this?

If you have altered the height of your aerial, you have also altered its capacity, and therefore, the natural wave-length of your aerial has been changed. Make sure, when you are tuning-in a station, that you allow for this variation. For instance, if you found the best tuning for Marconi House was on a certain stud with a certain condenser reading, you will very likely have to go on to another stud for the same station now that your aerial has been raised. In any case, the tuning position will be quite different.

FOR NEW READERS.

Special arrangements have been made by the Technical Staff of "Popular Wireless" to deal promptly and clearly with all questions sent in by new readers who have just bought, or who contemplate buying, a wireless set.

If you are in any difficulty with regard to wireless, write to us, and an answer will be sent free by post.

Tell your friends about this and the fact that a Special Beginners' Supplement commences in this issue.

J. A. E. (No Address).—In the erection of my aerial it is necessary to have it so that it is 50 feet long and parallel to some telephone wires which are 50 feet away, the only alternative is to run the wire less parallel, but that would mean bringing one end to within about ten feet of the 'phone wires. Would this latter be advisable?

In the circumstances it would not, but would be better to keep the aerial as far away as possible from the telephone wires along its whole length.

"AMATEUR" (Aberdeen).—What is the best crystal to use in the valve-crystal combination circuits?

Carborundum with a potentiometer and battery is the most suitable. Failing that, one of the treated galena crystals should be used, such as Permanite, Hertzite, etc. Sensitivity and stability should be aimed at in the detector of such a circuit.

(Continued on page 806).

WIRELESS HEADPHONES

Leather-bound adjustable headbands. Receivers instantly detachable. Guaranteed perfect and efficient. Thousands in use by satisfied wireless enthusiasts getting splendid results.

2,000 ohms.	4,000 ohms.	8,000 ohms.
17/6 Pair	18/6 Pair	21/6 Pair

Postage 9d. extra.

Cash with order.

WIRELESS ACCESSORIES CO.,

37, Sherrard Road, Forest Gate, London, E.7.

SEIZING THE OPPORTUNITY

GUARANTEED VALUE.

Only by Manufacturing in very large quantities are we enabled to offer these "Wireless" articles at the exceptionally attractive prices.

CRYSTAL DETECTORS Post free 2/4 each

(Beautiful workmanship and finish)

ALL FIXED CAPACITY CONDENSERS Post free 1/2 each

(From 0.0003 to 0.001. Very efficient.)

HEADPHONES, 4000 Ohms. Post free 21/- pair

We always hold large stocks of every Wireless

Accessory and everything electrical . . .

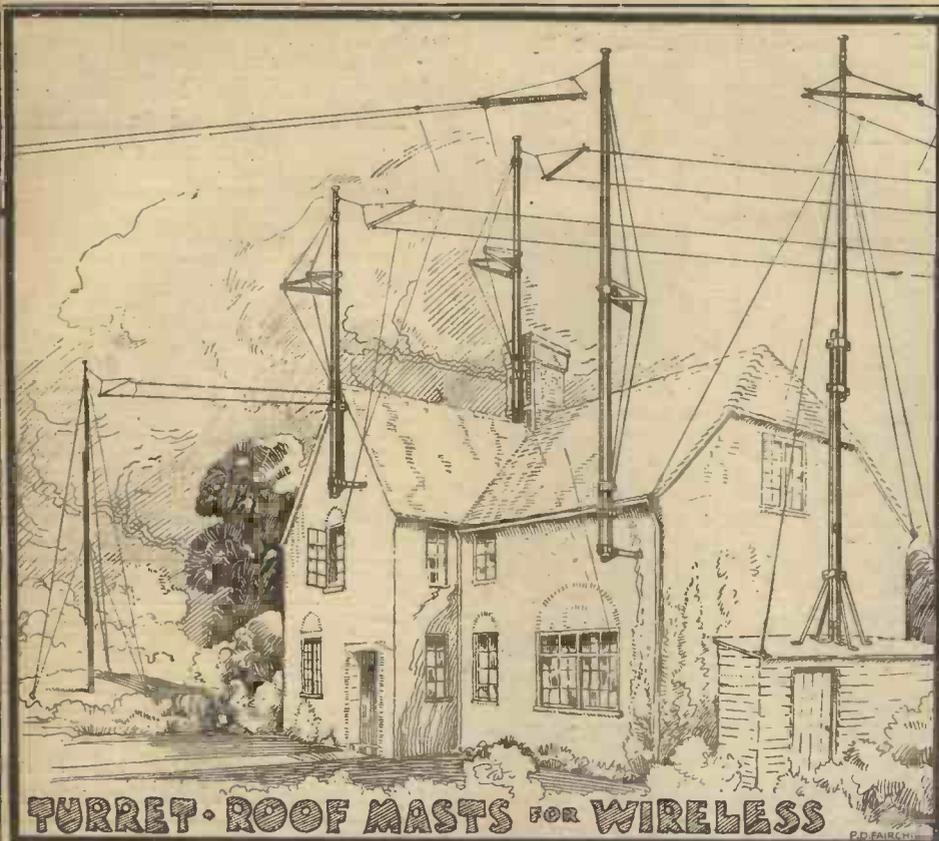
Our high standard is always guaranteed and Money will be gladly returned if entire satisfaction is not obtained.

We Are 1 Wireless and Electrical Experts and will gladly and freely help you if you will write and tell us of your difficulties.

THE BELGRAVIA ELECTRICAL CO.,

111, Wilton Road, Victoria, S.W.I.

Telephone: VICTORIA 1420



TURRET-ROOF MASTS FOR WIRELESS

TURRET, WIRELESS GROUND & ROOF MASTS

DESIGNED BY NAVAL EXPERTS

NO CURRENT JUMP OR STEEL TO RUST.

SELECTED COLUMBIAN UNBREAKABLE PINE, 2½-in. BASE (TAPERING).

WEIGHS 56 lbs. EASY TO FIX. (TELESCOPIC TOP MAST.)

SENT IN LIGHT 16-ft. BUNDLE.

PRICES.

Ground Masts.

- 28-ft. Mast, in 2 sections, complete ... 43/6
- 36-ft. Mast, in 3 sections, complete ... 69/6
- 42-ft. Mast, in 3 sections, with Telescopic Top Pole ... 79/6
- (All with Posts.)

FIXINGS FOR ANY ROOF.

Special Wrought Iron Brackets, Supports 1 cwt. on Eaves, Chimneys, or Town Copings. No Damage to Brickwork.

ALUMINIUM SPREADERS AND CANTILEVER STAYS SAVES ROOF WIRES.

ROOF MASTS.

- 13-ft. Mast (for Light Aerials), Aluminium Spreaders and Cantilever Wires, Brackets for attaching to roof (1 cwt. strain), all Fittings ... 45/-
- 16-ft. Mast (for Heavy Aerials) ... 55/-
- 28-ft. Mast, in 2 sections, but Guy Wires and Roof Plates (all Fittings) 75/-
- Masts without wall brackets and plates ... 28/6, 38/6, 49/6

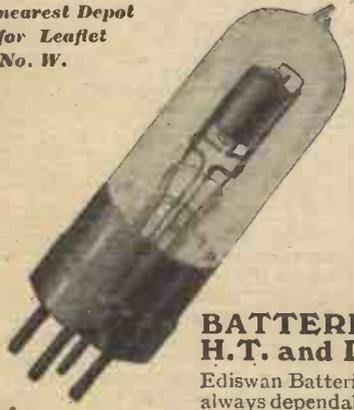
6-ft. Columbian Pine Spars, 1½-in. Aluminium Curl Ends. Weight, 2½ lbs. Strain, 1 cwt. (For Aerials.) ... 5/9

Regd. and patent applied for.

SIMPSON & BLYTHE,
STANLEY HOUSE, 8 & 9, Sherwood St., PICCADILLY

Send for list to S. & B. or agents.

If your usual dealer is unable to supply write to our nearest Depot for Leaflet No. IV.



BATTERIES H.T. and L.T.

Ediswan Batteries are always dependable for efficiency and service. Always insist on "Ediswan" products when buying Accumulators or Dry Batteries.

The Ideal Valve for Reception

IS THE

EDISWAN "AR"

Manufactured by a firm with over forty years' experience in lamp-making, Ediswan Receiving Valves represent the best of their class. Robust in construction, silent and economical in working, the "AR" Valve is equally suitable for the experimenter as well as for Broadcast reception.

Price 15/- each.

THE EDISON SWAN ELECTRIC COMPANY LTD.,
123/5, Queen Victoria Street, E.C.4.

BRANCHES: Aberdeen, Belfast, Bristol, Birmingham, Brighton, Cardiff, Dublin, Dundee, Edinburgh, Glasgow, Hull, Leeds, Leicester, Liverpool, Manchester, Newcastle-on-Tyne, Nottingham, Sheffield, Southampton, Swansea,

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 804)

"WORRIED" (Blackheath).—Do you think that the fact that I am the other side of the Thames will affect results from Marconi House?

No; on the contrary, wireless waves will travel with less absorption over water than over land.

W. P. L. (Blackpool).—How do they gauge the range of receiving instruments. Does this not depend to a great extent on the power of the transmitting station?

Yes, to a very great extent. When gauging the range of broadcasting apparatus a fair average of transmitting power is available, in that the power of the broadcasting stations is more or less similar. Even in this case there are many other more or less indeterminate factors to consider, such as atmospheric conditions, local conditions quite apart from the more controllable factors such as aerial efficiency, earths, etc., so that ranges of reception are always but an approximation.

NEXT WEEK.

"The future of Broadcasting in the Home."
A special interview with **Senatore Marconi.**

Tell your friends about the new **Popular Wireless Supplement.**

"AERIAL" (Southport).—1. What is the maximum height of an aerial for the reception of broadcasting allowed by the P.M.G.? 2. Have all sets to be marked with the B.B.C. stamp? 3. Is there any limit for the number of valves allowed for reception of broadcasting? 4. How far will a loud speaker receive from as compared with a telephone?

The total length of aerial used depends upon the height at which it is to be suspended. The measurements allowed by the P.M.G., 100 feet, include the length of aerial—from insulator to insulator; that is, the span—plus the length of lead in from aerial to the set, plus the maximum height above the ground. 2. All sets intended to be used under the broadcast licence should be stamped unless special permission to use a home-made set is obtained from the G.P.O. For full details, see our issue of Dec. 31st under the heading of "Home-made Sets." 3. No; any number of valves is allowed under the regulations, providing reaction is not used. 4. A loud-speaker considerably cuts down the range of a set. It reduces the range to about one-tenth of the distance over which signals can be received comfortably on a telephone.

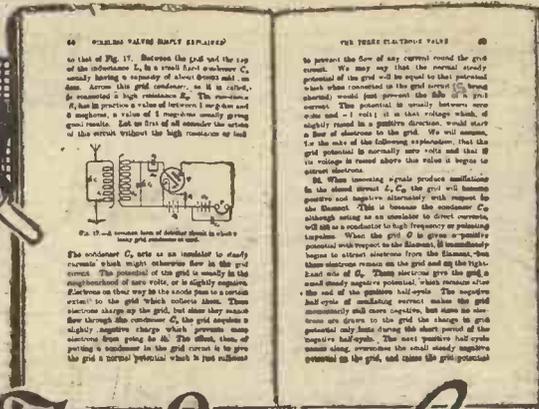
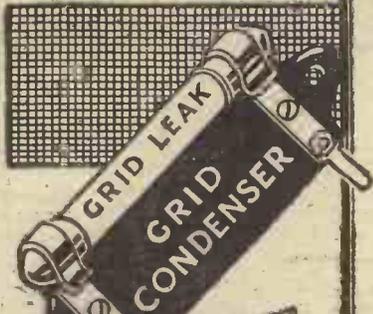
E. M. F. (S. Devon).—I am building a four-valve set, two H.F. and one L.F. 1. Will it be necessary to shunt a variable condenser across the primary of the H.F. transformers? 2. Should fixed condensers be fixed across the L.F. primaries? 3. What value blocking condenser should be placed across the H.T. battery? 4. What value grid leak and condenser? 5. What value 'phones?

1. Yes, a variable condenser is desirable for fine tuning; use a .0003 mfd. condenser. 2. Yes; these condensers should be connected across the L.F. primaries. About .001 mfd. 3. About .02 mfd. 4. A 2 megohm leak and a .0003 mfd. condenser will be about correct, but different leaks should be tried, as the correct value varies considerably with the type of valve used. 5. 4,000 ohm 'phones will be quite O.K. For safety these may be used in conjunction with a telephone transformer of a ratio of 1—1.

"LICENCE" (Eltham).—I am doubtful about the licence problem. Being only 14 years of age, can I build my own set and still have an ordinary Post Office licence, or must I get an experimental licence?

You should read the article on "Home-made Sets and the P.M.G.," published in our issue of Dec. 31st. In any case, the licence would have to be taken out in your father's or guardian's name. With regard to

(Continued on page 808.)



The Leaky Grid Condenser

—do you know how it really works?

EXPERT knowledge will make your Set twice as sensitive. If you understand how your Leaky Grid Condenser works, for instance, you will know whether you are using the most suitable value for your Set.

This Book explains the theory of Wireless in language you will easily understand, and a large number of diagrams will help you to appreciate the essential points.

Get a grip on the "reasons why" of Radio and you will find half your troubles disappear. Over 130 pages written by John Scott-Taggart, F.Inst.P.—the eminent authority on Thermionic Valves—get a copy to-day from your Bookseller, it will help you to understand your Set better.

Radio Press, Ltd
PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
DEVEREUX COURT, STRAND, W.C.2.

Some of Its Contents.

- The Theory of the Thermionic Valve.
- The 3-Electrode Valve and its applications.
- Cascade Valve Amplifiers.
- Principles of Reaction Amplification and Self-oscillation.
- Reaction reception of Wireless Signals.
- Continuous Wave Receiving Circuits.
- Valve Transmitters.
- Wireless Telephone Transmitters Using Valves.
- Broadcast Receivers.

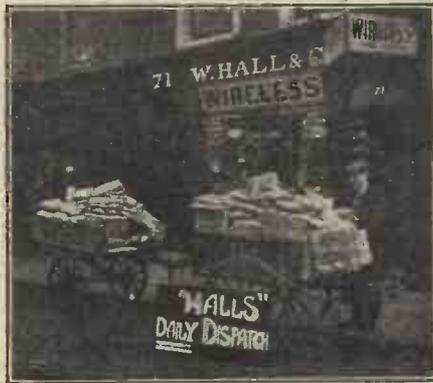
2/6
or 2/8 post free from publishers.
MARSHALL Ad.

LUNCH HOUR RAMBLE
STROLL ROUND TO
SPENCER'S STORES,
4-5, MASON'S AVENUE,
BASINGHALL STREET,
LONDON, E.C. 4.
CHEAPEST HOUSE IN CITY
FOR WIRELESS PARTS & SETS
PRICE LISTS FREE.

CRYSTAL SETS
Assembled and unassembled.
And all component parts.
Write for illustrated catalogue. Post free, 3d.
VALVE PANELS ON THE UNIT SYSTEM
Unassembled
Simple to build. Full instructions sent with each set. Ask for particulars.
P. H. BOYS & CO.,
Electrical & Wireless Engineers,
187, GOSWELL ROAD, LONDON, E.C. 1.
Phone: Clerkenwell 4454.

MATERIALS, TOOLS, & WORKSHOP SUNDRIES
OUR 1923 LIST of above (64 pages) is now ready. Wireless experimenters cannot afford to be without a copy. SENT POST FREE on receipt of Post Card.
GEORGE ADAMS (DEPT. P.W.), 255-6, HIGH HOLBORN, LONDON, W.C.1.

HALL'S WIRELESS ACCESSORIES



HIGHEST
QUALITY

LOWEST
PRICES

**Our Goods
Are Guaranteed**

"Dispatch by return"

DARLINGTON,
20th November, 1922.

Mesars. Hall's,
DEAR SIR,
"I am greatly satisfied
and pleased with the articles
already sent."
W. H. S.

HERTS,
20th November, 1922.

Hall's,
"All the goods are to
my entire satisfaction," etc.
A. BEADLE.

CHESHIRE,
19/11/22.

Hall's,
DEAR SIR,
"Goods received safely
and am very pleased with same."
B. B.

MANCHESTER,
14/11/22.

Hall's,
DEAR SIR,
"We thank you for
prompt delivery," etc. A. V. W.

PAISLEY,
Scotland.

Hall's,
DEAR SIR,
"Safely received
parcel. Delighted with quality
of contents," etc. R. B. E.

All originals are at our office, and
can be seen on request.

**"DISPATCH BY
RETURN"**

is no idle boast.

Our Stock of Wireless Equipment
and Accessories is such that we can
supply every Wireless need at once
and at lowest prices. If you do
not see what you want in our list,
please write to us.

BRITISH HEADPHONES

4,000 ohms. Very Light. Beautifully Finished. Stalloy
Diaphragms. Complete with Cords. Adjustable Earpieces. **19/6**
(Sold elsewhere almost exclusively at 35/-) Postage 9d

THE WELL-KNOWN
French "Brunet" Headphones **22/6**
Postage 9d.

French "Sidep" Headphones **21/-**
Postage 9d.

VARIABLE CONDENSERS

Capacity	Parts Complete	Assembled for Panel Mounting
.001	7/8	12/6
.0075	5/9	12/-
.0005	5/-	10/6
.0003	3/3	7/6
.0002	2/3	6/-
.0001	2/-	4/9

Top and Bottom Circular Drilled Ebonite
Plates, 1/6 extra. Vernier, 3/-
Interval Transformers, Ratio 4 to 1, finest manufacture
12/9; 5 to 1, **14/6**
Crystal Sets from 15/- to **23**
"Royal Phone" Loud Speakers, 4,000 ohms resistance,
ebonite horn, giving clarity of tone and freedom from
distortion .. each **30/-**

Orders in strict rotation.
Aluminium Condenser Vanes, fixed and moving, 22/24
gauge .. pair **1d**
Spacers, true to .001. Small, doz. 2d; large, doz. ... **3d**
Ebonite Knobs, tapped 2 B.A. with brass nut—1st quality
4d; 2nd quality **2d**
Aerial Wire, 7/22 hard drawn copper, in 100 ft. lengths .. **2/9**
Valve Legs, with nuts and washers, 1d each; doz. ... **9d**
Two Coil Holders, solid ebonite, mounted on mahogany .. **4/9**
Three Coil Holders, solid ebonite, with long arms to avoid
capacity effects .. **9/6**
Crystal Detectors, adjustable in every way .. **2/6**
Do. Do. enclosed in glass case .. **4/6**
Engraved Ivorine Scales, 0-180°, round or square ends **4/6**
Filament Resistances, extraordinary value, velvet action 2/6 &
Switch Arms, complete with knob, collar, washers, bush
nuts, etc. 1st quality, 1/6; 2nd quality **1/-**
Valve Holders, turned ebonite, complete with nuts, 1/3;
2nd quality .. **9d**
Crystal Cups. Plain 1d; one, two, or three screw .. **3d**
Large Terminals, complete with nut and washer .. **1d**
Basket Coils, set of 7 .. **5/-**
Contact Studs, 1/4 in. by 1/4 in., complete with nut and washer
doz. **6d**

Insulators, 2-in. reels—
1d each; white egg, 3d; green egg, 4d; green
shell .. each **4d**
Brass Nuts, 2, 3, 4, 5, 6 B.A., doz. 3d. Washers, doz. **2d**
Ebonite Sheets, 1/4, 1/2, 3/4 lb. **4/-**
Fixed Condensers, any capacity .. each **1/3**
Grid Leak and Condensers combined .. each **3/6**
Slider Plunger complete .. each **4d**
Slider Rods, 12-in. or 13-in. 1/4-in. square brass, drilled both
ends .. **4d**
Hertzite, 1/6. Bornite, Carborundum, Galena .. **4d**
Screwed Brass Lengths, 12-in. 2 or 4 B.A. .. each **3d**
Inductances, wound 22/24 enamelled wire .. each **3/3**
Orders under 30 - kindly remit ample postage.
Balance refunded if excess sent.

SEND FOR FREE CATALOGUE

TRADE SUPPLIED **HALL'S** DISPATCH BY RETURN

PHONE: REGENT 1282.

71, Beak St., Regent St., London, W.1.

Between Piccadilly Circus and Oxford Circus:
'Buses 3, 6, 12, 13, 15, 32, 51, 53, 59 and 88 pass

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 806.)

the building of a set, application for permission for the use of such a set should be made to the Sec., G.P.O. This permission, if granted, will enable you to use the set with an ordinary licence obtainable at the Post Office. Failing this, you will have to apply to the Sec., G.P.O., for an experimental licence.

T. M. N. (Ilford).—How many turns to the inch are there of No. 26 DCC, 22 DCC, 28 DCC, 26 DSC, 30 DSC?

35, 24, 38, 45, and 65 turns per inch. That is more or less approximate as these figures are liable to slight variation with different makes of wire and tightness of winding.

T. E. (Leeds).—Will you give a list of the more efficient crystal combinations?

Copper pyrites pressing against zincite or bornite is, in fact, the only one that can be classified as efficient. It is more generally known as the "Perikon" detector.

Y. H. (Doncaster).—Is a potentiometer and battery essential using a carborundum detector?

To obtain working results it is. By the way, there will be an article in POPULAR WIRELESS shortly, describing the construction of a potentiometer. Carborundum can be used without the applied potential to obtain quite good results in very rare cases, but only when a "freak" specimen of that substance is available. Also, we might mention that we have seen a set that gives very loud signals from 2 LO using a carborundum crystal without battery, and without either earth or aerial, but that particular set happens to be situated in the corridor outside the transmitting room at 2 LO.

R. P. (London, E.).—Could I charge a 2 volt accumulator from Leclanché batteries?

No; the current supplied by that type of battery is not sufficiently constant for the purpose you mention. Daniel cells, however, can be used if they are of a large capacity and of sufficient number to cover the voltage of the accumulators to be charged with 50 p.c. or so margin, as these cells are capable of producing a constant current for extended periods.

O. M. (Tooting).—How are honeycomb coils tuned—merely by induction?

No; a variable condenser is necessary for tuning purposes.

M. C. N. (Chester).—Must I have my earth connection to a spot directly under the aerial? Where do I apply for an experimental licence?

No, there is no absolute need for the earth connection to be directly under the aerial, but an advantage in efficiency is usually obtained by so doing. (2) The experimental licence application form can be obtained from the Secretary, G.P.O., London.

"AERIAL" (Newcastle).—I have a quantity of iron wire, which I should like to use as an aerial. Is this possible? It seems to me to have an advantage in tensile strength over the copper wire usually employed.

Iron wire is quite unsuitable for aerial purposes owing to its impedance. The high resistance, or impedance of the iron, would probably result in very poor results. If you feel that copper (stranded) wire is not strong enough, why not use phosphor-bronze or silicon-bronze. These have quite sufficient strength for the purposes of aerial wires.

Q. P. S. (Letchmore Heath).—I believe my accumulators are running down, but would like to make sure. What is the best method of testing the conditions of the cells?

The best test, in fact, the only really safe test, is by means of a hydrometer. You will find a suction hydrometer, Hick's type, can be obtained for a few shillings, and will be well worth getting. It consists of a glass tube with a rubber bulb, like a fountain-pen filler. In the tube are three glass beads, purple, blue and yellow. When acid out of the accumulator is sucked into the tube either one, two, or all the beads will float, according to the specific gravity of the solution. The yellow (bottom one) floats at 1.17, the blue at 1.185, and the purple at 1.2. Cells should not be allowed to discharge to a lower density than 1.18.

POPULAR WIRELESS Beginners' Supplement

AN INTRODUCTION TO WIRELESS.

By MICHAEL EGAN.

PART 1.

BEFORE starting to explain anything about wireless, I want to say this to my readers. If you have been trying to learn wireless from a highbrow text-book, and if your efforts have only resulted in burdening your mind with a number of confusing technicalities, please try, here and now, to forget everything you have learned. If you start your study of wireless by blocking up the hall-door of your mind with a stack of cumbersome technicalities, you will leave no room for common sense to get in. And you won't go far in wireless until you have first learned to apply ordinary common sense to the ordinary common facts of the job. With this preliminary injunction, we will ring up the curtain on the very common-sensed questions:

"Well, what is wireless, anyway? What does it do? And how does it do it? What is it that actually happens when a wireless message is sent out by one station and picked up by another?" Let us try to answer these questions in simple, straightforward language.

Sound Waves.

When two people converse together they may be said to be communicating by wireless in the general sense of that term. That is, they exchange messages between one another without the use of wires. These messages are vocally transmitted and aurally received. I speak; my friend listens. In other words, I transmit, and my friend receives. Now what is it that I actually transmit when I talk to my friend? Do I send out "sounds" or "words" or "air waves"—or what? The answer is that I send out *energy* which travels in waves through the air. And that energy comes, in the first instance, from the stock of life energy that animates my body.

But what kind of mechanism do I employ in transmitting this energy from myself to my friend? Well, nature has endowed me with a very delicate apparatus for this purpose; it is situated in my throat. And my friend is similarly endowed with an equally sensitive receiving apparatus in his ear. When, for instance, I wish to transmit the first letter of the alphabet I simply vibrate the vocal chords in my throat. As these vibrate they send out energy-waves in all directions through the surrounding air.

A few feet away, my friend is standing. Some of these energy-waves strike the sensitive diaphragm of his ear and cause it to vibrate at the same rate as my vocal chords, thereby producing in his mind a certain sound impression which we denote by the sign "A." Now the "pitch" of this sound will vary according to the rate at which his diaphragm vibrates, which, in turn, will depend upon the rate at which my vocal chords vibrate.

Suppose, once more, that I vibrate my vocal chords at such a rate that there is produced in his mind the sound "doh" on the "tonic sol-fa" scale. If, now, I increase

the vibrations of my vocal chords by a certain definite amount it will at once produce in his mind the sound "ray," and so on.

Human "Wireless."

The same holds good with ordinary speech. When I speak "in a low tone" it means that I am vibrating my vocal chords at a low rate. When I speak "in a high tone" it means that I am vibrating my vocal chords at a comparatively high rate.

Now this transmission and reception of wireless messages that goes on between two human beings in conversation is in many



The Thermionic valve, mounted on panel and ready to wire up to a set.

respects similar to what takes place between transmitting and receiving wireless stations. What are the essential factors in the system of "human wireless" communication we have just been considering? At the transmitting end we have (1) a couple of chords which are capable of being vibrated at different rates, and (2) a supply of energy which is capable of producing these vibrations. At the receiving end we have (1) a sensitive diaphragm which, when acted upon by the energy-waves set up in the surrounding air by the vibrating chords, will itself begin to vibrate "in sympathy," i.e., at the same rate as the chords; and (2) we also have, behind this diaphragm, a special mechanism for converting the received energy into the sensation of "sound" within the mind.

Now, these same factors are required for wireless of the "non-human" variety. At the transmitting end there are (1) a number of wire chords (usually called the "aerial") which are capable of being vibrated at different frequencies; and (2) a supply of electrical energy which is capable of producing these vibrations. At the receiving end there is (1) a sensitive vibrator (also usually

known as an aerial) which when acted upon by the energy waves sent out from the vibrating transmitting aerial, will itself begin to vibrate "in sympathy" with the latter; and (2) there is a special mechanism (usually called a "detector") for converting the received electrical energy into sound energy.

There is this difference between the two systems. In the case of "human wireless," the vibrations are what we may call physical vibrations. That is, the vibrating parts actually *move* backwards and forwards, or up and down, even though the movement is infinitesimally small. In "non-human wireless" the wires do not *move*, they vibrate *electrically*. Let me give one or two simple examples.

Suppose you had a rod of some particular kind of metal which you could heat and make cold, heat again and make cold again, in fairly rapid succession. On touching such a rod with your finger whilst this process was going on you would probably describe the sensation by saying: "This rod is *vibrating* with heat." You would, therefore, be experiencing *heat vibrations* in a stationary rod.

Respecting Sensitivity.

Similarly, if you were connected up to an electric circuit in which a slow vibratory electric current was flowing you would experience a series of "shocks," with intervening periods of "no-shock." In practical wireless work, however, transmitting aerials are vibrated at such terrific rates that none of our physical senses are capable of detecting the fact that they *are* vibrating. That is why special instruments have to be employed at the receiving station to detect the vibrations set up in the aerial by-passing wireless waves.

To return for a moment to our example of human wireless: if my friend happens to be a little bit deaf—he will probably fail to hear me when I speak to him in my usual voice at a distance of 10 yards. On the other hand, if his hearing is unusually acute (i.e., if he is endowed with a highly sensitive receiving apparatus in his ear) he will probably hear me over that distance even if I speak in a quieter voice.

Again, just as the distance over which we can communicate with each other is governed to some extent by the quality of his hearing, it is also affected by the quality of my voice, by the amount of energy I use to vibrate my vocal chords. Even if he is slightly deaf he will probably hear me over a distance of thirty yards if I "shout at the top of my voice." *Exactly* the same conditions obtain in connection with "non-human wireless," as we have chosen to call it for the moment. The sensitivity of receivers varies immensely. A "single-valve" receiver is a good deal more sensitive than a "crystal" receiver, and a "multiple-valve" receiver is more sensitive than either of these. Similarly with transmitters; the more "kilowatts" of electrical energy we use to vibrate an aerial, the longer the

(Continued on next page.)

THE BEGINNERS' INTRODUCTION TO WIRELESS.

(Continued from previous page.)

distance over which messages can be sent. There is yet another important point of similarity between the two systems. Should anything "stick in my throat" in such a way as to prevent my vocal chords from vibrating freely, I will not be able to speak loudly and clearly. Or, again, if my friend puts a finger in his ear he will prevent the energy waves from vibrating the diaphragm. He will, as we say, "shut out the sound of my voice."

What is Ether?

In the same way, receiving and transmitting aeri-als must be guarded from obstruction. That is why they have to be suspended carefully, so that they do not run any risk of coming in contact with trees, houses, etc. In other words, they have to be protected from a number of things which would prevent them from vibrating freely (electrically).

The analogy between these two systems of communication must be restricted, however. They differ in one important respect, although this difference is one which need not cause the beginner the slightest worry. The energy waves which result from human speech can only act through air. If the layer of air which surrounds our earth were suddenly dispersed completely, "sound" would cease to be possible. Not only would we be unable to hear each other speak, but we could no longer hear the roar of the traffic, nor even the report of a gun let off at a yard's distance. There would be "dead silence" everywhere. (Mind, we should still be able to see and feel, but we could no longer hear.)

Air, then, is essential to the transmission of those particular energy waves which rise to sound. But air is of no importance whatever to the transmission of those energy waves which are sent out from electrically vibrating wires. (This is also the case with reference to the energy waves which come to us from the sun and produce the sensations of "light" and "heat.") Even if there was no air, those energy waves could still pass freely over the earth. Moreover, they can pass through the earth—through anything, in fact.

I fancy I hear the enthusiastic reader murmur something about the "ether"? Well, if you must have it then, "ether" is the "medium" through which "wireless" waves move, just as air is the "medium" through which "sound" waves move. And now we have let ourselves in for the question: "What is ether?"

Here is the best answer that can be given to this absorbing problem at this stage: Wherever there is space there is ether. And by space, I don't merely mean space that is free of tables and chairs and houses. I include also the very space occupied by these things, and every "tiny dot" of space occupied by the whole universe. And wherever there is space wireless waves can move, i.e., through tables and chairs and houses, through the "unoccupied" space from here to the Milky Way, through the Milky Way and on to the back o' beyond. All this, of course, provided you have a sufficiently powerful transmitter.

I would like to warn the reader at this point against falling into a very common error. When the aerial wire of a transmitting station is vibrated electrically, electric currents do not flow out through space. No electricity leaves the aerial. What does leave the aerial is a wave of energy, which, on striking the sensitive receiving aerial, sets up sympathetic electrical vibrations in that.

I have said above that these vibrations occur at such an extremely high rate that none of our physical senses are capable of detecting them. It is therefore necessary to employ, at the receiving station, special instruments for the purpose of changing these rapid electrical vibrations into slow physical vibrations which we can detect with our sense of hearing.

Once more, there is no reason for the beginner to anticipate any difficulty in understanding how electrical vibrations can be changed into physical (or mechanical) vibrations capable of producing sound. We have all, at some time or other, heard a kettle "singing" on the fire. Well, there is a simple example of heat being responsible for the production of sound. And heat waves follow the same general laws as wireless waves, so—why not?

Vibrations and Waves.

Now let us try to sum up the different operations necessary for the despatch of a radio telephonic message. Let us suppose that I am at the transmitting station, and that the reader is the listener at the receiving station. It is understood between us, in the first place, that I am going to vibrate my aerial at a certain rate. The reader will, therefore, by twiddling the handle on his receiver, adjust the sensitivity of his aerial to the point at which it will be most sympathetic to this rate of vibration.

I also adjust the sensitivity of my own transmitting aerial and connect it up to a supply of electricity. I then speak into a microphone (similar to that used in ordinary land-line telephony) which is connected up to the transmitting instruments which control the supply of electricity. The impact of the sound waves on the microphone instantly sets a special mechanism in motion which produces corresponding electrical vibrations in my aerial. These, in turn, give rise to energy waves which move out in all directions across the earth.

When these waves strike the reader's aerial they cause it to vibrate electrically and, except for a certain loss in strength, these vibrations are an exact reproduction of the vibrations in my transmitting aerial. The reader's receiving instrument ("valve" or "crystal," as the case may be), now transforms these electrical vibrations into mechanical vibrations, which are an exact reproduction of my voice.

I will conclude this article with a few remarks on the relative merits of receivers. I have already called attention to the fact that the total efficiency of a receiver depends not only on its own sensitivity, but also upon the power used by whatever transmitting station it happens to be receiving from at a particular moment. In the case of broadcasting stations, however, the power used will not be a variable quantity. The same amount of power will be used by all broadcasting stations at all times. The efficiency of a broadcasting receiver will therefore depend upon the sensitivity of the receiver itself.

Range of Sets.

Two kinds of receiving aeri-als can be used: (1) An outdoor aerial, comprising one or two long bare wires running parallel to the ground, and (2) an indoor aerial, comprising one long insulated wire wound several times round a rectangular frame which stands at right angles to the floor of the receiving-room. For the purposes of broadcast reception the former type of aerial is, if properly erected, a good deal more efficient than the latter. The aerial is the cheapest and, in many respects, the most important part of a receiving equipment. Therefore, your first consideration should be to erect the best aerial that the conditions of your environment and the P.M.G.'s restrictions will allow. If you have accommodation for an outdoor aerial, make it as high and as long as possible. If you decide on an indoor aerial, make the frame as big as possible—5, 6, or 7 ft. sq.

With a good outdoor aerial you will be able to pick up signals on a crystal receiver from a broadcast station within a radius of 10-15 miles. With a single valve receiver on the same aerial you will get really loud signals at that distance, and you should still be able to receive satisfactory signals at a distance of 40-50 miles. On a two valve receiver you will get loud signals from a broadcasting station 40 miles away, and you will not be out of range for intelligible signals at a distance of 100-130 miles.

The best frame aerial will be useless in conjunction with a crystal. Even with a good frame aerial a single-valve receiver will not yield satisfactory results over more than a few miles. The maximum range with a two-valve receiver will be about 20 miles; and with a three-valve receiver about 45-55 miles. For really good results over long distances, 4, 5, or even 6 valves will be necessary.

(To be continued.)



Fixing in the Earth lead.

Send along your Wireless Photos to "Popular Wireless." If used we pay you 10/6.

METHODS OF ERECTING AERIALS.

The Simplicity of an Aerial.

Aerial - Copper Wire up to 100 feet in length.

Shell Insulator supporting Aerial Wire.

Receiver

Ebonite "Lead-in" tube

Wire to nearest water supply pipe.

Aerial entering the house through ebonite tube.

A Garden "T" Aerial.

situated at an equal distance from two broadcasting stations.

Garden Aerial - Single Wire from Tree to House.

A Frame Aerial

Aerial for small back-yard.

