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Popular Wireless

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

June 2nd, 1923.



LORD GAINFORD, CHAIRMAN OF THE B.B.C., WITH HIS CABINET SET.

FEATURES IN THIS ISSUE.

Tackling the Dead-End Problem.
 A Crystal Adapter.
 Some More Practical Ideas.

Easily Made Boxes for Panel Mounting.
 An Improvised Winder.
 Timed Spark for C.W. Transmission.

And interesting articles by Sir Oliver Lodge, F.R.S., D.Sc.,
 Dr. N. W. McLachlan, M.I.E.E., and P. J. Risdon, F.R.S.A.

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POPULAR WIRELESS

June 2nd, 1923.

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

[Every Friday.]

TOPICAL NOTES AND NEWS.

The "Rev." Uncle.

ACCORDING to a notice in a daily paper Uncle Rex has taken "Holy Orders," and should now be addressed as the Rev. Rex Palmer. Undoubtedly we must expect a new class of Sunday concert.

Not True.

SPEAKING to Mr. Palmer—I mean the "Rev." Uncle—about this, he indignantly denied that he had taken such a step, and pointed out that the "x" in Rex had been misprinted as a "v."

Uncle Arthur Chased.

I WAS surprised the other afternoon to see Uncle Arthur rushing breathlessly past the studio looking very perturbed. "What's the matter?" I asked. "There's a man after me," he said, and pushed me into the studio.

Ill-health Due to Broadcasting.

SAFELY inside, uncle unfolded his tale of a man who had chased him that morning, and how a policeman had to be called to take him away. "The man's possessed with the idea that I am the cause of the wireless waves interfering with his health. I only got in by the skin of my teeth — through the back door."

New Uncle.

I HEAR that Mr. Page has been promoted to the position of "Uncle" at 2 L O. Though his full title has not yet been designated, he often takes the part of announcer.

Lord Mayor at 2 L O.

THE Lord Mayor appeared to be quite at home in front of the microphone when he spoke at 2 L O some days ago. He told me that he was the first man to speak on the telephone in the days of Edison and Bell.

"Have to Get Used To It."

HE was very pleased with his first experience of broadcasting and was proud of the fact that he should be the first Lord Mayor to speak through the

microphone of the new studio. "I want to come again," he remarked, "and to say more to the listeners-in; you have to get used to it."

OUR COMPANION PAPER

"WIRELESS REVIEW AND SCIENCE WEEKLY" (3d. from all bookstalls and newsagents), is proving to be more greatly in demand than was anticipated, and to prevent disappointment, copies should be ordered in advance. No. 2, out on Tuesday, June 5th, will contain, among many other interesting features, articles by Dr. Lee de Forest, Sir William Noble, Sir Oliver Lodge, F.R.S., and many other well-known scientists. ORDER YOUR COPY NOW!

Wireless Racing.

FURTHER attempts at jockeyless horse-racing are being made in France. The horses are to be fitted with small frame

Hungry Uncles.

I BELIEVE the "uncles" enjoy themselves as much as the kiddies when children's story-time arrives. The other day I caught Uncle "Cactus" busily engaged with some cream buns while Uncle Jeff was in the studio telling the tales.

Tea or Tales?

UNCLE JEFF was not going to be left out of it for long, however, and he soon called out for Uncle "Cactus." The remainder of the children's hour was spent in a competition between the uncles as to who should tell the tale, and who should have the tea. After all, I don't think we can blame them, for they both work very hard all day, to say nothing of the evening.

Novel Demonstration Van.

IT is difficult to give demonstrations in remote country villages, but Messrs. Wireless Service, Ltd., have overcome this by rigging up a special van. It consists of a touring motor-car, the body of which has been camouflaged to look like a small country cottage. A short yet efficient aerial has been erected on the roof, and the interior is equipped with a Geophone two-valve receiving set and loud speaker equipment. Some very successful tours have been made in the country districts within 100 miles of London, and the van has visited several market towns and given demonstrations in the market-places.



This studio, that of the London Broadcasting Station, may become the central studio for all the British broadcasting stations, should the "group" system materialise. Note the "blanketing," the microphone, and, on the right, the famous tubular bells.

aerials and loud speakers in conjunction with receiving sets on their saddles. Each horse will be "tuned-in" to its own particular wave-length, and it is hoped will respond to the instructions from its jockey in the grand stand.

Brighter Tennis.

A CERTAIN lawn tennis club claim better and brighter tennis since a wireless installation and loud speaker has been installed. The club has prepared an open-air dance ground for the use of members during Saturday afternoons, when the proposed dance programmes will be broadcast.

Better Transmission.

I AM told by the B.B.C. that they are experimenting with a view to eliminate the "rushing" noises that are heard when a land line is used.

A New Code.

I AM told of a new alphabet for use in wireless telegraphy which will enable transmissions to take place nearly twice as quickly as at present. Tests have been made in America and at the G.P.O., London, and good results have been obtained.

(Continued on page 578.)

NOTES AND NEWS.

(Continued from page 577.)

Clear the Ether.

THE inventor, General Squier, said that the proposed improvement in sending messages would not only make it possible to send them faster, but would also help to clear the ether of disturbances over a wide range of frequencies.



Calling the tennis players by radio at Hurlingham.

In Use for Eighty Years.

IT is interesting to note that the international code perfected by Professor Morse was first used 80 years ago.

What Next?

THE following message has been sent to artistes who sing at the Sunday concerts organised by Reginald Mills, the controller of the Sunday League, who have broadcast:

"As we notice you have recently sung at a wireless concert, and as the British Broadcasting Company only pay you a guinea, if anything, we shall not be able to pay you a larger fee than a guinea at any concert at which you appear for us."

No comment is necessary.

The Sheffield Station.

IT is hoped that the relay station at Sheffield will be opened within about a month from now.

2 L O "Testing."

UNCLE REX tells me that his wife listens-in to Mrs. Peel's cooking recipes every evening, and often when Uncle returns, a dish from one or other of them is ready for him to sample.

New Stations.

I AM told that in June a high-power station will be opened at Buenos Aires; two other stations will be ready in South America later in the year. These stations will be in direct communication with the French station at Saint Assise, with Nauen in Germany, and with Long Island in U.S.A. If South America desires to communicate by wireless with this country, she will have to send her message via France, owing to the Post Office not yet having granted a licence for the erection of a station in this country.

Broadcasting and Theatres.

THE effect of the broadcasting of The Marionette Players, from the Scala some evenings ago, was instantaneous. The very next day seats were even more rapidly booked up than usual, the first bookers being listeners-in who had heard the play the evening before. This seems to me to point very strongly to the effect broadcasting has on the theatres.

The Causes of "Fading."

AMATEURS are invited by the Radio Research Board, through the Radio Society of Great Britain, to assist in the investigation into the cause of "fading" and similar irregularities in the strength of signals. Those who wish to assist should communicate with the Secretary, Dept. of Scientific and Industrial Research (for Radio Research Board), 16, Old Queen Street, S.W. 1. If this address is used, no stamp will be necessary. A form will then be forwarded, which should be filled up and returned after observations have been made.

Opera at 5 W A.

I HEAR that the Welsh station is to have an opera broadcast in the near future.

The opera, composed by Major Corbett-Smith, the station director, is to be performed and broadcast from the studio. This will be the first time that an opera will have been both performed and broadcast from the station itself. I am told that this particular opera was written in 1913 for the London Coliseum, under the title of "Elizabeth."

Broadcasting a Battle.

AN invention is said to have been perfected in America to transmit photos by wireless. The inventor, Mr. Francis Jenkins, suggests that it will soon be possible for an admiral to witness a battle at sea or a general to watch the movements of troops miles away. Further, it is claimed that it will be possible to have motion pictures by the same method.

New Form of Dull Emitter.

I AM given to understand that in the States the amateurs are adopting a type of dull emitter valve known as the W.D.—11, which operates on a filament current of only 1.1 volts which may be supplied by an ordinary dry-cell battery of 1½ volts. It certainly eliminates the accumulator troubles and charging difficulties that harass many amateurs. This class of valve, however, is little used in this country, though it has been on the market for some time now and is really most efficient.

"Sold Out."

OUR companion paper, "Wireless Review and Science Weekly," has had a tre-

mendous welcome among our readers. Quite a number of bookstalls told me that they were sold out very quickly and that many people were disappointed. After all, it is not very remarkable, for "W. R." contains such a host of wonderful articles from the pens of the foremost scientists of the day that an increasing demand is inevitable.

Virtue Rewarded.

IMMEDIATE reward followed 2 L O's recent explanation to the kiddies of how to clean their teeth, for on the following morning each "Uncle" received a neat little present in the form of a tube of tooth paste. Evidently some enterprising manufacturer believes in striking while the iron is hot.

Success of Operas.

LISTENING to the "Magic Flute" the other evening, I was agreeably surprised by the clearness of the transmission; the B.B.C. are to be congratulated on the progress made since the last opera season. I have received several letters from our readers stating that they were pleased with the improvement.

The Prince of Wales.

OVER 50 listeners-in from London and the neighbouring districts have sent a letter to Messrs. Chappell & Co. condemning the latter's decision to prohibit the broadcasting of the Prince of Wales' speech from the Queen's Hall on Whit Sunday. This shows the strong public feeling that has arisen owing to action of the theatres and music publishers with regard to the B.B.C.

Back to the Crystal.

MANY of the American "fans" are returning to the crystal as a detector, and remarkable results are reported. High-grade crystal sets have been constructed that do away with the usual dead-end losses, basket coils being used for tuning. Ranges of from 100 to 500 miles are nothing unusual. It must be remembered that some of the American broadcasting stations use more power than do ours.

ARIEL.



An interesting view of the double doors leading into 2 L O's studio.

TO ESTIMATE THE CAPACITY OF AN AERIAL.

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

In this article our scientific adviser deals with an important subject, which generally involves most advanced mathematics, in a manner well within the understanding of the amateur.

AERIALS can be made in innumerable shapes. But the original Marconi aerial of a single vertical, or nearly vertical, wire, suspended from a high post by an insulator, is one that is very likely to be used, with slight modifications, by an amateur, and in its simplicity it has advantages. To estimate the capacity of such an aerial, the simplest plan is to take it as one-twentieth of its length. It may be expressed in centimetres, or feet, or any units of length you please. It is unfortunately rather customary to specify it in micromicrofarads, which are not a convenient unit, though they are approximately of the order of a centimetre. Accurately, each micromicrofarad is $\cdot 9$ of a centimetre—that is, 10 micromicrofarads equal 9 centimetres—which is just near enough to be confusing. Besides, centimetres are so much handier to work with. To convert a capacity expressed in micromicrofarads into centimetres, you only have to multiply it by $\cdot 9$. That is to say, subtract about 10 per cent. of its numerical value—a centimetre being the larger unit of the two, and therefore a given capacity being expressed by a smaller number in centimetres.

A Rough Estimate.

I say, then, that the first rough estimate of a vertical wire is $\frac{1}{20}$ th of its length. It will depend a little on the thickness of the wire, and still more on how near objects, such as buildings, are to it. These always tend to increase its capacity. And $\frac{1}{20}$ th of its length will therefore be an underestimate. Fleming finds that it is well to add ten per cent. to the calculated value, in order to allow for the effect of the earth, which is inevitably not very far away from a part of the wire. This comes to the same thing as measuring it in micromicrofarads and then calling them centimetres, without reduction. In practice, it will be found that a wire suspended from any building, such as a chimney, although stretched quite free from it, but hanging down near it, will have a capacity not much less than 6 per cent. of its length, instead of 5 per cent. as above estimated for a fairly free wire.

If a wire, instead of being vertical, is horizontal, the influence of the ground is more marked; and, at any height likely to be adopted in practice, $\frac{1}{10}$ th of its length, or 6 per cent., is not a bad rough estimate.

Usual Type of Aerial.

If, however, any part of the wire is in a building, isolated in a moderate-sized room for instance, $\frac{1}{12}$ th of that part of its length would be a fair guess at its capacity. Hence, if an aerial has three portions, one part in a building, one part nearly vertical, and one part horizontal, we might take $\frac{1}{10}$ th of the length for the horizontal, $\frac{1}{20}$ th of the length for the vertical, and $\frac{1}{12}$ th of the length for the internal portion, and add them together for the total capacity. Any wire coming through an earthed tube will have a greater capacity, and to estimate that the size of the tube and of the wire must be more accurately known.

I have said that all the above fractions will depend to some extent on the thickness of the wire, but they change only very slowly with that thickness, and if the length and thickness of the wire increased together, so that if one was doubled the other was doubled too, no change would be made in these fractions. They may be taken as roughly correct for a wire 5 metres in length and $\frac{1}{10}$ th of a millimetre in diameter. If the length is made 50 metres and the thickness 1 millimetre, the fractions will remain the same—that is to say, still $\frac{1}{20}$ th of the length will be a rough approximation of the capacity for an isolated vertical wire, $\frac{1}{10}$ th of the length for an isolated horizontal wire, and $\frac{1}{12}$ th of the length for a wire isolated in a large room.

If the isolated vertical wire is much thicker, say ten times as thick, so that the 5-metre-length is a millimetre thick, then instead of taking 5 per cent. of the length, we must take 6 per cent. That is the kind of difference made by a tenfold increase in the thickness.

Multiple Wire Aerials.

Very often an aerial, instead of being a single wire, is a pair of wires in parallel, kept apart by distance pieces, say, a foot or two or a yard apart. In that case we might expect the capacity to be doubled. It is not quite doubled; it is about one and three-quarters what we should estimate for each wire separately. Professor Fleming has made experiments on the actual capacity of multiple wires, and his treatise must be referred to if more exact details are wanted. But really the capacity of an aerial ought to be measured by experiment, since that would take all the circumstances into account. It is impossible to calculate them all, and not worth while. But it is useful to be able to make a rough estimate of what the capacity will be.

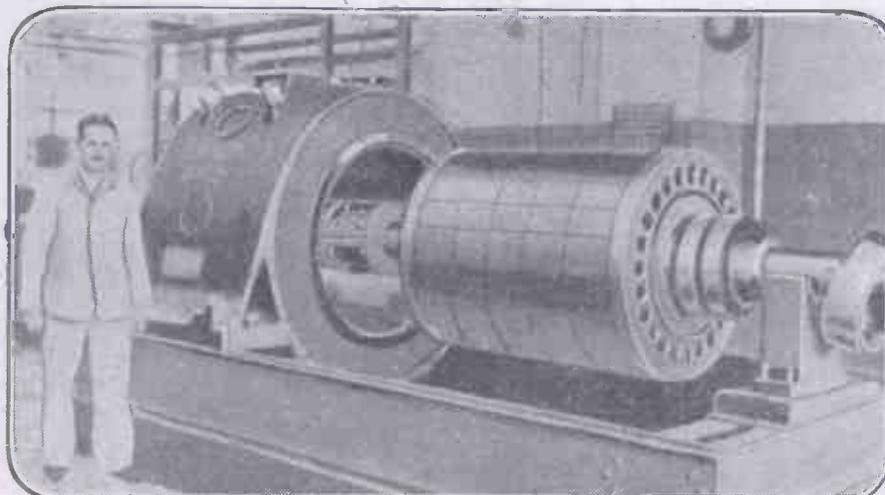
Another common form is four wires arranged at the corners of a square, being kept apart by a cross-piece of wood or other

material. Assuming that the wires are two or three feet apart, the combined capacity will be roughly between two and a half and two and three-quarters that of each wire separately; and, by using a factor like that, some useful notion is obtained of what capacity to expect in a given case.

Before leaving the subject, however, we had better write down the formulae which have enabled us to make the above rough estimates. But no simple formula like this can take account of all the varied circumstances associated with an aerial, for its capacity depends upon not only itself but upon everything in the neighbourhood. It is pretty easy to calculate the *self-induction* of a given wire, because that depends on its length, thickness, and shape. But its *capacity* is another matter. That depends on all those things, too, but it depends on other things in addition. Still, a rough estimate can be made, and the estimate is often quite sufficiently near for a knowledge of the wave-length to be expected when a given capacity is connected to a given self-induction.

CATALOGUES.

A NEW wireless map of Great Britain has been published by Phillips'. It has been compiled from information supplied by the Wireless Press, Ltd., and measures 36 in. by 48 in., with a scale of 12 miles to the inch, showing at a glance all transmitting stations with their call signs. Broadcasting, Commercial, Aviation, Amateur, and Admiralty stations are all included. There is a complete index to all amateur and experimental stations, the origin of a call sign being at once located by means of numbered squares. Diagrams with compass bearings show the direction of important overseas stations in relation to different portions of the map.



One of the huge high-frequency generators at the German station Eilvese.

A CRYSTAL ADAPTER.

This handy little device will prove very useful when a valve burns out, or when the battery unexpectedly runs down.

THE adapter about to be described was designed upon an occasion when the writer was unfortunate enough to break both his valves when he wished to receive a certain concert; thus, its origin arose from a necessity.

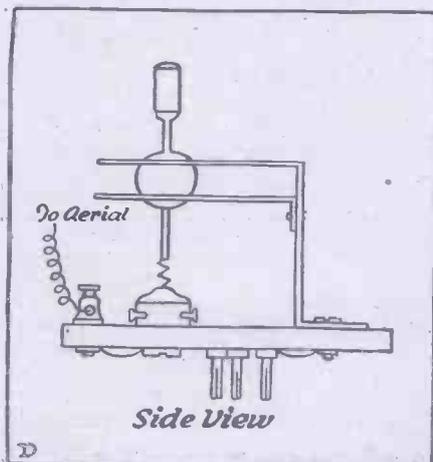
It consists of a crystal detector mounted on four valve legs. The base consists of a piece of ebonite, $3\frac{1}{2}$ in. by 1 in. by $\frac{1}{4}$ in. The four valve legs, terminal, crystal (Hertzite), and a crystal cup, were purchased from a local dealer for 2s.

The ebonite was trimmed up to size with a file and the holes drilled for the valve legs, the filament legs being $1\frac{1}{2}$ in. from the end and the grid and plate legs being set at the irrespective distances on either side of these. The crystal cup-fixing screw was 2 B.A., so a hole No. 11 was drilled $\frac{7}{16}$ in. from the grid leg.

Another hole was drilled $\frac{3}{4}$ in. from the crystal cup, with a No. 11 drill, to take the terminal. Three-quarter inch from the opposite end a hole of the same diameter was drilled to take the nut and bolt for clamping down the cat's-whisker adjustment arm.

The ball or socket arm was made from a piece of brass, $4\frac{1}{2}$ in. by $\frac{1}{2}$ in. by $\frac{1}{8}$ in. A hole $\frac{3}{16}$ in. from one end was drilled No. 11 to take a nut and bolt, at the other end a hole $\frac{1}{4}$ in. diameter and $\frac{1}{2}$ in. from the end was drilled.

Two and one-eighth in. from this hole was drilled another hole to take a $\frac{1}{8}$ -in. rivet. Another piece of brass, 2 in. by $\frac{1}{2}$ in. by $\frac{1}{8}$ in., was used for the lower arm, and $\frac{3}{16}$ in. from



one end a hole to take a $\frac{1}{8}$ -in. rivet was drilled, while at the other end a hole $\frac{1}{4}$ in. in diameter and $\frac{1}{2}$ in. from the end was made.

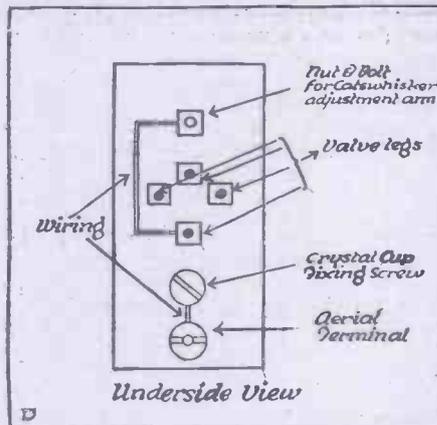
Universal Adjustment.

The piece of brass, $5\frac{1}{2}$ in. long, was bent at right angles, 2 in. from the end in which the $\frac{1}{4}$ in. hole was situated. The opposite end was bent at right angles, $\frac{5}{8}$ in. from the end, only in the opposite direction, thus the piece of brass formed Z shape. The smaller length of brass was bent at right angles, $\frac{7}{16}$ in. from the end, in which the rivet hole was drilled.

The ball is $\frac{3}{16}$ in. in diameter, and was made in brass with $\frac{1}{8}$ in. of $\frac{1}{8}$ in. brass rod

inserted in one end, and 1 in. of same in the other, or if any amateur possess a lathe he may be able to turn this all in one.

A piece of ebonite may be used to make a handle to fit on the 1 in. rod, and on the other piece of rod the cat's-whisker should be soldered. The ball should be put into place before the two arms are riveted



together, and when the arm is finished, it should appear as in the diagram.

Wiring Up.

After assembling, a lead was taken from the terminal to the crystal cup, and another from the adjustment arm clamping screw to the plate leg; this wiring should be done on the underside of the adapter. For use the adapter should be inserted in the detector valve socket of the valve set.

A lead is taken from the aerial terminal on the set to the terminal on the adapter. The H.T. and L.T. is removed and the terminals shorted with short pieces of wire. The tuning is done with the condenser and coils on the original set.

"POLITICAL NIGHT" AT 5 W A.

By our Cardiff Correspondent.

AS already announced in our interview with Major Corbett-Smith, the director of Cardiff Broadcasting Station, Saturday is known as "Political Night."

Accordingly, learning that Mr. J. E. Emlyn Jones, the well-known shipowner and Liberal M.P. for North Dorset, would be broadcasting his views on the 7th inst., I wended my way to the studio and had the pleasure of hearing an admirably concise and broadly based statement of that gentleman's political faith.

In the first place, it must be understood that controversial matter is not allowed to be broadcast. There will be political debates later on, but even then the discussions will not be of an electioneering character. "Political Night" is, without doubt, a bold conception; already has it been justified; it will continue to be justified.

As Mr. Emlyn Jones stated in his speech, it is the duty of every man and every woman to take keen interest in their country's welfare, and that could be done properly by faithful adherence to one or other of the great political parties. Party adherence, in fact, formed the really adequate vehicle of expression in state affairs. In the present welter of conflicting conditions no one could afford to be disinterested. Parliament is the organised opinion of the nation; that opinion is best organised when Parliament, through its members, is representative of the entire body of voters.

The Time Limit.

Dealing with his personal opinions, Mr. Emlyn Jones affirmed that his politics were a form of religion to him. He believed absolutely in the tolerance of all views, providing they were of national utility. He was at one with Voltaire in that, although many were bound to disagree with himself in political faith, he would fight for the right of his opponents to hold and to prosecute their own views.

I had a chat with Mr. Jones during the usual half-hour recess, and as a matter of course I wanted first to learn how he had felt while speaking into the 'phone.

"I missed," he said, "the inspiration of a seen audience, but Sir William Graham has just telephoned to say I did very well, so I suppose I ought to be satisfied. As you know, I have been reading from type-script to-night, whereas I never use notes when delivering a speech."

I remarked that Welsh speakers, as a rule, do not need notes when speaking.

"Quite so," replied Mr. Jones; "but I had a time limit, and also had to be careful to keep within the rule laid down by Major Corbett-Smith as to controversial matter. But speaking from notes is not conducive to inspiration, although it may be safer. It is, however, just as well I took the precaution of writing my speech, because of the time limit. I had no idea of the passage of time while at the 'phone.'"

I pointed out that most people lost the sense of time while broadcasting.

Mr. Jones was interested to learn he had been listened-in to from all parts of the country—London, the Midlands, and the North.

Great Educational Value.

"Broadcasting is a wonderful thing," he went on; "and I see in it a means of education such as we have not had before nor thought possible. People will be listening-in to subjects which up to now have hardly interested them. 'Science Night' will come along, with an address about something almost unknown to the average man. It is quite possible he will see that that something is of fundamental importance to human welfare. He will probably go to a library to read up the subject. He will feel an incentive to educate himself along that line. I say this, if broadcasting does not lead to more than that it will still have justified itself. But there is the musical side as well. The music given at the Cardiff station is an education in itself."

"Yes," I remarked, "the station in its ambitious programmes is representative of the Cardiff spirit of progress."

Mr. Jones agreed, and concluded with the expression of his belief that the city is indebted to Major Corbett-Smith for enabling Cardiff to add substantially to its already immense importance.

A TIMED SPARK FOR C.W. TRANSMISSION.

By B. H. J. KYNASTON.

This system is interesting, inasmuch as it is one that is well within the scope of the average experimenter possessed of a transmitting licence and the simple apparatus involved.

ALMOST every amateur who transmits on C.W. uses the valve as a generator of high-frequency oscillations. This article, which describes an entirely different method of C.W. transmission, should prove of interest to those amateurs who want to try other methods. Also those who require to alter existing spark sets into C.W. transmitters.

A few years ago I made a transmitter of the timed spark type, which transmitted on about 8½ watts, and had a normal range of approximately thirty miles, using three valves at the receiving station. Although the range obtained was not as good as that obtained by valve transmitters, the set had one decided advantage, which was the cost of maintenance. As the current used was taken from the 250-volt electric light mains, and there were no accumulators or valves, the running costs were very small.

The circuit used is shown in Fig. 1, and is slightly different from the circuit employed by the Marconi station at Carnarvon. The principle upon which the transmitter works is as follows. The trigger spark gap TS in Fig. 1, is revolved at a high speed by means of a small motor.

Two Primary Circuits.

Upon pressing the transmitting key K the induction coil causes a spark to pass between the gap, B. As the coil, A, is in this circuit, a high-tension current is induced in the coil, C, and the two small condensers in the circuit discharge across D and Q.

The spark which passes the gap, Q, is ionised, and as the condenser, K, is charged, owing to it being connected direct to the 250-volt mains it will discharge as soon as the ionised spark jumps the gap, Q. When the trigger disc has turned so that E1 and E2 are opposite, the induction coil will spark between these electrodes instead of the previous ones. The transformer F-G being now in circuit, the circuit containing K2 now discharges.

It will be seen that owing to the trigger disc revolving rapidly the two primary circuits will oscillate alternately. The coils, L, induce these oscillations into the aerial coil, M, and as the aerial circuit oscillates after the oscillations in the primary circuits

have died out, the power in the aerial circuit is radiated in the form of continuous waves, as shown by Fig. 2.

Construction of Disc.

The actual number of studs on the trigger disc is not shown in Fig. 1, but in the set made by the author this disc was made from a wooden wheel 4 in. in diameter, with forty copper nails driven in the rim, and all connected together by copper wire. The actual number of studs used is not important, however, to obtain good results over thirty should be used. This discharger was driven by a ten-volt motor driven from the 250-volt mains by placing a resistance of 80 ohms in series with the motor. This resistance consisted of two 50-candle-power lamps in parallel. Since the lamps consumed two amperes each, the current flowing through the motor could not exceed four amperes. However, to make sure no damage to the motor could be done, a five-ampere fuse was inserted in circuit. This fuse consisted of one strand of No. 38 copper wire.

The induction coil was worked from the mains in exactly the same manner, and a

foil and photo plates, and the actual capacity of these condensers is not important, since they do not affect the wave-length. Six sheets of tin foil, 3 by 4 in., should give a large enough capacity.

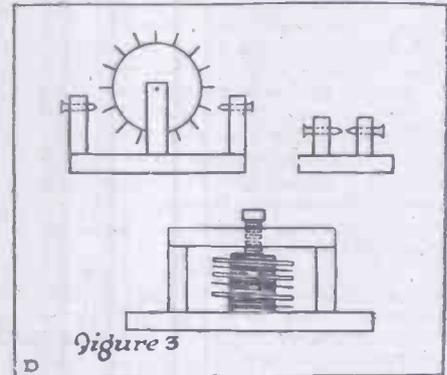


Figure 3

The coil, A, consists of 30 turns of No. 28 d.c.c. wire on a 3-in. former, and the coil, C, which is wound over the top of A, consists of 150 turns of the same wire. The coils, F and G, are of the same size.

About 8.5 Watts.

The condensers, K1 and K2, each consist of 10 sheets of tin foil, 2 by 3 in., separated by mica, and the coils, L, were each composed of 20 turns of No. 20 rubber-covered wire wound on a cardboard former of 2 in. diameter. The aerial coil, M, was wound upon the same former, but between the two coils, and consisted of 60 turns. However, the number of turns in the aerial coil will vary with different aeriels in order to obtain a wave-length of 1,000 m.

In Fig. 1 a milliammeter is shown in the 250-volt circuit, this was used to find the power in the primary circuit. The reading obtained was .0362 amperes, and since watts = volts × amperes it will be seen that the power supplied to this circuit was approximately 8.5 watts. This milliammeter, however, is not necessary for transmission.

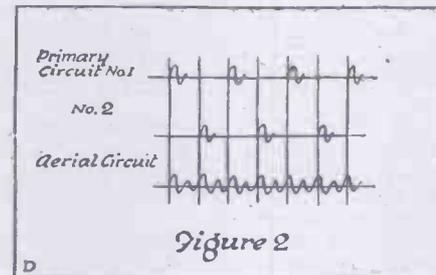


Figure 2

fuse also inserted in that circuit. Iron wire resistances instead of lamps can be used if desired, the amount of wire needed depending upon the size of wire used.

Fig. 3 shows how the various parts were made. It will be noticed that ordinary brass wood screws were used for the fixed electrodes of the trigger disc and spark gap, D. When making the trigger disc, care must be taken so that when one screw is opposite a moving electrode, the other screw is half-way between two.

Four Spark Gaps Necessary.

The distance between the electrodes should be very small in both gaps, 1/16 of inch, or smaller. The quenched gaps consisted of two gaps in series, and consisted of three circular copper discs, 1 in. in diameter. These discs are for cooling the gap.

On either side of these are small silver-plated discs of about 1/2-in. diameter, and these are separated from each other by means of 1-in. mica washers having a 1/4-in. hole in the centre through which the spark passes. Two quenched gaps and two fixed gaps are necessary. The four small condensers shown in Fig. 1 were made from tin

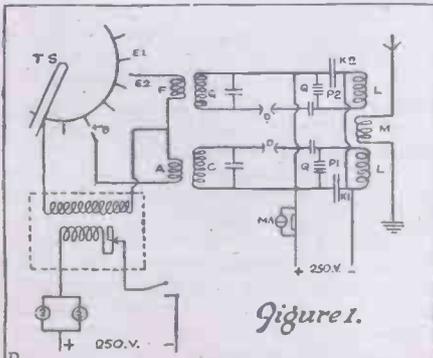
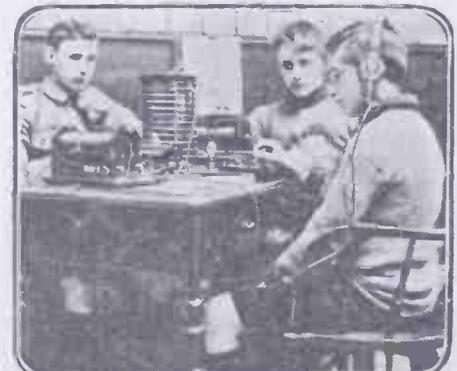


Figure 1.



Morse class in the 8th Liverpool Y.M.C.A. Scouts.

TACKLING THE "DEAD-END" PROBLEM.

By introducing this simple mechanically operated "break," greater efficiency on a "tapped" coil will be ensured.

SOONER or later, the amateur using coils for the long wave-lengths will be confronted with the disadvantage of the wasteful and weakening effects of the "dead end"—i.e., that part of a coil (often a considerable length) not in actual use. Where a coil is tuned by the familiar slide method the writer has found that by connecting the end of the coil to the earth terminal an improvement has resulted.

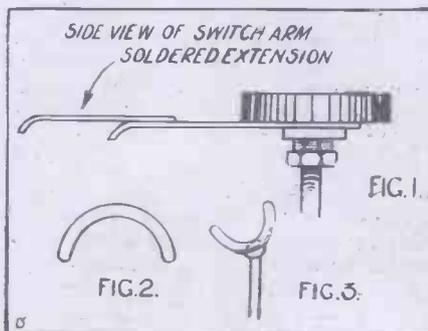
Simple in Action.

It is, however, in relation to coils from which tappings are taken to contact studs that I wish to deal, and by the method described below it is possible to disconnect entirely that part of the coil not in use, by automatically opening and closing a "break" in the tapping loops by the rotation of the switch-arm.

In the first place it is necessary to solder on to the laminated part of an ordinary switch-arm a piece of brass or copper forming a second finger about $\frac{1}{2}$ in. beyond the finger provided, as shown in Fig. 1. This extension will not be needed to act as a contact arm, but to actuate a movable arm or pawl.

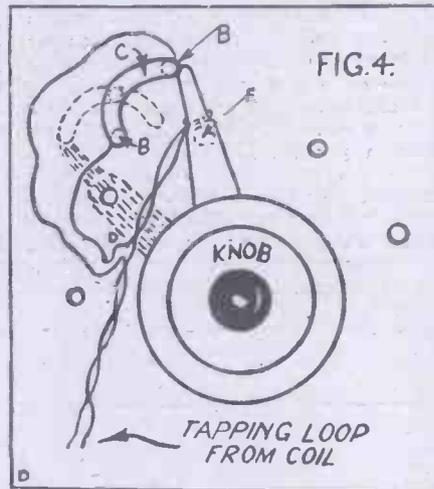
Automatic "Cut Out."

The other items needed are three small contact studs and a small piece of sheet brass or copper shaped as in Fig. 2, the size depending largely on the space between the ordinary contact studs and the length of the soldered extension to the switch-arm. Such a piece is easily fashioned from an old clock wheel with the aid of a file. This latter is



now soldered to the top of one of the small contact studs as shown in Fig. 3. The diagram (Fig. 4) should now be consulted. This shows clearly the position of the two small contact studs (B B) and the stud with the shaped top piece (C) in relation to the particular tapping and contact stud under treatment. Washer and nuts should fix the moving piece (C) so that it does not rotate too freely. The tops of the two studs (B B) should be slightly rounded to obviate the moving piece catching and jamming when switching to the right. By means of the switch-arm make sure that the moving piece functions in the way desired, and that the two studs are properly disconnected when switching to the left.

This done, the loop from the coil to the usual contact stud is broken on one side only (D), and the ends soldered one to each of the bottoms of the studs (B B). Thus it will be seen that as the normal finger of the switch-arm reaches the stud under treatment (E), the extension of the arm closes the circuit and puts in use just that length of coil needed. Inversely, in switching back a definite break is made, cutting out the portion of coil not required. The method described is entirely automatic in action, as



the movement of the switch-arm in one direction leaves the moving portion in position for the return journey.

Although it is possible to use this system with regard to each contact stud, it will usually be found quite useful if fitted to every third or fourth stud, to suit individual requirements, and correspondingly the parts need not be on so small a scale.

WIRELESS AT HOME.

By a Wireless Operator.

THIS is essentially the day of Wireless in the Home, and from a hazy admiration of this latest science the public has passed to a practical insight into its working. We operators have lost our monopoly, and I find that you laymen either look over your fence and envy the aerial of your neighbour, or you make an "earth" in your own garden, interrogate the high heavens by a questioning wire (the chimney and clothes post-aiding you), and, having thus tapped the illimitable ether, you have brought "Wireless, that latest marvel of man's ingenuity," from out of the intangible realms where it hovered almost beyond imagination, right down on to your own sideboard.

You will admit that you do not understand the full theory of wireless; but you

claim full recognition for knowing all about the pathway down which you ensnared the mystery. You will explain it to all who will listen, drawing diagrams that show your chimney, your window, and your garden, for all and sundry to see and to admire. For to-day wireless has descended from the austere heights of pure science, passed along home-made aeriels, through insulating tubes, traversed bedrooms and bathrooms, and has demonstrated itself, without fear of contradiction, by shouting jazz music at you across your own hearthstone.

Crystals No Good.

Having done so it goes to "earth"—not using that word in its planetary sense, vaguely, but in the most local, tangible, and familiar form that you know it—the form in which you plant potatoes.

As I said, this is the day of Wireless in the Home, but it was not always thus. I remember when wireless poles were so rare that one used to knock at the house where they appeared, and calmly ask if it was convenient to have a look at the set—moreover, one was welcomed! Devotees were few, but they had infinitely more in common than is now the case, when skill in pushing round shop-windows, or mere patience in standing, will gain a glimpse of the shining instruments.

In those days crystals were handled almost reverently, in pill-box and cotton-wool; and nobody foresaw the time when they would be piled in little heaps as part of a window-dressing scheme, labelled, and, worse still, libelled! Only yesterday I heard a young lady assistant at a counter, in tones of authority, judicially and with finality, inform a hesitating young man that "Crystals are no good, really. You want a valve." She almost smiled afterwards, but I did not smile, for I was thinking of my first piece of crystal, and my awe at its perfection.

Wireless Thrills.

To-day you hear in trains and buses snatches of conversation about "condensers" and "insulators," and as you try to read in the newspaper what "Our Wireless Expert" says, you have difficulty in following that gentleman's lucid explanations, because of the strap-hanger explaining to the man on your right how he first suspected, then logically traced, and finally gloriously overcame a faulty connection in his earth-lead.

Then there is the man who devours every word that appears on wireless, no matter in what paper, and proceeds to put all this knowledge to the test, in spite of the fact that the "evidence" of different writers is often contradictory, and then wonders why he has so many failures and mishaps with his set. In criss-crossing the world anywhere between Montreal and Vladivostok I gained the universal sense and feel of wireless. I saw it serenely independent over mere locality, indifferent whether the aerial swung beneath the "Great Bear" or showed as a black tracery against the stars that look down on Table Bay. Probably there was only one place where I should have been surprised at wireless penetration, and that is where I have found it now—"Wireless at Home," gathered in the back garden, welcomed through a window, discoursing in the drawing-room, and buried in your flower-bed!

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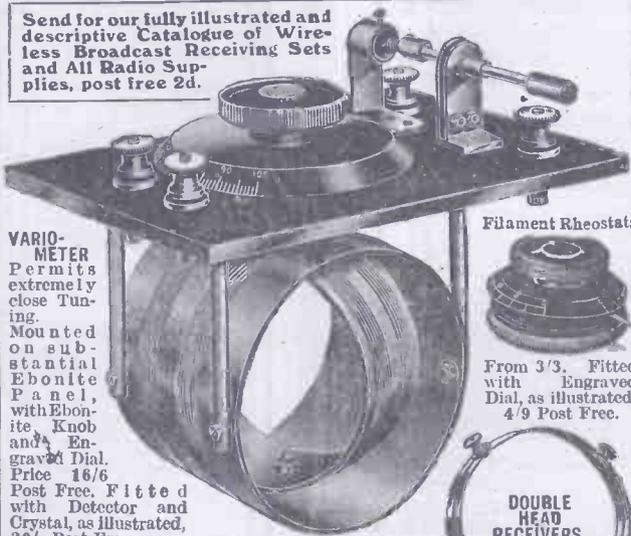
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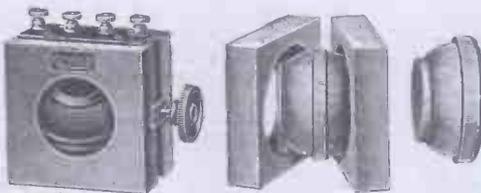
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Wireless Licences & how to obtain them
By E. Redpath

MISS ELLEN TERRY LISTENS-IN.

By "ARIEL."

England's greatest actress listens-in for the first time on the "Popular Wireless" Marconi portable receiver.

I HAD the privilege of demonstrating the six-valve portable set built specially for POPULAR WIRELESS by the Marconi Co. to Miss Ellen Terry on the evening of Harrods' All-Star concert. Miss Terry and her daughter—Miss Edith Craig—and a distinguished audience of well-known artistes and musical critics were present on this the first occasion on which England's greatest actress had listened-in. She was full of enthusiasm for the novel experience and took the keenest interest throughout the concert. Almost immediately I got in touch with 2 L O, announcing a performance of the band of H.M. Irish Guards. Miss Ellen Terry seized a pair of 'phones with feverish interest. I then gave the



Miss Ellen Terry.

remaining pairs of 'phones to the company present, and contented myself with watching the enraptured expression of Miss Ellen Terry at the rousing music which I knew was coming through.

"It is wonderful!" exclaimed Miss Terry, jumping to her feet, regardless of the limits of the length of 'phone cord.

"Who Is It Now?"

"Where does it come from?" she asked. I told her it came from Marconi House in the Strand. She could hardly believe it, as she said it was so distinct—in fact, just a little too loud. At her request, I promptly reduced the volume.

"That's much nicer," she remarked. "What a blessing this will be for those poor people who cannot get out and about to hear good music and plays." Several times Miss Terry alluded to the great boon of wireless for the sick, and it is characteristic of her sympathy towards the suffering that she considered them first in her appreciation of the advantages of wireless.

After this number had concluded and 2 L O gave out that there would be a short interval, Miss Terry wanted to know the other items of the programme. I read to her the whole list of the attractions, and my mention of the children's stories caused her to remark on the great educational value of broadcasting for the young mind. "What a help it would have been to me in my young days," she said. "The children must simply delight in it."

Shortly after the next number commenced, I thought I detected a smile of recognition in Miss Terry's face. "Who is it now?" she asked, much interested. On her daughter replying that it was Laddie Cliff singing "Don't Scrap the British Navy," the great English tragedienne remarked: "Oh, yes; I have heard him sing it before." It undoubtedly caused her much amusement, for she laughed many times.

A Non-Technical Explanation.

But when Miss José Collins sang "Cigarette," Miss Terry was carried away in admiration of this idol of musical comedy. "Splendid! Splendid!" she cried; and jumped to her feet again in ecstasy when Miss Collins reached her top note.

"Oh, what a grand thing to be able to sing like that, and to be heard by so many people at once!" she exclaimed. "The very thought thrills one as only music can. It brings to my mind those immortal lines of Shakespeare, 'If music be the food of love, play on, give me excess of it!'"

I do not know whether Miss Collins could have heard this characteristic quotation of the great actress, but she certainly did sing on—though without giving excess of it—when she followed with the popular song of "The Last Waltz."

At length when 2 L O announced the news bulletin, Miss Terry felt a little tired and rested awhile.

"You must forgive my ignorance," said Miss Terry when the telephones were removed from her head, "but I am as much mystified as to how, or from where, this wonderful music comes as I am enchanted by the great pleasure it has given me."

I then explained to Miss Terry in non-technical language how the concert had

been sent out by ether waves from Marconi House, and how the sensitive instrument before her picked up those waves by means of the aerial.

"I am afraid I should never understand it properly," she said, smiling. "I am just like a child in these matters. What will they invent next?"

"It is impossible to say," I rejoined. "Wireless is only in its infancy, and already it has caused consternation among theatre managers." I then pointed out to Miss Terry the dispute between theatre managers and the B.B.C. in the broadcasting of plays, and the intention of the B.B.C. to produce their own plays if necessary.

Preferred the Singing.

"I hope," said Miss Terry, "that the play will not be neglected by wireless."

"Of course, it must seem a little strange for an actress to have to rely entirely on her voice for effects. It is just the opposite with film acting. There it is not the voice, but the acting which is wanted."

"Would you like to broadcast, Miss Terry?" I asked.

"I should enjoy the novelty very much," she answered. And then, with a smile: "I have been asked this question so often that I feel I must have a try."

Miss Terry then took up the earphones, and listened to the rest of the programme.

When the concert was over I asked Miss Terry whether she considered the vocal or instrumental items the more distinct.

"With the exception of the violin, which I think the most realistic, I liked the singing best. But it was all very good, and I enjoyed the concert immensely. In fact, after to-night, I believe I shall become a confirmed listener-in."



Mr. F. S. Wright, of "Tiverton," King's Road, Clacton-on-Sea, listening-in on his neatly arranged receiving station.

WIRELESS TELE-VISION.

By P. J. RISDON, F.R.S.A.

The problem of wireless tele-vision is one that is engaging the attention of a vast number of scientists both amateur and advanced. A further stimulus to research in this direction has been given by the magnificent offer of £500 made by our companion paper, "Wireless Review and Science Weekly," as a prize in connection with practical discoveries in this branch of wireless. The competition is open to all, and in the following article Mr. Risdon briefly indicates the simple nature of a new line of research worth investigating.

THE suggestion that some day it would be possible to see a person at a distance whilst conversing with him on the telephone is by no means a new one. When it was first proposed I do not know, but it must have been well over a quarter of a century ago that I first heard it put forward as a serious proposition.

One thing seems certain—namely, that the solution of the problem of tele-vision lies at least as much in the field of wireless endeavour as in any other.

Properties of Light.

When we see an object, it is because light rays directed on to it are reflected by it to our eyes. These rays travel, to all intents and purposes, in straight lines. That is why we can only view objects up to a certain distance at sea, owing to the curvature of the earth's surface. If light rays instead of travelling in straight lines followed the curvature of the earth, as electro-magnetic waves do, there would be no such thing as a horizon, and, given a clear enough atmosphere, good enough eyesight, and a sufficiently powerful telescope, one would be able to view the back of one's head round the world. This curious suggestion is intended to convey a serious and not a humorous meaning, which a little consideration will make clear—namely, that vision—the act of seeing—is the result of reflected light rays travelling in straight lines.

Let us next consider what we mean by tele-vision. In the simplest and fewest possible words, it means seeing the image of a distant object, so placed that we could not possibly view it in the ordinary way, either by reason of distance—i.e., due to curvature of the earth's surface—fog, or solid intervening obstructions such as bricks and mortar. In so far as wireless is concerned, it implies the transmission of an image by means of ether waves so that we see it exactly as it is—not as a reproduction made up of dots or lines.

Wireless Telephony.

Before we can usefully discuss the possibility of such a thing as tele-vision, it behoves us to consider what can already be done with waves. Let us begin with wireless telephony, in which the procedure is briefly as follows.

First we produce air waves by speaking, singing, or playing musical instruments. By means of suitable apparatus these waves cause variations in the flow of electric current along the wire, and immediately we have finished with the sound waves, which die away. The electric current actuates certain instruments by which it is caused to impart its variations to another and far more powerful current oscillating in an aerial, and this current sets up electro-magnetic waves in the ether, which are next-of-kin to light waves.

The electro-magnetic waves, hugging the earth, pass round or partly round it, branded, so to speak, with the ethereal equivalent of the original air waves. Striking other aerials, they set up in each one a feeble electric current, the flow of which bears the imprint, as it were, of the ether wave modulations.

This faint current, in turn, imparts its rhythm to a stronger current which obediently speeds away, and finally produces in the telephone receiver or loud speaker air waves of exactly the same pitch as the original sound waves.

At each stage there is a complete severance of the proceedings, although, of course, there is a continuous wire and ether connection between the speaker and the listener. Incidentally, it must not be forgotten that electro-magnetic waves can be directed in beams—like searchlight beams except that they follow the curvature of the earth.

Types of Ether Waves.

Now let us consider what can be and is done with light waves. We can reflect them in any direction, up or down or round corners. We can focus them, disperse them, and polarise them, which means depriving them of their undulations in all except a given plane. We can reflect them and split them up into their individual component colour waves. In fact, we can do almost anything with light waves except bend them. Perhaps some day we shall learn how to do that.

A searchlight beam is itself imperceptible, and only becomes apparent when there is moisture, smoke or dust in the air. In a perfectly clear atmosphere, or in a vacuum, the beam would be invisible and we should only be aware of it by light rays reflected from an object interposed in its path.

The similarity between light and electro-magnetic waves is too well known to need detailed explanation here. The essential difference is that of wave-length and period of vibration which, so far as we know, accounts for the difference in their behaviour and effect. According to their properties and their relative positions in the spectrum, it would appear that at some intermediate

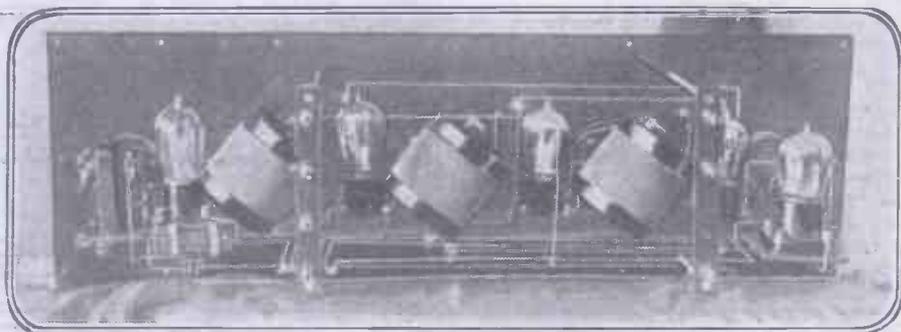
point there must be ether waves corresponding more or less to both types. No doubt from the sun we receive such intermediate waves, and probably we ourselves produce them, without being able to isolate and employ them for a definite purpose. An examination of a chart of the spectrum, however, discloses the fact that, in between light and electro-magnetic waves, there occur heat waves, so that it appears doubtful whether the discovery of any other intermediate waves would be of assistance in the matter of tele-vision.

A Possible Solution.

The position, in so far as tele-vision is concerned, is that although we can produce sound (air) waves, and translate them into the language of electro-magnetic (ether) waves, and vice versa—a marvellous proceeding when you come to think it out—and although we can produce electro-magnetic and light waves separately, we have not yet ascertained how to convert one type of ether wave into the other, although they are so closely allied.

The need for such conversion for the purpose of tele-vision is fairly obvious. In addition to the earth's curvature, atmospheric conditions constitute an effective barrier to the transmission of light over great distances, even without intervening objects. It appears, then, that in the transmission of light rays reflected from an object such conditions present an insuperable difficulty. Not so, however, in the case of electro-magnetic waves which, although not entirely independent of atmospheric conditions, pursue their course for the most part unhindered by such obstacles.

In such a discovery appears to lie a possible solution of the problem of tele-vision, in the conversion of light waves, reflected from an object, into electro-magnetic waves. These, at the receiving station, would be converted back again to light waves, which, on a screen, would faithfully reproduce the original image. And, with the aid of colour photography, we should not only be able to see, but should be able to photograph in colour a person, object, or scene thousands of miles away.



A further view of the Neutrodyne receiver, showing the lay-out of the panel.

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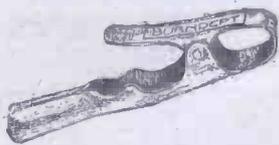
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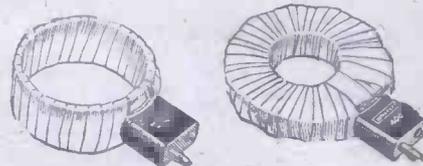
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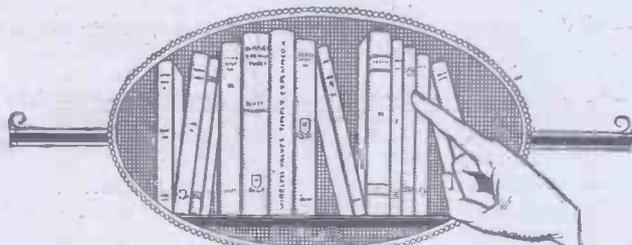
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THE CONSTRUCTION AND CALIBRATION OF GRID LEAKS.

This article covers far more ground than its title would at first indicate. It includes full constructional details of the apparatus required for correctly gauging the resistance of grid leaks—such apparatus can, of course, be employed for other useful purposes—and briefly outlines the theory and practice of the "Wheatstone Bridge."

MOST readers are aware that the high resistance or grid leak used in a detector valve circuit should have a value somewhere in the region of two megohms, but the best working value will of course vary with the characteristics of the

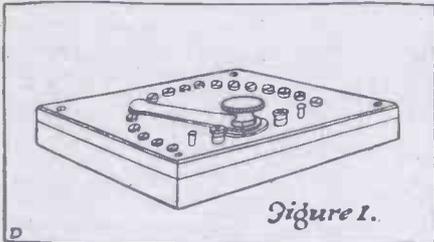


Figure 1.

other components of the set, so that it is a great advantage to have a leak which is roughly adjustable within the limits required. This article gives directions for the making and calibration of such a resistance, varying by steps of about 100,000 ohms from one to three megohms. (See Fig. 1.)

Firstly, cut out a piece of $\frac{1}{4}$ -in. ebonite as shown in Fig. 2. Having drawn the part circle centre A, mark off the positions of the studs by starting at B and marking each way ten steps $\frac{1}{4}$ in. apart. Lightly dot-punch these points, drill and tap them for 6 B.A. flat-headed screws. The hole at A

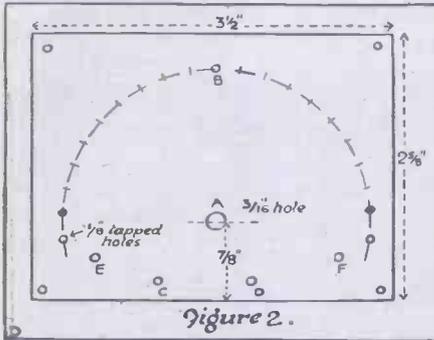


Figure 2.

should be drilled $\frac{3}{16}$ in., clearing hole for a 2 B.A. screw, and the holes C, D, drilled and tapped for terminals.

Four $\frac{1}{2}$ -in. brass wood screws are required to fix the ebonite to a wooden base, so drill and countersink for these in the corners. The two stops E, F, must also be arranged for.

Next rub both surfaces of the ebonite on a piece of fine emery cloth until all trace of the shiny surface has been removed. Then screw the studs and terminal C into position, filing away all metal projecting from the lower surface. Now screw in terminal D, allowing it to project underneath about $\frac{1}{16}$ in.

The knob and adjustable arm next claim our attention. It consists of the following parts:

1. Knob tapped for 2 B.A. screw. (Fig. 3).
2. A flat-headed 2 B.A. screw.
3. A thin brass washer dished spherical with the ball pane of a hammer.
4. Brass arm and 2 B.A. nut. (Details Fig. 4).
5. A brass washer about $\frac{1}{2}$ in. diameter.

Cut out a piece of $\frac{3}{16}$ in. brass to dimensions shown in Fig. 4, denting the end, E, to give good contact on the studs. To strengthen the arm the piece can be slightly dented along its length as in section C, D. Then carefully solder the 2 B.A. nut on the top side, taking care that the holes are in correct position. Place the parts as shown, screwing the arm down until fairly tight. The knob can then be used to lock the nut in its place on the screw. The dished washer will act as a spring, enabling the arm to turn without working loose.

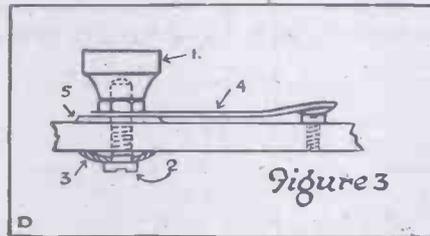


Figure 3.

A short wire soldered between the washer and terminal D will complete the construction of the top portion of the leak.

The resistance may now be placed on the under surface of the ebonite. Prepare a mixture of powdered graphite and Indian ink, and paint the lines as shown in Fig. 5. It is hardly possible to tell the reader the amount of graphite to use, he must discover this for himself by experiment. For the benefit, therefore, of those unfamiliar with electrical calculations, a little information dealing with resistance will not be out of place.

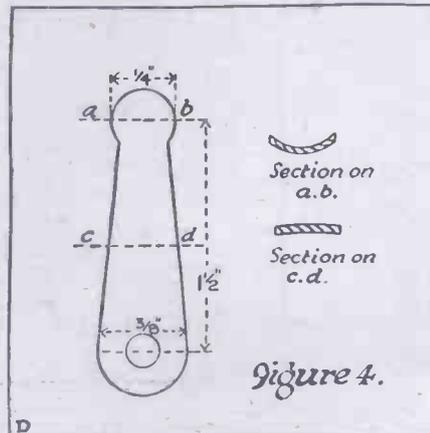


Figure 4.