Garden Aerial - 100 feet of single wire stretching from pole to insulator fixed in a small hole made in framework of door or window.

Roof Aerial - Four wires about 30 ft. in length. (Spreaders 20 feet long).

Garden Aerial - Two wires 50 feet in length.

The Earth Connections.

HOW TO ERECT AN AERIAL.

THERE are so many viewpoints from which one can take a first glimpse at the practical side of wireless communication, that the question of where to begin is by no means easy of solution. To the average "man in the street," however, radio telegraphy and telephony is invariably associated with a wire or wires suspended between masts or other supports above a wireless station, and it might be as well, therefore, to commence from this point. The antennæ or aerial, as it is more commonly called, is used either to radiate wireless waves or to receive them.

The Wire to Use.

There are several types of outdoor aerials which are capable of giving good results if sufficient care and thought is exercised in connection with their construction. The best wire to use for this purpose is stranded silicon bronze, phosphor bronze, or copper. The amateur will find, however, that to purchase, say, a 7 stranded silicon bronze aerial is a fairly costly business, and in these days of sensitive valve receivers, a simple single copper wire aerial will do all that could reasonably be expected of it provided that the set to which it is attached is in good working order. A good wire of about 16 gauge can be procured for about 2s. 6d. per 100 ft.

Other useful wires, together with their approximate cost, are as follows:—

100 ft. of Hard Drawn Copper wire, 7/22, together with two insulators	4/- to 5/-
100 ft. of Enamelled wire, 7/22, together with two insulators	5/- to 6/-
100 ft. of Bare Copper stranded, 7/22	5/- to 6/-
100 ft. Silicon Bronze, 18 gauge	2/6 to 3/-

If desired, the wire could be treated with any damp proof solution against the weather without affecting its efficiency.

Various Types.

Four types of outdoor aerials, which can be successfully erected for the interception of wireless waves, are shown in the accompanying diagram. A is known as the "L" or "inverted L" type. This type of aerial is generally used by amateurs on account of its adaptability to back gardens, and the comparatively easy manner in which the down lead can be brought into the instrument room. B is an elaboration of the foregoing type, and is known as the "double wire" or "twin inverted L" type. For this form of aerial two wooden spreaders are necessary to keep the wires in proper position. They should be made of strong, well-seasoned wood, preferably ash, as the use of soft white wood for this purpose is not advisable. A certain amount of strain is placed on the spreader once the aerial is installed and tautened, and faulty or unseasoned spreaders would probably warp or snap owing to the action of the weather. The two spreaders should be long enough to keep the two wires at least 4 or 5 ft. apart.

C is known as the "T" type of aerial on account of its similarity to that capital

letter when erected. This aerial will not usually be found so convenient to install as the single wire "L," although where both transmission and reception are performed by means of the same antennæ this kind of aerial will give as good results as any.

D is the double wire "T" type in the erection of which spreaders are also utilised in a manner similar to that of "L" aerials. This aerial is used principally on ships where the wireless cabin is often amidships, and therefore suitably placed for an aerial so constructed. It is also used on the roofs of high buildings or in the open country, anywhere, in fact, where space permits and the wireless room or cabin is conveniently placed to receive the lead in. When the double wire aerial is used the two wires should be parallel to each other in a horizontal plane, and stays will have to be introduced to keep the aerial in position.

Importance of Insulation.

An important point to remember is that the down lead of the "T" aerial should be attached exactly at the midway point of the horizontal wire or wires and not promiscuously connected to any point along the overall length. Careful attention should also be given to the insulation of the aerial. It must be remembered that the oscillations set up by the incoming waves are extremely weak, and no chance of leakage to earth should be permitted; all of the received energy, especially in the case of weak signals, being required to actuate the receiver.

Insulators, for preference, should be of china, ebonite, or of rope if the latter be treated with a thick solution of rubber. Any really satisfactory non-conductor of electricity is suitable for the purpose, provided

good insulation between the aerial wire and supporting mast is obtained.

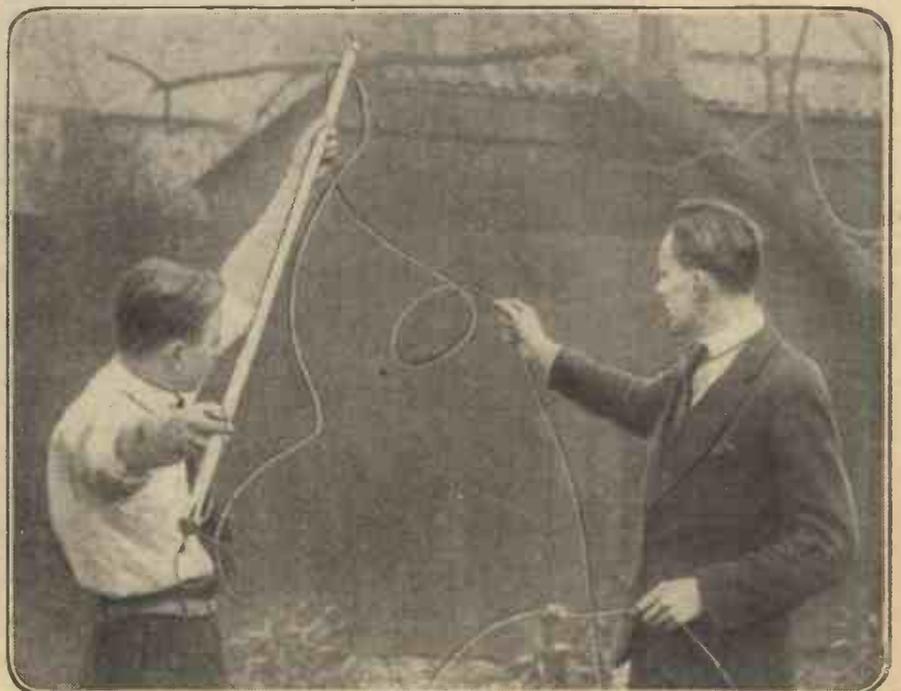
The aerial itself may be hoisted or lowered by means of a block and pulley fixed to the mast-head. The aerial should at all times be kept as far from buildings and trees as circumstances will allow, especially lead roofs, telegraph wires, or iron work, and should be elevated as high as possible. If it is desired to use a tree as an aerial support, the aerial proper should be so insulated that it does not in any way come into contact with the branches. A simple way to avoid this is to attach sufficient rope to the trunk of the tree to allow of the actual aerial swinging absolutely free.

The Down Lead.

In connecting the down lead to the flat top or horizontal wire or wires, the portion of the aerial to which it is proposed to make the joint should be thoroughly cleaned prior to soldering, and if necessary finally covered with insulation tape. When bringing the down lead from the aerial to the apparatus, make certain that it is well insulated from all parts of the building, including the actual point at which it enters. To obviate all danger of short circuiting the aerial to earth, use might be made of rubber covered or other insulated wire for that portion of the down lead in proximity to the house or receiving room.

The whole structure should also be periodically overhauled. For obvious reasons this is essential to the proper working of the station, and the aerial and all guy ropes should be thoroughly inspected for any sign of deterioration.

(This supplement will be continued next week.)



Two amateurs are shown here fixing the aerial wire to a spreader.



Important Notice to all Wireless Manufacturers, Retailers, Experimenters and Amateurs.

EX - GOVERNMENT WIRELESS APPARATUS

A few weeks ago, we advertised the purchase of a complete Government Wireless Depot and offered the same for re-sale at astonishingly low prices in accordance with our inevitable business rule to

SHARE OUR BARGAINS WITH OUR CUSTOMERS.

The immediate response to our advertisement resulted in our being absolutely "snowed under" with enquiries and orders from all over the country, and it was only through despatch staffs working night and day at full pressure that we were able to keep faith with our customers in respect of our promise to execute all orders

WITHIN 48 HOURS OF RECEIPT.

It was impossible to deal with the thousands of enquiries as expeditiously as we should have wished and we again take the opportunity of tendering our apologies to all those who unfortunately were kept waiting.

We shall be able in the near future to offer some wonderful bargains, having purchased two colossal depots. The work entailed in the compilation of lists is considerable, and we are unable to answer individual queries at the moment. You can assist us greatly by filling in the Form at the foot of this page.

YOU WILL THEN BE PLACED ON OUR MAILING LIST.

Immediately this Form is received, an envelope will be addressed in readiness and the moment we have the bargains to offer everyone on our mailing list will be informed simultaneously.

A FEW PRELIMINARY BARGAINS.

RECEIVERS C.W. MARK III.—This set comprises a complete two-valve receiving set with a wave-length range of 350-1,800 metres. The addition of high and low tension batteries, valves, and 'phones, completes the entire receiving station. For the reception of broadcast concerts this set is ideal, the strength and clarity of the signals being absolutely wonderful ... **£9-9-0**

Complete with 4-volt 40-amp. Fuller block accumulator, 60-volt H.T. battery, 2 Mullard "ORA" valves, and pair of Brown "A" Type headphones, complete with cords ... **£15-10-0**

C.W. TRANSMITTERS, MARK III, 30 WATT.—Complete with aerial ammeter, platinum-pointed Morse key, in mahogany case. One valve: wave-length 350-1,400 metres; Two valves: Wave-length 700-2,000 metres. (For transmission of telephony all that is required is to remove ammeter and insert microphone) ... **£3-5-0**

NOTE.—These instruments can be easily altered to any desired wave-length.

MARK III. S.W. TUNERS.—Wave-length 50-700 metres. Ideal for broadcasting. Being sold elsewhere at £10. Complete with one pair of Sullivan 8,000 ohm. 'phones and cords. Limited number only ... **£8-0-0**

TOWNSEND WAVE-METERS.—300-4,000 metres. Limited number only ... **£4 0-0**

FILL UP THIS FORM NOW

and post to us immediately. $\frac{1}{2}$ d. stamp only required.

Messrs. THE CITY ACCUMULATOR CO.

Mail Order Dept., 79, Mark Lane, London, E.C.

Please include my name on your Mailing List. I am particularly interested in

.....

(Signed)

Full Postal Address

.....

POP. WIRELESS.

Date 19



No Wireless Receiving set is complete without

THANKS to the Magnavox, the Reproducer Supreme, any progressive family can enjoy the marvellous wireless programmes. Every evening and throughout the year, in the comfort of your home and without limit as to numbers. Write for Literature.

We guarantee that all broadcast radio apparatus sold by us conforms with the conditions of the Broadcaster's Licence issued by the Postmaster-General.

To be obtained from all dealers or direct from the Manufacturers and Sole Licensees:

Sterling Telephone & Electric

TELEPHONE HOUSE, Co. Ltd.,

210/212, Tottenham Court Road, London, W.1.

Telephone No.: 4144 Muscum (7 lines). Telegrams: 'Cucumis, Wesdo, London.'

WORKS: DAGENHAM, ESSEX.

BRANCHES: MANCHESTER: 14, St. Peter's Square.

CARDIFF: 8, Park Place.

NEWCASTLE-ON-TYNE: 9, Clavering Place.

MAGNAVOX

The Reproducer Supreme

C.9

DON'T Let Violence in Advertising
Rush Your Judgment
FOR YOUR PROTECTION

INSIST on a comparative demonstration
before you purchase

It is all we ask to prove the demonstrable
superiority in signal strength, purity of tone,
simplicity in operation of

THE
Crystophone
REGISTERED

P.M.G. BROADCAST RECEIVERS

SOLD BY ALL LEADING STORES
AND WIRELESS AGENTS

All Crystophone Receivers are exclusively fitted with the
LATTIKONE TUNER

The ONLY Tuning Coil which actually builds up and
strengthens the incoming signal current and thus enables
us to claim a

50% INCREASE in Signal
Strength. Such is the reserve of power of

THE
Crystophone Type 33
REGISTERED (two valves)

that 4 invisible wires stretched across the
ceiling of ANY ROOM,
on ANY FLOOR,

in ANY HOUSE in
LONDON, BIRMINGHAM, MANCHESTER,
is sufficient for use with 6 pairs of head-
phones, while with a P.M.G. Aerial it is

Guaranteed for 100 Miles

PRICE £15 (INCLUDING
ALL ROYALTIES.)

Crystophone Crystal Receivers
with Lattikone Tuner,
PRICES from £3 10s. 0d.

Demonstrations Daily
From 5 to 10 p.m.

**THE CRYSTOPHONE
MANUFACTURING Co., LD.,**
16, WELLS STREET, OXFORD STREET,
LONDON, W.1.

TELEPHONE: MUSEUM 1664.

"POPULAR WIRELESS"

DIRECTORY OF AMATEUR STATIONS.

NOTE.—A few stations given in this directory are not shown on the map, as details of position are unavailable.

Call Sign.	System.	Name.	Address.	Call Sign.	System.	Name.	Address.
2 A A	—	Radio Communication Co.	Slough Experimental Station, Slough.	2 D T	—	Barrow & Dist. W/T Assn.	Barrow.
2 A B	Sp., C.W. & R/T	H. de A. Donisthorpe	Cathcart St., London.	2 D U	C.W. & R/T	Mr. Norbury	Beeston, Nottingham.
2 A F	C.W.	A. Rickard Taylor	49, Idmiston Rd., W. Norwood.	2 D V	—	Woodall	Bramhall, Cheshire.
2 A G	C.W.	Ditto	Ditto.	2 D X	C.W. & R/T	W. K. Alford	"Rosdene," Camberley, Surrey.
2 A H	C.W.	—	Oxford.	2 D Y	—	F. Haynes	157, Phillip Lane, S. Tottenham, N. 15.
2 A J	—	A. S. Atkins	16, Beauchamp Rd., Upper Norwood, S.E. 19.	2 D Z	—	Ditto	26, Avenue Rd., S. Tottenham, N. 15.
2 A K	Sp., C.W. & R/T	R.M. Radio Ltd.	Townsend Mills, Worcester.	2 F A	—	F. G. Bennett	16, Tivoli Rd., Crouch End, N. 8.
2 A L	C.W. & R/T	W. Halstead	Briar Rd., Thornton-le-Fylde, Chiswick.	2 F B	Sp., C.W. & R/T	W. Ison	80, Harnham Rd., Salisbury.
2 A M	—	—	Marlborough College.	2 F C	—	—	London, S.E.
2 A N	C.W. & R/T	A. W. Sharman	1, Morella Rd., London, S.W.	2 F G	Sp., C.W. & R/T	L. McMichael	32, Quex Rd., W. Hampstead.
2 A O	—	Reilly	Eastbourne.	2 F H	C.W. & R/T	T. S. Rogers	2, Park Hill, Moseley, Birmingham.
2 A Q	Sp., C.W. & R/T	Davis	Thornton Heath, London, S.W.	2 F K	—	—	Ilford.
2 A R	—	E. Gaze	3, Archibald St., Gloucester.	2 F L	Sp. & C.W.	C. Wilcox	21, George St., Warminster, Wilts.
2 A T	—	Beresford	Birmingham.	2 F N	—	L. Baker	Ruddington, Notts.
2 A U	—	A. C. Bull	25, Fairland Road, West Ham, E. 15.	2 F P	Sp., T.T., C.W. & R/T	F. Foulger	118, Pepys Rd., London S.E. 14.
2 A W	C.W. & R/T	H. H. Burbury	Crigglestone, Wakefield.	2 F Q	Sp., C.W. & R/T	Burndept Ltd.	Experimental Station, Blackheath.
2 A X	Sp.	G Sutton	18, Melford Rd., London, S.E. 22.	2 F R	Sp.	S. Rudeforth	54, Worthing St., Hull
2 A Y	Portable Sct	D. F. Owen	Limehurst, Sale, Manchester.	2 F T	C.W. & R/T	Edinburgh & Dist. Rad. Soc.	Edinburgh.
2 A Z	Sp., C.W. & R/T	William Le Queux	Guildford.	2 F U	Sp., C.W. & R/T	E. T. Manly, Jr.	27, Home Park Road, Wimbledon Pk., S.W. 19.
2 B C	C.W. & R/T	D. F. Owen	Limehurst, Sale, Manchester.	2 F V	Sp.	Rev. D. Thomas	St. Paul's B.P. Scouts, Bournemouth.
2 B M	C.W. & R/T	G. H. A. Whitehouse	25, Ennerdale Rd., New Brighton, Cheshire.	2 F W	Sp.	H. C. Binden	Bournemouth.
2 B O	R/T	Marconi Co.	(Private Call for 2 M T), Writtle, Essex.	2 F X	Sp., C.W., T.T. & R/T	—	—
2 B Z	C.W. & R/T	Basil Davis	Electric Pavilion, Marble Arch, London, W. 1.	2 F Y	Sp., C.W. & R/T	Manchester W/T Soc.	Albion Hotel, Piccadilly, Manchester.
2 C D	C.W. & R/T	Burton-on-Trent Wireless Club	Headquarters: "Barton Daily Mail," High St., Burton-on-Trent.	2 G D	—	Birmingham W/T Exp. Club.	Digbeth Institute, Birmingham.
2 C F	—	F. G. S. Wise	8, Vernon Rd., Hornsey, N. 8.	2 G E	—	A. H. Kidd	4, Kensington Gate, London, W. 8.
2 C H	C.W. & R/T	Science Society	The School, Oundle, Northants.	2 G F	C.W. & R/T	W. J. Henderson	2, Hollywood Rd., London, S.W. 10.
2 C I	Sp.	R. Brooks King	Widcombe, Taunton.	2 G G	—	Halifax W. Club	Clare Hall, Halifax
2 C Q	—	Elmer	Gernham House, Bitchington.	2 G H	Sp., C.W., T.T. & R.T.	W. Gaitland	Highbury, N.
2 C W	—	Com. Hippisley	Ston, Eastern Park, Bath.	2 G I	Sp.	1st Taunton Scouts	Parish Buildings, Wilton.
2 C Z	Sp., C.W., T.T. & R/T	C. Atkinson	17, Beaumont Rd., Leicester.	2 G J	—	T. Forsyth	Ashington.
2 D C	C.W. & R/T	M. Child	60, Ashworth Mansions, Maida Vale, London, W.	2 G K	(Portable)	Ditto	Ditto (Portable).
2 D D	Sp.	A. C. Davis	105, Brynland Av., Bristol.	2 G L	—	Halifax W/T Club	Halifax.
2 D F	Reallotted to	Miller	Malden High St., Malden.	2 G M	Sp., C.W. & R/T	Rev. J. Rigby	St. Lawrence Vicarage, Bristol.
2 D G	C.W. & S.P.	Mitchell's Elec. & Wireless	188, Rye Lane, Peckham, S.E. 15.	2 G N	Sp., C.W. & R/T	Allan Cash	Foxley Mount, Lynn, Ches.
2 D H	(Portable) C.W. & Sp.	W. Barnet	63, Mount Rd., Parkwood Springs, Sheffield.	2 G O	C.W. & Sp.	A. L. Megson	Bowden.
2 D I	Ditto	Ditto	Ditto.	2 H A	C.W. & S.P.	Ditto	Ditto.
2 D J	C.W. & R/T	A. T. Leo	The Court, Alvaston, Derby.	2 H B	(Portable)	L. H. Lomas	Macclesfield.
2 D S	Sp., C.W. & R/T	E. Redpath	29, Niger St., Barrow-in-Furness.	2 H C	C.W. & Sp.	J. W. White	Windcombe Lodge, Bucklesbury, nr. Reading.
				2 H F	—	W. G. Gold	Rosdale, Belwell Lane, Four Oaks, nr. Birmingham.
				2 H G	—	T. Boutland, Sr.	Ashington.
				2 H H	—	Ditto	Ditto.
				2 H K	—	A. A. Campbell	40, Chester Sq., London, S.W. 1.
				2 H L	—	Swinton	Ditto
				2 H O	—	Ditto	Ilford.
				2 H P	C.W. & R/T	H. C. Woodall	10, Holborn House, London, E.C. 1.

"POPULAR WIRELESS" DIRECTORY OF AMATEUR STATIONS—Continued.

Call Sign.	System.	Name.	Address.	Call Sign.	System.	Name.	Address.
2 H Q	C.W. & S.P.	A. W. Faucett	11, Leigh Rd., Clifton, Bristol.	2 K Q	—	—	Wolverhampton.
2 HR	C.W. & R/T	F. O. Reid & Co.	Queen St., Kingsway, London, W.C. 2.	2 K S	Sp., C.W., T.T. & R/T	C. Clayton-Breakell	Mill Bank, Church St., Preston.
2 HS	C.W., T.T., & R/T	G. W. Hale	51, Grafton Rd., New Malden, Surrey.	2 K T	Sp., C.W. & T.T.	J. E. Nickless	83, Wellington Road, Snaresbrook, E.11.
2 HT	Sp., C.W. & R/T	R. H. Klein	18, Crediton Hill, W. Hampstead, N.W. 6.	2 K U	Sp., T.T. & R/T	A. J. Selby	66, Edward St., Burton-on-Trent.
2 H V	—	Beresford Bros.	Bude St., Birmingham.	2 K V	C.W. & R/T	W. J. Crampton	Weybridge.
2 H X	Sp., C.W. & R/T	F. A. Love	Guildford Pk. Rd., Guildford.	2 K W	C.W. & R/T	W. R. Burne	Thorold Grove, Sale, Cheshire
2 I B	C.W. & R/T	W. Bemrose	Littleover Hill, Derby.	2 K X	Sp., C.W. & R/T	W. Stannorth	Fern Bank, Blackburn.
2 I D	C.W. & Sp.	E. S. Firth	Thames Ditton.	2 K Y	C.W. & R/T	L. Pollard	209, Cunliffe Road, Blackpool.
2 I F	C.W. & R.T.	S. W. Bligh	2, North Lane, Canterbury.	2 K Z	Sp., C.W. & R/T	B. Clapp	Brighton Rd., Purley.
2 I H	—	Technical College.	Cardiff.	2 L A	C.W. & R/T	H. F. Yardley	121, Victoria Road, Headingly, Leeds.
2 I I	Sp.	Southport W/T Soc.	74a, Kensington Rd., Cardiff.	2 L B	Ditto	Ditto	6, Blenheim Terrace, Leeds.
2 I J	(Portable)	Ditto	Ditto.	2 L F	Sp., & C.W.	P. Harris	Chilvester Lodge, Calne, Wilts.
2 I K	R/T	H. R. Goodall	Winchester Rd., Bassett, Southampton.	2 L G	C.W.	H. Whitefield	Primrose Lane, Hall Gr., Birmingham.
2 I N	C.W., Sp. & R/T	J. E. Fish	"Thornleigh," Thornton-le-Fyde.	2 L I	Sp., C.W. & R/T	H. E. Wilkinson	Lonsdale Rd., London, N.W.6.
2 I Q	C.W. & R/T	W. A. Ward	26, Marlborough Rd., Sheffield.	2 L K	T.T. & C.W.	S. Kniveton	Brooklands, Norman-ton, Yorks.
2 I S	—	Rev. H. W. Doudney	St. Luke's Vicarage, Bath.	2 L L	Ditto	Ditto	Ditto
2 I T	(Portable)	Ditto	Ditto.	2 L O	R/T	Marconi	Marconi House, Strand, W.C.
2 I U	—	G. A. E. Roberts	Twyford, Winchester.	2 L P	Sp., C.W. & R/T	A. W. Knight	26, Stanbury Rd., London, S.E.
2 I V	Sp., C.W. & R/T	L. F. White	Priory Rd., Knole, Bristol.	2 L Q	—	J. A. Henderson	Elm Hall Drive, Mosby Hill, Liverpool.
2 I W	—	G. R. March	Twyford, Winchester.	2 L R	C.W. & R/T	J. Scott-Taggart	6, Beattyville Gdns., Ilford.
2 I X	C.W. & R/T	S. G. Taylor	Littleover, Derby.	2 L U	C.W. & R/T	W. A. Appleton	Wembley Park.
2 I Y	C.W. & R/T	J. Briggs	66½, Corporation St., Birmingham.	2 L V	Sp., C.W. & R/T	W. R. H. Tingey	Queen St., Hammer-smith.
2 J A	—	A. J. Atkins	St. Malo, Beauchamp Rd., Norwood.	2 L W	Sp., C.W. & R/T	Ditto	Ditto
2 J F	Sp., C.W. & R/T	C. G. Williams	22, Scholar St., Sefton Park, Liverpool.	2 L X	—	S. Skeet	120, Highcross St., Leicester.
2 J G	—	W. A. Seed	Crigglestone, nr. Wakefield.	2 L Y	R/T	H. H. Thompson	59, Redlands Rd., Penarth, Glamorgan.
2 J H	—	C. Burrand Stefano	Willington St., Slough.	2 L Z	Sp., C.W. & R/T	F. A. Mayer	Stilemans, Wickford, Essex.
2 J J	Sp., C.W. & R/T	C. Worthy	4, Riversdale Road, Egremont, Wallasey.	2 M A	Sp.	P. S. Savage	14-16, Norwich Rd., Lowestoft.
2 J K	Sp., C.W., T.T. & R/T	Philip R. Coursey	138, Muswell Hill Rd., London, N.10.	2 M B	C.W. & R/T	E. H. Jeynés	67, St. Paul's Rd., Gloucester.
2 J L	Sp., C.W. & R/T	G. G. Bailey	The Beeches, Cowley, Middlesex.	2 M D	Sp., C.W. & R/T	C. Chipperfield	Victoria Rd., Oulton Broad, Lowestoft.
2 J M	Sp., C.W. & R/T	G. G. Blake	10, Onslow Rd., Richmond, Surrey.	2 M F	C.W. & R/T	Marconi Scientific Instrument Co.	21-25, St. Anne's St., Dean St., London, W.1.
2 J O	Sp., C.W. & R/T	J. W. Whiteside	30, Castle St., Clitheroe, Lincs.	2 M G	C.W. & R/T	C. E. Miller	Ardenne, Bearsden, nr. Glasgow.
2 J P	Sp., C.W. & R/T	M. C. Ellison	Hutton's Ambo Hall, York.	2 M H	R/T	A. Lawton	Brown Edge Vicarage, Stoke-on-Trent.
2 J U	Sp., C.W. & R/T	E. J. Pearcey	610, Fulham Rd., London, S.W.	2 M I	Sp., C.W. & R/T	L. McMichael	Stag Works, Kilburn, N.W.
2 J V	Sp., C.W. & R/T	A. G. Robin	Station Rd., Epping.	2 M K	—	A. W. Hambling	23, Winchester Ave., Brondesbury, N.W.6.
2 J W	C.W. & R/T	J. R. Barratt	Westgate Court, Canterbury.	2 M L	Sp., C.W. & R/T	R. C. Clinker	Bilton, Rugby.
2 J X	C.W. & R/T	L. Vizard	12, Seymour Gardens, Ilford.	2 M M	Sp., T.T., C.W. & R/T	C. C. A. Hines	Watley Twyford, Winchester.
2 J Z	C.W. & R/T	R. D. Spence	Araighead House, Huntly, Aberdeenshire.	2 M O	Sp., C.W. & R/T	Burndept Ltd Exp. Stn.	Chiswick.
2 K A	Sp.	N. Curtis	Belvedere West, Taunton.	2 M R	Sp., C.W. & R/T	R. H. Reece	The Corner House, 62, Addison Gdns., London, W.14.
2 K B	C.W., R/T & T.T.	W. E. Earp	675, Moore Rd., Mapperley, Nottingham.	2 M S	Sp., C.W. & R/T	Ditto	"Baskettas," Birching-ton, Kent.
2 K D	C.W., R/T & T.T.	P. Denison	Saville Park, Halifax.	2 M T	Sp., C.W. & R/T	Marconi Scientific Inst. Co.	Writtle, nr. Chelmsford.
2 K F	C.W. & R/T	J. Partridge	Park Rd., Merton, S.W.19.	2 M V	—	R. Wallis	Denk de Lion, Westgate-on-Sea.
2 K G	Sp., C.W. & R/T	A. E. Hay	Abernant, Aberdare.	2 M Y	C.W. & Sp.	H. M. Hodgson	Clifton House, Hartford, Cheshire.
2 K H	R/T	Ashley W/T Co.	Renshaw St., Liverpool.	2 M Z	Sp., C.W. & R/T	J. Mayall	St. Paul's Rd., Gloucester.
2 K K	—	Hutchinson & Co.	101, Dartmouth Rd., Forest Hill, S.E.23.	2 N A	C.W. & R/T	H. Frost	Longwood, Barr Cmn., Walsall.
2 K L	Sp.	F. Pemberton	50, Peak Hill, Sydenham.				
2 K M	Sp.	C. Stainton	44, Kimberley St., Hull.				
2 K N	C.W. & R/T	A. B. Day	Finchley.				
2 K O	C.W. & R/T	C. S. Baynton	48, Russell Rd., Moseley, Birmingham.				
2 K P	C.W. & R/T	E. Edwards	2, Yewtree Rd., Edgbaston, Birmingham.				

"POPULAR WIRELESS" DIRECTORY OF AMATEUR STATIONS—Continued.

Call Sign.	System.	Name.	Address.	Call Sign.	System.	Name.	Address.
2NB	—	J. W. Barnaby	Broad Rd., Sale, Cheshire.	2QN	Sp., C.W. & R/T	A. Hobday	Northdown Rd., Margate.
2NC	—	J. Goodwin	Crown St., Duffield, Derby.	2QO	R/T	P. Pritchard	Broad St., Hereford.
2ND	—	E. H. Pickford	6, Wilson Rd., Sheffield.	2QP	C.W., R/T & Sp.	L. C. Grant	3, Langhorn St., Newcastle-on-Tyne.
2NH	C.W. & R/T	A. R. C. Sherwood	41, Queen's Gate Gdns., London, S.W.	2QQ	—	Burnham & Co.	Experimental, Wembley.
2NI	—	P. H. Lyne	Dartford & Dist. W/T Assn., London.	2QS	Sp., C.W. & R/T	S. Ward	339, Brixton Rd., London, S.W.9.
2NL	—	F. G. Hughes	129, Well Rd., Bath.	2QT	—	C. C. Barnett	Lower Farm, Nether Compton, Sherborne.
2NM	C.W. & R/T	G. Macuse	Queen's Pk., Caterham, Surrey.	2QU	—	—	Blackheath.
2NN	—	Brig. Gen. Palmer	Epping.	2QV	R/T	Altrincham W/T Soc.	Plane Tree Rd., Hale, Cheshire.
2NO	C.W., T.T. & R/T	H. R. Adams	Crescent Cabinet Works, Walsall.	2QY	—	—	London, N.W.8.
2NP	C.W. & R/T	H. S. Treadwell	Middleton Cheney, Banbury.	2RB	Sp., C.W. & R/T	H. B. Grylls	Carew Rd., Eastbourne.
2NQ	—	Norton	Woodside Rd., Kingston.	2RD	C.W. & R/T	G. W. Fairall	27, Newbridge St., Wolverhampton.
2NR	—	J. Knowles Hassall	Wooden Box, nr. Burton-on-Trent.	2RC	—	E. W. Scammell	147, Solihull Rd., Sparkhill, Birmingham.
2NS	C.W. & R/T	M. Burchill	30, Leighton Road, Southville, Bristol.	2RH	Sp.	H. A. Pound	101, High St., Broadstairs.
2NY	C.W., T.T. & R/T	J. N. C. Bradshaw	Bilsboro, nr. Preston.	2RK	Sp.	A. E. Blackall	7, Maple Rd., Surbiton.
2NZ	C.W., T.T. & R/T	Ditto	Ditto	2RM	C.W. & R/T	D. Cross	3, Norman Rd., Heaton Moor, nr. Stockport.
2OA	—	F. Townsend	46, Grove Lane, Ipswich.	2RP	C.W. & R/T	F. W. Emerson	178, Heaton Moor Rd., Heaton Moor, nr. Stockport.
2OD	C.W. & R/T	E. J. Simmonds	Meadowlea, Queensway, Gerrard's Cross.	2RV	—	A. L. Rawlings	162, Burnt Ash Hill, Lee, S.E.
2OF	Sp., C.W. & R/T	H. C. Trent	Secondary School, Lowestoft.	2RY	—	S. Hanley	Forbury, Kintbury, Berks.
2OG	C.W. & R/T	A. Cooper	16, Wentworth Rd., York.	2RZ	Sp., T.T., C.W. & R/T	Mr. Wood	50, Parker Rd., Winton, Bournemouth.
2OI	C.W., T.T. & R/T	Colin Bain	Newcastle-on-Tyne.	2SD	(Portable)	J. Mayall	Burfield, St. Paul's Rd., Gloucester.
2OM	C.W. & R/T	H. S. Walker	Park Edge, Brentford, Middlesex.	2SF	C.W., T/T & R/T	C. Midworth	4c, Vicarage Mansions, West Green, N.15.
2ON	Sp., C.W. & R/T	Major H. C. Parker	56, Shern Hall St., Walthamstow, E.17.	2SH	C.W., T.T. & R/T	F. L. Hogg	37, Bishops Rd., London, N.6.
2OP	Sp., T.T., C.W. & R/T	G. Courténay Price	8, Landsdown Terr., Cheltenham.	2SI	Sp., C.W., T.T. & R/T	L. C. Holton	112, Conway Rd., London, N.14.
2OT	—	Ilford Radio Soc.	Ilford.	2SK	—	K. G. Styles	52, Jerningham Rd., S.E.14.
2OX	—	J. R. Ratcliffe	Elmden Wate, Green Road, Birmingham.	2SL	—	A. G. Styles	"Kitscot," Maidstone, Kent.
2OY	C.W. & R/T	Capt. E. J. Hobbs	4th Tank Battalion, Wareham.	2SP	C.W. & R/T	L. Mansfield	Ley Hey Park, Marple, Cheshire.
2PA	Sp., C.W. & R/T	C. Z. Auckland & Son	395, St. John St., London, E. C.1.	2ST	—	L. Lambert	46, Clarendon Rd., Holland Park.
2PB	C.W. & R/T	D. E. O. Nicholson	41, Up Kennington Park Rd., Lambeth, S.E.11.	2SX	C.W. & R/T	F. B. Baggs	24, Westhorpe St., London, S.W.15.
2PC	—	A. G. Davies	Redcote Park Rd., Timperley, Cheshire.	2SZ	Sp., C.W. & R/T	W. H. Brown	Mill Hill School, London, N.W.7.
2PF	Sp.	F. Fculger	118, Pepys Rd., S.E.14.	2TA	C.W. & R/T	H. Andrews	8, North Grove, Highgate.
2PG	—	B. Hisketh	High St., Chalvey, Slough.	2TG	C.W. & R/T	Sheffield University	St. George's Sq., Sheffield.
2PI	Sp., C.W. & R/T (Portable)	—	Loughborough College, Leicester.	2TH	C.W. (Portable)	Ditto	Ditto.
2PJ	Sp., C.W. & R/T	—	Do.	2TI	C.W. & R/T	H. Bevan Swift	49, Kingsnead Rd. Tulse Hill, S.W.
2PR	C.W. & R/T	A. E. Whitehead	King's Ride, Camberley, Surrey.	2TL	Sp., C.W. & R/T	E. V. R. Martin	128, Dairy House Rd., Derby.
2PS	C.W. & R/T	J. H. Gill	18, Fourth Av., Sherwood Rise, Notts.	2TN	C.W. & R/T	C. E. Stuart	Polesworth, Tamworth.
2PU	Sp., C.W. & R/T	C. R. W. Chapman	44, Chaplin Rd., Wembley.	2TO	C.W. & R/T	F. Townsend	46, Grove Lane, Ipswich.
2PX	C.W. & R/T	H. H. Lassman	4, Avenue Rd., Barking Rd., E. Ham.	2TP	—	—	Putney, S.W.
2PY	C.W., T.T. & R/T	H. Carter Bowles	51, Gunerstone Rd., W. Kensington.	2TV	—	E. W. Wood	68, Colwyn Rd., Northants.
2PZ	—	A. Symonds	Addison Av., Holland Park.	2TW	(Portable)	Ditto	Ditto.
2QD	—	Ayers	West Barnes Crossing, near Raynes Park.	2TX	—	A. R. C. Johnston	Twyford Ave., Ealing.
2QH	C.W., T.T. & R/T	A. Hewins	42, St. Angushire Ave., Grimsby.	2TZ	C.W. & R/T	E. Jones	Newholm, Hempshall Lane, Offerton, nr. Stockport.
2QI	—	—	Balham.	2UA	C.W. & R/T	J. P. B. Barnes	38, Avenue Rd., Highgate.
2QJ	C.W. & R/T	H. R. Walton	70, Moorfield Rd., Pendleton, Manchester.	2UG	C.W. & R/T	W. Humphreys	103, Portland Rd., Nottingham.
2QK	C.W. & R/T	J. Bever	85, Emm Lane, Bradford.	2UJ	C.W. R/T & T.T.	L. R. Richards	25, Cholmeley Park, Highgate, N.6.
2QL	C.W. & R/T	R. J. Hibberd	Graywood School, Haslemere, Surrey.				