The resistance to the flow of current along a circuit depends upon three things:

- (a) Length of conductor.
- (b) Area of cross section of conductor.
- (c) The nature of the material of the conductor.

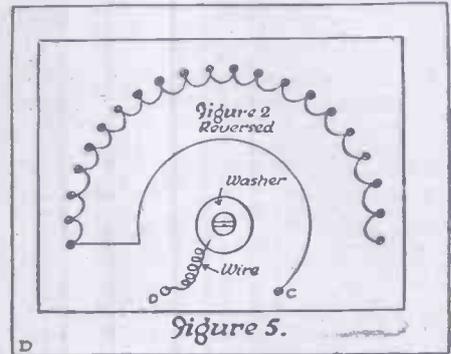


Figure 5.

Copper and silver offer very little resistance, but with carbon or graphite it is very large, so that the few inches painted as above, may amount to several million ohms. Obviously the longer the conductor the greater the resistance, but the greater the thickness the less the resistance.

You will thus see that, assuming your line is not the correct resistance at first,

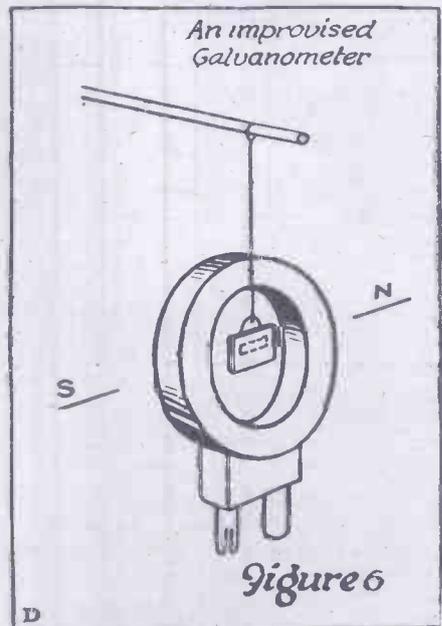


Figure 6.

the method of rectifying it must be by altering the thickness of the line. It is better to have it too thick, as when dry it can easily be scraped thinner.

(Continued on page 590.)

CONSTRUCTION & CALIBRATION OF GRID LEAKS.

(Continued from page 589.)

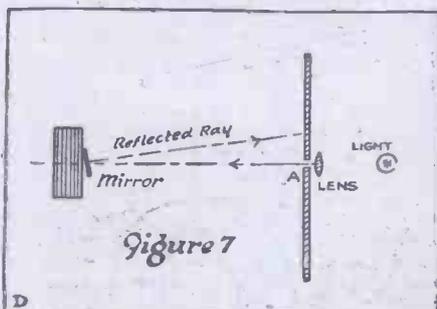
Paint plenty of liquid over the contact points, and when perfectly dry test each stud for flow of current by connecting the terminals of the instrument in series with a battery, switch, and telephone. The resistance may be roughly tested by noticing the loudness of click for the length of line you intend to be two megohms, and then inserting in place of the instrument a bought leak (which, of course, you must take for granted to be two megohms), noticing if the click in the 'phones is louder or softer.

The calibration of the leak is rather a tedious undertaking, but its accomplishment will give great satisfaction to those desiring practice in experimental work. The circuit needed for the tests is shown in Fig. 9, and depends on the principle that if four resistances are connected as in Fig. 8, and if their values are in proportion—i.e. $\frac{A}{B} = \frac{C}{D}$, then when a current is sent along them no part of it will flow between x and y . If we, therefore, in our test make B the unknown resistance which we wish to measure, and A the two megohm grid leak, by having a high resistance potentiometer the slider of which can be made to vary the ratio $C : D$ until no current flows through a delicate galvanometer placed between x and y , we can by measuring the lengths C and D find the ratio $A : B$.

B can then be found from the equation

$$B = \frac{A \times D}{C}$$

C and D are not, of course, the actual resistances of the two parts of the potentiometer, but are proportional to them assuming that the wire is the same thickness throughout the instrument.



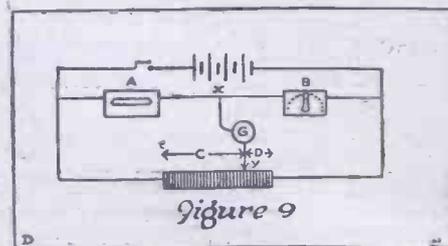
Our next difficulty is the galvanometer, and it must be capable of detecting the very small amount of current flowing when the potentiometer is near the critical point, y .

An Improvised Galvanometer.

First obtain a piece of watch spring about $\frac{1}{2}$ in. long, and magnetise it. Next procure a piece of silvered glass about $\frac{1}{2}$ in. square, the thinner the better. Stick the magnet on the back of the mirror and cover with stout brown paper. When dry suspend the whole by a silk thread, as shown in Fig. 6. It will, of course, set itself north and south. Now place a duolateral or similar coil up against the thread with its face in the same

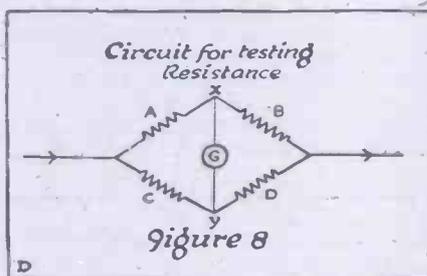
plane as the mirror, and with the mirror as near the centre of the coil as possible.

The magnetic effect due to sending a current through the coil will, of course, tend to turn the mirror, but the movement may be so small that one cannot see the movement. To detect these small deflections, therefore, we cast a beam of light on the mirror, and watch its reflection on a screen.



Use of the "Bridge."

Fig. 7 will explain how this can be managed. A is a small aperture with a lens placed on the opposite side of the screen to the coil, and the same height as the centre of the mirror. A camera with plate attachment removed would answer admirably for the lens. Place a small flash lamp, as shown, and shift it about until its reflection from the mirror can be seen on the screen. The distance the light should be from the screen can soon be found by trial. This sensitive galvanometer can then be tested by passing a very small current through the coil, and observing the movement of the spot of reflected light.



Having set up the circuit, Fig. 9; with the galvanometer described above placed between x and the slider of potentiometer, proceed to test the line you intend to be one megohm. The correct position should, of course, be $\frac{C}{D} = \frac{2}{1}$ because A is two meg-

ohms. Test for current at this spot by pressing down switch. Notice the direction in which spot of light moves.

Now test another position of slider. If the light moves in the opposite direction you will know that the position for no current to flow through the galvanometer is somewhere in between. When the correct place has been found, common sense will tell you whether the resistance is too large or too small, so that you must scrape away, or add on graphite accordingly, and proceed again with the test until correct.

Final Adjustments.

Having corrected the one megohm line, set the arm of the instrument at stud B , Fig. 2, and in correcting after a test, scrape or add equally the ten spaces between the studs. Obviously for this resistance the potentiometer slider should be in the middle.

Lastly, check the total length of line which will be correct when the ratio $C : D$ is $2 : 3$ —i.e. C is $\frac{2}{5}$ and D is $\frac{3}{5}$ of length of potentiometer.

The base can be made from a solid piece of wood about $\frac{1}{2}$ in. thick, scooped out with a gouge so that when screwed to the leak only wood and ebonite make contact.

I might mention, in conclusion, that if the reader has not a potentiometer, he could use a long piece of thin high-resistance wire stretched quite straight between two terminals fixed to a board with a sliding terminal for y .



The "aunt" and "uncles" of 2LO singing a chorus during the kiddies' hour.

DISTORTION DUE TO MICROPHONE DIAPHRAGMS.

By Dr. N. W. McLACHLAN, M.I.E.E. (of the Marconi Research Works, Chelmsford).

It will be remembered that Dr. McLachlan is the inventor of a wonderful new wireless recording device, and that his last article gave a full description of his invention. In this, and a further article that will appear shortly, Dr. McLachlan discusses the more common causes of the distortion arising in telephonic transmission.

THE majority of microphones have some form of vibrating system, usually a circular diaphragm secured at its periphery. Unless the diaphragm is very thick or under considerable radial tension, its fundamental or natural frequency of vibration will lie well within the audio frequency range—i.e., between 600 and 1,500 cycles per second. The maximum displacement of the diaphragm from its central or normal position will, for a uniformly varying force impressed on it due to vibrations of the air, alter with the frequency, the relationship between these two quantities being in the form of a resonance or selectivity curve.

Simple Musical Sounds.

Thus, if a musical scale of uniform intensity is played on a violoncello, the microphone currents corresponding to the various notes will have different magnitudes. Considering, therefore, a steady musical sound, which consists of numerous simple harmonic or sine wave vibrations of unequal amplitudes, if the relative intensities of these vibrations are altered, due to the resonance or selectivity characteristic of the microphone diaphragm, distortion of the original sounds will ensue. Assuming the fundamental frequency of the diaphragm to be 1,000 periods per second, the microphonic currents whose frequencies are in excess or in default of this figure will suffer reduction in amplitude.

Now, in speech the frequency ranges from 100 ~ to 5,000 ~ and the major portion of the energy is conveyed by frequencies less than 1,000; but the essential characteristics which determine interpretation are carried by frequencies greater than 1,000. It follows, therefore, that a system which robs speech of a portion of its energy and of its interpretational qualities causes distortion. Hitherto, we have dealt with sounds whose electrical equivalent is a steady alternating current, but in speech and music there is another important condition with which we are concerned, namely, the transient state. This state is obtained at the initiation or termination of a spoken or musical sound, and varies in degree according to the particular characteristics of the sound and the person or instrument from which it is emitted.

Effect of Forced Vibrations.

One of the most common examples is a note struck on the piano; it commences very quickly and dies away quietly. When any vibratory system receives an impulse, it oscillates in its own natural way, and thus, at the initiation of a sound, the microphone diaphragm superposes on the original sound its own natural frequencies. This yields the well-known forced and free vibrations.

The forced vibrations are those in which the diaphragm follows the motion of the air in front of it, and the free vibrations are those due to the impulse or shock, and have

the same frequencies as the diaphragm when tapped lightly by hand. In general, however, with speech and non-percussive instrumental music, the damping of the diaphragm, or rate at which it comes to rest when left alone, is such that the effects are not so pronounced as might be anticipated. In some cases the diaphragm has ceased to vibrate appreciably before the termination of a sound—e.g., the sustained tone from the pianoforte.

The next phase of the subject is one in which the displacement or movement of the diaphragm from its central position, for varying intensities of the sound, will be contemplated. If the diaphragm is truly elastic, the displacement will be proportional to the impressed force for small movements. For large movements this is no longer true, and the law of linearity is violated.

We can assume for the sake of example that the relationship between force and displacement is represented by a parabolic curve or square law, i.e., the displacement increases more rapidly than the force causing it, and if the force is doubled the displacement is quadrupled. Under such circumstances we will endeavour to describe what happens when the system (a circular diaphragm in this case) is subjected to impressed vibratory forces due to the motion of the air in front of the diaphragm.

Original Tones Destroyed.

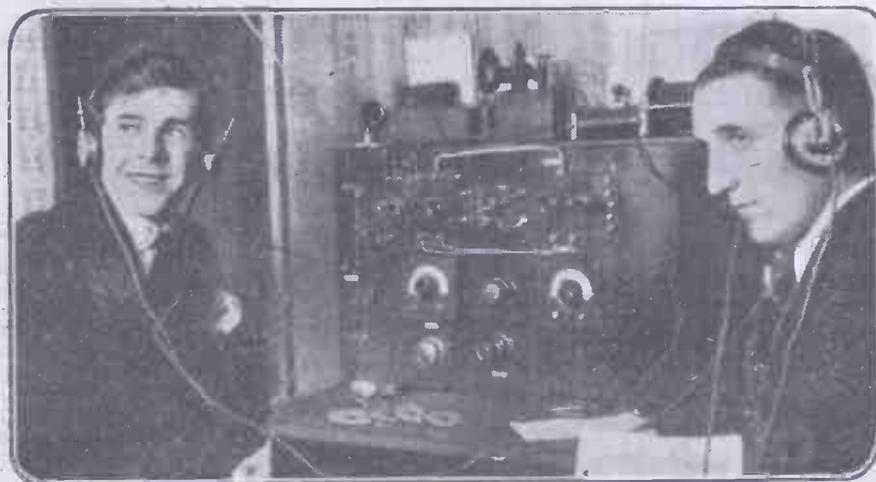
A system of this nature is said to be asymmetric or unsymmetrical. If a steady, pure tone—devoid of upper partials—is impressed on the system, the resulting vibration of the diaphragm contains a family of overtones, and a fundamental whose pitch is slightly different from that of the pure tone. An interesting case is that of two pure tones impressed upon a system which is asymmetric—i.e., of the above nature. If the tones are of sufficient intensity there are created combination

tones (sum and difference) and tones of double frequency, the strengths of which are proportional to the squares of the intensities of the primary tones from which they originate. Thus, under favourable conditions, the alien tones can easily eclipse the pure tones.

With a complex musical sound there are many tones, and if their amplitudes are of sufficient magnitude, the resultant vibration of the diaphragm will bear little resemblance to that of the original sounds—i.e., there will be considerable distortion. Now, a microphone diaphragm will exhibit this effect if the movement of its diaphragm is too large, and therefore arrangements must be made so that this does not occur.

Four Causes of Distortion.

It has been shown hitherto that a circular diaphragm, rigidly clamped at its circumference, causes distortion for the following cardinal reasons: (1) The relationship between amplitude and frequency of vibration for impressed forces, due to the motion of the air in front of the diaphragm, the forces all having the same strength, is in the form of a resonance or selectivity curve, whereas for zero distortion the relationship ought to be a horizontal line. (2) The effect of a sudden or impulsive sound is to set the diaphragm vibrating at its natural frequency and this is always accompanied by a series of overtones. These overtones constitute what is known as an enharmonic series, since their frequency relationships to the fundamental or natural vibration are not in the ratios of 2, 3, 4, etc. (3) The damping or rate at which the natural vibration decays when the diaphragm is oscillating freely—i.e., at the termination of a sound, is different from that of the sound. (4) For large amplitudes of vibration a single pure tone is transformed into a different tone with its family of overtones, and a multiplicity of pure tones such as make up a steady musical sound, yield combination tones and tones of double frequency.



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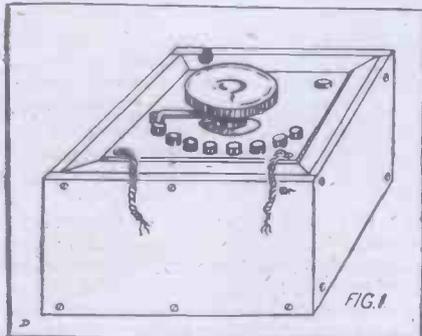
Quite an original note is struck in this article, but the resultant appearance of panels mounted upon such boxes is very pleasing

FIGURE 1 shows how a variable grid leak was mounted, and the construction of such a box is very simple. Narrow plain wood photo-frame moulding of a section as shown in Fig. 2 can be purchased quite cheaply, and a length of this will make several small boxes.

The first thing is to make a frame of the moulding, as in Fig. 3, of such a size that the rebate opening just takes the ebonite panel to be mounted,

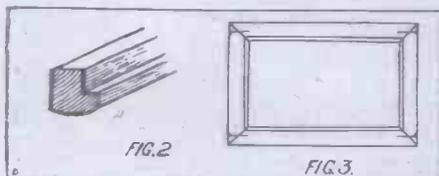
A Great Advantage

The making of the frame should not present any difficulties—the corners are mitred, which can be easily done by using a block of wood in which a saw cut has been made at an angle of forty-five degrees, as a guide for the saw when cutting the moulding. The corners are then glued or seccotined and the four pieces put in a cramp—made of four pieces of wood and a length of cord (see Fig. 4)—until the glue has set.



When taken out of the cramp the corners can be further secured by four thin wire nails; when knocking these nails in, keep the frame flat on the table with the opposite side resting against something solid.

Pieces of thin wood (fretwood or 1/4-in. three-ply being very suitable) of the proper length and depth can now be screwed by means of 1/4-in. screws to the outside of the frame as shown in Fig. 1. For the bottom a piece of 1/4-in. or 3/8-in. wood, of the same size as the outside of the frame, can be fixed by small screws.

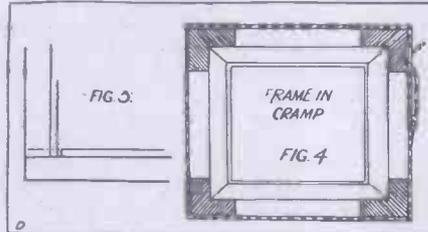


Should the sides project beyond the ends they can be made flush, and neatly finished with a rasp.

It will be found that although the sides of the box are only made of thin wood, the frame top and the bottom make it a very strong and serviceable box, and it can

be finished by staining and polishing, or it will look very well if given two coats of shellac varnish.

If 1/4-in. ebonite is used for the panel it will no doubt project slightly above the rebate, and it adds to the appearance if the



edges of the ebonite have a slight bevel; this can be easily done by drawing (not cutting) a knife edge along it.

One great advantage of mounting a panel in this way is that it can be lifted out of the rebate if necessary to get at the underside, without the trouble of undoing screws as when mounted in the usual way.

Another Method

As an alternative to using the mitred joint for the corners of the frame, they can be butted by cutting the moulding square and removing the rebate, as shown by dotted line in Fig. 5, at each end of two of the side pieces.

BOOKS, CATALOGUES, ETC.

S. GUITERMAN & CO. have just introduced a new type of hydrometer, an instrument essentially for those wireless enthusiasts who wish to keep their accumulators in good condition. The instrument is simple to use, and cannot be broken owing to the stout carton in which it is packed, hence the name "Break Not." By using one of these hydrometers one can tell at a glance the state of the accumulators.

* * *

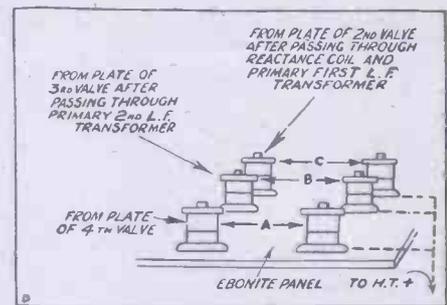
"Electrons, Electric Waves, and Wireless Telephony," by J. A. Fleming, M.A., D.Sc., F.R.S. (The Wireless Press, Ltd., 7s. 6d. net).

A very interesting and useful little book has been brought out by Dr. J. A. Fleming, in which he amplifies upon the subjects dealt with in his course of Christmas lectures which he gave at the Royal Institution of Great Britain during December, 1921, to January, 1922. It takes the reader through the whole theory of wave production, and is written in such a way as to make it equally interesting both to the beginner and the more advanced student of wireless. Leaving the subject of waves, the book deals concisely and

conclusively with the atomic theory, and the main details of the electron theory as applied to electro-magnetic forces and wireless in general. The book is crowded with illustrations, both photographic and diagrammatic, there being hardly a page on which some useful figure does not appear. Containing only seven chapters, the last three being devoted to the production of electric waves from the practical side of wireless telephony, both transmission and reception, it is indeed amazing that so much explanatory detail has been crowded into so few pages. Dr. Fleming has filled a long-felt gap in the literature of wireless, and every earnest radio student would be well advised to make a thorough study of this most excellent work.

CUTTING-OUT VALVES

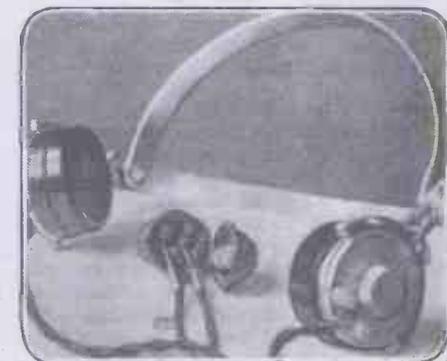
To wireless amateurs who have three, four, or more, valve wireless sets, it is often only necessary, and sometimes preferable, to be able to listen in on a less number of valves. This can be



effected without the necessity of switches or plugs and jacks at very little cost in the following simple manner, referring to the above diagram:

Terminals A are usual telephone terminals; B and C are extra terminals for cutting out unnecessary valves. For two valves the leads from high resistance telephones are placed in terminals C. For three valves the leads from high resistance telephones are placed in terminals B, but terminals C must then be strapped across.

For four valves the leads from high resistance telephones are placed in terminals A, and both sets of terminals B and C must then be strapped across. Filaments of valves not in use are switched out by means of the rheostats.



Wireless in a nutshell. Mr. A. Watson, 168, Burbage Road, Dulwich, S.E., claims to receive signals upon this miniature set with as great strength as on a crystal set of more orthodox size.

AN EASILY CONSTRUCTED CRYSTAL SET.

This article describes the construction of a complete crystal set suitable for broadcast reception. The methods of dealing with those parts, such as the contact slider, etc., which are invariably purchased, is both ingenious and simple.

By A. W. DRANSFIELD.

THE "set" about to be described is for the benefit of the absolute beginner, and it will work quite well and at the same time is so simple to construct that the veriest amateur need have no fear that it will be labour lost.

A receiving set consists of tuning coil, detector, aerial and earth, and a pair of telephones. That is the simplest form of receiver, but there are several little extras that may also be added that will assist in giving better results. However, the first step will be to make the simplest set and add to it later.

The tuning coil will be the first thing to construct. Procure a piece of cardboard tube $4\frac{1}{2}$ in. or 5 in. diameter and 6 in. long. This should be of fair thickness, as the wire has to be wound on it, and consequently there will always be a slight pressure on it.

Winding the Coil

Dry this tube, and then shellac varnish it, inside and out. It may be well waxed instead, with paraffin wax; but if treated in this manner the whole coil should be warmed in front of the fire and then wiped off smooth with a piece of rag. Drill or pierce a small hole about $\frac{1}{2}$ in. from each end; these holes are for the ends of the wire—the commencement and the finish. The wire required will be 20 gauge for the 5 in. diameter, and 22 gauge if the smaller tube is used. It is as well here to mention, for the guidance of the amateur, that the higher the number of the gauge, the thinner the wire will be. Hence 22 or 24 gauge would be thinner wire than 20 gauge. Commence

with various parts of the crystal to select the sensitive spot. The holder for the crystal is usually in the form of a cup, the bottom having a bolt that goes through the base to hold it down, and this may be made from a piece of thin tubing, such as an old piece of cycle pump tubing. If soldering presents difficulties, cut out a star-shaped piece of thin sheet brass and make a hole in the centre to take the "holding down" bolt; then turn up all the points to

The coil should be mounted at one end, to allow room for the detector. A method has to be now arranged that will allow selection of the coil at any turn desired for tuning.

Additional Insulation

There are several ways of accomplishing this, but perhaps the easiest way will be to cut a strip of fairly thick sheet brass that will reach from end to end as shown. If this presents any difficulty, use two pieces of brass wire and form a slider out of thin sheet brass (Fig. 2). If it is possible to solder an old plunger from an electric lamp holder it will make a good slider, but the springy brass slider will do. The copper wire on the coil must be scraped clean of all insulation at the point where the slider engages, so that good contact is made.

It is now only necessary to add the terminals and connect up, and the method of doing this is shown in the diagram (Fig. 2). A good plan when mounting the terminals is to drill the holes slightly larger than the thickness of the terminal, then wax a strip of paper the width of the thickness of the base-board, and before passing the terminals through, wrap a little of the paper round the terminal. Then place a well-waxed cardboard washer on the top and on the underneath side.

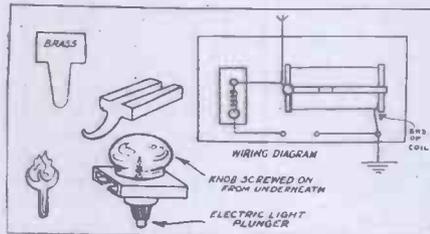


Fig. 2.

make a setting for the crystal (Fig 1). Before mounting the crystal, put the bolt through the hole, then press the point on to the crystal until it is firmly held in its mounting. The selector portion may be made in the "cat's-whisker" form, which consists of a piece of thin springy brass, German silver, or copper wire twisted into a spiral with a loop at one end, to screw it down with, and a point at the other end to rest on the crystal.

These two fittings would be better mounted on a small strip of ebonite; dry wood will do, but is not so good.

The inductance when ready for finishing off should be attended to. Cut two pieces of wood $\frac{1}{2}$ in. thick to shape shown, nailing a strip of wood on the inside of these two ends to take the coil, which will be held in its place when mounted on the base-board. The base-board is a piece of $\frac{1}{2}$ in. or $\frac{3}{4}$ in. wood, 10 in. by 6 in. Fasten the ends in the coil by means of a small screw at each end, then stand it on the base-board and mark the position.

Drill a hole at each of the marks, so that screws passed up through the underside of the base-board will screw into both ends.

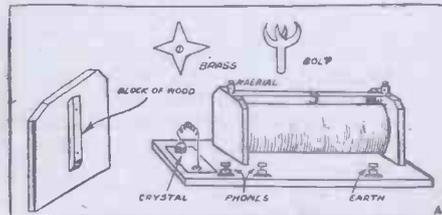


Fig. 1.

winding the wire on the tube by passing it through one of the holes, leaving about 2 in. over to be used for connecting purposes later on. Then wind along the tube, keeping the wire close and uniform until the other hole is reached.

Construction of the Detector

Cut the wire off the reel, and pass the end through the last hole, plugging it with a piece of matchstick. If the tube was shellacked, shellac it again, as this will hold the wire tightly to the tube. If the tube was waxed, well warm it again, and the wire will settle down and adhere to the wax.

The detector is rather an important piece of the apparatus. It consists of a cup or fixing to hold the crystal, and an arrangement to engage it with a point that will be allowed to move about so that contact may be made



The interior of the Levallois-Perret Station from which the Radiola concerts are broadcast.

AN IMPROVISED WINDER.

By T. MURRAY, A.M.I. Mech.E.

THE two supports, S, together with the bottom piece, B, which are secured together by means of wood screws, were made of hard wood $\frac{1}{2}$ in. thick, two pieces of brass tubing being used for the spindle bushes, these latter being given a coat of shellac on the outside before being driven into the supports. The spindle, either of hardwood, brass or steel, must, of

One end of the transformer wire is then secured to the former and led over the jockey pulley, the reel of wire either being held in the hand, or on a small spindle, with just sufficient pressure to keep the wire taut.

The details can, of course, be modified to suit various parts that one may have by them, also, the bottom piece, B, made to

Bromwich, St. Inglebert, Le Bourget, Brussels, Rotterdam, Amsterdam, and occasionally Königswusterhausen, all these stations in connection with the aeroplane overseas service, and from 2 o'clock (French time) till 3 o'clock there is generally an exceedingly good concert from Paris; and then from 3 o'clock till about 5.30 p.m. an excellent concert from The Hague; and at 6.20 we have still another concert from Paris, and at 8.30, of course, the usual B.B.C. concert; and then again, at 8.45 (French time), another concert from Paris until about 11 o'clock. Surely this should satisfy the most enthusiastic listener-in.

I do not, for one moment, wish you to think that I do not appreciate the B.B.C. concerts, but at the same time, being a resident within about ten miles of 2 L O, it is a pleasure sometimes not always to have to listen to them or receive their interruption, and I should very much like to see, as far as 2 L O are concerned, for every night of the week at least half an hour interval, say from 8.30 to 9, in order that those who are capable of receiving other stations should have the opportunity of doing so; and I hope that this remark may come before the eyes of the people interested for their consideration.

Yours truly,
W. PRATT.

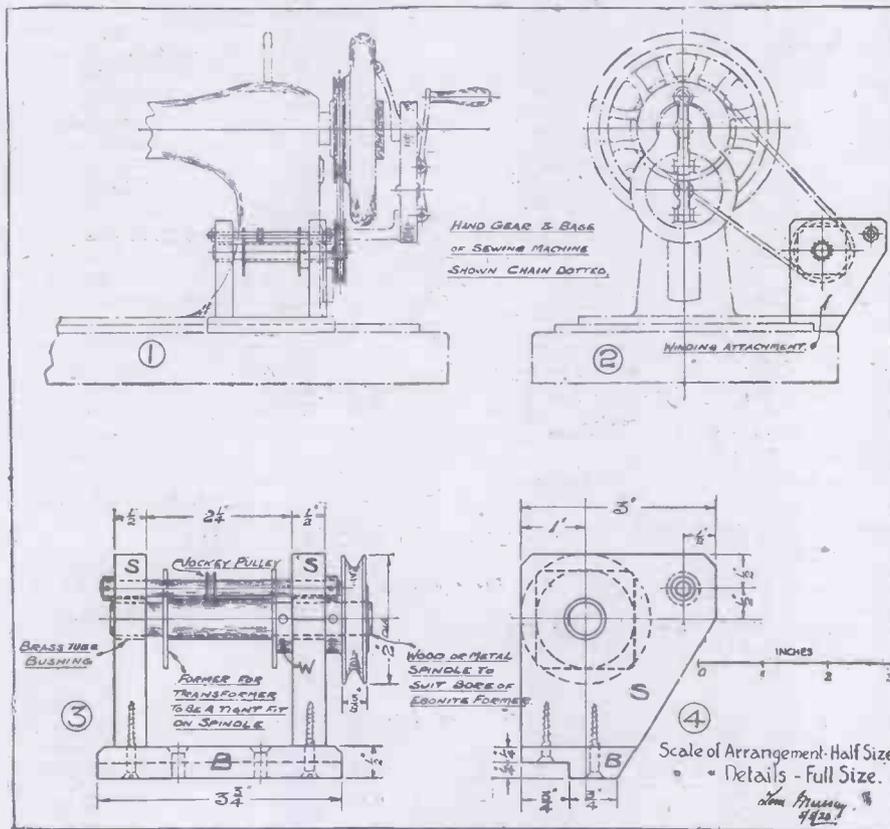
The Editor, POPULAR WIRELESS.
RADIO SOCIETIES.

Dear Sir,—In view of the impending issue of the new form of wireless licence, making it possible for amateurs and experimenters throughout the country, without previous knowledge, to make up their own wireless receiving sets from parts and accessories, may I draw your readers' attention to the advantages gained, particularly by those who have at present little or no wireless knowledge, by joining one of the many radio societies in London and the provinces?

The Radio Society of Great Britain has affiliated to it now upwards of some 250 such radio societies throughout the country. Practically all these radio societies are giving weekly or monthly lectures to their members, and those of your readers just commencing this interesting new science would do well to get in touch with their local society. If for no other reason, it is of the utmost importance that those making up their own sets should be educated in how they may make such sets and use them without risk of interference to their neighbours by re-radiation from their aerials. The Radio Society of Great Britain has, since broadcasting commenced, formed a new class of members known as associates. No previous knowledge of wireless is necessary to join this class, the subscription is a nominal one of 5s., and there is no entrance fee. Special elementary lectures are arranged each month for associates.

If any of your readers are in doubt as to the nearest radio society in their district, I shall be pleased to give them the necessary information if they will kindly enclose stamped addressed envelope; or to those who desire to join the Radio Society of Great Britain, application forms and full particulars of the different grades of membership will be sent.

Yours faithfully,
L. McMICHAE, Hon. Sec.
32, Quex Road,
West Hampstead, London, N.W.6.



course, be a tight fit in the ebonite or fibre former; but, if found to be too slack, a strip of glasspaper pasted around it will hold the former tight and prevent slipping.

The pulley used was found in the scrap-box, the bore being altered to suit, and pinned to the spindle; the washer, W, is also pinned to prevent lateral movement of the spindle between the supports. The grooved jockey pulley, about $\frac{1}{2}$ in. diameter, is mounted on a $\frac{1}{4}$ in. diameter spindle, and is free to rotate and also to slide along the spindle.

A Useful Accessory.

When assembled, it is screwed to the base of the sewing-machine as shown in Figs. 1 and 2, care being taken to line up the large pulley with the belt pulley on the machine, and a short piece of $\frac{1}{4}$ in. diameter belting used for driving purposes. The stitching mechanism is put out of gear by the means provided and the handwheel used in the same manner as when filling the thread spools.

suit the particular sewing-machine that the arrangement is to be fitted to. The same idea can be used for winding telephone ear-piece bobbins, bell and buzzer bobbins, etc.

CORRESPONDENCE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I was very interested to read the communication from your correspondent in your issue of May 5th last, but cannot help expressing my surprise when he asks the question: "Why Sunday is such an 'empty day' for 'listeners-in'?"

In my opinion, Sunday is one of the most interesting days which I have on my radio set, and I can, practically from 10 o'clock in the morning till 11 o'clock at night, interest myself and friends the whole of this time. Surely one does not want to hear anything more interesting than Croydon, Lympne, Fulham, Manchester, Castle

It's the valve that counts!



Users of valve receiving sets will do well to realize that the efficiency of their outfit is largely dependent upon their choice of valves. It's the valve that counts!

You will positively ensure the best reception of vocal and musical items by using

MARCONI VALVES

MADE AT THE OSRAM LAMP WORKS

Made with the same scrupulous care that has always characterised the manufacturing operations of the famous Osram factory.

MADE TO LAST.

Sold by leading Electrical Contractors, Wireless Dealers and Stores.

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Branches throughout the United Kingdom and in all the principal markets of the World.

BROADCASTING TRANSMISSIONS.

GREAT BRITAIN.

Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.
London	2 L O	11.30-12.30 (B.S.T.)	Music	369	Every week day.
"	"	5 p.m.	Women's "Hour"	"	" "
"	"	5.30-6.15 p.m.	Children's Stories	"	" "
"	"	7 and 9.45 p.m.	News	"	" "
"	"	8-10.30 p.m.	Music and various	"	" "
"	"	8.30-10.30 p.m.	News and music	"	Sundays.
Newcastle	5 N O	11.30-12.30 p.m.	Music	400	Every week day.
"	"	Usually 5.0-10 p.m.	Music, News, etc.	"	" "
"	"	8.30-10 p.m.	Music and News	"	Sundays.
Manchester	2 Z Y	11.30-12.30	Music	385	Every week day.
"	"	Usually 5.0-10 p.m.	Music, News, etc.	"	" "
"	"	8.30-10 p.m.	Music and News	"	Sundays.
Birmingham	5 I T	11.30-12.30	Music	425	Every week day.
"	"	Usually 5.30-10 p.m.	Music, News, etc.	"	" "
"	"	8.30-10 p.m.	Music and News	"	Sundays.
Glasgow	5 S C	Usually 5-10 p.m.	Music, News, etc.	415	Every week day.
"	"	8.30-10 p.m.	Music	"	Sundays.
Cardiff	5 W A	11.30-12.30	Music	353	Every week day.
"	"	Usually 5.0-10 p.m.	Music, News, etc.	"	" "
"	"	8.30-10 p.m.	Music and News	"	Sundays.
Croydon	G E D	Throughout day	Aeroplane Traffic	900	" "

BELGIUM

Brussels (1)	Brussels	12 noon (G.M.T.)	Weather report	1100	Working days.
		4.50 p.m.	Aeroplane traffic	1100	When necessary
		6 p.m.	Concert	1300	Sunday, Tuesday and Thursday.

HOLLAND

The Hague	P C G G	3-5 p.m. (G.M.T.)	Concert	1050	Sunday.
		8.40-9.40 p.m.	Concert	1050	Monday & Thursday
The Hague (Laboratorium Heussen)	P C U U	7.45-10 p.m.	Concert	1050	Tuesday.
		9.40-10.40 a.m.		1050	Sunday.
The Hague (Velthuyzen)	P C K K	8.40-11.40 p.m.	Various	1050	Friday.
Ymuiden (Middelraad)	P C M M	8.40-11.40 p.m.	Concert	1050	Saturday.
Amsterdam	P A 5	8.10-11.10 p.m.	Concert and News	1050	Wednesday.

FRANCE

Levallois-Perret (Radiola)	S F R	2-3 p.m. (B.S.T.)	Music	1780	Sunday.
		5 p.m.	Stock Exchange News	1780	Every day.
		5.15-6.15 p.m.	Instrumental music	1780	"
		8.45 p.m.	General News	1780	"
Paris (2) (Eiffel Tower)	F L	9-10.30 p.m.	Vocal and instrumental concert	1780	"
		6.40 a.m.	Weather Forecast	2600	"
		11.15 a.m.	Weather Forecast	2600	"
		3.30 p.m.	Stock Exchange News	2600	"
		6.20 p.m.	Weather Forecast, Concert	2600	"
		10.10 p.m.	Weather Forecast	2600	"
École Supérieure des P.T.T. Radio-Riviera (Nice)		7.45-10 p.m.	Radio Concerts	450	Tuesday, Thursday,
		2.30-7.30 p.m.	Radio Conferences	450	Saturday.
		11 a.m.	News, Concert, tzigane	460	Every day.
		5-6 p.m.	News, instrumental Concert	460	"
		9-10 p.m.	Latest News, Concert.	460	"

GERMANY, CZECHO-SLOVAKIA, AND SWITZERLAND

Berlin (Königswusterhausen)	L P	6-7 (G.M.T.)	Financial News, etc.	2800	Every day.
		11-12.30			
Prague	P R G	4-5.30 p.m.	Financial News, etc.	2800	"
		7-11 a.m. and 3 p.m.	Weather News, General News	1800	"
Geneva	H B	9-2 p.m. and 9 p.m.	Concert	4500	"
		6-7 p.m.	Concert	1200	"

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

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

See Notes and News page for later details or alterations, if any, to hand.

"True MusiC."

T.M.C. LOUD SPEAKER COMPETITION.

THE enormous number of entries we have received for this competition testifies to the very great interest the Public are taking in all matters relating to Wireless Broadcasting, and we have much pleasure in announcing the names of the successful competitors:

FIRST PRIZE: 100 GNS. T.M.C.
SUPERB CABINET "DE LUXE."

W. R. MILNER,
4, MEATH ROAD,
ILFORD, ESSEX.

who was the first competitor to submit the word

"True MusiC."

SECOND PRIZE: £30 : 0 : 0 T.M.C. 3-VALVE
RECEIVING SET WITH LOUD SPEAKER.

W. GREENWALD,
3a, BEECHWOOD ROAD,
HORNSEY, N.8.

whose entry was the first submitting the word

"Tru MusiC."

"True-Music" aptly describes all we claim for our Loud Speaker. Every note of music reproduced from the Broadcasting Stations rings true, and *really is music.*

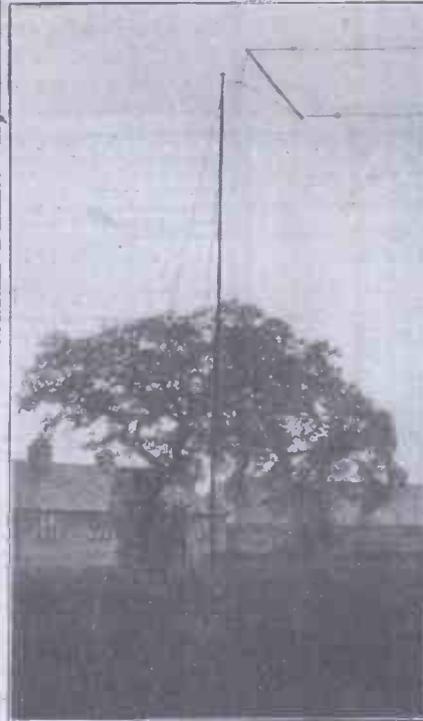
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Designed by Naval Experts like a ship's mast. Columbian pine, painted 3 coats. 500 in use.

No current jump or steel to rust. Unbreakable and easy to fix.

Rigged by ex-seamen. Light, rigid and sent complete, no extras.

Fixings for any roof or confined space.

"TURRET" TWO

27 ft. As Photo.

37/6 Complete.

28 ft. "Turret" Super,
59/6

36 ft. Complete,
79/6

42 ft. With Telescope
top pole, **89/6**

56 ft. In 4 sections,
extra guys, and Tele-
scopic top poles,
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SOLDER OR SORROW—



WHICH is it to be? The Wireless aspirant who is satisfied in leaving the connections of his aerials and set terminals to look after themselves by just twisting them together is asking for trouble. Apart from the untidy appearance, careless connections are going to lower the efficiency of the finest receiving set in the

world. SOLDERING will make doubly sure of them, and, incidentally, FLUXITE will make sure of the soldering. Soldering is child's play when you've a tin of FLUXITE at hand to help you, or, better still, a complete Soldering Set that we have had specially prepared for the convenience of customers. Ask your Ironmonger or Hardware Dealer to show you the neat little

FLUXITE SOLDERING SET

It is perfectly simple to use, and will last for years in constant use. It contains a special "small-space" Soldering iron, with non-heating metal handle, a Pocket Blowlamp, FLUXITE, Solder, etc., and full instructions. Price 7/6 sample Set, post paid, United Kingdom.

FLUXITE SIMPLIFIES SOLDERING

All Hardware and Ironmongery Stores sell FLUXITE in tins, price 8d., 1/4, & 2/8. Buy a Tin To-day.

Reduced
Price
7/6



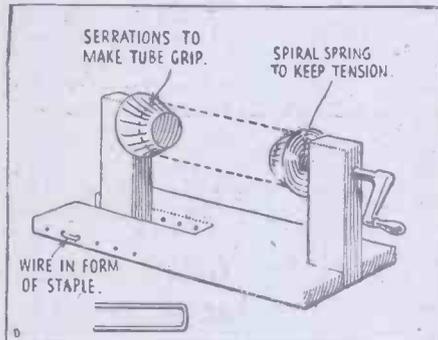
For the tool-kit of your car or motorcycle, or any soldering jobs about the home.

FLUXITE LTD., 324 Bevington St., Bermondsey, England.

SOME MORE PRACTICAL IDEAS.

COIL WINDER.

THIS coil winder may be made out of a few odds and ends. The cone ends may be made from two wooden barrel-bungs. The spindles are made from two pieces of $\frac{1}{8}$ in. iron wire, flattened out and driven into the centre of the bungs. The handle end, of course, has a thread

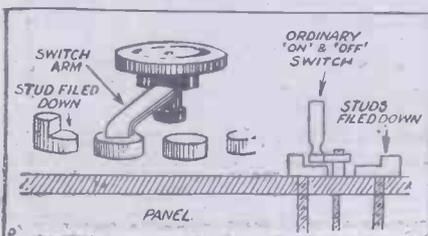


to fasten the crank on. The crank is made out of a piece of sheet brass 2 in. long, with a hole at each end; one hole should be $\frac{1}{8}$ in., the other only large enough to rivet the intended handle in.

The wood uprights are 4 in. long, $1\frac{1}{2}$ in. wide, and $\frac{3}{4}$ in. thick; the base-board is 1 ft. long, $2\frac{1}{2}$ in. wide, and 1 in. thick. The base-board is slotted to take the uprights, and it will be seen that the slot is extended at one end to accommodate varying lengths of tube; the taper also allows of different diameter tubes being wound. The plugs should have small serrations scratched lengthwise to make the tubes grip. The dotted lines show a tube in position ready for winding. The spindles should fit fairly tight in their holes, so that there will be no slip when winding. The dimensions may easily be altered to suit the particular coil to be wound, or it is very easy to have cones on spindles interchangeable so that they may be placed in the uprights at will. It will be noticed that a spiral spring is placed between the handle-end bung and the upright; this will keep a tension and keep the tube central.

SWITCH ARM STOPS.

TO avoid the expense and trouble of fitting stops to switch arms, and also drilling the necessary holes in the panel, the following tip will be found efficient, especially where a number of switch arms are in use. For the first and

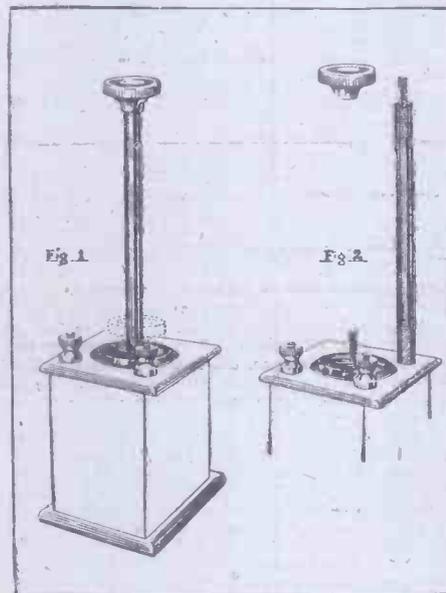


last stud on each row of contact studs, use two studs which stand about $\frac{1}{4}$ in. above the others, and file about two-thirds of the head down as per sketch. This will leave an upright edge for the switch arm to engage with, and so act as a stop.

The same idea can be utilised where simple on-and-off switches are in use. These switches can be purchased very cheaply, and when the wood base is removed, can be fixed direct on to the panel, using two ordinary studs for contacts filed down as above.

UPRIGHT EXTENSION HANDLES.

EVERYONE who has had any experience at all with valve receiving sets knows something about the capacity effect set up by the hand when placed upon the adjusting knob of a tuning condenser, and will readily appreciate a device that will obviate most of this. By the introduction of an upright extension handle fitted to an



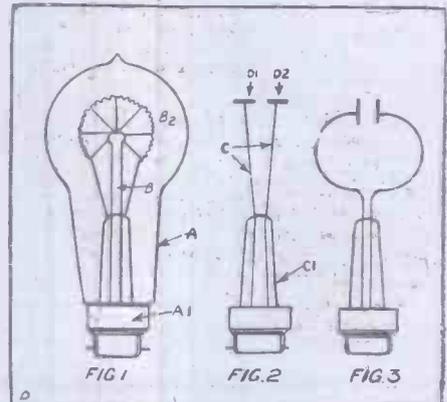
adjustable portion of a valve set the capacity effect is practically nil, giving the advantage of permitting much finer tuning, thus adding greatly to the efficiency of the set.

The extension handles shown in the diagrams hardly need any explanation, and the making of them is simplicity itself. I have drawn two diagrams which show at a glance how they are constructed. In Fig. 1 the handle is fitted to a condenser, whereas Fig. 2 shows the handle in sections.

All that is required to make one handle is a piece of ebonite tube, 5 in. long by $\frac{1}{2}$ in. in diameter with $\frac{1}{8}$ in. bore, also 1 in. of No. 2 B.A. screwed rod. Thread both ends of the tube with a 2 B.A. tap, the latter can be made by filing to a taper a piece of No. 2 B.A. screwed rod, then unscrew knob from the condenser, and fit it to one end of the ebonite tube by means of the 1 in. of screwed rod, next fitting the rod as shown in Figs. 1 and 2.

A SIMPLE LIGHTNING ARRESTER.

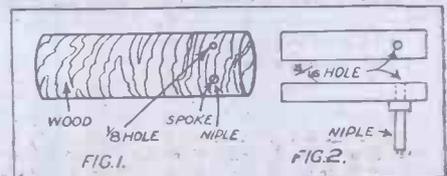
QUITE a good lightning arrester can be made from old half-watt electric globes. The glass globe A, Fig. 1, is first removed, care being taken not to leave any glass in the collar, A, or a nasty cut may result. The glass rod B and filament supports B1 and B2 are next taken out, leaving the filament leads, C, Fig. 2, and glass tube, C1.



Two copper or brass plates, D1 and D2, about half inch square, are soldered to the filament leads as in Fig. 2. The filament leads are now bent as shown in Fig. 3, so that the plates D1 and D2 are parallel. The distance between the plates can be altered by bending the leads C. The arrester is now complete and only requires fixing into a holder. This is an ordinary electric lamp holder which can be screwed on to a panel or baseboard.

NOVEL SPIDER COIL FORMERS.

TAKE a piece of round, hard wood (Fig. 1), cut according to size of coil. Space round the wood to the amount of spokes required, and then bore a $\frac{1}{8}$ in. hole at each space. Take some cycle spoke nipples and drive one in each hole. To



prevent damaging the tapered hole in the nipple, a piece of metal (Fig. 2) with $\frac{1}{16}$ in. drill will overcome the difficulty. When all the nipples have been driven in, screw the spokes into the nipples and the former is ready for use.

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.

Swansea and District Radio Experimental Society.*

At a large gathering of members of the Swansea Radio Society recently held at their headquarters, the Y.M.C.A., a lecture was given by Mr. McNamara, entitled "Elementary Principles of Wave Motions," Mr. A. T. Sage presiding.

The lecturer compared in a simple manner the differences between waves in water, air, and ether, which was eagerly followed by those present.

The chief aim of the lecturer was to cater for the non-technical man, and the lecture proved to be of exceptional interest to the experimenter.

A further series of elementary lectures will be given at a future date, and all beginners in wireless theory are cordially invited to attend.

Hon. sec., H. Morgan, Esq., 218, Oxford Street, Swansea.

Walthamstow Amateur Radio Society.*

On Thursday, April 26th, a large audience gathered to witness a wireless demonstration held at the Hut, Church Hill. Mr. A. Kruse, M.M., was in the chair. The demonstration was held for the purpose of providing funds for the Y.M.C.A., in whose grounds the Hut stands, and was given by the Radio Association, in co-operation with the Walthamstow Amateur Radio Society. Prof. A. M. Low, D.Sc., demonstrated his audiometer, and many of the audience had the pleasure of seeing their voice on the screen. Prof. Baker, B.Sc., then told the audience how wireless was made possible, and the theory of the wireless wave. Major Raymond Phillips then showed his wireless controlled train, and proved how easy wireless control of mechanism was. Capt. Drury Coleman addressed the audience, and told how the Radio Association was anxious to help the amateur. Many well-known local amateurs—whose call-signs are usually to be heard, and in some cases have been picked up at Nice—were seen on the platform. The meeting ended with a hearty vote of thanks to the Radio Association, and the Y.M.C.A. funds will be considerably increased, the whole of the proceeds being handed over for that purpose.

Sec., Mr. R. H. Cook, Y.M.C.A., Church Hill, Walthamstow, E.17.

Treharris and District Radio and Scientific Society.

A radio society has been formed at the above place. The informal meeting was held at Mr. Dan Osborne's Studio, Perrott Street, Treharris, who has very kindly given the society the use of his studio as the society's headquarters, which offer was greatly appreciated. It was decided to hold two meetings weekly, on Tuesday and Thursday, at 6.30 p.m. Tuesday will be devoted to construction of members' sets and parts; Thursday will be devoted to lectures and discussion. All intending members will be given every assistance and welcome.

Hon. sec., David D. Richards, Mametz House, Bontnewydd Terrace, Trelewis, Glam.

The Southampton and District Radio Society.

The first meeting of the Southampton and District Radio Society at the new headquarters, Y.M.C.A., Ogle Road, was held on Thursday, May 3rd, when, after the business items were disposed of, Mr. Bateman gave a very instructive lecture on the interesting topic of dual amplification. He dealt with various circuits, and gave his audience the benefit of a description of a dual amplification circuit which he has devised, and with which excellent results have been obtained. He concluded his discourse by a practical demonstration of this circuit in a set of his own construction. Mr. Bateman also described the construction of a novel form of potentiometer. New members will be welcomed.

Hon. sec., Mr. P. Sawyer, 55, Waterloo Road, Southampton.

Leyton and District Wireless Club.

A very successful meeting of the above was held at headquarters on Monday, May 7th, when, after the usual Morse, etc., classes, a very interesting lecture and demonstration was given by one of the members, Mr. P. J. Slade, on valves.

At the close of the lecture, the chairman, Mr. W. Bassett, very successfully operated his three-valve set.

Meetings are held fortnightly, and the secretary will be glad to hear from any interested persons.

Hon. sec., W. G. Peacock, 73, Frith Road, Leytonstone, E. 11.

"Wireless Review and Science Weekly."

In our new companion journal will be found full details for a £1,000 award in cash prizes for readers.

£500 is offered for an invention, and £500 for an Ideal Broadcasting Programme.

Some of the greatest living writers contribute to WIRELESS REVIEW AND SCIENCE WEEKLY—Senator Marconi, Sir Oliver Lodge, Dr. J. A. Fleming, Professor J. A. Thomson, Dr. Lee de Forest—to mention only a few names.

The fascination of popular science is also clearly demonstrated in the science articles appearing in this new journal every week. "Making the Cinema Talk" is the theme round which Dr. Lee de Forest has written, in a long article in No. 2 of the new journal, and in which he describes his invention which has at last made the "movies" vocal.

The Radio Society of Highgate.*

Mr. H. Andrews, B.Sc., continued his series of lectures on Friday, May 4th, by giving a lecture on "C.W. Transmission." He explained that a C.W. heterodyne was really a low-power transmitter, ordinary transmitting sets differing therefrom only in the matter of the amount of power dealt with. Receiving valves of the ordinary type may be used, a range of 50 miles having been accomplished by means of an "R" valve; but in such cases it is necessary to overrun the filaments, thereby reducing the life of the valves. Various examples of British, French, and German transmitting valves were exhibited, and their characteristic features explained. The usual methods of obtaining the necessary high voltage direct current supply for transmitting purposes were described, and the lecturer then went on to describe in what respects the inductances used differ from those used in receiving sets. Transmitting condensers were also dealt with, it being mentioned that the capacity of an ordinary variable condenser can be approximately doubled by immersing it in good quality insulating oil. Various transmitting circuits were then drawn on the board, special mention being made of the Colpitt Circuit. This circuit hails from America, and in the experience of the lecturer is very efficient, and easy to adjust. Using an input of 10 watts, an output of 1 amp. in the aerial had been obtained. Methods of keying and modulation were then dealt with, and the lecturer concluded with a few remarks on the subject of microphones and speech amplifiers.

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

Dewsbury and District Wireless Society.

The Dewsbury and District Wireless Society recently had a meeting at the Central Liberal Club, Bond Street, Dewsbury. It was their first "difficulties" night, and several members brought up radio troubles for discussion, and an interesting hour or so was spent. A temporary aerial had been erected, and the programme from Manchester, and part of that from London, was afterwards received. The receiving sets used were lent by Mr. F. Dransfield (a three-valve home-made set) and Mr. J. T. Foggo (Gecophone and two-valve note magnifier).

It was decided that the society should accept the offer of the directors and hold their future meetings and demonstrations in the Central Liberal Club. The conditions for reception of radio concerts, etc., are distinctly more favourable than at their present rooms in Church Street.

The members also decided to hold several field days during the summer.

Hon. sec., F. Gomersall, 1, Ashworth Terrace, Dewsbury.

WIRELESS IN SUMMERTIME COMPETITION.

(A selection from the hundreds of postcards sent in by competitors in the "Summertime" competition. The result and the name of the prizewinner will appear very shortly.)

MR. W. J. DAVIES, of 86, Corporation Street, Stafford:

"To keep up a steady interest during the summer months, I suggest the issue of a 'supplementary' licence to prevent licence-holders allowing them to use their sets portably. The wireless man could then take his set out in his motor-car, side-car, etc., or even carry it. What would be more enjoyable to the town-dwelling wireless enthusiast than to take his set into rural surroundings and receive the concerts with the aid of an improvised aerial, etc.? Even the humble crystal user would derive pleasure in testing his set under varying conditions of distance and surroundings. The fee for the licence would have to be small, say 2s. 6d. to 5s. for three or four months (half to G.P.O. and half to B.B.C.). Amateur wireless clubs with transmitting licences would be able to supply additional "fare" for the members to pick up when out with their sets."

MR. W. A. COOMBS, of 20, Norfolk Street, Mile End, E. 1:

"With reference to broadcasting during the summer, I suggest that programmes should be of a light character, similar to what one would hear at the seaside, such as good bands and concert parties, chats about the various holiday resorts and tours, etc., with news regarding the various sports.

"One's imagination could be carried a long way listening-in to a good concert or band whilst lounging on the lawn, or in the back garden during the warm weather."

MR. T. A. SCRUBY, of 17, Castleton Road, E. 17.

"Wireless could be made very popular in summer time if the B.B.C. were to broadcast some good musical and dance items say from 4 to 7 and 8 to 10.30 p.m. on Saturdays, so that Sports Clubs could install a loud speaker set (not an expensive item where the membership is 100 or more) and entertainment would thus be available for musical teas and dancing on the lawn in the twilight.

"Also, if the weather should turn out wet, this suggestion provides a means of keeping the club pavilion always popular on a wet evening. Also members waiting their turn for a game would find interest in wireless. Adaptations of this would naturally suggest themselves."

Advertisement issued by Peto-Scott Co., Ltd.

My home-assembled Set

—the interesting experiences of an Amateur's first steps in Wireless

ALWAYS being fond of mechanics—in a mild sort of way—I fell an easy victim to the fascination of wireless. After reading one or two little books on the subject I made up my mind to build up my own set. A timely article in a wireless paper describing a simple crystal set seemed to me to show just the instrument which would fill the bill.

A Crystal Set

It was simple and consisted of few parts—a great advantage to a novice—and could be constructed for a few shillings. I well remember the thrill experienced when I heard my first telephony on it—the excitement of other members of the household at hearing this “music through the air.” But this set, good though it was, later on began to pall. My interest seemed to wane; I wanted to hear more than the nearest broadcasting station and the few amateurs in my neighbourhood. In short, I had tired of this crystal set and wanted a more ambitious valve receiver.

After looking around I found that to buy a ready-made instrument was far beyond my means, and constructional articles in the wireless papers seemed hard to understand and to require rather more skill in the use of tools than I possessed.

A Unit Valve Receiver in sets of parts

There seemed no alternative until by chance I discovered just the type of receiving set I had in mind. It was in units—that is to say, it could be made to expand and more valves could be added just as often as one's purse permitted, until eventually a super-sensitive multi-valve receiver is obtained.

Just like a certain expanding bookcase, in fact, “always complete, yet never finished.” And the greatest advantage of all, perhaps, was that it was supplied

in complete sets of parts all ready to assemble at home.

The manufacturers and designers of this clever set were the Peto-Scott Co., Ltd., of 64, High Holborn, London, W.C.1, and having found that they issue a little six-penny booklet describing the whole system—as well as giving an interesting description of the whole principles of wireless—I lost no time in getting a copy and studying it.

Making a start with one Valve

I found that I could make an excellent start—using the tuning coils from my old

crystal set—with the Detector Unit (No. 4) alone. Having bought the complete set of parts for the modest sum of 17s. 6d., and followed the directions contained in a six-page illustrated instruction folder, a couple of hours' work gave me a complete valve unit. There were no holes to drill; all I

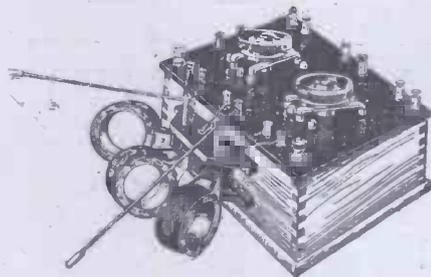


The Detector Unit

had to do was to insert the parts as shown. Although my valve now gave me much better results than I had ever been able to obtain with my crystal set, I found that my primitive tuning arrangements had very serious drawbacks, therefore I decided that my next step would be to invest in a proper tuner.

A Tuner for all Wavelengths

An outlay of £3 9s. 6d., therefore, procured for me all the requisite parts for a really first-class tuner in two units suitable for all wavelengths. The tuner unit itself is most ingenious. Besides a three-coil holder it had two rotary switches; one is for putting the condenser in series or in parallel with the primary coil, and the other is for “Stand by” or “Tune.” The advantages of the former are probably very well known to you, but the latter may be as new to you as it was to me.



Tuner Unit

It operates like this: When the switch is at “Stand by” the tuning is done on one coil only—the other one for the time being is not in use at all. The result is that the tuning is quite “broad” and non-selective. This has advantages: for instance, if you are searching for a station you can find it so much quicker on a non-selective circuit. Also, if you are listening to a couple of amateurs talking to one another, you can hear them both without having to re-tune each time, supposing they are not exactly on the same wavelength.

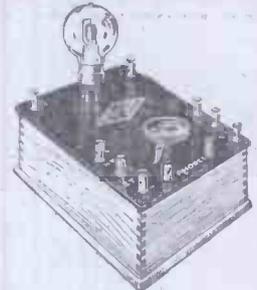
When the switch is at “Tune” you are operating two circuits at once and are able—

by separating the coils and adjusting the condensers—to cut out all interference from near-by stations.

Every Broadcasting Station heard on this Set

I was now on the high road to success. These three units enabled me to pick up all the broadcasting stations with ease from London to Newcastle, as well as the splendid Eiffel Tower concerts from Paris.

In due course—and as funds permitted—I added a high frequency amplifying unit (at the moderate cost of but 13s. 6d.) enabling me to pick up the Hague, and a low frequency unit which gave me the necessary strength to use my headphones attached to an old gramophone horn as a loud speaker.



L.F. Unit

Building the Set into an old Bureau

You will observe that I have said nothing about cabinets. Although I could have purchased suitable mahogany ones from Peto-Scott, Ltd., for as little as 3s. 6d. each, I did not do so; instead I bought at a local auction sale a fine old bureau which I am now converting as a suitable receptacle for all these five units. The result of my efforts, I am convinced, will be a three-valve set worthy of any home, and one which would have cost me probably three times as much had I bought it ready made. It will certainly be an investment I shall never regret. E. R. G.



H.F. Unit

PRICE-LIST OF SETS OF PARTS

(Complete for Home Assembling)

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

Postage 9d. per Unit extra, but paid on all Orders of £2 or over.

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We are always pleased to receive from our customers similar interesting experiences. Any photographs of Peto-Scott Units built into special cabinets or into articles of furniture will be liberally paid for upon acceptance.

RADIOTORIAL.

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

I hope by now that the majority of POPULAR WIRELESS readers have seen a copy of our new companion paper—"Wireless Review and Science Weekly."

It is not often that such excellent value for 3d. is published: readers have only to glance at the contents of the first issue to get an idea of the enormous cost of production.

But "Wireless Review and Science Weekly" meets a long felt want.

POPULAR WIRELESS has laid out for itself a definite policy—a policy to please a very large public; in "Wireless Review and Science Weekly" the aim is to cater more extensively, elaborately and technically for those desirous of taking a deeper interest in wireless and popular science. To that end some of the greatest living scientists and experts have been asked to contribute, and the result is a publication unique in the history of British journalism. The popular appeal is not lacking in the new journal. Many of the articles are of universal interest, and can be easily understood even by the non-technical reader; and the offer of £500 in cash prizes for an ideal Broadcasting Programme should prove more than popular. To all readers who have supported POPULAR WIRELESS I earnestly recommend them to purchase a copy of our companion paper, so that they can see for themselves the excellent value offered for the low price of 3d. weekly.

THE EDITOR.

Questions Answered

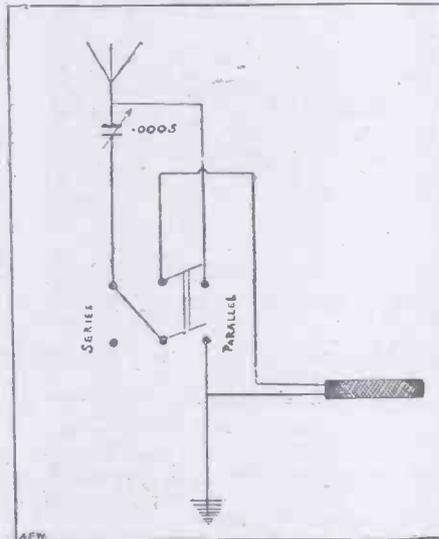
Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be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

Readers are requested to send the necessary postage for reply.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most

recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

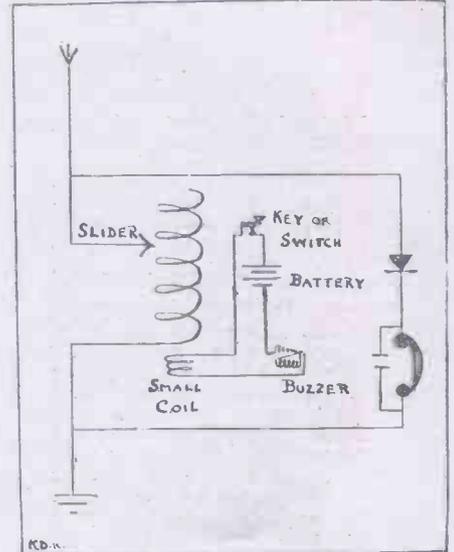
S. I. D. (Ely).—Will you give a diagram of a double-pole, double-throw switch for connecting the aerial tuning condenser in series or parallel with the aerial inductance for short or long wave reception?



Above is a suitable diagram. When the switch is in left-hand position, the condenser is in series with the A.T.I. and aerial. When in the right-hand position the condenser is in parallel. In the diagram a honeycomb coil is shown. With an ordinary slider inductance connect earth stud to end of the coil and the top middle terminal of the switch to the slider. In the case of a double-slide coil the

same connections hold, the second slider going to the detector.

S. E. D. (Thorpe Bay).—What is the method used to test a crystal with a buzzer? What voltage is required for the buzzer, and do you advise any special make?



The above diagram of a crystal with buzzer tester will be quite satisfactory. You will notice that the buzzer circuit is only inductively coupled to the crystal circuit and is not connected mechanically. The small coil can be of the spider-wound type, and is made as follows. Wind about twenty turns of No. 28 S.W.G. D.C.C. on a cardboard former one inch in diameter. A 41-volt dry battery will be suitable for the buzzer. Any buzzer will do. An old bell makes a good buzzer as long as it is still in working order. Remove the gong and saw off the hammer, and a useful buzzer results, the note of the buzzer being varied by the adjustable contact screw. For crystal adjustment a high-pitched note from the buzzer is most suitable. To adjust crystal press key while moving cat's-whisker until loudest signals are obtained in 'phones. It does not matter where the slider is placed as long as it makes contact with the coil.

G. B. C. (Enfield).—I have some wire the diameters of which are .7 millimetres, .25 millimetres, and .4 millimetres. Which of these will be most satisfactory for an inductance to tune

(Continued on page 604.)

HOW 2 L O's DANCE ITEMS WERE RECEIVED ON THE RIVER.



MARCONI'S LATEST

New Popular Marconiphone Brings ALL Broadcasting Stations within Range



THE NEW MARCONIPHONE V2.

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PRECISION VARIABLE CONDENSERS

**THE ACME OF
PERFECTION.**

**G U A R A N T E E D
NOT UNDER STATED CAPACITY.**
Accurately and completely assembled.
INCLUDING KNOB AND DIAL.
Large metal to metal Bearings. One
hole only required for fixing to Panel.

*British made throughout,
:: :: therefore best :: ::*

·001 - - 8/6
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Full Guarantee given with each
Instrument.

Packing and postage extra.
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Obtainable through your Dealer or direct from :-

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Set, comprising:—Variometer, Crystal Detector, etc.,
mounted on Polished Oak. Complete. Assembled,
10/-; Unassembled, 7/- Add 1/- for Postage

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is a necessity to every one wishing to take proper care of their wireless equipment. Tells at a glance if accumulators are fully charged, half charged, or discharged, and being packed in unbreakable carton, can be placed in tool-box without fear. Your local dealer can supply you, but if you have any difficulty send us your order and we will arrange for same to be executed.

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E.V. (B.B.C.) - - - - - 19/6
C.E.S. Silk wound to 4,000 ohms guaranteed. Perfect reception, superior finish - - - - - 21/-
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1 pair, 9d. 2 pairs, 1/- 4 pairs, 1/3

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137, Englefield Rd., London, N.1

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 602.)

up to 3,000 metres? How many turns, etc.? What are the gauges of each?
7 mm. = 22 S.W.G., 25 mm. = 32 S.W.G., 4 mm. = 28 S.W.G. For a coil to tune up to 3,000 metres wind 500 turns of No. 32 S.W.G. on a former 4 inches in diameter.

POLARITY (Huddersfield).—Please will you give me details of a cheap "polarity" indicator?

Procure about threepennyworth of sodium sulphate from a chemist and threepennyworth of phenolphthalein. Put as much of the former as will cover a five-shilling piece into a cup half full of warm water and as much phenolphthalein as will cover a farthing. Stir until dissolved. To test this mixture, place leads into it about 1 1/2 inches apart, when the negative lead will turn the surrounding liquid a reddish colour. Shaking the liquid will make the colour disappear. To make a container, obtain a glass tube about 3 in. long, and two rubber stoppers to fit. Terminals should be fitted tightly through stoppers protruding about 1/4 in. on the inside. Fill the tube with the liquid, leaving a small air space.

"PAN" (Ealing).—I am putting up a double aerial, 30 ft. long. What size spreaders do I need, and what wood? Using a crystal set, am I likely to get any telephony, except from the London Broadcasting Station, if my inductance coil is large enough? My aerial is about 26 ft. high.

The spreaders should not be less than four feet long, and six feet wood for the spreaders, such as bamboo or ash, though this latter is on the heavy side. You will probably get telephony from Croydon which frequently transmits to aeroplanes throughout the day, and you should also get any local amateur transmitters. Otherwise we are afraid that 2 L O will be the only station from which you will be able to hear telephony.

V. G. L. (Berwick).—Is there any real advantage in a variable grid leak, as I wish to have one put in my new set in place of one of the fixed type?

For long distance work a variable grid leak is very useful, and should always be incorporated in a set, especially if the valves are being constantly changed, as very often a valve will give very poor results on a leak that may be highly satisfactory when working with another valve. For short distance work, or on a B.B.C. set, they are not so necessary.

(Continued on page 606.)

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THE SUPER CRYSTAL.

Extremely sensitive and reliable, no better Crystal obtainable. Price per piece 1/6 each with special contact wire. We guarantee to return your money if you are not entirely satisfied. We are sole distributors of Ensenite and can offer special terms to the trade.

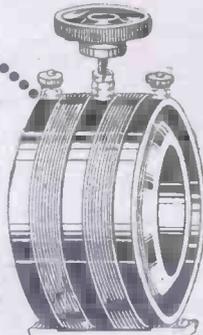
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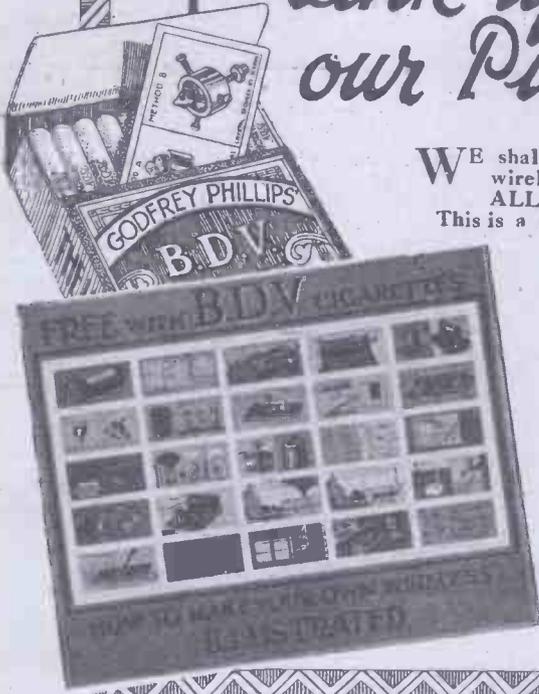
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CRYSTAL DETECTORS, Adjustable.....	1/6 ^d	SPACING WASHERS, large..... per doz.	2 ^d .	SWITCHES ON EBONITE, D.E.D.T. (quality the best)..... each	2/9			
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SWITCH ARMS, best makes..... 1/3 &	10 ^d .	CRYSTAL CUPS, 2 screw..... each	1d.	SCREWED ROD, 2 B.A., 12 in. long, each	3d.			
AERIAL WIRE, 7/22, guaranteed hard-drawn copper, 100 ft. (postage 1/-).....	2/-	CRYSTAL CUPS, 4 screw..... each	2d.	SCREWED ROD, 4 B.A., 12 in. long, each	2 ^d .			
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Real Silver Cat's Whiskers..... each	2d.	TELEPHONE TERMINALS, nuts & washer, each 1d.....	1/4	INSULATORS, white Egg, each 2d., 1 ^d per doz.	1/9			
CONDENSER SCALES, 0 to 100, each	3 ^d .	W. O. TERMINALS, nuts & washer, each 2d.....	1/9	SPECIAL HERTZIAN CRYSTAL, large piece..... each	10 ^d .			
IVORINE LABEL SET, 12 different readings..... the set	8 ^d .	PANEL BUSHES, drilled, each 1 ^d	1/4	WOUND INDUCTION COILS (postage 9d.).....				
NUTS, 2 B.A..... per doz.	2 ^d .	per doz.	11d.	12 x 4	8 x 2 1/2	6 x 3	6 x 2	
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WASHERS, 4 B.A..... per doz.	1d.	per doz.	9d.	TAPPED INDUCTION COILS, 20				
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		SLIDER ROD, brass, 13 in. long, 1 in. square, drilled..... each	4d.					

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**RADIOTORIAL
QUESTIONS AND ANSWERS.**

(Continued from page 604.)

F. S. (Melrose).—What is meant by a "characteristic curve"?

This is the relation between two variables. For a valve, characteristic curves may be plotted between volts on grid and current in anode-filament circuit, or between current in anode and volts applied to anode-filament circuit.

* * *

A. W. (Langley).—I wish to make a high-tension battery of small accumulator cells. How is the paste on the positive plates made?

It is not advisable to attempt the formation of accumulator plates, as it is a very tedious undertaking to get the paste to remain in the holes for any length of time, owing to the tendency of the materials to crumble away. The paste is made of oxide of lead, usually red lead or litharge, and some extra substance such as potassium silicate, and sulphuric acid. The plates are dried after being carefully filled with this paste, and then placed in a bath of dilute sulphuric acid with some pure lead plates as negative electrodes, and a very gentle current of about one half of an ampere is passed through. After a few days the paste on the positive plate should have undergone a change, the lead oxide having been still further oxidised to lead peroxide, and they will then be of a dark brown colour. The plates are then said to be "formed." A better plan would be to cut up some old accumulator plates and use those for your battery.

* * *

W. R. (Bourne End).—What is meant by "parallel resonance"? How many watts are there in one horse-power?

The condition of parallel resonance is said to exist in a circuit when it is tuned to the same frequency as that of the electro-motive force introduced across it. In this condition an oscillating current is caused to circulate in the circuit of such a value as to produce across the circuit an oscillating voltage, equal at every instant to the electro-motive force introduced across it. The current flowing to the circuit from the source of electro-motive force will depend upon the resistance of the circuit. There are 746 watts in one horse-power.

* * *

"IGNITION" (Epping).—A friend told me that a great deal of those so-called "atmospherics" may be waves sent out by the thousands of magnetos on moving vehicles. Is this at all possible?

It is quite true that magnetos used for ignition in petrol engines act as small transmitters. In fact, one hears the magneto "transmission" from the powerful engines used on an aeroplane if one is passing close overhead when tuning for telephony. But the waves so radiated are very damped and very short, so that they do not travel far. The range of disturbance caused by an ordinary magneto would be but a few yards.

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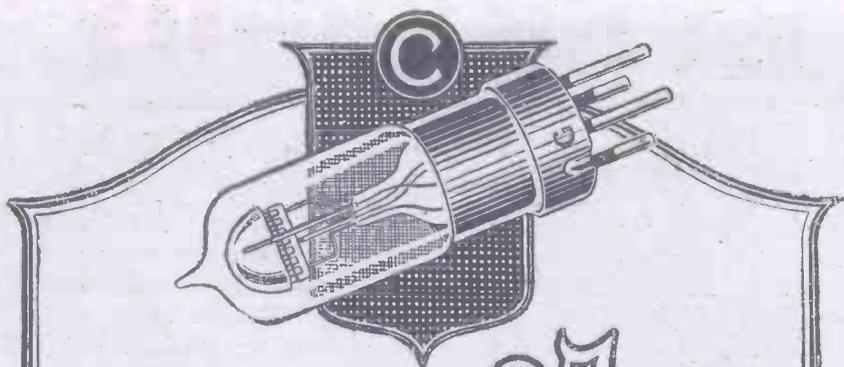
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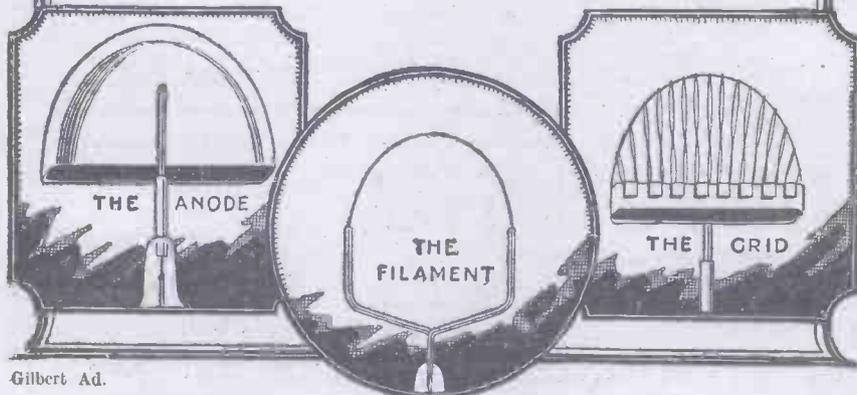
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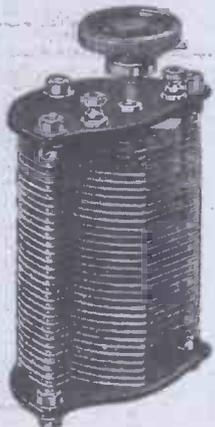
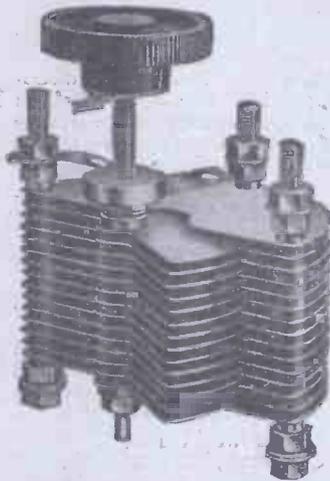
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•0001	7	2/3
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Vernier	3/3

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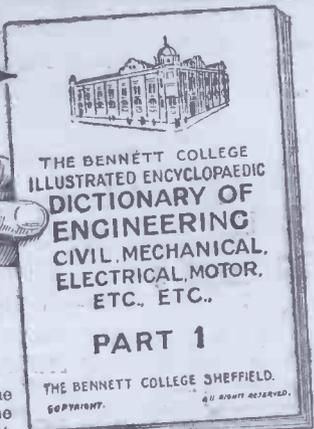
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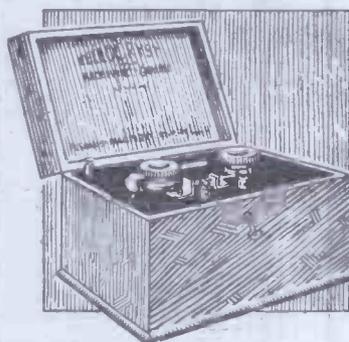
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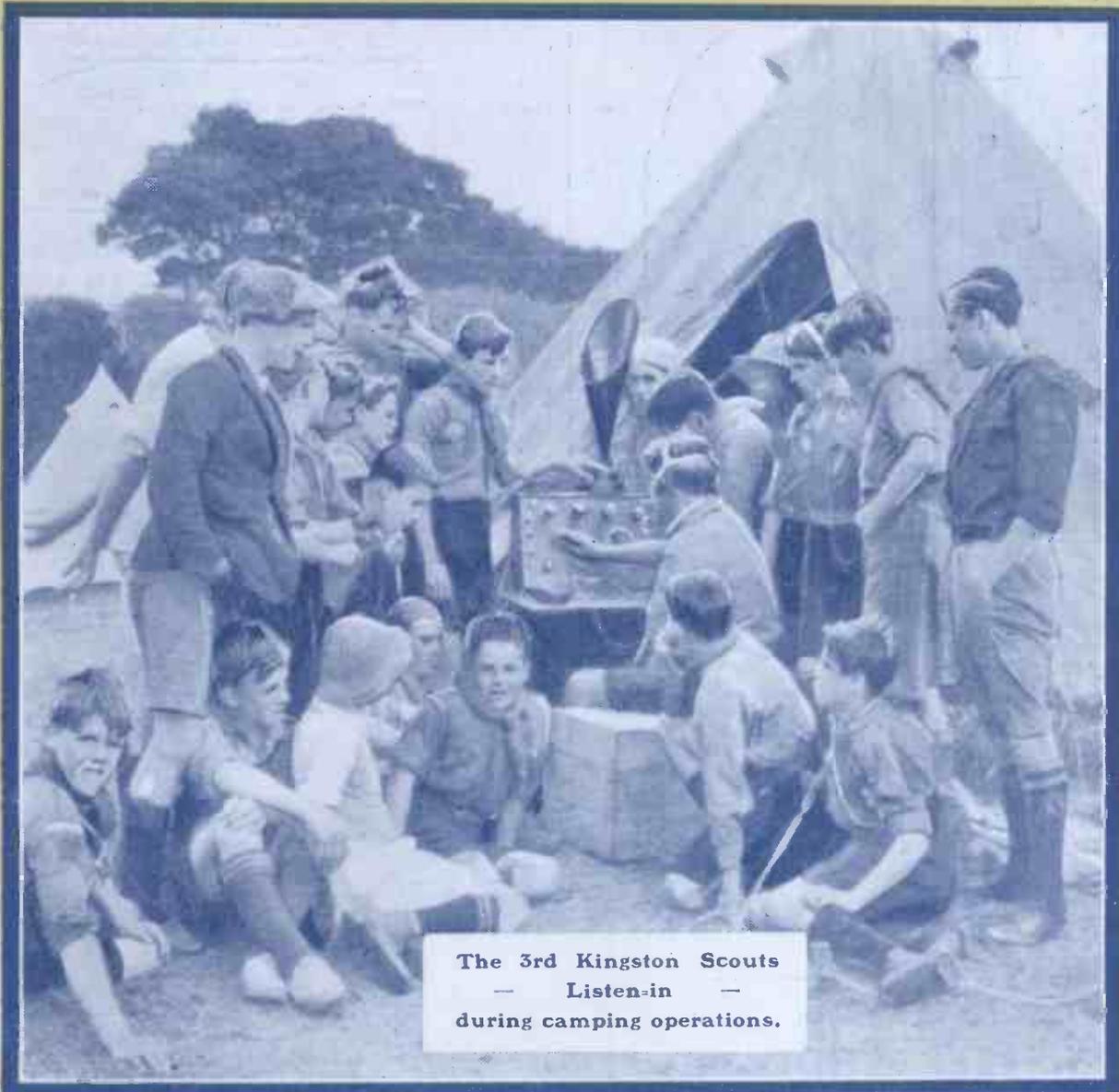
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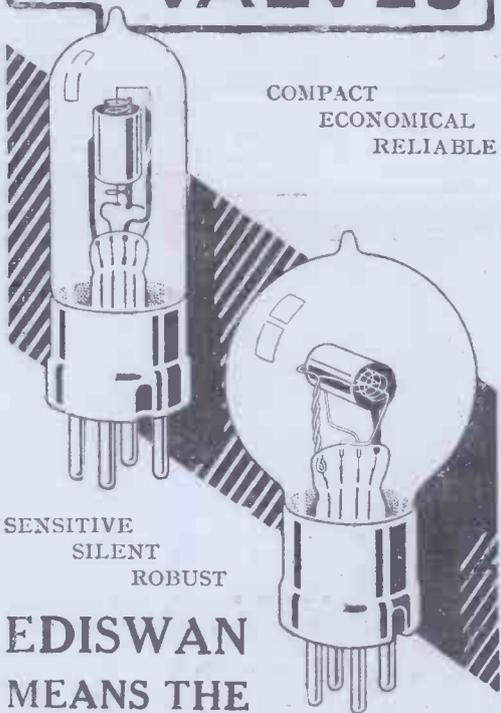
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POPULAR WIRELESS

June 9th, 1923.

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

[Every Friday.]

TOPICAL NOTES AND NEWS.

Royal Wireless Station.

THE King of Italy, a correspondent tells me, is having all British goods in connection with his wireless set, and is favouring Messrs. Burndepts' receivers, while the aerial is to be supported by a "Turret" mast 56 ft. high, supplied by Messrs. Simpson and Blythe.

Less Blanketing.

I AM glad that the blanketing round 2 L O's studio is to be reduced. The tremendous amount of canvas at present used quite spoils the otherwise perfect transmissions. A little "echo effect" is necessary in order to give the voices and instruments their natural tone.

Howling.

THOSE who suffer from "noisy" sets will find that a very useful hint is to place the set on a steel plate which is earthed. This will practically eliminate body capacity, and the tuning will be more stable. I believe that "tables" for this purpose are already on the market.

Gramophones.

THE gramophone companies, I am told, are obtaining increased business through the medium of the B.B.C., because listeners-in who possess gramophones desire to hear broadcast tunes again.

The King's Set.

IT is probable that by the time the King and Queen arrive at Balmoral for their autumn holiday, towards the end of August, a special wireless set will be installed.

A Secret Code.

THIS will bring the Royal Scottish residence into much closer communication with the Government, but it will be necessary to inaugurate a new code so that it cannot be understood by listeners-in. I am given to understand that the transmission of messages to and from Balmoral will not affect broadcasting or the usual traffic.

Articles for "Popular Wireless."

THE Editor tells me that he has arranged for several useful series of articles to appear shortly in POPULAR WIRELESS. Among these a very interesting

series will be one dealing with the simple mathematics met with in calculations of capacity, inductance, and similar electrical problems.

"WIRELESS REVIEW AND SCIENCE WEEKLY" is THE journal of wireless, electrical, and general science. Authoritative, yet written in such a way that even the veriest amateur will find it intensely interesting, it possesses a universal appeal, and should find a place in the home of everyone desirous of following the romantic trend of advancement in science. No. 3 on sale Tuesday, June 12th, price 3d., from all bookstalls and newsagents.

ORDER YOUR COPY NOW!

"Twelfth Night."

IT was a pleasant change to hear Shakespeare's "Twelfth Night" broadcast from the London station last week although the general programmes from this station do not lack interest, and there is plenty of variety in them. I am sure that a fairly regular transmission of this type of feature would prove popular to a vast number of "broad-catchers."

Voices Well-Balanced.

CATHLEEN NESBIT, who took the parts of Sebastian and Viola, the twin brother and sister, has a good broadcasting voice and came through very well indeed. On the whole, the transmission was a great success, and the artistes must have been placed very carefully in the studio so that no drowning effects were caused by a strong voice being placed nearer to the microphone than one not so powerful.

Complete Set 1s.

IT seems that the order of the day is to endeavour to establish a record in the "cheapness" of "complete" sets, but "complete" does not generally

cover such indispensable items as telephones, aerial wire, etc. However, a correspondent informs me that he has endeavoured to break all preceding records with a set, the total cost of which did not exceed 1s. complete.

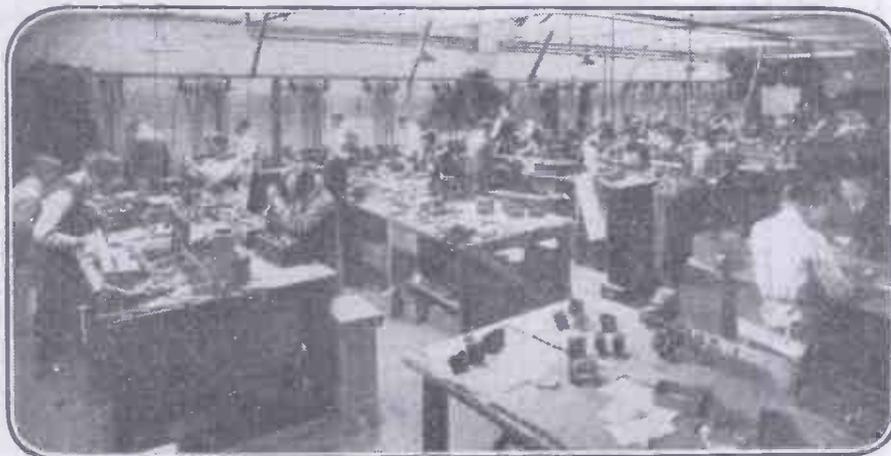
Some Detector.

THE inductance was wound and the aerial erected with "disposals" wire purchased in a length of 25 yards from a "junk" stall for 6d., old bottles forming the insulators. A low-resistance earpiece was picked up for another 6d., and the detector constructed from the veriest of scrap. The latter included a piece of iron pyrites found in the household coal, and an ordinary pin.

Quite So!

THE coil, by the way, was wound on a cocoa tin. My correspondent claims quite good results on this peculiar set, but adds that he is but a mile or so from the broadcasting station. A technical friend tells me that although interesting, the idea is not original, and that he has himself tried out a set constructed on

(Continued on page 610.)



A section of one of the efficient workshops in the factory operated by Radio Instruments, Ltd.

"Amateur's Day."

I DO not know how many readers of POPULAR WIRELESS listen-in on Sunday, but personally I find it by far the most interesting day of the week. All our old friends, the amateurs, who have been comparatively silent since broadcasting began, reappear during the morning, and lately 2 O M has been very busy.

"2 L O Testing."

THIS well-known station is still steadily improving, and indeed will soon rival 2 L O in its transmission. The latter also very often does a great deal of "ether shaking" during Sunday, and a week or so ago gave a very prolonged test during the afternoon and early evening.

The New Paper.

GOING up to town the other day I noticed that quite a lot of people in the train were reading the new paper. As one man put it, "Wireless Review" is just what was wanted, a magazine that will go with 'P.W.', and carry you still further into those realms which that paper opens up."

NOTES AND NEWS.

(Continued from page 609.)

similar lines with quite fair results. "With H.R. 'phones, a good detector, and finer tuning, results would have been much better," was his intelligent comment.

Silent Periods.

READERS owning multi-valve sets will be glad to learn that the various broadcasting stations are to close down for half an hour each evening. This will enable long-distance reception to be carried out without interference. The "silent" periods are: 2 L O, 7.30 to 8 p.m.; 2 Z Y and 5 S C, 7.45 to 8.15 p.m.; 5 W A and 5 N O, 8.0 to 8.30 p.m.; 5 I T, 8.15 to 8.45 p.m.

Stop Howling.

I HOPE 2 X Z catches the "gentleman" at Wimbledon who caused him to close down his tests the other evening owing to the latter's efforts on a multi-valve reaction set.

Wireless in the Open.

THE annual charity fair at Eastcote, Middlesex, on June 9th, is arranging an extensive programme for listeners-in. The Marconi Co. have promised to give demonstrations, and to exhibit some of their latest receiving-sets, while 2 L O will provide the music. A large open-air dance floor has been laid and altogether the fair should be a great attraction.

Restriction on Plays.

AT a meeting of the Society of Authors, Playwriters, and Composers, it was unanimously passed that no member of the society should permit his works to be broadcast without a fee, and that the society should be notified the amount offered.

The Largest Aerial in the World.

A NEW and powerful station is to be built in Germany, and I am told that the station will have for the aerial masts two mountains 5,680 ft. and 3,083 ft. high respectively, and nearly two miles apart.

Wireless and the Derby.

I AM given to understand that wireless will again be used to control traffic at Epsom Races. A special transmitting set will be installed in the Grand Stand, and to a number of cars. If the traffic is unduly congested at any point messages will be sent round and cars will be



A Royal Aerial. A 56 ft. "Turret" Wireless Mast for His Majesty the King of Italy.

despatched to the points where they are needed.

Local Stations to Remain.

SEVERAL of our readers have been asking me if the B.B.C. intend to link up the whole of the B.B.C.'s stations with land lines and have only one programme transmitted. I can assure them that this is not to be the case. The B.B.C. are going to continue district broadcasting and they are still going forward with the erection of new stations in the districts not adequately served at present.



Cadets at Sandhurst undergoing training in field wireless work.

B.B.C. Operas.

THE company intend not only to continue their local stations, but to send operatic and musical companies on tour so that the concerts at provincial stations may be on the same high level as those of 2 L O.

Music Traders and B.B.C.

MR. FERGUSON, of the National Association of Radio Manufacturers, gave an address to the Music Industries Convention at Buxton. He said that broadcasting had come to stay, and advised them to push the sales of wireless sets, and that the listeners-in in England would soon be as big a force as in America, where 3,000,000 homes were fitted with receiving sets, providing entertainment to 10,000,000 out of a population of 166,000,000.

"Pirates."

HE went on to say that there have been eighty thousand licences issued in England, and more than 200,000 "pirates" who had not secured licences were being entertained.

Plays Broadcast Regularly.

CAPT. LEWIS tells me that over 300 letters commenting on the Shakespeare Night have been received by the B.B.C., and only four of these were offering any adverse criticism. In view of this 2 L O hopes to make this type of evening a fortnightly feature.

"The Merchant of Venice."

THE second play to be broadcast from 2 L O will be "The Merchant of Venice," to be performed on June 12th. The story of the play will be found on page 628.

Broadcasting Committee.

THE committee under the chairmanship of Major-General Sir Frederick Sykes, which was appointed by Sir William Joynson-Hicks to consider the agreement between the Post Office and the British Broadcasting Company and the future of broadcasting, is now meeting three times a week. A considerable amount of evidence has been given by representatives of the Post Office, the British Broadcasting Company, and the manufacturing and trading interests concerned.

A Lonely Station.

A SMALL island, near Iceland, uninhabitable except for a small wireless station, is to be let for hunting. The operator must have a cheerful time, as the island is noted for blue fox and polar bears.

THE ANNOUNCER'S DAY.

By CAPT. C. A. LEWIS.

This is a sketch of those hectic days a few months ago when the Broadcasting Company was just formed, when the day was too short to dream of getting through the work that lay before one. It is not, however, the state of affairs at present, and the writer will be excused, no doubt, if he has coloured his picture a little too highly. Much remains to be done in the organisation of our programmes, but our Staff is now able to cope with the work. In the glorious days of old it was not—but that was half the fun.

One Side:

ABOUT seven-thirty any evening in perhaps 20,000 homes or more crystals are being adjusted, valves are being turned on, condensers twirled, as the innumerable Mr. Jones and Mr. Smiths wait for the opening chimes from the Broadcasting Station.

"Two minutes past the half," says Mr. Jones. "They ought to be on by now. I wonder if there's anything wrong with the set?" And he commences to twirl the condensers more vigorously than ever.

"Five minutes late again!" says Mr. Smith, pulling out his Ingersoll. "I do wish they would get a decent clock at the station; nothing is more irritating than to sit and—ah! there they are!"—and he sits down to enjoy or criticise the concert.

The Tired "Voice."

"I don't know who's announcing to-night," says Mr. Brown to his wife. "He sounds as if he were going to sleep. As if we weren't all tired and depressed enough in the evening without having to listen to a voice droning away like that! I shall write up to them and complain. It must be easy enough to get a cheery fellow to talk in the evening. Why, I believe I could do it better myself."

"Who does the announcing? Do you know, dear?" asks his wife.

"Oh, one of those chaps who arranges the programmes, I think," replies her spouse. "But there's nothing in this announcing, anyway, and it ought to be done properly!" And so on.

The Other Side:

Just for the sake of argument, then, let us look at the other side of the picture.

About a quarter to nine the "announcer," as he is known to the general public, boards his train or 'bus and leaves for the office. He turns over in his mind, as the 'bus jolts along, the long list of things that he had no time to do yesterday, and doubts if he will find time to do to-day. Arrived at the office about nine-thirty, the rush begins. A hundred letters from his beloved nephews and nieces await him. Each separate little letter, sometimes so carefully written that he knows it must have taken an hour of patient toil to form the letters, has to be considered and answered. He lingers, perhaps, longer over these than he should. Next a pile of manuscripts: Lectures, articles, children's stories, followed by another heap of criticisms and suggestions.

Day Too Short.

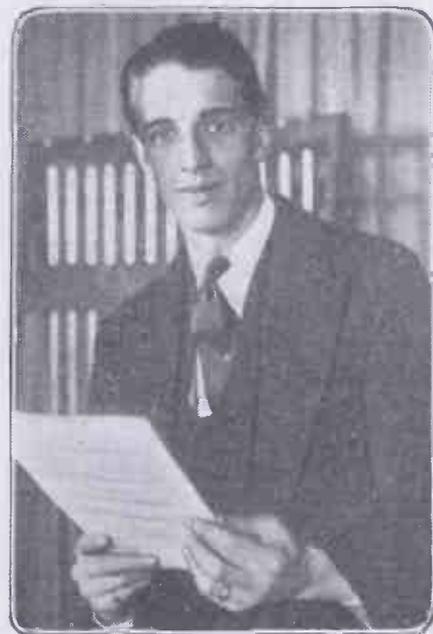
As he attempts to wade through these, the telephone hardly ever stops ringing. There are future engagements that must be made, confirmations of others, and the hundred-and-one things that crop up in a young, rapidly-growing organisation.

In the middle of all this, hurried consulta-

tions will be held by the programme staff—a suggested enlargement and improvement of some part of the programme, the best way to circumvent some barrier placed in the company's way—and there are many—by an organisation whose interests supposedly conflict with our own.

It is a wild rush. A fight, with a spice of adventure in it, seeing that every day brings fresh problems, fresh difficulties, and fresh obstacles that must be overcome.

Lunch-time comes in a flash. Tea-time seems to be about three o'clock, and before he knows that the day has passed the



2 L O's popular announcer, Uncle "Cactus," Capt. C. A. Lewis.

"announcer," who is among other things an "uncle," leaps for his hat and dashes off to the "Children's Hour."

A Frantic Rush.

Here, for the moment, he will forget his worries and troubles. The hour must be a jolly and a happy one. His remaining energy goes to the accomplishment of this. He trusts to the personality of his colleagues and his own imagination to carry the thing through. The secret of success of the "Children's Hour"—if it is a success—lies in the fact that the "uncles" themselves love their work and the children, too.

At six-fifteen the hour is over and, if our "announcer" is lucky, he has nothing more to do than go back to the office and sign up the day's mail he has dictated and go home. He may be away by seven.

But suppose for a minute that he happens to be "on" that night—i.e. entrusted with

the announcing and supervision of the evening programme. Then his day's work is only just beginning.

He has then to scrape in a little fuel—to keep the engines running—between six-fifteen and seven. There is no time for the half-an-hour digestive period! He digests as he reads the news bulletin. (Now you know why his voice is a bit "down," Mr. Brown!) Then at seven-thirty the night's work begins in earnest. The orchestra arrives, the first item is announced, off we go. What do you think the announcer does while they are playing? He rushes off to another part of the building and listens to them. "That trombone is playing too loud," shouts the engineer; "cut him down a bit." The announcer forthwith attempts to do so. Then Miss X. has lost one of her songs, and wishes to change her items. By this time the orchestra has finished and the next item has to be announced. No sooner is this started than someone rings up to complain of fearful oscillation in the Belfast district, and while the announcer is advising him to buy a set of direction finders, the orchestra stops again.

End of a Trying Day.

"I do hate these waits between each item!" says Mr. Smith. "Why can't they announce the items as soon as they are over, instead of waiting like this?"

While Mr. Smith is saying this, the announcer is doubling down the passage to the microphone in the studio, using the most unperdonable language about the gentlemen from Belfast.

And so it goes on. Ten-thirty comes, and after his final "Good-night," our much-criticised announcer emerges into the Strand. He gets on a 'bus and goes rolling down to Charing Cross. The electric signs are glittering everywhere, and the happy crowds are just emerging from the theatres.

And so as Big Ben tolls out eleven, the 'bus, bearing its precious burden, jolts on through the depths of London.

A fourteen-hour day, Mr. Jones! Fourteen hours! Trying to give you and your family and your children an evening's pleasure. I admit I was a bit off-colour to-night, but now, this is strictly between ourselves—would you care to tackle it, seven days a week?

There is one thing about it; you don't need rocking to sleep on this job!

£1,000 in Prizes.

For full details of this magnificent offer, see No. 3 of "Wireless Review and Science Weekly," out on Tuesday, June 12th, and obtainable at all Newsagents' and Book-stalls; price 3d.

SCOUTING AND WIRELESS.

By H. RUSSELL JONES.

Wireless is becoming one of the most popular features of scout work, and no more interesting or instructive subject could be chosen. This article recounts the progress made in this direction by one of the first troops to introduce it into their programme of summer activities. Doubtless scores of other troops will follow this splendid example during the coming months, and wireless will become an indispensable feature of camping and field operations.

HOW eagerly did certain members of a North Wales Troop of Boy Scouts await the day (in 1919) when the war-time W/T restrictions would be removed. Waiting for broadcasting to begin wasn't in it! For months and months had we practised Morse, and made strenuous efforts to master the art of "iddy umpty." Sheets of paper had been used in drawing diagrams and sketches of the apparatus to be constructed "as soon as these bloomin' restrictions are removed."

A Primitive Set.

At last the great day dawned, and in went our application for a crystal set licence. After a week or two of impatient waiting the imposing O.H.M.S. letter arrived, and we were free to get on with the making of our apparatus and to erect an aerial. Then our troubles started. There was no place suitable for the erection of an aerial to enable us to get decent signals on a crystal set, and, of course, we didn't dream of spending what was, to us, a small fortune on valve apparatus.

After much solemn discussion it was decided to make a portable set, and after having had the licence amended we proceeded to do this. Mothers were besieged for cardboard jam containers for inductance tubes, old electric bells were stripped in order to obtain wire for coils, and many money-making schemes evolved in an attempt to raise the necessary for a pair of high-resistance 'phones. Eventually we were able to buy a re-wound single "Brown" earpiece.

At last all was ready and a weird-looking crystal set, mounted in a Tate sugar box, made its appearance in the club-room. The "non-scientific" members of the troop were highly amused at our amateur efforts. A test aerial, about 15 feet high and 12 feet long, was erected, but in spite of all adjustments and tuning not a signal was received.

The "scoffers" scoffed more than ever, and the noble band of "scientists" were very depressed. It was then decided that the aerial arrangements were far from satisfactory, and that we must get an aerial "high up" and not screened. "Only get as high as you can and all will be well," quoth a wise one. So the next Saturday afternoon we bought a hank of galvanised iron wire and set out for the Cambrian heights.

True Enthusiasm.

After climbing to a height of about 2,000 feet two very high trees were discovered, and soon we had a decent aerial erected. I should mention that it was a winter's afternoon, with the snow lying thickly on the ground. We were in shorts and had our sleeves rolled up. But minor details like the snow and icy blast were forgotten in the effort to obtain signals.

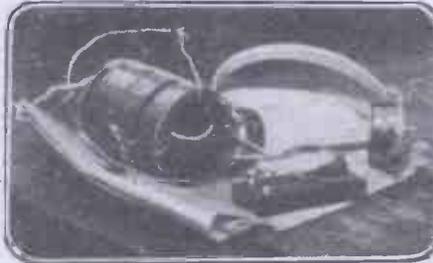
Soon all was ready, and the earth mat buried in the snow. "Telephones" were put on, and after very careful adjustment of

the detector (carborundum and steel with a potentiometer) signals began to "come through." It was our (now) old friend F L with his weather report, and presently on going down to 600 metres Seaforth (G L V) and several ships were heard. Words failed to express our delight, and after a period of listening-in until we were nearly frozen, we returned to the club-room. The aerial and earth mat (a roll of wire netting) were left in position on the mountain.

Soon the news of our success spread around, and the scoffers scoffed a little less, and the enthusiasm of the troop was good to see. When could we go again? That was the great question.

New Use for Aerial.

Two of us being free on the following Wednesday, it was decided to hike up again on that day. After wearily dragging the set for many miles imagine our dismay, on arriving at the scene of our former labours, to find that an enterprising farmer had used the aerial to repair a broken fence, and the



This photograph shows the simple nature of the components of a variometer tuned crystal set.

earth mat in the construction of a home for a happy crowd of chickens! However, minor setbacks of this nature didn't upset us much, and our enthusiasm still ran high.

In a month or two the novelty of listening in to the longer wave European spark stations and ship stations began to die away and we longed for a valve. It was ever thus among W/T amateurs! Give 'em a crystal set and they want a valve. Give 'em a valve and they soon want two, and so the game goes on, until a 6-valve receiver, loud speaker, and a transmitting set doesn't satisfy 'em! Still, to get on with the "story."

Joys of a Valve Set.

The financial position of some of the interested members began to improve and a valve was purchased. The usual accessories were gathered from the junk heaps of older scientific friends. The day of "basket" and "slab" coils had arrived, and soon the valve set was ready.

The Easter holidays were now at hand, and four of us had the good fortune to secure the loan of a hut, on the sea-shore, for a week. Blankets and grub were got ready

and the trek cart loaded with "aerial masts" (tent poles), etc., and off we went, looking like a mixture of an anarchist gang and a crowd of rag and bone merchants. What a glorious week we had! There was hardly time to eat or sleep, and if it had lasted much longer it is very doubtful if some of us would have survived. One of the boys, when wearied out, was heard to say, "After all, one must make sacrifices in the cause of science"! One difficulty, however, slightly marred our joy, and that was our inability to receive C.W. stations above a thousand metres. Try as we would only spark stations (natural note) could we get above this wave-length. The set would not oscillate above this.

Imagine how we felt during the Marconi speech tests, which lasted for three weeks. Not one single word did we hear. At last the "mystery" was solved. The reaction coil was not large enough to cause the set to oscillate above a thousand metres, and we couldn't find the carrier wave to enable us to make a critical adjustment for speech. Soon all was well and we received C.W. on all wave-lengths.

And So It Goes On.

Then the event occurred. Dame Melba was to sing from the Chelmsford Marconi station. The day of preparation for the reception of that concert will live long in my memory. The accumulator was freshly charged, a new H.T. battery made up, new insulators fixed to the aerial, all connections tested, and everything looked to that would assist our chances of a successful reception of the music and speech.

Just before 8 p.m. (the time of the concert) one or two long-wave C.W. stations were tuned in as a final test. Then as we came down to 2,800 metres Chelmsford's carrier wave was heard, and the set was then kept just off oscillation point ("radiators" of 1922 please note!). Soon the music came through, and on this single-valve set at a distance of 200 miles from Chelmsford the concert was clearly received. In these days of improved circuits and apparatus (for great strides have been made since 1919) such a result is quite ordinary, and with a crudely made set and at the first attempt I can assure you we felt very proud of ourselves.

The next move was to obtain transmitting licences, and a kindly P.M.G. granted us permission to use two portable 10-watt spark sets on a wave-length of 180 metres. Many interesting experiments were carried out with these sets, and the calls of 2D A and 2D B were often to be heard. However, shortly after this the wireless enthusiasts were parted, and so ends the story of a troop's W/T activities.

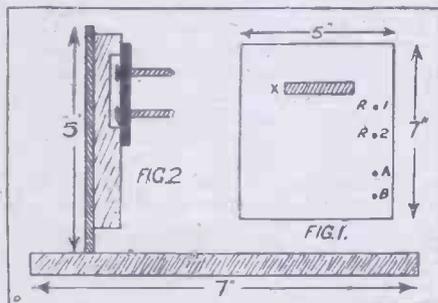
To-day as I "listen-in" on a "posh" four-valve set with loud speaker, those earlier efforts and experiments seem very primitive, but the experience gained was worth it all.

THE CONSTRUCTION OF A SINGLE-VALVE RECEIVER.

By H. G. HERSEY.

This set differs from those previously described by the author in POPULAR WIRELESS not in efficiency, but in type and wave-length range. It is worthy of note that every piece of apparatus detailed by Mr. Hersey has actually been constructed, tested and proved to be satisfactory before being written up for POPULAR WIRELESS.

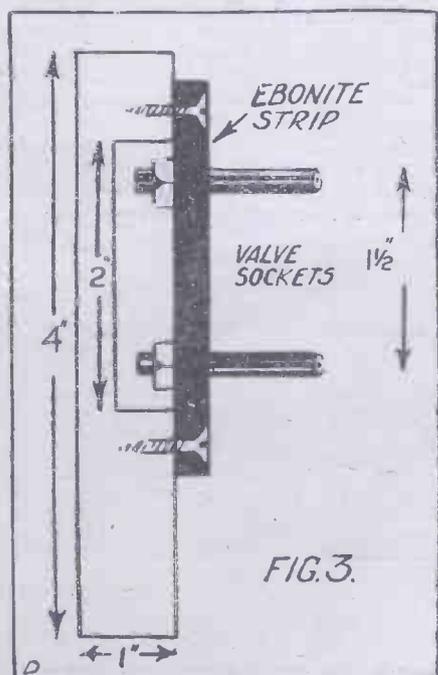
THE valve receiver I am about to describe is to be more of an experimental nature and to cover from 150 metres to 4,000 metres. This receiver when built will be ideal for the reception of broadcast, and at the same time enable the reader to reach the longer wave-lengths at present employed by aircraft, Dutch con-



certs, and Paris transmissions; also by going down below 200 metres it will enable the reader to hear some of the excellent amateur transmissions. From the above it will be understood that one tuning coil can hardly be expected to fulfil all these purposes efficiently; therefore a number of basket coils are to be constructed, each having its particular range of wave-lengths.

The Coil Holders.

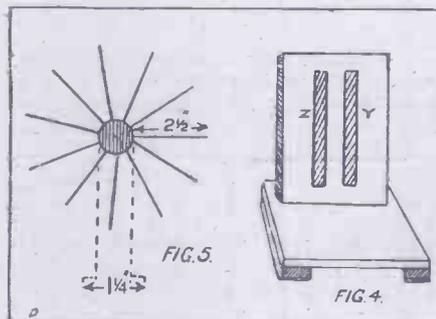
The tuner will be dealt with first. For this a piece of wood is cut about 5 in. by 7 in. (Fig. 1); on the right, in the position shown, four terminals are mounted (prefer-



ably upon a piece of ebonite strip). These are lettered A, B, and R 1 and R 2. A second piece of wood, half an inch or thicker, is now cut, 3 1/2 in. by 5 in., and screwed firmly in the shaded portion X. This is the back support for the coils. Upon this piece of wood two coil holders are mounted, one fixed, and the other upon a hinge so as to open like a book. The holders should be constructed according to Fig. 3 from a piece of 1/2 in. wood, and a strip of ebonite mounted in the position shown.

Winding the Coils.

Upon the ebonite two valve sockets are mounted 1 1/2 in. apart. The fixed holder should be mounted in the position Z, and the swinging holder should be mounted in the position Y upon a hinge, the holders being about 1/4 in. apart. Two short lengths of flex are now connected to the terminals and the sockets by connecting A and B to the fixed holder and R 1 and R 2 to the



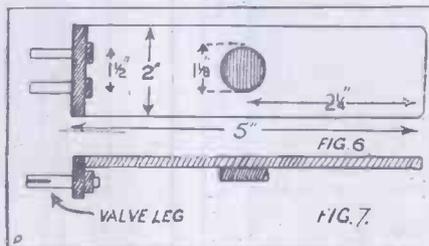
moving holder. This completes the coil holder so far, and we can proceed to make the coils.