"POPULAR WIRELESS" DIRECTORY OF AMATEUR STATIONS—Continued.

Call Sign.	System.	Name.	Address.	Call Sign.	System.	Name.	Address.
2UM	Sp., C.W. & R/T	H. Lloyd	3, Ventnor Place, Sheffield.	2XD	C.W. & R/T	H. R. Gladwell	London Rd., Abidge, Essex.
2US	C.W. & R/T	W. Soc. of Highgate	11, South Grove, Highgate.	2XF	Sp., C.W. & R/T	E T. Chapman	Abbotsford, Supar-tarie Road, Poole.
2UV	T.T., C.W. & R/T	W. Corsham	104, Harlesden Gdns., London, N.W.10.	2XJ	—	Sheffield Dist. W/T Society	—
2UX	—	A. T. Headley	255, Galton Rd., Bearwood, Birmingham.	2XK	—	Ditto	—
2UY	C.W. & R/T	W. Fenn	Holly Cottage, Polesworth, Tamworth.	2XR	—	—	Poplar.
2VB	—	—	Shooter's Hill.	2XZ	C.W. & R/T	Lewis T. Dixon	4, Heythorp St., Southfields, S.W.18.
2VC	—	A. S. Gosling	63, North Rd., W. Bridgeford, Notts.	2YG	—	Wireless Equipt. Co. Ltd.	Charing Cross Rd., W.
2VD	C.N. & R/T	Capt. E. L. Crowe	Juniper Rough, Har-drew, nr. Canterbury.	2YH	—	Duveen	Marble Arch, W.1.
2VF	C.W. & R/T	H. A. Blackwell	Whyto House, Bis-pham, Blackpool.	2YJ	R/T	Wireless Equipt. Ltd.	90, Charing Cross Rd., London.
2VI	—	Curtis	Tower Hall Lane, Walsall.	2YQ	—	W. P. Wilson	Christ Church Vicarage S. Norwood.
2VM	C.W. & R/T	J. Lipowsky	614, Old Ford Rd., Bow, E.	2YR	—	W. Pike	Hounslow W. Soc., Council H., Hounslow
2VN	C.W. & R/T	H. Orury-Lavin	Old House, Sonning, Berks.	2YV	—	G. M. Whitehouse	Allport House, Can-nock, Staffs.
2VP	—	P. G. A. H. Voigt	121, Honor Park, S.E. 23.	2ZC	—	General Radio Co.	Acton Lane, Harlesden, N.W.10.
2VQ	C.W. & R/T	H. Old	St. Judas Ave., Maper-ley, Nottingham.	2ZD	—	A. Woodcock	1, Montague Rd., Handsworth, Bir'm.
2VS	—	—	Beulah Hill, W. Nor-wood.	2ZK	C.W. & R/T	W. L. Turner	Purley Cald, nr. Bir-kenhead.
2VT	—	—	Ditto.	2ZZ	—	Fellows Magneto Co.	Cricklewood.
2VW	C.W. & R/T	E. H. Robinson	125c, Adelaide Rd., N.W.3.	5AJ	—	W. C. Barradough	61, Bridge St., Man-chester.
2WB	Sp., T.T. & C.W.	George W. Jones	8, Rosebery St., Wol-verhampton.	5AT	C.W. & R/T	The Dubilier Con-denser Co., Ltd.	Shepherd's Bush, Lon-don, W.
2WD	C.W. & R/T	C. W. Clarabut	Beechcroft, Beverley Crescent, Bedford.	5AZ	Sp., C.W. & R/T	F. Charnley	43, Reeds Avenue, Blackpool
2WM	Sp., C.W. & R/T	J. W. Pallett	24, Glenfield Rd., Leicester.	5BA	R/T	Capt. Stevens	Newcastle.
2WN	—	A. H. Wilson	67, Broad St., Hanley, Stoke-on-Trent.	5BH	Sp., C.W. & R/T	A. V. Simpson	28, Westgate, Burnley.
2WQ	C.W. & R/T	C. H. Gardener	Denmark Hill, London.	5BL	—	Mrs. Vick	Gresham Rd., Hall Green, Birmingham.
2WR	—	L. Burcham	Cheshunt Ave., Oulton Broad, Lowestoft.	5BV	R/T	Ryan	66, Home Park Rd., Wimbledon Park, S.W.
2XB	Sp., T.T. C.W. & R/T	A. T. Crancher	35, Douglas Rd., High-bury.	5CP	—	Fellows Magneto Co.	Ealing.
				BXH	—	Capt. C. H. Bailey	Cricklewell, Aber-gavenny.
				KCLX	Sp.	Prof. Wilson	University of London, King's Col., London.

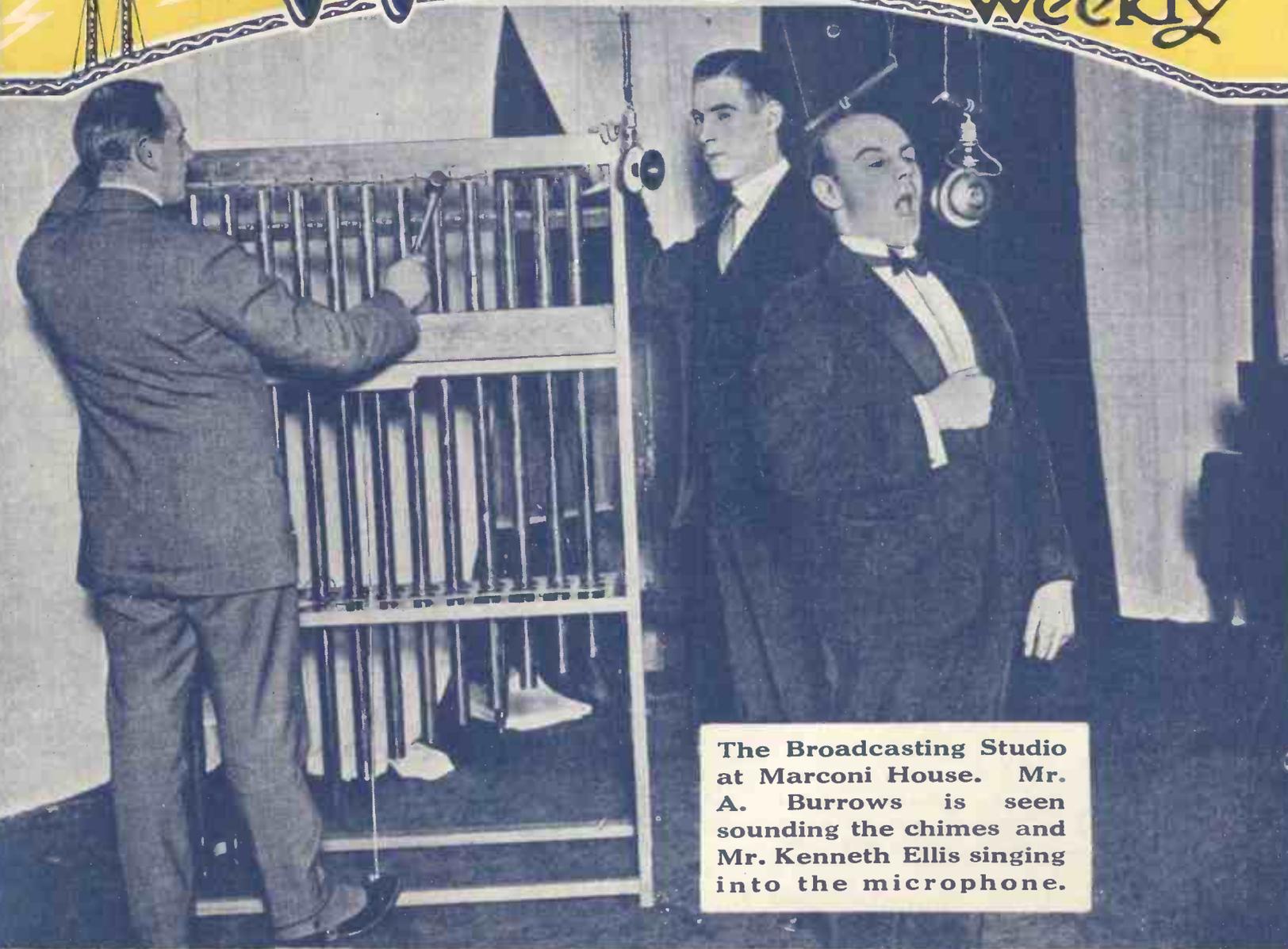
NOTE.—The above space is left for readers to fill in with details of other stations as they come to hand. Amateurs work chiefly on 180 metres nowadays, though some may be heard on 400 metres.

A FOUR-PAGE BEGINNERS' SUPPLEMENT (PART 2).

POPULAR WIRELESS Weekly

3d

No. 35, Vol. 2.
Jan. 27, 1923.



The Broadcasting Studio at Marconi House. Mr. A. Burrows is seen sounding the chimes and Mr. Kenneth Ellis singing into the microphone.

FEATURES IN THIS ISSUE.

How to Make an L.F. Panel.

What is Inductance and Capacity?

The Melody Man at 2 L O.

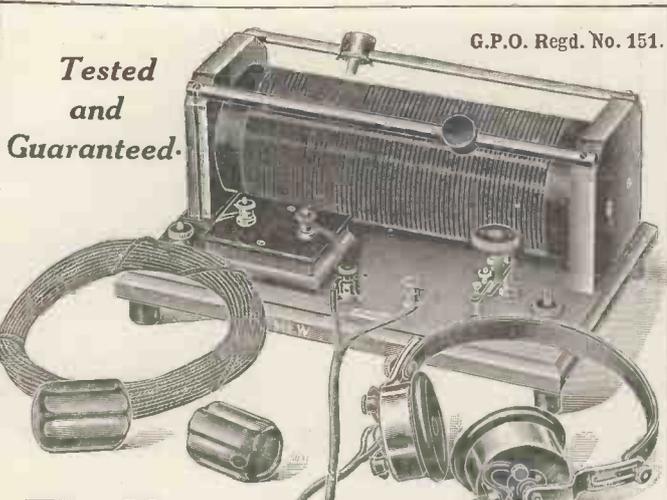
A Home-made Variometer

And Articles by William Le Queux and E. Blake.

Special Interview with Senatore Marconi.

G.P.O. Regd. No. 151.

Tested and Guaranteed.



The No. 1 HOME WIRELESS SET
FOR
LONDON, BIRMINGHAM, & MANCHESTER

PRICE **£4 : 10 : 0** including B.B.C. Royalty.

COMPLETE WITH AERIAL WIRE, INSULATORS, ONE PAIR OF MITCHELL 'PHONES, and BOOK OF INSTRUCTIONS for use.

MITCHELLS ELECTRICAL AND WIRELESS Ltd., 188, Rye Lane, Peckham, S.E.15

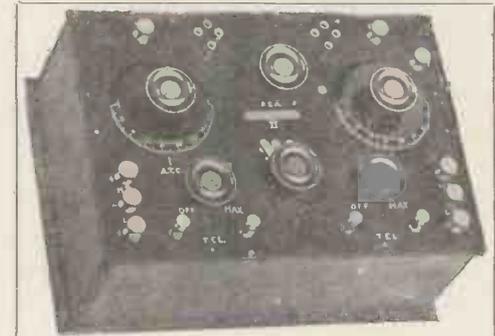
SHOWROOMS at No. 2, Gerrard Place, London, W.1. (Next to Shaftesbury Theatre).

DO YOU WANT TO HEAR
THE LONDON BROADCASTING STATION
in **PENZANCE** or **GLASGOW** ?

THE

G.P.O. Reg. **"HESTAVOX II"** No. 2049.

WILL ENABLE YOU TO DO SO.



This instrument, the result of many weeks of experimental work, complies with all the requirements of a Broadcast Licence. It will, under favourable conditions, receive ALL BRITISH BROADCASTING, and by the addition of L.F. Amplifiers (Hestia Unit II), signal strength may be increased as required.

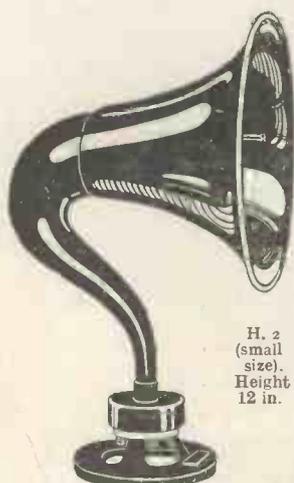
PRICE—Receiver only **£12 : 7 : 6** (including all Royalties)

AGENTS. J. P. PARRY, 68, George St., Oldham, Lancs.
BARDENS, Ltd., 62, Sizewell Rd., Leiston, Suffolk.

WRITE FOR AGENCY TERMS AND CATALOGUES.

The "HESTIA" ENGINEERING COMPANY, Showrooms open
32, PALMERSTON ROAD, 9 a.m. — 6 p.m.
1 min. South Acton Stn. ACTON, LONDON, W.3. Telephone :
(N.L. and District Rlys.) Chiswick 586

The "BROWN" LOUD SPEAKERS



with new improved Curved Horns

THE requisites of a Loud Speaker are pure tone, clear articulation, and good volume of sound. The BROWN Loud Speaker possesses all these qualities in a marked degree. Type H. 2 has been designed to meet home requirements, both as to volume of sound and price.

PRICES

- H. 2 (Small), Low Resistance. 120 ohms, height 12 in. **£3 0 0**
 - H. 1 (Large), Low Resistance. 120 ohms, height 21 in. **£6 5 0**
- High Resistances for either size, 2/6 to 5/- extra.

THE BROWN MICROPHONE AMPLIFIER.

This amplifier gives a magnification much greater than that obtained from a two-valve amplifier

Prices
Low Resistance (120 ohms input) **£6 0 0**
High Resistance (2,000 ohms input) **£6 2 6**
Obtainable from All Wireless Dealers.

Sole Manufacturers :

S. G. BROWN, Ltd.,

London Showrooms (Retail only):

19, MORTIMER STREET, LONDON, W.1.
Head Office and Works (Trade Only), Victoria Road, North Acton, W.3.

HULLO!!! C.Q.
WILL DAY CALLING
TO ANNOUNCE SOME RARE BARGAINS.

BRITISH MADE HEAD PHONES,
150 ohms **18/6** per pair

SPLENDID QUALITY BRITISH MADE HEAD PHONES, 4,000 ohms **26/-** per pair

BEST FRENCH HEAD PHONES, REAL SOLID COMFORT, 4,000 ohms **21/-** per pair

BEST FRENCH HEAD PHONES, 8,000 ohms **27/6** per pair

Single Head Phones with cord, 150 ohms **6/-** each

100 feet 7 Stranded Copper Aerial Wire **2/6** per coil

Trench Buzzer Sets, complete with Morse Tapping Key and Head Phone **10/6** each, postage 1/6

Best Quality Filament Resistance **2/9** each, postage 3d.

3-Way Coil Stand for Panel Mounting **15/-** each, postage 6d.

Insulated Sleeving, all colours, 1 1/2 mm. **5d.** per yard

Brass Terminals with Nut and Washer **1/6** doz.

Bobbin Type Insulators **1/-** doz., postage 9d.

Porcelain Shell Type Insulators, **5d.** each.

Sheet Ebonite, Grade A, cut to any size.

Every Requisite in Stock for Wireless. **TRADE SUPPLIED.**

These are only a few of our bargains. Do not fail to send for our Price List giving the lowest prices for the best quality goods. Postage on all goods extra.

Write for our new January Catalogue, now ready.

We always Stock the Famous **HERTZITE CRYSTAL** at 2/6 each, or mounted in Brass Cup 2/10, Postage 3d. extra.

WILL DAY, LTD.,
19, Lisle St., Leicester Sq., London, W.C.2.
Phone : Regent 4577. Telegrams : Titles, Westrand, London.

NEXT WEEK.
ANOTHER FOUR-PAGE
INSTALMENT OF THE
BEGINNERS' SUPPLE-
MENT.

Containing another popular article explaining Wireless in a simple manner, and numerous valuable suggestions for the beginner who wishes to instal a set.
FOUR EXTRA PAGES.
 Tell your friends about this Supplement.

Popular Wireless

TOPICAL NEWS AND NOTES.

NEXT WEEK.
A PAGE OF IDEAS
FOR AMATEURS.

TELEPHONY FROM
NEW YORK.
 An Account of the Recent Tests.

CONSTRUCTIONAL
HINTS
FOR AMATEURS.
 And Many other Articles of General Interest to Wireless Amateurs.

The End of a Perfect —

THE conclusion of the Covent Garden Opera Season last Saturday must have been noted by all listeners in with real regret, for it is seldom the man in the street has the opportunity of hearing such a feast of fine vocal and instrumental music. I can hear some of my readers saying "What about the gramophone?" Yes, but you never get atmosphere on a gramophone; you never hear the clapping; the orchestra tuning; you don't get the sensation of listening to real opera played as you listen. There's a big difference.

A Critic's Impressions.

THE Music Critic of the "Times" listened in the other day, and the following is an extract from an article he wrote in the "Times" describing his experiences:

"Act III. was unbroken; we heard everything, from the applause which greeted Mr. Goossens on coming to the conductor's desk to the Australian coo-ee's from the gallery bestowed on Mmc. Austral at the end. Indeed, the process of listening-in Act III. was entirely different from that in Act II., partly, no doubt, because one's ear had taken the measure of things, but more because the transmission had been marvelously improved. The first bars of the orchestral prelude proved it. The themes of Wotan and Erda surging through the orchestra were not only themselves; they had their proper relation to one another. One no longer caught at this or that fragment; the strings began to speak with their own vibrant quality. Soft passages, particularly the high violin notes and the harp in the Awakening scene, sounded exquisite."

Look Out C Q!

I HEARD from a friend the other day that the wireless clique in his neighbourhood had been cast into an unseemly panic by the unexpected tour of the district by a G.P.O. Wireless Inspector. All houses with aeriels were visited and sets examined. And B.B.C. sets without the stamp were promptly sealed up! Look out, you great Unlicensed!

Empire Wireless Scheme.

MR. NEVILLE CHAMBERLAIN, the Postmaster-General, in reply to a deputation last week from the Empire Press Union on the subject of an Empire wireless system, said that the Government were reconsidering the policy of the late Government as to the method by which a wireless station should be installed in this country and operated.

They were fully alive to the necessity of cheap and abundant wireless communication within the Empire. The cost of the station was a matter for serious consideration. Another important point was the technical one of the type of the station. The art and science of wireless telegraphy was still in its infancy. But he did not think the decision of the Government would be long delayed.

7,500 Miles by Radio.

A GROUP of medium power wireless stations employing valve transmitters has been erected by Marconi's Wireless Telegraph Company, Ltd., at North Weald, near Ongar, Essex, for the purpose of conducting commercial wireless services with France, Switzerland, and Spain.

These stations have been brought to a high state of efficiency, and for some months one of them, although only designed for European communication, has been carrying on a Transatlantic service to Canada.

One of the other stations (G L O) which is used for communication with Madrid, a distance of about 720 miles, can be heard at Bandoeng, Java, 7,500 miles distant. This fact is reported by the chief of the Bandoeng Radio Department, whose interest was aroused in the Marconi high-speed services from Ongar by a magazine article. He set out to see if he could hear the signals trans-

mitted by these stations, and was successful in receiving the signals from G L O with a two-valve set and an aerial only 45 feet in length and 15 feet above the earth. He reports that signals are audible almost every night in spite of the strong atmospheric disturbances which are common in Java at this season.

Sir Landon Ronald.

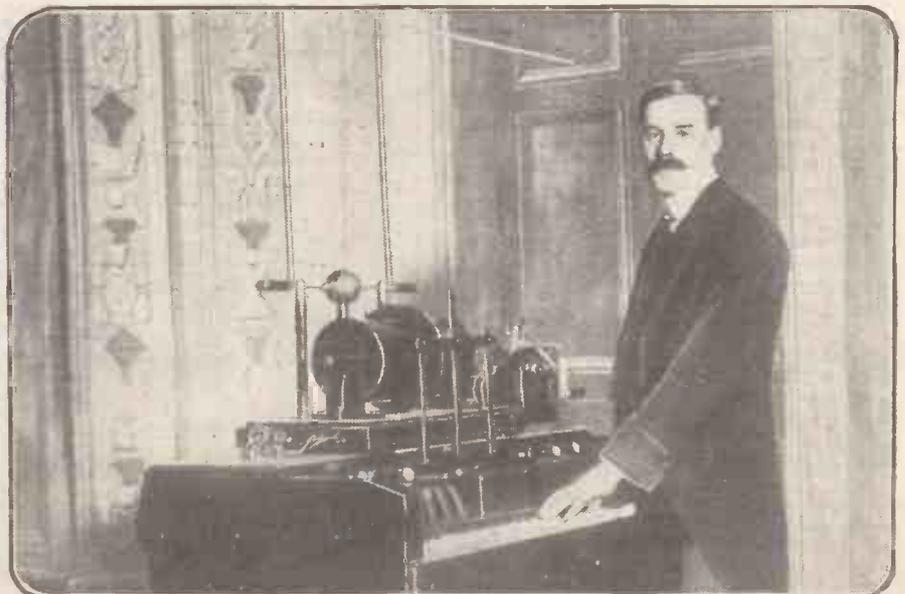
OWING to Sir Landon Ronald's sudden illness it was not possible to include a promised article on his opinions of wireless opera in this number of POPULAR WIRELESS. I trust, however, that Sir Landon will enjoy a speedy recovery. The article will appear in this paper in due course.

Broadcasting in Norway.

LISTENERS-IN may soon be looking out for concerts broadcast from Norway. I hear application has been made by a Norwegian Wireless Company to the Christiania Government for a concession to erect and exploit broadcasting stations in that country.

Duke of York's Wireless Set.

AN ex-Air Force mechanic has presented a complete wireless receiving set to the Duke of York, who has accepted it. The set was entirely made by the ex-Service man. It employs a frame aerial, and is suitably constructed for use in a flat.



Major Raymond Phillips and his apparatus for playing a piano by wireless. Major Phillips recently gave a successful week's demonstration of his wireless controlled air-ship at the Albambra Music Hall.

NOTES AND NEWS.

(Continued from previous page.)

Speech from America.

SPEECHES specially transmitted by wireless telephone from New York by Mr. Thayer, President of the American Telegraph and Telephone Company, and others, were clearly heard at the New Southgate works of the Western Electric Company, the other morning, by a party of about fifty persons, including Senator Marconi, a number of representative engineers, and representatives of the Government.

A full account of this interesting experiment will appear in a subsequent issue of POPULAR WIRELESS.

Gift to Melba.

HOW much the broadcasting of opera has been appreciated was shown on the last night of the Covent Garden Opera Season. On that occasion, Dame Nellie Melba was presented with a huge bouquet, representing a house, complete with "birds flitting over the roof" and an aerial erected among the chimney-pots. It was labelled, "From your unseen listeners-in."



Mr. Arthur Burrows reading a news bulletin at the London Broadcasting Station.

The Melba Fund.

A MELBA Fund was opened by wireless on the last opera night. Listeners-in, who have enjoyed the broadcast opera, are asked to contribute to this fund, which Dame Nellie Melba will be responsible for. She undertakes to see that the proceeds of the fund will be devoted to the cause of British Opera. All contributions should be sent to "The Melba Fund," c.o. The British Broadcasting Co., Magnet House, Kingsway, London.

Taxi Wireless.

A TAXICAB fitted with an aerial and listening-in set complete is plying for hire at Nottingham. It is owned by Mr. Frank Lees, who is an enthusiast in scientific research, and he has fitted the cab up so that patrons can enjoy broadcasting.

The aerial is only two feet high, and an old cycle chain is fitted for earthing.

"George's Turn."

I EXPECT that there were many thousands of listeners-in disappointed at the alteration in time of George Robey's "turn" from 2 LO last Saturday. Owing to a pressing engagement, "George" turned up at Marconi House at five minutes to six and expressed an urgent desire to rush his "turn" through. It would have been kinder to have given notice of his inability to perform on that occasion and postponed the event to some future date.

A Rush for Radio.

THE extraordinary success in broadcasting Covent Garden opera has resulted in a wireless "boom."

There has been a rush for broadcasting licences in the provinces by those who heard Dame Nellie Melba as Mimi in "La Bohème" on the long-distance wireless sets of friends.

"In December we received 6,000 applications for licences," said a Post Office official to a Press man the other day. "This month's figures are expected to double those of the last two months."

The rapidly spreading interest is also

shown by the large sales this week of valve sets capable of receiving on a very much longer range than the crystal sets.

"People have been astounded by the success of broadcasting opera," said an official of the British Broadcasting Company. "We have proof that the opera was heard distinctly in Madrid and in Denmark, Sweden, Belgium, Holland, and distant parts of Scotland."

Trouble at 5 NO.

THE other night a breakdown occurred at the Newcastle Broadcasting Station in West Blandford Street. The trouble was due to the bursting of a water-pipe "sprinkler" flooding the premises. The fault was quickly rectified, and speeches and music were successfully broadcast at 9.50 p.m. as a test.

2 LO's Generator.

BY the way, 2 LO should take notice that his generator noise has returned. It is hardly audible on a loud speaker, but "on 'phones" it is very noticeable. I was asked by a "new amateur" the other evening why I allowed my house to be provided with A.C. lighting current, but the point is that I do not. 2 LO must smooth that "noise" out. **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.
Marconi House, London, Broadcasting Station	2 LO	369	Usually every evening, 5 to 5.45 p.m.; 7 and 9.30 News; 7.15 Orchestra; 8.25 to 10.30 Music.
Newcastle Broadcasting Station	5 NO	400	6.10 p.m. (approx)
Manchester Broadcasting Station	2 ZY	385	Every evening, usually from 4.30 to 10 p.m.
Birmingham (Witton) Broadcasting Station	5 IT	425	Every evening, usually from 6.30 to 10 p.m. (News, Concerts, etc.)
Croydon	GED	900	Throughout day to aeroplanes.
Writtle, Essex	2 MT	400	Tuesdays, 8 p.m. (Concert.)
Paris	FL	2,600	11.15 a.m. Weather report; 6.20-7 p.m. Weather report and Concert; 10.10 Weather report.
Königswusterhausen	LP	2,800	Between 6 and 7 a.m., between 11 and 12.30, and between 4 and 5.30 p.m.
The Hague	PCGG	1,085	Sundays, 3 to 5 p.m. (Concert.)
Haren	OPVH	900	Practically every 20 minutes past each hour from 11.20 to 4.20; giving messages to aeroplane on the Brussels-Paris, Brussels-London, and Brussels-Amsterdam lines.
Radio-Electrique, Paris	—	1,565	5.5 p.m. News Items; 5.15 to 6.10 Concert; 8.45 p.m. News Items; 9 to 10 p.m. Concert.

Note.—See announcements in daily Press for last minute alterations in times of Broadcasting Programmes.

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

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

All times given are G.M.T.

BROADCASTING IN THE HOME.

A Special Interview with Senatore Marconi granted to a representative of "Popular Wireless" in which the great inventor expresses his opinion on the Future of Broadcasting in the Home.

NOW that broadcasting is so firmly established, and wireless sets are to be seen in so many homes all over the country, it is extremely interesting to have the views on this subject of such a distinguished scientist as Senatore Marconi.

POPULAR WIRELESS was particularly fortunate in obtaining a special interview with Senatore Marconi, and his opinions on the future of broadcast reception in the home will be of utmost interest to our readers.

The great inventor is a tall, dark, well-built man who appears to be ever searching into the future, trying to pierce farther and farther into the depths of the unknown.

A New Interest in Life.

His face is that of a great dreamer, but a practical dreamer whose mind is ever active in conceiving plans whereby his visions may be materialised.

He speaks slowly and distinctly, weighing each word carefully before he utters it. His whole demeanour, indeed, suggests the popular conception of him, as of one who has stepped paces in front of the general line of progress of his time, who thinks in the future, and who has that grasp of practical possibilities that enables him to bring his dreams to earth.

Senatore Marconi has no doubt in his mind that broadcasting has come to stay. In giving his ideas on the position of wireless telephony in the home, he said:

"I believe that in the future most homes will have their receiving sets, and the reception of broadcasting will form a part of their daily life. It will be a great attraction, and will provide an added source of interest to life."

He believes that the educational side of this new application of his invention has immense possibilities. As ever, his mind is searching deeply into the future, and is able to conceive developments in the science of wireless telephony which are far beyond the imagination of the mere listener-in.

A Closer Bond.

Senatore Marconi hopes that the interest of thousands will be stimulated by the advent of broadcast telephony, and that it will give rise to a really scientific interest in the minds of many who at present are content with just the bare accomplished facts, without any desire to probe further in the subject, or to fully realise all the mysteries that lie behind those coils and condensers that make up their apparatus.

In expressing this hope, Senatore Marconi said:

"Another great possibility that may arise from the inception of broadcasting in the homes of the country is that it will have the effect of interesting a great many more people in the study of electricity and the science of wave motion."

Returning to the more material and general side of the subject, he pointed out that, with the added source of interest

and amusement into the home life of the people, by means of wireless telephony, there would be created a closer bond between the members of families.

Effect on Youth.

"I think another effect which may be of great value," Senatore Marconi continued, "and, I believe, has been found so in many cases, will be that the fascination of wireless telephony reception, added to the interest in hearing the musical programme, and, of course, the news, will help a great deal in keeping the young folk at home during the evenings. I believe



Senatore Marconi.

it will prove a great advantage in that respect, as the younger members of the families will be able to have the music and entertainment they desire without having to go out to places of amusement for it.

"Easing the Crush."

"For dance purposes, broadcasting has great scope, and many homes far from a large town, may thus enjoy a really good jazz band, which would, of course, be impossible otherwise, unless special journeys to the large cities were made. Really good bands are, naturally, few, and these are only to be found in the leading cities of a country."

But while we have been enjoying the concerts and news, and now lately the opera, transmitted from the broadcasting stations, Senatore Marconi has been pushing on with a view to still further harnessing the ether to the service of mankind.

Much as has been accomplished by wireless in the way of providing safety for vessels at sea, and lately for aircraft, Senatore Marconi has been conducting experiments in another field of research. He has decided that the ether is getting congested, and that shorter wave-lengths could be employed to "ease the crush," as it were. In doing this, it has been found that short-wave wireless has wonderful directional properties. Owing to these

properties it will be extremely useful for guiding ships and aircraft.

Giving his view on the matter, Senatore Marconi said:

"With regard to the short-wave tests that have been carried out, I think that the very short waves will be mainly useful in directional wireless. They will provide a great help in the future to ships in narrow waterways, coming round rocky coasts, and passing up tortuous channels; and, of course, in fogs.

Use of Short Waves.

"This fact was pointed out very clearly during tests conducted at Inchkeith, when using a wave-length of a very few metres—about three or four only. Of course, the shortness of the wave-length limits the range over which the waves will carry; but for navigation purposes ships only require these directional bearings when nearing the shore. At sea they can have the longer range wireless reception, but for navigating vessels through straits, narrow passages, and round rocky coasts, during fog and at night, the short wave will prove exceedingly useful."

During the course of the interview Senatore Marconi was asked his opinion on the value of the recent tests between amateur stations in England and America. He expressed the view that these tests had undoubtedly succeeded in proving that such communication by means of telephony or low-power C.W. telegraphy was possible.

"But," he added, "it would be impossible to hold a regular service on such waves over that distance."

"You do not think these tests have any likelihood of heralding the end of the high-power station?" he was asked.

"Oh, no!" he exclaimed. "It was known twenty years ago that short waves would travel that distance, but only on certain nights and during certain conditions. In the day-time, and especially in summer, there is a great deal of absorption, and regular services on this wave-length would be impracticable. I do not think that the high-power stations will be replaced by short-wave stations."

At the conclusion of the conversation, Senatore Marconi discussed the present broadcasting. He said that he thought the hours of transmission might be arranged somewhat differently.

"Personally, I always have to miss the eight to nine o'clock portion of the concert, and I expect a good many people dining at that hour do the same.

"I should think that if transmission took place during the periods between seven and eight o'clock and between nine and eleven, it would be suitable for everyone, and those who could not listen in between eight o'clock and nine would not have to miss any of the concert.

"Of course, the bed-time stories for the children would have to be sent early, but I am thinking of the evening concerts."

WHAT IS INDUCTANCE AND CAPACITY?

By GEORGE SUTTON, A.M.I.E.E.

THERE is perhaps no more perplexing problem confronting the new wireless amateur than understanding the proper relation between the inductance and capacity in his receiving set. Even before he has "tuned in" his first signals, the trouble may have become acute, for he is quite likely to put more store on the acquisition of a variable condenser than the necessities of the occasion warrant.

We will assume that the amateur has in contemplation the construction of a crystal set, with a sliding contact on his inductance coil, that is, a coil not brought out by tappings on to a stud switch. He is more fortunate still if he can get a "variometer" type of tuner.

Every text-book which he reads will tell him that to receive signals he must have both inductance and capacity in his set. The inductance he believes that he has, as a characteristic of his tuning inductance coil, so-called, and he feels that he ought to have some tangible form of capacity.

It is true that you cannot tune in without capacity in the circuit, but it is also true that even a straight wire has capacity, and if the wire is wound on a tube, or in any other coil form, it has self-capacity as inevitably as a moving train has noise. Properly applied, the self-capacity of the inductance coil is quite sufficient to enable one to tune in perfectly—indeed, it is safer to trust to this self-capacity than to introduce external capacity unless you know pretty well what you are doing.

A Useful Analogy.

The writer has, time and time again, in investigating causes of failure to receive signals, found it due to excessive capacity. Generally, a large variable condenser is inserted in the aerial lead. It is rarely that three movable plates and four fixed ones of ordinary wireless size do not provide ample capacity as a series condenser in the aerial circuit.

A larger condenser than this may easily impose a greater capacity, even in its minimum position, than that most suitable to the needs of the circuit. If you cannot "tune in" by operating the series condenser in the aerial circuit you are better off without it.

We will now invoke the aid of a simile to illustrate the combination of inductance and capacity, but we must warn our readers that even this simile must not be taken too far in its application. Most of us are familiar with the toy whistle which changes its note with the pushing up and down inside its barrel of a piston, and some resemblance of a tune can be produced from it by the skilful.

Let this whistle represent an aerial tuning circuit. We desire the note the whistle emits to match a note which we can hear. If we have a long thin whistle we shall get a shrill note, but if we have a short squat one, we may get a note of the same pitch, but a very different quality, produced by our blowing.

Now consider the length of our whistle pipe to correspond to the inductance of our tuner, and the diameter to correspond with its capacity. We see that, within limits, a big inductance and small capacity will tune to the same note as small inductance and a bigger capacity. You cannot make a whistle so thin that there is nowhere for the plunger to go, and you cannot have an inductance so constructed that it has no self-capacity. So also you cannot make the diameter of your whistle too great, or it will not whistle, and you cannot tune in on capacity alone, you must have inductance.