A piece of wood 1 1/2 in. in diameter is cut as per Fig. 5, and 11 knitting-needles are placed around the circumference, each 2 1/2 in. long. Now wind up the coils basket fashion. The first five coils are wound with No. 26 D.C.C. wire, the turns being 25, 30, 38, 50, 67; after winding, each coil is waxed and the spokes removed. The second range of coils should be wound with No. 32 D.C.C. wire with the following turns, 90, 115, 148, 185, 220, in the same manner as the previous coils, giving us the following table of coils and approximate wave-lengths with .0005 variable condenser:

Coil No.	No. of Turns.	Aerial Condenser Series.	Aerial Condenser Parallel.
1	25	140 — 250	350 — 305
2	30	160 — 260	380 — 450
3	38	180 — 300	430 — 550
4	50	215 — 360	540 — 700
5	67	300 — 485	670 — 925
6	90	385 — 640	900 — 1,200
7	115	490 — 800	1,100 — 1,530
8	148	640 — 1,050	1,470 — 2,000
9	185	825 — 1,325	1,900 — 2,500
10	220	940 — 1,530	2,200 — 3,300

Having constructed the coils, we next require a holder. This is made as follows:

A piece of wood 1/2 in. thick is cut as per Fig. 6; in the position shown a circular piece of wood 1 1/2 in. in diameter is screwed. It is over this the coils are to be placed. At the end a strip of ebonite is screwed, and to this two pins (valve legs) are screwed 1 1/2 in. apart, so as to plug into the tuning stand holders. This is shown better in Fig. 7. As many of these as possible should be constructed; if possible, one for each



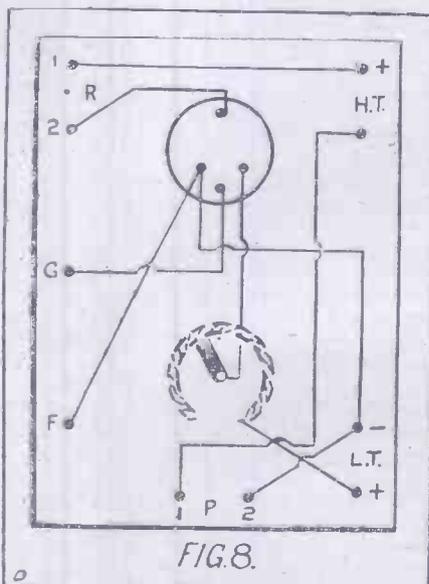
coil, and the latter could then be permanently fixed in the holder, connections from the inner and outer ends going to the two pins.

The Detector Panel.

It should here be well noted that the connections of the coils to the pins should be the same throughout the set—i.e., always connect the inside end to the lower pin, or vice versa, and always place the coil upon the holder in the same way—i.e., the winding from the centre clockwise or anti-clockwise.

If this is done, when the reader connects up he may have to reverse a pair of leads, and the set is then ready for all times and for any of the coils, otherwise he may have to reverse certain connections for every other coil he may plug in circuit.

(Continued on page 614.)



THE CONSTRUCTION OF A SINGLE-VALVE RECEIVER.

(Continued from page 613.)

The valve panel may now be considered, and, seeing that the set is to be of an experimental nature, should consist of a valve holder and filament resistance only, together with the necessary terminals.

The panel itself may consist of a piece of ebonite for preference, 6 in. by 4 in., mounted upon a suitable base or box about 2 in. deep. The valve holder may consist of four valve sockets purchased at 2d. each,



This photograph shows the finished parts and lay-out of the single-valve receiver.

and mounted in the position shown; or a moulded ebonite valve holder can be employed. A filament resistance suitable for panel mounting is now obtained, and mounted as shown in Fig. 8. Ten terminals are next mounted upon the panel as per Fig. 8, and lettered accordingly.

For the panel wiring connect the filament circuit first, using well-insulated wire of No. 20 or 22 gauge; connect L.T. - to left-hand filament socket and L.T. + to filament resistance; from the centre of latter connect to right-hand filament socket; connect F to left-hand socket and G to grid socket.

Now connect H.T. + to B 1 and R 2 to plate socket. From H.T. - connect to P 1 and P 2 to L.T. -

Construction of Condensers.

We next require two small fixed condensers of about .0003 mfd. These are constructed by cutting eight pieces of tin-foil or copperfoil 3 in. by 1 1/2 in., and several pieces of well-waxed notepaper 2 1/2 in. by 2 in. Four pieces of foil are used for each condenser, as per Fig. 9, the overlap being bent over and a short piece of flex soldered to each end.

The condensers assembled, they should be bound between two pieces of cardboard with thread and the whole well waxed. One condenser is connected inside the panel between the phone terminals. This condenser is to by-pass the high-frequency currents set up in the plate circuit.

The second condenser is to be the grid condenser, and should be connected between two terminals mounted upon a piece of wood 3 1/2 in. by 2 1/2 in. by 1/4 in. The wood should be recessed upon the underside for about 1/2 in. and the condenser let in, finally being sealed with wax.

For the grid leak a piece of slate pencil is obtained 2 in. long; the ends of the slate for about 1/4 in. to 1/2 in. should be well rubbed with copying lead all round; the centre

portion of the slate should now be lightly rubbed with ordinary lead pencil. The two ends of the slate covered with copying lead are now bound with fine wire, so as to make good connection with the pencilling.

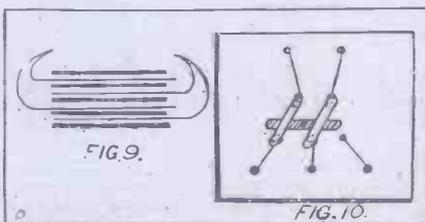
The two ends of wire are now connected between the grid condenser terminals. The grid condenser and leak are to be seen in the diagram (Fig. 11) between the switch and valve panel. The series parallel switch is the next component, its function being to place the aerial tuning condenser either in series or parallel with the aerial tuning inductance. The switch may be made as per Fig. 10, or, if purchased, it is known as a reversing switch. It should be connected as shown.

For the aerial tuning condenser the reader is advised to purchase a .0005 mfd. variable condenser, and if possible an extension handle should be fitted so as to reduce capacity effects when the hand is placed near for tuning. A .0005 condenser will be found conveniently large enough to give each coil a fair range of wave-lengths, and not too large so as to render tuning difficult upon short waves.

The condenser shown in Fig. 11 is of larger capacity, and used merely for illustration purposes, the writer's .0005 being enclosed in a wooden cabinet.

Choosing the Batteries.

For the high-tension battery the reader is advised to buy flash-lamp batteries and connect them up in series; ten to twelve batteries will be found sufficient. The batteries for preference should be housed in



a suitable box with two terminals upon the front or side, and labelled + and -

For the accumulator the reader should first consider the size of his pocket. By this I mean not to consider the cost of various makes, but to think how far his wireless activities are going to take him. Is he going to stop at one valve, or build up a set a little later with three or perhaps

four valves? If so, a 6 volt 40 amp. or 6 volt 60-amp. accumulator should be purchased; but if a single valve is to be the limit, a 4 volt 20 amp. accumulator will be found to suffice. The telephones and valve are the two final items that we cannot make ourselves. For the phones the reader should purchase as good a pair as his means will allow, of about 2,000 or 4,000 ohms resistance. The valve should be of the hard or R type, purchased at about 15s. or 17s. 6d.

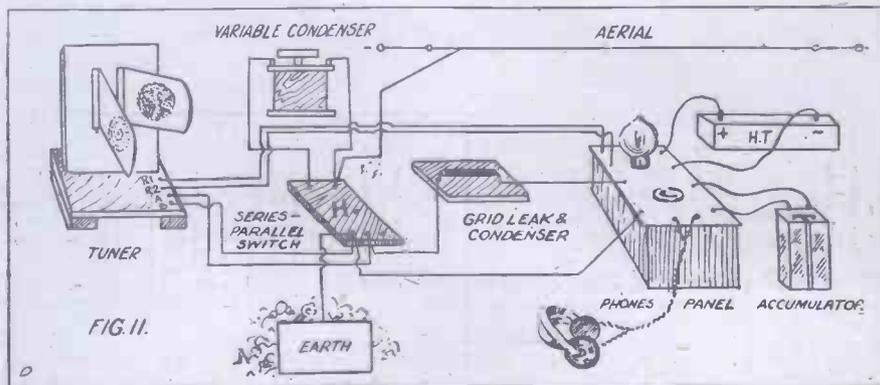
The Final Lay-out.

With all the components purchased or built, the reader should wire the set up as per Fig. 11, and it should resemble the photograph. Place a large coil in the fixed holder and a size smaller in the moving holder; now advance the moving coil to the fixed coil and adjust or turn the variable condenser. Chirps should now be heard. If not, reverse the connections upon R 1 and R 2 terminals of tuning panel, and the set should oscillate. If by approaching the reaction coil the set breaks into a howl, use a smaller reaction coil. When using the smallest coils in the A.T.I., a size larger will usually be required for reaction.

The reader when using this apparatus for the reception of broadcasting should adhere to the regulations regarding reaction and cut it out. This is done by removing the reaction coil and shorting either R 1 and R 2 terminals of the tuner or detector panel. With a set so constructed, my reader should make an effort to learn the Morse code, and he will then spend many a pleasant evening listening to the various Continental stations such as Gibraltar, Malta, Berlin, Warsaw, Nauen, Karlsborg, Paris, and Rome, only to mention a few, all of which are easily received upon a single-valve receiver using reaction.

£1,000 IN CASH PRIZES.

It is not too late to submit entries for the splendid competitions in respect of which our companion paper, "Wireless Review and Science Weekly," is offering prizes totalling to £1,000 in cash. For full particulars see No. 3, on sale Tuesday, 12th inst., and obtainable from all newsagents and book-stalls, price 3d. Apart from the question of competitions, "Wireless Review and Science Weekly" is in itself a prize well worth securing, and the modest outlay required will place at the purchaser's disposal a group of articles from contributors that hitherto no periodical of this nature can boast of securing. Sir Oliver Lodge, F.R.S., Dr. Lee de Forest, Sir William Noble, M.I.E.E., Dr. J. A. Fleming, F.R.S., Prof. J. Arthur Thomson, M.A., LL.D., Prof. A. O. Rankine, O.B.E., D.Sc., constitute but a few of the great scientists who are supporting "Wireless Review and Science Weekly," mostly in both in advisory and contributory capacities.





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AS much depends upon the efficiency and comfort of your head-phones, a discriminate selection is of vital importance.

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Head-phones—specially designed to meet Broadcasting requirements—are the last word in efficiency, comfort, and finish, and embody the following special features:—

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to users of
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Reactance
(P. Patent).

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If a signal is too feeble to operate the Detector Valve, it could never be heard, no matter how many stages of amplification were used after rectification.

But the LISSEN REACTANCE (P. PATENT) METHOD BUILDS UP WAVE ENERGY before passing it on to the Detector Valve, and so makes easily heard signals that would otherwise be inaudible.

Use the LISSEN REACTANCE (P. PATENT) Method of H.F. amplification, and so build with your own hands a receiver that shall be capable of spanning great distances.

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Makes a receiver so sensitive that under many conditions both aerial and earth connections may be dispensed with.

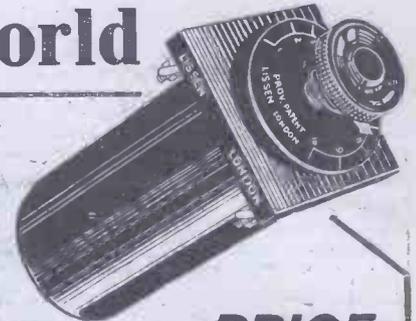
Provides fully variable non-radiating reaction in highly efficient form.

Self-tuned; but the use of a new LISSEN Vernier Condenser is recommended. (Price 12/6, barely 1 in. diameter.)

LISSEN one-hole fixing—fitted in a few minutes.

One knob controls tuning and reaction.

Range, 150 to 4,000 metres—WITH REGENERATION OVER THE WHOLE RANGE.



PRICE
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Lissen one-hole fixing.

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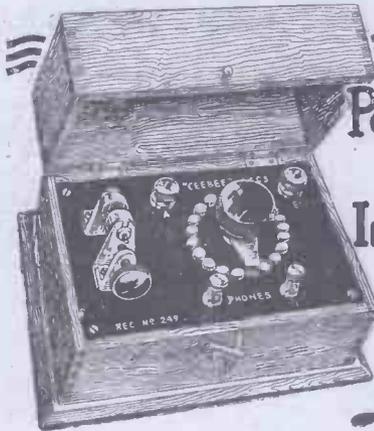
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SOME PICTORIAL FOUR-VALVE CIRCUITS.

By OSWALD J. RANKIN.

The author prefaces his description of four-valve circuits with a few remarks on the application of knowledge and experience, and the necessity for the possession of at least a fair amount of both, before the construction of multi-valve wireless sets can be successfully attempted.

BY this time no doubt our valve enthusiasts have become more or less expert in the gentle art of knob turning. Those who have arrived at this stage have naturally "been through the mill," and consequently have acquired that knowledge that only comes through practical experience. It will, therefore, not be necessary to enter into a lengthy discussion on the operation of valve circuits. It has already been said that the success of any valve receiver will depend almost entirely on experiments, and it may also be well to consider the individual ability to carry out those experiments.

One enthusiast, whom we will call A, may not have known how to drive a nail into a piece of wood before he decided to take up wireless, while another, whom we will call B, is perhaps already a fully qualified mechanic. It naturally follows that B has the advantage over A, who must embody his first term of apprenticeship with his first attempt at making a receiver. B will know many little dodges of which A is ignorant, and consequently he should turn out the best job.

Speaking from Experience.

The idea which the writer wishes to impress on the reader's mind is this: At the present moment there is a prevailing notion amongst the younger enthusiasts that anyone can construct a wireless receiver out of any old material, whether they be butchers, bakers, or candlestick makers, and no matter if the material is purchased or dug up from the garden. A would-be listener-in may first acquire some authoritative or unauthoritative information on the subject, and then begin to hunt around for a screwdriver. Being no screwdriver, nails are next considered, and in the absence of a hammer these are often driven home by a brick.

Soldering is quite out of the question, and there are a hundred and one other little things, all of the greatest importance, which are entirely ignored. This is no exaggeration, but a true page from life. The writer having a practice as a "wireless doctor," meets many cases such as this, and if he described them all it would necessitate writing a book. When motor-cars first began to boom, everybody did not rush home and make their own cars, for the simple reason that they had no knowledge of mechanical engineering.

Six Essentials.

Why, therefore, should anyone attempt to build an elaborate valve set if he has no idea of (1) the underlying principles of telephonic transmission and reception, (2) electrical induction, (3) insulation properties, (4) high-frequency currents, (5) capacity effects, and (6) combining theory with practice. We are told that if a job is worth doing at all it is worth doing properly. In other words, if we cannot do it properly, we had better leave it alone until we have learned how to do it.

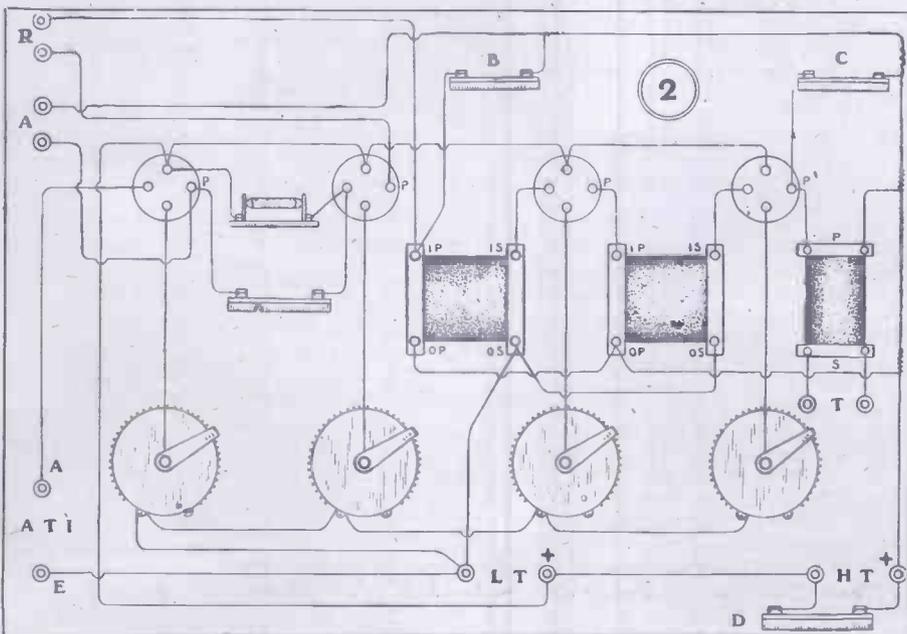
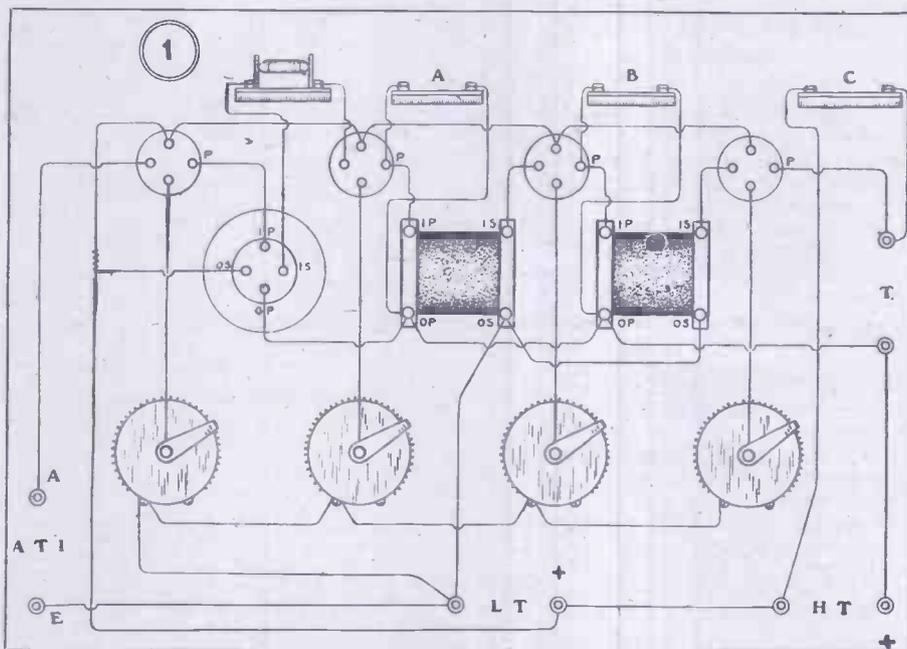
The thing not to do is to rush into the job without knowing how to tackle it, and then, on being disappointed, place the blame on the diagram, book, tools, or materials. Our friend A will make a few mistakes at first, but he should be consoled by the thought that the man who never makes a mistake never makes anything. With regard to the aerial, it seems that the one who gets the highest pole wins. Apart from the insulation problem, there is nothing very intricate in

the erection of aerials, this being a job which calls for brute strength rather than brains.

A Short Cut.

Practical knowledge is gained by actual experience, and to acquire the necessary theoretical knowledge I can think of no better suggestion than the Q. and A. columns of POPULAR WIRELESS. Each week

(Continued on page 618.)



SOME PICTORIAL FOUR-VALVE CIRCUITS.

(Continued from page 617.)

numerous questions are answered by experts and it is a good plan to clip them out week by week, and paste them in alphabetical order in a scrapbook. In a very short time the book becomes almost priceless. A polytechnic institution would probably charge a fee of 5s. and upwards for the same amount of information contained in these columns each week, and if we consider that this is real expert advice for the modest sum of threepence weekly, we should certainly be rather foolish if we did not take advantage of it. Select a question which you would like to ask an expert. Study the accompanying reply, imagine the expert in front of you answering your question—and you have learned something. This is undoubtedly the shortest cut to a thoroughly reliable theoretical tuition.

An H.F. Stage.

Fig. 1 represents a good all-round four-valve receiving circuit, employing the first valve as a high-frequency amplifier, the second as a detector, and the third and fourth as low-frequency amplifiers. The H.F. valve is coupled to the detector by means of a simple plug-in air core transformer, and this should have a .0002 mfd. variable condenser shunted across the primary winding. A and B are .001 mfd. fixed condensers in shunt with the primary windings of the L.F. transformers, and C is a fixed condenser of .01 mfd. capacity connected in shunt with the 'phones and the high-tension battery. If low resistance 'phones are used it will of course be necessary to include a telephone transformer as shown in Figs. 2 and 3. High-resistance 'phones will give good results on this circuit. The input terminals from the aerial tuning inductance are indicated by the initial letters A.T.I., the aerial side of which will be connected to grid and the earth side to L.T. negative.

Tuned Anode Coupling.

Fig. 2 shows a circuit in which the valves are similarly arranged—i.e. one H.F., one detector, and two L.F., but instead of employing the transformer, a tuned anode coupling is provided. Reaction is also arranged on the anode coil, this being permissible on the broadcasting wave-lengths. A represents the connections for the anode coil, and R the connections for the reactance coil. A suggested tuning circuit suitable for a receiver of this description is shown in Fig. 4. The terminals R, A, and A.T.I. are connected to the corresponding terminals on the valve receiver. A .0002 mfd. variable condenser should be shunted across the anode coil. An alternative method is to construct two small cylindrical inductances arranged on similar lines to a loose coupler. Full details of such a coupling were given in POPULAR WIRELESS, No. 41. B is a .001 mfd. fixed condenser connected in shunt with the primary winding of the first L.F. transformer, and C is another of the same capacity similarly connected to the primary side of the telephone transformer. This, of course, is a step down transformer, having more turns of wire on the primary than on the secondary, for use with low-resistance

headphones. If high-resistance 'phones are used they are connected direct to the plate of the last valve and the H.T. positive. A 1 or 2 mfd. fixed condenser D is shunted across the high-tension battery.

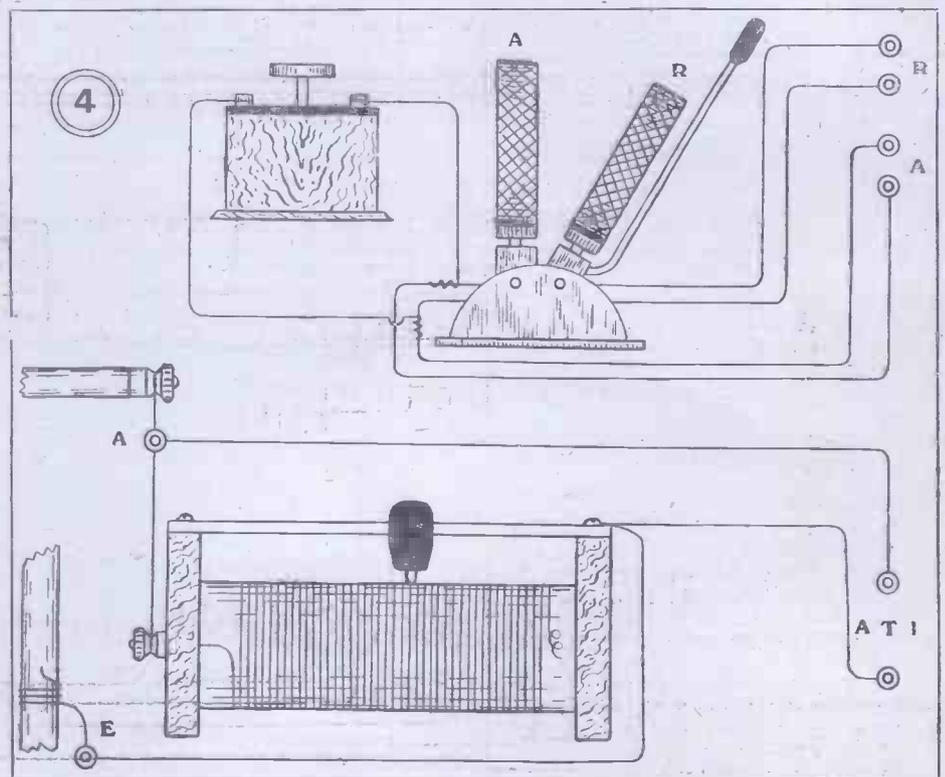
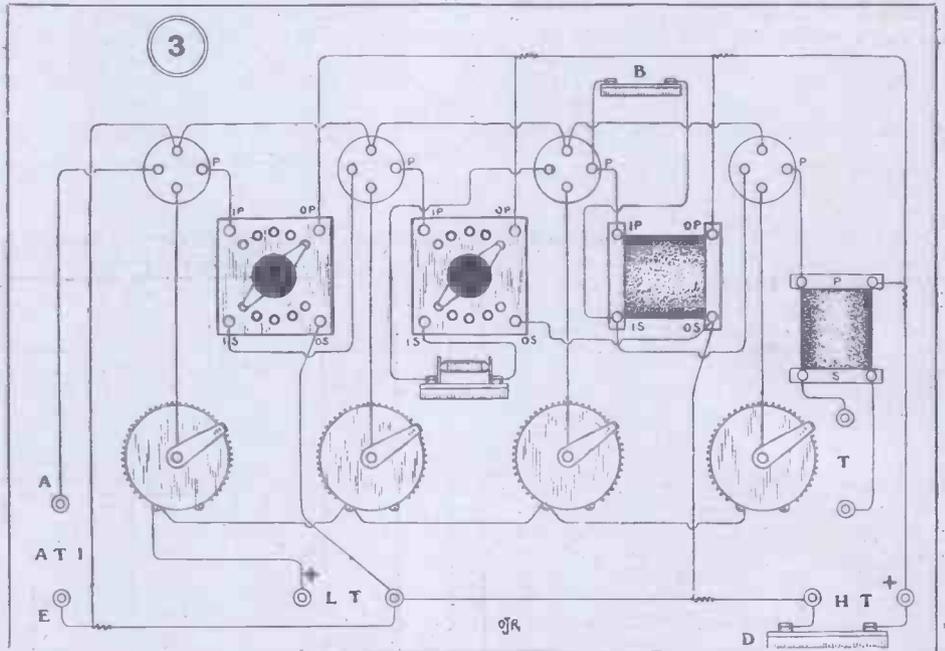
A Frame Aerial Set.

Diagram 3 depicts a rather more complicated circuit employing the first two valves as H.F. amplifiers, the third as a detector, and the fourth as a L.F. amplifier. Variable H.F. transformers are used as suitable coupling devices, but this may be replaced by plug-in transformers or anode coils if desired. This circuit is to be recommended where signals require strengthening such as in the case of frame aerial reception.

The tuning will be very critical, and it will probably be necessary to shunt the secondary sides of both H.F. transformers with .0002 mfd. variable condensers. B and D correspond with the condensers in Fig. 2.

All these circuits are suitable for operating loud speakers within reasonable distances from the broadcasting station although obviously four valves would not be necessary in cases when the distance was but a few miles.

Finally, it must be remembered that in multi-valve circuits the greatest care and attention must be paid to the wiring, in order to avoid capacity effects, leakage and risks of "shorting."



METHODS OF MEASURING THE PROPERTIES OF VALVES.

All serious experimenters should devote a little time to the study of characteristic curves, as these can almost be styled the link between theory and practice. Much valuable knowledge can be gained by plotting the behaviour of a valve on test, and in this article the writer clearly shows the various comparatively simple methods of enabling the required measurements to be carried out.

THE properties of a thermionic valve which determine its behaviour and the uses to which it can be put are best studied from a characteristic curve, and the method of obtaining these curves, as described below, is what is generally known as the step-by-step method.

The most important curves to be determined are :

and voltage being given by I_f and E_f , respectively. It should be noticed that the filament voltmeter, E_f , is connected across the filament and the ammeter; in consequence we are actually measuring the voltage drop along the filament, plus the drop across the ammeter. Were the voltmeter connected straight across the filament terminals the voltage drop in the ammeter would be dis-

dealing with valves which are somewhat "soft."

The operations necessary for taking a characteristic curve are as follows, reference being made to both Figs. 1 and 2.

A Universal Principle.

The filament voltage and current having been adjusted to a required value, as indicated by I_f and E_f , sufficient negative potential is applied to the grid, via B_g , the change-over switches being at Y and Y_1 . The latter changes over the voltmeter connections, but it is not required when a central zero instrument is used. The desired plate potential measured by E_a is applied through X and X_1 .

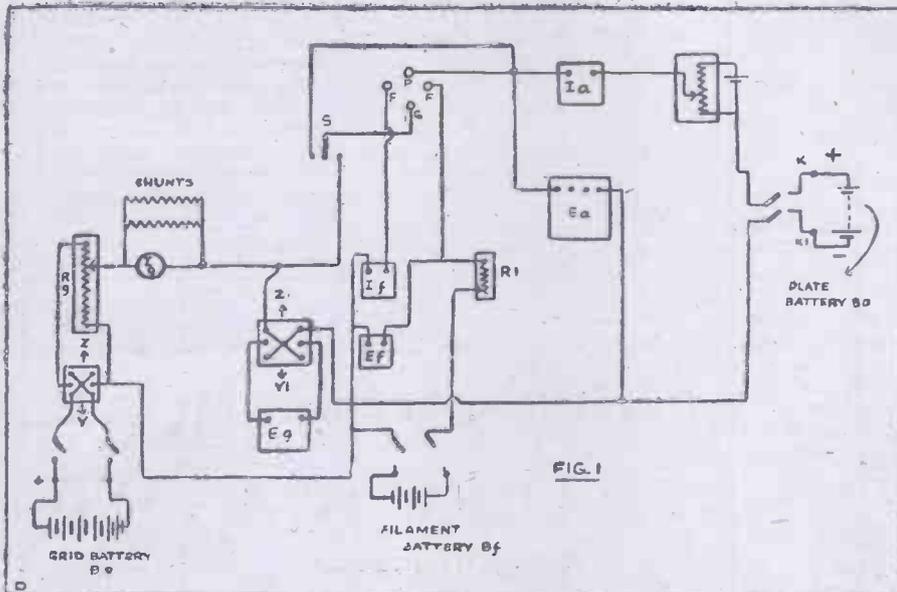
If the full characteristic is required, negative potential is applied to the grid until the plate milliammeter reading is reduced to zero. The grid potential is then reduced, step by step, for each setting of which the grid and anode current is recorded. When zero grid potential has been reached positive potential is applied by changing over the grid switches to Z and Z_1 , and the readings continued as before.

Care should be taken to keep the anode voltage constant throughout the test, and a slight adjustment of the anode potentiometer may be required from time to time. It is also advisable, before commencing to take readings, to allow the valve a moment or so to become steady in operation.

So far sufficient data has been obtained to plot one curve. The anode potential may now be increased to some higher value, and the whole operation repeated, each setting of anode potential providing one curve.

Here, then, we have the method of obtaining characteristic curves, whether the valve is a power tube capable of dealing with several kilowatts, or whether it is a tiny receiving tube. The only difference is in the magnitude of the constants and consequently the measuring instruments.

(Continued on page 622.)



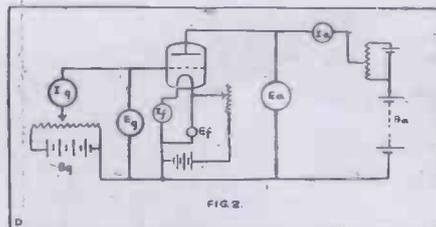
The relation (1) between anode current and grid volts.

(2) The relation between grid current and grid volts.

(3) The filament emission.

The lay-out for a complete testing table by which the properties of a valve can be measured is shown in Fig. 1, but for sim-

plified with; but in this case the ammeter would register the current flowing through the voltmeter in addition to the filament current. Since the former method introduces the lesser error it is to be preferred, and the circuits are usually connected in that way. I_a is the plate ammeter and E_a the plate voltmeter, the former remarks regarding the filament voltmeter applying also in this case.

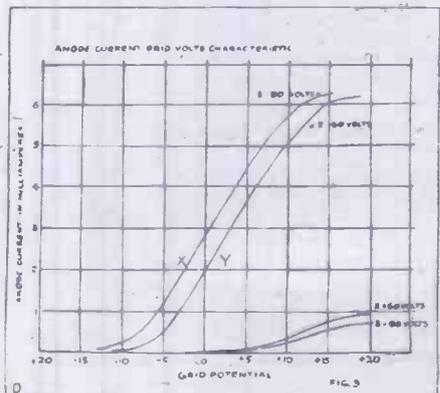


Regulation of Plate Voltage.

The anode battery, B_a , should, where possible, consist of small accumulators, connection thereto being made by means of a "wander" clip. If this is not possible, small dry cells may be used. With 4-volt cells it is difficult to get the exact voltage required, as a certain tapping may be too low while the next may be too high. This may be overcome by connecting one cell across a potentiometer, as shown. This method is preferable to shunting the whole battery with a potentiometer. Grid current is read either on a sensitive galvanometer or on a milliammeter I_g , provision being made so that the galvanometer may read current in either direction, though this latter expedient is necessary only when

plarity, diagrammatic sketches are given indicating the circuit utilised for any particular test.

Readings for the anode current grid volts and grid current grid volts curves can be obtained simultaneously, and Fig. 2 shows the circuit employed. The filament energy is regulated by a variable resistance R in series with the filament battery, the current



METHODS OF MEASURING PROPERTIES OF VALVES

(Continued from page 621.)

For a power valve the anode battery is replaced by a dynamo or other means of obtaining high voltages, and the instrument for measuring the plate current should be capable of measurement up to at least one ampere. From the readings obtained a series of curves can be plotted as in Fig. 3, which gives the characteristics for a certain type of receiving valve.

Two very important properties of a valve

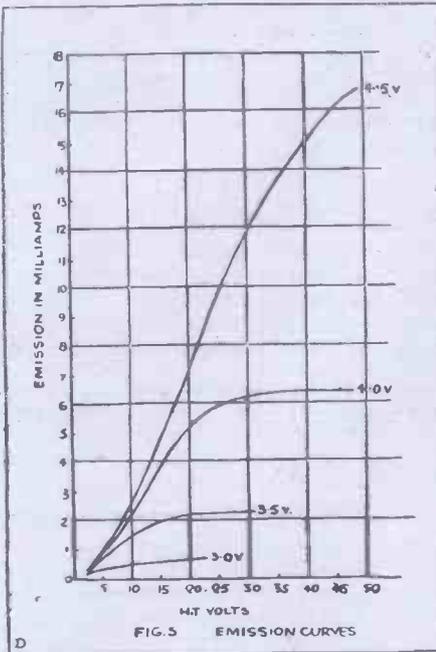


FIG. 3 EMISSION CURVES

are readily determined from the characteristic. These are the Magnification Factor and the Anode Impedance.

Static Characteristics.

The magnification factor of a valve is the ratio of the change in anode volts to the change in grid volts for the same current value. In Fig. 3 the change in anode volts is $80 - 60 = 20$, and requiring the magnification factor at, say, 2 milliamperes anode current, we find the change in grid current to be XY, which measured along the grid axis is 2.5 volts. The magnification factor at this point is therefore $20 \div 2.5 = 8$.

The anode impedance is the ratio of the change in anode volts to the change in anode current for some definite value of grid potential. The change in anode volts is, as before, $80 - 60 = 20$, and the change in anode current is given by YX, which measured along the current axis is equal to 0.8 milli-ampere. The plate impedance is therefore 20 divided by 0.008 (since the current must be stated in amperes), which gives 25,000 ohms. These two properties of the valve are of great importance in the design of a circuit for which a particular valve is to be used.

The curves described above are known as "static characteristics." In practice, resistances are generally included in the

anode circuit, and this somewhat alters the shape of the curve. If a resistance of, say, 100,000 ohms is inserted in the anode circuit and a characteristic plotted, it will be found that the curve is flattened out; that is to say, its slope is not so steep. It is easy to see the reason for this. As the current through the valve increases the current through the resistance will also increase. In effect, we are reducing the anode voltage for each increased value of grid potential, which obviously causes the characteristic to rise less steeply.

Another important series of curves is that showing the relation between the filament temperature and the electron emission. In order to determine the total emission from the filament the grid and anode are connected together (switch S to the left in Fig. 1) and are in consequence at the same potential. Having set the filament at any required wattage, the potential on the cold electrodes is increased in steps from zero to such a value that no further increase in emission is obtained. This is the saturation current for that particular setting of filament energy.

Plate Impedance.

The diagrammatic scheme of connections shown in Fig. 4.

The filament wattage may now be increased to some other value and the operation repeated. For each setting of the filament a different value of saturation current will be obtained (Fig. 5). Since a valve should always be operated at the lowest possible value of filament energy this characteristic is of great use in determining this factor.

When the constants of a number of valves are required the process of drawing characteristics for each one is a long and laborious task; but there is, however, a quick method which gives fairly accurate results. Making use once more of Fig. 3, and requiring the magnification factor and resistance at the same point as before, the work can be very much abbreviated.

Having adjusted the filament current to the correct value, we apply a potential of 60 volts to the plate, the grid potential being

zero, and read the anode current. This proves to be 2 milliamperes. For a general case call this a . The plate potential is then increased to 80 volts, and with the grid still at zero potential the anode current is again read off. It has now increased to 2.8 milliamperes, which for a general case we will call b . The plate impedance is at once given by dividing the change of anode voltage by the change in anode current, that is $(80 - 60) \div (2.8 - 2.0) = 20 \div (0.8 \times 10^{-3}) = 25,000$ ohms. Calling the initial anode voltage E_1 , and the second voltage, greater than the initial, E_2 , we have for a general case, $m = (E_2 - E_1) \div (b - a)$.

The Magnification Factor.

One more reading is required in order to determine the magnification factor. With 60 volts on the plate the anode current was 2.0 milliamperes, and when the plate voltage was increased to 80 the anode current increased to 2.8 milliamperes. We now apply a negative potential to the grid until the anode current is again reduced to 2.0 milliamperes. In this particular case this occurs when the negative potential is 2.5. We thus have the magnification factor, which, equal to the ratio of the change in anode volts to the change in grid volts, now becomes $20 \div 2.5 = 8$. The foregoing describes a rapid method of dealing with any number of valves of the same type, once it is known at which part of the curve the measurements are required.

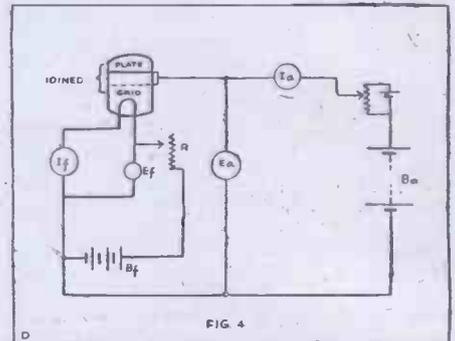


FIG. 4



Prof. Hazeltine (left) examining one of his neodyne receivers. Enormous ranges without re-radiation are claimed for this wonderful instrument.

HINTS ON METAL WORKING.

By ALBERT BULL.

The following hints will assist the amateur constructor of wireless apparatus to a very considerable extent in turning out the metal parts of a set.

It cannot be impressed upon the amateur too strongly that patience is a virtue, and that in all classes of delicate work it must be exercised, otherwise disastrous results may follow.

The very first thing to do when about to work upon metals is to memorise the following saying:

Oil on copper, not on brass,
Oil on wrought, but not on cast.

A very familiar quotation for all who have to handle metals of this description.

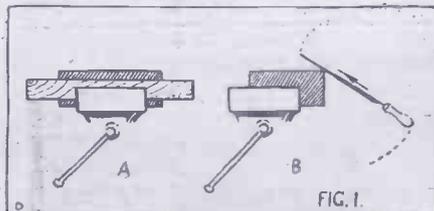
When drilling metal, ebonite, or vulcanite be sure that a flat bed is made for your work to rest upon.

When tapping a hole do not endeavour to force the tap through directly, but ease it backwards a little after each turn; this will allow the cuttings to clear.

Oftimes it is desired to use up a few odd-sized screws, for which perhaps no taps are at hand; a tap can be improvised from one of the screws themselves, if it is for vulcanite or ebonite by simply filing a slot across the threads similar to the ordinary tap and with ordinary care will last for quite a long while.

Soldering Fine Wires.

Filing flat surfaces is only accomplished by practice, and is probably one of the most difficult problems that confronts the amateur. A piece of ebonite can quite easily be held between two straight edges of wood and filed down until level or parallel. See Fig. 1, A. If, on the other hand, it is desired to file a round corner, do not endeavour to follow with the file, in the direction of the required radius, but against it, as it were. See Fig. 1, B. In pushing the file forward, rock it radially, and it will be found that a round corner can be filed perfectly in this way in a very short time, and will be void of those amateurish-looking "flats" when finished.

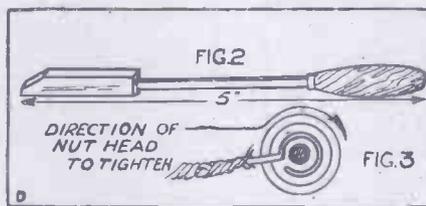


If your brass rod or sheet is very brittle, heat it to blood red and immerse quickly in cold water; this will soften it and render it pliable.

Do not attempt to bend brass in the vice without first covering the jaws with lead sheet, thus avoiding fractures at the bending point.

When soldering fine wires such as are used in winding H.R. 'phones, the great "secret" is in the flux, copper bit, and the softness of the solder. Firstly, use soft solder with a little powdered resin as a flux, and a very small copper bit. A full-size sketch is shown, in Fig. 2, of the writer's copper bit used for the work mentioned. It can be quickly heated in an ordinary candle flame.

When soldering heavier work, such as brass rod or sheet, do not overlook the fact that a certain amount of time is necessary for the transference of heat from your copper bit to the work and that, in consequence, the bit should be held perfectly still until the solder commences to run from underneath it. In most amateur cases impatience is the cause of imperfection, so spare a little time, and note the improvement.



In securing wires between nuts and terminals, the ends in all cases should pass round the stem in the same direction as that in which you turn the nut or terminal head. See Fig. 3.

Never allow the end of the wire to over-ride the main wire underneath the nut or terminal head, as it is liable to fracture and cause very trying faults.

Sometimes difficulty is experienced with silk and cotton-covered wires through the insulation "running back." An effective preventive is beeswax. Melt the wax and dip the wire in, afterwards wipe with a clean duster. This will be found a most excellent insulator, and incidentally a perfect binder.

Rust Prevention.

Brasswork that has been lacquered is best cleaned by means of ordinary lubricating oil rubbed over with a duster, then wiped off as dry as possible.

A piece of stiff brown paper will be found a splendid cover for your bench, and can be secured by means of drawing pins. Renew when torn.

Small cigar boxes make good receptacles for spare parts, screws, small tools, etc.

If you are not likely to use certain tools for some little time, do not forget that a smear of oil will prevent them from rusting.

A FEW AERIAL DON'TS.

DON'T contemplate erecting the aerial until the following points have been considered, and a rough plan drawn up showing type to be used, length, height, length of wire and number of insulators required, position of down lead, pulleys and guy ropes.

Don't make numerous journeys up and down a ladder when one would do. Try to remember all that will be required, and take as many requisites as can be conveniently carried.

Don't forget to wear rubber shoes for scaling roofs. They are less liable to slip than ordinary boots.

Don't measure the length of your aerial from chimney to pole. Measure from insulator to insulator. Otherwise you will find that you have overestimated the length to the extent of three or four feet, owing to the size of pulleys, insulators, rope, etc.

Don't use rope for stays and guys if wire is available. Rope has the disadvantage of being at the mercy of the weather, and is continually stretching or shrinking.

Don't wear a long apron when working on a roof; it is apt to get under one's feet.

Don't take an aerial over a street if it can be avoided. Even if permission is obtained, it will cause endless trouble if it falls among traffic.

Don't Spare Insulators.

Don't despair if a 20 ft. pole to be attached to a wall seems expensive. Use two clothes props bolted together. This makes an excellent pole at the cost of about 2s., and is quite rigid when used with back and side stays.

Don't attach a down lead anywhere, except to the end or the exact centre of the horizontal wire. This is important for efficient working of the aerial.

Don't let kinks appear in the wire while erecting. Even when removed they will be found to have taken the twist out of the stranded wires.

Don't spare the insulators, especially if of the cheap variety. Two at each end should be the minimum.

Don't erect an aerial without having at least one pulley. If a pulley is not available, a substitute can be made by using a reel type insulator, the pulley rope being taken over the groove in the insulator which is loosely fastened to the top of the pole.

Don't commence the roof work until all the ground work has been completed, such as the erection of the pole, completion of spreaders, soldering of down lead, and fixing of insulators.

Don't erect the pole until the pulley, pulley rope, and all the guy ropes are affixed, as a 35 ft. pole is rather an unwieldy object to take down, when a little foresight would have eliminated the necessity of doing so.

Don't attach aerial ropes to chimney pots. They are often not as safe as they look. A rope or wire round the chimney stack is much safer.

Don't have the down lead so tight as to cause a strain on the horizontal portion of the aerial.

Don't hurry any part of the job. Remember it is the most likely part of the installation to receive the least attention, and the strength of an aerial depends upon the time devoted upon its erection.



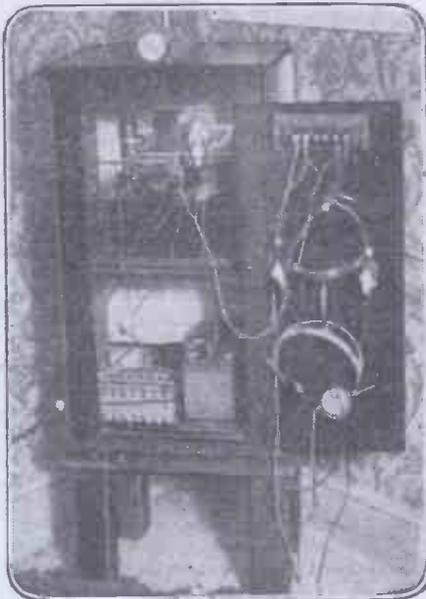
The operator at the London Broadcasting Station signalling to the studio through the window provided for that purpose.

WIRELESS IN THE MIDLANDS.

BY OUR SPECIAL CORRESPONDENT.

An article of particular interest to all readers within range of the Birmingham Broadcasting Station.

ON November 16th, last year, broadcasting was commenced from 5 I T—the Birmingham station—which was thus among the first three stations of the British Broadcasting Company to transmit. The station had been dismantled in London, set up in three days at Witton, on premises belonging to the General Electric Company, and on the 16th inst. power was put on the aerial for the first time. The same evening a concert programme was broadcast and from that day onwards 5 I T has been broadcasting without break.



A single-valve cabinet set assembled by Mr. F. Bourne, of 251, Wimbledon Park Road, Southfields, S. W.

But, and this is a fact which has affected 5 I T very much and made its difficulties as great, if not greater, than any other station, the very situation of the station has militated against its complete success. Its transmissions have always been perfect—it has been picked up over as great distances as any of the stations and only recently a listener-in from the other side of the Atlantic claimed to have heard 5 I T.

But its distance from the city has made the question of the laying of landlines almost impossible, even had the theatrical managements been inclined to permit their productions to be broadcast.

For 5 I T, however, the future, in this direction is now far more promising and there has just been brought about between the Birmingham station and the municipal authority an arrangement which is to their mutual advantage.

Search for New Site.

The search of the company for a more accessible site than Witton has been long and arduous. Even when broadcasting first commenced from Birmingham we were warned that it was only a temporary site, but nevertheless it has only been within the past few weeks that the search has been

successful, while there still remains another find to be made.

5 I T's acrials will shortly vanish from Witton. Instead they will appear extended between two high chimney stacks at the Summer Lane power station, one of the city's electric power stations, situated a very few minutes' walk from the Town Hall, the Council House, the Theatre Royal, the Prince of Wales' Theatre, the Empire and Grand Variety halls, as well as the University and Midland Institute. From its position it would be a comparatively simple and inexpensive business to effect connection by land-line with any one of these places—and it is at them that 95 per cent of the most important events in the life of the industrial centre of England takes place.

At these works, the B.B.C. are to build, at their own expense, a small room to house the transmitting gear, and the move will be made immediately a position for the central studio can be decided upon. It is in this respect that there has been difficulty, but it is likely to be shortly solved.

Big Ben Interrupts.

Finding a place for a broadcasting studio is no easy matter, as any wireless thinker will realise. For example, in seeking a new location for 5 I T's studio it was thought by the station officials that the ideal place had been found in a suite of rooms particularly well placed, and in all respects admirable. The discussion was nearing a business ending when there occurred a totally unexpected interruption. Birmingham's Big Ben sounded the hours, and thus with the first note of the clock the suitability of the site became a myth, and the search commenced once again.

When the central studio is put in hand, its design will be as far as possible upon the lines of 2 L O, and include all its improvements.

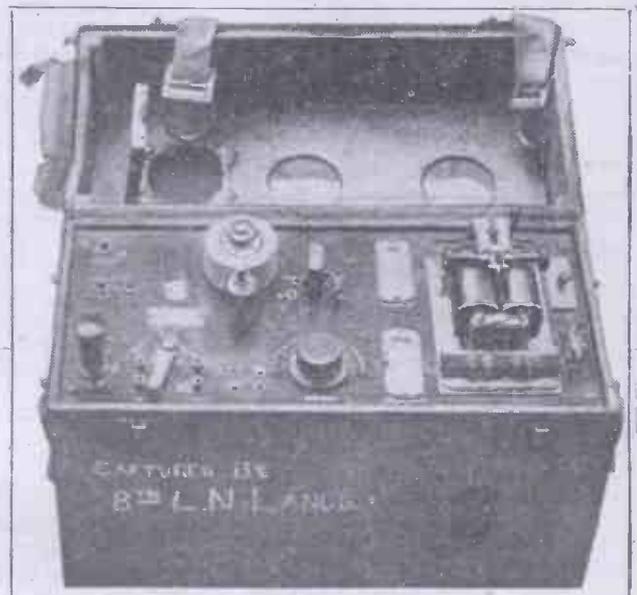
With this new central studio 5 I T will be enabled when opportunity offers to engage the services of any great artiste who may be temporarily in the city, or even to induce some public personage, passing through the city, to broadcast his message to the world of radio. In a word, with a studio so close to the heart of things 5 I T's greatest problem will have been solved.

In the meantime, while the plans for the change-over have been perfecting a land-line is being carried from the Witton site to a place of entertainment close at hand, and thus the broadcast programmes will be augmented.

Recently, the station staff were afforded an illustration of the importance of wireless to ruraldom by the news received from a little village in the heart of Leicestershire. Well off the beaten track its villagers were enthusiastic in praise of 5 I T because it was their privilege through the instrumentality of the squire to listen-in whenever the night was one of favourable weather. From the great house the multi-valve set, mounted on a wheel-barrow, was conveyed down the drive and at about a distance of 120 yards from the house an aerial was set up and Birmingham was tuned in on a loud-speaker. The people of the village foregathered in the drive, and added their interest to the mighty flood which daily grows throughout the kingdom.

A Novel Experience.

It is a curious claim by the 5 I T station, and one which should be of interest to amateurs, that Bristol appears to tune-in very frequently indeed to Birmingham rather than to Cardiff. This may be due to certain consideration of local conditions. On one occasion recently this provided the staff at 5 I T, which, by the way, at the present time consists of Mr. Percy Edgar, the station director; Mr. F. H. Amis, the engineer; and Mr. Charles Black, the assistant engineer, with the opportunity of hearing that unheard-of thing, so far as radio work is concerned—applause. The inmates of the Bristol Institution for the Blind had been listening-in, and were so enthusiastic at the pleasure of the new experience that cheers were given for 5 I T. The enthusiasm was deemed sufficiently important to communicate with the station immediately, and a telephone call being put through to 5 I T, the station staff and artistes were thanked even while the sound of the blind audience's applause could be heard.



A souvenir of Messines. A German portable wireless set.

LOW-FREQUENCY AMPLIFIERS.

A few notes and suggestions intended to assist the amateur in obtaining silent and efficient results when employing stages of low-frequency amplification.

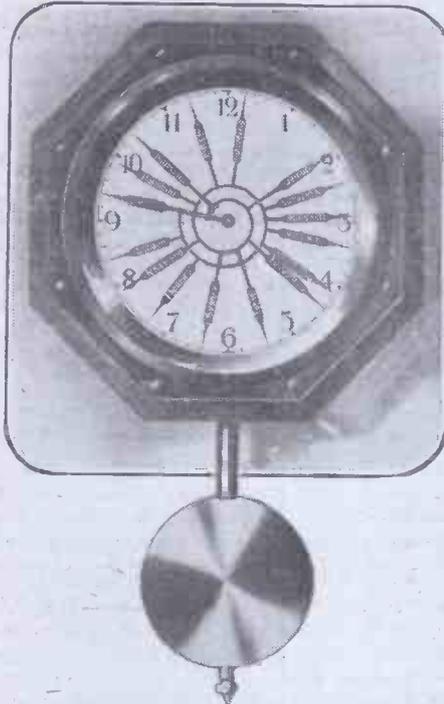
IN order to obtain good results with an amplifier, it must be carefully built, and all the connections soldered. The transformers should be placed far enough from each other to prevent induction effect which produces in the telephones a characteristic roar.

As it is desirable to obtain maximum amplification without distortion, transformers having different ratios should be used in the different stages, otherwise distortion is most likely to occur when a high plate voltage is applied to the valves to operate a loud speaker at full volume.

Tendency to "Howl."

This effect is more marked in a three-stage amplifier, and it is best to experiment with various makes of transformers to obtain maximum amplification with the valves in use. The grid potential must also be adjusted when high voltages are used. For voltages below 100, a potentiometer connected across the filament battery and having its slider connected to the secondary of the transformers provides sufficient variation; but above this voltage a grid battery is often necessary. Its voltage may vary from two to forty-five, according to the plate voltage used. To supply a loud speaker which is designed for great volume, the last stage of the amplifier should consist of a five-watt power valve, with 200 to 400 volts on the plate. It is not necessary to use transmitting valves in all of the stages.

the value of which depends upon the make of the transformer. If the amplifier has a tendency to howl, it may be stabilised by



Another form of timepiece that gives simultaneously the different times of different longitudes.

connecting fixed condensers between the grid and filaments of the valves. Another good precaution to prevent noises is to connect the iron cores of the transformers, and other metallic parts, to the positive of the plate battery, so that no difference of potential exists between these parts. A high-capacity condenser should be connected across the plate batteries of the amplifier for the purpose of providing a path of low resistance for the oscillations, which are considerably damped when the resistance of the plate battery increases with age, if this condenser is not used.