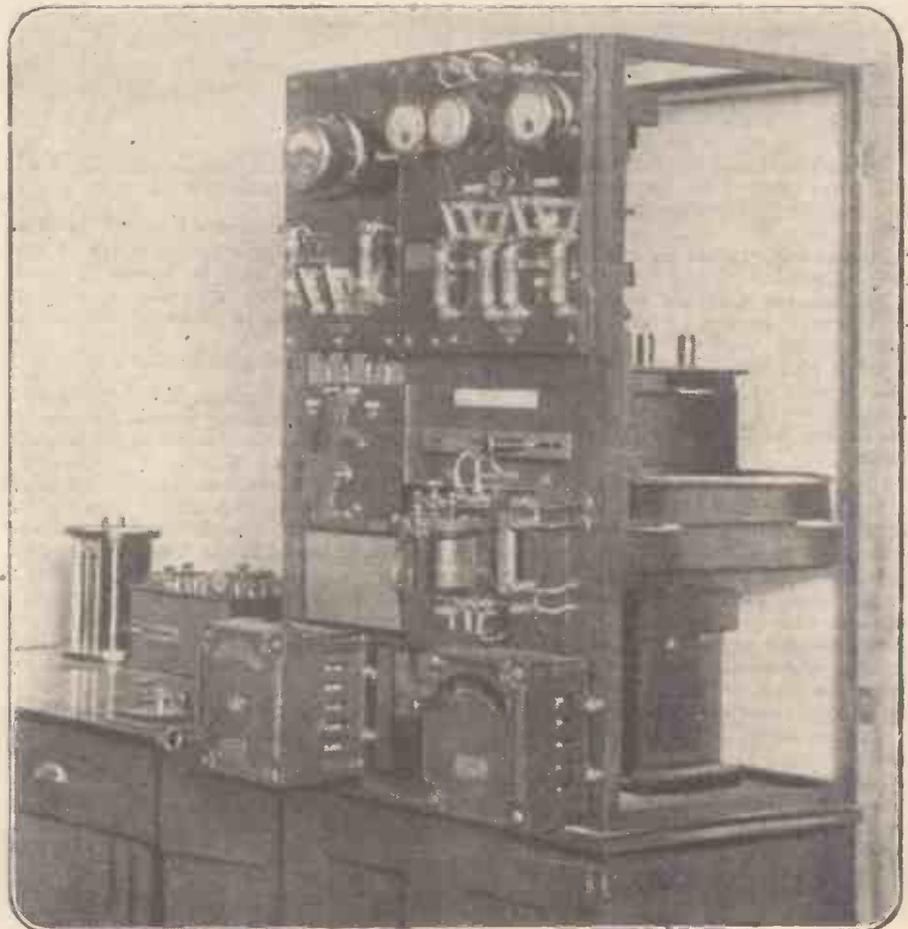
Adjustment Between Tappings.

It is found that generally no added capacity is necessary, if the increments of length of wire on the tuning coil are short enough—that is, if we can pick up separate turns along our coil; but if we tap at, we will say, intervals of ten turns, we shall have to use a small capacity to tune-in between the increments and make them gradually variable. Thus, if we have tapped out 10, 20, 30, 40, or 50 turns, and our set tuned best with 43 turns, we should have to get on to the 40 turn stud and add a little capacity for sharp-tuning.

We have warned the reader against applying the simile of the piston whistle too literally, but it is hoped that it will enable the non-technical man to understand something of the method of combining the properties of inductance and capacity which his tuning coil possesses. Remembering that his coil and his aerial already possess capacity sufficient for most purposes of tuning, on short wave-lengths at least, he will perhaps be more careful as to adding a large condenser and drowning out some of his chances of success.

Series or Parallel?

Before leaving the subject, we may perhaps be permitted to point out, that in adding capacity for short-wave tuning, the small series condenser, when used, enables the experimenter to tune in with the maximum amount of wire on his inductance coil, and gives him a more ample margin on received power than will a condenser connected in parallel on his coil, and this he can easily prove for himself by experiment. A series condenser improves signal strength on wave-lengths up to about 400 metres, but above this a parallel condenser is better to use.



A modern 1/2 kw. Marconi set fitted in a cargo ship. The crystal detector is seen on the left of the transmitting panel.

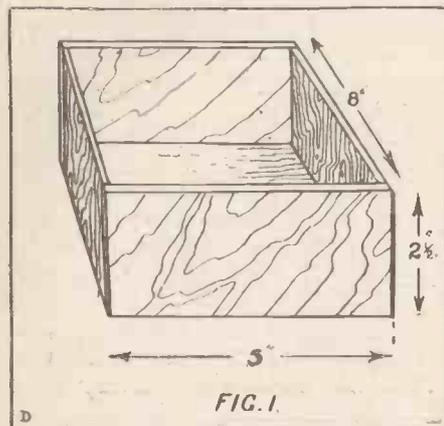
HOW TO MAKE AN L.F. PANEL.

This is the third article by a well-known Radio Expert describing the construction of Receiving Units. Amateurs will find little difficulty in following out Mr. Hersey's instructions.

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

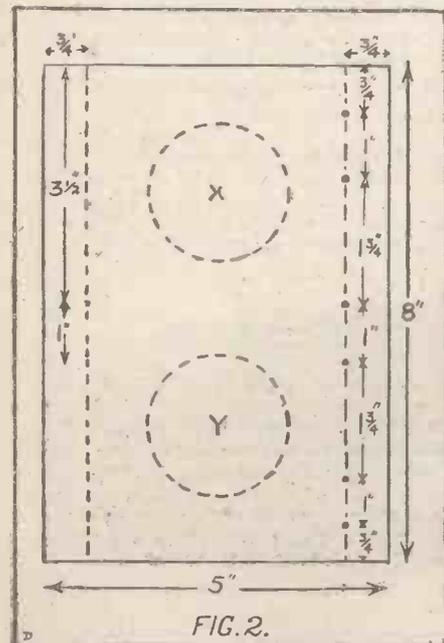
THERE are doubtless many readers desirous of increasing the strength or volume of their signals in order that more persons may listen-in, or to render signals audible over a room. It is intended here to give some constructional data for the building of a low-frequency or note-magnifier panel.

This piece of apparatus is offered as a companion to the two panels previously described in POPULAR WIRELESS, thus forming an ideal combination of valves for all purposes, i.e., one tuned high frequency, one detector, one note magnifier. The note magnifier should particularly appeal



to the possessor of a modest crystal receiver and prove a valuable asset, increasing the power of signals heard some four or five times.

A base for the ebonite panel should first be made up in the same manner as with previous panels, the dimensions being 8 inches \times 5 inches \times 2½ inches, Fig. 1.



A piece of ebonite 8 inches \times 5 inches \times ¼-inch is now purchased and marked out as in Fig. 2, the eight holes around the edges are for the terminals, and the letters X and Y denote the positions for the valve holder and filament resistance. In all eight terminals will be required, the holes for these depending upon the size of terminals purchased.

The Interval Transformer.

The valve holder should now be mounted in the position X, according to the particular method of mounting called for, i.e., either screwed to base by means of nuts provided on the socket pins, or by separate screws and nuts through the holes already drilled in the valve holder flange.

The space Y is to be taken up by the filament resistance; this again will have to be mounted according to the requirements of the resistance. Some very good resistances for panel mounting can now be purchased for less than 3s., and require only two small holes for screws to be drilled as a means of attaching to the panel. The terminals should now be screwed in their positions.

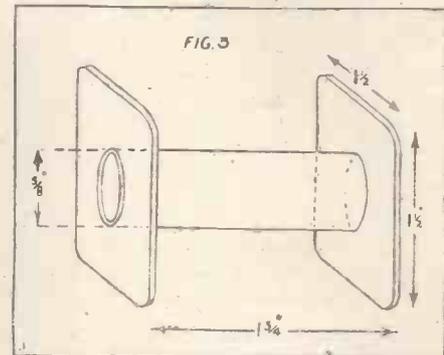
We now require an inter-valve transformer (low frequency). This will prove the most expensive item, costing from 19s. 6d. upwards, if purchased. To the reader who would like to make this component himself the following instructions will be of great value.

A former in which to wind the primary and secondary should be made up from vulcanised fibre, as in Fig. 3. The flanges at each end can be secured to the centre cylinder by means of liquid celluloid. For the primary winding a small quantity (approx. 1½ ozs.) of No. 38 S.C.C. or 38 D.S.C. wire will be required. This is wound on as evenly as possible, and should be waxed occasionally until the winding reaches a depth of ¼-inch.

The ends of the primary winding should be brought out through two small holes pierced through one of the flanges. These ends should be of well-covered flex, preferably rubber-covered, and labelled I.P. for inside primary, O.P. for outside primary. This winding should now be wrapped with two thicknesses of well waxed notepaper.

The secondary winding can now be commenced. The inside end should be taken through the flange and noted or labelled I.S., this winding to consist (approx. 1 oz.) of No. 47 S.C.C. wire wound to a depth of ⅜-inch. The outside end should be taken through the flange and labelled O.S. The wire should now be well bound with waxed tape for protection.

A small quantity of about No. 26, or 28 S.W.G. soft annealed iron wire is now required. This should be cut into lengths of about 4½ inches. These are passed through the centre of the transformer until the space is nicely filled. The ends should now be bent over the flanges in two



bunches, see Fig. 4, and bound down to the waxed tape over the secondary winding by a further length of tape well waxed.

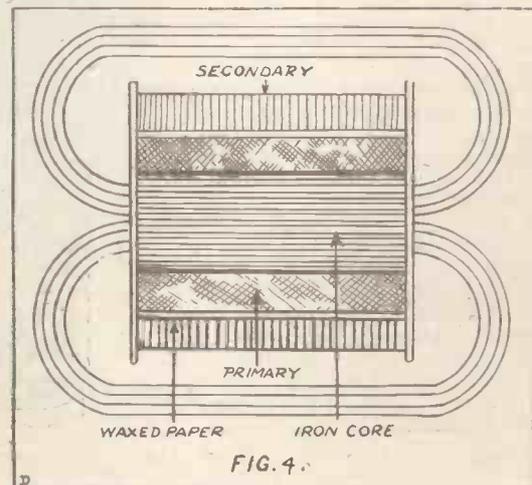
The transformer so built will be found extremely efficient; its primary consists of about 3,000 turns; resistance, approximately 250 ohms; its secondary 15,000 turns; resistance, approximately 9,000 ohms, and the ratio 1 to 5 step up. If the reader should purchase an inter-valve transformer he should see that the leads are labelled as to their respective ends.

The "By-pass" Condenser.

The transformer should now be screwed or clamped with fibre to the woodwork of the panel base at the top end to come under the valve holder, care being taken to see that room is left when the ebonite is in position for soldering leads to valve holder.

A small by-pass condenser is now required; this should be constructed in exactly the same manner as the grid condenser described in POPULAR WIRELESS, No. 26, page 569, Figs. 3 and 4. This condenser is to be placed across the primary winding of the transformer, its function being to provide an easy path for high frequency currents set up in the plate circuit. These would otherwise have difficulty in passing through the primary winding, owing to the impedance of the latter.

This effect is most pronounced on short wave-lengths; the condenser when assembled. (Continued on next page.)



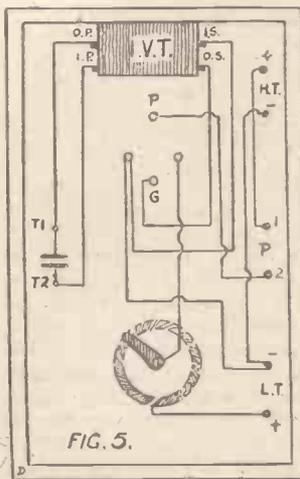
HOW TO MAKE AN L.F. PANEL.

(Continued from previous page.)

bled should be screwed or clamped by a strip of fibre against the left-hand side of the panel base, so as to come under the terminals lettered T1 and T2. The panel is now ready for wiring; the lettering will be followed from Fig. 5. A lead is soldered from L.T. + to filament resistance, and from the centre of the latter to right-hand filament leg of valve holder, from L.T. - a lead is soldered to left-hand filament leg of valve holder, completing the filament circuit.

Wiring Up.

The terminals H.T. - and L.T. - should next be connected together by a short lead. A lead is taken from H.T. + to the terminal



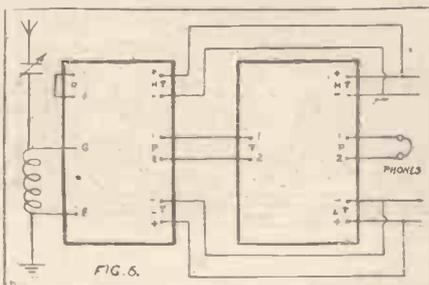
P1, another from P2 to the plate, or anode leg of valve holder.

The panel should now be screwed permanently to its base by countersunk screws along the edges and the ebonite, finished off flush to woodwork. Turning the panel over the condenser should be connected between the terminals T1 and T2. It now remains for the transformer to be connected, the rule being:

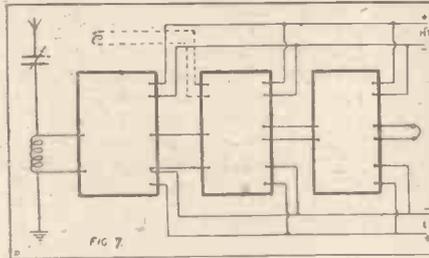
- Inside primary to plate.
- Outside primary to H.T. +
- Inside secondary to filament.
- Outside secondary to grid.

How to Use It.

A lead is taken from O.P. of transformer to terminal T1, another from IP to T2. The secondary leads O.S. to grid of valve holder, and I.S. to left-hand filament leg. The woodwork should now be polished or varnished, and the instrument is complete. Although this panel is offered as a com-

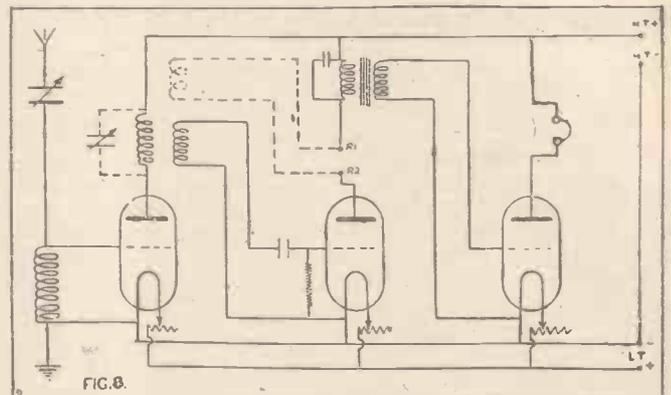


panion to the detector, and high frequency panels described in POPULAR WIRELESS, it can be used after any type of single detecting valve, providing the telephone terminals of the latter are placed direct in the plate circuit between H.T. + and plate, and not between H.T. - and filament.



The panel should be connected up to the detecting panel as in Fig. 6. Fig. 7 shows the three panels joined up, and a simplified diagram of the circuits so formed is shown, Fig. 8. As an addition to any crystal receiver the panel should be connected by the terminals T1 and T2 to the two telephone terminals of the crystal receiver.

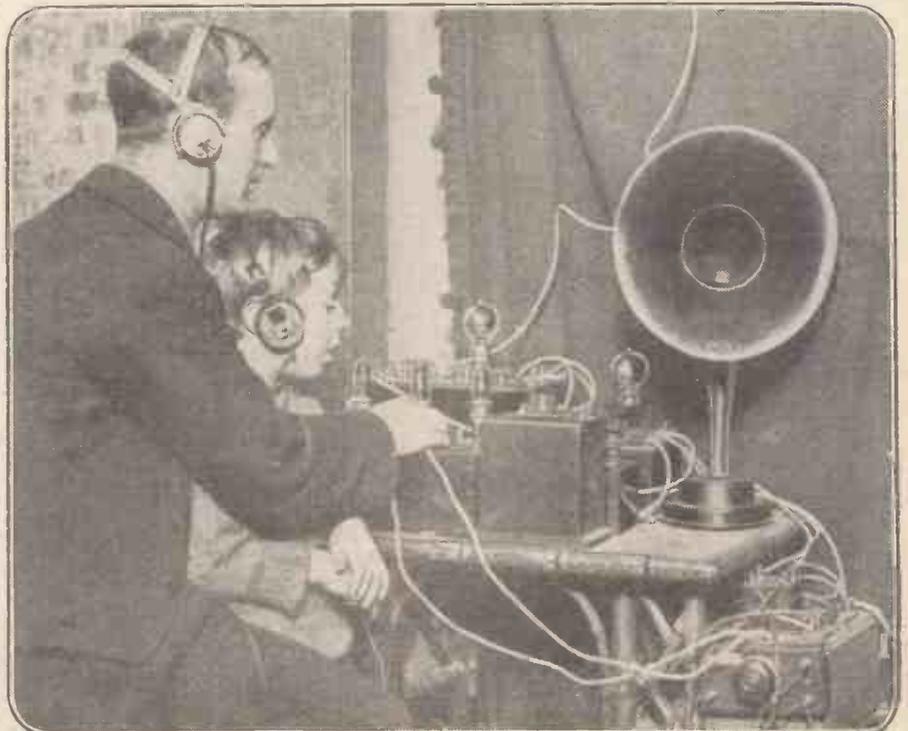
Should the reader desire further amplification, more panels may be constructed, and added, remembering to add high frequency panels before detecting panel to increase range, and low frequency panels after detection to increase audibility.



ASSORTED TIPS.

THE two greatest enemies of crystals are damp and dirt. Condensers also are best kept free from either. A very easily made protector or case can be made round a crystal from two small tin lids and a cylinder, or sheet wound round to form a cylinder, of celluloid. To fasten the celluloid to the tin, use a compound of shellac 2 parts, absolute or concentrated alcohol 4 parts, and spirits of camphor 3 parts. Condenser vanes can be enclosed by celluloid in the same way, fixing the celluloid to the ebonite bases instead of using tin.

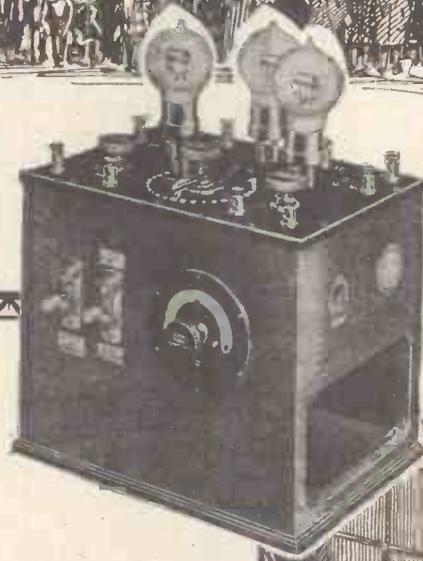
If you use a loud speaker, experiment with your H.T. current until you get best results. Too much or too little H.T. is often the cause of bad results with a loud speaker.



Mr. G. H. Burgess, of 58, Sunnyside Road, Bridgend, Wales, who received good speech from New York on his 5-valve set.

T.M.C. WIRELESS

for football results



A T.M.C. Wireless Set will enable you to follow your favourite team and hear the results of each match practically as soon as the game is over.

Or, you may be interested in boxing, the latest news, stock exchange quotations, the weather forecast, delightful concerts or an evening of dancing.

You can have all these, enjoyably and pleurably, in the comfort of your own home with a T.M.C. Wireless Receiver.

There is no trouble to you. T.M.C. have engineers in every large town to advise you, free of cost and without obligation, as to the best apparatus to use.

Your choice having been made, T.M.C. engineers will install the apparatus and periodically inspect it.

T.M.C. Wireless Receivers, which are fully approved by the Postmaster-General, bear the seal of the British Broadcasting Company.

The wide variety of models are entirely British Made.

**From £4 : 5 : 0 upwards,
including all Royalties.**

London, Birmingham, Manchester, and Newcastle are broadcasting now:

Come and listen to them any evening up to 10 p.m. at our showrooms in London, Birmingham, Belfast, Bristol, Cardiff, Dublin, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Sheffield.

Write to us for our nearest address.



The "Everset" Crystal.
No adjustment necessary.
Fits any crystal receiver.

10/- each.

ES
51

T.M.C.
Makes Wireless
Worth While

TELEPHONE MFG. CO. LTD.

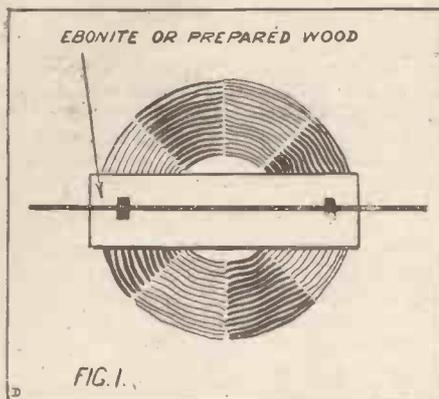
HOLLINGSWORTH WORKS, DULWICH, LONDON, S.E.21.

THE CONSTRUCTION OF VARIOMETERS.

By CHARLES F. FORD.

Some Expert Advice for the Amateur Experimenter in the Making of a Useful Item of Apparatus.

MUCH has been written of inductances and tuners, but very little mention has been made of the very handy and generally useful variometer. With this type of variable inductance, condensers—a rather expensive item—are dispensed with, as the tuning is as fine as could be over its entire range. It is much more efficient, especially on low wave-lengths, than the single circuit usually given to beginners,

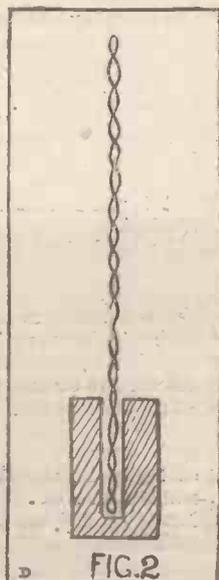


and such as is embodied in some, if not most, of the broadcast receivers now on the market. Additionally it is capable of loading up to almost any wave-length, still dispensing with the need for condensers. Yet it is as simple to construct as any single circuit yet designed.

Basket Coil Type.

The following two types have actually been made and thoroughly tried out. Hertzite, permanite, and perikon (zincite-bornite) were the detectors used on test for crystal reception.

The first is wound on a basket coil former. Readers already possessing one will find it quite suitable, as the dimensions do not matter materially, but the writer's was wound on an old wire bobbin 2½ ins. in diameter, with 21 3-in. spokes cut from cycle spokes pushed into it. Twenty feet of No. 24 D.C.C. is then wound on in the usual way and the end made fast. Next wind on a length of insulating sleeving; ordinary string to a depth of ¼ in. all round will do just as well. But great care must be taken when remov-



ing it, otherwise the coils will be broken and disarranged. Over this wind a further 20 ft. of 24 D.C.C., and when completed, shellac varnish the whole and allow to dry enough to remove the spokes.

Pull away the sleeving, or string, as the case may be, and bake the coils, of which you have two. The smaller coil, termed the "rotor," is mounted on a thin strip of ebonite or thoroughly dried wood well shellacked, as shown in Fig. 1, and the larger, termed the "stator," on similar material, as shown in Fig. 2, both perfectly simple operations, and the two are then assembled as Fig. 3, the rotor being aligned to rotate quite freely within the stator and equidistant. Then join one end from the rotor and one end from the stator with sufficient flexible lead to allow the former to take a complete half-turn (180°), the two remaining ends being taken to terminals for connection to aerial and earth. This type covers a wave-length range of 280-450 metres.

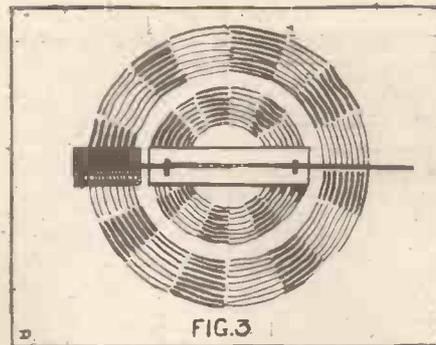
Making a "Varfo-coupler."

2 L O comes in with the rotor at 90-100°; 2 M T, 105-115. The tuning is remarkably sharp for such a simply made "gadget," and decidedly superior to slider or stud. For the benefit of those amateurs carrying out further experiments on these lines, it may be added that 30 ft. of No. 30 D.C.C. wound on each coil will give a wave-length range of 320-640, still tuning 2 L O, and also bringing in ship signals; but the tuning is hardly as critical, as it may be noticed that the tuning would appear to be sharper between about 70° and 120°, 2 L O being 10-20°. Larger ranges of this type are rendered awkward owing to the size the coils would assume.

The second is also wound with 24 D.C.C., and is of the conventional type, but the dimensions, etc., may prove of interest to amateurs contemplating the construction of such a variometer of this type.

The rotor is a piece of cardboard tubing ½ in. in thickness, 2 in. in length, and 3¼ in. in diameter. This is rubbed down with a rough rasp or very rough sandpaper block to the shape shown in Fig. 4. Holes are drilled as shown; small ones at A, B, C, and D to take the D.C.C. wire; slightly larger, to take a flexible lead at E and F; and one to take a brass rod (2 b a) to pass right through the opposite side also at G. Dead centre can be obtained by cutting a strip of paper the exact length of the circumference of the former, doubling in half, stretching round again, and marking at the two ends.

It is then thoroughly dried out, given two coats of shellac varnish, inside and out, and baked to ensure that moisture cannot possibly re-enter. Owing to its shape it is necessary to wind from the outside to the middle. A row of pins should be inserted around the edge and the winding carried out with 18 ft. of wire from A to B, the end

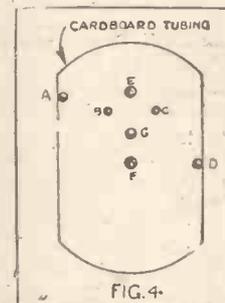


being tucked through and made fast. It must be wound tightly or the turns will jump.

The process can be repeated with the other segment, winding from D to C, or the one half can be shellac varnished, dried, and the pins removed before winding the second, this really being the more convenient arrangement. Sufficient shellac must be used to ensure that the wire adheres tightly or obviously the winding will slide off.

Hints on Assembling.

Solder the inside ends (b and c), making the length of wire as short as possible, and solder also a 6-in. length of flexible lead on each outside end (a and d) close to the former, and pass the ends up through E and F. That completes the rotor. The former can be bought ready made, of course, but they are somewhat expensive, and no better in results than that described. It may be of anything almost that is capable of being cut to the required shape and size: a wooden or composition ball, such as is found on the end of some curtain poles,



for instance, but it must be thoroughly dried out and shellac varnished.

The stator former is made by cutting two strips 7½ by 2¼ in. across the centre of an old gramophone record; immerse in boiling water for a few moments, and quickly mould around a 3-lb. jam jar. Tie tightly, preferably with wire, and firmly amalgamate the overlap with a red-hot poker.

When cool and set remove from jar and drill holes to correspond with those on the rotor with a hot wire, the hole at G being made large enough to allow the spindle to run freely, but not to shake; the pairs of holes, A and B and C and D, to be made slightly nearer one another, rendered necessary by the fewer turns, due to the increased diameter of the former.

Care must be taken to ascertain before commencing the winding and assembling that the wax is perfectly hard again.

Measure off a further 18 ft. of wire and mark it, allowing for lead, but do not cut, and wind from A. Having wound to the mark, measure off the last 18 ft., cut, and pass down B and up through C; then complete the winding, and, as usual, shellac and dry, but do not bake for obvious reasons.

(Continued on next page.)

AN AUTOMATIC PILOT VALVE.

By SEXTON O'CONNOR.

THE thermionic valve is probably the most adaptable device at present known to electric science. From its original use as a detector of feeble radio currents, it has developed and expanded into a bewildering number of practical applications. As a supersensitive detector, it has brought long-distance work within the range of the ordinary amateur, enabling him to use a small loop aerial in place of a hundred feet of outside wire.

It is far and away the most convenient and efficient generator of radio currents yet devised, and to this extent has removed many of the early difficulties of radio transmission.

As the ideal amplifier, it has found a wide application in solving the more difficult

problems relating to trunk-line telephony and cable telegraphy. The older "line" systems will in all probability owe their escape from the dust-heap to the valve, which has made it possible to develop the new principles of "wired wireless."

It is already extensively used in high-power electrical work, for rectifying alternating currents, for controlling and regulating dynamos, and in transmission and distributing systems generally; finally it has begun to rival the alternator as a generator of electric power supply.

Sensitive Grid Control.
Quite recently the suggestion has been made to utilise it as an automatic control or steering device for airships, torpedoes or other moving bodies. In this connection, an ingenious use is made of the extremely sensitive control exercised by the grid of a three-electrode valve upon the current flowing between the filament and plate.

Suppose the grid, instead of being stationary as is usual, were to be pivoted so that it could swing to and fro. Then if two separate plates are provided, the electron stream from the filament will be diverted from one plate to the other according as the pivoted grid is moved nearer to one plate and further away from the other.

The inventor of the "pilot" valve utilises a magnetised compass needle as the grid, and provides the two plate circuits

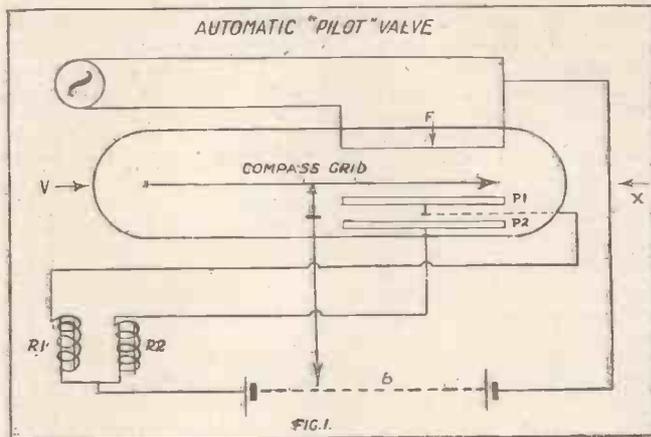
with separate relay mechanisms, which automatically control the steering gear so as to compensate for each swing of the compass needle away from the set course. Alternating current is used to heat the filament, in order to prevent disturbance of the "needle-grid" by the magnetic field from the supply-current.

The action of the device will be clearly seen by reference to Figs. 1 and 2. The compass needle forming the sensitive grid is pivoted on a stand fixed in the centre of the exhausted vessel or tube V containing the electrodes.

The filament F is mounted above and is parallel with the needle as it lies centrally along the tube. (It should be mentioned that the tube V is rotatable as a whole so that the needle can be set centrally for any given direction, say North and South).

The needle is located close to the filament. Below and further removed from it are the two plates marked P1 and P2. These are joined to the positive end of the battery B and include in their circuits two electro-magnets R1 and R2, each connected to the steering gear through suitable relays (not shown). The lead from the compass terminal is tapped to an intermediate point of the battery as shown, so that the grid carries a positive charge.

Any tendency to pitch will then be corrected by means of relays similar to R1 and R2, arranged to control the position of the ailerons or elevators, so as to maintain an even keel.



split between the two plate circuits and affects both relays R1, R2 equally.

THE CONSTRUCTION OF VARIOMETERS

(Continued from previous page.)

To assemble, pass the two rotor leads through the holes provided, pass the rod through, and run a small condenser spacer washer on it, and screw through rotor, inserting another washer before passing it through to the under side of stator. Add other washers when assembling if necessary, to keep the rotor central. The four ends are best brought out to two pairs of terminals, as no doubt the reader will carry out further experiments with this type in use as a vario-coupler. As we now desire it in use as a variometer, one each of the terminals must be shorted with a brass strap or heavy wire.

This one tunes over a range of 330 to 750 metres. If wound with 30 ft. of No. 30 D.C.C. a wave-range of 400-1200 is attained, but it will be noted that 2 L O cannot be reached.

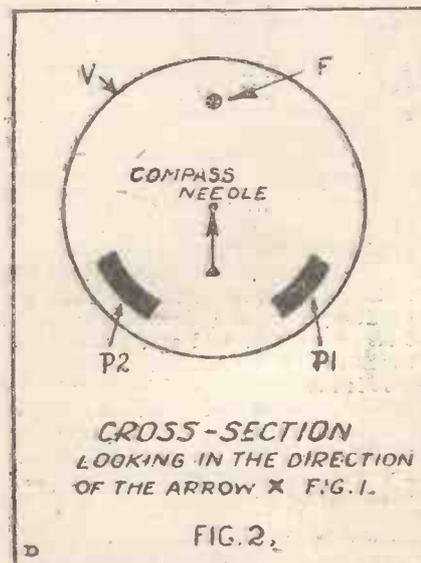
Both of these types should be finished with a knob and scale, and mounted in a box; the writer's is made of ordinary three-ply, shellac varnished and polished with furniture polish. They have given splendid results, and having tested them out on the same crystal point and on the same transmission against a single-circuit receiver, it may be confidently asserted that the variometer shows a superiority of 20 to 25 per cent. Writtle is clearly received at a distance of 40 miles with two head-sets in circuit on the second described, and three pairs have been used for 2 L O, 10 miles distant, crystal reception, at a very good strength.

mediate point of the battery as shown, so that the grid carries a positive charge.

Application to Aeroplanes.
Once the control device has been so fixed that the compass points along the desired course and lies centrally along the tube, the electron current through the space path is

Application to Aeroplanes.

Once the control device has been so fixed that the compass points along the desired course and lies centrally along the tube, the electron current through the space path is



ELWELL
High Power
Wireless
Stations

Oxford

Cairo

Northolt

Horsea
Island

Eiffel
Tower

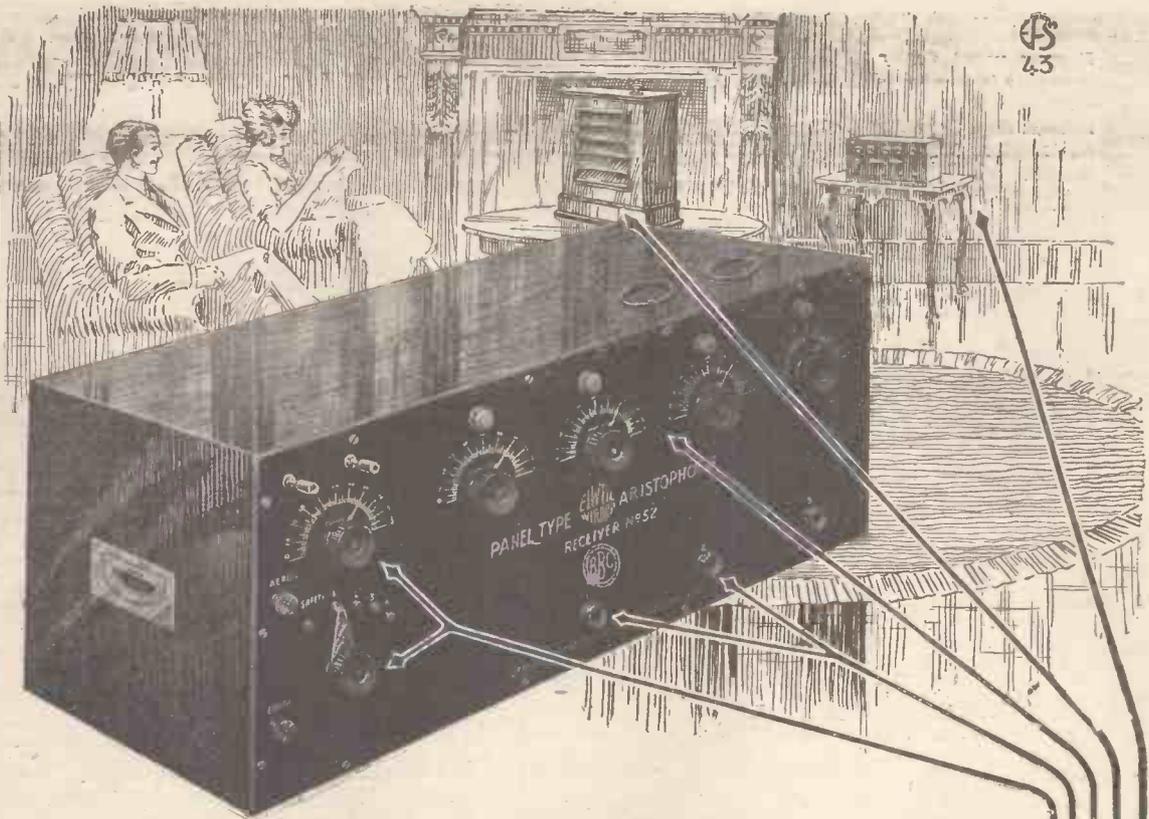
Lyons

Nantes

Rome

& others

ELWELL
WIRELESS



COMPLETE.

Aristophone Panel 52 is essentially the complete receiver.

You can quickly and readily listen to the Broadcasting, Shipping, Aeroplane Telephony, Amateurs, and the usual High Power Stations.

You can listen on two, three, or four valves as you desire, and if you wish to obtain particularly loud reproduction you can use power valves in the last two valve holders.

You will also appreciate both batteries being self-contained within the case. The only external leads are the aerial and earth.

Wherever you live, Panel 52 will give you satisfactory reception from at least one Broadcasting Station, and probably the choice of three.

Panel 52 is entirely British made and approved by the Postmaster-General.

Four position and fine adjustment switches for tuning-in to Broadcasting, Amateurs, Shipping or Aeroplane Telephony, as desired.

Elwell Jacks for connecting the Loud Speaker or Head Telephones to 2, 3 or 4 valves at will. Only the valves in use are allight, ensuring economy in battery current.

Separate filament control on each of the 4 valves, ensuring maximum efficiency and range.

The Aristophone Loud Speaker for which this panel has been specially designed, ensures perfect reproduction.

Aristophone Panel 52 is a completely self-contained receiver. Both L.T. and H.T. Batteries are included in the case. There are no untidy battery leads.

Aristophone Panel No. 52

Comprising 4 "Ora" Valves, one pair supersensitive head telephones, 6 volt H.T. battery, 6 volt 50 A.H. filament battery, aerial, lead-in insulators, earth connection and everything ready for reception.

£40

Complete as above, but with 120 volt anode battery, and larger valves, suitable for demonstrations or where maximum volume is desired

£42 10s.

Aristophone Loud Speaker

£10 extra.

Ask for the name and address of the nearest Elwell Service Agent.

C. F. ELWELL, LTD., Radio Engineers,
(Dept. P.W.) CRAVEN HOUSE, KINGSWAY, LONDON, W.C.2.
Telephone: Museum 1384.

If your usual dealer is unable to supply write to our nearest Depot for Leaflet No. W.



BATTERIES H.T. and L.T.

Ediswan Batteries are always dependable for efficiency and service. Always insist on "Ediswan" products when buying Accumulators or Dry Batteries.

The Ideal Valve for Reception

IS THE

EDISWAN

"AR"

Manufactured by a firm with over forty years' experience in lamp-making, Ediswan Receiving Valves represent the best of their class. Robust in construction, silent and economical in working, the "AR" Valve is equally suitable for the experimenter as well as for Broadcast reception.

Price 15/- each.

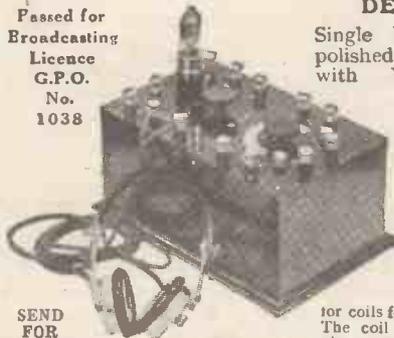
**THE EDISON SWAN ELECTRIC COMPANY LTD.,
123/5, Queen Victoria Street, E.C.4.**

BRANCHES: Aberdeen, Belfast, Bristol, Birmingham, Brighton, Cardiff, Dublin, Dundee, Edinburgh, Glasgow, Hull, Leeds, Leicester, Liverpool, Manchester, Newcastle-on-Tyne, Nottingham, Sheffield, Southampton, Swansea.

BROADCASTING RECEPTION SETS

One-Valve Set Complete for Working £7:10:0

Passed for
Broadcasting
Licence
G.P.O.
No.
1038



SEND FOR CATALOGUE AGENTS WANTED.

DESCRIPTION:

Single Valve, mounted on polished 1/4-in. Ebonite Panel with Variable Condenser, smooth acting resistance, grid leak and condenser and all terminals' clearly engraved in white, in a Mahogany Polished Cabinet, 9 in by 5 in. by 5 in. **£3:15:0**

A TAPPED COIL for wave-lengths up to 900 metres with 2 terminals for coils for any higher wave-lengths. The coil is enclosed and the tappings are brought out to an 8-way switch mounted in the front of the cabinet.

ACCESSORIES INCLUDED:

Siemen's 54 volt high-tension Battery with plugs for altering the voltage	£0:15:0
4 volt 50 amp. hour low tension Accumulator in case with carrying strap	1:4:0
One pair of Sensitive Head Phones of 4,000 ohms resistance	1:1:0
One Detecting Valve	0:15:0
Total	£7:10:0

Plus B.B.C. Royalties.

**WIRELESS INSTALLATIONS LTD.
15, ALDRSGATE STREET, LONDON, E.C.**

A GREAT DISCOVERY

THE

AMERICAN ATMOSPHERIC ABSORBER

FOR USE IN

WIRELESS TELEPHONY AND TELEGRAPHY.

Prov. Pat.

A boon to all Wireless Amateurs. Can be attached to any set, either crystal, single or multi-valve.

Eliminates Atmospheric Noises in the 'Phones.

EACH ONE IS TESTED BY EXPERTS.

Users declare this to be the most epoch-making discovery.

PRICE 17/6 Post free.

Trade enquiries solicited.

**GARQUARM SPECIALITIES,
AVERSROYD, GOLGAR, HUDDERSFIELD.**

THE "MAGNIPHONE" LOUD SPEAKER



Is not a receiver with a horn, but a specially made LOUD SPEAKER, 15 inches high, and adjustable

-£3 10 0 each.

SOLE MAKER:

J. W. GREENWOOD,

Electrical Instrument Maker, SKIRCOAT GREEN, HALIFAX.

LEAVES FROM AN AMATEUR'S NOTEBOOK.

By "CYMOPHONE."

1923 has indeed opened well so far as the progress of radio art is concerned. The broadcasting of opera by wireless is no longer a promise for the future; it is an accomplished fact, and has been the means of bringing the wonderful melodies, produced by the world's greatest musicians, right into the homes of thousands of eager listeners.

The technical difficulties encountered and overcome in reaching the present perfection must have been very formidable, and the degree of success already attained reflects the greatest credit upon the B.B.C., and upon the expert engineers who have assisted them. For reception of the opera in London on head phones, a simple crystal set gives ample volume; but a prolonged sitting wearing head telephones—even the best of them is not altogether pleasant—and the installation of a two or a three-valve set operating a loud speaker makes things very much more enjoyable. One naturally likes to have the loud speaker downstairs in the dining-room or drawing-room, but there is no need to bring down all one's gear from the technical den.

Improving Loud-Speaker Tone.

A length of twin flexible wire running from the den to the sitting-room is all that is required. The lower ends of the flex are permanently connected to the loud speaker terminals, and upstairs a two throw two pole switch connects the set either to a head set upstairs, used for tuning it, or to the loud speaker downstairs. Most of the commercial loud speakers are greatly improved as to the tonal quality of the music produced by connecting a small condenser of about 0.005 microfarad across their terminals.

This small capacity does not reduce the volume to any noticeable extent, but it removes any "tinny" sound, giving pure, round, and natural reproduction. If you wish to still further improve the quality, and do not mind a slight reduction in volume, you can use a rather greater capacity up to 0.01; but not more than that, or you will get "drummy" or "woolly" sounds.

The "Weakest Link."

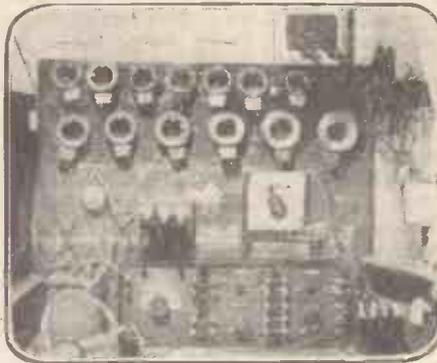
These figures relate to loud speakers wound to a resistance of 2,000 ohms or so, and working direct in the plate circuit of the last amplifying valve. The position of the loud speaker in the room is important, if you wish to get the best possible results.

A corner of the room, on a shelf rather high up, is generally the best position for a single loud speaker. The most satisfactory arrangement of all is to use two loud speakers arranged in this way, one in each of the corners opposite each other at one end of the room. They work best when connected in series, and the result is beautifully natural and diffused, so that you cannot tell exactly where the sound is coming from; but it is very mellow and pleasant to listen to.

What a splendid year of technical progress 1922 has been! And what tremendous developments of our well-beloved art-science 1923 seems to offer us!

Our science is growing rapidly. It is, perhaps, the commercial developments—the new things the amateur can buy, and the new and sensational things he can now do—which claim our attention here, rather than the latest advance made in the pure theory and in the development of the science itself.

The establishment and excellent operation of the new B.B.C. stations, together with the new and simpler method now available for obtaining the P.M.G. reception licence, has caused a phenomenal increase in the number of amateur enthusiasts in all parts of the country. It can safely be said that radio is now the most important hobby of the day, but it is far more than a hobby; for the practical study of the science is one of the best forms of mental gymnastics. It demonstrates clearly the utility of mathematics, and makes all the



Mr. J. Hay's 3-valve set, 15, Meals Drive, Hoylake, Cheshire

dry old scientific facts real, vital, and companionable thoughts.

We are often informed that 2 L O's wave-length is 369 metres, but it isn't. "Aerial" has tracked it down to 373½, and tells me that it can be adjusted to a quarter of a metre. If that is really the case, we think 2 L O might let us all into his wave-length secret, so that we can accurately calibrate our receivers; 4½ metres may mean quite a lot to some, more especially those connected with the sartorial art.

All this development has reacted upon the commercial electrical world. The demand for wireless apparatus and material now exceeds the supply, and, as always happens under conditions of this kind, all sorts of people—not always trained electrical engineers—have rushed into the market and, under truly wonderful styles and titles, such as "The Radio-Interplanetary Conversations Corporation, Ltd.," offer their sinful products to every Simple Simon who, were it not for their skilfully worded advertisements, would, like any wise person, pass by on the remote side!

Of course, there are plenty of new firms making really good apparatus, well designed and thoroughly tested; but, alas, there are others! Don't forget that *your* station is only as good as its worst component. An inefficient instrument is dear at any price, and if in doubt, write and ask POPULAR WIRELESS. We will give you the information you want, faithfully and fearlessly.

The power of the Press, for good or for evil, is universally admitted; it is, in fact, proverbial. We now have a new and, we think, an equally great power working in our midst—that of the B.B.C. In their daily chats and comments, addressed to an ever increasing audience, they wield a power for good or for evil second only to that of the Press itself.

Much More Suitable.

We all know and gladly admit that the work of the B.B.C. is being very ably carried out, and is improving day by day. There is much to praise and little to complain of, but there is ample excuse for just a word of warning.

We have had one instance of political party matter which was scarcely fair, and we know that the excuse made was, "We were not broadcasting, but merely experimenting." That is scarcely good enough, for at present all the transmissions are more or less of an experimental nature.

One of the "Bed-time Stories"—part of the B.B.C. programme, enjoyed quite as much by all parents who are fortunate enough to be able to find time to listen-in as by the kiddies—was hardly suitable stuff for our little ones. We do not hear so much about that very unpleasant place, "Hell," now as we used to in the "good old days," and it was not a very suitable tale for the little minds to sleep on.

The reference to "the King of Heaven" was rather near to the profane. Why not give us some of those delightful little gems from the "Never Never Stories" by Rudyard Kipling? We believe the story called "How the Elephant got his Trunk" is so delightfully funny that we very much doubt whether any human being can read it aloud without laughing. We have tried it, but suffered risible convulsions half-way through.

A Wonderful Achievement.

By the time that you have read these words you will doubtless have heard the glorious voice of our wonderful Melba through the medium of that ever adaptable ether. The broadcasting of opera by wireless, and the carrying of the wonderful melodies produced by the greatest vocal and instrumental musicians in the land right into the homes of thousands of listeners-in, is the greatest thing the B.B.C. have yet accomplished.

We hear on good authority that the Queen's Hall will be the next classical transmission attempted, and we can only hope that it will prove as successful as the Covent Garden effort.

THE MELODY MAN AT 2 L O.

An interview with Mr. L. Stanton Jefferies, A.R.C.M., the popular "Uncle" in the Kiddies' Radio Stories and versatile accompanist for 2 L O's Concerts.

By MICHAEL EGAN.

IT is not very long since I spent a whole evening behind the scenes at 2 L O, studying the manner in which broadcast concerts are conducted. On that occasion, I remember noting that Mr. Jefferies was kept hard at it all through the performance. He accompanied each instrumental and vocal solo, and during the many three-minute intervals that were in vogue, he was constantly rehearsing special little parts for the artists whose "turns" had yet to come.

Reflecting on this, I expected to find Mr. Jefferies enjoying a well-earned rest as I entered the concert-room at 2 L O the other morning. To be quite candid, I expected to find him reclining in a comfortable arm-chair, enjoying a comfortable smoke before a comfortable fire. I was speedily disillusioned on this score, however, when I found him hearing prospective broadcasting artists. A song was in progress when I arrived, and I waited until it and a number of others had been tried over.

That Unseen Audience.

When the artist had taken his departure, I confessed to Mr. Jefferies that I was somewhat surprised to find him at work so early in the morning.

"Yours must be a pretty long day," I said. "I suppose you find it necessary to do a good deal of "trying out" or "testing out"?"

"Oh, yes," he replied quite gaily, as if rehearsing was the best fun in the world. "We're kept fairly busy. It isn't like ordinary concert work, you see. Apart from testing the suitability of an artist's voice, each artist has to be given a little instruction with regard to the best method of singing into a microphone. Some singers feel quite at home with it from the beginning; others are, naturally enough, just a little bit nervous of this new method of entertainment.

"It's rather an interesting psychological problem, isn't it? An artist who shows no lack of confidence before a large critical audience becoming self-conscious in the presence of a humble microphone! But, of course, this nervousness, when it exists at all, is soon over. It is only a matter of getting accustomed to the strange experience of performing before an invisible audience."

Mr. Jefferies, I soon found, was one of those few beings who are able to make people feel "at home" in a very short time.

"I suppose a good deal depends upon the method?" I observed. "Is there much special technique involved in singing into a microphone?"

"No, very little, really," replied Mr. Jefferies, "though there are one or two points which need to be remembered in order to obtain best results. It isn't advisable, for instance, to deliver a strong high note direct into the microphone, at the ordinary range; the note produced in the receiving telephones from such a delivery is anything but pleasant.

"Some artists overcome this problem by taking a step back from the microphone

preparatory to delivering strong notes; others obtain the same effect by turning the head slightly to one side, thus sending the main energy of the voice obliquely across the microphone. Then there is the question of pronunciation, which requires particular attention. It doesn't do to be careless about pronunciation. On the other hand, it is easy to produce a bad effect by "clipping" words unnecessarily. But it is hard to say what constitutes the ideal method. As in everything else, practice and experience are the main factors in bringing about improvement."

Trying Out Voices.

"Are some voices naturally suitable for broadcasting purposes?" I asked. "Are there certain definite characteristics which denote that one voice is likely to prove much more effective than another?"

"Well, of course, since experience shows that some voices 'get across' much more clearly than others, it follows that there must be some distinguishing characteristics, I suppose. But what these characteristics actually are, it isn't at all an easy matter to decide. You see, a voice which sounds perfectly delightful in a concert-hall may, or may not, 'get across' satisfactorily by wireless. On the other hand, a voice which sounds quite ordinary in a concert-room, sometimes produces excellent results when delivered into the microphone.

"As I say, it isn't easy to judge the quality of voices in advance; but I'm gradually developing some kind of extra faculty which enables me to form a pretty sure opinion of the broadcasting powers of various voices."

While he made these remarks, Mr. Jefferies was called to the telephone in the far corner of the room at least half a dozen times. It seemed, on each occasion, as if the clamorous little bell had made a firm resolve to interrupt our conversation. When he returned from a particularly long

visit to the troublesome instrument, I put a question to him on a subject which I had heard discussed by several people since broadcasting began.

"Apart from the qualities of individual voices, is any particular class of voice more effective than others? Do sopranos, for instance, carry better than tenors, on the whole? I have heard a good many different opinions on the matter."

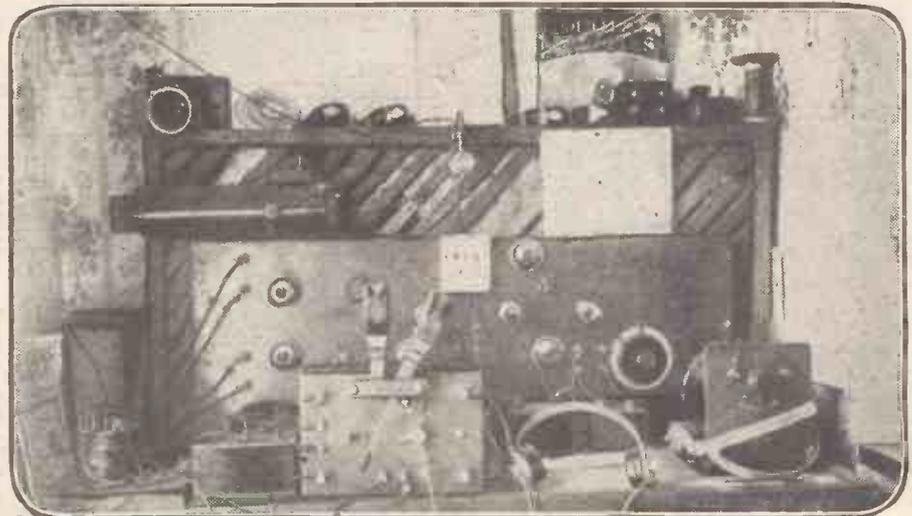
"Yes, so have I," replied Mr. Jefferies; "but I don't think any of the opinions I have heard are corroborated by experience. It doesn't seem to matter whether a voice is soprano or contralto, or whether it is a male or female voice. Excellent results have been obtained with all kinds of voices. The important thing is the method of delivery, and that depends, in turn, upon a certain 'unknown quantity' which any class of voice may or may not possess."

"And, with regard to instruments," I said, "do they exhibit superior qualities over each other?"

"No; most instruments carry well. The main problem with orchestral music is to secure a good balance between the various instruments. At present, as you can see, we are using a number of microphones; but this method has not been adopted permanently. At the moment this matter is being given particular attention."

Before taking my departure I congratulated Mr. Jefferies on the excellent musical quality of the programmes he has been giving us at 2 L O, and mentioned that I have repeatedly heard the highest praise bestowed upon his efforts.

"Our listeners-in are very gentle critics," he replied appreciatively, "and I look forward to the time when we shall be able to increase the scope of our programmes considerably. It isn't very far off; there are great things in store for the near future. Meanwhile, I always welcome good criticism, and am glad to receive any suggestions which are likely to help to increase the enjoyment of our large audience."



Mr. G. G. Crump's home-made set, 13, Oxford Road, Canterbury, Kent.

WHY YOU SHOULD HAVE A SET.

By WILLIAM LE QUEUX, M.Inst.R.E.

THERE is an intense fascination in concerts transmitted by radio, probably because of the mystery of sounds being sent through hundreds of miles of space into one's own room at home, and there reproduced in exactly the same tones in which they were sent. The radio telephone is undoubtedly a marvellous invention, and the possessor of a wireless receiving set can always find entertainment even though he may live far away from any human habitation.

Take, for instance, the person living in a remote country village. He is cut off from the world to a very large degree. The morning newspaper reaches him perhaps at mid-day, but no evening paper ever comes to him. The village concerts held at rare intervals are not particularly lively affairs, and even in the nearest town life is pretty dull. Yet if he applies for a broadcasting licence and purchases a receiving-set, he can at once bring many of the pleasures of the outside world into his own home each evening.

From one or other of the official broadcasting stations in London, Manchester, Birmingham, Newcastle and elsewhere he can listen to selections of the finest music played by eminent musicians, songs by well-known artistes, bed-time stories for the children and, what is most eagerly awaited by those living far from town, a tabloid account of the day's news.

Until quite recently only those experimenting in radio were able to listen to the speech and music transmitted by a dozen or so fellow experimenters, and then only for test purposes. But to-day, when the very strict Government regulations regarding wireless are to a great extent relaxed, an infinite amount of pleasure is open to anyone who invests in a receiving set. And further, instead of the complicated apparatus of a year ago, we now have fool-proof sets which can be worked efficiently by anyone.

Instructive and Amusing.

It is fascinating to sit with the telephones upon one's ears on a Sunday afternoon and listen to a speech in Dutch from across the North Sea, or to the gentleman speaking in French from the Eiffel Tower in Paris, telling you what weather is forecasted for France, followed by the short selection of instrumental music, or to listen to an amusing story from one of the British broadcasting stations. Listening-in is both instructive and amusing, as everyone knows. One often hears curious things, especially if the listener knows Morse.

Having been the first experimenter to broadcast regularly each evening, I know something of the humours and disappointments on the transmitting side, the annoying breakdown, the vagaries of valves, and the distortion of speech and music. Since the time when from eight-thirty to nine each evening I endeavoured to entertain my fellow wireless experimenters with music from a worn-out gramophone with badly-scratched records, many improvements have been made, until the distortion of speech has almost been eliminated as well as many other faults of early transmission.

Personally, I think that listeners would welcome a little less music from wind instruments and more from stringed instruments, as the strains of the latter can be better reproduced in the loud speaker.

The heavier sounds from a wind instrument have always caused distortion, and nowadays together with radiation from careless amateurs, spoil an otherwise excellent concert. Again, certain horns of loud speakers are responsible for distortion, and the horn has yet to be devised that will actually reproduce both the music and voice perfectly. That, however, is a matter that will quickly be remedied and accuracy achieved.

My point is that the man without his wireless set misses a lot of the good things in life. Until two years ago, wireless apparatus was both expensive and unreliable. To-day a receiving-set is within the bounds of every man's pocket.

The Americans are never slow to recognise any good thing. That is why radio is so popular in the United States, and why in the city of Chicago alone there were not long ago more possessors of wireless outfits than in the whole of the United Kingdom. The wireless receiver is not like the gramophone with its fixed and limited records.

One hears something fresh each day. Therefore, if you wish to be up-to-date, to derive intense pleasure and entertain your friends, install a set in your own room at once, and join the ever-increasing brotherhood of radio enthusiasts.

HOW TO FIND THE SENSITIVE POINT ON A CRYSTAL.

FINDING the sensitive point on a crystal is not such a terribly difficult business as some amateurs seem to make out, provided you go about it in the right way.

In addition to the set you need a buzzer, a dry cell, and a short length of copper wire, all of which can be bought for a few shillings.

The two terminals on the buzzer are attached by short lengths of wire to the two terminals on the dry cell. If the buzzer does not operate at once, turn the small screw on the trembler to right or left, so as to vary the pressure on the spring. As soon as the buzzer is operating, connect a short piece of insulated copper wire to the terminal of the buzzer—a couple of feet of wire should suffice—and hang the wire up over a chair or gas bracket.

Now, with the buzzer going, listen-in on your set, vary the contact on the crystal up and down the face of the mineral until you hear the loudest "buzzes" in the phones. These should be quite clear and distinct. This spot is then the most sensitive point on the crystal.

It is not necessary to vary the tuning of the set in any way; only the crystal contact

should be altered. The buzzer should be at least 3 or 4 feet away from the set. After the buzzer signals have been heard distinctly you can disconnect the batteries. Your crystal is now correctly adjusted for the reception of proper signals.

This process should be gone through every time the crystal needs adjustment. For ease in testing, a switch can be fixed to the buzzer so that it can be switched on when required.

SOLVING THE LICENCE PROBLEM.

WHERE the sole and only aim of the intending purchaser of a wireless set is to listen to the music transmitted by the broadcasting stations, the following procedure should be adopted. First obtain from the nearest branch post-office a B.B.C. wireless licence; this costs 10s., and is valid from the first day of the quarter until the first day of the same quarter in the following year.

Having decided upon the type of set suitable to fulfil the desired requirements, it should be ascertained before purchase that the instrument bears a registered G.P.O. number and the stamp of the British Broadcasting Company—the letters B.B.C. enclosed in a circle. A set that does not carry the foregoing cannot be used with a broadcasting licence.

It will therefore be seen that this form of licence will not cover home-made sets or sets built up from components not stamped with the B.B.C. monogram. Those people who intend to build up their own sets and devote a certain amount of their time to the study of "how it works" should endeavour to obtain an experimental licence.

In order to do this a polite letter should be sent to the Secretary of the G.P.O., London, asking for a "form of application for an experimental wireless licence." When in due course this arrives it will be found to be almost self-explanatory.

In the case of persons under 21 years of age it should be made out in the name of the parent or guardian. When completed the form should be sent back to the G.P.O., but no money should be sent with it; the required 10s. will be asked for if, and when, the application is approved and the licence granted.

An experimental licence allows the holder to listen-in to broadcasting, and it is not necessary to possess both for that purpose. It must, however, be added that the P.M.G. requires that the holder of an experimental licence should have a definite experimental reason for doing so.

HAVE YOU IDEAS?

SEND ALONG THE RESULTS OF YOUR EXPERIMENTS TO "POPULAR WIRELESS." WE PAY WELL IF ACCEPTED FOR PUBLICATION.

Tele. :-
HOP 134

IMPORTANT

We have opened very commodious premises at
54, GRACECHURCH STREET, LONDON, E.C.3
for the demonstration and sale of all types of
WIRELESS RECEIVING SETS and "**CLARITONE**" **LOUD SPEAKERS.**

Amateurs and Experimenters will be able to obtain every part required for any type of Set

INCLUDING—

Transformers, L.F. and H.F.	Brass W.O. and Telephone Type Terminals.
Headphones (all types, all resistances).	Nuts, Washers, Contact Studs, and all other parts.
Condensers, variable and fixed (all capacities).	Accumulators.
Vario-Couplers and Variometers.	Dry Batteries.
Coil-Holders and Coils.	Aerial Wire.
Anti-Capacity Switches (all types).	Insulators.
Rheostats (all types).	Hertzite and Galena Crystals.
Radial Switches (5, 10, and 15-way).	Cotton and other Tubings (all colours).
Valves (M.O. and Mullard's).	Etc., etc.
Ebonite Valve Holders, Dials, Scales, other parts and in Sheet.	

PRICE LIST FREE ON APPLICATION

PETTIGREW & MERRIMAN, LTD., 122-124, TOOLEY STREET, LONDON, S.E.1.

NOTE—54, Gracechurch Street is a few yards from Monument, Falsoheap, Bank, Cannon Street, and London Bridge.



RADIO ESSENTIALS

BARGAINS BY POST.

TRANSFORMERS—Telephone, 13/6; L.F. Intervalve, 15/-
FILAMENT RESISTANCES—Specially good quality, 2/3
CONDENSERS FIXED—All capacities, 1/6
GRID LEAKS, 1/-
GRID LEAK and CONDENSER—Best Quality, 3/9
VALVE HOLDERS—1st Quality, 1/3; 2nd Quality, 1/-; 3rd Quality, 9d.
ENAMELLED AERIAL WIRE, 7/22 Copper, per 100ft., 4/9
BATTERIES, H.T.—16.5 Volt Plug Tappings, 3/6; 36 Volt Plug Tappings, 7/-; 60 Volt Plug Tappings, 14/-
CRYSTAL DETECTORS—Special Adjustable, Mounted on Ebonite, Remarkable Value, 2/6. Enclosed Dust Proof Type, 7/6
HEADPHONES—4,000 ohms. Clear as a Bell. French or British, £1 : 1 : 0
LOUD SPEAKER HORNS—Curved with N.P. bent arm and base. Polished inside and out. Trumpet 10 ins. diameter, 10 1/2 ins. high, 10/6. Straight Type, 8/3
SWITCHES KNIFE—S.P.S.T., 1/- S.P.D.T., 1/6. D.P.S.T., 2/- D.P.D.T., 2/6
SWITCH ARMS (Complete) 1st Qual., 1/5; 2nd Qual., 1/-
VARIOMETERS—As used exclusively by a well-known firm of Government Contractors. Range from 300 to 3,000 metres. Mounted on ebonite panel with graduated dial and terminals, 25/- Unmounted, 17/6
Orders of £1 and over post paid; below include postage.
Complete list of Radio essentials post free.
All Post Orders: Dept. P. 10, MANOR GARDENS, PURLEY, SURREY.

OFFICES ·
10 MANOR GARDENS
BRIGHTON ·
PURLEY ·

HALL AND BRENARD

TELEPHONE ·
CROYDON ·
973 ·



THE MAGNAPHONE

**The Very Latest
LOUD SPEAKER,
giving perfect
reproduction of
the voice and
music without
mechanical noises.**

120 ohms
£1 18 6
2,000 & 4,000
ohms
£2 2 0

Postage, etc.,
1/6 extra.

THE SCIENTIFIC SUPPLY STORES,
126, Newington Causeway (4 doors from Elephant and Castle).
AND
8, Newington Causeway (Opposite London Sessions).
LONDON, S.E.1.
Phone: Hop 4177.

THE EFFECT OF RESISTANCE.

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

IN previous articles we have made an elementary study of resistance, and saw how for direct current the resistance of a conductor depends upon its temperature, the nature of the material composing it, the area of its cross-section, and its length.

Resistance = $\frac{\text{length}}{\text{area}}$ multiplied by the specific resistance of the material, but this is only true if the current flows in equal density throughout the conductor.

In conductors carrying high frequency currents such as are employed in wireless the current is much denser near the surface, and falls away in density towards the centre of the conductor. Thus the wire has, as it were, a skin of current, the phenomenon being known as the "skin effect."

An irregular distribution of current throughout the cross-section of a conductor increases the resistance of the conductor. Moreover, it follows also that the high frequency resistance of a coil is greater than that of the same wire when it is unwound and stretched straight, because the current density in the coil is irregular, not only because of the "skin effect," but also because the "skin effect" itself is non-uniform, being denser towards the inside of the coil.

Any increase in the resistance of the circuits of a wireless receiver, or such circuits in which the transformation of current energy into heat would be unfavourable, reduces the efficiency of the receiver, and as great lengths of wire are used, much of it in coils of various forms, steps must be taken to reduce the "skin effect."

Waste of Power.

For H.F. circuit connections, such as between various units, and to earth, it is advantageous to use thin metallic strips, because such conductors are practically only "skin," and the current distribution therein has a chance to be more or less uniform.

For winding coils it is a common practice to use a braided conductor composed of numerous strands of insulated wire, the braiding being done in such a fashion as to ensure that each strand presents as much surface on the outside of the braid as every other strand.

This kind of cable is known as *litendraht*. If any additional argument against the use of sliding contacts for variable inductances were needed, it would be supplied by the fact that braided cable, which is the best for high-frequency work, is not suitable for use with sliding contacts.

Let us now turn to the transmitting station and look for a few moments at the part played therein by resistance. Considered quantitatively, wireless transmission presents a picture of waste. Valuable energy is put into the system, one may say by the bucketful, and the greater part of it is wasted. If, for instance, we consider a station which delivers several hundred kilowatts to the aerial, only a tiny fraction of a watt is "picked up" by the receiving

antenna, and, except in the case of "broadcasting," all the rest is wasted.

Even the electrical energy which actually survives to leave the aerial as electromagnetic waves is but a small part of that which is delivered to it, for some of the latter helps to heat up the earth-wires and the aerial itself; the mast and stays take some more, and the insulators squabble over the rest with the surrounding buildings, trees, and the surface of the earth near by. Meanwhile a general leakage goes on in the form of brush and corona discharges.

Obviously, as in the case of the receiver, all possible steps must be taken to reduce energy losses. Eddy current losses and those which occur in the aerial system and tuning coils, all of which vary inversely as the square root of the wave-length, can be reduced by eliminating extraneous conductors from the field of the tuning coils and aerial, in the case of eddy losses, and by providing better conducting paths in the cases of the aerial and earth systems.

Radiation Resistance.

Dielectric losses, such as are occasioned by vegetation, or artificial structures coming within the field between aerial and earth, can only be eliminated by removing their causes.

Leakages due to "brushing" or "corona" discharges or insulators must be tackled by attention to aerial voltage and the design of the insulators themselves, any increase in wave-length and aerial current being met by a compensating increase in aerial capacity.

This brings us to the question of radiation resistance, which by definition should be as high as possible. Radiation resistance is that imaginary resistance which would absorb an amount of power equal to that radiated by the same current in the aerial; that is to say, the higher the radiation resistance of the aerial the better the aerial radiates.

In general, radiation is better the shorter the wave-length, the law governing this being that the power radiated varies directly as the square of the frequency—for a simple vertical aerial.

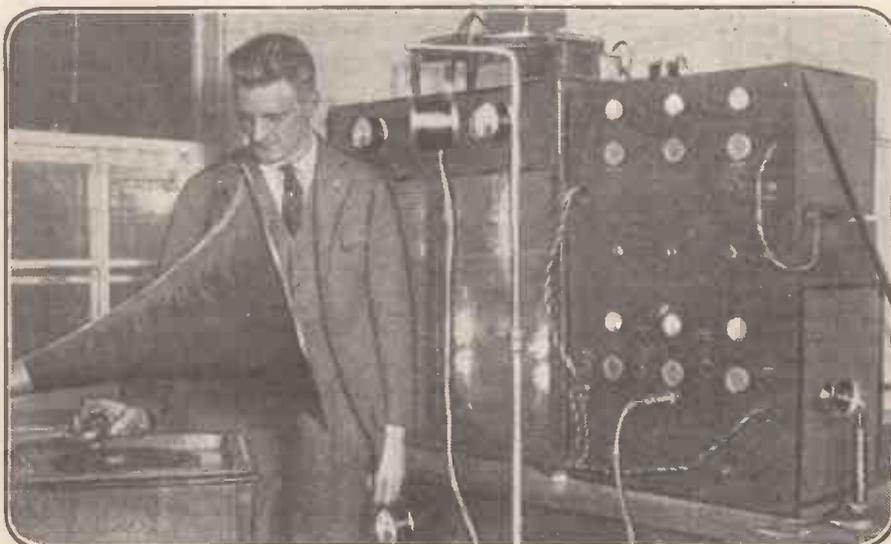
The power radiated from an aerial is the square of the aerial current multiplied by the radiation resistance, and the radiation resistance for a long, flat-topped aerial is, according to Hertz, the square of the mean height of the aerial divided by the square of the wave-length (both in the same units), multiplied by 1,600.

An Earth Screen.

In view of the loss in radiation efficiency due to increase in wave-length, it is necessary in the case of long-distance aeri-als (which invariably use long waves) not only to arrange for minimum losses in respect of those causes which are controllable, but to counteract as far as possible those due to eddy currents in the earth beneath the aerial, and to dielectric losses in surface vegetation. To this end the Marconi Company has devised an earth-screen, the object of which is to provide a low resistance capacity to neutralise at the earth's surface the magnetic and electrical fields produced by the aerial.

This screen takes the form of wires extended underneath and parallel to the aerial, and extending beyond the aerial for a distance not greater than the aerial's height. The spacing of the wires of the screen being proportional to its height, a compromise has to be made between the cost of the supports for a high screen and the cost of the wire for a low screen, but the screen must be clear of obstructions and beyond the reach of persons beneath it.

As an example of the efficiency of the Marconi earth-screen, it may be mentioned that in the case of Clifden, on a wave-length of 5,770 metres, the use of the earth-screen reduced the aerial resistance from 4.5 ohms to 0.55 ohms.



The broadcasting set at W.J.Z.—the Newark Station, New York. Many English amateurs have heard this station.

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.

New Clubs

Mr. William Day is about to form a wireless club, to be called the Pirbright and District Wireless Society.

All interested please communicate with Mr. W. Day (sec. pro tem.), The Gardens, Pirbright, Surrey.

It is proposed to form a Mitcham Wireless Society, and all interested should communicate with Mr. S. J. Miller, 56, Melrose Avenue, Mitcham, Surrey.

Bath Radio Club: Hon. sec., G. I. Barron Curris, F.S.A.A., 6, Pierrepont Street, Bath.