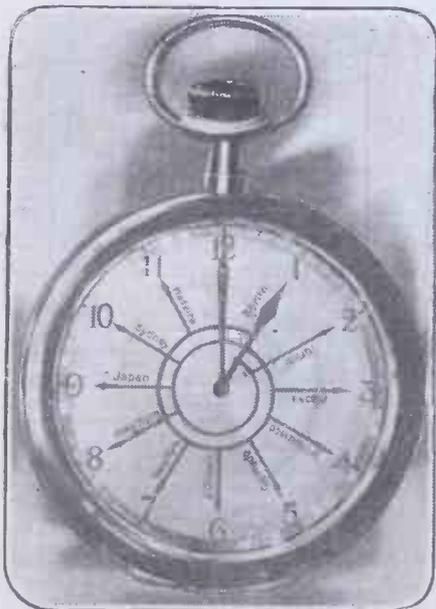
The noises which are heard on an amplifier, especially of the audio frequency type, are of various kinds. When intermittent crackling, which sounds like a discharge, is heard, the trouble should be sought in the batteries, especially the filament battery. There may be a bad contact in one of the sockets or the rheostat or in the leads from

the amplifier to the battery. Frying noises and intermittent faint whistling sounds are generally caused by bad or run-down cells of the H.T. battery. Poor amplification is generally caused by an interruption in one of the grid circuits, either in the connection from the transformer secondary to the filament or in the secondary of the transformer; if a grid is entirely insulated, howling is heard, which shows an interruption in one of these circuits. When no signals at all are heard, the trouble generally lies in one of the plate circuits, and the transformers should be verified for continuity, either with a milliammeter and a battery, or by changing their positions in the amplifier, trying the different transformers in only one stage of amplification.

Question of Design.

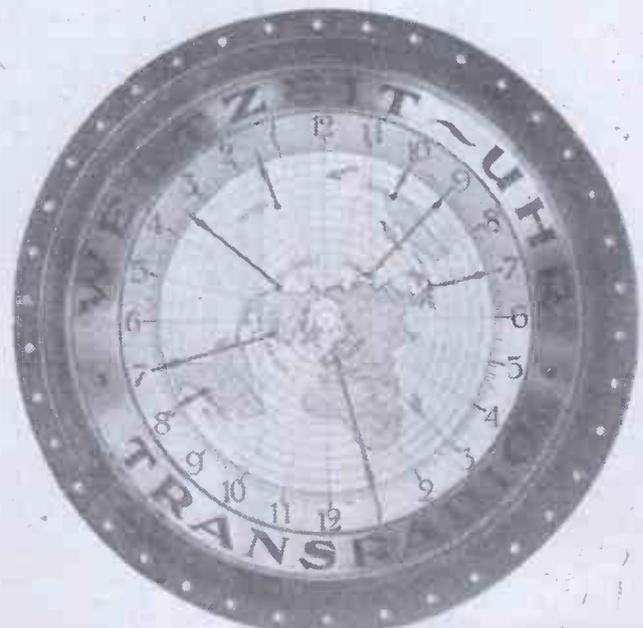
Almost any noise in an amplifier may be eliminated by methodic and careful search, and it will generally be found that the cheaper types of transformers give much more trouble than the better types designed and built by experienced firms. One of the details of construction which should be looked for by the buyer is the assembling and size of the iron cores, which, if too small, become saturated easily and produce distortion when used in a multi-stage amplifier.

It is hoped that the little information and few suggestions given in this article will be of some use to those who contemplate making an amplifier for their receiving set, and, to conclude, we would say that for best results it is necessary to use good materials, for, as the saying goes, "the cheapest is the most expensive in the long run."



One of the "polytopi" watches employed by the larger wireless stations to indicate the time in any part of the world at any moment.

To minimise the possibilities of distortion, if more than one stage of power amplification is used, it is best not to connect the transformers between the high tension source and the plate, but to use a choke-coil. Similarly, the secondary of the transformers should be shunted by a grid leak,



This wonderful clock is of German manufacture. The map is lit from behind, and a moving shadow indicates that part of the world where it is night. An arrow is drawn from each station's position on the map. Thus it is possible to gauge the time and whether light or darkness reigns at any of the large wireless stations in the world at a glance.

AN AMERICAN VIEW.

An extract from the questions answered by Mr. M. C. Rypinski, Vice-President and Director of the Canadian Brandes Ltd., and Chairman of the Radio Associated Manufacturers of Electrical Supplies, concerning broadcasting in Great Britain and America, at the offices of the B.B.C.

DID the broadcasting companies begin voluntarily or by arrangement with the Government?

Broadcasting began spontaneously with the broadcasters, and almost before the Government realised the situation it had got out of hand, due, however, entirely to lack of discretionary power under the existing laws.

Considerable Chaos.

How many broadcasting stations are there in America?

There are about 700 licensed broadcasting stations and about 3,000,000 unlicensed receiving stations. The latter figure is, however, only an estimate as no exact data is available.

As data bearing on this point, I offer the information that my company, Canadian Brandes Ltd., of London, Toronto, and New York, which is only one of about twenty makers of radio head telephones supplying that country's demands, has put out in America over 500,000 telephones since broadcasting started there. It is estimated that the average receiving set includes two pairs of head telephones even where a loud speaker is also installed.

Is it a fact that two broadcasting stations may exist in the same block on the same wavelength and functioning at the same time?

Unhappily, yes, as there is no regulatory control over the proximity of broadcasting stations. Fostered by the Department of Commerce, however, steps have been taken to get the broadcasters in a given area of interference to agree on an allocation of broadcasting hours. This prevents absolute chaos, but it has the disadvantage that small 5 to 50 watt stations are given recognition equal to 500 watt stations, and give inadequate broadcasting over the area when they are operating.

Have the broadcasting conditions in America produced chaos?

To a degree, yes, although the public spirit of the broadcasters and the influence of pending legislation are controlling in some measure to give passable, though by no means perfect, broadcasting. Interference due to re-radiation, or reaction, as you call it here, makes reception difficult in certain localities and at times; but the public is being educated up to the operation of their sets so as to minimise this effect, and the manufacturers are striving to eliminate re-radiation possibilities through improved design.

What do you think of the British system of broadcasting?

I believe you have a much better plan in America, and one which we may have to approximate to if we are to solve our interference difficulties and provide a permanent source of revenue for broadcasting. As you may know, the expense of broadcasting now falls in part upon a few of the larger radio manufacturers who write a small part of it off against the profits from the sale of radio apparatus, while the greater part is charged off to advertising. In the case of the newspapers, the department stores and others, all of it is borne as an indirect expense charged off probably to advertising. I cannot avoid, however, commenting un-

narrow view of broadcasting, assuming that it would hurt their business; but now it is fairly well recognised as an excellent advertising medium and the more progressive managers are permitting a single act or parts of an act to be broadcast, and are experiencing quicker general recognition of the merits of a production.

Boycotting Not Permitted.

Do they allow theatre artistes to broadcast from the various studios?

Yes.

What fees are the artistes paid?

None; but it is usual to provide suitable transportation and dinner, as the case may be.

Is there any attempt on the part of the entertainment world in America to boycott broadcasting?

No. The boycott is in bad order in America as our laws do not permit it in most cases.

Do you think that broadcasting will prejudice the entertainment industry?

Does the production of gramophone records interfere with Grand Opera or music publishing? Grand Opera became popular in America only after the great artistes were permitted to sing for record purposes.

Question of Copyrights.

So broadcasting will serve to popularise still further the entertainment industry, and to encourage the people isolated in their homes to make further tribute to this industry as new features are brought to their attention by radio broadcasting.

What is the attitude of American music publishers towards broadcasting?

Recently they decided that they would attempt to collect against their copyright for broadcasting rights. The broadcaster denied their request and for a time eliminated copyrighted music from their programme. A

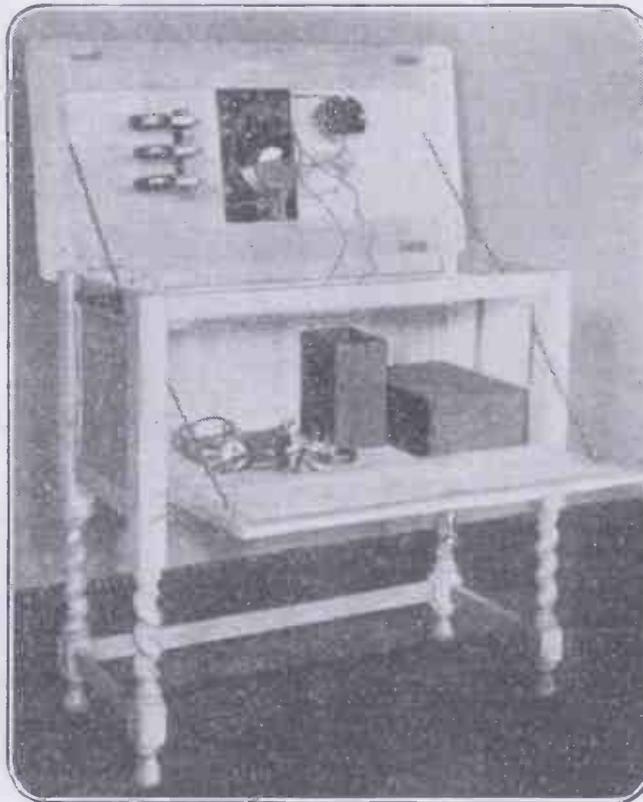
vigorous protest was made by the public, and my latest information is that the association has decided to permit the free broadcasting of copyrighted music for the present.

What is the attitude of the American Society of Authors towards broadcasting?

I do not know definitely what action, if any, has been taken by them; but I am inclined to think they are awaiting the result of the music publishers' request which has only just been announced.

Do you approve of the formation of a single Broadcasting Authority?

I do, and I am sure that we will welcome the day in America when the Secretary of Commerce may be made such an authority as the pending legislation proposes.



The handsome cabinet set assembled by Mr. F. Dewhurst of 52, Goldsmith Rd., Kingsbury, N.W.9.

favourably on the fact that your plan, as at present carried out, does not appear to protect the unsuspecting public from being offered merchandise which cannot be legally used, because it has not met with the approval of the Postmaster-General. I refer particularly to the poorly made, and no doubt inferior, merchandise of foreign make which appears in such quantities in the dealers' windows.

Regarding the Theatres.

What is the attitude of the theatre managers of America to broadcasting, and do they allow extracts from their plays to be broadcast?

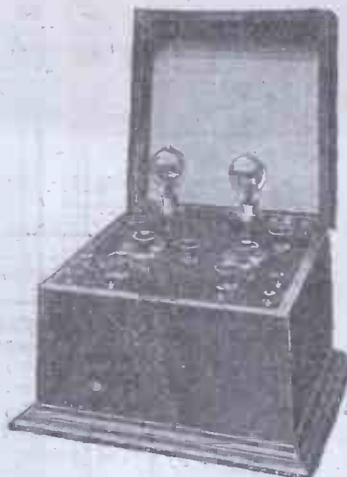
Originally some of the managers took a

Opera by Wireless!

THE London Broadcasting Station are broadcasting opera from Covent Garden during the present season, and tens of thousands of wireless owners living anywhere near a broadcasting station are finding it impossible to listen-in to their favourite works, except during the short intervals in which their local station closes down, as with the ordinary non-selective receiving set the transmission of the near-by station drowns all other signals within a wide radius.

The owner of an R.F.H. Reaction set is untroubled by an unwanted station, even if only two or three miles away, and by means of this wonderful set he receives perfect telephony from any British Broadcasting station as well as the principal Continental concerts, such as The Hague, Paris, Berlin, &c. Such a set is used under the ordinary broadcasting licence, it is approved by the Postmaster-General, and all B.B.C. and other royalties are paid.

The Orpheus Radio Telephony Company, of Silloth, write: "Glasgow opera came through very nicely on your 2-valve reactance set, type 'B'. We are satisfied that this set is thoroughly efficient, and fully bears out your advertised tests. The prima donna's voice was loud and clear; the applause was plainly heard."



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2-valve	25 guineas
3-valve	30 guineas
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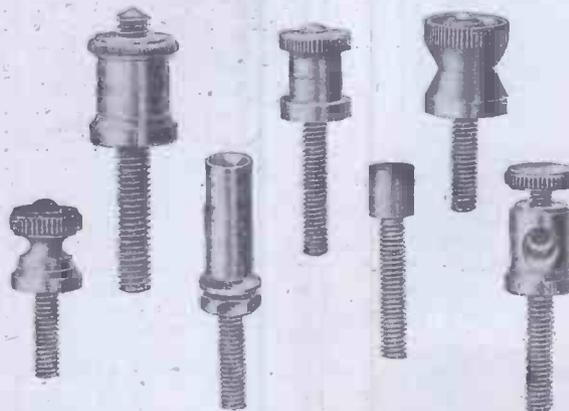
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BERNARD STREET, WALSALL.

PHONE: 560 WALSALL

THE STORY OF "THE MERCHANT OF VENICE"

Which will be broadcast by the London Station (2 L O) on June 12th.

SHYLOCK, the Jew moneylender.
ANTONIO, a rich merchant.
BASSANIO, Antonio's friend.
GRATIANO, Portia's servant.
PORTIA, an heiress.
NERISSA, Portia's serving maid.

THE chief character study of this play is Shylock, the Jew moneylender, who lived at Venice, and who was renowned for his severe treatment of all who borrowed money from him. He was universally hated, especially by the Christian Antonio, who would grant loans without interest. Antonio had an impecunious friend called Bassanio, who was in love with Portia, a wealthy lady, heiress to a large estate. To pursue his courtship he asked Antonio for the loan of 3,000 ducats.

Antonio had no money just then and so borrowed the sum from Shylock on the

credit of his merchandise-laden ships which were due to arrive at any moment. Shylock granted the loan on condition that if it were not repaid by a certain date, the penalty should be that Antonio would forfeit a pound of flesh from any part of his body that Shylock wished. Antonio agreed to this, and Bassanio was able to win Portia for his wife. Gratiano and Nerissa, who served Portia, were married at the same time, and each lady presented her husband with a ring from which they vowed they would never part.

The festivities of the marriage were somewhat marred by the arrival of a letter from Antonio announcing that his ships were lost, and that Shylock insisted on claiming his pound of flesh. Bassanio and Gratiano set out post haste for Venice, and Portia, after a careful consultation with a lawyer named Ballario, decided to conduct An-

tonio's defence herself, and disguised as a lawyer, with Nerissa as her clerk, they arrived at Venice on the very day of the trial.

Portia's masterly conduct of the trial and her ultimate and crushing defeat of Shylock are too well-known to need detailed description here. After it was over, Bassanio, who throughout the proceedings had not recognised his wife, went with Antonio to thank her, and she persuaded her husband to give her the ring she had originally given to him. Nerissa played a similar jest with Gratiano, who also failed to recognise his wife. This led to pretty complications afterwards, and the tragic beginnings of the story end with Gratiano's merry oath that:

"While I live I'll fear no other thing
So sore, as keeping safe Nerissa's ring."

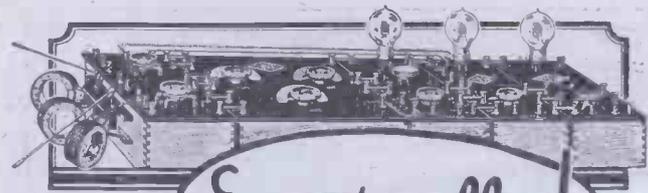
BROADCASTING TRANSMISSIONS.

GREAT BRITAIN.					
Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.
London	2 L O	Usually—5.30-11 p.m.	Musical Items, News, etc.	369	Every Weekday.
Newcastle	5 N O	5.30-10.30 p.m.	" " " "	400	" "
Manchester	2 Z Y	5.30-10.30 p.m.	" " " "	385	" "
Birmingham	5 I T	5.30-10.30 p.m.	" " " "	425	" "
Glasgow	5 S C	5.30-10.30 p.m.	" " " "	415	" "
Cardiff	5 W A	5.30-10.30 p.m.	" " " "	353	" "
BELGIUM					
Brussels (1)	Brussels	12 noon (G.M.T.)	Weather report	1100	Working days.
		4.50 p.m.	Aeroplane traffic	1100	When necessary.
		6 p.m.	Concert	1300	Sunday, Tuesday and Thursday.
HOLLAND					
The Hague	P C G G	3-5 p.m. (G.M.T.)	Concert	1050	Sunday.
		8.40-9.40 p.m.	Concert	1050	Monday & Thursday
The Hague	P C U U	7.45-10 p.m.	Concert	1050	Tuesday.
Laboratorium Heussen		9.40-10.40 a.m.		1050	Sunday.
The Hague (Velthuyzen)	P C K K	8.40-11.40 p.m.	Various	1050	Friday.
Ymuiden (Middelraad)	P C M M	8.40-11.40 p.m.	Concert	1050	Saturday.
Amsterdam	P A 5	8.10-11.10 p.m.	Concert and News	1050	Wednesday.
FRANCE					
Lavallois-Perret (Radiola)	S F R	2-3 p.m. (F.S.T.)	Music	1780	Sunday.
		5 p.m.	Stock Exchange News	1780	Every day.
		5.15-6.15 p.m.	Instrumental music	1780	"
		8.45 p.m.	General News	1780	"
		9-10.30 p.m.	Vocal and instrumental concert	1780	"
Paris (2) (Eiffel Tower)	F L	6.40 a.m.	Weather Forecast	2600	"
		11.15 a.m.	Weather Forecast	2600	"
		3.30 p.m.	Stock Exchange News	2600	"
		6.20 p.m.	Weather Forecast, Concert	2600	"
		10.10 p.m.	Weather Forecast	2600	"
Ecole Supérieure des P.T.T. Radio-Riviera (Nice)		7.45-10 p.m.	Radio Concerts	450	Tuesday, Thursday, Saturday.
		2.30-7.30 p.m.	Radio Conferences	450	"
		11 a.m.	News, Concert, tzigane	460	Every day.
		5-6 p.m.	News, instrumental Concert	460	"
		9-10 p.m.	Latest News, Concert	460	"
GERMANY, CZECHO-SLOVAKIA, AND SWITZERLAND					
Berlin	L P	6-7 (G.M.T.)	Financial News, etc.	2800	Every day.
(Königswusterhausen)		11-12.30			
		4-5.30 p.m.	Financial News, etc.	2800	"
Prague	P R G	7-11 a.m. and 3 p.m.	Weather News, General News	1800	"
		9-2 p.m. and 9 p.m.	Concert	4500	"
Geneva	H B	6-7 p.m.	Concert	1200	"

The British Broadcasting Stations transmit on Sundays between 8.30 and 10.30 p.m., and at varying times during weekday mornings and afternoons. The programmes appearing in the daily Press should be consulted for full details.

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

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



Eventually!

—why not now?



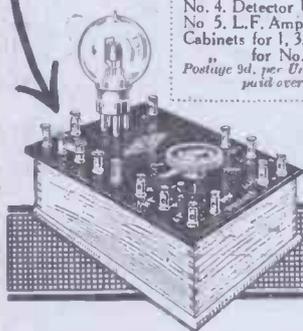
EVENTUALLY you'll come to the Unit System because it is the only method which enables you to add Valves and change your Circuits when you will.

Price List of Units for home construction

No. 1. Tune Unit	27/6
No. 2. Condenser Unit	4/-
No. 3. H.F. Amp. Unit	13/3
No. 4. Detector Unit	17/6
No. 5. L.F. Amp. Unit	33/8
Cabinets for 1, 3, 4 & 5	3/6
for No. 2	7/-
Postage 9d. per Unit extra, but paid over £2.	

Therefore why not start now with the Peto-Scott System—you'll save money and gain useful experience. The first step is to send 6d. for a copy of "Radio"—an illustrated Booklet describing the whole System

Peto-Scott Co. Ltd.
64 High Holborn, W.C.1



SPECIFICATION.
Set comprises solid best ebonite drilled detector panel, wound induction coil, tuning slider, screw clamp crystal cup, best quality crystal, universally jointed detector, giving accurate and easy adjustment, terminals, screws, and all parts for assembling by our patent method.

The "BROWNIIE WIRELESS" CRYSTAL RECEIVER.
7/6 COMPLETE. BY POST 8/6

Contains every part necessary for simple erection. A Scientific Achievement. Guaranteed equal to sets costing many times the price. Full and complete instructions enclosed with each outfit. London make. Money returned if not as advertised.



READ WHAT THE TRADE PRESS SAYS:
"Electricity," Feb. 23rd.
"The voice might have been that of a speaker in the same room. The set is a marvel of value. . . We anticipate that it will make quite a stir in the wireless world."

Send postcard for folder "The Brownie Wireless and all about it."
The J. W. B. WIRELESS COMPANY,
19, GARRICK STREET, LONDON, W.C.2.
(First Floor)
Near Leicester Square Tube Station.

(When writing mention "Popular Wireless.")

THE "MAGNIPHONE" LOUD SPEAKER

is charming everyone, and making new friends daily with its superior, mellow, and natural tone.
You certainly *must* have one to complete your set.

•£3 10 0 each.

SOLE MAKER:

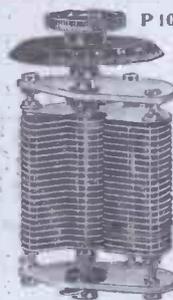
J. W. GREENWOOD,

Electrical Instrument Maker, SKIRCOAT GREEN, HALIFAX.



Woodhall-Wireless Components are evolved by experimenters, for experimenters

Examine these prices: they are right to suit *your* pocket. And the articles are designs upon which we were working long before "Broadcasting" days. They are of reliable construction—made to give service, easy to assemble, efficient and simple to work with.



Variable Condensers

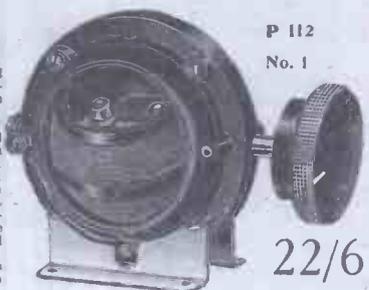
Assembled complete as shown with aluminium end-plates and ebonite bushes, for panel mounting. Adjustable bearing, accurate spacing; aluminium vanes 22 gauge; attached to panel by drilling one hole only.

P 114 5 Plates	5/6
P 115 9 "	6/-
P 116 15 "	6/6
P 117 25 "	8/-
P 118 31 "	8/6
P 119 43 "	10/6
P 120 57 "	12/-

Postage, 1/3 extra. Knob and Dial 1/9 extra.

Woodhall Variometers for full efficiency

Put one of these in your set, and increase range and signal strength. Extremely close coupling (approx. 1.16th between windings). Internal winding firmly fixed by special process. Eliminates dead-end effect and capacity losses. W.L. with 100 ft. aerial, 250/750 metres. For A.T.I. as supplied; or with small basket-coil in series, this forms a most efficient anode tuning inductance. With massive ebonite knob, as shown (or knob and dial), and terminals. Postage 1/3 extra. Brackets moveable for panel or table mounting.



P 112 No. 1

22/6

P 121



No. 2

Woodhall No. 2 Variometer

325/475 metres wave-length

Constructed of Paxolin tubing (not cardboard), it is equal to ebonite in insulation, and more rigid. The walls allow close coupling, and the bearings are accurate and robust. Wound with S.C. wire; attached to panel by drilling one hole only; complete with terminals, and fitted with knob and dial. Postage 9d. extra.

10/9

Perikon Detector

Adjustable tension, instantly fixed on "sensitive spot." Vibration cannot disturb. Complete with crystals.
P 107 (Nickel plated) 3/6
P 107a (Brass) 3/3
Postage 6d. extra.



P 107

P 108



Dustproof Detector

Neat, with ball-joint, and 9-d. gold Cat's-whisker.
P 108 (Nickel plated) 3/9
P 108a (Brass) 3/6
Postage, 6d. extra. Special Guaranteed super-sensitive crystal, 1/- extra.

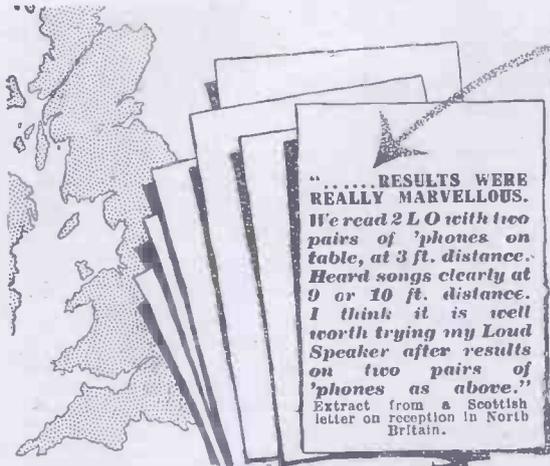
Ask your Dealer for Woodhall-Wireless Components. If he does not stock, order direct by post from us, giving your dealer's name and address. Quote number as well as description of article required. Money back in 7 days if dissatisfied. Postage free on orders of 30/- and upwards.

The Woodhall-Wireless Manfg. Co.,
15, FURNIVAL STREET, LONDON, E.C.4.

TO LONDON EXPERIMENTERS. Call at the Wireless Den in Took's Court (next door to Patent Office), Furnival Street, for all your Radio requirements.

Telephone: Holborn 5919.

Radio-Call Letters 2 H P.



".....RESULTS WERE REALLY MARVELLOUS. We read 2 L O with two pairs of 'phones on table, at 3 ft. distance. Heard songs clearly at 9 or 10 ft. distance. I think it is well worth trying my Loud Speaker after results on two pairs of 'phones as above." Extract from a Scottish letter on reception in North Britain.



"results really marvellous -"

This letter is typical of many we receive from users of our valve sets all over the country. Some clients get the U.S. concerts consistently. You see, the secret of this big-distance reception is that we build our sets with the very utmost reaction allowed by the P.M.G. Valve users know what that means.

These valve sets are so simply made that a novice can operate one in half an hour. Complete from aerial to 'phones £20, carriage paid.

Write to-night for lists giving particulars of our crystal sets and famous 'phones.

The British L. M. Ericsson Mfg. Co., Ltd., International Buildings, 67-73, Kingsway, W.C.2.

WARNING

When you ask for Ericsson 'Phones look for the name ERICSSON BEESTON stamped thereon Don't accept "Continental" stuff as Ericsson's



VALVES

We stock all makes for sale to the trade on usual terms.

CRYSTAL

We specially draw attention to our wonderful "Pinnacrite." Everyone invited to try this. Price 1/6 to 2/6 per piece.

THE WHOLESALE ELECTRICAL CO. (1922), LTD.
78, CHARLOTTE STREET, LONDON, W.1.
Sets, parts, and sundries in stock.

Are you a "Pirate"?

Radio Press Series No. 11.

THE P.M.G. has now begun to grant a large number of Experimenters' Licences. If your earlier application for one has been turned down, we advise you to try again. Many keen amateurs—although possessing the requisite amount of wireless knowledge—have been refused because they did not conform to the Post Office requirements.

The object of this book is to show you exactly what you should know before you can be granted this Licence.



Remember the Experimenter's Licence will give you much greater freedom than the Constructor's Licence (even if the latter is issued) and your position is legalised once and for all.

Radio Press, Ltd.,
Devereux Court, STRAND, W.C.2.

From all book-sellers or post free direct.

1/1½



ELECTRONITE
The WORLD'S MOST FAMOUS CRYSTAL

RHYME No. 2.

Her pretty ears were covered with the 'phones ;
Her pretty face with music was alight ;
Her spirit soared to meet the dulcet tones
Made crystal clear by our Electronite.

TRADE SUPPLIED
RADIO SUPPLIES
234, HIGH HOLBORN, LONDON.

'Phone: HOLBORN 2188.
Sole Agents for Lancashire and Cheshire :
Messrs. HENRY HOLLINGDRAKE & SON, LTD.,
PRINCES STREET, STOCKPORT.

Wireless Licences & how to obtain them
By E. Redpath

FURTHER PRACTICAL IDEAS.

JOINING AND SOLDERING WIRES.

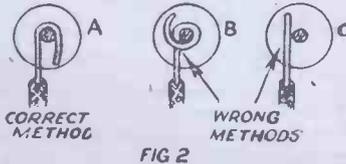
A FACT to bear in mind when constructing apparatus is that all joints must not only be strong mechanically but also electrically. Fig. 1 shows the manner in which two wires should be joined together, prior to soldering, if they are to be subjected to any mechanical strain.

Where a wire is to be held beneath a lock-nut or a flat-headed screw, the wire should be passed completely round the screw, as in Fig. 2A, but should not be allowed to cross itself, as in Fig. 2B. An insufficient quantity of wire beneath the nut or screw head, as shown in Fig. 2C, is also a bad plan to adopt, as such a connection possesses practically no mechanical strength, and will easily become disjointed.

Cause of Corrosion.

In cases where more wires than one are to be attached to the same screw, the different wires should be separated by washers, or, failing this, they should be twisted together to form one comparatively thick wire, and this should be clamped down beneath the screw-head as shown in Fig. 2A.

Do not cover any joint with insulating tape unless the joint has been soldered. The rubber compound contained in the tape possesses in many cases a certain proportion of sulphur which will form a thin film of copper sulphide, which will, in time, work in between the wires and impart to the circuit an unnecessary and undesirable high resistance.

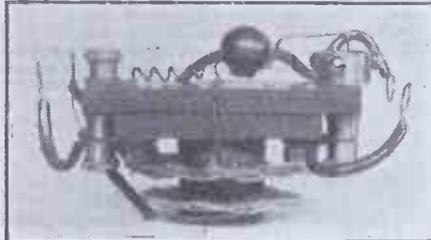


A COMPACT CRYSTAL SET.

THE photographs of this cheap, yet remarkably efficient, crystal set, will be found to be practically self-explanatory. The two small basket type inductance coils were wound continuously on a short length of rubber hose pipe to the wave-length of the required broadcasting station, and by alternatively winding and testing with crystal and phones, the inductance value was obtained correctly to a turn.

The tube and coils were then dipped in molten wax, and having been drained and

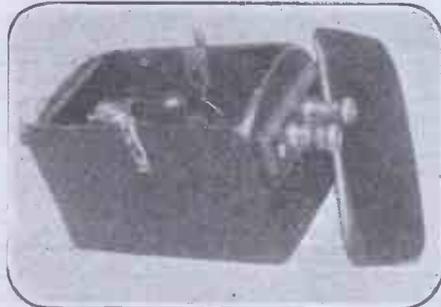
allowed to fix, the pins on which they were wound were withdrawn. It was then mounted on a fixed condenser of .001 capacity. Through one of the holes usually found drilled in the ends of the condenser for a wood screw, a terminal is passed on which



The internal view of the compact crystal set.

was screwed a crystal cup, and on a terminal passed through a hole at the other end was fixed a copper wire wound as in photo.

The whisker should fit loosely so that by loosening the terminal holding it, a long longitudinal movement is obtained and the natural tension on the spring allows a cross movement. The whole is wired up in the usual way, the case being left to the ingenuity of individual readers.



The complete set as described in the above short article.

A FEW HINTS.

Here is a good tip for those with limited aerial space. If your house is fitted with electric light, and metallic casing is used to protect the wires, try connecting the aerial terminal by means of a length of wire to a convenient part of the metallic casing. Excellent results have been obtained by this means, even with a crystal. And it is found to be more effective than a frame aerial.

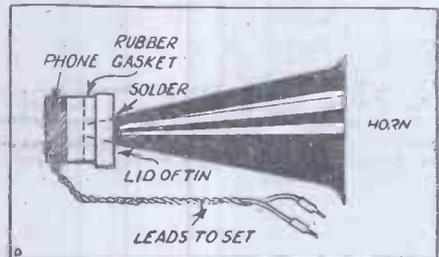
With the following device, the chief draw-back of using galena—the difficulty of keeping the sensitive point—may be overcome. Choose a longish piece of galena, and, having mounted it with as much as possible protruding, get a bone thimble—which will just fit over the crystal cup—and drill a number of holes in it, to hold tightly a few gramophone needles. Place the thimble over the cup, and make contact with the galena at several points

with the needles. Solder leads to each needle, and take them to a small tapping switch. In this way, a sensitive point may quickly be found, while the detector is dustproof.

It is a good idea to give your inductance a coat of shellac occasionally—varnishing it from top to bottom, and not left to right—thus ensuring that the shellac gets well between the turns, and insulates them from one another where the enamel has been broken off. When dry, scrape the part where the slider makes contact, free from the shellac.

A SIMPLE LOUD SPEAKER.

A VERY simple form of loud speaker is shown in the accompanying diagram. The instrument illustrated is efficient, and possesses an advantage over the majority of loud speakers in that it is cheap and can be constructed in about three-quarters of an hour, provided that the essential components are to hand. These consist of an old gramophone or phonograph horn and a fairly large tin of the type used by certain manufacturers for packing toffee, a rubber gasket, a soldering iron, and a stick of soft solder. The gasket may be fashioned out of an



old piece of thick rubber, such as a piece of rubber mat or old motor-car tyre. Cut a hole in the lid of the tin just sufficiently large to take the narrow end of the horn. Care should be taken to see that the horn fits accurately, so as to simplify the soldering process.

Doubly Useful.

The telephone receiver should be fitted against the rubber gasket, as shown, the gasket itself being placed between the telephone and the cover of the tin.

The gasket serves a double purpose, as, in addition to keeping the telephone in place, it will serve to obviate to a certain extent the undesirable "resonance" usually associated with loud speakers.

As a further precaution against this trouble, a few strips of insulating tape wound on the inner surface of the horn will be found to help. A further small-hole must, of course, be cut in the side of the tin to permit of the entry of the telephone leads.

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 Hornsey and District Wireless Society.*

At a meeting held on April 30th a demonstration was given on the society's new receiving set. The set, which was constructed by a member of the committee, Mr. W. Trotman, is on the unit system, and contains 5 panels connected by brass strips. The first panel contains 3 condensers: this is followed by high frequency, detector, and 2 low frequency panels. The set is mounted on a baseboard 3 ft. long by 15 in. wide, and each panel is easily detached to enable members to inspect the wiring. When not in use the whole set is enclosed by a polished mahogany cover.

Hon. sec., Mr. H. Hyams, 188, Nelson Road, Hornsey, N. 8.

Leyton Radio Association.

The 9th meeting of the above association was held at the Russell Mission on May 1st. A letter was read from the Radio Society of Great Britain to the effect that this society's application for affiliation had been duly approved.

After a short lecture on Morse by Mr. F. F. Betts, the members proceeded to listen in to 2 L O's May-day concert until 9.30 p.m., when the wiring of the society's new detector panel was carried out.

New members will be welcomed.

Hon. sec., Capt. H. Thorley, C.A., Russell Mission, Leyton, E. 10.

Wimbledon Radio Society.*

A most interesting and informative meeting was held at the above society's headquarters, 59, Church Road, on Thursday, May 10th. In a short lecture, Mr. C. E. Palmer Jones gave a most instructive half-hour on "The Construction of Valves," and was greatly appreciated. All interested in radio telegraphy and kindred sciences in Wimbledon and district are cordially invited to join, and the hon. sec., Mr. C. Stokes, 6, Worples Avenue, Wimbledon, S.W.19, will welcome applications for new membership.

The Fulham and Putney Radio Society.*

At a crowded meeting held at the headquarters, Fulham House, Putney Bridge, on Friday, May 4th, Mr. H. B. Gardiner gave a lecture on High Frequency Alternators and the Production of Wireless Waves.

Mr. Gardiner first described the principles employed, and illustrated his points with models and diagrams. He then went on to describe the various commercial types of machines in use, and the various devices employed to overcome the mechanical difficulties.

Altogether the lecture was very instructive and much appreciated by the crowded meeting. After the usual votes of thanks, Mr. Gardiner promised to give a further lecture at a future meeting.

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

Nottingham High School Wireless Society.

The Nottingham High School wireless society has just held an exhibition in conjunction with the photographic society of the same school. There are about twenty members of the wireless society, as it is restricted for membership to those in the science sixth form (in which form it is studied as a branch of physics). The photographic society is open to all boys in the school.

The exhibition was held in the prayer hall, as it is the largest room in the building, on Thursday, May 24th, from 6 p.m. to 9.30 p.m. The exhibits were mostly of an experimental nature, arranged almost entirely by the boys.

Fulham and Chelsea Amateur Radio and Social Society, Chelsea Polytechnic, S.W.3.

A meeting of the above society was held on Tuesday, May 15th, when a most interesting lecture and demonstration was given by Mr.

Tarrant, a member of the physics staff of the college, on the subject of electrons.

Hon. sec., N. Mickle, Esq., 544, King's Road, Chelsea S.W.

Radio Association, Brockley and District Branch.

Professor P. M. Baker, B.Sc., A.M.I.E.E., A.M.I.E.E., gave an interesting lecture on Friday, May 25th, at Gladstone Hall, New Cross Road, on "Crystal and Valve Circuits," showing how to construct various types of sets in panel form. The time allotted to the professor was limited to one hour, and he, therefore, could not say all that he had intended. He will, however, be continuing his lecture at a later date.

During June, July, and August the meetings will take place on the last Friday in each month. Therefore, the next meeting will be on June 29th, when Mr. Geo. Sutton, F.R.A., will lecture.

Hon. sec., R. O. Watters, Grove House, Brockley Grove, S.E.4 (letters only).

The Sydenham and Forest Hill Radio Society.

A lecture was given recently before the above society on "Elementary Electricity," by W. V. Pegden, Esq. (the chairman), starting from magnetism. It was proposed that the chairman should give a lecture on the above subject, once a month throughout the year.

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

Raymaid Wireless Club.

A meeting of the above club was held on Thursday, the 17th-ult. It was originally arranged that Mr. F. Boulden should deliver a lecture on the "Construction of Portable Receivers" (proposed to be used during club's outdoor demonstrations), but he was unfortunately prevented from so doing.

Mr. J. Ayres kindly filled the gap, and gave a very lucid explanation on "Inductance, and Its Relationship to Wave-length."

Particulars may be had from the secretary.

Hon. sec., Mr. F. E. Baker, 28a, Estella Avenue, New Malden.

Tottenham Wireless Society.

On Wednesday, May 23rd, Mr. F. Haynes gave a lecture to the above society on "Electro-Static Loud Speakers."

He pointed out that in electro-magnetic loud speakers the distortion increases with the power in use, whereas, electro-static loud speakers are remarkably free from this defect. Mr. Haynes first explained the theory of the machine, pointing out that if a semi-conductor be placed across it, the attractive force is very large.

In his instrument, the semi-conductor is a cylinder of agate, and the conductor is a brass shoe made to fit tightly round it. The shoe is connected to the diaphragm of the loud speaker and the agate cylinder revolved by worm gear.

Between the spindle of the cylinder and the brass shoe a choke coil and a battery of 200 volts is connected together, with the output of a receiving circuit.

The vibrations received alternately help and hinder the steady voltage, and so vary the attraction between the shoe and the cylinder; this is transmitted by a metal arm to the diaphragm.

The hon. sec. will be pleased to forward particulars to anyone desirous of joining the society.

Hon. sec., S. J. Glyde, 137, Winchelsea Road, Tottenham, N.17.

North Belfast Radio Association

The above club was recently formed at a meeting held on May 24th. Particulars can be obtained from the hon. sec., H. C. McFerran, Esq., 32, Cliftonville Avenue, Belfast.

North London Wireless Association.*

Mr. F. S. Angol gave his 8th paper on elementary principle, his subject being, "Rectifying and Detecting," at the 129th meeting, on May 14th.

Hon. sec., Mr. J. C. Lane, Physics Theatre, Northern Polytechnic Institute, Holloway Road, N.

WIRELESS IN SUMMERTIME COMPETITION.

(A further selection from the hundreds of postcards sent in by competitors in the "Summertime" competition appears below. The result and the name of the prize-winner will appear as soon as possible.)

Mr. ERNEST S. CLEGG, 34, Montague Road, S. Tottenham, N.15:

"I think that in order to keep up the interest in wireless throughout the summer months, the B.B.C. could arrange lectures and talks on popular sports by well-known athletes. The district councils could also instal sets equipped with loud speakers in parks, etc., so that a large proportion of the public could hear these programmes."

Mr. ALBERT H. WEEDON, of 23, Tabley Road, Holloway, N.7:

"The boom in wireless will, of course, slacken, but if the third (constructor's) licence is issued, it will be given a decided boost up again. If this occurs shortly, it will have the effect of keeping up interest in wireless during the summer. A friend of mine is already arranging his aerial with the lead-in, in his summer-house. Wireless in the garden, the portable set on the boat up the river, at country picnics, and on the beach will all be in great vogue. In this way I consider the interest of the listener will be held through the coming summer."

Mr. P. GIBSON, of 14, Alexandra Road, Stockton Heath, Warrington:

"A few ideas which might make summer broadcasting more attractive:

- "1. The main items to be given after 8 or 8.30.
- "2. The women's hour to contain attractive and useful recipes for summer drinks and dishes.
- "3. Music by good composers, or else popular songs and recitations of lighter kind.
- "4. Talks on—
 - (a) Sport of week. (Day's sport quite fully in news bulletin.)
 - (b) Gardening.
 - (c) Natural History (not treated too technically).
 - (d) Holidays—characteristics of suitable pleasure resorts.
 - (e) The house, decoration, etc.
 - (f) Politics (short summary) once a week.
 - (g) Motoring, motor-cycling, and walking, including practical hints on care of machines and suggestions for tours for each class.
 - (h) Station itself (difficulties, alterations, improvements, methods)."

MARCONI'S LATEST

New Popular Marconiphone Brings ALL Broadcasting Stations within Range



THE NEW MARCONIPHONE V2.

A new and improved Two-Valve Marconiphone has been perfected and is now on sale.

With it, no matter what part of the country you live in, you can listen-in with perfect results to all the British Broadcasting Stations from Glasgow to Cardiff.

Price Reduced

Owing to the enormous demand created for this instrument, it has been found possible to economise largely in overhead charges. The public is given the benefit of these economies, and the New Marconiphone V2 is on sale everywhere at

£16 : 3 : 6

without accessories—or £24 complete

The Marconiphone

The Triumph of the Master Mind

Ask your local dealer at once about the New Marconiphone V2. All orders are being dealt with in strict rotation.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
Marconiphone Department, Marconi House, Strand, London, W.C. 2

ACME RADIO SUPPLIES CO.

GUARANTEED CRYSTAL SETS, enclosed crystal, lidded cabinet, variometer tuning, B.C.	32/- each
TRANSFORMERS I.V.	14/- "
FILAMENT RHEOSTATS	2/4 "
SWITCH ARMS, superior quality, lacquered	1/4 "
FIXED CONDENSERS	1/6 "
VARIOMETERS, wound for Broadcast wave-lengths	6/- "
DITTO, on ebonite	7/- "

PRICE LIST FREE ON APPLICATION.

1, LONSDALE ROAD, KILBURN, N.W. 6.

Carriage paid on all orders over 20s. Please remit sufficient postage. Balance will be refunded.



Ohms
4,000
Per
Pair

BONTONE **BRITAIN'S BEST**
MARVELLOUS EFFICIENCY
MARVELLOUS PRICE

16/6 Per pair
Plus 1/- extra for postage.

Manufactured entirely in our works, Goswell Road and City Road, under mass production, hence the quality and price.

We specialize in the manufacture of Precision Tools, stamped and turned parts, in large quantities. Send us your enquiries.

We are experts in the production of Magnets of all shapes and from Tungston or Chrome Steels.

SPECIFICATION:

Case. Best hard Aluminium, solid drawn and accurately finished.

Magnets. Latest type horseshoe pattern of finest Tungston Steel, resulting in strong and permanent magnets.

Core Pieces. Finest quality of special soft iron, with fibre insulating checks.

Wire. Each earpiece is wound with best English high conductivity copper wire to 2,000 ohms by special machines.

Diaphragms. Made from selected Iron, perfectly flat, to ensure perfect tone.

Ear Caps. Solid ebonite of ample size, best finish and correctly proportioned.

Insulation. This is a particular feature and receives careful attention, finest materials only being used.

Head Bands. Made from best quality Spring Steel, copper plated, oxydized, and relieved, giving beautiful finish.

Testing. Every earpiece is tested thoroughly during, and after assembly.

Finish & Workmanship. Of the best possible throughout.

Assembly. By skilled labour under expert supervision.

GUARANTEE We agree to return cash in full if not satisfied, and returned to us undamaged, within 7 days.

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Ditto, Adjustable, 2/6 per pair, post 6d.
Basket inductances, 150-4,000 metres, per set of 6, 2/6; per set of 7, 3/6; post 3d. Complete with 8 diagrams and calibrations.

Pair of Coils, for broadcast wave-length, 1/3 per pair.

3-way Switches, mounted on Ebonite, 2 in. x 2 1/2 in., Laminated Arms, first-class finish. Suitable for change-over and multi-valve, 2/9 each, 3d. postage.

Basket Coil-holders, adapted to fit Standard Tuning Stands; the very latest; 1/6 each, post 3d.

H.F. Transformers: "A," 150-225, 1/3; "B," 320-490, 1/3; "C," 550-810, 1/6;

"D," 790-1,800, 2/-; "E," 1,650-2,900, metres, 2/6 each; postage 3d.

47 S.W.G. D.S.C. Wire, sufficient to wind one H.R. Ear-piece, 1/- per bobbin; ditto, enamelled, 10d. per bobbin. Double quantity, 1/6 per bobbin, post 2d.

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RADIOTORIAL.

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

According to the calendar Summer has arrived, but at the time of writing it is a fact that is difficult to credit. It is to be hoped, however, that the weather will improve so that new recruits to the ranks of the army of listeners-in will be able to enjoy to the full summer wireless and all that it means. Extravagant pictures of punts on the river and picnic parties in verdant glades, complete with portable wireless apparatus, have been drawn by enthusiastic artists, but somehow the idea seems to fall flat with the town dwellers and other unfortunates whose outdoor facilities for amusement do not include boats on the river and other such delights. To these I would recommend wireless teas on the lawn or, if no lawn is available, in the garden or "backyard." It is wonderful what a difference a few cheap deck chairs can make to the most confined and "concrety" "garden" when the sun is shining and "Hark, hark the lark!" is filtering through a pair of comfortably fitting 'phones. A nice warm summer twilight after a strenuous day in the city—or on the farm—spent in a deck chair with the "phones," will tend to soften the attitude of the most carping critic against the broadcasting programmes. Some people say wireless is essentially a winter diversion, but to those whose good fortune it is to be able to command the river, the pristine glade and the shaded lawn, or the imagination to transform sixteen square feet of concrete to such, wireless will be but in bud during the winter months and in full bloom during the summer.

Our companion paper, WIRELESS REVIEW and SCIENCE WEEKLY, has been received in such a genuinely enthusiastic manner that it has fully qualified its relationship with POPULAR WIRELESS. The policies and contents of the two papers, however, do not in anyway overlap, and because you have purchased the one it does not follow that the contents of the other would in any way be duplicated. This has, of course, been fully explained before and everyone interested in wireless science should make a point of purchasing both journals, for in so doing everything that matters in wireless will be adequately covered week by week from A to Z. Finally, I must emphasise the point that POPULAR WIRELESS will in no way be affected in respect of its contents nor will WIRELESS REVIEW draw upon POPULAR WIRELESS for its subject matter. An adequate staff of experts and contributors have been engaged to supply both periodicals with the highest possible standard of wireless and science material, and I honestly believe the combination of two such papers to be the strongest that the world has yet seen. The EDITOR.

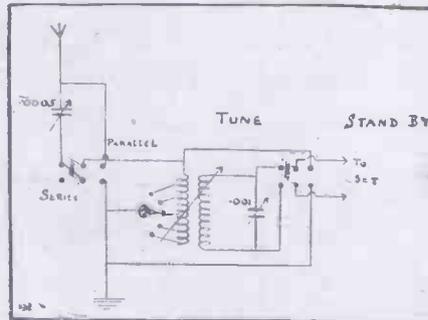
Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be exercised in answering queries. Until further notice three questions

from one reader will be the limit for one letter. All questions should be addressed to POPULAR WIRELESS Queries Department, Room 133, Fleetway House, Farringdon Street, London, E.C.4. Readers are requested to send the necessary postage for reply.

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

Questions Answered

"STANDEE" (Taunton).—I should be much obliged if you would give me a diagram of a tune and stand-by switch, and give directions for manipulation of same.



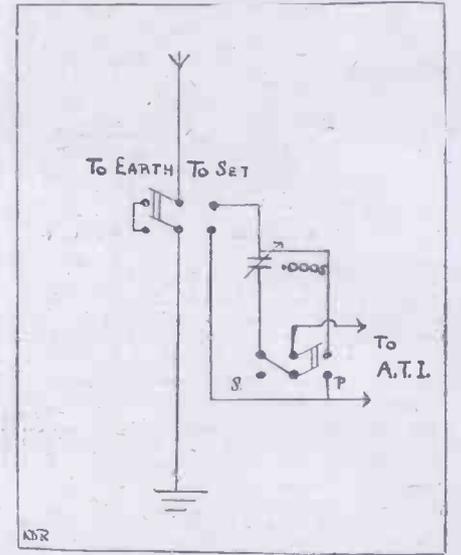
Above is a suitable diagram. To tune in put switch to "stand-by" position, and tune on primary coil alone until best results are obtained. Change to "tune," and then readjust, but this time with the aid of the secondary. Without this switch the tuning of a loose-coupled circuit is very

tedious. The series parallel switch may of course be omitted, but is a useful addition to any set.

"FILAMENT" (Basingstoke).—I have broken the filament of my valve. Can I repair it at home as I believe it costs a great deal to have them repaired?

If the filament is broken only in one place and only a very small gap results, probably the two ends can be brought together by tapping the valve. In this case you may be able to mend the filament as follows. Connect the two filament legs across the accumulator, 6 volts should be used, and tap until the two ends of the filament meet, they will fuse together after one or two attempts. A repaired valve does not, of course, last as long as a new one, and if repaired by some firm usually takes a slightly larger current than it did previously. The charge is about 6s. 6d. to have them repaired at the works, so this is not really so very expensive considering the initial cost of a new valve. Repaired valves act very well, and though they are not quite as efficient as the new valve they form exceedingly good emergency valves.

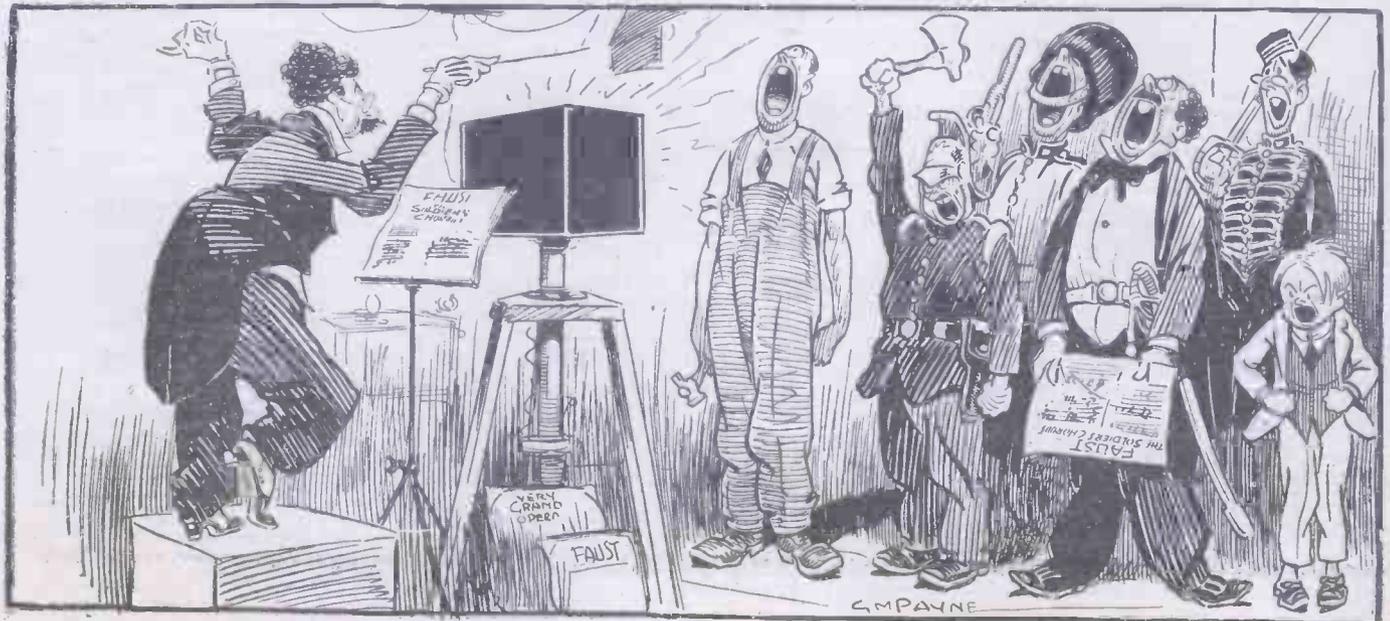
R. D. K. (St. Albans).—I intend putting in an aerial-earth switch and a series-parallel switch. What are the connections of same?

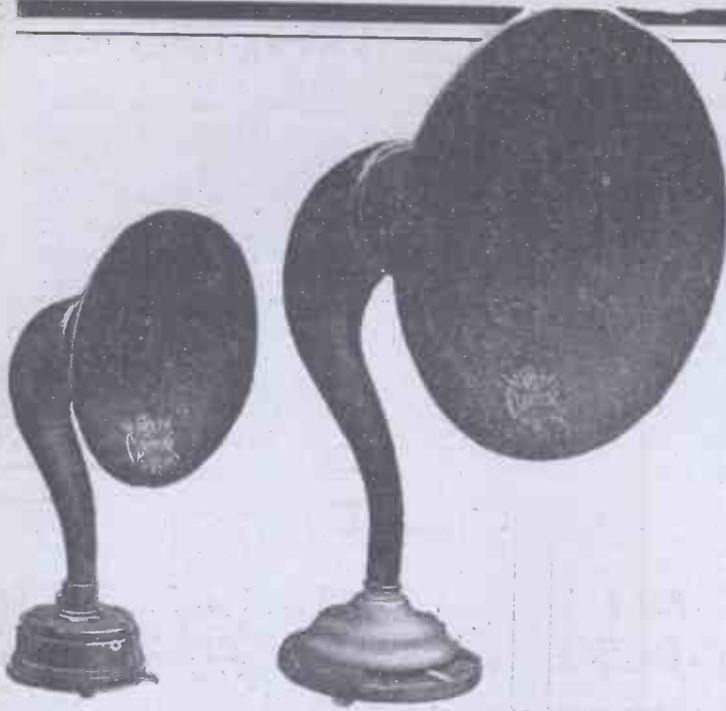


The above diagram shows a switching arrangement suitable for your requirements. The earth switch should be in the left-hand position to earth the aerial. The studs for placing the condenser in series or parallel are marked S. and P., so you should have no difficulty in following them. When the

(Continued on page 636.)

THE "BEAUTY" CHORUS OF THE RADIO OPERA COMPANY.





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LETTER FROM THE AGENTS

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Prior to using yours, we made extensive tests of every other class of speaker on the market, and were not satisfied that any of them came up to the standard you set.

When yours came along, we decided, after tests, that it was of such quality and efficiency that we could go ahead and make it our standard for all purposes, mainly for building into high grade cabinet sets.

We are, dear Sir, Yours faithfully,

W. A.
RADIO-TELEOLA
Walter R. Howard

"CLARITONE" LOUD SPEAKERS

A RESULT OF INTENSIVE RESEARCH WORK—A PRODUCT OF THE FINEST INTELLECTS IN BRITAIN'S RADIO INDUSTRY FOR CONCERT HALL OR FIRESIDE

LIST PRICE

- W 295-2000 ohms £3/5/0
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Dear Sir,

"CLARITONE" LOUD SPEAKERS

In enclosing our Order No. 1229 for an additional 2,500 "Claritone" Loud Speakers, we take this opportunity of complimenting you upon the highly efficient production, as evidenced by the large number of enquiries and sales we are regularly experiencing.

The demand for the "Claritone" Loud Speaker by our representatives in various parts of the country is constantly increasing, and reports from all quarters are unanimous in praise of the high quality of the "broadcasting" reproduction.