Virginia Water Wireless Club. Hon. sec., G. A. Broomfield, Post Office Cottage, Virginia.

The Eastern Enfield Wireless and Experimental Society.

Anyone interested who has been thinking of joining the society is strongly advised to do so at the earliest possible moment, in order that advantage may be taken of our elementary lectures.

One of the new members brought up a home-made crystal set recently, which was tested on the society's aerial and which proved to be quite a success, the broadcast concert being well received on it. The society's three-valve set is now going strong, the loud speakers having to be switched whilst business is being discussed. The commencement of the very fine broadcasting programmes has given a spurt to the members' activities, and many home-made sets are in course of erection.

The hon. sec. will be pleased to give particulars to any intending member, who will be welcomed at any of the Thursday evening meetings of the society.

Hon. sec., Mr. Arthur I. Dabbs, 315, High Road, Ponder's End, N.

Blackpool and Fylde and Lytham Saint Anne's Wireless Societies.*

At the second annual general meeting, held at the Café Waldorf, Church Street, Blackpool, Colonel P. Warren, C.M.G., C.B.E., the president, presided over a fair number of members.

Mr. C. Sheffield Doeg, the hon. sec., presented the annual report, which stated that the mem-

bership in November, 1921, was 84. Later it went down to 70, a drop of 14, but at present it stood at the satisfactory figure of 112, an increase of 42, this being due in the main to the public interest in the broadcasting scheme. During the year various apparatus had been purchased, and a branch had been opened for Lytham Saint Anne's members in their own borough.

All communications to be addressed to the hon. general sec. at The Poppars, 6, Seventh Avenue, South Shore, Blackpool.

The East London Radio Society.*

Some thirty members of the above society attended a recent meeting held at the Lecture Hall, Woodstock Road, E. 14; the vice-chairman, Mr. A. J. Alexander, taking the chair.

While the society's 3-valve receiver was being prepared, a large proportion of those present sat down to serious buzzer practice, our secretary, Mr. Simmonds, officiating. Buzzer practice is becoming a very popular feature.

At 8 p.m. attention was given to 2 M T. It was a matter of remark that each transmission by this station is an improvement upon the last. 2 M T's operator certainly is the right man in the right place.

At 8.30 p.m. the chairman introduced the lecturer for the evening, Mr. W. C. Wells. The management committee had received many requests from the newer members for a few more elementary lectures than have been recently given. In response to this request, Mr. W. C. Wells lectured upon "The Construction of a Single Valve Panel." His lecture proved very instructive to those yet in the elementary stage and very interesting to those already past that stage. The evening closed with votes of thanks to the lecturer and chairman at 10 p.m.

Although our membership increases week by week, yet we are still far from our ultimate aim. A representative radio society should have all amateurs of the district on its membership roll. We meet at the above Lecture Hall every Tuesday and Friday. Pay us a visit and you will want to join.

Hon. sec., L. E. Lubbock, to whom all communications should be addressed.

Hackney and District Radio Society.*

At a recent weekly meeting of the above society at its headquarters, Y.M.C.A., Mare-

Street, Hackney, it was stated that the lecturer for the evening, Mr. J. W. Francis, who had promised to lecture on "Electrical Units," was unfortunately ill, and the meeting was therefore given over to informal discussion. Various sets of apparatus were exhibited and demonstrated, 2 L O and Birmingham coming in quite clearly. A small, neatly made crystal set was also exhibited, made by a young member of the Y.M.C.A. section of the society. The vice-chairman promised to award a prize to the Y.M.C.A. member making the best crystal set by Christmas. This offer was much appreciated by the Y.M.C.A. boys present.

The chairman announced that the Mayor of Hackney had agreed to become the first president of the society, and Sir Arthur Lever, the now M.P. for Central Hackney, the first patron.

Sec., Mr. E. R. Walker, 48, Dagmar Road, London, E. 9. Inquiries to be made only by letter, with stamped, addressed envelope for reply.

Plymouth Wireless and Scientific Society.

At a recent demonstration of telegraphy and telephony given in aid of the funds of the Service Men's Y.M.C.A., with a seven-valve set and Magnavox the 5.10 concert and weather forecast from Paris was made audible to a large audience, the set being the property of Mr. S. F. Heal. In the main hall of the building, through the kindness of Messrs. Tregilgas, Gundry, Brand, and Lock, quite a good exhibition of modern wireless apparatus was given.

Hon. sec., G. H. Lock, 9, Ryder Road, Stoke, Devonport.

TO NEW READERS.

If you have bought a wireless set, or contemplate buying one, you cannot but feel interested in the science of wireless. Without plunging too deeply into technicalities, you can become a keen amateur by joining a local wireless club. By doing so you will gain useful knowledge and will be able to discuss with your fellow members the problems that puzzle you.

Join a wireless club at once. It will repay you in the long run.

Do not forget that the "Popular Wireless" Queries Department is also at your service. Send in your questions, and we will answer them free by post.



See Our Stand at the forthcoming Manchester All-British Wireless Exhibition, 17th-24th March, Burlington Hall, Burlington Street, Manchester.

THE CHEAPEST FIRM ON EARTH

for Stamped, Turned, and Moulded Components.

THE BEST FIRM ON EARTH

for Scientific Components.

When we say *the cheapest* we mean generally speaking. It is not a case of the "Swings and the Roundabouts." We do not advertise a few catch lines at cost prices and make our profits on goods which you will no doubt require at the same time. All our prices are competitive. This is particularly applicable to stamped, turned, and moulded components. In the case of our scientific components, however, our aim is efficiency combined with massed production, enabling us to sell at a reasonable figure. All goods can be supplied by post. Our Mail Order Department is efficiently systematised, our stocks are of gigantic proportions, and our Works are continually providing for your requirements and our services are yours.

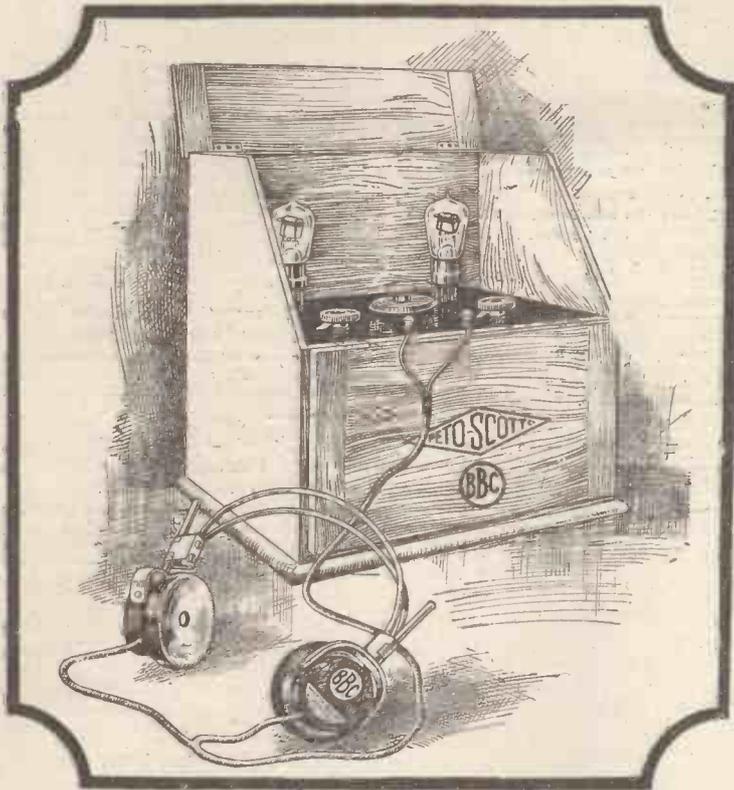
Send for our 24-page illustrated revised catalogue, now ready, 1d. post free, which gives prices of practically everything required by the average experimenter.

J.L. Cartwright & Co.

(Dept. P.), 24, LONDON ROAD, MANCHESTER

Works: BERRY STREET.
Phone: CENTRAL 4209. Grams: Fladuram, Manchester.
Business Hours: 9 a.m. to 6 p.m. except Fridays, 9 a.m. to 5 p.m. Saturdays, 9 a.m. to 1 p.m.

Wholesale Agents for Scotland:
J. CORSTON SINCLAIR & CO., 47, Waterloo St., Glasgow.



FIVE
people were
listening-in at
one time

Read this remarkable
testimonial to the
efficiency of the

BROADCAST MAJOR

(Passed by P.M.G.)

THE acid test of a Receiving Set is *performance*—a handsome Cabinet is poor compensation for weak reception. If you live within 25/30 miles from any of the four Broadcasting Stations—London, Birmingham, Manchester and Newcastle—this is just the Set you need for perfect reception of music and speech.

Its solid mahogany, hand-polished Cabinet is a worthy addition to any room, and as all connections are at the rear nothing disturbs its handsome and symmetrical appearance.

You cannot purchase a better Instrument, although you may be asked to pay very much more.

Remember every Instrument besides bearing a Certificate of actual test on our own Aerial, carries our full guarantee of complete satisfaction after 7 days trial in your own home, or money willingly refunded.

Read the Specification

The Tuning is controlled by one rotating dial from 350-550 metres—all the Concert wave-lengths. The L.F. Transformer is the MAX-AMP—our own design and manufacture. Included with the Set is an Accumulator (6 volt 40 amp. hours), and H.T. Battery (50 volts) both of best British Manufacture, and a pair of Western Electric Head-phones. A complete Aerial outfit, including 250 feet of Aerial Wire together with Insulators, is supplied without extra charge. With the exception of the Valves, which, owing to the risk of breakage should be purchased locally, there is nothing more to buy.

£9-9-0

Valves 15/- each extra.

When this Set is required for use with Broadcast Licence, a royalty of 35/- must be paid at time of purchasing. The royalty of 25/- due to the Marconi Co. is being paid by us.



Head Office & Showrooms
64 High Holborn W.C.1

MARSHALL AD.

The Cottage
Greenford Green
South Harrow
Telephone 6 111111 1111

January 6th 1923

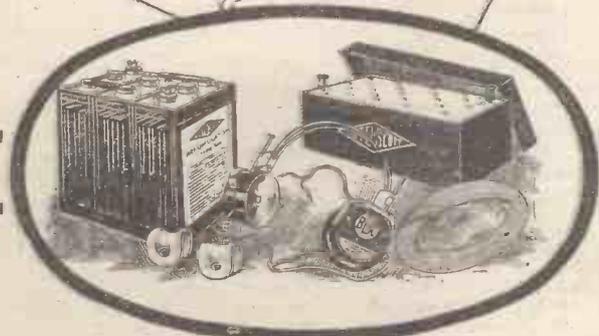
Dear Sirs,
I beg to inform you that I have received your letter of the 24th inst. regarding the Petto-Scott Co. Broadcast Major, which I have now received and am pleased to hear of personal experience with the Broadcast Major which I obtained from you a few days ago on behalf of a friend.

Having had considerable experience in the design of Radio Instruments, I am present not being the sceptical as to the results likely to be obtained with such a simple tuning arrangement as incorporated in the "Broadcast Major".

After a thorough trial, however, during which I received the London Broadcasting Station with perfect clearness and at excellent strength on as many as five pairs of head-phones at once, I am glad to offer you my hearty congratulations.

You have certainly been able to manufacture an excellent two-valve set at a very moderate figure. I need hardly state that my friend, on whose behalf I purchased the instrument, is equally pleased with it, and is nightly receiving the excellent concerts from 250 at his home some 20 miles from London.

Wishing you every success,
I am yours truly,



RADIOTORIAL

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

It is evident that thousands of potential readers of this paper were only waiting for the commencement of a new series for the "absolute beginner" before they became regular readers of POPULAR WIRELESS. The increase in orders for the paper indicates that a great number of people are not only keen on just "listening-in," but also on acquiring a working knowledge of wireless. Therefore, I feel that the Beginners' Supplement, the second instalment of which appears in this issue, will be all the more appreciated. Readers who have taken the paper from number one may rest assured that they are by no means forgotten. It will be seen that four extra pages have been added to POPULAR WIRELESS, so that the Beginners' Supplement shall not encroach on the space allotted to the ordinary features of the paper.

That wireless has again captured the imaginations of thousands seems fairly obvious. The broadcasting of grand opera set the seal on its popularity; and now I hear that the B.C.C. are preparing fresh surprises for "listeners-in."

Truly this new hobby is going to have "some innings."

Let me once more remind new readers that the Queries Department of POPULAR WIRELESS will reply to questions by post free of charge. The minimum of delay is now assured, as an increase of staff has been made owing to the popularity of this form of answering readers' queries. Below, each week, a selection of the most interesting questions are reproduced for the benefit of other readers.

Meanwhile, tell your friends about the new supplement, and the fact that POPULAR WIRELESS will assist them to its utmost if they are in any trouble with their sets.

THE EDITOR.

Questions Answered

Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have decided to reply individually by post. A weekly selection of questions will, however, be printed on this page, together with the answers, for the benefit of readers of POPULAR WIRELESS in general. Questions should be clearly and explicitly written, and should be numbered and written on one side of the paper only.

All questions to be addressed to: POPULAR WIRELESS, Queries Dept., Room 132, The Fleetway House, Farringdon Street, London, E.C.4.

Readers are requested to send necessary postage for reply.

F. C. P. (Luton).—My aerial is now directional for the Hague. Can I erect another wire at about 45° from the first, but using the same lead-in so that I have a twin aerial? If so, will the aerial be directional as before, or should I have two directional effects, one for each wire?

The aerial you propose to erect is quite practicable but you will lose the directional advantage you had before. In fact, you tend to destroy any directional effect of the aerial altogether. It would be better to make the first aerial into a double aerial, using parallel wires if you wish to increase its size.

J. D. (Birmingham).—I wish to erect a frame aerial for the purpose of listening to the local broadcasting. What size frame do you advise?

A frame of about 4 feet square—diagonals roughly 5' 6"—wound with 5 turns of 22 D.C.C. spaced about 1" should be quite O.K.

T. Y. O. (Edinburgh).—Has a fixed reactance any value when it is so fixed that regeneration is impossible?

No, not a great deal; you might almost as well dispense with it altogether.

Does it matter in which direction the reaction coil is wound or must it be wound the same way as the coil to which it is coupled?

It must be wound in the same direction as the coil to which it is coupled, so that when the reaction coil is at its maximum point of coupling the wire of both coils run in the form of winding of one coil.

E. B. (Peterborough).—What would be the resistance per yard of the following sizes of S.W.G. wire if of copper, 30, 36, 40, 42, 44, 47?

1901 ohms, 5299 ohms, 1329 ohms, 1913 ohms, 2989 ohms, 7652 ohms.

O. L. P. (Kettering).—I have an accumulator which is rated as 80 ampere hours. Will that mean that if my valve takes 5 of an amp. I can light it for 160 hours on that accumulator?

No, not at all. In the first case it is most probable that the 80 ampere hours refers to the ignition or very intermittent discharge capacity of the cell. More possibly the actual capacity of the accumulator is but 40 ampere hours. This actual discharge capacity refers to the continuous discharge such as is required for valve set work, and is generally referred to as the *actual* or *lighting* capacity while the cell will be presumed to have twice that capacity for intermittent work such as for ignition on motor-cars. This is styled the *ignition* capacity, and it is this owing to it being the higher figure that it generally figures more plainly on the labels and price lists. So that brings down your accumulator possibly to 40 ampere hours actual capacity. Do not, however, discharge it for 80 hours, but with a voltmeter, test the voltage frequently while it is on circuit and immediately the voltage per cell drops below 1.8 volts have it re-charged.

How can I gauge the rate of current necessary for charging such an accumulator?

By dividing the *actual* ampere hour capacity by ten. In this particular case that will mean that the cell should be charged at not more than 4 amperes.

T. P. L. (Ilford).—Is it possible to obtain two electrode Fleming valves, and are they very efficient for wireless work?

The two electrode type of valve is quite obsolete and is not now used for wireless purposes. The introduction of the grid, the third electrode, quite revolutionised the valve. Without this it would not be as sensitive as a crystal detector.

R. T. P. (Canterbury).—What is the difference between "forced" oscillations and "free" oscillations?

A "forced" oscillation is one which occurs in a circuit at a different wave-length from that to which the circuit is tuned. That is, an oscillation at a given wave-length may take place in a circuit which is tuned to quite a different wave-length than that of the oscillation. This is due to tight coupling, or high impedance in a circuit. "Free" oscillations are said to be taking place when a circuit is supplied with energy and then left to oscillate by itself. It will then oscillate at the wave-length to which it is tuned, or its natural wave-length.

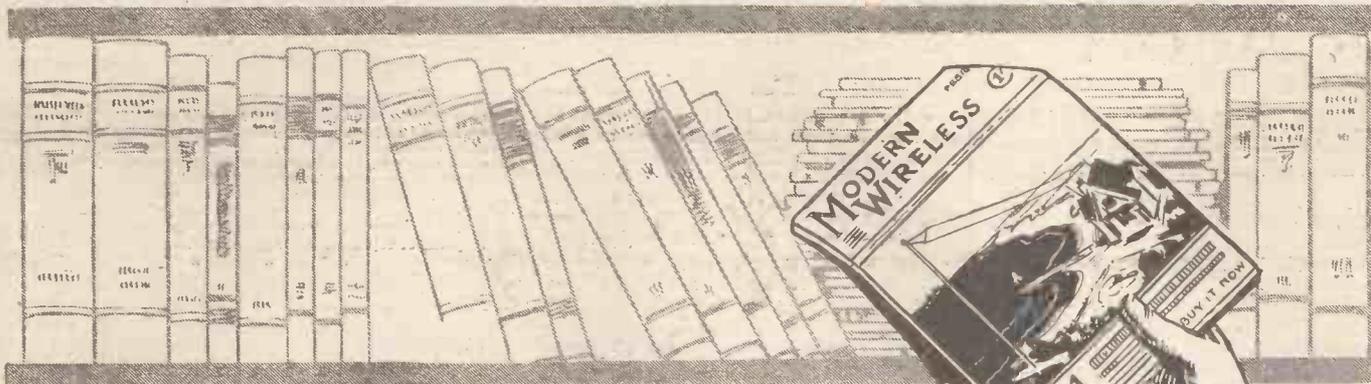
"LISTENER" (St. Albans).—What is the cause of the rushing sound which commences when 2 L O switches on the opera at Covent Garden? It does not occur while the ordinary programme is in progress.

The sound is due to the amplifiers at Covent Garden. These magnify the reception of the microphones employed there. In the case of London's usual concerts the microphones used are not coupled to any amplifiers, and thus parasitic noises are largely eliminated.

(Continued on page 830.)

THE REAL REASON WHY KING ALFRED LET THE CAKES BURN.





We apologise

—if you had difficulty in obtaining your copy of

MODERN WIRELESS

THE whole of the first edition of 20,000 copies was sold out within a few hours of its appearance on the Bookstalls.

A reprint of a further 30,000 copies—making 50,000 in all—is now in hand and will be on sale on January 26th. To make sure of your copy this time, order it in advance from your Newsagent.

Read the list of Contents—note the large number of practical and constructional articles by well-known experimenters. If you want to build up your own Set, for instance, you are given a choice of several types—from a simple Crystal Set to receive the Concerts to an ultra-sensitive 5-Valve Receiver with a radius of 4,000 miles.

Read also the first full description of a new development in the use of

double Reaction—there are big possibilities for amateurs in this.

If you are making the acquaintance of Wireless for the first time you will surely appreciate the very clear and instructive articles from the pen of John Scott-Taggart, F.Inst.P.—the editor of this new Monthly.

If you were unlucky enough to be disappointed on the 15th and unable to get your copy—never mind. The reprint will be on sale almost as soon as this appears, and it will be well worth waiting for.

Sold by all Booksellers and Newsagents and published by

Radio Press, Ltd
PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
DEVEREUX COURT, STRAND, W.C.2.

1/-
MONTHLY

MARSHALL AD.

Edited by John Scott-Taggart, F.Inst.P., assisted by E. Redpath and Paul D. Tyers, and published on the 15th of every month.

SOME OF THE CONTENTS OF No. 1.

- "Northolt"
- The First Published Description of the New Government Wireless Station. By E. H. SHAUGHNESSY, O.B.E., M.I.E.E., Chief of the Wireless Section of the General Post Office.
- "Receiving Radio Signals from Electric Lighting Wires." By PHILIP R. COURSEY, B.Sc., F.Inst.P., A.M.I.E.E.
- "The Transmission of Wireless Waves." By SIR OLIVER LODGE, D.Sc., F.R.S.
- "A 4,000-mile Receiver." (Constructional Article.) By L. VIZARD.
- "A Two Valve Broadcast Receiver." (Constructional Article.)
- "Valve Receivers Employing Crystal Detectors." By JOHN SCOTT-TAGGART, F.Inst.P.
- "Dual Amplification." By P. B. A. H. VOIGT, B.Sc.
- "A Simple Winder for Wave-wound Coils." By O. S. HALL.
- "The Dynatron." By PAUL D. TYERS.
- "Charging Accumulators at Home."
- "The Sing Wave." By GEO. SUTTON, A.M.I.E.E.
- "A Great New Wireless Invention." (A hitherto unpublished account of the receiving system used on the Imperial Wireless Chain.)
- "A Conducting Cement."
- "The Sinking of the s.s. 'Hammonia.'" (A personal narrative by a wireless operator concerned.) By A. E. HUNTER.
- "A Simple Wireless Telephone Transmitter." (A practical article.)
- "The Outlines of Wireless." (An article for beginners.) By Lt.-Col. O. G. CHETWODE-CRAWLEY, R.M.A., M.I.R.E.
- "Double Reaction—A New Development." (This is the first published account of an entirely new and effective type of valve circuit.)
- "An Amateur Wireless Society and How to Conduct It." By F. HOB-JONES, M.I.E.E., Chairman of the Radio Society of Great Britain.
- "Directional Wireless." (The first of an important series of articles.) By J. ROBINSON, M.B.E., Ph.D., M.Sc. F.Inst.P.
- "How to Make a Simple Broadcast Receiver Using a Crystal Detector." (A constructional article giving full details.)
- "The World's Land Stations: Their Calls and Wave-lengths." (A list invaluable to all listeners-in.)
- "Choosing a Broadcast Receiver." (A valuable guide to all who propose to buy a radio set.) By MICHAEL EGAN.
- "Wireless Operators and their Careers." By "TRAFFIC MANAGER."
- "Recent Additions to Our List of Experimental Call-Signs." (A very useful supplement to the Radio Press Wireless Directory.)
- "Map of European Wireless Stations." (This map also gives the call-signs.)
- "The Construction of a Valve Panel."
- "How to Make a Note-amplifying Panel."
- "A Vernier Condenser and Its Construction."
- "A Home-made Telephone Transformer"
- "Methods of Fixing Windings and Inductances."
- "A Simply-made Grid-leak."
- "Times of Regular Transmissions." (A thoroughly checked list of stations, their calls and times of working.)
- "Greenwich Time by Wireless." (Full details of the time-signal programmes.)
- "How I Heard the American Concert." By J. H. RIDLEY, who was the first in this country to receive American broadcasting.
- "Experimental Licences." By E. REDPATH. (A long and most complete article on experimental licences and how to obtain them.)
- "A Page for the Absolute Beginner." (A condensed account of wireless for those who are just starting, with some sound advice to the beginner.)

ELECTRADIX RADIOS

Best for ALL equipment

EVERYTHING FOR WIRELESS

DYNAMOS AND INSULATED WIRES BELOW COST

RELAYS, RELAYS, Siemens and Western Electric Co., complete with contacts, 10/6; Small type for remote control, minus contact, 2/6. Ordinary M.C. Weston Relays, 20/-.

RIGID BASKET COILS, set of 7, 200/1800, 7/6; 3 coil holder for same, 7/6.

LADIES' PHONE, cord and handle, L.R., 5/-; H.R., 9/6.

FIXED CONDENSERS, .0001 to 2 mf., 2 -- Grid Leaks, 2/-

MURDOCK VARIABLE ditto, all sizes. Lowest prices.

WAVEMETERS for Transmission and Reception from 300/3000, £4; 130/9000, £6 10s., few only.

ANGLE PLOTTERS in leather case, 8/6.

TEAK, 13 x 12 x 5 Panels, Ebonite top, 10/-.

3-VALVE AMPLIFIERS, £5.



LESLIE DIXON & CO.
9, Colonial Avenue, Minories, E.1.
Near Aldgate Station, Met. Rly.

ACCUMULATORs, etc. New and Guaranteed
4-Volt, 25-Amp. Celluloid, 11/3. Postage 1/-.
4-Volt, 40-Amp. 17/6 6-Volt, 40-Amp. 25/6
4 " 60 " 21/3 " 60 " 31/-
4 " 80 " 27/- " 80 " 36/-
Packing, 1/6 extra. Packing, 2/- extra.
7/23 Aerial, 5/8 100 ft. Millard Ora Valves, 15/-;
15-V. Siemens H.T. Batteries, 4/-; Marconi R. Valves, 17/8; Accumulator Charging Board, 37/8.
Voltmeters, Watch pattern, 0/12. Volts. 8/-.
Cash with order. Goods despatched per return
LOWKE & SONS, Ltd., Northampton.

LUNCH HOUR RAMBLE

STROLL ROUND TO
SPENCER'S STORES,

4-5, MASON'S AVENUE,
BASINGHALL STREET,
LONDON, E.C.

CHEAPEST HOUSE IN CITY
FOR WIRELESS PARTS & SETS

PRICE LISTS FREE.

THE BEST BOOK ON WIRELESS FOR AMATEURS

How to make and use a Wireless Valve Receiver Set, By E. K. Spiegelhalter. This book has been specially written for Amateurs in Wireless. Clear Constructional details accompanied by 24 very practical illustrations are given, which will enable the operator to build his own set economically and to work it successfully when made.

Price 2/- net. Send P.O. for a copy.

E. & F. N. SPON, Ltd., 52, Haymarket, London, S.W.1.

CUT THIS OUT

"Popular Wireless" **PEN COUPON** Value 2d.
Send 7 of these coupons with only 2/9 direct to the Fleet Pen Co., 119 Fleet St., E.C.4. You will receive by return a splendid British-Made Ick Gold Nibbed Fleet Fountain Pen, value 10/6 (fine, medium, or broad nib). If only 5 coupons is sent the price is 5/9, 2d. being allowed for each extra coupon up to 6. (Pocket Clip, 4d.) Satisfaction guaranteed or cash returned. **Special New Offer:—Your own name in gilt letters on either pen for 1/- extra. Lever Self-Filling Model with Safety Cap, 2/- extra.**

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 828.)

J. A. E. (London, E.C.4).—(1) Would H.F. or L.F. be more suitable for me to use for reception of telephony? I am situated in the south of England and shall be using reaction and a good aerial. (2) What kind of transformer should I use to charge an accumulator, from the plug of a Ford car? (3) What is blue-glow?

(1) An H.F. valve amplifier would be best in your case. (2) We do not think you can charge from the source you mention. (3) Blue glow is caused by the ionisation of the molecules of residue gas occurring in "soft" valves. The ionisation causes the gas to emit a brilliant blue light.

"CAPACITY" (Nottingham).—What is a "capacity" earth or a "counterpoise" earth?

This is a means employed to form the second plate of the large condenser formed by aerial and earth. Usually the earth supplies the second plate, but an insulated wire, stretched about two feet above the earth directly under the aerial can be used instead. This is connected to the earth terminal of the set and acts as a "counterpoise" to the aerial. It is used when parasitic currents are encountered if a proper earth connection is made. If the receiving station is near the electric light-mains and these develop a leak, these stray currents sometimes cause humming or crackling in the receiver set. A capacity earth does away with this, though it is not so efficient as the ordinary method of "earthing."

T. M. N. (Oxford).—Is there any rule as to the capacity of an accumulator to employ with a certain number of valves?

No, there is no rule, but a minimum of 10 ampere hours per valve should be allowed. However, it is always as well to obtain a cell of good capacity in the first place, whether an extended number of valves is contemplated or not. For a two-valve set it is advisable to purchase a 6-volt 60-ampere-hour accumulator, which will give a very useful run on the two, and would be quite O.K. for three or four valves.

O. K. (Liverpool).—Why am I advised not to have a variable condenser with a greater capacity than .0005 mfd.? Surely a larger condenser could be used as it is variable and can be adjusted to zero?

That latter is just the point, no variable condenser can be adjusted to have zero capacity. When at its absolute minimum position there will still be the end-to-end capacity effects of the vanes.

W. L. B. (Paris).—When erecting a double aerial is it necessary to have insulators both sides of the spreaders—two between the wire and the spreaders, and two between the spreaders and the rope at both ends?

It is not essential if the insulators between the spreaders and the wire are quite efficient, but, at the same time, it is advisable to have the extra insulators you mention. An aerial cannot be too highly insulated, and it is better to have the margin that way than in the direction of insufficiency.

G. S. (Leicester).—How can I test my high-tension battery and tell if it is running down?

A voltmeter is necessary for that purpose, although a voltage test is not always satisfactory with dry cells, and the only true test is by results. As a matter of fact, you have hit upon one of the hardest questions in connection with the tracing of faults in wireless, and there are times when a faulty H.T. has completely baffled amateurs with quite a fair knowledge of the subject. An H.T. unit might show good voltage on a voltmeter, but might be causing trouble or failure owing to internal local action, or the development of undue resistance in one of its cells. This can be located first by bringing it down to the H.T., by borrowing another H.T. unit and trying it out against the other on the set, and then localising the actual cell that is causing the trouble by cutting out the cells one by one and in groups. The fault, generally evidenced by "noises" or complete failure, however, might exist in the majority of the cells, when the above procedure would give negative results. If so, the whole battery must be put by for at least a time. It is quite possible that it will be found that after a period of rest the battery will recover.

"NEWRADIO" (Enfield).—Would you advise me to invest in a wireless set? I can only

lay out at the most £5, and that I am told would merely provide a crystal set. Would it be worth while?

That depends exactly upon what it will take to satisfy you in the way of results. With a good outdoor aerial and a reliable crystal set, you should be able to hear the concerts from 2 LO clearly, but not so loudly as to permit of hearing them through ordinary conversation in the room. A loud speaker with such a set is, of course, outside the question. We should enjoy concerts on a crystal set 9 miles from a broadcasting station as much, or if not better, than hearing it via three valves and a loud speaker. Signals will not be strong, but would be remarkably faithful in point of reproduction with no distortion whatever.

"AMATEUR" (Dorking).—When winding inductances I always seem to be able to commence the winding tightly and tidily, but towards the middle and the end the first turns begin to run loose. How can I prevent that?

That is caused by the tightness of the winding causing the former to "sag." If you use a more solid former and brush some paraffin wax over the surface, and do not wind the wire on with too much tension, we think you will be able to complete the job with greater neatness.

Y. M. (Carlisle).—Are they Marconi or Post Office people that run the Leafield, Cairo, and other wireless stations on that route?

The staff is drawn from the Post Office.

G. V. N. (Winchester).—The other day when I went to visit a wireless friend, I noticed that he had his set connected up so that the aerial lead-in was on the earth terminal, and the earth lead was connected to the aerial terminal, and yet the set was working quite well. Can you tell me if that is right?

The only effect, generally speaking, that is occasioned in a crystal set by reversing the aerial and earth terminals is to reverse the connections of the aerial tuning inductance, and that would make very little if any difference in results. However, if the set was of the single or multi-valve type, the consequences would be very different. For instance, the grid of the valve would then be taken to earth, whilst the common return of the circuits, i.e., the L.T. and H.T. minuses, instead of going to earth would be taken to the aerial, and that while not perhaps causing failure, would not prove as efficient an arrangement as the other and orthodox way round.

"INVENTOR" (London, W.).—In automatic telegraphy, as dealt with in so interesting a manner in a recent number of POPULAR WIRELESS, mention is made of speech work with printing instruments. Would not greater speed still be obtained by reproducing and transmitting the signals in the form of shorthand? The idea would seem to me to make for simpler apparatus as well.

No, it would be little or no gain to receive the message in the form of shorthand as it would necessitate translation, for which extra staff would have to be available. A possible and interesting method that might be adopted to speed up automatic wireless is discussed in another article on the subject that will appear shortly in POPULAR WIRELESS.

U. P. (Ilford).—Has the B.B.C. the power to issue and enforce by-laws in regard to the reception, etc., of their concerts?

Any registered company can draw up a list of by-laws, but must appeal to the justices of the land in the case of infringements. Taken into a court of law such by-laws might or might not be upheld; that would depend entirely upon whether it was thought that they were reasonable or not.

"VALCRYST" (Romford).—What would you advise for me as being the most useful combination. I want to use a crystal detector to save, as you suggest, accumulator wastage, but am not sure whether high frequency or low frequency will be the simplest to manage.

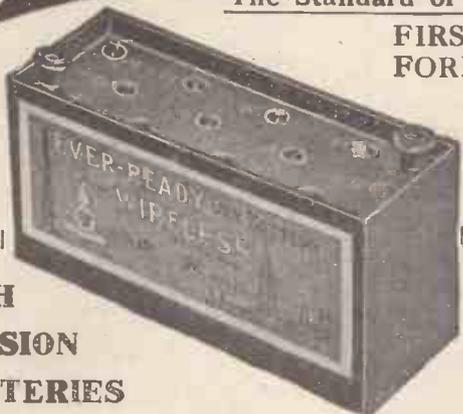
Low-frequency amplification is always the simplest to handle, because you are amplifying something that has, as it were, already arrived. In other words, the signal has been rectified, and the first remark can be justified by adding that L.F. amplification is not, generally speaking, of much use except where the signal is audible without it. On the other hand, H.F. amplification, with its necessary tuning, takes place before the signal is rectified and the signals are still

(Continued on page 832.)

“Ever-Ready”

British Made

The Standard of Quality



FIRST AND FOREMOST

HIGH TENSION BATTERIES

As supplied to H.M. Government. The highest electrical efficiency maintained. Any size or voltage with any tappings or sockets at 3 or 6 volt intervals for use with Wander Plugs can be supplied to order. With 13 sockets as illustrated.

No. W.10. 36 volts, 24 cells, 8'6 each. Size 6½ x 2½ x 3½. Weight 2 lb. 8 ozs. With 2 Spring Contacts.

No. W.11. 15 volts, 11 cells, 3'6 each. Size 9½ x 1½ x 2½. Weight 1 lb. 2 ozs.

Art Catalogue of Standard Sizes and Voltages and list of Accumulators for Valve Filament Supply sent on request. Dept. P.W.

THE EVER-READY WORKS, Hercules Place, Holloway, N.7

GUARANTEED VALUE

Only by manufacturing these Wireless Accessories and Sets in very large quantities are we enabled to offer them at such attractive prices.

CRYSTAL DETECTORS. Post free, 2/4 each.

Assembled on Ebonite, and Finely Finished. Remarkable Value.

FIXED CAPACITY CONDENSERS, 0.0003 to 0.001. Very efficient. Post free, 1/2 each.

BRUNET FRENCH HEADPHONES (double). Post free, 21/6 the pair.

Complete Sets of Parts for making Variable Condensers. Everything ready to assemble, and consisting of the following: Accurate Aluminium Fixed and Moving Vanes, Large and Small Spacer Washers, Centre Square Spindle (screwed ends, 2 B.A.), 3 Side Rods, Nuts, and Brass Washers (2 B.A.), Pointer Scale, Terminals, Bushes, and Spring Coil Washers, Best Quality Knob, with 2 B.A. Nut.

App. Capacity in Microfarads	Plates	Price for Complete Sets	Filament Rheostats for 1, 2, or 3 Valves, post free, 2/9 each.
.001	57	7/6	..
.0005	29	5/3	..
.0003	19	3/6	..
.0002	13	3/0	..
.0001	7	2/7	..
Vernier	3	2/3	..

We always hold large stocks of everything Electrical. Write or call at:

The Belgravia Electrical Company, Telephone: 111, WILTON ROAD, VICTORIA, S.W.1. Victoria 1420

THE CHEAPEST 2-VALVE SET

£9-0-0, complete with HEADPHONES, ACCUMULATOR, Etc. B.B.C. surcharge extra £3-0-0.

INTERVAL TRANSFORMERS Cash returned if not satisfactory. 20/- each.

21/-

Complete HEADPHONES 4,000 ohms.



British make throughout.

BRITISH CENTRAL ELECTRICAL CO., LTD., 6 & 8, ROSEBERY AVENUE, LONDON, E.C.1.

RADOLIONS

P.M.G. BROADCAST RECEIVERS OF QUALITY and TONE
2, 3, 4 and 5 Valves

AMPLIONS

THE MASTER LOUD SPEAKER

for POWER and TONE

ALL MODELS IN STOCK—ALWAYS

DEMONSTRATIONS EVERY EVENING 5 to 8.30

TRADE SUPPLIED at full discounts

RADIONETTE

BROADCAST RECEIVERS.

We have contracted for the entire output of these Instruments, and a campaign of the widest publicity will commence next week. Write now for particulars of our

EXTRAORDINARY OFFER!!

Crystor

COWL INSULATORS

(PROV. PATENT)

THE ABSOLUTE ESSENTIAL OF A PERFECT AERIAL



AERIAL INSULATORS
Price 1/9 each.

Crystor Aerial Outfit

SINGLE-WIRE AERIAL, containing 2 Crystor Cowl Aerial Insulators; 1 Crystor Cowl Lead-In (vertical or horizontal), 100 ft. Best Quality stranded copper Aerial Wire, 100 ft. Best Hemp Rope, and one pulley block, packed in box. Price complete, 18/6 Postage 1/6 extra.

Horizontal Wall or Window
LEAD-IN 6/6

Vertical Roof
LEAD-IN 6/-

STOCKED by all leading stores and Wireless Agents EVERYWHERE

I was recommended by Mr. — (a well-known amateur) to fit your Cowl Insulators to my aerial. The effect was extraordinary; it was just as if I had switched in another valve. . . . I received signals I had never heard before. S. D. (Ealing).

SOLE DISTRIBUTING AGENTS:

WIRELESS AGENCIES Ltd.,
64, Mortimer St., London, W.1.

'Phone: Museum 2672. 'Grams: 'Adragonax, Wesdo, London.'

- AT -

HALL'S

PRICES THAT SPEAK FOR THEMSELVES!

BRITISH HEADPHONES

4,000 ohms. Very Light. Beautifully Finished. Stalloy Diaphragms. Complete with Cords. Adjustable Earpieces.
(Sold elsewhere almost exclusively at 35/-)
19/6 Postage 9d.

The well-known—
French "Brunet" Headphones **22/6** Postage 9d.
French "Sidap" Headphones **21/-** Postage 9d.

GUARANTEED GOODS DISPATCH BY RETURN

VARIABLE CONDENSERS:

Capacity	Parts Complete	Assembled for Panel Mounting	
.001	6/6 .. .. .	.. .. .	12/6
.0075	5/6 .. .. .	.. .. .	12/-
.0005	4/8 .. .. .	.. .. .	10/6
.0003	3/- .. .. .	.. .. .	7/6
.0002	2/3 .. .. .	.. .. .	6/-
.0001	2/- .. .. .	.. .. .	4/3
Top and Bottom Circular Drilled Ebonite Plates, 1/3 extra. Vernier, 3/-			
Interval Transformers, Ratio 4 to 1. finest manufacture 12.9; 5 to 1, 14/- from 15/- to 23			
Crystal Sets			
"Royal Phone" Loud Speakers, 4,000 ohms resistance, ebonite horn, giving clarity of tone and freedom from distortion. each 30/- Orders in strict rotation.			
Aluminium Condenser Vanes, fixed and moving, 22/24 gauge pair 1d			
Spacers, true to .001. Small, doz. 2d; large, doz. 3d			
Ebonite Knobs, tapped 2 B.A. with brass nut—1st quality, 4d; 2nd quality 2d			
Aerial Wire, 7/22 hard drawn copper, in 100 ft. lengths 2.9			
Valve Legs, with nuts and washers, 1d each; doz. 9d			
Two Coil Holders, solid ebonite mounted on mahogany 4/9			
Three Coil Holders, solid ebonite, with long arms to avoid capacity effects 9/6			
Crystal Detectors, adjustable in every way Do. do. enclosed in glass case 2/6 4/6			
Engraved Ivorine Scales, 0-180, round or square ends 4/6			
Filament Resistances, extraordinary value. velvet action 2/6 and 3/6			
Switch Arms, complete with knob, collar, washers, bush nuts, etc. 1st quality, 1/6; 2nd quality 1/-			
Valve Holders, turned ebonite, complete with nuts, 1/3; 2nd quality 9d			
Crystal Caps. Plain 1d; one, two, or three screw 3d			
Large Terminals, complete with nut and washer Basket Coils, set of 7 1d 5/-			
Contact Studs, 1/2 in. by 1/4 in., complete with nut and washer doz. 6d			
Insulators, 2-in. reels—1d each; white egg, 3d; green egg, 4d; green shell each 4d			
Brass Nuts, 2, 3, 4, 5, 6 B.A., doz. 3d. Washers, doz. 2d			
Ebonite Sheets, 1/4, 1/2, 3/4 lb. 4/-			
Fixed Condensers, any capacity each 1/3			
Grid Leak and Condensers combined each 3/6			
Slider Plunger complete each 4d			
Slider Rods, 12-in. or 13-in. 1/4-in. square brass, drilled both ends 4d			
Hertzite, 1/6. Bornite, Carborundum, Galena 4d			
Screwed Brass Lengths, 12-in. 2 or 4 B.A. each 3/6			
Inductances, wound 22/24 enamelled wire, each 3/3			
Orders under 30/- kindly remit ampts postage. Balance refunded Express sent. SEND FOR FREE CATALOGUE.			

TRADE SUPPLIED **HALL'S** DISPATCH BY RETURN

'PHONE: REGENT 1282
71, Beak St., Regent St., London, W.1
Between Piccadilly Circus and Oxford Circus
'Buses 3, 6, 12, 13, 15, 32, 51, 53, 59 and 88 pass

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 830.)

of radio frequency. Therefore, as has been mentioned many times before in these columns, H.F. should be employed to increase the range of reception of the set, and L.F. where it is required to increase the strength of signals audible before the addition of that stage of amplification. This latter, L.F., is necessary, for instance, for loud-speaker work. From the foregoing you will be able to arrange your circuit to suit your own special requirements.

J. H. (Darlington).—Why the difference in price of telephone receivers? Are the expensive reed type suitable for telephony? I have been told otherwise.

Prices of all things tend to differ greatly with type, make, etc. Personally, we are obtaining excellent results from telephone receivers of the "cheap" variety—they are advertised in POPULAR WIRELESS—and are using them in preference to our "adjustables." These latter, however, even although reproduction is not quite so mellow as with the flat diaphragm 'phones, are far more sensitive, and are always called into service when weak signals have to be dealt with.

R. M. (Northampton).—In our special "colony" they are commencing to instal electric light. This I admit is useful, but why should they make it A.C. when we have all got valve sets? Would a polite note to the authorities assist in preventing this?

We are afraid not. A.C. is more or less necessary in some areas where there is a fair amount of transforming up and down to be arranged. Unless you are all using an unduly large number of stages of low frequency amplification, and avoiding H.F., or do not see that the wiring systems of the lighting and wireless outfits are kept as far apart as possible, we do not think you will find yourself "jammed" right out by A.C. interference.

P. I. K. (Southend).—When it is said that an aerial is directional by pointing to the station from which it is desired to receive the loudest signals, do they mean that the end farthest away from the set should point in that direction?

No, the lead-in or nearest end to the receiving set should do so.

R. L. N. (Brixton).—Can the Morse code be transmitted by telephony?

We hardly see the point of that question, because there would seem little reason for wishing to do so. However, telephony is superimposed on ordinary C.W. which, of course, can be where necessary interrupted in the form of the short and long impulse of the Morse code.

G. A. (Dorridge).—I have a crystal set, and should like to use a loud speaker. What type of valve should I use? Would it increase the range?

You should use one or more stages of L.F. amplification. Not appreciably; the function of L.F. amplification, or audio-frequency amplification, as it is often called, is to magnify the strength of signals that are already audible without the magnifying valve.

F. H. N. (Plumstead).—I have a crystal set and wish to use a frame aerial for the reception of Marconi House broadcasting. What size frame shall I use?

A frame aerial for use with a crystal set will not give you satisfactory results over the distance for which you wish to use it. The size of the frame should be about four feet square, with 5 turns of 22 or 24 d.c.c. wire. Your frame is rather small, being only about 3 ft. square, and you would require about 6 or 7 turns of wire to give satisfactory results. We do not advise its use on a crystal set, however.

H. L. P. (Liverpool).—How can I add a L.F. amplifier to a crystal set?

(Continued on page 834.)

"I CAN ALWAYS GET AMERICAN BROADCASTING, USING YOUR 3 VALVE."

Absolutely complete £16-10s. Carriage 5/-.
(Diagrams, parts, valves, batteries, etc.)
HINKS' WIRELESS DEPT., HARDINGTON, YEOVIL.



Concentrated Radio knowledge

If you want to learn the elementary principles of Wireless, here are the two Books you need. Both are from the pen of John Scott-Taggart, F.Inst.P.—a master in the difficult art of explaining technical subjects lucidly and clearly.

Spend an hour with these two Books. You will learn exactly how speech and music is transmitted by wireless, and the kind of Receiving Set you should have to pick it up.

Sold by all Booksellers and Newsagents.

Wireless 6^d
for all
POST FREE 7½"

Simplified 1^d
Wireless
POST FREE 1/1½"

Radio Press Ltd
PUBLISHERS OF AUTHORITY WIRELESS LITERATURE
DEVEREUX COURT, STRAND, W.C.2.

POST ORDERS OUR SPECIALITY

Satisfaction Guaranteed or Money Refunded

PRICE LIST SENT POST FREE.

AERIAL WIRE 100 ft. 7/22 Copper 2/9
HERTZITE CRYSTAL DETECTOR, Complete 3/9
BASKET COILS, seven in set. 4/9
CRYSTAL RECEIVING SET Entirely Enclosed in Mahogany Cabinet. B.B.C. Royalty paid. Fully tested and guaranteed. Carriage paid. 32/6

HEADPHONES, Accumulators, Resistances, Insulators, Vanes, Terminals, Ebonite parts, Condensers, or anything Wireless.

Carriage paid on 20/- orders.

DE-LUXE COMMODITIES,
151A, OXFORD STREET, LONDON, W.

WIRELESS (Compl. te Sets) 29/6

Single Slide Tuner, Sensitive Detector, Phone, Aerial Wire, Insulators. Cheapest Set 29/6 Tested. Fully Guaranteed. Trade enquiries solicited.
TURNER, 16, JODRELL RD., LONDON, E. 3.

TO THE TRADE.

Ebonite—Copper Wire, Bare & Covered—Aerials—Sleeving, &c.

Wireless Supplies. Prompt Delivery.

Cables & Electrical Supplies, Mica House, Olford St., Caledonian Rd., London, N.1. Telephone: North 805

OMNIPHONE

Wireless Service

EBONITE:—

"A" grade, polished sheet, 3/16th inch thick, cut to any size required, at 1/2d. per superficial sq. inch.

Ditto, 1/4 inch thick, 3/4d. per sq. inch.

All above post free. Send stamp for list.

OMNIPHONE WIRELESS CO.,
24, Warwick St., Regent St., London, W.1.

YOU ARE WANTING First Quality Goods for Building Your Own Sets

Contact Studs, highly finished, with nut and washer	doz. 8d.
Aerial Wire, finest quality, 7/22 hard drawn copper, 100 ft. 3/-; by post	4/-
Terminals (large), 2 & 4 BA, doz. 2/-; with nut & washer	2/6
Terminals, W O pattern (large), 4 BA, doz. 1/8; with nut and washer	2/-
Terminals, W O pattern (small), 4 BA, doz. 1/4; with nut and washer	1/8
Terminals, Ordinary, doz. 1/6; 4 BA, with nut and washer	2/-
Terminals, Telephone, 4 BA, doz. 1/10; with nut and washer	2/4
Aluminium Vanes, extra quality	doz. pairs 1/-
Crystal Detector, complete, mounted ebonite, 2/6; special quality dust proof	5/-
Lead in Tubes, beautiful finish, 6 in. 1/-; 9 in.	1/6
Spacers (large), doz. 3d.; (small) (for condensers)	doz. 2d.
Switch Arms, first quality only, complete	each 1/4
Knobs (Ebonite), first quality, tapped, 2 BA, brass nut	each 4d.
Ebonite Dials, marvellous value, 0-180, bored in centre	each 1/-
Ebonite Valve Holders, with 8 nuts, 1st quality only	1/4

Insulators (egg type), each 3d.; reel type	each 1d.
Filament Resistances, finest quality	each 2/8
Oojah Basket Coils, 7 in. set	5/-
H.T. Batteries, 30 volt, 6/-; 60 volt	12/-
Ebonite, 1/2 in., cut any size	lb. 4/-
Headphones (double receivers), Best British make, 4000 ohms	21/-
" " " " French " " "	25/-
" " " " Federal " " "	30/-
" (Single) " " Best British Make, " " "	12/6
Condenser Spindles, all sizes, 6d., 4d., 3d., and	each 2 1/2d.
Crystal Cups, with 4 screws	each 3d.
Crystal Cups, with 2 screws,	each 2d.
Ivory Scales (engraved), 0-180, best quality	each 6d.
Variable Condensers, suitable for first-class panel work, mounted on ebonite, 001, 14/-; 00075, 11/-; 0005, 9/6;	
0002, 8/6; 0001, 8/-; 00005,	6/-
Hertzite Crystal, per piece, 1/-, 1/6	2/-
Brass Rods, screwed, 12 in., 2 BA, 5d.; 4 BA	4d.
Mullard Valves, type R, 17/6; Ora, 15/-; Cossor Valves each	15/-
Accumulators (British Make), highest quality, 4 vlt. 20 amps, 18/-; 4 vlt. 40 amps, 24/-; 4 vlt. 60 amps. 32/6; 6 vlt. 20 amps, 24/-; 6 vlt. 40 amps, 32/6; 6 vlt. 60 amps.	42/-

SPECIAL LINES IN CABINET SETS

THE FELLOPHONE Two-valve Set, complete with Aerial, High-tension Battery, Accumulators, Headphones, etc.,	£10:10:0
THE FELLOCYST Super-receiving Cabinet, complete in Oak Cabinet, with Aerial Insulators and instructions,	£4:7:6
THE CEE BEE 3 Double Crystal Set, very compact, in polished Mahogany Cabinet, with Compartment for 'phones. Complete with Aerial, Insulators, Headphone. Gives perfect result from inside aerials:	£3 3 0
THE CEE BEE Junior Double Crystal Cabinet. The most wonderful machine on the market. Mounted in polished Mahogany Cabinet; very compact. Results from inside aerials wonderful.	£1:12:6
THE CEE BEE 1. Very fine Crystal Set, Ebony Panel mounted on highly polished Mahogany Cabinet. Complete, with Aerial Insulators, Headphones, Wonderful value	£4:10:0

Send Ample Postage:

FOWLER & BRIGDEN,

130, Euston Rd., King's Cross, LONDON, N.W.1. Tel. Museum, 4827.

Use a Note Magnifier and AMPLIFY Your RECEPTION 500%

The Wates Unit System of Note Magnifiers enables you to build up your crystal or single valve set, step by step, to the equivalent of a larger and very expensive-receiving set.

If within 20 miles of the Broadcasting Station, a One-Valve panel allows of a Loud Speaker being fitted.

For greater distance, a Two-Valve panel, or 2 One-Valve panels, are sufficient for a Loud Speaker.

Mounted on best quality ebonite panel, and enclosed in highly-polished mahogany case

£3 10 0

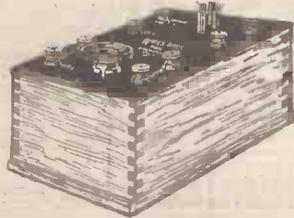
Including all Royalties and Taxes.

TWO-VALVE AMPLIFIER IN ONE UNIT

£6 0 0

Send to-day for lists giving particulars of our complete wireless sets, accumulators, H.T. Batteries and all component parts.

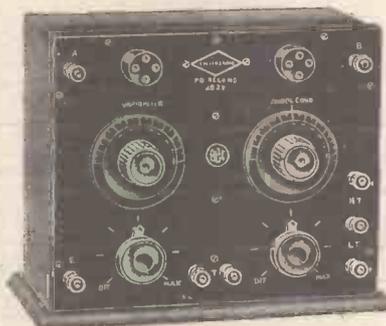
Post orders executed in 24 hours.



- Filament Resistances...3/9
- "Ideal" Valve Accumulators in cases.
- 4-Volt 50 amp. 24/- (Carriage 2/-)
- 6-Volt 50 amp. 35/- (Carriage 3/-)
- Variable Condensers (of various capacities) ... From 6/-
- Fixed Condensers ... 2/6
- 3-Coil Holder, complete Unit for use with Standard Coils ... 20/-

Wates Bros. 13/14, Great Queen Street KINGSWAY, LONDON, W.C.2
Phone: Gerrard 576. Telegrams: Zywateseng, Westcent.

"THE ENSIGN" TWO VALVE RECEIVER



RELIABLE
EFFICIENT
SELECTIVE

PRICE
INCLUDING
ROYALTIES
£9:17:6

THE IDEAL RECEIVER FOR RECEPTION of "BROADCAST"

Price with all accessories, including Valves, Brown's featherweight 'phones, 6 volt accumulator, 60 volt H.T. Battery and Aerial Equipment

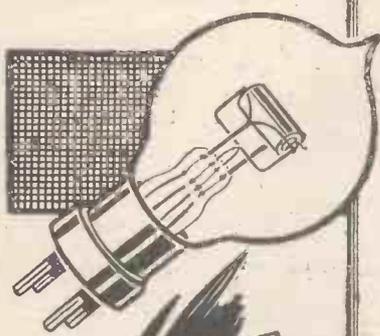
£15:19:0 Carriage paid

Write for List—

THE ENSIGN RADIO CO.
15, STRAND, LONDON, W.C.2
Telephone: Gerrard 6703

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 832.)



CHAPTER VI
REACTION RECEIVERS OF WIRELESS
SETS

III. Reaction Amplification. We have seen in the previous chapter that by transferring energy from the anode current of the three-electrode valve to the grid current we are enabled to obtain the desired gain of the grid current. This phenomenon is clearly of great advantage when receiving wireless signals. The reacting current necessarily produces an appreciable resistance which lowers the strength of the anode current. By transferring energy from the anode to the grid side of the valve we can overcome the conditions in an equal degree, particularly in the case of weak signals.

Fig. 14 shows a circuit in which reaction is employed to assist in receiving signals. The incoming signals produce oscillations in the circuit L₁ C₁. The oscillating potentials across C₁ cause the grid to become alternately positive and negative. These slight potential variations produce magnified anode current variations in the anode circuit of the valve and these anode current variations pass through the inductance L₂ which may if desired, be shunted by a loading inductor L₃. Across the secondary circuit L₄ C₂ the induced current is fed back to the grid. If the current L₂ C₂ has no inductance of its own coupling effect on the circuit L₁ C₁, the oscillations in L₁ C₁ will be of the ordinary inductive character. That is to say, they will be several times as strong

as the oscillations taking place in L₁ C₁. If the coupling effect is due to inductive action, we receive from a given station much greater energy and the magnitude of the magnified oscillations in L₂ C₂ will be modified by the detector and grid current which acts in the telephone T. If now we bring the inductance L₂ close to the inductance L₁ so that there is magnetic coupling between them, the incoming signals will appear very much louder.

The mutual inductance between the primary and secondary circuits is such that the current in the secondary circuit is several times as strong as the current in the primary circuit.

It is to be noted that the reacting inductance in L₂ C₂ are built up to a very much greater strength than formerly on account of the magnified oscillations induced by L₂ into the circuit L₁ C₁. These conditions being nearly the same as those existing in L₁ C₁, increase the effects on the grid T, and the final oscillations in L₂ C₂ will be several times stronger than the magnified signals which would be obtained merely by using the mutual inductance properties of the valve. The action on the incoming signals will be several times as strong

2/6 net
WIRELESS VALVES
SIMPLY EXPLAINED

A VALVE RECEIVER

BY
JOHN SCOTT-TAGGART, F.Inst.P.

Radio Press Ltd., 15 South Square, London, W.1.
In South Square, London, W.1.

Reaction

— here's a simple explanation you will understand

Contents.

- The Theory of the Thermionic Valve.
- The 3-Electrode Valve and its applications.
- Cascade Valve Amplifiers.
- Principles of Reaction Amplification and Self-oscillation.
- Reaction reception of Wireless Signals.
- Continuous Wave Receiving Circuits.
- Valve Transmitters.
- Wireless Telephone Transmitters Using Valves.
- Broadcast Receivers.

2/6
or 2/8; post free from Publishers.

THE use of Reaction gives almost the additional strength of another Valve, but carelessly used it is a source of great annoyance to all other receiving stations within two or three miles. Therefore the P.M.G. has rightly banned all reaction coupled to Aerial Circuits on Broadcast wave-lengths. No need to cut it out altogether though, because it is quite easy to arrange Circuits employing Reaction which do not cause oscillation in the Aerial Circuit.

If you are not now using Reaction, get this new book by John Scott-Taggart, F.Inst.P.—the eminent authority on the Thermionic Valve—you will find that the explanation of its principles is given lucidly and clearly in language you can understand.

Get this book—it will certainly help you to understand your Set better. From all Booksellers and Newsagents, or direct from

Radio Press, Ltd
PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
DEVEREUX COURT, STRAND, W.C.2.

Your guarantee of dependable information

Finest Quality Money can buy

Wireless HEAD-PHONES

10/6 per pair. 150 Ohms each. Postage 6d. extra. Special Quotation for Quantities.

Jacks 6/- doz. Not less than 1 doz.

HYAMS, 25-26, King St., Camden Town, N.W.
Mention paper. Estab. 80 years. Phone 2832 North

CRYSTAL SETS
Assembled and unassembled.
And all component parts.
Write for illustrated catalogue. Post free, 3d.

VALVE PANELS ON THE UNIT SYSTEM
Unassembled
Simple to build. Full instructions sent with each set. Ask for particulars.

P. H. BOYS & CO.
Electrical & Wireless Engineers,
187, GOSWELL ROAD, LONDON, E.C.1.
Phone: Clerkenwell 4454.

MATERIALS, TOOLS, & WORKSHOP SUNDRIES

OUR 1923 LIST of above (64 pages) is now ready. Wireless experimenters cannot afford to be without a copy. SENT POST FREE on receipt of Post Card.

GEORGE ADAMS (DEPT. P.W.), 255-6, HIGH HOLBORN, LONDON, W.C.1.

The primary of the inter valve (L.F.) transformer is connected to the 'phone terminals on the crystal set. The secondary of the transformer is connected to the grid and the L.T. negative of the valve panel. The plate of the valve is connected to one 'phone terminal on the panel, while the other terminal goes to the H.T. positive. The H.T. negative is connected to the L.T. negative and thence, as above, to the secondary of the transformer. The L.T. positive goes to the filament via the filament resistance. A .002 mfd. condenser should be placed in shunt across the 'phones and H.T. negative, and the original .001 'phone condenser on the crystal set is left across the primary of the transformer. Usually the connections of the transformer are: IP to crystal, OP to earth, IS to grid, OS to L.T. negative.

A. S. A. (Crofton Park).—What capacity should a 'phone condenser be? (2) In stating the value of a variable condenser, is the figure given the average or the maximum? (3) What dimensions should I need for a 'phone condenser?

(1) About .001 mfd. (2) The maximum capacity is given. (3) About 6 plates of tin-foil separated by mica .002 in. thick. The plates should have an overlap of 2 sq. cms.

"CRYSTAL" (Manchester).—(1) I have several crystals, but am not sure which is which. (2) Could you give me a brief description of galena, carborundum, silicon, zincite, and copper pyrites? Do these require batteries?

(1) Galena is a bluish grey, like cut lead. Carborundum is usually silver grey, though it varies from a deep grey to a purple colour. Silicon is grey in colour with a metallic lustre. Zincite is red, while copper pyrites is a bright yellow, brass colour. (2) No batteries are needed, with the exception of carborundum, when a potentiometer and battery must be used.

A. H. (Preston).—I am told that the larger the diameter of a coil the greater will be its inductance and therefore wave-length tuning. But is there any limit to that?

Yes, decidedly, because the coil may give a diameter too large to allow you to tune down to the lower wave-lengths desired. Also, it is as well to bear in mind that with a given length of wire the inductance value is at its greatest when the diameter is two and a half times the length of the winding. Above that, loss would be occasioned.

Is the inductance of a coil its only useful factor?

Absolutely. There will naturally be a certain amount of self capacity and resistance, both of which are undesirable but unavoidable. However, they can be kept down to a minimum where efficiency is desired.

R. J. W. (Tunbridge Wells).—I have a single valve set and am experiencing difficulty in obtaining results on the shorter wave-lengths. What coils do you recommend for these?

Basket type or small solenoids of the usual single-layer cylindrical type are the best type to employ for the shorter wave-lengths.

K. M. N. (Neath).—How much further would I be able to hear by adding a L.F. valve to my crystal set?

The addition of L.F. amplification would increase the strength of existing signals, but would not increase to any very appreciable extent your range of reception. In order to do this H.F. amplification is required.

F. J. (Stoke Newington).—Will the P.M.G. pass a diagram of a set where the reaction is coupled to a secondary closed circuit inductance?

No, only inter-valve reaction is permissible. This is obtained by introducing a stage of H.F. and coupling the reaction coil to the secondary of the H.F. transformer.

(Continued on page 836.)



Two Symbols



When these two symbols appear in conjunction on a Broadcasting Receiver, no further recommendation is necessary. The one signifies that the instrument has been approved by the Postmaster-General.

The other tells you that the greatest brains in Wireless have directed its manufacture. Look for *both* signs always. You will find them only on

The Marconiphone

The Triumph of the Master Mind.

Your local dealer can supply you. In case of difficulty apply to:

MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED
(Marconiphone Department), MARCONI HOUSE, STRAND, LONDON, W.C.2.

Griffin's The Mail Order Stores "GRIFPHONES" THE IDEAL HEADPHONES 22/6

MONEY BACK IF NOT SATISFIED.

- | | |
|--|--|
| GRIFFIN EXPERIMENTERS' PANEL (Postage 1-) 25/-
10 x 6 x 1/4 in. Ebonite Panel.
Fitted with Filament Resistance, Valve Holder, .0005 Condenser, Scale and 10 Stud Tapping Switch. Eight Terminals. | SWITCH ARMS .. 1/- & 2/-
Ebonite Dials, 1 to 180 .. 1/6
Siemens H.T. Batteries, 30V. .. 7/6
66V. .. 15/- |
| TRENCH BUZZER SETS .. 7/6
Complete with Ear-piece, etc. (Postage 1/3) | Potentiometers .. 4/-
Filament Resist. .. 2/6, 3/-, 3/6
Ebonite Panels, all sizes per lb. 4/6
Knobs .. 6d.
Sliders .. 9d. and 1/8 |
| INTERVALVE TRANSFORMERS
Guaranteed THE BEST, being Distortionless, Noiseless. These are HEDGEHOG pattern, Ratio 5-1. Wound with D.S.C. Wire .. 20/- (Postage 9d.) | Aerial Wire, 7/22 Copper, 100 ft. .. 3/9
Enamelled .. 4/6
Resistance Wire, 12 yds. .. 10d.
Rubber-Covered 20 g. Copper, 12 yds. 1/4
1/2 oz. Bobbins, 47 g. D.S.C. (for re-winding Phones) .. 1/-
Pkts. of asstd. Crystal (Real Value) 2/6 |
| TELEPHONE TRANSFORMERS
As specifications of above .. 17/6 (Postage 9d.) | QUALITY CRYSTAL DETECTORS 2/6
" " Super. Qual. 6/-
Wound Ind. Tubes, 3 x 12, 3/3; 4 x 12 .. 4/-
Valve Holders, Mid., 1/-; " A " 1/2 .. 1/6 |
| QUALITY FILAMENT RESISTANCES .. 2/9
GRIFFIN Fixed CONDENSERS, .001 .. 1/6
" DUBILIER " .0001 to .0009 .. 2/6
" .001 to .005 .. 3/-
" Grid Leaks, 2 Megs. .. 2/6 | BASKET COILS , special line, shelled, not waxed. Wound with 3 stranded wire .. 7/6 |

GRIFFIN Valve Sets **MAGNUM**
1, 2, 3 & 4

Complete List of all Parts sent Free.

GRIFFIN WIRELESS SUPPLIES CO.,
82, Newington Causeway, LONDON, S.E.1.
(3 minutes from Elephant & Castle Stations).
Hop 1806. (The corner of Lancaster St.).

Can I help you?

I will give you £50

if I fail to produce over 7,000 testimonials from others I have helped to

A Successful Career.

Yours to Success

J. B. Bennett

We teach by POST.

ADVICE FREE
Most Moderate Charges
Payable Monthly.

Learn a trade or Profession.



Every man is the architect of his own fortune?

- Write for one of our FREE BOOKLETS on any of the following subjects:
- | | | |
|------------------------|------------------------|--------------------------------|
| Architectural Drawing | Engineering | Pattern Making |
| Building Construction | Foundry Work | Salesmanship |
| Clerk of Work's Duties | Internal Comb. Engines | Sanitation |
| Aviation | Marine Engineering | Shipbuilding |
| Boiler Engineering | Mathematics | Structural Engineering |
| Boiler Making | Matriculation | Surveying & Levelling |
| Chemistry | Metallurgy | Telegraphy & Telephony |
| Civil Engineering | Mining | Wireless Telegraphy |
| Concrete and Steel | Mine Surveying | Special Course for Apprentices |
| Draughtsmanship | Motor Engineering | |
| Electricity | Naval Architecture | |

WE SPECIALISE IN ALL EXAMS, WIRELESS, ELECTRICITY, P.M.G., C.G.I., A.M.I.E.E., and B.C.D.

If you are preparing for any exam, ask our advice. All particulars free of charge. Parents should seek our advice for their sons. If you are interested in any of the subjects mentioned above, write, naming the subject, and we will send you our FREE BOOKLET. Please state your age. Courses specially combined to meet all requirements.



Department 106



RADIO PRESS

WIRELESS DIRECTORY

Keep it handy

As indispensable to the listener-in as the telephone directory is to a subscriber. This book gives over 12,000 Call Signs of all land and ship stations as well as a very full list of British Amateurs. Keep a copy handy and know who is sending—you'll get much more enjoyment from your Set.

2/6

From all Booksellers and Newsagents.
Published by **Radio Press Ltd**
DEVEREUX COURT, STRAND, W.C2

WIRELESS INVENTIONS
Patents and Trade Marks. Advice Hand-book and Cons. free.—**B. T. KING, Regd. Patent Agent (G.B. & U.S.A.), 146A, Queen Victoria St., E.C.4.** Phone: Central 682. 36 yrs. refs.

STOP BUYING INFERIOR MATERIAL LET US SUPPLY YOU WITH
EBONITE Sheets, Rods, Tubing, Knobs, etc. Panels cut to size. Sheets matted.
EBONITE PARTS SUPPLIES,
92, BETCHWORTH ROAD, SEVEN KINGS, ESSEX.

Beginners Guide to Wireless
Explains, in plain everyday language, everything beginners wish to know about wireless telegraphy. **HOW TO ERECT, CONNECT, AND MAKE** all the apparatus required for reception of telephony or morse, and full instructions and diagrams for making coils, tuners, and complete valve and crystal sets. 112 pages, price 1/-, post free.—**SAXON RADIO CO. (Dept. 14), South Shore, Blackpool.** 32-page cat. of wireless apparatus. 2d., post free.

BARGAINS

Crystal Detectors	2/8
Valve Holders (ebonite)	1/-
Fixed Condensers	1/6
Reel Insulators	2d.
Egg Insulators	3 1/2d.
Laminated Switch Arms	1/10
Terminals	1d.
Aerial Wire, stranded 150 ft.	4/6
Contact Studs	doz. 5d.
Valve Legs	1d.
Crystal Cups (3 screws)	4d.
Valve Pins	1d.
Spade Terminals	1d.
Condenser-Vanes	doz. 1/-
Filament Resistances	2/10
Lead-in Tubes, 8 in.	1/6
" " 12 in.	1/9
Slide Rods, with terminal	6d.
Large Spacers	doz. 4d.
Small Spacers	doz. 3d.
Loud Speakers	10/6
Intervalve Transformers	13/6
Phones, 4,000 ohms	21/-

Send Ample Postage.

Illustrated Catalogue, including List of Stations, Post Free, 6d.

EONS WIRELESS SUPPLY CO.,
115, FLEET ST., E.C.4.

(Next "Daily Express" Offices.)

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 834).

"UNCERTAIN" (Midsomer Norton).—Have the holders of experimental licences to have all bought parts stamped by the B.B.C.?

No; an experimental licence does not make any stipulation of this kind.

G. E. B. (Manchester).—Which would be best, a direct earth 20 ft. long, an earth to a lead roof 4 ft. long, or a water pipe earth lead 16 ft. long?

We prefer the earth lead to the water pipe. In this case, stout wire, such as No. 16, should be used, or aerial wire—7/22 stranded type—is quite O.K.

W. L. (Norfolk).—Would an accumulator of 4 volt 40 amp. be sufficient for two "Ora" valves? (2) Which type should be used for detecting and for amplifying?

Hardly. Though it would do the work, it is better to use a 6-volt battery and have a fair amount of variation in the resistance. This will give you more chance to obtain the best out of your set. We suggest a 6-volt 40-amp. accumulator. (2) For detecting, a fairly soft valve should be used, or an old hard one which has become soft. You will probably find that the old type of "Ora" valve will give better results as a detector than the new ones. These latter valves will be found to be very good as amplifiers. It is usual to employ a harder valve for amplifying than for detecting.

J. F. T. (Durham).—At which end should the lead-in be taken from the aerial?

The lead-in should be taken as nearly at one end as possible—preferably the higher end—but it should also be taken from a point as near the receiving set as can be done. The great advantage of having the lead-in at the end is that the aerial then has a directional effect, according to which direction the lead-in end points.

E. M. C. (Nottingham).—What size frame aerial should I use to receive Birmingham on four valves?

A frame, 4 ft. square, wound with five turns of 24 D.C.C. wire. The wires should be spaced about 1 in. apart. You should have a .001 mfd. variable condenser across the aerial so as to be able to tune-in to the station.

"FRAME AERIAL" (Birmingham).—Is a tuning inductance necessary when using a frame aerial?

No; the aerial should be wound as nearly as possible correct to the wave-length required. The fine adjustment of tuning is accomplished by a .001 mfd. variable condenser connected in shunt across the aerial.

B. C. T. (York).—Was there not a mistake in your reply to S. E. B. (Doncaster) in your issue of January 20th? The statement that the gravity of the acid in an accumulator should not drop below 1.85 seems rather doubtful.

Yes, there was a misprint in that question, though if you look up the last question in that issue you will see the correct values. Of course, the value of the gravity should not drop below 1.185. The other values should be 1.2 and 1.17 respectively.

L. G. B. (Notting Hill Gate).—I have a one-valve set, but I should like to add another valve. What kind should I use?

If you intend to still further increase your set, we would advise the addition of a L.F. panel to your existing detector. This will enable you to receive 2 L O and local amateurs very loudly, while if you require a longer range, an additional H.F. panel will be of use.

W. R. (San Roque, Spain).—What is the wave-length of my coil wound with about 400 turns of 24 on a 10 in. by 3 1/2 in. former? (2) What condenser should be used across the A.T.1 Tappings for finer tuning? (3) What is my range on a crystal set for telepathy (Morse) reception? (4) What condenser should I use across the 'phones?