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

Yours faithfully,
W. A.
Walter R. Howard

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LIVERPOOL

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 634.)

condenser is in series you decrease your wave-length while in parallel you increase it. The switching circuit is connected to the earth and aerial terminals of the set in the ordinary manner.

H. W. S. (Sheffield).—How can I tell if my set is oscillating and causing interference to others? How can I stop the valves howling?

Damp your finger and then if on touching the aerial terminal and on removing the finger a distinct click is heard in the 'phones you may be sure that your set is oscillating. Try the following, any of which may be the cause of howling. Earth the iron cores of L.F. transformers and keep all transformers as far as possible away from each other when building a set. Try a different value of grid leak, a variable one is a great help if you are constantly changing your valves as each valve will require slightly different treatment. And lastly, and this is very important, try and keep all wiring as much at right angles as possible, parallel wires often cause a great deal of trouble in this manner. The grid connections should also be as short as is convenient, while if H.F. valves are employed it is advisable to use potentiometer grid control.

"KOYL" (Chatham).—If a conductor or coil is moved in a magnetic field a voltage is produced in the coil. Is there any method of determining the voltage that is generated?

Yes, this can easily be calculated providing that you know the strength of the magnetic field through which the coil passes. Suppose that the strength of the field is so many lines per cm. and that conductor passes through at the rate of one cm. per second. That is, it cuts that number of lines of force per second. Now the E.M.F. (volts) will be

$$\frac{\text{change of flux}}{10^9 \times \text{time in seconds}} \text{ volts}$$

If the number of lines cut, or rather embraced, by the conductor at one moment is x_1 , and at another moment is x_2 , then if the intervening period is t seconds, the average E.M.F. induced is

$$\text{E.M.F.} = \frac{x_1 - x_2}{10^9 \times t} \text{ volts.}$$

Now, suppose a coil is used instead of a single conductor, and that the coil has N turns of wire. The E.M.F. will then be

$$\frac{(x_1 - x_2)N}{t \times 10^9} \text{ volts,}$$

because we must take into account the fact that each of the turns is cutting the same number of lines of force in each period of time. For example, we will take a coil of 400 turns passing through a magnetic field and cutting the lines of force at 100,000 per second.

$$\text{E.M.F.} = \frac{N(x_1 - x_2)}{t \times 10^9} = \frac{400(100,000 - 0)}{1 \times 10^9} \text{ volts because there}$$

is no change in flux density.

$$\text{This gives E.M.F.} = \frac{40,000}{10^9} = .4 \text{ volt.}$$

Cristo (Woolwich).—On two occasions my crystals have gone dead. Is there any way of preventing this?

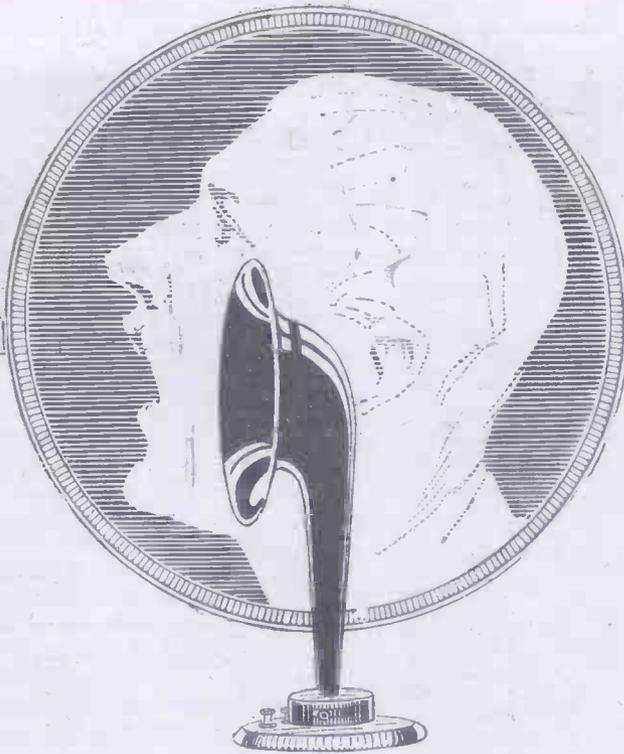
Crystals have a habit of going dead, but you seem very unfortunate to lose two in this manner. It is advisable to handle the crystals as little as possible. Brush them over with a camel-hair brush frequently, to get rid of any dust. A bath in methylated spirits often rejuvenates a crystal to a surprising degree. The cats-whiskers are liable to become corroded, and often need cleaning with emery or sand-paper. Gold and silver cats-whiskers have a distinct advantage over other metals, as they do not corrode. Do not fix your crystals in their cups with ordinary solder, as the heat is liable to impair their sensitivity.

(Continued on page 638.)

YOU CAN ASSEMBLE YOUR SET

with the certainty of success if you get a Radiax outfit. You may adopt the unit principle of building up an Extensible Experimental System, or select a combined set to suit your locality and taste. Everything is planned, and our diagrams and booklets—to say nothing of our unequalled personal service to clients—are invaluable. A splendid 1-valve set costs 39/6. Ask for our catalogue and advice, stating your ideas.

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Throat-like Tone

THE purity of the tone reproduced by the Peto-pan Super—the clear Speaker—is a revelation to those who have only heard the distorted effects from other Loud Speakers.

Made in two Models

With curved Horn:
4,000 ohms **63/-**

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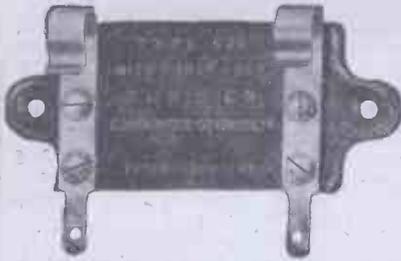
Its wonderful powers of reproduction are obtained, firstly, by a double sized diaphragm (adjustable by an external lever), and secondly by means of a moulded horn of non-resonating material shaped to a throat-like opening exactly conforming to the laws of acoustics.

The Peto-pan Super is the ideal Loud Speaker for indoor and fireside use where purity of tone is the first essential. Its soft mellow voice renders it an indispensable adjunct to every Valve Receiver. Compare it on actual test in our Demonstration Lounge.

PETO-SCOTT Co. Ltd., 64, HIGH HOLBORN, W.C.1

Peto-pan Super
— the clear Speaker

DUBILIER



DUBILIER CONDENSER, TYPE 600, with grid leak clips



DUBILIER CONDENSER, TYPE 600A

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QUALITY PRODUCTS AT POPULAR PRICES.

Because we concentrate on manufacturing condensers you get good deliveries.

DUBILIER MICA CONDENSERS

Types 600 and 600A for Wireless Receivers.

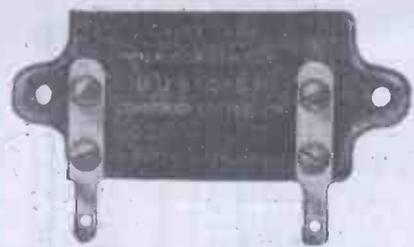
Type 600 in capacities from 0'0001 mfd. to 0'0005 mfd., supplied with grid leak clips and soldering tags.

Type 600 in capacities from 0'0005 mfd. to 0'005 mfd. and Type 600A in capacities from 0'0001 mfd. to '005 mfd. supplied with soldering tags only.

Each
PRICES: 0'0001 mfd. to 0'0009 mfd. (inclus.) 2/6
0'001 mfd. to 0'005 mfd. (inclus.) 3/-
GRID LEAKS: 1 Mr. to 5 Mr. ... 2/6

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SIDPE HEADPHONES, 4,000 ohms, our price.....	17/3	WASHERS, 2 B.A.....	per doz. 1/4d.	SLIDER KNOB.....	each 2d.
THOMSON HOUSTON HEADPHONES, (French) 4,000 ohms, our price.....	18/11	FILAMENT RESISTANCES, smooth action, marvellous value.....	1/10d.	SWITCHES ON EBONITE, S.P.S.T. (quality the best).....	each 1/6
BROWN'S FEATHERWEIGHT HEADPHONES, 4,000 ohms, our price.....	27/11	CONTACT STUDS, with nuts and washers.....	per doz. 5d.	SWITCHES ON EBONITE, S.P.D.T. (quality the best).....	each 1/11
MARCONI R. VALVES.....	13/6	STOPS, with nuts and washers.....	per doz. 7d.	SWITCHES ON EBONITE, D.P.D.T. (quality the best).....	each 2/9
MULLARD "ORA" VALVES.....	12/9	TERMINALS, with nut & washers, each.....	1d., 1 1/2d. & 2d.	CONDENSER SPINDLES, all sizes in stock from.....	each 1/4d.
DUTCH VALVES.....	8/9	EBONITE KNOBS, 2B.A., each 2d., 3d., & 4d.....	2d., 3d., & 4d.	SCREWED ROD, 2 B.A., 12 in. long, each.....	3d.
L.F. TRANSFORMERS, Ratio 5 to 1. All guaranteed. (Postage 1/-).....	each 11/3	SPACING WASHERS, large.....	per doz. 2 1/2d.	SCREWED ROD, 4 B.A., 12 in. long, each.....	2 1/2d.
CRYSTAL DETECTORS, Adjustable.....	1/3 1/2	SPACING WASHERS, small.....	per doz. 1 1/2d.	RUBBER-INSULATED LEADING-IN WIRE.....	per yard 1 1/4d.
CRYSTAL DETECTORS, enclosed in Celluloid unbreakable case.....	2/3	CRYSTAL CUPS, 2 screw.....	each 1d.	INSULATORS, white reel, 2 in., each 1 1/2d.....	per doz. 1/4
SWITCH ARMS, best makes.....	1/3 & 9/4d.	CRYSTAL CUPS, 4 screw.....	each 2d.	INSULATORS, white Egg, each 2d., per doz.....	1/9
AERIAL WIRE, 7/22, guaranteed hard-drawn copper, 100 ft. (postage 1/-).....	2/-	FIXE CONDENSERS, all capacities, each.....	1 1/2d.	SPECIAL HERTZITE CRYSTAL, large piece.....	each 10 1/2d.
CONDENSER VANES, fixed or moving, per doz.....	3/4d.	EBONITE, cut to any size by machinery while you wait.....	per lb. 3/6	WOUND INDUCTION COILS (postage 9d.).	
Real Gold Cat's Whiskers.....	per doz. 2d.	TELEPHONE TERMINALS, nuts & washer, each 1 1/2d.....	per doz. 1/4	12 x 4.....	9 x 4 8 x 2 6 x 3 6 x 2
Real Silver Cat's Whiskers.....	per doz. 1/8	W. O. TERMINALS, nuts & washer, each 2d.....	per doz. 1/9	2 1/8 2/5 2/2 1/11 1/8	
CONDENSER SCALES, 0 to 180, each	3/4d.	PANEL BUSHES, drilled, each 1 1/2d., per doz.....	1/4	TAPPED INDUCTANCE COILS, 20 tappings wound to 1,600 metres.....	each 2/11
IVORINE LABEL SET, 12 different readings.....	the set 7/4d.	TOP CONDENSER, bushes, each 1d.; per doz.....	11d.	VARIOMETERS (Tube Type) complete with knob.....	3/11
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		VALVE LEGS, nut & washer, each 1d.; per doz.....	10d.		
		VALVE PINS, nut & washer, each 1d.; per doz.....	9d.		

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RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 636.)

"WAVEMETER" (Manchester).—Referring to your article on the "Amateur Wavemeter" some time back, how can one measure C.W. wave-lengths when harmonics can be heard on several adjustments?

This can be done quite simply by using a little algebra. Harmonics are invariably exact multiples of the fundamental wave-lengths. Thus, the first harmonic of, say, 1000 metres would be 500 metres, and the second 333 metres, and so on. If on a certain coil you tune in a signal, and you know it to be, say, 500 metres, and then find the "silent point" of the same station at 600 metres, then you can tell that the fundamental wave-length will be some number multiplied by 600, and the same number times 500 plus 500. Now let x represent the unknown number, and y the fundamental wave-length; then both $600 \times x$ and $500 (1 + x) = y$. Therefore, eliminating y , $600x = 500x + 500$. By subtracting $500x$ from both sides we get $100x = 500$; therefore $x = 5$, and reverting back, 600×5 and 500×6 is the fundamental wave-length, viz. 3,000 m. This wave-meter will cover a very useful range, and both high and low value coils can be calibrated by means of harmonics.

R. S. R. (Parkgate).—I am continually being worried by a loud buzzing sound in my 'phones, caused by a power station quite near. How can I prevent this, as it is almost continuous during the evening transmissions? I am using a three-valve set, H.F. and L.F.

Try a capacity earth. This is formed by stretching wires beneath and parallel to the aerial about six feet above the ground, and well insulated from it. Failing this, the only other alternative is to "shield" the set. Use tinfoil for the purpose. Shellac the panel well, and when well dry give it a second coating, and at the same time give one side of the tinfoil a good coating. When nearly dry but still sticky, apply the foil to the side of the cabinet and panel, giving a third coat when dry. Cut away the foil where the holes go through the panel, and place well-shellacked brown paper over the foil. The brown-paper is an added precaution against short circuiting, and is well worth the time spent in preparing it.

No Name (Skipton).—Is it true that the "dull-emitter" type of valve lasts much longer than the ordinary type?

Although this type of valve is rather expensive, we think that you will find that it will eventually pay, especially if you have trouble in getting your accumulators charged. The L.T. current can be obtained from a primary battery, as the filament of this type of valve only needs to be red hot to give good results. An ordinary dry cell of large capacity is quite satisfactory. The filament will be found to last much longer than the ordinary valve. It takes about 3 amps, and a voltage of only 1.8 volts, giving wonderfully silent working and clear reception.

A. T. (Coventry).—What is an auto-transformer?

This is a special type of transformer used for a small step-up or step-down of voltage. It consists of a coil of wire wound on an iron core and having four tappings, two together at one end, another pair way along the winding and the last at the further end of the coil. For a step-up effect the primary circuit is connected to the bottom end or beginning of the coil and to the tapping pair way along it. The secondary is then connected to the common terminal where the primary was connected, and to the other end of the coil. The position of the tapping depends upon the ratio of step-up that is required. Suppose there are N turns between the beginning of the coil and the tapping, and M turns in the whole coil—that is between the two secondary leads, then the voltage step-up will be proportional to the ratio $\frac{M}{N}$, because the voltage of N will of course be balanced by the counter E.M.F. of the turns N , though the flux from N will interlace the whole coil. Thus a voltage will also be induced into the part of the coil that is not included by N . This being added to the voltage in N will give the secondary D.P. as $\frac{M}{N}$. This type of transformer is connected conversely for a step-down effect, but is only useful in cases where a small voltage increase or decrease is required, and not where any large variation of pressure from primary to secondary is likely to exist.

TO WIRELESS EXPERIMENTERS. PATENT YOUR INVENTIONS.

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Accumulators at less than cost

The accumulators are all filled with acid and fully charged. They cannot be sent by post.

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HEADPHONES.

Genuine British Ericsson. Stamped B.B.C., 4,000 ohms.....	25/6
The LADIES' Headphones, very light, 4,000 ohms, with TORTISESHELLITE Headbands.....	21/-
"ULTRA" adjustable magnets, 4,000 ohms, leather-covered Headband.....	30/-
"ULTRA" non-adjustable leather-covered Headbands, 4,000 ohms.....	20/-

VARIABLE CONDENSERS.

Complete with knob scale, pointer, and instructions, and TOP and BOTTOM EBONITE PLATES, ready bushed and connections made. Neatly boxed.

	Parts	Assembled for complete.	Panel Mounting.
.001	7/6	12/6	
.00075	6/6	11/-	
.0005	8/6	9/6	
.0003	4/3	8/-	
.0002	3/6	7/-	
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Vernier (Ready assembled).....	3/-		

AERIAL INSULATOR.

Reel Type.....each 11d.	Baby Shell.....each	3d.
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LEAD-IN INSULATORS.

Simplex Lead-In Patent (no more damaged window frames).....	1/6
Ebonite Tube types, well made.....	1/-
Aluminium Pulleys.....	1/4 & 1/8
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Aluminium Condenser Vanes, fixed and moving.....dozen	6d.
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Valve Legs, with nuts and washers, 9d. doz.; each.....	1d.
Valve Holder, turned Ebonite and 8 nuts, 1st quality.....	1/3
Crystal Detector, fully adjustable.....each	2/6
Crystal Detector, glass enclosed for panel mounting.....	4/-
Crystal Detector, glass enclosed, mounted on base.....each	4/3
Coil Plug Mounts, with strap and connector.....	1/-
Terminals, large telephone, 21d. Mk. III.....	21d.
Filament Resistance.....31 from	2/3

Fixed Condensers, in ebonite cases, tested and guaranteed correct capacity. .0002, 3 or 5. 1/3; .001, 2 or 3.....	1/6
Grid Leak, 2, 3 or 5 Megohms (Peto-Scott type).....	1/6
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Switch Arms, complete with knob collar washer, bush nuts, etc., best quality laminated—2nd quality.....	101d.
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Contact Stops.....doz.	7d.
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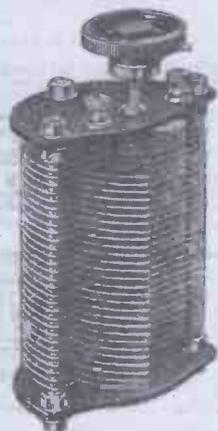
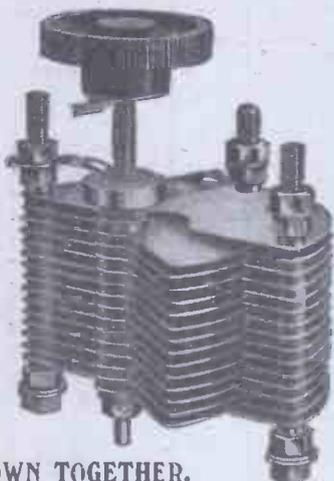
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·0005	29	4/6
·0003	19	3/3
·0002	13	2/6
·0001	7	2/3
Vernier	3	1/9



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 Rotax Accumulators, 4 v. 40 amp., 17/-. Carriage, 2/- each.
 Fixed Condensers. Good value. 11d., 1/3. Post, 6d. each extra.
 H.T. Batteries, 60 volt, 9/-. Carriage, 2/- each.
 H.T. Batteries, 15 volt, 2/6. Carriage, 1/- each.
 Ebonite Valve Holders, 10d., 1/-. 1/3. Post, 6d. each extra.
 Basket Coils, "Oojah," set of 7, 5/-. By post, 6/- set.
 Basket Coils, 2/8 and 3/6 set. Post, 6d. extra.
 Insulated Steeving, 5d. and 6d. length.
 Crystals (Mounted), Hertzite, 1/-. By post, 1/6.
 Crystal Detectors, on ebonite, 1/5. By post, 2/-.
 Perikon Detectors, enclosed with 2 crystals, 2/4. By post, 3/3.
 Perikon Detectors, suit expensive set, 3/9. By post, 4/6.
 Enclosed Detectors, 1/8, 2/3, 3/6, 3/9. Post, 1/- each extra.
 Valve Pins, slotted, 7d. doz. By post, 1/-.
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 Dubilier Condensers, at usual prices.
 Telephone Transformers (R.I.), 20/. Post, 1/6.
 H.T. Batteries, 30 volt, 4/6; 36 volt, 5/-. Post, 1/- each extra.
 Telephone Leads, long, 1/-. Post, 6d. extra.
 Filament Resistances, 1/8, 1/8, 2/-, 2/6, 3/-. Post, 9d. extra.
 Transformers, L.F. (Radio Instruments, Ltd.), 25/- Post, 1/-.

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4,000 ohms (different headbands) 22/6 and 25/-
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Explains, in plain everyday language, everything
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RECENT WIRELESS INVENTIONS.

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

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

194,765. — E. POLLOCK.—
VALVE RELAYS.—Two or more diode valves are interposed in the output circuit of an alternator and when they are cold no current passes. The circuit is such that an output transformer is energised only when the filaments are heated by currents induced in corresponding transformers by a microphone or key-controlled circuit. A low-frequency alternator may have the microphone or key circuit shunted across it, but for a high-frequency alternator the current is supplied through an interrupter from a separate direct current generator.

195,102.—A. M. LOW.—TRANS-
FORMERS.—One winding—e.g. the secondary, of a high-frequency transformer has some of its turns of smaller diameter than the others so forming two sets of turns which are arranged, eccentrically. Thus a small high-tension current and a larger low-tension current of different phase, useful in the wireless control of torpedoes, aeroplanes, etc., are produced.

195,310.—P. HEMARDINQUER.—
AERIALS.—A frame aerial is combined with a table, being wound upon a vertical wooden frame which also serves instead of legs to support one end of the table, part of the table top forming a shelf within the aerial. For portability, the shelf portion and the legs may be hinged. Glass or ebonite rods may support the corners of the aerial.

195,337.—FORGES ET ATELIERS
DE CONSTRUCTIONS ELECTRIQUES
DE JEUMONT.—INDUCTANCES.—An agglomerate of iron filings or magnetic powder and insulating material is moulded to form two ring-shaped pieces adapted to encase a ring-shaped loading-coil when clamped together by a central rod, an air space being left at the centre.

195,410.—A. M. LOW.—DISTANT
CONTROL.—In the wireless control of aeroplanes, torpedoes, etc., a rotary interrupter breaks up the emitted waves into timed impulses which when of a certain frequency operate a selective switch in the receiving apparatus.

195,440.—GENERAL ELECTRIC CO.,
LTD.—VALVES.—Electric discharge devices have a "soft" vacuum to increase the potential gradient at the cathodes, they are coated with a highly electro-positive substance such as thorium or sodium. Such a cathode may be obtained by coating an anode of relatively electro-negative material such as nickel with a salt of an electro-

positive metal, the metal being deposited upon the cathode by a high voltage discharge in vacuo.

195,461.—C. W. C. BECKMAN &
P. ALEXANDER.—INDUCTANCES.—Tuning inductances having stationary and pivoted coils movable like the pages of a book, have special crown wheels on the pivot pins of the coils. Pinions rotated by operating handles engage the crown wheels, and thus a fine adjustment of the positions of the coils may be obtained.

The crown wheels are made of insulating material with a separate circular rack which may be of metal let into the lower surface of the material, so that the coils are perfectly insulated.

195,546.—N. F. S. HECHT.—VALVE
GENERATORS.—To prevent over-heating in a power valve due to non-functioning, a condenser shunted by an auxiliary valve oscillated by the power valve is inserted in the high-tension supply. The condenser is thus periodically discharged, but should oscillation cease, the auxiliary valve becomes non-conductive and the condenser blocks the high-tension supply.

195,589.—WESTERN ELECTRIC CO.,
LTD.—RECEIVING SETS.—A cabinet contains a loud speaker, a phonograph, a wireless receiving set, and a motor-generator mounted upon springs to reduce vibrations. The loud speaker may be connected at will to a microphone operated by the phonograph or to the wireless receiving set, the motor-generator being driven by house-main current and supplying current to the wireless receiving set and the microphone circuit of the phonograph.

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4 .. 60 ..	21/3	6 .. 60 .. 31/-
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Packing 1/6 extra.		Packing 2/- extra.

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60 ..	14/-	.. 1/-

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WOUND INDUCTANCE COILS.
Wound on Waxed Impregnated Formers, with 26 S.W.G. Enam., and finished with a dressing of the well-known "HARDICOL" Shellac Varnish Cement, ensuring a perfect and reliable coil.
6x3 6x4 12x2 12x2½ 12x3 12x3½ 12x4
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Handphone which has been specially designed for ladies. It has no headband 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.

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All Fellows Radio Instruments are British Made throughout and guaranteed.

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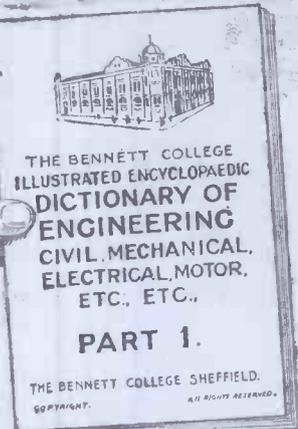
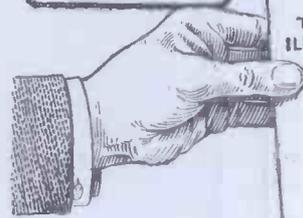
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*For they are jolly
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BRITISH MADE

COMBINED VALVE AND CRYSTAL RECEIVING SET



Photo by Swaine.

Miss Doris Lemon as Nedda in "Pagliacci."
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the British National Opera Company, Ltd.



No. R. 1570.

The ideal receiver for Broadcast Reception,
and the best possible set for Opera Reception.

APPROX. WAVE-LENGTH RANGE 280 - 2,800 METRES,
RECEPTION RANGE 150 MILES.

USES A DULL EMITTER VALVE REQUIRING ONLY
1.8 VOLTS FOR THE FILAMENT.

This instrument will enable you to derive the greatest possible pleasure from "listening-in" to

GRAND OPERA AT COVENT GARDEN

and will introduce you to one of the highest forms of musical art. You will then be more than ever anxious to hear the actual performances.

PRICE:

Complete with High and Low Tension Batteries, 1 pair of Head Telephones (2,000 ohms), and all necessary plugs and cords, but exclusive of Dull Emitter Valve,

£20 - 15 - 0

1 Dull Emitter Valve for above - £2 extra.

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BIRMINGHAM: 150, Edmund Street. CARDIFF: 10, Park Place. MANCHESTER: 14, St. Peter's Square. NEWCASTLE-ON-TYNE: 9, Clavering Place. WORKS: Dagenham, Essex.

The above instrument bears the B.B.C. Seal.

HINTS ON PANEL DRILLING.

Popular Wireless

PRICE 3d.

No. 55. Vol. III.

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

June 16th, 1923.



The Aunt and Uncles
— of 2 L O —
Receive a Present.

FEATURES IN THIS ISSUE.

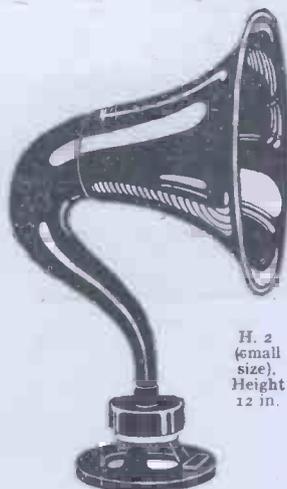
Birmingham's Melody Man.
Simplified Power Amplification.
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Photographing Electricity.
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Well-known Artistes of 2 Z Y.

And an article by Dr. N. W. McLachlan, M.I.E.E., on the
"Reproduction of the-Pianoforte."

The "BROWN" LOUD SPEAKERS

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H. 2 (small size). Height 12 in.

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
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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

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

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HULLO !!! C.Q. WILL DAY CALLING

THE LATEST MARVEL, a pair of Midget Headphones, weigh under 4 ounces, 4,000 ohms. Call and test these at our showrooms Price 21/- per pair
A THOROUGHLY RELIABLE PAIR OF HEADPHONES, stamped B.B.C. 20/- per pair
100 feet 7/25 Stranded Copper Aerial Wire 1/10 per coil

HAVING PURCHASED THE WHOLE OF A MANUFACTURER'S STOCK OF GUARANTEED 7/22 HARD DRAWN AERIAL WIRE IN 100 FT. HANKS, WE ARE ABLE TO OFFER THIS AT THE LOW PRICE OF 2/2 PER HANK OR 2/- FOR 50 HANKS AND UP.

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 Catalogue, now ready.

Do not fail to try the NEW "DAYZITE," Regd.
The super marvel Crystal with Silver Detector Point at 2/6 each, or mounted in Brass cup, 2/10, Postage 3d. extra.

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2-VALVE RECEIVING CABINET

A high-grade instrument at a very low price. This set has been especially designed for receiving broadcasting, and complies with all the Postmaster-General's regulations. It can be used either for listening-in with headphones or with a loud speaker. Additional interest and use is secured because it will receive all amateur transmitting stations within a range of 20 miles. The "Fellophone" is mounted in a handsome oak cabinet, and is sent out complete with H.T. battery, 6 volt accumulator, 100 ft. aerial, 2 shell insulators, and one pair of Fellows 4000 ohms double headphones, but without valves.

British Made Throughout.

Made under Marconi Licence and approved by the B.B.C. and Postmaster-General.

PRICE COMPLETE £12 inclusive of all taxes without valves. Carriage 2/-
EXTRA FOR 2 VALVES 30/-
EXTRA FOR ADDITIONAL FELLOWS
DOUBLE HEADPHONES, 21/6 (Postage, 1/-)

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For they are jolly good Fellows

POPULAR WIRELESS

June 16th, 1923.

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

[Every Friday.]

TOPICAL NOTES AND NEWS.

Taxing Aerials.

A "TAX" of £1 has been imposed by the L.C.C. on wireless aerials installed on their Housing Estate, near Catford. On making inquiries, I am told that "officially it is not a tax, but a deposit, returnable to the tenant when the aerial is dispensed with," providing that no damage has been done to the property.

* * *

Well Received.

FROM letters I and the B.B.C. have received, the broadcasting of the "Twelfth Night" was very well received. The B.B.C.'s letters numbered about 400. I have not had time to count mine, but it is a large number.

* * *

Congratulations.

I FEEL sure that our readers will join me in congratulating Miss Kathleen Nesbit for the hard work and the success she made of the production.

* * *

Miss Ellen Terry.

TALKING to Miss Ellen Terry the other day, before she had broadcast, I asked her if she felt nervous. "Yes. And it is strange that I should do so, considering my profession. It is like waiting for the dentist."

* * *

Tears in the Studio.

MANY listeners-in may have heard the break in Miss Ellen Terry's voice when she came to the moving scene of Hubert and Arthur. It was a great effort for Miss Terry, for she acted and delivered her part as if she were on the stage. It was a most touching scene, and the few in the studio were greatly moved.

* * *

Dining with Mrs. Jack London.

AT dinner the other evening Mrs. Jack London, the wife of the famous novelist, told me that she thought broadcasting was "Just fine!" "I would like to have a set," she added, "but I guess I can't travel and listen-in, too."

"Ragtime" for 2 L O.

I AM told by Miss Toni Farrell, the well-known composer of "Ragtime," that she is going to write a song entirely for broadcasting.

"WIRELESS REVIEW AND SCIENCE WEEKLY"—No. 4 out next Tuesday. "Problems of Long-Distance Telephony," by Dr. J. A. Fleming, F.R.S., and a special practical wireless article by Sir Oliver Lodge.

ORDER YOUR COPY NOW!

Search for the "Perfect."

2 L O is still endeavouring to obtain "perfect" transmission, though it is difficult to see exactly where improve-

The Amplion Loud Speaker.

ONE of the most popular loud speakers on the market and one of the most perfect, must be the Amplion. I was in a famous store the other day when a series of comparative loud speaker tests were carried out, and the Amplion scored heavily—over what, I suppose, I must not mention.

* * *

Valves Repaired.

THE Radio and Electrical Supply Co., 29, Paternoster Row, London, E.C. 4, inform me that they can undertake the repair of broken valves and re-exhaustion to any degree of vacuum for 6s. 6d. I think I will send a few of my "derelicts" along to them.

* * *

Long Distance Reception.

OWNERS of multi-valve sets living near a broadcasting station will be pleased to hear that arrangements have been made to close down the various stations for half an hour every evening. This will enable long-distance reception to be carried out without interference.

* * *

"Closing Down."

THE stations will close down for half an hour as follows: 2 L O, 7.30 to 8 p.m.; 2 Z Y and 5 S C, 7.45 to 8.15 p.m.; 5 W A and 5 N O, 8 to 8.30 p.m.; 5 I T, 8.15 to 8.45 p.m.

* * *

The Bar Lightship.

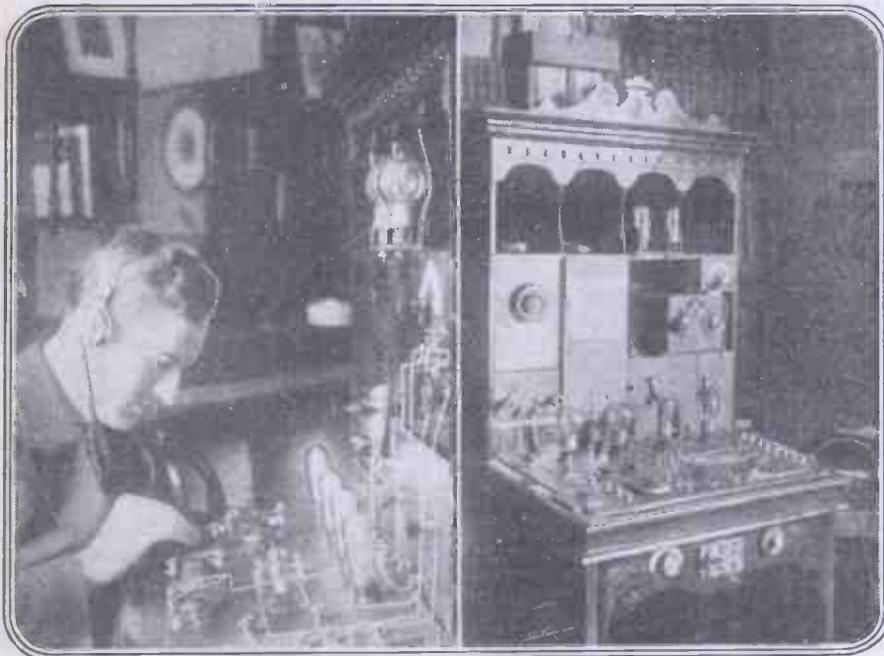
MANY people have been disappointed at not being able to get the Bar Lightship, Liverpool. The reason for this is probably that the power used is only 100 watts, with an effective range of about 40 miles. It is obvious that a higher power installation is not necessary as the distance from the lightship to the harbour is only about 11 miles.

* * *

Automatic "Call-up."

COMMUNICATION is carried on by the Marconi bell system whereby a bell rings at the harbour offices when the lightship is calling, thus working like

(Continued on page 642.)



Mr. L. C. Poole (left), of 16, Market Place, Carnington, Nottingham, operating his efficient receiving station. Right: another view of Mr. Poole's set.

ment is to be made, unless it is in the resonant effects of the studio and perhaps the occasional lisp from the microphone.

* * *

Peculiar Ringing Echo.

PERHAPS the peculiar ringing echo that occurred frequently on Sunday evening was due to some of these tests, though it was not regular enough to suggest that the blanketing had been removed. We could still do with a little less of that "far-away-in-a-field" effect.

NOTES AND NEWS.

(Continued from page 641.)

an ordinary land line telephone. There are no definite times of communication, the lightship calling when necessity arises. The wave-length is 400 metres.

Wireless and St. Dunstan's.

I AM glad to see what a great deal wireless is doing for the blind of St. Dunstan's. Looking through the "St. Dunstan's Review" the other day I was surprised to see that a special part was devoted to wireless, and several letters were printed which had been received from blind ex-soldiers reporting results.

Long Range on Crystal.

ONE especially was interesting, that of an ex-soldier, with a crystal set situated at Cirencester, who reported good reception both from the London and the Birmingham broadcasting stations.

Special Children's Stories.

MR. DRAYCOT M. DELL, the famous children's story writer, tells me that he may write special stories for broadcasting, and possibly will tell them himself.

Wireless Medical Advice Free.

ARRANGEMENTS have been made by the Norwegian and Swedish Governments for the transmission of medical advice from the Bergen and the Gothenburg Radio Stations gratis in cases of sickness or accident on board ship.

The Devil's Wireless.

SOME time ago the Admiralty established a wireless station on the island of St. Kilda, so that the islanders could communicate with the mainland in case of stormy weather, but the set has never been used. With good old-time fear of the devil and all his machinations they refuse to seek help by wireless.

Wireless at Bleak House.

DURING a visit to Broadstairs I noticed that a wireless set had been installed at Bleak House, made famous by Dickens years ago.

A New Opera.

I AM interested to learn that an opera from the pen of one of our leading English composers, Dr. Ethel Smyth, is to be broadcast on June 22nd. It is called "Fête Galante," and was produced in

Birmingham on June 4th, where it met with an enthusiastic reception.

Further Items.

ON June 18th part of the "Merchant of Venice" is to be broadcast from 2 L O, and on July 11th, from 8 to 9, we shall be able to listen to the last dress rehearsal of the great Handel Festival, which is taking place at the Crystal Palace. Quite an orgy of good things to look forward to!

Wireless in Summertime Competition

The £5 prize in connection with this competition has been awarded to Mr. P. Gibson, of 14, Alexandra Road, Stockton Heath, Warrington, to whom a cheque for that amount has been forwarded. The details of his entry appeared on page 632 in the last issue of "Popular Wireless."

The Heart of a Receiver.

THE telephones are the heart of any receiver, crystal or valve, and for really first-class results they must be first-class themselves—not just anything of 120, 2,000 or 4,000 ohms.

Send for Particulars.

MESSRS. The British L.M. Ericsson Mfg. Co., Ltd., International Buildings, 67-73, Kingsway, will be very pleased to forward all particulars to all interested in telephone efficiency.

Mr. Edgar Wallace.

TALKING to Mr. Edgar Wallace, the famous journalist and author, he told me, in regard to broadcasting and copyright, that in his opinion the opposition was ridiculous, and that broadcasting is the finest publicity one could have.

Carmen Dale.

THE other night I was listening to Miss Carmen Dale singing in the London Broadcasting Station Studio, and was surprised at the nervousness she displayed. On inquiring the reason, she said, "I can't see my audience, and I am always nervous if I am afraid that I am not singing just right."

2 L Q's "Jam Jar."

2 L O have changed their microphone again. In the place of our old friend the "sugar box," there now stands a much smaller erection, consisting of one cylinder only, and known as the "jam jar." It was established a few days ago, and has been a great success.

B.B.C. Critics.

I DO not think the "attack on the Shakespeare night" in a certain weekly paper was quite deserved. Though it may have been open to criticism as regards "acting," it cannot be fairly compared with the stage representations. Wireless is still young, and will do a lot yet, and I for one am glad I do not live in a more "peaceful" age.

A Special H.F. Valve.

IT is always best to choose your valve to suit the purpose for which you want it, and the new Cossor valve, made specially for H.F. amplification, should be in great demand in this respect.

Not Officially Approved.

A COUNTRY correspondent tells me that he can hear 2 L O quite well on a crystal set by clipping his aerial terminal to the earpiece rest of the telephone. The ordinary earth is used, but the aerial, of course, consists of the 'phone lines. It is not a "stunt" however, that is likely to meet with the P.M.G.'s approval.

ARIEL.



Off for a wireless picnic. Some Glasgow youngsters transporting their wireless gear to the countryside.

Must be Comfortable.

THEY must be sensitive, they must give strong signals in their full strength, they must reproduce broadcast programmes in all their volume and purity, they must withal be robust and comfortable.

In Peace and War.

WITH all these essentials of a good telephone, the famous "Ericsson" make comply. In pre-war days the Navy used them, during the war the R.A.F., and in these more peaceful days of broadcast and transatlantic telephony they still carry their message of efficiency to the ever-widening circle of listeners-in.

REPRODUCTION OF THE PIANOFORTE.

By Dr. N. W. McLACHLAN, M.I.E.E., of the Marconi Research Works, Chelmsford.

In this article Dr. McLachlan deals with a very interesting source of distortion. It will be remembered that in order to obtain efficient transmission of pianoforte music the B.B.C. introduced their now famous "machine gun" microphone. This instrument consists of several independent microphones arranged in such a manner that reproduction of both high and low notes with the greatest of efficiency is possible. Readers who listened-in to 2 L O during the time when only the one suspended microphone was employed, will be able to appreciate the vast improvement obtained since the introduction of the new form of transmitter, more especially in respect of the pianoforte.

TO everyone who has attempted pianoforte reproduction, whether on the gramophone or for broadcasting, the inherent difficulties have been patent. It is the purpose of this article to investigate the reason why the piano is so difficult to reproduce accurately. We are not concerned with the intrinsic quality of any particular pianoforte, although it is of interest to mention that this depends on the design and material used for the sound-board, its seasoning, the diameter, length, and material of the strings, the shape and material of the hammer point, the mass of same, the duration of contact and the force of the blow—the two latter factors controlling the amplitude of vibration of the string—the striking distance of the hammer from the end of the wire, and the design of the framework generally.

A. Comparison.

From the dynamics of the instrument it is easy to see that pianoforte music is of the percussive type. When the wires are struck by the hammer, the sound reaches its maximum intensity very rapidly, and therefore the initial increment or rate at which the sound grows is very large. If the sound is prolonged by holding down the key, it dies away gradually, unless, of course, the sustaining pedal is employed; but the decrement is small in comparison with the increment.

During the complete cycle of operations there is no period during which the sound is of uniform intensity—i.e. there is no steady state, so that we are really dealing with a transient state, or one which is changing continuously. With a violin the greater portion of a note is of a steady nature, although the initial and final periods are highly damped. In pizzicato playing, the percussive effect obtains, but it is not so violent as in the case of a pianoforte.

There is also a transient effect in violin playing when increasing or decreasing the intensity. When this is gradual, the transient or impulsive effect is small, and when sudden, the effect in the reproducer is masked by the steady tone which follows. A comparison can be made between spark and continuous wave transmission on the one hand, and between the pianoforte and the violin on the other. The spark is electrically impulsive or percussive, whereas the greater part of continuous wave transmission is steady, there being the usual growth and decay periods.

Characteristic Tonal Quality.

The peculiar timbre or characteristic tonal quality of a musical instrument is due to (a) the relative intensity of the overtones to the fundamental—(b) the number of overtones present and their frequency relation to the fundamental—i.e. whether the series is harmonic or enharmonic; (c) whether the instrument is of the percussive, bowed or

wind type; (d) the value of the increment and decrement at the beginning and end of a sound—in a word, the damping of the instrument.

The discriminating tonal quality of various classes of instrument is independent of the relative phase relationships of the different tones in a musical sound, but variations in quality of instruments of a particular class depend to a certain extent on phase. The question of overtones is of great interest scientifically, and it may not be out of place to cite a case from the writer's experience.

One of the copper loaded strings in the author's pianoforte was broken and replaced by another string. It was impossible to bring the two strings into tune, beats always being produced. On examining the string, the new copper loading wire was found to be of different diameter from that of the unbroken string. Moreover, although the unisons or fundamental notes of the strings were in tune, the overtones were not, and gave beats. This seems to show that the overtones in a loaded pianoforte string do not form a strictly harmonic series—that is, they are not 2, 3, 4, etc., times the frequency of the fundamental or unison.

Peculiar Acoustic Effects.

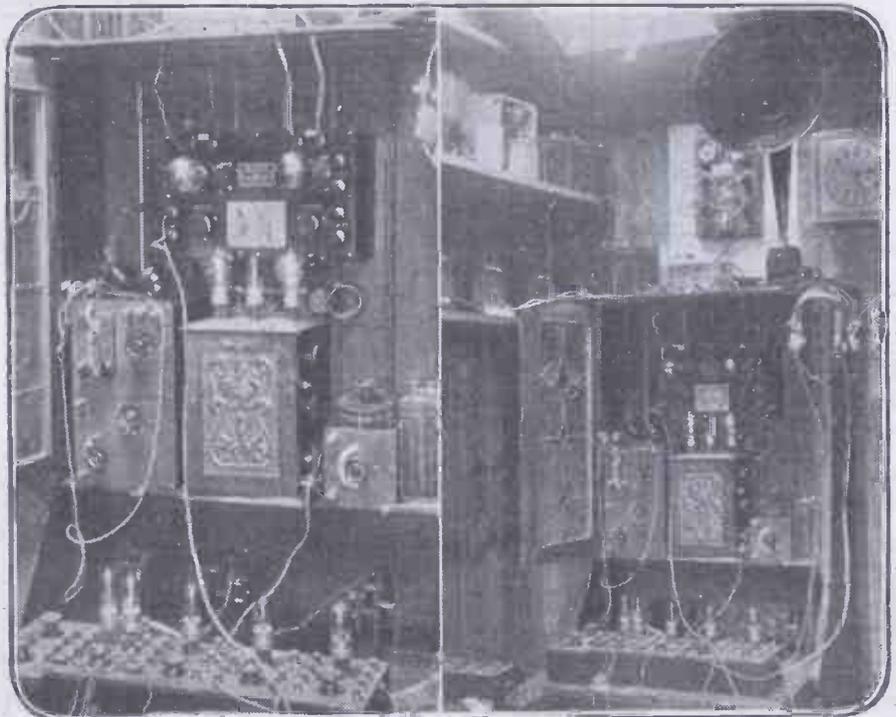
The shortcomings of ordinary vibrational systems used for acoustic reproduction have already been set forth in detail in POPULAR

WIRELESS (see No. 53). Moreover, all the deleterious effects mentioned in that article occur when the diaphragm of the microphone—unless, of course, it is of special design—is subjected to the impulsive music of a pianoforte. With the ordinary carbon granule microphones the acoustic effects are peculiar.

Selective Properties of Diaphragms.

The diaphragm executes its own enharmonic series of natural vibrations—i.e. they are not in the ratio 1, 2, 3, 4, etc., with the forced acoustic vibration due to the particular tones from the pianoforte superposed, and the effect on the whole appears to be much more highly damped than the actual sound. The result is the production of oscillations of different amplitude, frequency and damping from the original musical sounds.

Owing to the selective properties of a diaphragm (resonance effect), the important upper partials of a note in the upper register (treble) which determine the characteristics of the instrument are deleted, as are the fundamentals in the bass. When a series of notes (chord) is struck simultaneously, the diaphragm is bewildered and the combination tones created are aurally unpleasant, and yield the well-known banjo effect. In order to secure good pianoforte reproduction, it is essential to use special forms of microphone.



The experimental station assembled by Mr. L. C. Solomon, of Clovelly, St Anne's Rd., Faversham, Kent.

BIRMINGHAM'S MELODY MAN.

In this interview a special POPULAR WIRELESS representative obtains some very valuable and interesting information from 5 I T'S musical director on the subject of "radio-itis" or wireless stage fright.

WHEN I visited the studio at Witton—an outer district of Birmingham where the Birmingham broadcasting station has found a temporary home—I was introduced first to Mr. Percy Edgar, the director, and it seemed that I had timed my visit well.

In the artistes' room, or waiting-room, I found the members of a male voice choir as well as several soloists, and not one of them had previously had the experience of performing for broadcasting, of singing their best and most popular numbers to an unscen and unknown audience. They were comparing impressions, and it was interesting to note that scarcely one of them was fully satisfied with the ordeal, though, of course, everyone enjoyed it from the point of view of novelty. One or two members of the male voice choir agreed that it seemed more formidable than that of singing in competition at an Eisteddfod to an audience of many thousands.

But my impression was gained only from those who actually described their experiences, and since it was rather a difficult kind of interview it is possible that there were some of them for whom the realisation of the magic of wireless had coloured the imagination, and who, as they sang, had seen, if only in the mind's eye, the drawing-room in some far-off village in which a family listened-in.

I mentioned this point to Mr. Edgar, and he related his own first broadcast experience to me. An entertainer for many years, well known and popular throughout the Midlands, when he gave his first wireless number probably it was easy for him to feel that his audience was there, even if he could not see it.

"I knew they were there. I enjoyed it. Before I had been transmitting a minute I could see my audience smiling. 'Tis true I found myself waiting for the actual laugh at first, and I find myself waiting for it now. Of course, it is there, and even if it does not reach me that night, it has been known to reach here by a post during the next day or so.

Humorists Affected Most.

"The main point for a successful wireless item," he observed, "is for the artiste to realise that audience. It is somewhat difficult at first. In a measure the conditions of the studio are against him. He stands on a little platform before a little cup-like microphone. The heavy draperies, and the thick carpet, the emptiness of the studio cause embarrassment. The effect of 'damping' is to get out all resonance and make the artiste feel as if the voice is not carrying as it should do, and thus they endeavour to pierce their way through it. In fact," added Mr. Edgar, "I have noticed beads of perspiration on their foreheads from their exertion towards that end."

Mr. Edgar's remark was an interesting corollary of an observation which had been made to me a few minutes previously by a

baritone who had just sung his first radio item and was endeavouring to analyse his impression.

"I think if I sang here a great deal," he said, "I should become a tenor. I could not get the notes off my chest. There was no vibration in them at all."

"What class of artiste is most affected by the studio conditions?" I asked the Melody Man.

"Well, I think it is the humorist who suffers most. He, more than any other, expects something from his audience. He wants some sign of interest, he wants to know that his jokes and his manner are getting to them. He expects to hear them laugh. Here he sings his most popular number into the microphone, and when he comes to his patter he speaks across the mouth. When he comes to the point, which never before has failed to incite a laugh he naturally waits for it. Nothing



The set constructed by Mr. L. W. Gandell, of 43, Grosvenor Park Road, Walthamstow.

happens. There is a deadly silence, and most probably a cold shudder runs down his back.

Alleviating Conditions.

"There, you see, to be really successful as a radio artiste you have to imagine that audience. You have to see it listening to you. Towards that end Mr. Thompson and I have tried to produce, as far as possible, the actual conditions of the stage. In fact, I have wondered whether it would not be helped by building a miniature stage, so that the artistes could feel more at home."

"Why not hang a representation of a crowded auditorium behind the microphone?" I suggested boldly.

He laughed.

"Yes, that might be of use," he commented. "But we manage, I think, to suggest it in a measure by following this method. The artiste waits in the ante-room until his turn is due. Then he is admitted and he hears his number being announced. He steps forward, and as he advances we turn on additional lights, giving the idea of the limelights which normally flood the stage. He steps upon the little platform, and starts off."

For a few moments I sat in the studio, and it happened that a humorist was the

artiste occupying this most strange of stages. It was his first experience also, and it was obvious that for the first moment or so he was not at all sure of himself. He stammered, the slightest of stammers it was true, and when he broke into the opening sentence his manner of utterance—short, clipped words—revealed that he was slightly nervous.

When I returned to Mr. Edgar's room to resume our talk I asked him if many artistes exhibited signs of "microphone-funk" or a new kind of stage nerves.

Regarding the Future.

"Indeed they do! The other day, for example, I had a particularly striking case. The performer was a very well-known concert singer. He had been used to singing before large audiences. He sang quite well, and when we asked him to sign the book, as every artiste is asked to do, he had to wait a few minutes before doing so. He was shaking so much that it was impossible for him to hold a pen, much less write his name. I have seen many of them like that. There is no doubt that there is wireless stage-fright."

"What do you do?"

"Well, I assure them that there is nothing in it, nothing to worry about. I tell them that as soon as they have started I'll slip out and listen-in, and that if everything is all right I will pat them on the back. Of course, I invariably pat them on the back."

The Melody Man went on to speak of Birmingham's future concerts. "We are planning big developments," he said. "The programmes that we are transmitting now are not to be regarded with what we are going to do in the future. We are putting in a permanent orchestra, starting with one of four members and comprising piano, violin, cello, and flute, and they will give selections of everything, varying from dance music to a sound classical programme. It will be capable of giving a whole night of chamber music if necessary. In fact, it is my idea to set apart one night a week for a really classical programme, for it has been our experience so far that it is little short of a human impossibility to please everyone, and, therefore, if we set aside certain nights for certain programmes, then those who listen-in will be able to please themselves.

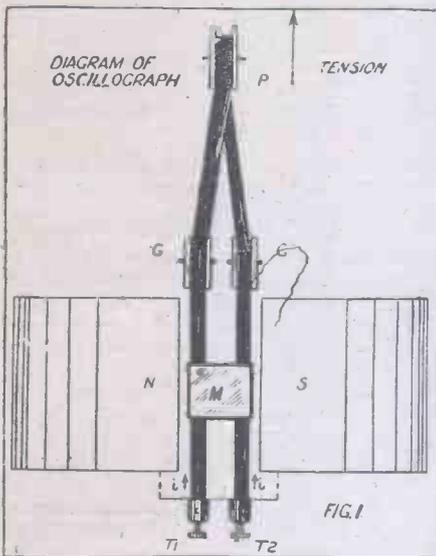
Mr. Edgar's Ambition.

"In addition to instrumental and vocal musical programmes, we also intend to include talks on educational subjects such as literature and a number of other subjects of general interest to the community. And when any public men are passing this way we hope to get them to break their journey and to give a talk. It is my ambition," he concluded, "to provide and maintain something that will even surpass 2 L.O."

PHOTOGRAPHING ELECTRICITY.

The taking of oscillograms is an extremely interesting operation, and one that all amateurs desirous of obtaining a clear conception of what happens in an electrical circuit under certain conditions, should attempt.

OHM'S law states that the current in any circuit multiplied by a constant number is equal to the potential difference applied. The constant number is commonly called the "resistance" of the circuit, and is different for different circuits. In symbols the statement is $E=RI$, where E is the potential difference, the I resultant current, and R the resistance. Now this is only true when E is steady, such as the pressure at the terminals of a battery. E may vary periodically—that is, it may go through a recurring series of similar values in similar intervals of time, as does the current in a circuit under an alternating potential, or it may vary continuously, as does the current in a telephone circuit.



In either case it is of importance for the correct design of the circuit to know exactly how the current is varying under the changing potential. The rate of change of current at any instant of time may often be calculated mathematically, but the actual variations of current can be photographed with a modification of the kinematograph camera by means of the Oscillograph.

The Oscillograph.

The instrument is shown diagrammatically in Fig. 1. NS, the field magnet, is a circular ring of steel, square in cross-section, from which a narrow gap has been cut away to form a pair of poles, between which a strong magnetic flux passes on magnetisation. The ring may be wound with a magnetising winding, but is often simply a permanent magnet. Suspended in the gap between the poles is the moving part or "vibrator," consisting of a very fine flat strip of phosphor bronze, doubled over the ivory pulley P, and fixed at each end at the terminals T1, T2. The strip also is guided by passing over the grooved pulleys GG.

A very small mirror bridges over between each leg of the strip. Tension is put on the loop by means of a graduated spring attached to P. Now consider a small current flowing from T1, through the loop, to T2. In the left leg attached to T1, the direction of the current is upwards, and at right angles to the flux passing between the poles. By applying one of the "finger" rules it will be seen that the effect is to cause this leg to advance in a direction upwards at right angles to the plane of the paper. Since the current coming down the other leg of the loop to T2 is in the opposite direction, this leg tends to recede. The total effect is to cause the small mirror to rotate through a small vertical angle. The instrument is a modification of the suspended coil galvanometer, the strip taking the place of the moving coil.

In the oscillograph the magnetic field is comparatively very much more intense than in the galvanometer, and the re-resistance of the vibrator to torsion is much greater than that of the coil suspensions, whilst in comparison with the moving coil, its inertia is almost negligible. Further, as in the analogous oscillatory circuits, oscillations are prevented by the introduction of a certain amount of pure resistance, and finally the whole movement is immersed in that viscous liquid, castor oil. The instrument is then quite dead-beat.

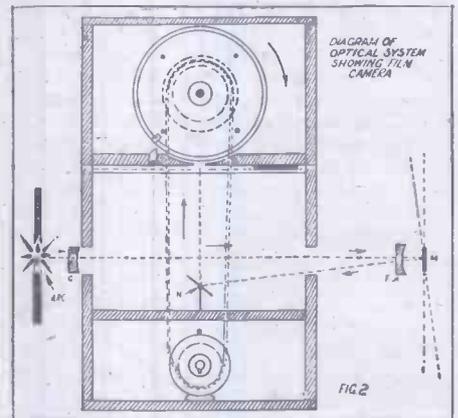
Measuring the Current.

When a varying current is passed through the strip, the deflection of the mirror is a measure at any instant of the current. By focusing a beam of light on the little mirror, the beam can be used as an index, and made to give an image on a screen. If the position of the spot of light be marked at the zero position, on applying a current to

the strip the vibration of the mirror about a vertical axis will cause the spot of light to move along a horizontal line, through the zero point, the displacement from zero being the amplitude. The eye, in general, cannot detect variations in amplitude as these occur, but photographs are easily obtained using ordinary cinema film.

The "Kinematograph" Camera.

To obtain a graph of the variations, that is the wave form, with respect to time, it is necessary to move the film in a direction at right angles to the direction of the to-and-fro movement of the spot of light. Fig. 2 shows the optical system of the oscillograph and camera. The source of light is an arc, the rays of light from which are focused into an intense ray on the mirror M, by the condenser C.M. being set at a small angle to the vertical plane reflects the ray slightly downwards, as shown, through the lens F to

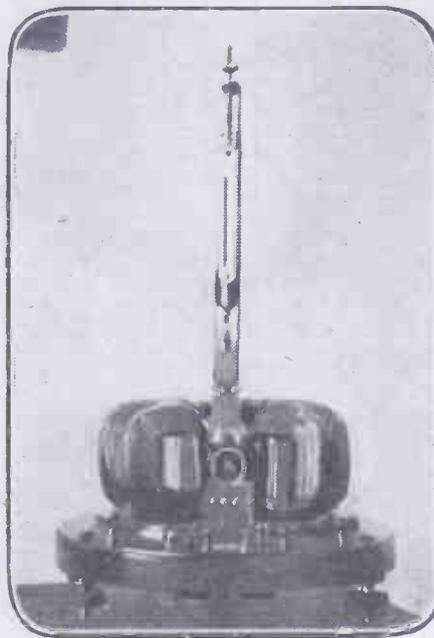


the mirror N. The focal length of F is such as to give a sharp image on the film. The mirror N simply serves to throw the ray upwards, where it is usually convenient to have the camera. The film rolled on a spool in the camera is driven past the aperture with uniform speed by means of a toothed sprocket engaging in its perforations. Another spool is designed to take up the exposed film which has passed the aperture.

A Simple Camera.

For a great many purposes a record of from one to two feet is sufficient, and the camera shown in Fig. 2 is of a much simpler construction. The one used by the writer takes 15 inches of film. It consists of a light-proof box containing a wooden drum, wide enough to hold the film, and mounted centrally on a steel shaft. The bearings are gun-metal bushes fixed suitably in opposite sides of the box. A pulley is attached to the spindle for driving purposes, which may be effected by means of a spring belt from a small motor, geared down to a suitable speed. The aperture is a slit in the bottom of the box, parallel to the shaft and opposite the lowest part of the drum. A shutter arrangement, which need not be described in

(Continued on page 646).



The Duddell Oscillograph.

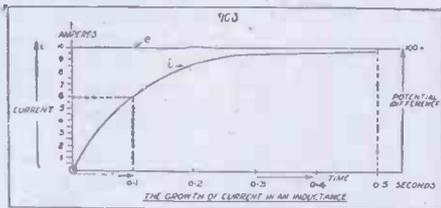
PHOTOGRAPHING ELECTRICITY.

(Continued from page 645.)

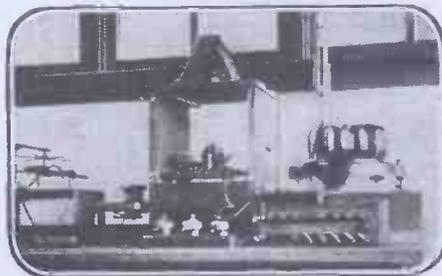
detail, opened the aperture at the start of the record, and closed it on completion. The film was fastened along the periphery of the drum, one side of the box being removable for this purpose.

The Use of the Instrument.

The taking of oscillograms is a peculiarly fascinating study. Two vibrators (or even more) may be used in the same instrument, when films of current and voltage may be taken simultaneously, and so we can actually see what is happening in a circuit at any instant of time. Suppose a steady voltage



of 100 volts be applied to a circuit of resistance 10 ohms, then by Ohm's law the current flowing will be 10 amperes. Now, suppose also that the circuit's inductance is 1 henry, what will be the effect of applying 100 volts to it in this case? Fig. 3 shows the oscillogram. From it we see that it takes approximately $\frac{1}{6}$ second for the current to reach the value of 10 amperes. (Mathematically speaking the current never actually reaches 10 amperes.) After T seconds the current has attained 0.632, or roughly $\frac{2}{3}$ of its final value. The time T is called the "time constant" of the circuit, and is in this case $\frac{1}{10}$ second. It is of interest to note that T is equal to L/R, so that by taking the oscillogram, we could



This photograph shows the apparatus employed in conducting the experiments described in this article.

have found the ratio L/R, or, knowing R, the inductance L could have been determined.

Some Typical Results Obtained.

This record gives the conception of inductance as an inertia, or, as it is sometimes called, a "fly-wheel" effect. The time $\frac{1}{2}$ second may also be thought of as the time required for the inductance to build up its magnetic field to a steady value. As long as the magnetic field is increasing a counter E.M.F. is induced in the coil which tends to oppose an increase of current in it. A clear conception of inductance and capacity is essential for all intelligent wireless work, and this is best obtained by looking at their effects from as many standpoints as possible.

Fig. 4 shows the waves of voltage and current in an A.C. arc circuit, and Fig. 5 shows the effect on the wave forms of the addition of a certain capacity. Resonance is produced with a current wave whose frequency is 15 times that of the fundamental, that is, with the 15th harmonic.

Investigation of Distortion Effects.

Where transformers have iron cores, such as intervalve or telephone transformers, if not properly designed, great distortion of the current wave form may be produced. Fig. 6 shows an oscillogram of the distortion produced by a small core-type transformer worked at a high flux density. The form of the wave supplied to it was a smooth sine-shaped one. The distorted wave gives a good idea of the resultant of a fundamental and third harmonic. The oscillograph has been of great value in the construction of telephones which distort speech and sounds least, and the distortion due to the telephone receiver can readily be seen. The distortion is of course partly mechanical, but this gives a quality test for telephones. Fig. 7 is an oscillogram of the vowel sound \bar{o} , and Fig. 8 one for $\bar{e}\bar{e}$. The vowels are true musical notes, the waves repeating themselves regularly,

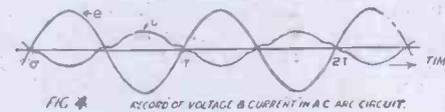


FIG. 4 RECORD OF VOLTAGE & CURRENT IN A.C. ARC CIRCUIT.

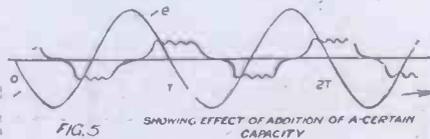


FIG. 5 SHOWING EFFECT OF ADDITION OF A CERTAIN CAPACITY

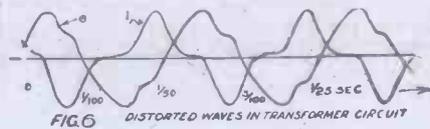


FIG. 6 DISTORTED WAVES IN TRANSFORMER CIRCUIT

with the same frequency as they would if sung. The amplitude of Fig. 7 is steady, but Fig. 8 is increasing in loudness. As a last illustration, Fig. 9 shows ripples superimposed on the steady voltage wave of a D.C. generator supplying a distributing system. The ripples are due to the effect of armature teeth on the flux distribution within the machine. Note the resemblance to the vowel sounds in Figs. 7 and 8. This is one reason why the D.C. mains cannot be used for the plate circuit of a thermionic valve.

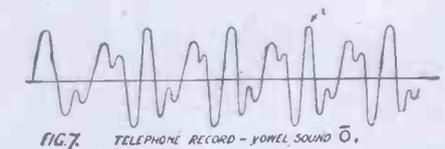


FIG. 7 TELEPHONE RECORD - VOWEL SOUND \bar{o} .

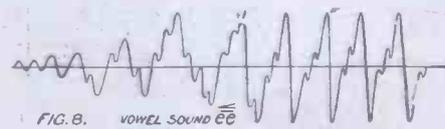


FIG. 8 VOWEL SOUND $\bar{e}\bar{e}$

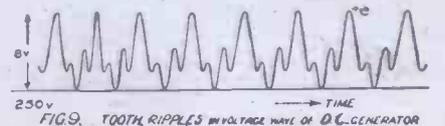


FIG. 9 TOOTH RIPPLES IN VOLTAGE WAVE OF D.C. GENERATOR

CONSTRUCTION OF THE TRANSMITTER.

SINCE broadcasting commenced, hundreds of amateurs have taken up wireless for experiment and research, and possess transmitting and experimental licences.

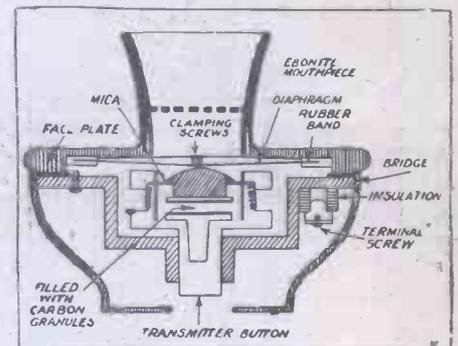
Naturally every amateur wants to understand the fundamental principles of his hobby, and the detailed action of every instrument that he employs.

The transmitter, commonly known as the solid back transmitter, has a button whose vibrating side is clamped to a light diaphragm.

Construction of the Microphone.

The mouthpiece is of a very hard high quality ebonite to withstand rough usage, and is clamped to the face plate by means of a brass bush. The face plate is heavily constructed of solid brass and given a plating of copper which is then oxidised. The back case is similarly finished.

The bridge is a brass forging, heavily made to support the transmitter button rigidly, and is screwed to and insulated from



the face plate—fibre washers and sleeves being utilised. Also mounted on the bridge is a solid insulating block carrying a terminal screw which is connected to the vibrating face of the transmitter button.

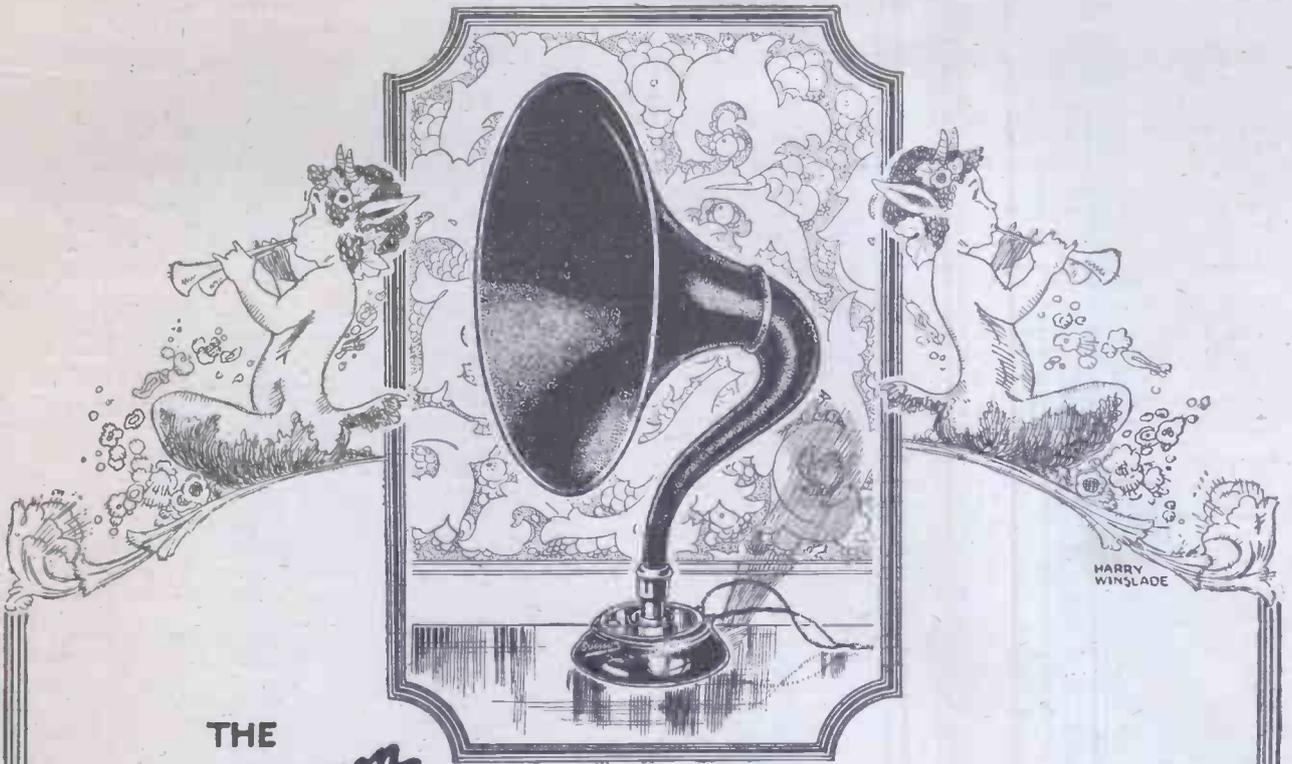
The transmitter button consists of a brass case carrying two carbon electrodes, one mounted on a thin, flexible mica disc and the other built solidly to the back. The intervening space is occupied by about 570 milligrams of granular carbon.

A Useful Tip.

The diaphragm (2.5 in. diameter) is securely clamped to the electrode mounted on a mica disc and locknut. It is made of sheet aluminium 5 mm. thick, and varnished black on one side.

A circular hole, 0.0935 in. diameter, is punched in its centre to accommodate the clamping screw. A rubber band is fitted over the edge to insulate it from the face plate of the transmitter. The outer edge is clamped by means of two steel solid springs bearing rubber tips to which is fastened the pieces of plush.

The ideal working position of the transmitter is found to be about 20 deg. to the vertical.



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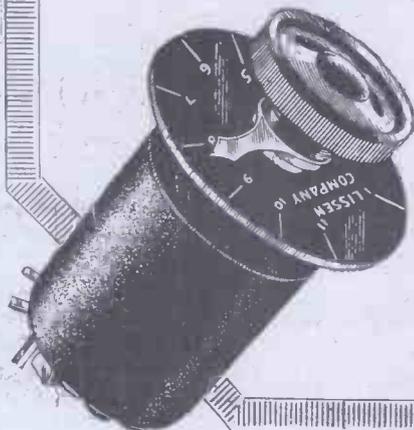
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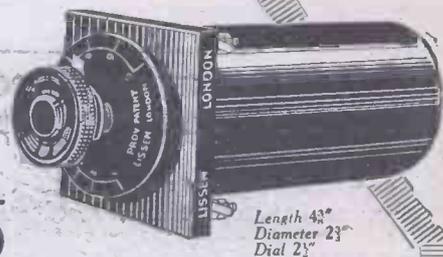
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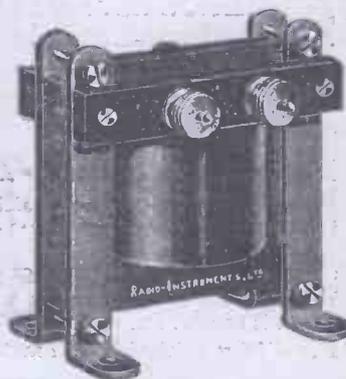
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(E.P.S. 59)

SIMPLIFIED POWER AMPLIFICATION.

By CAPTAIN IAN FRASER, C.B.E.

Almost any audio-frequency circuit can be styled a "power" amplifier when excessive H.T. voltage is employed, but the efficient "power" amplifying circuit must be so arranged that it is capable of SAFELY standing the increased pressure. This article clearly shows how this can be arranged in a comparatively simple manner.

I GATHER from conversations with a number of amateurs who have not reached a very advanced stage in their experiments with Wireless Telephone Receivers, that the words "power amplification" convey to them the idea of something rather difficult and requiring much apparatus, additional to the note-magnifying units they already possess. This is an erroneous idea, as I hope to show by a brief description of experiments I have carried out in this subject.

Increasing the H.T.

The phrase "power amplification" usually refers to amplification of audio-frequency currents, and is affected with apparatus which is similar in design to ordinary note-magnifiers. The power amplifier is in fact a note magnifier in which are employed valves and transformers capable of standing a higher potential in the plate circuit than is normally used.

I possess a three-valve unit, supplied by one of the leading firms, constructed for R. type valves, using one as a detector and two as note magnifiers. I started my experiments in power amplification by merely increasing the potential on the plates of the two R. valves being used as low frequency magnifiers. I found that a pressure of about 140 volts gave the best

results, and if this figure was exceeded no greater amplification was obtained, but in fact the quality of the reproduction appeared to be prejudiced. I should not advise experimenters to employ so large a voltage on ordinary R. valves, for to accommodate the valve to this potential it is necessary to increase the filament brilliancy beyond that for which the lamp is constructed, and though this does not appear to do the valves any harm it very materially affects their length of life.

In this same experiment I went up to as high a figure as 240 volts, and finding that the transformer, which of normal though extremely good construction, would stand this abnormal strain without any appreciable effect, I utilised it for my next experiment.

Excellent Results Obtained.

I obtained two T.15 valves, and applied to their plates a pressure of 300 volts. This greatly increased amplification, but brought with it a certain amount of distortion. I then took out both transformers, and removed those parts of the soft iron windings which were surrounding the copper windings, leaving only the iron core through the centre of the former. As would be expected amplification was slightly reduced, but the improvement in tone and quality

was most marked. The removal of the iron had another advantage which was to lower the impedance of the transformers, and thus bring them into closer sympathy with the T.15 valves, which have a lower impedance than the R. valve. Later this result was slightly improved by replacing the second transformer from which the iron had been removed, by a much larger coil such as those utilised in the construction of the Magnavox power amplifier. This transformer is of the one to one type—that is to say, the primary and secondary are wound with the same wire and the same amount of wire. Incidentally the two wires are wound on to the "former" together, which provides a much tighter coupling than is obtained when the primary is wound on first, and the secondary is superimposed upon it.

I have utilised this combination for a considerable time and can recommend it as

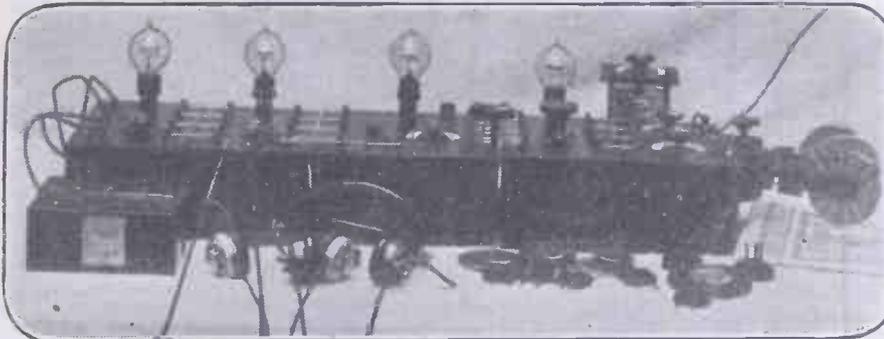
them, or perhaps both, cause a variation, which usually has an audible frequency, to be passed through the secondary of the first transformer in the amplifying unit. Coming thus into the grid circuit of the last power valve the amplitude of this audio-frequency current is immensely magnified, with the distressing result I have referred to. Much can be done to minimise this ripple by the use of high capacity condensers and choke coils placed respectively across and in the main leads before they are connected up in the plate circuits, but my experience showed that it was not a convenient or practicable proposition. Six microfarads, and as much inductance as I could provide from secondaries of old inductance coils, etc., etc., do not cure the evil.

Transformer Connections.

I then adopted the expedient of running my detector and first note-magnifier with 100 volts in the plate circuit, and utilising the T.15 valve as the last note magnifier with the 240 volt d.c. main in its plate circuit. With this combination only a two microfarads condenser across the main was required to give almost perfect freedom from ripple. The explanation of this is that the variation in the current from the main is relatively small, and produces but little effect when it is in the output circuit of the last valve, a very different proposition from that first explained, when being introduced in the output circuit of the first note-magnifying valve it was energising the grid of the second valve and causing greatly increased variations in the plate circuit in which the telephones are included.

This final arrangement I use constantly. The results are not quite so good as those obtained by the use of two T.15 valves and the dry batteries, but I prefer it because of the fact that it dispenses with large dry batteries which, for constant working, are a source of trouble.

Some beginners are apt to be careless about the way in which they connect up transformers. When the secondary is superimposed upon the primary it is most important to see that the inner and outer leads of the primaries and secondaries are properly connected. The outer lead from a primary winding should be connected to the plate of the valve which precedes it, and the outer of a secondary winding should be connected to the grid of the valve which follows it. When high degrees of amplification are used the effect of wrongly connected transformers, particularly in the case of the secondary winding, is most marked, a noticeable diminution in signal strength being at once observed.



An experimental 4-valve set constructed by Mr. C. W. Beardon, 31, Brookfield Avenue, Walthamstow, E.17.

an easy and inexpensive method of converting a double note-magnifier into a power amplifier for use with a large loud speaker. I might mention that with this unit I have on more than one occasion given a demonstration to an audience of between 75 and 100 people, in a large hall.

Using D.C. Main Supplies.

There is available at my station 240 volts direct current from the municipal mains. The inconvenience of using 300 volts provided by dry batteries and the deterioration of these batteries when a relatively heavy current such as that taken by two T.15 valves is required, led to my investigating the possibility of utilising the main. The beginner may imagine that a direct current from a municipal main would be extremely suitable for the purpose, but he will be disappointed, for immediately he connects up he will hear a roar not unlike the distant sound of an aeroplane. At least this was my experience. It is caused by the fact that though the current is often called "continuous," it is, in fact, caused by a number of impulses following each other in rapid succession, as the brushes on the big generator pick up the current from the swiftly revolving commutators. These impulses themselves, or small surges in the voltage resulting from

WIRELESS IN NORTHERN IRELAND.

By T. P. ALLEN, B.Sc.

IN Ulster there is an ever-growing interest in wireless matters, and were it not for the restrictions placed upon amateurs by the Government, I should say that the Ulster district would be successful in experimental work. As things are now, no transmissions are permitted, and, to my knowledge, only one experimental transmitting licence has been issued (a temporary one for six months), while the aerial used has to be a frame aerial and not exceed one foot square. Such severe restrictions only penalise the genuine experimenter.

For experimental receiving or "broadcasting" sets, one must first have the permission of the Home authorities, and after that the actual licence must be obtained; a lengthy process.

Room for Improvement.

A large number of local people have been refused permission to have even a "broadcasting" licence, although the most unintelligent novice knows how harmless the B.B.C. set is. But despite these petty troubles, those of us who have been fortunate enough to obtain licences have been getting results. Glasgow's is, of course, the strongest transmission in this area; and several people, one a Belfast man, claim to be able to hear this station on a crystal set, while it certainly can be heard on one-valve without reaction. Two valves, 1 H.F. with reaction on anode, bring in the station quite comfortably on the headphones, and an extra valve as a note magnifier will work a loud speaker and give a fair volume of sound. The programmes given by 5 S C are very good, but two little defects strike the listener-in. Firstly, the announcer speaks a little too quickly, and secondly, the generator hum, or so I take it to be, is very prominent. This hum is so unmistakable that I can tune in the Scotch station by the hum when no speech is available.

The children's stories in Glasgow might be improved a great deal, if children are really to be interested. After all, children are not at all interested in other people's letters, and they are usually the first of us to notice any change in a person's voice, so I think the operator should speak as he would, and does, to "grown-ups," and not attempt to talk "to the children." I think the stories from the London station are examples of how the children's hour should be conducted.

The Mystery Station.

Manchester still seems to have trouble with its microphone, and most of its words are unintelligible here, although the singing is very good, and also the orchestral transmissions. The 2 Z Y morning transmissions seem to be clearer than the evening ones, and the voice distortion seems to be at its worst when the time signals are being explained.

Newcastle is very clear and distinct, but rather weaker than the others; while Birmingham requires a little extra tuning to get in properly. Cardiff is very good, and the quality of its programmes is excellent. May I congratulate this station on its announcer, whose words are always crisp and clear here, on three valves.

London is a mystery. Usually one cannot get any sort of results from 2 L O until after 9 o'clock in the evening, but then they come in very strongly. The Guards' band, on Tuesday the 1st, was an excellent transmission, and was perfectly clear to me with my 'phones hanging on the wall. Considerable fading is noticeable on 2 L O and seems to affect this station most.

Spark "Jamming."

For a long time, the enjoyment of the broadcasting was marred by the transmissions on spark, from the steamers leaving Belfast at 9 o'clock; but latterly no trouble of this sort has been experienced, though we still suffer a little from the police transmissions.

Eiffel Tower, Radio-Electrique, Königswusterhausen, and the School of Posts and Telegraphs are all quite clearly received on the three-valve set, while several amateurs have received American transmissions.

Representatives of most of the large wireless firms are already covering Ulster, and fine results are being obtained on Marconiphone and Gecophone two-valve sets.

It has been suggested that the B.B.C. should open a relay station in Belfast for the benefit of crystal users, and I hope that something in this line will be accomplished.

CORRESPONDENCE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I would like to warn your readers, per P.W., of a new "wireless" danger. I have found that many people who use single earphones, such as ex-army 'phones, are suffering from artificial deafness in one ear, brought about by the use of single ear-pieces.

I will make an explanation of this curious phenomenon. It is caused in this way:

Most people are naturally more efficient on one side of their bodies than on the other, and this is equally the case with regard to the ears; that is, we can usually hear better with one ear than with the other. Consequently, the enthusiastic owner of a wireless set which has only one single ear-piece naturally uses his more efficient ear.

Now the mind begins to do damage. One cannot keep out sound from the other ear by means of cotton-wool, and most listeners-in will admit that it takes some considerable time for the mind to sift out the signals from the extraneous noises. That mental process is termed "aural inhibition," and it is a surprisingly efficient process. If any reader doubts this, let him recall that much of our modern, first-class music is based on the

fact that our minds can listen to several "planes" of harmony that are unrelated to each other, at the same time, without annoyance or difficulty. This is "aural inhibition," or, as the composer calls it, "horizontal listening."

Therefore, when the mind is listening attentively by one ear only, it automatically deafens the other by inhibition; a state which, if it persists, as it may, becomes a case of nervous deafness, and a source of trouble to the sufferer.

That this is a danger will be borne home to one if he should experience a fright such as I had recently. My friend complained of "funny ears." I diagnosed it as "wireless ear," and about five minutes later he nearly jumped under a motor-cycle, because, as he said, he "misjudged the direction of the horn." For half a minute I cursed all ex-Government single earphones! Yours truly,

J. BARI-WOOLLS.

39, Poole Road, E.9.

To the Editor, POPULAR WIRELESS.

Dear Sir,—It may interest you to know that I receive Cardiff and Birmingham on the Super Crystal Set, the construction of which was recently described in POPULAR WIRELESS. The reception is under quite normal conditions—the aerial used being of the usual twin type, approximately 50 ft. long and about 25 ft. high. I should be pleased to hear if any other reader has ranged this distance.

Yours faithfully,

62, Woodville Road, S. R. DONALDSON.
Golder's Green, N.W. 11.

The Editor, POPULAR WIRELESS.

Sir,—As it seems to be the rule rather than the exception to use 12 or 14-inch inductances as tuners for crystal sets, I should like to suggest the following idea for cutting out the "dead-end effect" generally experienced when using only a small amount of a long inductance.

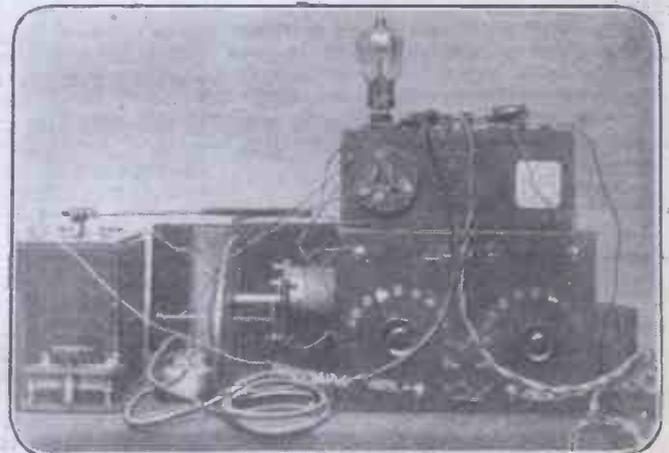
Instead of leaving the end of the winding "dead," as seems to be favoured by most handbooks on the subject, this end should be connected straight to earth, which is in most cases the slider rod, or, in the case of a tapped inductance, the switch arm.

This method has proved highly satisfactory in all cases in which it has been tried by the writer.

I remain, yours faithfully,

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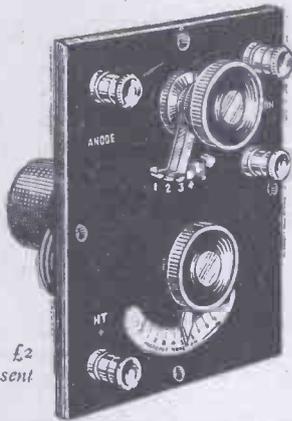
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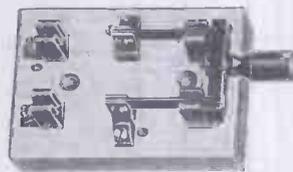
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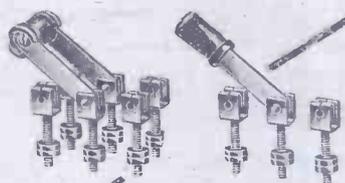
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CONSTRUCTIONAL HINTS.

By H. E. COWLEY.

Some useful words of advice on the subject of the construction of wireless apparatus, more particularly with regard to "finish." This is the factor that renders the "home-made" set professional in appearance; it is quite easily obtainable with a little care, as this article clearly shows.

IT is a waste of money to decide on your circuit and straightway go to the nearest wireless dealer, buy the parts, and positively push them together. An evening spent with a piece of paper and a pencil will save you much after regret and add greatly to your joy when showing the finished instrument to your friends.

After deciding on your circuit take the paper and pencil and arrange all your knobs, switches, terminals, etc., as conveniently as possible; do not cramp them, but at the same time keep them together with the different knobs and switches evenly placed.

An Improved Lathe.

If you intend at some future date to add another unit, keep this in mind and allow accordingly. Decide on the shape of the cabinet, whether you will have a sloping front or one with a lid, or just a plain box. Personally I have found that a sloping front with all tuning switches, and a flat top with the valves or crystal installed upon it, is by far the most convenient and attractive. Make sure that the different parts clear one another; by this I mean that you should notice if the transformer is liable to touch the filament resistance, or whatever it might have near it, and above all make sure that you can, with convenience, make all the necessary connections.

When your design is decided upon in every respect the next thing to do is to buy the necessary materials and commence the actual construction.

If you are not the proud owner of a lathe then you are somewhat held back, but I have found that quite excellent plain turning may be done with the aid of an ordinary hand drilling machine and a few files. Hold the brass or whatever other metal or material you wish to turn, in the chuck, and fix the machine in the vice or on the bench; then with the left hand turn the handle and with the right file the material into the shape required.

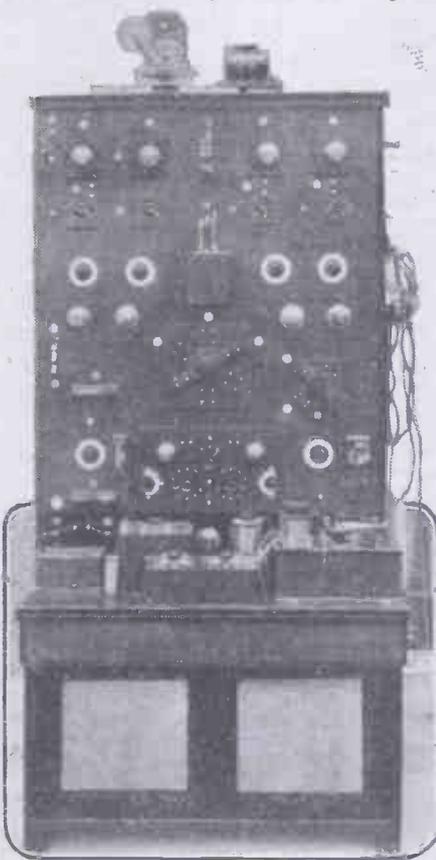
Metal Finishing.

Ebonite may be finished up on its edges by planing with an ordinary wood plane or by filing; if you intend to plane it make sure that the plane iron (or blade) is sharp and not set too coarse, or you will find your ebonite in pieces.

The next thing to be considered is the methods of finishing metals. The best way to make the edges look smart is to draw-file them. This is done by holding a very fine cut file, commonly known as a Swiss file, in both hands, and drawing the file crosswise along the length of the work, a very fine grain finish is the result. There are many ways of finishing metal surfaces, especially brass, three of which I will describe, but one method only should be used on each instrument, as a mixture of different finishes gives a rather poor effect to the completed instrument.

No. 1. *Straight grain.* With a file clean the surface, and then with different grades

of emery-cloth and paper (the emery-cloth gradually getting finer as you obtain a better finish) work the face into a beautiful flat surface, making sure that you keep the "grain" in one direction only. This is best done by obtaining a piece of wood which you can conveniently hold and folding the



The compact and efficient receiving station assembled by Mr. S.G. Freudmache, 58, Calmont Road, Bromley, Kent.

emery-cloth around it and working it backwards and forwards over the work, finishing off with what is known as blue-black emery-paper grade "F."

Curling and Scraping.

No. 2. *Curly grain.* This method is very attractive, although it is only an improvement on No. 1 method. Prepare the surface as in No. 1, making sure that up to this stage all looks well, and then obtain about an inch of round wood—a piece cut from the end of a pencil will do quite well, and on the end of this glue a piece of blue-black emery-paper the same size as the section of the pencil or wood. Put this into the chuck of your drilling machine or lathe, fix the machine in the vice or on the bench, and revolve the chuck and emery pad with the left hand while the right gently presses the work against the pad, and at the same time working circles upon the metal. The

result obtained is an endless whirl of an attractive and pleasing appearance. This idea may be modified by making distinct little circles, each one overlapping the other perfectly evenly and symmetrically over the whole surface.

No. 3. *Scraping.* I think this method is the most attractive of the three, and with practice it may be done as quickly as any method; another advantage is the fact that the surface need not be perfectly flat.

First clean the work and then obtain an old flat file and grind off the teeth from all sides, and on the end grind a very slight radius (this should be on the broad side of the file). Take off the very sharp corners and edges, but only very slightly, the point being that they must cut, yet at the same time not be sharp like a knife. Hold the work in the vice, the handle of the file or scraper in the right hand, and gently pressing the handle of the scraper down on to the work with the left hand, scrape the metal with short forward pushing motions in all directions. When finished a very beautiful light and shade effect is obtained.

Lacquering and Polishing.

A few hints on lacquering will probably be useful.

First obtain some "old gold" cold lacquer and put this into a cup or some receptacle sufficiently large to take the largest item to be lacquered. Warm the article to be treated to about blood heat, and dip it bodily into the lacquer, take it out at once and give it a good shake in order to remove all unnecessary fluid, and stand it on one side to dry. I should state that metals to be treated in this way should be perfectly clean; do not even touch them with the hands, but hold them with clean rag or pliers, or an even better method is to bind them round (in some place where the lacquered surface does not show) with thin wire, the wire then comes in handy for hanging them up to dry.

In the making of the cabinet little can be said here, but the following tips may prove useful.

Before polishing always fill the grain with some wood-filler—whitewash or whitening is quite good for this.

Mahogany polished in its natural state looks very ugly; it should always first be stained to a deep red with "Dragon's Blood."

If you have never tried French polishing before do not start on a well-made cabinet, for quite excellent results are obtained by painting the polish on with a camel-hair brush. Two, or sometimes three coats may be necessary, but as the polish dries very quickly this is no drawback. Use a very wide brush, one inch and a half or two inches will do, and paint the polish on very quickly, not going over the work more than once. The second and third coats can be given after a lapse of an hour or an hour and a half.



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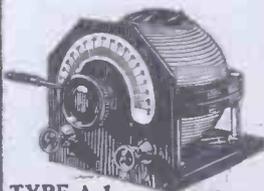
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THE ANTENNA STAR OF EILVESE.

By Dr. A. NEUBURGER, our Berlin Correspondent.

THE curious star we show in our figure can easily give the impression that it is the microphotograph of a "radiolaria," a class of animalcules living in the water, which, as is well known, shows many variations, a good deal of which have the structure of a star. But the star has nothing

to do with the water and is no living being. It is a model of the great aerial of Eilvese, one of the two great German radio stations which entertain the service with America. Commonly you hear only from Nauen, and there are not many people who know that there is a second great radio station in Germany that works with the United States.

Therefore it will be of interest to our readers to hear something about this station, which is less known than Nauen, as it is situated in a kind of desert, where it is difficult to visit it. Eilvese lies on an isle of sand in the great fens of the Lüneburg Moor, very much out of the way. But its situation is a very good one for the purpose of the radio service, as its distance from Berlin, from Hamburg and Bremen, and from the great industrial cities of the Rhine, is nearly the same. Therefore from all sides telegrams can easily be sent to Eilvese by cable.

Two Aerials in One.

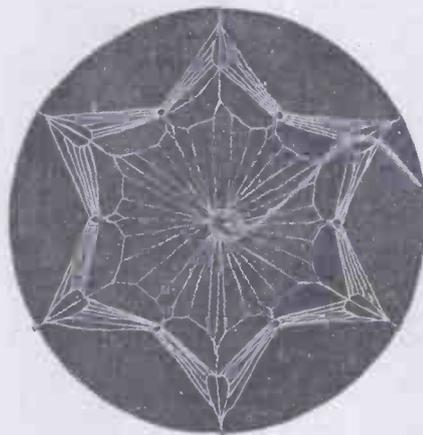
The aerial has, as shown by our star, the form of a double-cone umbrella antenna. The main mast has a height of 250 metres, and is surrounded by six smaller masts, each of which is 120 metres high and stand 460 metres away from the main mast. The aerial itself is composed of an umbrella of 16,000 centimetres capacity, and a second cone or ring arranged round that umbrella with a capacity of 34,700 centimetres. Both aerials are isolated each from the other, and each one has its own connection with the station.

The aim of this arrangement is to gain the possibility of a "duplex service" with different waves. The umbrella aerial works alone for itself with a wave of 9,700 metres, the ring aerial alone with a wave of 14,600 metres. In the first case, the antenna current has a power of 180, in the second case of 250 amperes. It is possible to switch both antennas together by using all

the available high-frequency energy. Then an antenna current of 450 amperes at a wavelength of 14,600 metres can be obtained. As can be seen, the aerial system is easy to survey, and is remarkable by its elasticity and stability.

15,000 Volts.

The power of the station is derived from two generators, though no steam-engines or turbines are used. The current is taken from the water-power station at Döberden, which supplies a three-phase current of 15,000 volts. This is transformed to 5,000 volts, and then the current goes into a 650 PS



How the aerial wire arrangement would look from a point centrally above the main mast.

three-phase motor, which works two continuous current generators of 440 volts 1,000 amperes and 220 volts 240 amperes.

The 220-volt generator serves as exciter for the high-frequency machines, while the 440-volt generator drives the two 184 and 165 kilowatt continuous-current motors, which are directly coupled with one or other of the two high-frequency machines. The rotors of these machines give 3,000 revolutions per minute, so that good cooling is absolutely necessary. For this purpose a special pumping and compressed air installation was built, and the oil for the bearings is cooled in a special way and is made to circulate freely.

The transmitters are tuned for two frequencies of 30,800 and 20,800 periods, corresponding to a wave-length of 9,700 and 14,600 metres. For the moment Eilvese is a transmitting station, while the receiving is carried out at Geltow, near Potsdam.

BOOK REVIEWS.

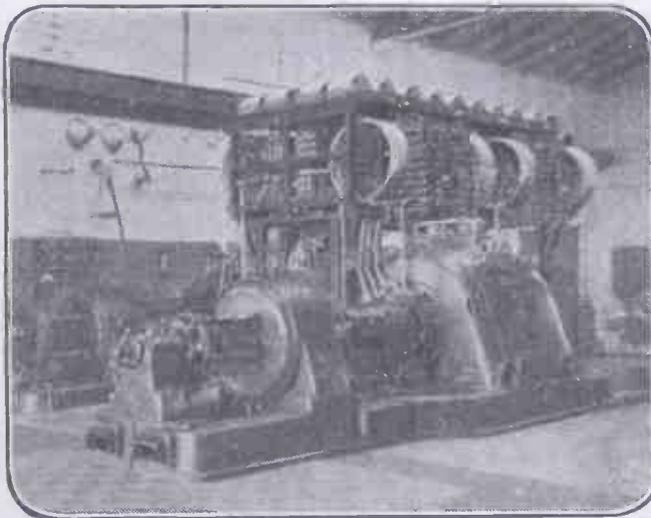
The Wireless Press, Ltd., have just published a new handbook, entitled, "How to Build Amateur Valve Stations," by Philip R. Coursey, B.Sc. (Eng.), A.M.I.E.E. This book, while containing only six chapters, gives full constructional details for making a one, two, or three valve set on the unit system. One chapter is devoted to an explanation of the use of the valve and gives many useful circuits. But perhaps the most useful section of this work is that which contains a complete list of components, together with a description and explanation of each. This chapter contains over forty photographs and other illustrations. A chapter is also given to aerial construction.

* * *
"The Radio Experimenters' Handbook," Part II., by Philip T. Coursey, M.A., B.Sc. (Eng.), F.Inst.P. (The Wireless Press.)

This second edition of Mr. Coursey's book, as is explained in the preface, has been brought out with the intention of keeping pace with recent developments, modifications, and changes in the science of wireless. It is devoted to useful data and actual quantitative design dealing with radio receiving apparatus. Useful chapters are given on tuning coils and the measurements of inductances and on condensers. Calculation of capacity is fully explained, and the two chapters mentioned should be of especial use to our readers. Useful tables are included, and numerous examples of the working out of the various formulæ are given.

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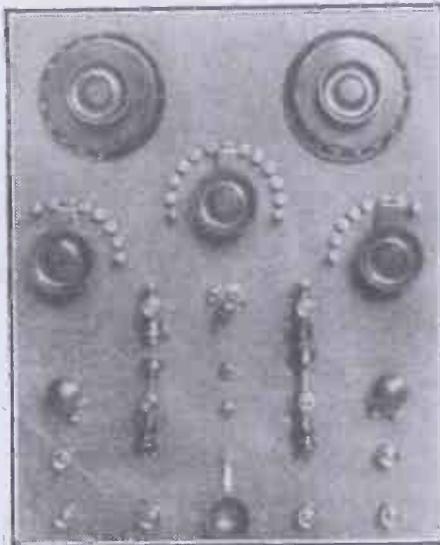
The Goldschmidt high-frequency generator employed at the Eilvese station.

HINTS ON PANEL DRILLING.

Poor panel drilling will spoil the look of any wireless set, and, providing ordinary care is taken, there is no reason why the drilling should not be as good as on any professionally made apparatus, yet this standard of perfection is rarely attained by the amateur. The following hints, describing methods used by the writer, may be of help to amateurs.

PENCILLING on ebonite is a fruitful source of future trouble and is best avoided. Take a sheet of fairly stiff paper the same size as the panel, and mark with a cross the centres of the holes to be drilled, making a note by each to show what size it must be.

The holes should be arranged in such a manner that the knobs, etc., which are to be put on will be as symmetrically placed as

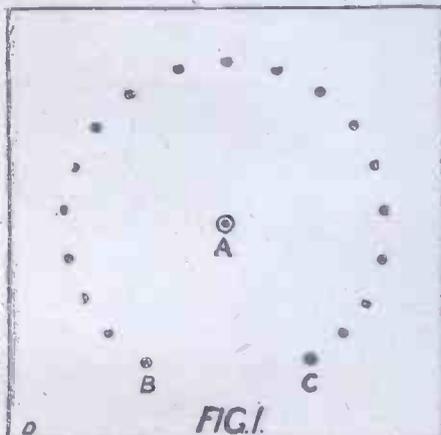


This photograph shows the neat appearance of a panel which is obtained by due attention being paid to symmetry.

possible. If the paper used is graph paper it will help the worker in placing the holes correctly.

The paper is now placed on the panel, which should have been trued up to shape, and, by means of paperweights or other handy objects placed on top of it, the pattern can be kept in its proper position whilst three small holes are drilled through those crosses which are farthest away

Marking Out Positions.



from each other; these holes need only be quite fine, and can be best made with an Archimedean drill such as is used for fretwork.

Now take three drawing-pins, sticking their points into the three holes thus made, the pattern cannot move now without the worker being aware of the fact, and it is an easy matter, should this happen, to replace the pattern in its correct position.

Now drill through the paper at all the points marked sufficiently to make a mark on the ebonite, when this has been done the paper can be removed. The ebonite should now be placed on a flat piece of wood and the holes drilled out the size noted on the pattern, drilling, of course, all holes of a similar size first, then going on to the next.

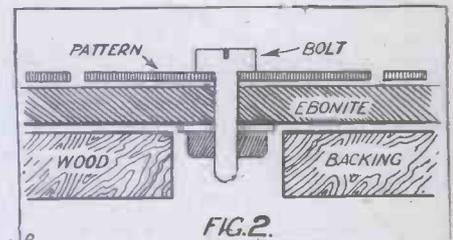
Multi-Stud Switches.

A breast-drill as used for metal drilling makes the cleanest hole, the "bits" used for wood drilling are apt to crack the ebonite and break the edges of the hole. If any of the holes have to be tapped, drill a half-inch hole in the piece of wood used for backing the panel, and place the panel so that the hole to be tapped is concentrically above the hole in the wood. Clamping a panel in a vice, even between wood, for the purpose of drilling a tapping should never be attempted. Any countersinking which is desired can now be done, the panel should then be dusted, and finished by rubbing in vaseline, taking off afterwards all the surplus with a clean rag.

Multi-stud switches seem to cause some workers no small amount of trouble. A very useful pattern was made by the writer out of some sheet aluminium four inches square; a glance at Fig. 1 will give the reader a better idea of this accessory than any written description. Rub the aluminium on one side with fine emery-paper. You will now be able to draw quite easily in pencil, with "A" as the centre, by means of a pair of compasses, the arc of a circle B.C., using a convenient radius. Decide on the spacing of the studs, add this to the diameter of the studs—e.g., with $\frac{1}{4}$ in. studs the spacing will be

$\frac{1}{2}$ in. and the required length $\frac{3}{8}$ in.—and with a pair of compasses mark off on the arc B.C. equidistantly spaced points separated by this distance. Drill these with a 5 B.A. clearance drill, if the studs are 5 B.A., and drill the centre point A out to 2 B.A. clearance, which is the usual size for switch-arm screws.

When using this pattern it is only necessary to mark on the paper the centres of the stud switches. When these are drilled



out to 2 B.A. size, bolt the pattern to the panel by means of a nut and bolt or an old terminal. Place the ebonite flat on a piece of wood which has a hole in it to accommodate the bolt head (see Fig. 2), and drill through the holes in the pattern straight through the ebonite. A final dusting will complete the operation, and the assembly of the set can be commenced.



Mr. Stanley Hilton, of 71, Orlands Street, Bolton, and the 4-valve set that he has assembled.

WELL-KNOWN ARTISTES OF 2 Z Y.

(By OUR MANCHESTER CORRESPONDENT.)

Readers who listen-in to the Manchester Station will appreciate these brief notes of some of the artistes that have broadcast from 2 Z Y. It will bring listeners into closer touch with the performers and thus interest will be still further increased when the artistes again perform.

LOOKING back through the 2 Z Y programmes for the last four months, one is struck by the frequency with which well-known names meet the eye. Probably the first we find is that of that very brilliant soprano, Miss



Miss Agnes Clarke, a most popular 2 Z Y soprano.

Beatrice Sirette, with whom we sympathise in her recent nervous breakdown, which forced her to abandon her professional duties for the time being. Soon after her visit came Reaney Booth, of Australian and New Zealand fame, whose dramatic interpretations one Sunday evening

delighted many listeners-in.

The most famous violinist who has broadcast from 2 Z Y is Miss Isolde Menges, who, with her husband, Mr. Tod Boyd, the composer, has twice been heard from this station.

"Most Wonderful Experience."

Probably the next artiste we meet who calls up memories of brilliant public recitals is Mr. Seth Lancaster, the only British 'cellist who has ever received a Royal command to appear before the Queen. His accompanist, Miss Marjorie Clare, whose delightful songs at the piano have charmed many an audience, added to the enjoyment of the broadcast programme by singing two little plantation songs, which brought immediate calls by telephone from Blackpool and Southport for an encore.



Mr. Hamilton Harris, the famous basso, who has appeared on 2 Z Y's programme several times.

Recently, the most famous artiste at 2 Z Y was Miss Sybil Thorndike, who at the time astounded crowded houses at the Prince's Theatre, Manchester, with her wonderful interpretation of the "Medea," and in "Scandal," broadcast with Mr. Louis Casson, the other leading spirit in Miss Thorndike's company, a scene

from "As You Like It."

In a few days' time, Madame Sophie Thomsón de Konshen will again visit 2 Z Y. One listener-in who heard her sing "I Would tell of My Love," by Rachmaninoff, wrote delightedly to the station immediately afterwards, saying that it was the

most wonderful experience of its kind that he had ever had. Such reports, of which this is one example, speaks well for the high state which the technical side of broadcasting has reached, even at this present stage, and it is the satisfaction of receiving such reports that repays the staff of any broadcasting station for its hours of arduous and unremitting toil, and gives encouragement to aim even higher.

Some of the Pianists.

Another old student of the Moscow Conservatoire, who for many years has given joy to Manchester, and recently broadcast from 2 Z Y, is Professor Carl Fuchs, the 'cellist, who in English concerts has long been a familiar figure.

A series of greatly appreciated half-hour piano recitals are at present broadcast every Tuesday night; and the pianist who so generously showers his gifts on so wide, and to its credit be it said—appreciative

audience, is Mr. Edward Isaacs. Other pianists who have charmed the listeners-in of 2 Z Y include Mr. Charles Kelly, Miss Annie Lord, Mr. Arthur Spencer, Miss Annie Young (whose delightful interpretations of modern French works were an almost unusual event in broadcasting), Miss Yvonne Tiano, Miss Jessie Cormack, and others.



Harold Derbyshire, "the Manchester baritone."

Mr. Hamilton Harris, a basso whose fame has gone far beyond Manchester, gave a widely appreciated programme from Manchester a few weeks ago. Another Manchester vocalist, Mr. Dale Smith, has kindly consented to give, commencing on May 31st, a series of British song recitals, assisted by Miss Dora Gilson, his able accompanist. A soprano, who has won the unstinted praise of unseen listeners, is Miss Florence Holding, whose voice has been described more than once as the most perfect that the Manchester Broadcasting Station has been honoured to transmit.

The Orchestra.

It is difficult to single out any one of the many other artists who have given their services to the new science at 2 Z Y.

The present orchestra of 2 Z Y is probably smaller than that of most other stations, for the simple reason that the studio in Manchester is not of very ample proportions. The nucleus of this orchestra one knew in the form of the original "Radio Trio," the personnel of which deserves special attention. It was led by Mr. Leonard Hirsch, a violinist of great talent, previously known in Dublin, and

now in Manchester, is carving for himself a name high on the roll of musicians' honour. One of Dr. Brodsky's most successful pupils, Mr. Hirsch has had a wide experience in orchestral and chamber as well as solo work, and one doubts if a more efficient leader to the Radio Orchestra could be found.

The 'cellist of the Radio Trio was Sydney Wright, and its pianist, Miss Jessie Cormack, who for some months has delighted the artistes as well as listeners-in of 2 Z Y with her charming accompaniments. The other members of the orchestra are Mr. Alfred Stott, principal double bass to the "Hallé" Orchestra; Mr. Harold Widdup, long a popular viola in the Hallé; Mr. Patrick Ryan, probably the most promising of Manchester's young clarinet players; Miss Keem McEhdoo, the popular violinist of the Royal College in Manchester; and Mr. Arnold Perry, the organist whose recent Beethoven pianoforte recitals in the city have created more than usual interest.



One of Manchester's most popular sopranos, Miss Elsie Juddah.

The "Talk" Items.

Among the speakers of 2 Z Y, the names that first call our notice are Professor Elliott Smith; Professor Pear, head of the new Psychology department at Manchester University; Major C. H. Douglas, of Social Credit fame; Mr. J. E. Phythian, M.A., of the Manchester Arts Committee, who is giving a series of talks on "Pictures and their Appreciation"; Professor Miles Walker, who will soon commence a series of talks on "Vocational Selection"; Rev. P. H. Johnson; Miss Andrews, of the "Manchester New Thought School"; the Rt. Hon. the Lord Mayor of Manchester, whose recent appeal for two million shillings for the hospitals has met with such generous support; and many other famous men.

Finally, Foden Williams and Victor Smythe, undoubtedly the most popular entertainers of the station, are certainly deserving of mention.



Miss Isolde Menges, the famous violinist, who has upon two occasions charmed the 2 Z Y listeners-in.

WIRELESS AND THE CINEMA.

Mr. Hepworth, the well-known film producer, gives in an interview with a special representative of POPULAR WIRELESS, his views regarding the possibility of wireless tele-vision in connection with cinematography and the synchronization of speech with the pictures ("talking pictures").

MR. HEPWORTH is too well known as the leading British pioneer in the film-production world for any further reference to that fact to be necessary. But those who picture him, as the writer did, simply as the chairman of a company who takes no active part in the work, may dismiss any such idea.

The interview took place at the world-famed studios at Walton-on-Thames, in Mr. Hepworth's private workshop, whither he retires to work, coatless and with upturned shirt sleeves, when assailed by too many worries.



Mr. Hepworth.

"Will you talk to me about wireless and the cinema?" I asked.

"How can I do that?" he replied. "I don't know anything about wireless."

"What do you think of the theory put forward by a writer in POPULAR WIRELESS

WEEKLY, to the effect that possibly, some day, a means will be found for transmitting pictures by means of wireless waves, so that they may be reproduced on a screen by true wave impression?" I asked.

Not at all Hopeful.

"No one would say anything is impossible nowadays," he replied. "But I cannot see any opening in that direction. I do not see where one is to make a start on investigation. It is conceivable that light itself and even colour might be transmitted and reproduced in that way, but the difficulty that appears to me insuperable is to reproduce form. Visible light itself is a complicated problem, in the sense that it is propagated by waves of varying length and periodicity. Consider the reflection of light from that piece of brass—the infinite number of rays proceeding from an infinite number of points. The eye receives a little bundle of those rays that travel in straight lines. Even supposing that they could be in some way impressed on a series of electro-magnetic waves, I cannot see any possibility of those waves being converted or manipulated so as to reproduce form by wave impression in the sense you mean.

"Oh, yes, I quite appreciate the attributes common to light and electro-magnetic waves. If you come to that, you may run right through the spectrum, and say that X-rays are invisible light, in somewhat the same sense that ultra-violet rays are light rays. But, so far as we know, visible light is the only means of directly indicating form—the form of an object—and I cannot see that this property can be transferred to another class of wave."

"Do you think there is any possibility of wireless playing a part in the synchronization of the human voice with moving pictures?" I asked.