(1) About 280 to 2,220 metres. (2) Use a .0003 or a .0005 mfd. variable condenser. (3) Range is about 200—300 miles, depending largely upon the power used by the transmitting station. (4) Use a .001 mfd. fixed condenser across the 'phones.

FOR THE EXPERIMENTER

Microphones, W.E. Solid Back, for Transmitting	15/-
Microphones, Inset Pattern	5/-
Receivers, 150 ohms, P.O. Watch Pattern, with cords and jock complete	5/-
Condensers, 2 M.F. Mansbridge	1/3
Mica Sheets, Best Ruby, 4 x 2 1/2 ins.	2d.
Buzzers	2/6 & 3/6
Morse Tapping Keys	3/6 & 5/-
Variable Condensers, 0 to 80 ohms, with Radial Switch Arm	4/6
Telephone Jacks, Switchboard pattern	1/-
Telephone Plugs, Switchboard Pattern	2/-
Telephone 4-way Plug and Jack	3/9
Solid Ebonite Knobs, with 4 BH. spindle	3d.
Solid Ebonite Knobs, with Bush and Slot	3d.
W.D. Terminals, Brass, with 2 nuts, 4 B.A.	per doz. 2/-
W.D. Terminals, for Aerial and Earth, 0 B.A.	per doz. 2/6
Relays, 200 ohms, Double Line, Very Sensitive	5/-
Dewar Switches, 6 spring	1/9
Dewar Switches, 12 spring	3/6
P.O. Induction Coils, containing 2 iron cores of S. Covered Wire, and Bundle of fine iron Wire	2/- extra. & 1/-
Resistance Wire, Silk Covered Eureka, in 22—30 yards.	1/-

The above are ex-W.D., and in good condition. They are also limited to quantity.

EXCEPTIONAL VALUE IN VARIABLE CONDENSERS

Unassembled:	Assembled:
.001 200 6/6	12/-
.005 4/-	9/6
.003 3/-	8/6
Vernier 2/-	6/6
Turned and Drilled Ebonite Plates, 1/6 extra per pair; Ebonite Scale and Knob, 2/- extra.	Complete with Knob, Ebonite Scale, and Turned Circular Plates.
Crystal Detectors, Complete, Polished and lacquered	2/6
Slider Knobs, Complete with 13-in. Brass Rod, Drilled	11d.
Switch Arms, 2 1/2, 2/9 & 1/6	9d. & 1/6
Contact Studs, with 2 nuts, 1 x 1/2 head, per doz.	9d.
Ebonite Knobs, Turned and Hand-Polished, Solid Topped, 2 B.A.	6d.
Cheaper Mouldings	2/-, 2/9 & 3/3
Filament Resistances	14/6 & 25/-
Intervalve Transformers	14/6 & 25/-
Ebonite Valve-Holders, with 16 nuts, 1/- & 1/3	
Double Headphones, 4,000 ohms, by sensitive Brunel, French Manufacture; very sensitive	22/6
Ebonite "A" Quality, Matt. Finish, 1 sheet, per square inch, post free	1d.
Drilling and Engraving, and Oak, Teak, and Mahogany Cabinets to Order.	

W. H. AGAR,
WALROND STREET WORKS,
258, Mitcham Lane, Streatham, S.W.16.

ELECTRADIX RADIOS.

Immediate Delivery from our Huge Stocks.
Everything from a Recorder to an Earth Clip.
The best equipped city depot.
COME AND SEE US.
9, Colonial Avenue is first opening on left in the Mipories, near Aldgate Station, Metropolitan Railway.
LESLIE DIXON & CO. Tel.: Avenue 4166.
9, Colonial Avenue, London, E. 1.

CABINETS & CASES

IN POLISHED MAHOGANY OR TEAK. QUOTATIONS PER RETURN.
J. LANCASTER & SON, LTD., 87, PARADE, BIRMINGHAM.

PORTLAND'S

Parts by Post. "EBONITE."

8 x 1	7	12 x 10	7 6
4 x 4	1 3	17 1/2 x 8 1/2	9 6
7 x 5 1/2	2 8	18 x 18	12 10
10 x 6	3 9	36 x 18	1 3 0
17 x 5	5 3	7lbs.	1 3 0

Quarter, Mat, British. Postage Free. Any size cut.
JAMES PORTLAND,
39, Sinclair Road, Olympia, W.14.
Mr. Portland stocks 200 Wireless Parts

POPULAR WIRELESS Beginners' Supplement

PART II. THE MEANING OF "TUNING-IN."

By MICHAEL EGAN.

I WOULD like to say something about "tuning" at this stage. Anyone who professes to know the first thing about wireless can tell you that most of the little knobs and handles on a modern receiver are for the purpose of tuning the receiving circuits to the wave sent out by the transmitter. This tuning is a very simple, yet a very extraordinary, process. At one moment no signals are received. Then, by turning one or two little handles, the tones of a human voice are suddenly conducted into the drawing-room from out of the intangible ether.

How does this happen? What does the turning of a handle do? Why do signals get loud and weak alternately as one particular handle is moved backwards and forwards? These are questions which must occur to every imaginative person on seeing a wireless receiver operated for the first time.

A Simple Analogy.

Well, they are not very difficult questions to answer so long as we do not seek anything in the nature of an exact technical explanation. Let us take a simple analogy from music—a violinist who is tuning up for a concert. We can all conjure up the picture of the violinist thumping G on the piano several times and then plucking the G string on his violin. If the two do not correspond he adjusts the violin string until it gives the same note as the piano string.

In this operation we speak of the musician as "tuning his violin to the piano." What he really does, of course, is to make one of the violin strings vibrate at the same rate as one of the strings of the piano. If he has a "practised ear" he can now tune the other violin strings without further reference to the piano. The notes emitted from the two adjacent

violin strings are at a distance of a musical "fifth" from one another, and the trained musician can gauge this distance to a nicety.

There is a great similarity between the methods employed by the violinist and wireless operator in tuning their respective instruments. The violinist has four strings on his violin, each of which has to be tuned to emit a certain note when touched by the bow. That is, each string must be stretched to such a degree of tautness that it will vibrate at a definite rate when the bow is drawn across it. Like the wireless operator, the violinist has also got a number of little handles on his instrument which have to be turned backwards and forwards during the process of tuning-in. Each string on the violin is connected to a small handle which, on being turned in either direction, increases or diminishes the tautness of that particular string.

There are certain factors that determine the pitch of the note that will be emitted by any particular string, when vibrated. One of these factors is the *length* of the string; another is the *tension* of the string, i.e., the extent to which it is stretched; a third is the *quality* of the material of which the string is made. This latter factor cannot, of course, be altered at will. The amount of *tension*, however, can be, and is altered in the manner referred to above. The *length* of the string is also altered by the musician in the act of playing. He places his fingers at different points along the strings, and thereby effectively alters their length, with the result that different notes are emitted as the bow crosses them.

Tension.

Now, when a violinist tunes a string what he is really doing is to "prepare" that string. He is preparing it to vibrate at a definite rate. He is making it specially sensitive to one particular rate of vibration. And he usually gets his "cue," in the first instance, from a piano or some other instrument on which he knows he can depend.

In a similar way, the circuits of a wireless receiver have to be tuned, or prepared to vibrate at a special rate. The circuits we may regard as corresponding to the strings of the violin. Also, as there are variable factors of length, tension, and quality connected with the latter, there are variable factors connected with the former; but these need not be considered here.

Moreover, just as different stringed instruments possess different numbers of strings, so there are different types of wireless receiver which vary in the number of circuits they contain. A crystal receiver, for instance, might have only one circuit, whilst a valve receiver might employ three.

To appreciate the analogy that has been drawn between these two operations of tuning, it is not necessary to know what comprises a receiving circuit. For the moment it should suffice that a circuit is tuned to a certain value by turning a small handle on the top of the receiver box, just as

a violin string is tuned by turning a small handle at one end of the violin.

Attention has been called to the violinist's use of the piano when tuning up. The piano note gives him his "cue" for one string. Having got one string properly tuned, he can then tune the other strings from it. Sometimes, in fact, a violinist does not even need another instrument to give him the first note. He has such an excellent musical memory that he can recall the desired note at will.

In the same way an inexperienced operator may sometimes have to use a special instrument (known as a wave-meter) for tuning up one circuit. Having got one circuit tuned, moreover, it is always an easier matter to tune the others. With experience, of course, the use of special tuning instruments becomes unnecessary, whilst with instruments that are specially designed for the reception of broadcast signals the operation of tuning is one of extreme simplicity. Each instrument is tuned before being sent out by the manufacturers, and the smallest adjustment of the tuning handles should enable signals to be heard on an amateur aerial.

(Another article for the beginner next week.)

"EARTHING" YOUR SET.

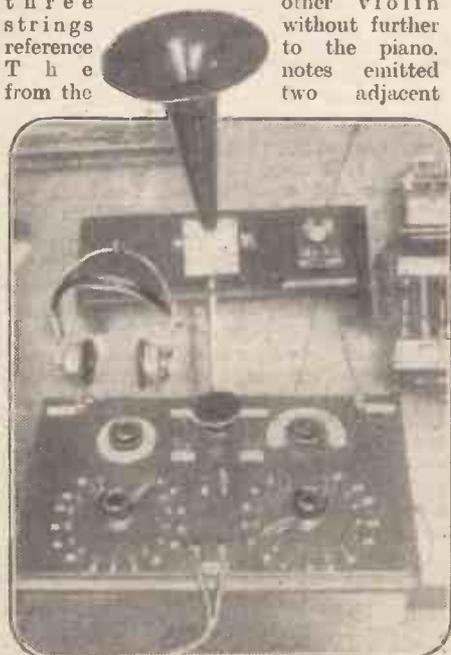
THE connection from the receiving set to the earth is quite as important as the aerial, but both should be arranged to as great an advantage as possible without decreasing the efficiency of the other. As a matter of fact the current received exists in its greatest quantity in the earth connection. Therefore it is necessary that the wire used should be as thick and as short as possible to reduce its resistance. The theory of the subject will not be dealt with here—suffice that the first and really only rule in earths is to have in the connection the least possible electrical resistance.

Use copper wire for the earth lead, as copper has a low resistance. By the way; it can be bare wire—the earth lead need not be insulated.

Keep the lead as short as possible. Anything above 12 feet is long, and where this length is exceeded run very thick wire or several lengths of wire connected together.

The most efficient form of earth is what is known as the direct earth. This is a plate of metal buried in, or a metal rod driven into, nice damp ground. Water pipes are good too.

The rod, which should be 2 or 3 feet long, or the plate can be of any metal. A large biscuit-tin or an old saucepan can be used with satisfactory results. Solder the connections.



A receiving set made by Mr. E. Ward, 18, Elliott Road, Selby Oak, Birmingham.

THE SET YOU WANT TO BUY.

MANY people, upon deciding to take up wireless, rush off and buy a set, put up an aerial, and then are disappointed with the results. Before you buy a set, make up your mind definitely what you want to receive in the way of signals, and what facilities you have for aeriels, etc. It is no use having a crystal set if you can only use an indoor aerial. In this case valves must be used. If you live more than twenty miles from the station whose telephony you wish to hear you must have a valve set—a crystal is not likely to give satisfactory results.

Briefly, the ranges for telephony are: crystal, 15-20 miles; one valve, 50 miles; 2 valves, 150 miles. Above that number each extra valve increases the distance by about 50 miles. An indoor aerial cuts down your distance by about 75 per cent. These ranges are liable to variation either one way or the other, according to the conditions under which the set is working.

When you have decided upon your aerial, and the set you require, make up your mind whether you will buy your set or whether you will make it. Remember, if you buy it, always buy from a good firm—cheapness is not always to be aimed at when dealing with wireless goods.

The cheapest reliable set that can be obtained ready for use is the crystal receiver costing about £5. With an outdoor aerial this gives a range of about 20 miles for broadcasting reception. A loud speaker cannot be used with this set, head telephones, one or two pairs, being employed. The crystal receiver is not satisfactory with an indoor aerial at a distance over one mile from a broadcasting station.

Range of Valve Sets.

The next set to consider is the one valve type. This requires upkeep in the way of accumulators and batteries, whereas the usual crystal set does not. A valve receiver costs about £9, and has a range of 35 miles with a good aerial, or 3-6 miles with an indoor

aerial. A loud speaker is not a success with this set.

A still larger set is the two-valve receiver, capable of a range of 50-70 miles, using an outdoor aerial and head 'phones, or 6 miles using the same aerial and a loud speaker.

With a frame aerial and this set a range of 10 miles can be attained, using head 'phones, but a loud speaker cannot be employed with this type of aerial. The cost of the set is about £15. In this case, as in all valve sets, accumulators and batteries must be used, thus incurring a slight expense for upkeep. This should not be more than 2s. 6d. per week, including all valve breakages, new batteries, accumulator chargings, etc.

A still larger number of valves increases the range over which a loud speaker, or 'phones can be used, but, of course, it also increases the initial outlay required and also slightly increases the upkeep. A 6 volt 60 ampere hour accumulator will be found the most useful size for either one, two, three or four valves. A 60-80 volt high tension battery should be quite sufficient.

Some Useful Hints.

Always keep your set in a dry place—moisture is one of its greatest enemies, especially to batteries and crystals.

If you choose a crystal set, see that you get a good crystal, one that can be adjusted fairly easily, and will keep its sensitivity. Hertzite or permanite are good types, as are galena and silicon, but galena is apt to require a lot of adjustment.

Your 'phones should be carefully chosen—4,000 or 8,000 ohms are best—test them if possible before purchasing. A loud speaker cannot be used with crystal sets. It usually requires at least two valves.

Always remember that a crystal takes a good deal of adjusting—for this purpose use a buzzer, with a tiny aerial attached to it, and in another room. All connections that are to remain permanent should be soldered.

The crystal should be handled with care, and not taken hold of in your hands—the film of grease thus caused on its surface will prevent you finding a sensitive spot.

See that the crystal is securely in its holder. The contact with it varies according to the mineral used, but it should always be firm, though not exerting undue pressure on the crystal.

The telephone receivers should always be carefully handled—never drop or jar them, and keep them free from moisture.

Remember that valves take more upkeep than crystals and require more delicate tuning—they, however, give greater range for reception. Whichever set is chosen, the same rules apply, care, gentle treatment, keep dry, and don't expect too much at first. You will soon find ways of improving results after you are used to the set.

"SETS FOR APPROVAL THIS WAY."

I PASSED through the long galleries of the London Central Telegraph Office, vainly endeavouring to become accustomed to the chattering of hundreds of sounders, the "machine-gun" crackling of dozens of "Creeds" and other automatic instruments, and was quite glad when this mechanical bedlam was left in the very far distance upon emerging into the famous museum corridor, the silence of which provided a very striking contrast.

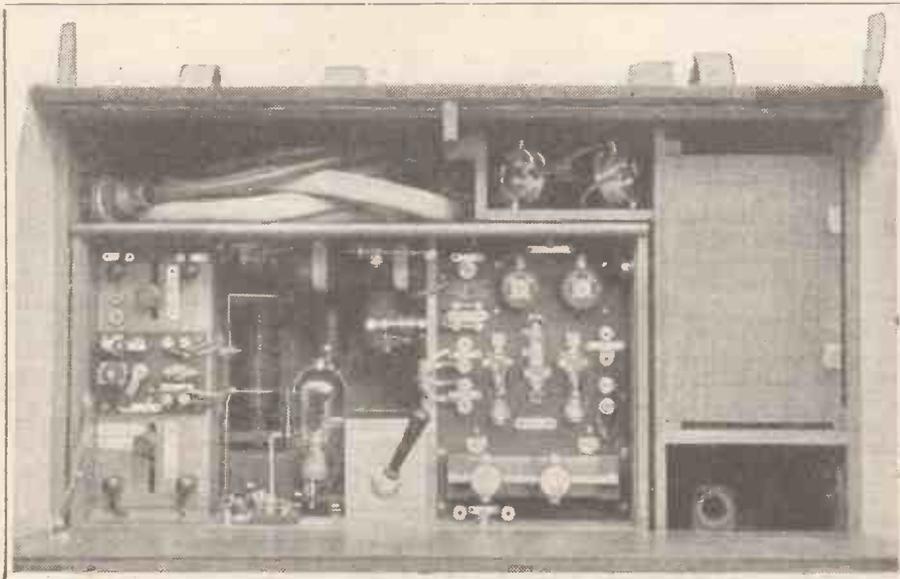
This corridor, lined with glass cases, contains the official collection of the romantic relics of the early periods of cable, landline, and wireless telegraphic and telephonic work, and is worthy of a less dim and more accessible accommodation.

A Sure Indication.

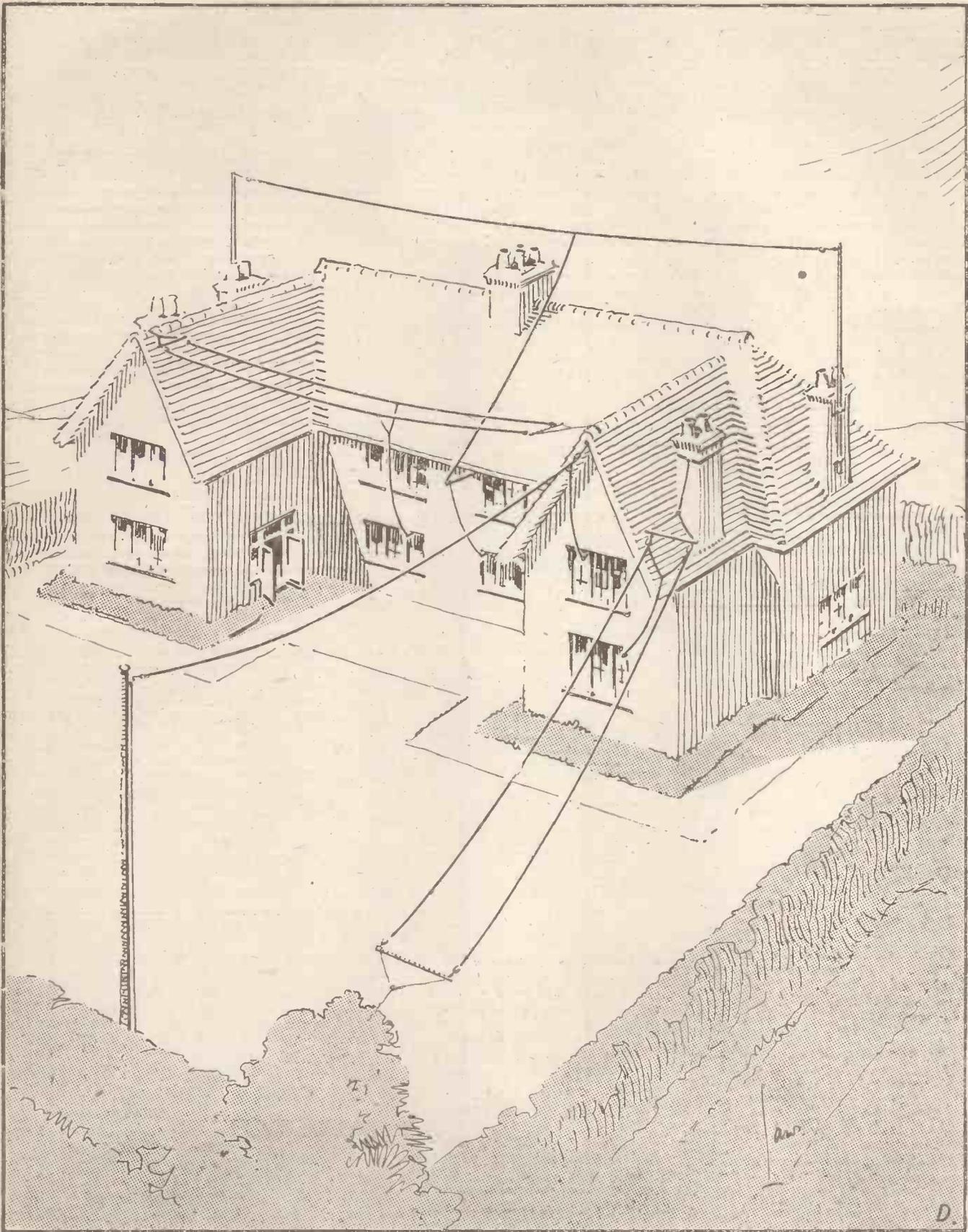
I had just turned away from a case containing some specimens of primitive thermionic valves, including several of the Fleming two electrode type, when the notice "Broadcasting Sets For Approval This Way" came into my view. This was certainly an alarming, but not original, example of officialdom. From that end of the corridor there seemed to be no other direction in which to go except in that indicated by the notice, but on the other hand I had already experienced the fact that one could wander through miles of galleries and corridors, ask hundreds of officials and probably be directed to the "Licence Dept." (in another building) or anywhere else, without discovering a clue as to the position of that "useful" notice.

A further notice, "Sets here," indicated with remarkable clearness the table of the gentleman to whom is delegated the onerous task of receiving the instruments from the emissaries of the traders sending samples of their sets to be passed for B.B.C. stamping and allotment of the registered G.P.O. numbers. Half a dozen were lined up when I arrived and a vast mound of brown paper and packing provided evidence of the many who had been there before.

I tackled one of the officials of the department with the question, "Pretty busy?" and received the reply, "This broadcasting business is a blessed nuisance." What more satisfactory indication of the prosperity of the wireless trade could be desired?



A Marconi transmitting and receiving set in travelling case for mobile pack transport.



The four types of antennæ shown in the above illustration are the most frequently used, because of their simplicity in erection. From the accompanying text the various types will be easily identified. It will be noticed that the lead-ins are taken into different rooms. When deciding upon the type of aerial to be employed, it must be ascertained that it will allow a short direct lead-in. A second very great consideration is the directional effect. Signals will come in very much more strongly on the inverted "L" types from the direction to which the lead-in ends are pointing. In the case of the "T" type aërials the directional effect will be equally marked in either direction in line with the horizontal wires. For all-round reception the single "T" type aerial will be the best of the four shown in the illustration, mostly because of its greater height,—this being one of the most important factors that contribute to the efficiency of an aerial.

QUESTIONS & ANSWERS FOR BEGINNERS.

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

Q. What is the best material to use in making an aerial?

A. Copper wire. This is usually sold in stranded form—commonly known as 7/22 (seven strands of 22 gauge).

Q. Must an aerial be of any special type or size?

A. No, but the higher and longer it is, the better chance there is of good reception. Unfortunately regulations do not permit of unlimited length or height. There was an interesting picture diagram showing various types of aerials in last week's supplement.

Q. What are the regulations governing the size of aerials?

A. The regulations state that the total length of the aerial, including the lead-in, from the farthest point (or, as it is known, the free end) to the aerial terminal on the set, plus the height from its highest point to the ground, must not exceed 100 feet.

Q. What does a receiving set do?

A. It is merely an instrument, or collection of instruments, to "detect" the incoming signals from the aerial, and to turn the energy into sound so that you can hear the messages being sent, or the music that is being transmitted.

Q. What is the difference between the crystal and valve sets?

A. The result in each case is the same, though it is attained by different methods. In the former case, this is obtained by passing the received energy through a mineral-crystal; and in the latter, by passing it through a Fleming valve.

Q. Must telephones be worn on the head during the whole time that signals are coming in?

A. Not necessarily. If large sets are used a loud speaker may be employed, and the sounds heard easily all over a large room. But for clearness of reception the telephones are best. They are not so uncomfortable, however, as many people would seem to believe.

Q. Why must insulators be used on the aerial?

A. To prevent the energy—in the form of a small electric current—from escaping to the ground, or earth, instead of going down its proper path—the lead-in wire. If it escapes you will not be able to receive any signals, as none of the energy will be going through the receiving apparatus.

Q. Can I use an ordinary house type of telephone?

A. No; a special type must be used. For general purposes phones of 4,000 or 8,000 ohms should be employed. There are other types, namely, 120 ohms, but these necessitate another instrument being added to

the receiving set. This instrument is called a telephone transformer.

Q. What is meant by so many metres wave-length?

A. Wireless signals are sent out in the form of ether waves. These waves, like ripples in a pond, have crests and troughs, and it is the distance in metres from crest to crest that gives you their length. Telephony waves have usually a length of 400 metres. The length can, however, be varied at will by the transmitting station. Unless the apparatus in the receiving station is "tuned" to receive waves of the same wave-length as those sent out by the transmitting station, no signals will be heard.

Q. Is there much difference in efficiency between an indoor aerial and an outdoor one?

A. Yes; the indoor aerial cannot be nearly as efficient, as it is impossible to construct it so large as the outdoor aerial. An indoor aerial will work, however, and if it is impossible to erect one outside, by increasing the size of your set you can obtain quite good results from an aerial of the indoor or "frame" type.

Q. Will wireless waves pass through everything?

A. Through most substances, yes; iron absorbs a little but reflects most of the waves, whereas houses, etc., allow the waves to pass through, although a certain amount of their energy is lost during the passage.

Q. Don't all the wireless waves get muddled up?

A. Only to a certain extent, but, by a process known as "tuning," it is possible to pick out the wave you require and let the others go by.

Q. What is meant by "tuning"?

A. Varying certain factors in your set—such as the inductance or capacity—so that your aerial will only respond to the waves that you require.

Q. How far will a crystal set receive wireless telephony?

A. About 20 miles, though in many cases this distance has been exceeded. A great deal depends upon the type of crystal used, and the size and height of the aerial, besides other smaller factors.

Q. Can two wireless sets be connected to one aerial?

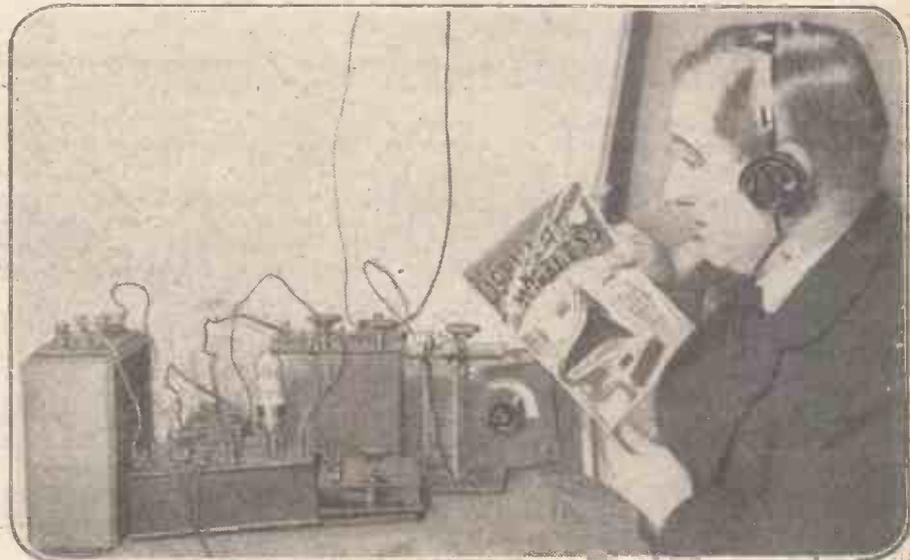
A. Yes; although separate aerials should be provided for each set if possible otherwise, results are apt to be disappointing.

Q. Is it necessary to have any protection against lightning on a wireless aerial?

A. Yes, it is advisable; what is known as an earth arrestor will provide perfect safety. This is a small gap fixed between the earth and aerial terminals across which the atmospheric energy in the aerial can jump and thus go straight to earth without passing through the set. Otherwise, the aerial lead can be connected directly to the earth lead when the set is not in use.

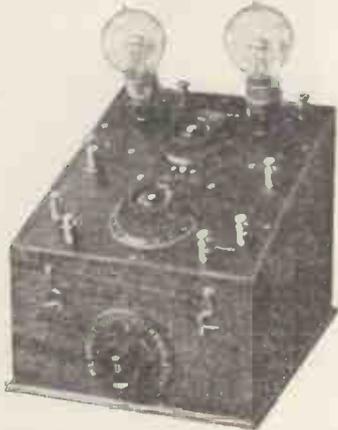
Q. Will any set be all right for receiving telephony and concerts?

A. Yes; any standard receiving set with a suitable wave-length range of adjustments covering the wave-length of the desired stations will be quite O.K. for the reception of telephony. The range of reception of the various types of sets varies considerably, and another article in this supplement deals very fully with that side of the question.



A Home-built set by Mr. A. J. Harris, of Stoughton Street, Leicester.

Don't Decide on Your Wireless Outfit until You have had a Demonstration on



THE IONOPHONE

UNRIVALLED experience in the design and production of wireless apparatus is behind every "Ionophone" model and every happy owner is more than satisfied with his purchase.

The range of the "Ionophone" set, as illustrated, enables the user to get the Hague and Paris Concerts, the Eiffel Tower as well as all ordinary broadcasting programmes with wonderful reception and clarity of tone.

Other Models are as follows:—

- CRYSTAL SET (Variometer tuned) 300—700 metres £4 : 12 : 6 with 'phones
- VALVE AND CRYSTAL SET (,,) " " " £6 : 12 : 6
- 3 VALVE SET (,,) 300—3,000 " £14 : 0 : 0 with H.T. Battery and 'phones.

Demonstrations are given daily in our Reception Room and we offer a cordial invitation to all interested in Wireless to call and inspect the full range of "Ionophone" Models. If you cannot call, our fully illustrated list will be sent on request. Write for it to-day.

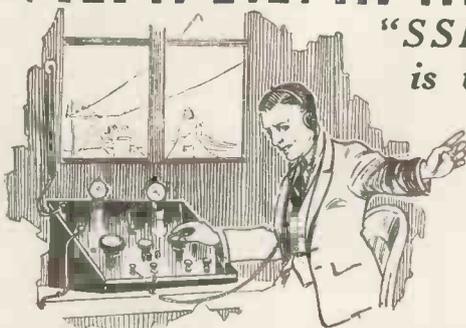
Ionophone 2 Valve Set.

This panel is designed for one H.F. Valve and one Detector. All tuning is carried out on a single variometer and the range of wave-length from 300 to 3,000 metres. The Cabinet contains a space to hold a pair of headphones. Army type Transformers used exclusively throughout.

Price .. £10 : 0 : 0
Including 1 pair Headphones.

2 Valve Amplifying Panel for above £8-0-0

G. DAVENPORT & Co., Ltd., 99-105, CLERKENWELL ROAD, E.C.1.



"SSH!—PCGG is through!"

IT'S waste of time trying to tune continental or distant stations through inferior 'phones. Perhaps you've reconditioned headpieces. Often as not they're pure "junk." And however expensive and selective your set may be, "dud" 'phones won't pick out weak signals.

Fit Ericsson 'Phones. The Services use them—for their never-failing sensitivity and ability to stand up to the hardest test. The Admiralty adopted them as standard in 1909, the R.A.F. in 1917. Easy to the head, robust in construction, delicate and sensitive in operation.

Write to-night for free illustrated list

The BRITISH L.M. ERICSSON MANUFACTURING CO., LTD..

International Buildings, 67/73, Kingsway, W.C.2.



"The Services use them."

Ericsson

Telephones

2,000 ohms, price 31/-; 4,000 ohms, price 32/-. All resistances in stock.

RELIANCE RADIO SERVICE CO.

THE "RELIANCE" CRYSTAL RECEIVING CABINET. P.O. Reg. No. 277.

Consisting of Ebonite Panel in Oak Case, with lid, Tuning Coil, 900 metre wave-length, .001 Condenser, Patent Crystal Detector, Silicon or Hertzite Crystal, Spring in small chuck, ball joint action with Variable Pressure, the whole totally enclosed in glass tube, thus eliminating dust and damp.

Accessories include 1 Pair Fellows 4,000 ohms Double Headphones, 100 feet Stranded Copper Wire, and 4 Insulators.

No further outlay. A guaranteed range of 20 miles for broadcasted concerts and will take 2 Pairs of Double Headphones with perfect clearness. Each Set tested and fully guaranteed and we confidently assert that for the price it is the most reliable yet offered to the Public and it is manufactured by one of the oldest firms in the trade.

Price Complete. Post Paid. £3-7-6

Instrument Only. Postage 1s. £1-18-6

We have also a complete range of Valve Sets in stock from £7 to £24. Call and inspect the famous Fellophone 2 and 4 Valve Sets, Prices £10 10s. and £17 10s. respectively. Also the Fellocryst Super Crystal Set. Price £4 7s. 6d. Demonstrations given daily. Call and get satisfaction, no fancy prices but honest value for money. Hours 10 a.m. to 7 p.m.



Illustrated Catalogue Post Free.

RELIANCE RADIO SERVICE CO.,
233, St. John Street, Clerkenwell, London, E.C.1
PHONE: CLERKENWELL, 4290.



*Listen in
with the Fellows*

Handphone which has been specially designed for ladies. It has no head band to catch or tear the hair. Beautifully finished, very comfortable to use and wound to 4,000 ohms.

HANDPHONE - - - - 15/3 each.
Inclusive of all taxes. Postage 1/-

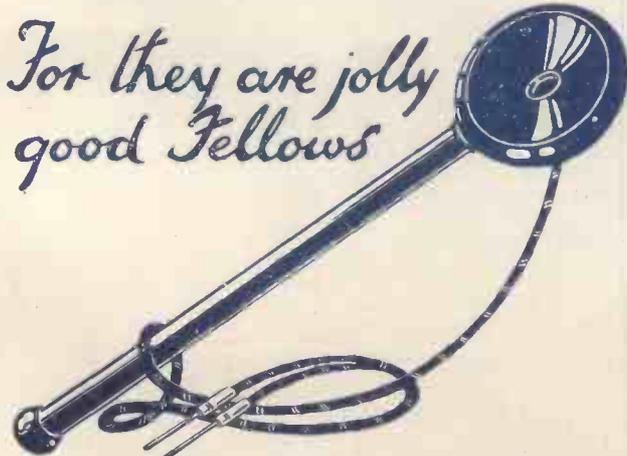
He will use Fellows *Headphones* with two earpieces in light die cast non-ringing metal and wound to 4,000 ohms.

HEADPHONE - - - 21/6 per pair.
Inclusive of all taxes. Postage 1/-

All Fellows radio instruments are British Made throughout and guaranteed.

FELLOWS MAGNETO Co., Ltd.
LONDON, N.W. 10.

Telephone: WILLESDEN 1560-1. Telegrams: "QUIXMAG," PHONE, LONDON



*For they are jolly
good Fellows*

DON'T Let Violence in Advertising
Rush Your Judgment
FOR YOUR PROTECTION

INSIST on a comparative demonstration
before you purchase

It is all we ask to prove the demonstrable superiority in signal strength, purity of tone, simplicity in operation of

THE
Crystophone
REGISTERED

P.M.G. BROADCAST RECEIVERS

SOLD BY ALL LEADING STORES
AND WIRELESS AGENTS

All Crystophone Receivers are exclusively fitted with the
LATTIKONE TUNER

The ONLY Tuning Coil which actually builds up and strengthens the incoming signal current and thus enables us to claim a

50% INCREASE in Signal Strength. Such is the reserve of power of

THE
Crystophone
REGISTERED Type 33
(two valves)

that 4 Invisible wires stretched across the ceiling of ANY ROOM,

on ANY FLOOR,

in ANY HOUSE in LONDON, BIRMINGHAM, MANCHESTER, is sufficient for use with 6 pairs of headphones, while with a P.M.G. Aerial it is

Guaranteed for 100 Miles

PRICE £15 (INCLUDING ALL ROYALTIES.)

Crystophone Crystal Receivers with Lattikone Tuner, PRICES from £3 10s. 0d.

Demonstrations Daily

From 5 to 10 p.m.

PLEASE NOTE CHANGE OF ADDRESS.

THE CRYSTOPHONE MANUFACTURING Co., Ltd.

(Formerly trading as Wireless Supplies Co.),
16, WELLS STREET, OXFORD STREET,
LONDON, W.1.

TELEPHONE: MUSEUM 1664.

All Applications for Advertisement Space in POPULAR WIRELESS to be made to JOHN H. LILE, Ltd. (Sole Agents), 4, Ludgate Circus, London, E.C.4. Phone: 10806 Central.