"Indirectly, perhaps. But so long as projection is accomplished by mechanical means, synchronization must be dependent upon similar mechanical contrivances. If the theory of wave transmission we have been discussing were developed, and true wave impression of pictures became *a fait accompli*, then wireless speech could, of course, be synchronized—in fact, synchronization would be almost automatic, since the speed of transmission would be the same. But in the present stage of development, the only sense in which wireless can be applied is in the matter of music and speech during intervals."

No Direct Connection.

"Have you taken up wireless as a hobby, Mr. Hepworth?"

"No. I dare not, just now. In fact, I could not take it up as a hobby. If I were to take up wireless, it would be to undertake research work, and I simply haven't the time for it. That does not mean I should not like to, for I should, but one cannot do two things at once."

"What about the transmission of pictures by such methods as are already in vogue?"

"There, again, I see no direct connection. You still require mechanical appliances—photography and a projector—to utilise such pictures for the cinema. It is true that an individual picture thus wireless might be shown as a novelty, but it would only serve as one of a number of topical subjects, to be shown for a few moments. Consider the length of film and the number of separate pictures in it involved in presenting a play or any other production of appreciable length. But come with me. I will show you over the works."

We visited, first, one of the studios where a number of players were being "filmed" in connection with a play now in course of production; then groped our way through various dark rooms, with double, light-tight doors, where films were being developed.

From these dark rooms the negative films are taken and examined for faults, and are then transferred to the printing department.

Printing Films.

From the printing machine the negative film is wound on to a spool, the positive film passing on over a roller through the bath of fixing solution, and thence through successive water-tanks, where it is well washed and rid of every vestige of chemicals which would impair its life. Then it disappears upwards through a slot in the ceiling into the drying-room above, which is carefully heated and ventilated.

Here the film first passes over a succession of cloth-covered rollers to rid it of surface

water; and from these rollers it passes up and down, scores of times, round pulleys, being finally wound, perfectly dry, on to drums or spools.

In due course these spools of film are again unwound, examined, and pieced together, and thus, subject to everything being found in order, the film is at last wound on to a spool in one continuous length, ready for the cinema projector.

When Wireless "Settles Down."

"You spoke of educational possibilities just now," said Mr. Hepworth. "What has been happening for years, and is happening now, is that the cinema is Americanising the world. Go where you will, you find American films, from tiny villages in the Welsh hills to New Zealand. You may think it an exaggeration, if you choose, but it is so. And when the real educational stunt begins, it will begin in America, and then America will utilise it to exploit the world for the benefit of American trade. And when it is too late, we shall follow in her footsteps."

"Then, what is the remedy?" I asked.

He shrugged his shoulders.

"That can only be effected by combined action—by educating the public—possibly only with State assistance. The present tariff on imported films is insufficient; but even if it were effectual, in so far as this country is concerned, there are still our colonies and foreign countries that have hitherto constituted markets for our goods.

"With all such inventions the commercial beginning is always the result of a craze for novelty. It was so with the cinema. The novelty soon evaporated, and left producers with the task of providing for the demand for something really good.

"It will be much the same with wireless. At present it is a craze. When that has worn itself out, there will be no purchasers for the inferior sets that now flood the market and find a ready sale, and the public will demand something really good. Listening to ether-borne speech and music will no longer be a wonder and novelty, and the public will demand something better for their money than they are prepared and are even glad to pay now. They will settle down to the serious enjoyment of wireless as a commonplace recreation."

SHORT ARTICLES

Especially of a constructional nature, are always welcome and well paid for if accepted for publication. You may have ideas regarding something really interesting and worth passing on through the medium of "Popular Wireless" to other amateurs, but feel incapable of expressing yourself on paper. This should not deter you; as long as the details in the text and drawings are clear, the Technical Staff of "Popular Wireless" will do the rest.

Yours faithfully

MARCONI VALVES

MADE AT THE OSRAM LAMP WORKS

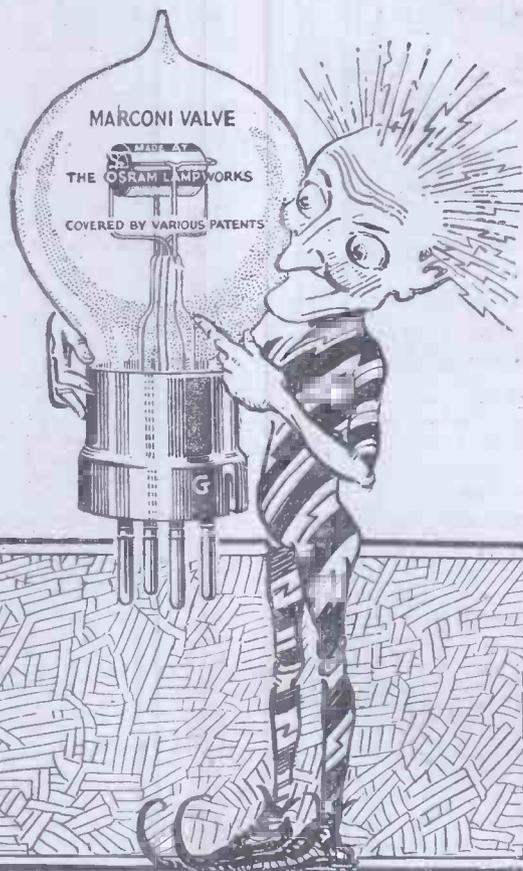
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THE ELUSIVE ELECTRON.

A few facts concerning that wonderful ultimate particle of matter which will give some idea of its size and activities.

WHEN the filament current of the receiving valve is switched on, the high-tension battery connected to the set and the instrument adjusted, the electrons in the valve begin to bestir themselves. It is well known that the current which heats the filament has only a value of just under one ampere, and it is hardly conceivable that the heating effect of this current on the filament is sufficient to disturb about 7,000,000,000,000,000,000 electrons each second, in a wire having a cross section of about 24 millionths of a square inch. These are the figures given by Mr. John Mills of the Western Electric Company, in a recent issue of the "Wireless Age," and it is beyond the imagination to conceive such a mass of tiny particles all in motion within the confines of the small electric light bulb known as the thermionic valve. It is also stated that in each cell of the storage battery molecules of lead sulphate form at the rate of approximately 25 thousand billion billion

each hour that the filament circuit is complete. It is not to be supposed that the same electrons which leave the negative plate of the battery traverse the complete circuit, returning to the cell by means of the positive plate. While some of them may complete the whole journey, it is assumed that, at any rate, the same number of electrons reach the positive plate each second as start from the negative plate. Some of the electrons on their journey will leave the hot filament and become free electrons in the vacuum which exists inside the valve, but their place is filled by others from the various connecting wires, and from the filament.

"Free" Electrons.

Assuming that the wire employed is of copper, the path of the electron stream will lie through the copper atoms. These atoms are each composed of a small number of electrons (29 to be exact) surrounding a

minute positive nucleus or core. The formation of the atoms of the filament depends upon the material from which it is constructed. It is stated that each tungsten atom, for instance, is composed of 74 electrons clustering round a nucleus which does not greatly differ from that of the copper atom.

Upsetting the Atoms.

The manner in which the electrons are arranged about the positive core appears to be doubtful, but it is known that the size of the electron in comparison to the distance which separates it from adjacent electrons is very small.

When the electrical circuit is completed, some of the electrons clustered around the nucleus of the atom are influenced to such an extent that they join the electron stream. This, of course, means that some atoms are left without their correct number of electrons, and these atoms readjust their correct balance from other electrons passing in stream.

The rate at which the individual electrons progress is very rapid, and it is this disturbance and its effect upon the atoms that heats the filament. The effect on the plate or anode of the valve, which is, of course, charged positively, is to attract the electrons which have left the heated filament.

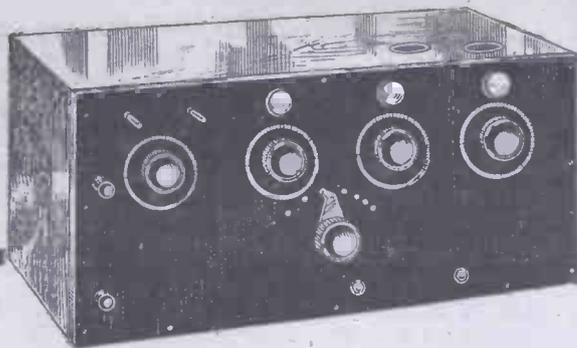
BROADCASTING TRANSMISSIONS.

GREAT BRITAIN.						
Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.	
London	2 L O	Usually—5.30-11 p.m.	Musical Items, News, etc.	369	Every Weekday.	
Newcastle	5 N O	5.30-10.30 p.m.	" " " "	400	" "	
Manchester	2 Z Y	5.30-10.30 p.m.	" " " "	385	" "	
Birmingham	5 I T	5.30-10.30 p.m.	" " " "	425	" "	
Glasgow	5 S C	5.30-10.30 p.m.	" " " "	415	" "	
Cardiff	5 W A	5.30-10.30 p.m.	" " " "	353	" "	
BELGIUM						
Brussels (1)	Brussels	12 noon (G.M.T.)	Weather report	1100	Working days.	
		4.50 p.m.	Aeroplane traffic	1100	When necessary.	
		6 p.m.	Concert	1300	Sunday, Tuesday and Thursday.	
HOLLAND						
The Hague	P C G G	3-5 p.m. (G.M.T.)	Concert	1050	Sunday.	
		8.40-9.40 p.m.	Concert	1050	Monday & Thursday	
The Hague	P C U U	7.45-10 p.m.	Concert	1050	Tuesday.	
(Laboratorium Heussen)		9.40-10.40 a.m.		1050	Sunday.	
The Hague (Velthuyzen)	P C K K	8.40-11.40 p.m.	Various	1050	Friday.	
Ymuiden (Middelraad)	P C M M	8.40-11.40 p.m.	Concert	1050	Saturday.	
Amsterdam	P A 5	8.10-11.10 p.m.	Concert and News	1050	Wednesday.	
FRANCE						
Lavallois-Perret (Radiola)	S F R	2-3 p.m. (F.S.T.)	Music	1780	Sunday.	
		5 p.m.	Stock Exchange News	1780	Every day.	
		5.15-6.15 p.m.	Instrumental music	1780	"	
		8.45 p.m.	General News	1780	"	
		9-10.30 p.m.	Vocal and instrumental concert	1780	"	
Paris (2) (Eiffel Tower)	F L	6.40 a.m.	Weather Forecast	2600	"	
		11.15 a.m.	Weather Forecast	2600	"	
		3.30 p.m.	Stock Exchange News	2600	"	
		6.20 p.m.	Weather Forecast, Concert	2600	"	
		10.10 p.m.	Weather Forecast	2600	"	
Ecole Supérieure des P.T.T. Radió-Riviera (Nice)		7.45-10 p.m.	Radio Concerts	450	Tuesday, Thursday, Saturday.	
		2.30-7.30 p.m.	Radio Conferences	450	"	
		11 a.m.	News, Concert, tzigane	460	Every day.	
		5-6 p.m.	News, instrumental Concert	460	"	
		9-10 p.m.	Latest News, Concert	460	"	
GERMANY, CZECHO-SLOVAKIA, AND SWITZERLAND						
Berlin	L P	6-7 (G.M.T.)	Financial News, etc.	2800	Every day.	
(Königswusterhausen)		11-12.30				
		4-5.30 p.m.	Financial News, etc.	2800	"	
Prague	P R G	7-11 a.m. and 3 p.m.	Weather News, General News	1800	"	
		9-2 p.m. and 9 p.m.	Concert	4500	"	
Geneva	H B	6-7 p.m.	Concert	1200	"	

The British Broadcasting Stations transmit on Sundays between 8.30 and 10.30 p.m., and at varying times during weekday mornings and afternoons. The programmes appearing in the daily Press should be consulted for full details.

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

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



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| 2/8 | 2/5 | 2/2 | 1/11 | 1/8 | | | | | | | | |

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AMERICA DISCOVERS GEARY.

By HIGHAM BURLAC.

When a real "ten-cent radio hustler" came over from the States expecting to find the "Briddisher" still delicately manipulating coherers, Geary rose to the occasion and arranged that he should not be disappointed.

A DULL August day was drawing very perceptibly into an autumn evening. Clapham was obscured in a kindly mist of rain, and Clapham's aeriols were steadily leaking. The period was six months after Geary was exported from those United States, and a casual observer, poking his nose into Acacia Villa, might have observed Aloysius Geary, Esq., F.R.E.A.K., drawing a well-sucked lead-pencil across a small piece of ebonite. Yes, it was a grid leak in process of formation. For further information please see other pages of this journal.

The "Ambassador" Arrives.

Mr. Geary had just licked his BBB in readiness for another traverse of the line when the bamboo hallstand shook to the sound of a knock at the front door. Dustman? Never at that hour—or without the cry peculiar to his species. Hawker? Did not the plate on the front garden gate forbid the invasions of itinerant merchants? Policeman? Dash it! the dog-licence was only seven months in arrears, the wireless licence was unexpired, Mrs. Geary did not suffer from kleptomania, and young Bill Geary hadn't done anything of note for several weeks, owing to the fact that he was in hospital. When Bill wasn't in hospital recovering from motor-bicycle bites, he was out on bail. Better open the door and chance it.

Geary cautiously pulled the latch and swung the door inwards without enthusiasm ("Probably got to buy a ticket for the Railwaymen's Fête!"), and a voice said, "Mister Winnabahn!"

"No one of that name—" began Geary, but the voice thereupon proceeded with more joyous and decisive intonation:

"Waal, how's muh friend Geary? Guess you recollect Winnabahn of Chi. Member me picking you up four bloeks east o' Wannamaker's in the flivver and parking you parallel with Coney. Come to, Briddisher, and open up the wigwam!"

Ultra-violet light illuminated Geary's memory cells upon this Pelmanic oration.

"Ah! It's Mr. Winterbottom. Dee-lighted. C'm in!" he cried.

Mr. "Winnabahn" shifted his plug of Wrigley's to starboard, gripped his sombrero like a strong man in agony, and entered the Respectable Briddish Home.

Geary conducted him directly to the studio—where the grid leaks were sketched—and sat him on the sofa which was constructed when Victoria was a mother of schoolboys and horsehair was cheap.

A "Genwin Raddio Riot."

"Well, this is a pleasure!" lied Aloysius in the most approved manner. "Whatever are you doing over here?"

"Snooping around for kahtracts. Heard there was a few dallers left here, and guessed I'd hike across and collect same. Represent the Oklahoma Milling, Mining, and Lumber Sales Negotiations (1922) Corporation. Cordially yours, I should smile. Know any boobs? Interdoobe Karl O. Winnabahn."

"I—I gather," faltered Geary, whose knowledge of the vernacular had faded, "I gather that you would like to be introduced to some of my influential business friends? Sure—I will see what I can do."

"Gosh! You're on. Yours cordially would ruther lamp a stainless steel, corn-on-the-stalk, patent-applied-for, nix-plus-ultra Briddish business feller than a goldanged, pink-whiskered wuggerzoo with radiium eyes, and when I've said that, believe me, I've said a mouthful."

"Ah, quite so. If you are in town to-morrow night I shall be pleased to introduce you to the Wireless Club. Several of the members are highly-connected in business, and at least four have received Newark on frame aeriols."

The man from Chicago leaned forward, his eyes alight with the unearthly fire which appears in the optics of an entomologist who is promised a visit to the haunt of a new kind of bug.

"Say!" he hissed. "Can I really blow in on a genwin Briddish Raddio Riot? Me heart's weak. Can I stand for it? Do they require references and a vote of confidence? Is there a Strangers' Gallery? Do they turn down the light before they bring on the pre-Armstrong hook-ups? Let's get there, brother!"

Pith Balls and Sealing Wax.

Geary sometimes had lucid moments, and this was one of them. He sensed an air of leg-pulling. Mr. "Winnabahn" on the irregular paving-stones of a New York suburb, with his neckwear flying free, seemed to fit into the picture; here, his friend's Normal School enunciation and boob-hunting proclivities sorted ill with Clapham's culture. A sharp lesson seemed to be indicated. For once in his life Geary (I never represented Geary as a streak of lightning) was quick on the uptake. He fell for Mr. "Winnabahn" good and plenty.

"Well," he said, "it's true we're a mite slow over here, but you must make allowances for us. Call here at seven o'clock to-morrow evening and I'll take you round to see the boys playing at wire—er—raddio."

"Put it there," replied the visitor, and when he had gone, Geary wrote a postcard.

"Pleased to meet you, Mr. Winterbottom," said Mr. Ezra Perkins, the Clapham Wireless Wonder, on the following evening. "We are about to try a little experiment, and welcome in our midst a visitor from the land of De Forest, Tesla and Booker Washington—not to mention Edison, Confucius, Jane Addams and the gifted author of 'Who's Who in the Molasses Trade.'"

"Cordially Yours" emitted a smothered gasp, and said he guessed Mr. Perkins could show him a few man-size, quick-selling, mass-production, all-rubber, money-back stunts in four shakes of a broncho's fly-whisk.

Mr. Perkins, slightly dazed, agreed. When the members had assembled, Mr. Perkins rose and led them in singing "Rule Britannia," after which he read six fruit-

paragraphs from "Perks' Primer on Pith Balls and Sealing Wax," adding, to Mr. "Winnabahn," "That, you know, is the English amateur's Great Charter." And then, turning to the members: "Brothers, what are we without Pith Balls and Electrified Sealing Wax?" Geary and several others said, "Hear, hear." Several members gravely said, "Ah, true, true!" and three were overcome with emotion, and hid their faces. Mr. "Winnabahn" loosened his collar slightly, and gazed at Mr. Perkins, who began to speak again.

Too Much for America.

"Friends, I need hardly remind you that when Aristotle discovered the—"

Here a member rose and complained that another, to wit, William Digson, was wearing a knitted waistcoat. Mr. Perkins groaned aloud, and requested Mr. Digson to quit the premises. The incident then closed.

"Holy beans!" said Mr. "Winnabahn" to Geary. "Are you all loony?"

"Hide your smoke!" replied Geary, "or they'll tie the can on us, too. I've no standing here worth mentioning since I abandoned 'plain aerial.'"

"You don't say? Who is the left-eyed flounder that got all het up about the other guy's vest?"

"Oh, him! That's Lord Linerusta's cousin."

"Lemme have another lamp at him! Can you speak to him?"

"Not directly, of course, but through the secretary."

"Say, does he live in the Tower of London? Ne' mind! Tell me what is this expurrment the old nanny with the lopsided lugs is working up to."

"They're going to have a jolly evening with the club coherer, and then some nice dissolving views of eminent ex-engineers of the Clapham Waterworks."

This overawed "Cordially Yours."

"B' Gosh!" said he. "I wouldn't have missed this for a piece. What would happen if I mentioned raddio here?"

Geary looked solemn.

"I'm not sure. Under the constitution of the club a committee would be formed first of all, but the regulations provide that this may not sit until its terms of reference have been balloted over for three successive annual general meetings. Eventually a ruling would be drafted—"

Something between a sob and a howl burst from the dry lips of Mr. "Winnabahn." He rose and looked anxiously at the door.

"By the shining goats! Show me the sidewalk and lemme hit the grit. Those quicksilver hombres will make me a honorary member if I don't shift my location. Coherers! Aristotle! A. Relay League to Everlasting Petrification! Help!"

Mr. Perkins, who was just then solemnly connecting a Wimshurst machine to a Leyden jar, saw Geary slip out of the room in the wake of Mr. "Winnabahn," and not until the door had closed did he remove his grey beard and with his colleagues give way to the holy glee which is the reward of faithful workers who have done their job well.

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.

North Middlesex Wireless Club, 100, Pellatt Grove, Wood Green, N.22.

This club held a very successful meeting at Shaftesbury Hall, Bowes Park, N., on the 2nd ult. As a change from the last meeting, when a demonstration was given of commercially-made wireless apparatus, the evening was devoted to a lecture on "Workshop Wrinkles," by Mr. T. Weaire.

Hon. sec., Mr. H. A. Green, 100, Pellatt Grove, N. 22.

The Radio Association, South Norwood and District Branch.

At the Stanley Halls, South Norwood, on Thursday, May 17th, a lecture was given by Mr. A. E. Saunders (a member of the branch), entitled: "A Few Considerations of Ether, Electrons, and Material Phenomena." The chair was taken by Mr. S. W. Butters (5 V U).

Hon. sec., C. H. P. Nutter, 234A, Selhurst Road, South Norwood, S.E.

The Wireless Club, Ltd.

The weekly lecture before the club at the Manchester Hotel, Aldersgate Street, E.C. 1, on Monday last, was of so interesting a character that it has been decided to print in pamphlet form the lecture on "What is Ether?" which was delivered by Mr. T. F. Gaynor. Miss Euphemia Smith, a trustee of the club, was in the chair.

Registered office, 56, Long Lane, West Smithfield, City of London, E.C. 1.

The Radio Society of Highgate.*

A lecture and demonstration was given on May 18th by Mr. J. F. Stanley, B.Sc., A.C.G.I., F.R.A., his subject being, "Selective Tuning Circuits." The lecturer described a series of experiments which he had carried out in order to find the most selective receiver possible, without entailing the expense of a large amount of apparatus.

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

Bath Radio Club.

The members of the Bath Radio Club held a radio auction and social evening at their headquarters, the Red House, on May 11th.

The radio auction, held for the purpose of enabling members to dispose of their surplus wireless gear, was conducted by Mr. Bertram Fortt, of Bath, and proved very interesting.

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

Birmingham Experimental Wireless Club.

A very successful lecture and demonstration was given before the above club by Mr. Towers on the subject of "Receivers and Amplifiers for Broadcasting Reception."

Some interesting results were shown by impressing up to 15 volts on the grids of the valves used, and Mr. Towers managed to introduce into his lecture a great deal of information very useful to the experimenter.

Very good results were obtained on the club's aerial, and an instructive evening was spent.

Hon. sec., A. Leslie Lancaster, Lancaster Bros. & Co., Shadwell Street, Birmingham.

"WIRELESS REVIEW" PRESS REPORTS.

SINCE the advent of broadcasting, interest in the science of wireless telephony has increased. A large section of the British public are not merely content to "listen-in"; they want to "know why." The "Wireless Review and Science Weekly," which makes its first appearance (price 3d.), is designed to appeal to their tastes.

It contains an offer of £500 for the most successful demonstration of the possibility

An interesting pamphlet, entitled "The History of a Lamp," has been forwarded to us by Crowther & Osborn, Ltd., which gives a general idea of their factory capabilities. They also state that they are undertaking the repair of wireless valves by a special method which prevents the re-sagging of the filament. They even undertake the repair of cracked stems. The repaired valves are returned exhausted either "hard" or "soft" according to customers' requirements. The cost is 6/6 per valve.

The Metalastene Co. have sent us a sample of their patent jointing compound, concerning which they have had many letters from customers stating they have used it for wireless work, particularly as a means of making a satisfactory and lasting joint on the end caps of "grid leaks." It is very easy to use and is a metallic and conductive paste.

Many people who have not decided on any special make of set would take it as a boon if they could see many makes of instruments at one address. A. J. Dew & Co. have issued a catalogue in which are many types of sets, and one can make a good choice from their showroom as they are agents for many firms.

of wireless "television"—in other words, the ability to see by wireless from, say, a London room, what is going on in a room at Liverpool. The list of contributors to the new weekly includes prominent wireless experts, and Sir Oliver Lodge is to act as scientific adviser.—"The Times."

"Wireless Review" is the latest and most important addition to the ranks of wireless papers. Sir Oliver Lodge is its scientific adviser, and other leading experts compose its editorial board.

"The Daily Mail."

"Wireless Review and Science Weekly" is the latest and, without doubt, the most authoritative of the weekly magazines dealing with wireless. Teachers who are interested in this subject, and are anxious to keep abreast of the latest developments, could not do better than subscribe to this very beautifully produced magazine.

"The Schoolmistress."

"Wireless Review" will be supported by the strongest editorial board ever formed. . . at the price of 3d., the value it gives is marvellous.

For those who wish to follow all the latest developments of wireless, both theoretical and practical, it will be indispensable.—"The North Star."

Concerning the prize offer, the "Western Mail" says:

"This offer is certain to attract widespread attention among scientists and the more brilliant amateurs, and it is designed to promote progress along a most fascinating line of scientific discovery."

In style, authoritativeness, and general appearance, the new periodical, "Wireless Review and Science Weekly," gives evidence of being a valuable addition to the list of technical magazines.

"The Glasgow News."

Listeners-in who want to understand the principles and details of wireless are referred to the "Wireless Review and Science Weekly."—"Daily Chronicle."

CATALOGUES, BOOKS, ETC.

A NEW type crystal detector has been placed on the market by Cahen & Son, Ltd., for which is claimed unique features. It is known as the "Davis Patent Detector." The ball and socket joint has been placed at the base of the selector support, and the selector arm is stiffly pivoted at the top of this support. By this arrangement the motion is made continuous and gradual. We like the movement very much, but suggest that the cat's-whisker should be made replaceable instead of being pinched in the selector arm as it is in the present design.

We have received from Ward and Goldstone, Ltd. a copy of their April catalogue, which includes complete sets and all components. An interesting feature is their junior transmitting set which sells at a reasonable price, and should be a boon to those who want a cheap yet efficient transmitting set and are not prepared to make their own apparatus. They also enclose a sample of their chain braided 7/22 copper aerial wire, which they state is taking the place of the single wire or the strand owing to the large reception surface. A sample will be sent to anyone writing for same.

Radio Instruments, Ltd., are putting on the market a new variable inter-valve reactance in order to give the radio experimenter and others desirous of constructing their own sets an opportunity of using inter-valve reaction during broadcasting hours, avoiding re-radiation and yet get maximum efficiency. The wave-length range is 200-4,000 metres, and the component is fully approved by the P.M.G.

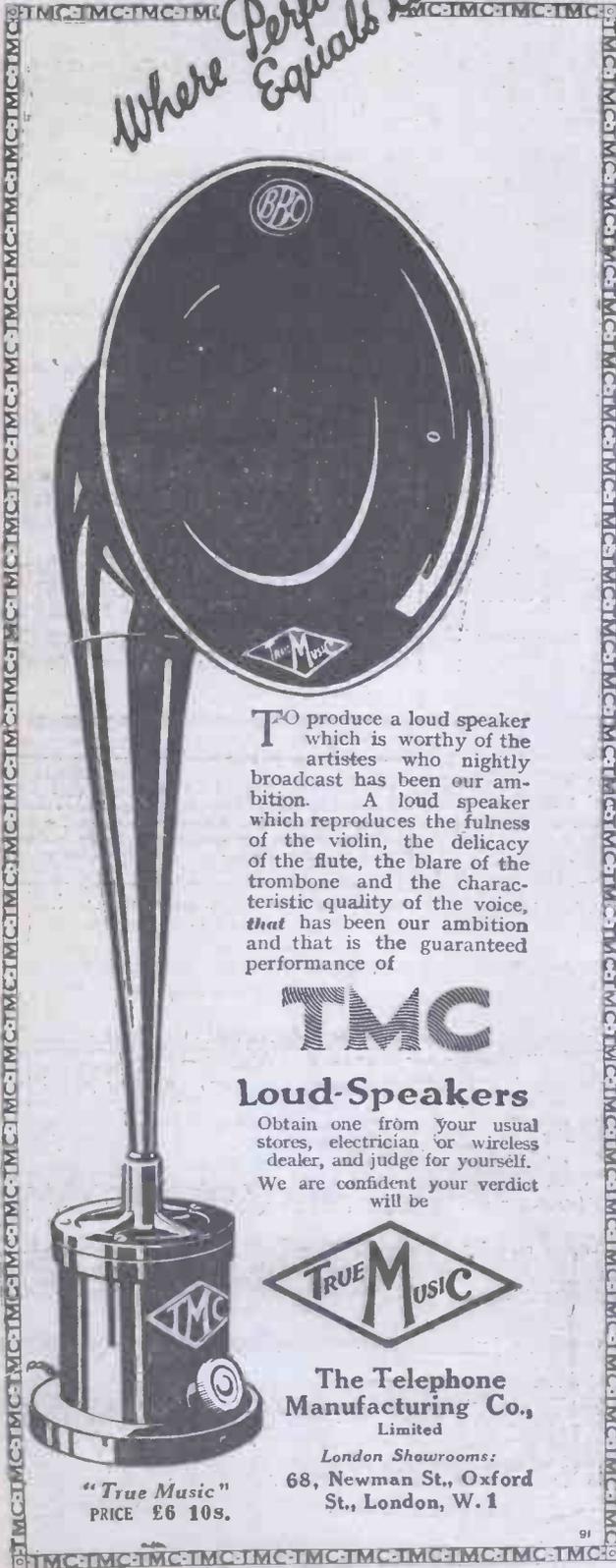
We are very pleased to see that the "Readers' Guide" of the public library of Norwich contains quite a number of books on wireless telegraphy and telephony.

"Progress" is the title of a booklet published by Bertram Day & Co., Ltd., giving full details of their advertising scheme.

Very neat crystal and valve sets are illustrated in the new catalogue of the "Abbey Industries, Ltd." Of special note is their "Miniature" Crystal Set, which is smaller than the palm of the hand and has a telephony range of 15 miles.

Henry Wiggin & Co., Ltd., manufacturers of "Snake" brand resistance wires and tapes have forwarded us their booklet giving full details of all their wires.

Where Performance
Equals Ambition



To produce a loud speaker which is worthy of the artistes who nightly broadcast has been our ambition. A loud speaker which reproduces the fullness of the violin, the delicacy of the flute, the blare of the trombone and the characteristic quality of the voice, that has been our ambition and that is the guaranteed performance of

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Obtain one from your usual stores, electrician or wireless dealer, and judge for yourself. We are confident your verdict will be



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	Price	Over-all Dimensions		
		Length	Breadth	Depth
.0005 mfd.	30s. Od.	7" × 4 1/2"	3 1/2"	3 1/2"
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* Capacity essential for interference elimination.

Wherever you may be, whatever the station you desire to receive, the "Autoveyors" 3-Electrode Variable Condenser gives you just what you want, exactly when you want it. Get one now and learn the delight of listening-in without disturbance.

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Write for General Catalogue—the most comprehensive list in the Wireless Trade—3d., Post Free.

SOLDER OR SORROW—



WHICH is it to be? The Wireless aspirant who is satisfied in leaving the connections of his aerials and set terminals to look after themselves by just twisting them together is asking for trouble. Apart from the untidy appearance, careless connections are going to lower the efficiency of the finest receiving set in the

world. SOLDERING will make doubly sure of them, and, incidentally, FLUXITE will make sure of the soldering. Soldering is child's play when you've a tin of FLUXITE at hand to help you, or, better still, a complete Soldering Set that we have had specially prepared for the convenience of customers. Ask your Ironmonger or Hardware Dealer to show you the neat little

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Reduced
Price
7/6



For the tool-kit of your car or motor-cycle, or any soldering jobs about the home.

FLUXITE LTD., 324 Bevington St., Bermondsey, England.

RADIOTORIAL.

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

Thousands of my readers have at one time or another asked me how they can take up a career in the wireless and engineering line. It is obvious that broadcasting has inspired many young men with the desire to enter some sphere of life where their knowledge of wireless and engineering may be of benefit. The careers open to young men with a sound scientific training are many and attractive, and in our new companion paper, "Wireless Review and Science Weekly," there will shortly commence a series of articles outlining the various ways in which profitable employment may be obtained by those who have studied certain branches of applied science.

In No. 4 of "Wireless Review and Science Weekly" two special articles of great importance will appear. One is by Dr. J. A. Fleming, F.R.S., the famous inventor of the valve. Dr. Fleming deals with the problems of Long Distance Telephony, and no amateur should miss this fascinating article.

The other is by Sir Oliver Lodge, F.R.S., Scientific Adviser to this paper and "Wireless Review and Science Weekly." Each week our companion paper publishes articles by the world's leading wireless and scientific authorities, and I urge every reader of P.W. to place a standing order for a copy at once. These two papers constitute the VERY BEST in wireless and popular scientific literature, and should prove all-sufficient for amateurs. THE EDITOR.

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

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

QUESTIONS AND ANSWERS

D. N. (Nottingham).—Is there any direct ratio between the primary and secondary windings of a loose coupler?

No, there is no direct ratio. The secondary in conjunction with a suitable variable condenser must be constructed so that it will give a wave-length variation coinciding as nearly as possible with that of the open circuit, which consists of not only the primary winding of the coupler, but also the aerial and earth system. Therefore, the secondary will, generally speaking, require to have a greater value than the primary. As a general rule the secondary has about 4 more turns than the primary, using a wire of about two or four gauges smaller than the latter.

X. P. (Dulwich).—I am going to Vashir (Rumania) and should like to know what laws are in force over there as regards amateur licences for reception.

In Rumania the Director of Radio Communication controls all matters relative to wireless telegraphy. Authority to possess installations is given to scientific institutions and also to those engaging in special wireless research work. New laws and regulations are in course of preparation. We are of opinion that no broadcasting is carried on in that country yet.

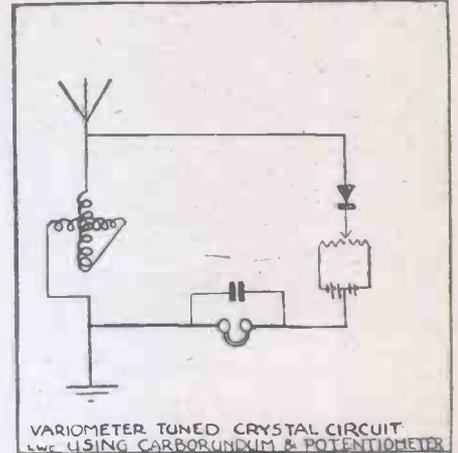
"SUPER" (Elstree).—I have built up the Fleweller circuit that was published in POPULAR WIRELESS recently, but cannot stop it howling. Why is this?

Probably your grid leak and condenser are not suitable. Try a variable grid leak of 0-5 megohms and different sizes of condenser also. You will find that a condenser of about .00025 will be most suitable. Try different sizes of inductances also, the usual sizes

for broadcasting being 50 and 75 turn coils of the honeycomb type, the A.T.C. being in parallel with the A.T.I. The bank of condensers of .005-.006 mfd. also should have some attention. Vary the capacities until best results are obtained. It is convenient to have a variable leak in that position also—that is, across the bottom condenser. If you have 2,000-3,000 ohm phones you will probably find that these are more suited to the loud signals than are those of 4,000 or 3,000 ohms, because when the circuit is functioning correctly the signals from London should be unbearably loud situated as you are.

You will find on experimenting that the correct sizes of coils must be employed, otherwise the set will either howl continuously or will not oscillate at all easily. Naturally the happy medium must be found where the set will howl if you let it, but where the howling can be controlled by means of the variable leaks.

"SEMAPHORE" (Burnham).—Can Léc-lanché cells be used for a carborundum crystal detector? What cat's-whisker proves most satisfactory with this detector? Please give a circuit using variometer and the above crystal, and details for variometer for broadcasting purposes.



Three Léc-lanché cells can be used with this crystal. We prefer, however, the ordinary type of dry battery, as it is more handy. A steel strip contact will give best results with carborundum. Using cardboard tubing for the variometer, a serviceable one for broadcasting wave-lengths will be 25 turns of 26 D.C.C. on both rotor and stator, the rotor being 3 1/2 in. diameter and the stator 4 in. diameter. The telephone

(Continued on page 668.)

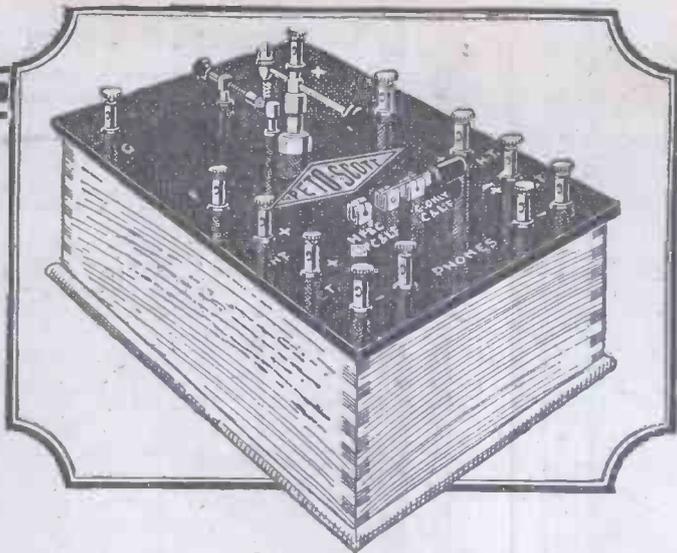
DRAMA BEHIND THE MICROPHONE.



No. 5 of a Series of talks on Peto-Scott Units.

No Batteries or Valves to buy

—start the famous Peto-Scott Unit System with this novel Crystal Unit



Pat. applied for

Once again the Peto-Scott slogan of "Economical Wireless" has been demonstrated by the introduction of a new Crystal Unit (No. 6).

As will be seen from the illustration, it bristles with original features. The Crystal Detector permits instant change of crystal without altering a screw or a connection. It also allows cat-whisker adjustment over the whole of the surface of the Crystal.

The Unit has been fitted with a two-way switch which—when the Unit is working with the remainder of the series—gives four different combinations of circuits.

When connected after a No. 3 Unit (H.F. Amplifier) and before a No. 5 Unit (L.F. Amplifier), if the switch is *to the left*, it gives:

1. High-Frequency amplification followed by Crystal rectification.

2. H.F. Amplification, Crystal rectification and Low-Frequency Amplification.

When the switch is *to the right*, it gives:

3. Crystal rectification only with no H.F. amplification.
4. Crystal rectification followed by Low-Frequency amplification.

Many experimenters prefer to use a Crystal Detector always instead of a Valve. To these we say, the Peto-Scott Unit System covers every possible requirement, and is invariably in accordance with the latest practice.

It was the *original* Unit System and the only one to be licensed under Marconi Patents.

Read all about the ingenious Peto-Scott Unit System in a 24-page illustrated Booklet "Radio" (post free 6d.).

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No. 1. Tuner Unit	27/6
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The man starting Wireless cannot do better than commence with the above three Units (illustrated below). They form a wonderfully efficient Two-Circuit Receiver, very sensitive and particularly selective. At any time Valves for increasing its range or power can be added without making any alterations in the wiring or discarding a single piece of apparatus.

No. 3. H.F. Amplifier Unit	13/6
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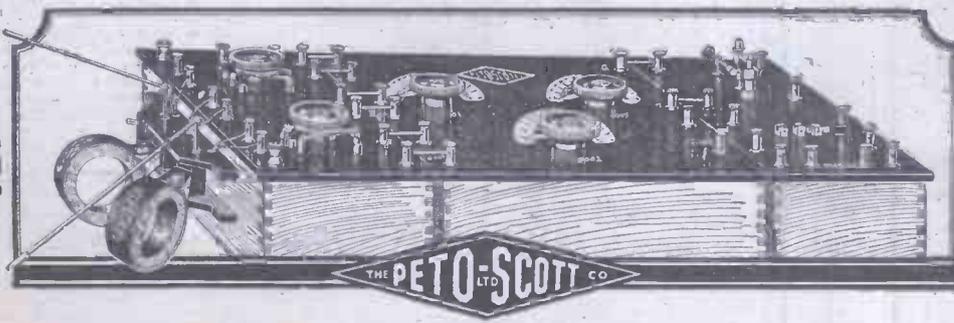
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W.C. 2

No Batteries or Valves to buy for this efficient 3-Unit Receiver



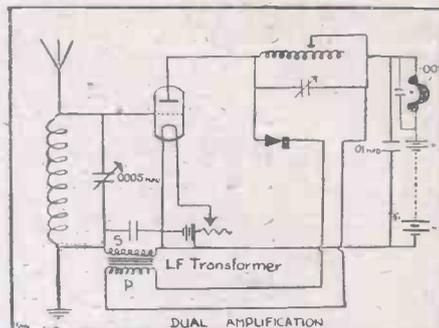
Gilbert Ad.

RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 666.)

condenser should be of about .001 mfd., while the potentiometer should have a resistance of 200-300 ohms. The batteries should have a voltage of about 1.5 each, connected in series with the telephone tapping taken from the neutral point.

T. G. (Barnet).—I have at present a crystal set and am getting quite good results from 2 L.O., but wish to increase my range. I intend adding a valve, and should like it to work both as H.F. and L.F. at the same time.



The above is a diagram giving a dual amplification circuit which can easily be used in conjunction with any existing crystal set. The circuit may require a little patience at first, but will give very good results. The aerial coil may be of the basket type with a variable condenser of .0005 mfd. across it, or else a slider or variometer. Condensers of .001 mfd. are put across the secondary of L.F. transformer and also across the telephone while a larger one of .01 mfd. is placed across the H.T. Should the set at first refuse to function, a .0003 mfd. variable condenser across the tuning coil of the original crystal set may improve matters. The diagram will make everything clear.

E. S. P. (Cardiff).—What is a step-down transformer? What can I do when the acid creeps or spills on anything to save a hole being burnt through?

A step-down transformer is one on which the windings are so arranged that the pressure of voltage induced in the secondary will be less than the pressure applied to the primary. Thus there are fewer turns in the primary than in the secondary. To stop the acid burning through where it spills, apply strong ammonia solution, but keep the ammonia away from the cells. A good plan to prevent the acid in the cells from spraying or creeping is to put half an inch of oil on the surface of the acid. Such oils as "Blancol" are best, as the oil should be properly prepared.

D. A. N. (Bordeaux).—How many foils and what thickness of mica shall I need for the .006 fixed condensers in the Flewelling circuit? Is this circuit allowed for the reception of broadcasting in England, as I intend making it there?

For the condensers you will need mica as dielectric .002 inches thick, and 11 foils 2 by 3 centimetres overlap. Owing to the strong reaction properties of the set, it should not be used on broadcasting wavelengths.

C. E. V. (Ipswich).—What is the cause of, and the remedy for, sulphating?

Sulphating is generally due to insufficient charging, over-discharging, or allowing the battery to stand in a discharged condition. The best cure for sulphating is overcharging at a very low rate, not exceeding half the normal charging current. Sulphating can, however, only be cured if it has not gone too far; if the plates are too badly sulphated they will be ruined, and the only remedy will be to renew them. This applies especially to the positive plates: the negative plates will stand much more ill-treatment without destruction, and can often be saved when the positive plates are quite spoiled.

"TRANSFORMER" (Bideford).—How many turns and of what gauge wire shall I require to make a telephone transformer having a ratio of 8:1. Please also give details of a suitable former.

The former is made from a thin ebonite tube, 3½ inches long and of ½ in. internal diameter, with

(Continued on page 670.)

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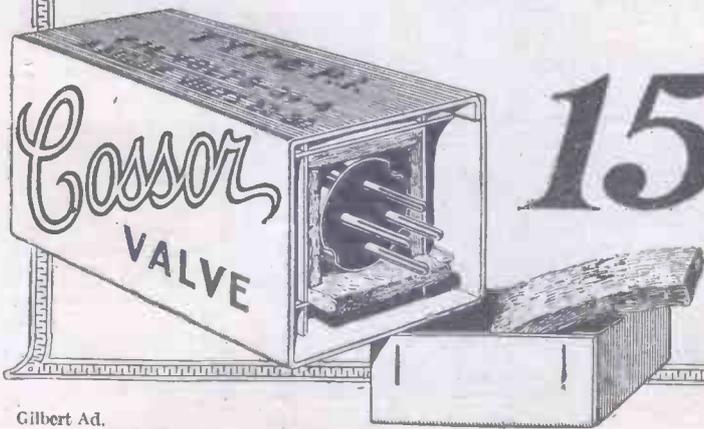
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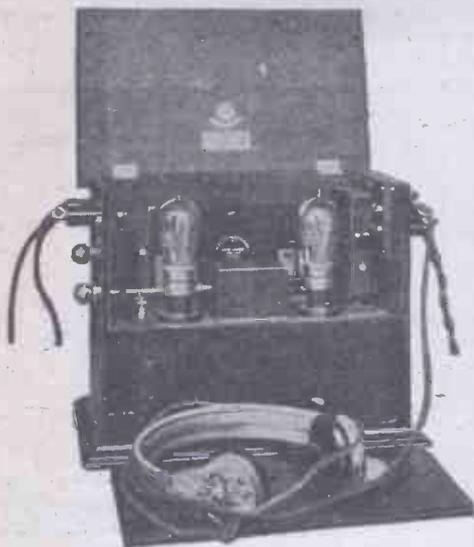
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RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 668.)

two blocks of 1 in. ebonite drilled to fit snugly over the ends. For the secondary wind on 1,200 turns of No. 38 S.W.G. (about 1/2 oz.), wrap some cartridge paper over this secondary winding when complete, to act as inter-winding insulation. For the primary you will need 3 1/2 ozs. of No. 42 S.W.G. The core is formed of 10 in. lengths of 22-gauge iron wire.

V. T. N. (Bexhill).—I wish to make a variometer to tune between about 300 and 1,000 metres. How many turns of what wire shall I require, using shellacked cardboard formers? What size formers shall I need?

On the rotor you will need about 55 turns of No. 24 S.W.G. D.C.C. on a diameter of 3 inches. The stator should have the same number of turns of No. 22 S.W.G. D.C.C., diameter 4 inches.

S. E. D. (Thorpe Bay).—I have been told that a short aerial should be used for the reception of the British broadcasting stations. Is this correct? I had intended to use a 60 ft. double aerial, but have been told that I should use a 60 ft. single aerial for preference, and also that it would be better to use a 60 ft. single than one, say, 90 ft. long.

Your information is quite correct, and a single aerial is better than a double one if it is to be over 50 ft. long. This is taking into consideration the fact that you are using it for broadcasting, of course. With regard to the choice of a shorter single aerial, the reasons why a long aerial is to be avoided are these. In the first place, an aerial has a fundamental wave-length, and to tune to stations sending on various wave-lengths it is necessary mostly to add inductance on to it in order to increase its wave-length and bring it to that value, where it will correspond or be in tune with that of the desired station. If the natural wave-length of the aerial system is above that of the transmitting station, then the capacity factor must be attacked and reduced by placing a condenser in series. The next point to consider is that of potential. A detector is a potential operated device, and therefore it is as well to tap the detector circuit off across points of as great a difference of potential as possible. Therefore, the inclusion in the aerial circuit of a reasonably sized inductance is advantageous. Further, the introduction of capacity is, as is well known, disadvantageous, owing to the damping that results. Therefore, a moderate aerial with a fair amount of inductance in the set is necessary for obtaining efficient results on the shorter and broadcast wave-lengths. It must be added that height is the important factor in aerial efficiency.

P. S. (Berwick).—What are the necessary alterations for adding an L.F. amplifier to a crystal set of the single slider type, with as few alterations as necessary to the existing crystal set?

No alterations whatever are necessary to the existing crystal set. The coupling of the valve amplifier circuit is obtained by means of an intervalve low-frequency transformer. This is connected so that the primary leads take the place of the 'phones on the crystal set—that is, the primary of the transformer goes to the telephone terminals of the set. The 'phone blocking condenser may be left as it is across these terminals. The secondary of the transformer is connected to the grid of the valve and to the negative side of the low-tension accumulator. The rest of the valve circuit is, as usual, plate to the 'phones and thence to the high tension positive terminal, the negative of this battery being connected to the negative of the low-tension accumulator. The positive of this latter then goes to the filament resistance arm, and then from the resistance wire of this to the filament of the valve. It is always advisable to insert a blocking condenser across the 'phones—about .001 mfd. will be O.K.—and a fairly large capacity condenser across the high tension battery of about .02 mfd. to smooth out any irregularities in its discharge.

E. L. (Bradford).—I do not quite understand how the tuned anode circuit is connected. Is it a satisfactory method of coupling?

The tuned anode method of coupling will be found to be a very efficient method. The plate of the first valve is connected direct to the grid of the second, a small condenser being placed in series while a grid leak is placed between the grid and the earth of the second valve. The tuned anode coil is connected between the plate of the first valve and the positive side of the H.T. battery. A small variable condenser of .0002 or .0003 mfd. is shunted across the coil for tuning purposes.

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Mr. Frederick Blamey,
as Samson in
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CONSTRUCTION OF A SPHERICAL VARIOMETER.

Popular Wireless

PRICE 3d.

No. 56. Vol. III.

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

June 23rd, 1923.



*With Best Wishes
to "Popular Wireless"
from -*

Allenby

FEATURES IN THIS ISSUE.

Double Crystal Circuits.
A Series Parallel Switch.
Page of Practical Ideas.

An Accumulator H.T. Battery.
Reaction—Its Uses and Abuses.
Two Methods of Magnifying Signals.

And special articles by the Bishop of Birmingham and
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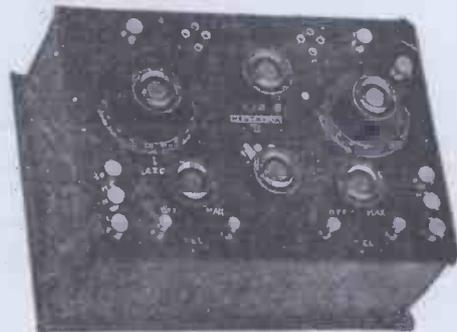
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POPULAR WIRELESS

June 23rd, 1923.

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

[Every Friday.]

TOPICAL NOTES AND NEWS.

Miss Ellen Terry's Appeal.

MISS ELLEN TERRY is very pleased with the special appeal that "P.W." is making in connection with the blind, and has promised to send an autographed photo of herself to every contributor who gives ten shillings or more. I feel sure that our readers will support this appeal to their utmost.

Send to "Ariel."

BY the way, all contributions should be sent to "Ariel," c/o. "The Servers of the Blind League," 3, Upper Woburn Place, W.C.

The Flewelling "Super."

I HAVE recently been trying the Flewelling "Super" and really wonderful results are obtainable, Birmingham being loudly audible on an indoor aerial two feet long at 15 miles north of London. The circuit is certainly worth trying, but up to the present, though amplification leaves nothing to be desired, it has been impossible to cut out the high-pitched whistle without decreasing signal strength. However, I shall persevere, for the set is much easier to control than the Armstrong "Super," and seems to be quite as effective.

Less Reaction.

THE reaction fiends are still hard at work and trying their utmost to ruin everybody's reception. Not content with heterodyning the waves from the broadcasting stations, they are devoting themselves to jamming the amateurs, especially on Sundays. After all, such conduct is of the "dog in the manger" type, for misused reaction is of no use to anyone, least of all to the perpetrator of the squeals.

Amateurs Jammed.

I HEARD 2 V J vigorously protesting to a confrere that it was no use testing owing to the "howling condenser twiddlers." After all, it is from amateur research that a great many useful discoveries are made, and neighbouring "reactionists"

should keep quiet while tests are being made. Wireless societies should organise "reaction hunts," and scotch some of these nuisances.

Birmingham's Popularity.

5 IT'S programmes are becoming very popular with the average listener-in, and the nature stories are in great

"WIRELESS REVIEW AND SCIENCE WEEKLY" is THE authoritative journal of wireless and popular science. No. 5 will contain many most interesting articles written by leading authorities, and will be on sale at all bookstalls and newsagents on Tuesday, 26th inst., price 3d.

ORDER YOUR COPY NOW!

A Useful Application.

REPORTS of a race meeting were 'phoned by wireless over a distance of 100 miles, and the results of the various races were thus made public a very few minutes after the race.

News Items.

QUITE a number of listeners-in object to the news items, and some have written to me to say that they prefer to hear music rather than news that has been published in the papers three hours earlier. Others, however, take quite an interest in the news, and I know some who would rather hear those items than anything else. You cannot please everybody.

The "Brownie" Receiver.

THE J. W. B. Wireless Company have sent me along one of their "Brownie" receivers for test. This little set, which retails at 7s. 6d., is worth every penny of that sum. I connected it to quite an ordinary aerial 12 miles away from 2 L O, and the reception was excellent—quite as good as that obtainable with another and much more expensive receiver.

Hardly!

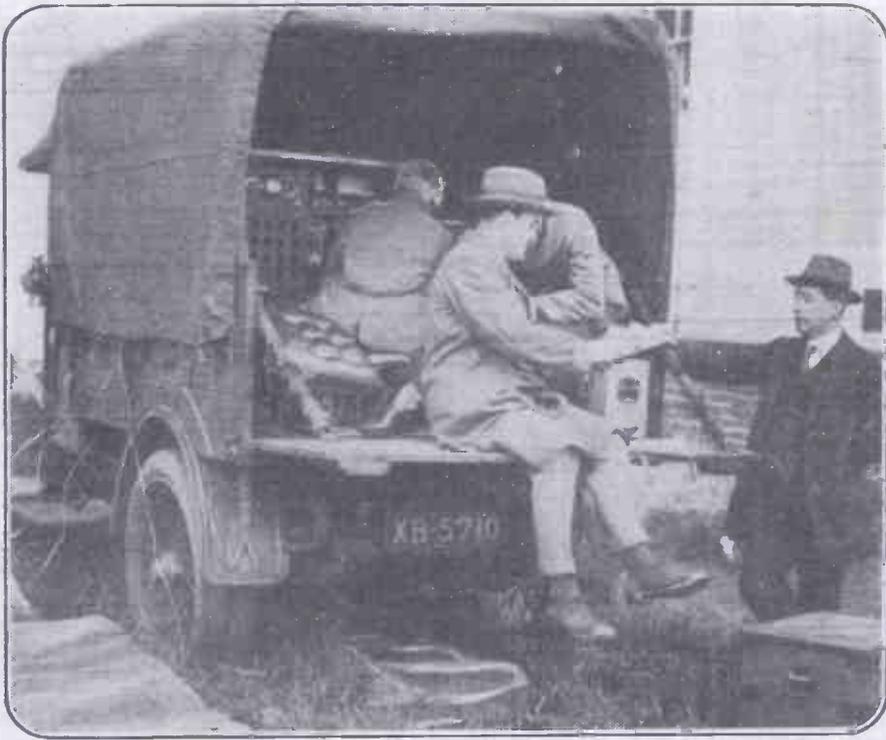
I WAS invited by Mr. Harry Tate to see his sketch, "Broadcasting," at the Coliseum. It keeps

the whole house simply rocking with laughter. It certainly does not require an expert to understand his sketch, and the information that he gives his audience did not come out of POPULAR WIRELESS or "Wireless Review."

T. 8.

DRIVING home in his car after the performance, I was amused by the number of the vehicle, which innocently advertises the name of this well-known comedian—T. 8 (Tate).

(Continued on page 674.)



Controlling the traffic at Epsom racecourse by wireless. An aeroplane equipped with transmitting apparatus hovers over the course and gives directions.

demand among the country folk. Personally, though living nearer London than Birmingham, I always have to tune-in to the latter station when the Poultry Talks are on.

Broadcasting in India.

A CORRESPONDENT tells me that if broadcasting were to start in India it would have a tremendous boom. Demonstrations of wireless telephony have been carried out by the Posts and Telegraphs Dept., and very successful results have been obtained.

NOTES AND NEWS.

(Continued from page 673.)

Solving the Licence Problem.

THOSE who wish to know how to solve the P.M.G.'s difficulties should see Harry Tate's version of "Broadcasting." He tells you how to do away with the Post Office altogether. I am still working out his idea, and will let you know the results later.

H. T.'s Land Yacht.

H. T. has fitted a wireless set to his land yacht, and will tour the whole country, leaving London about three weeks' time with his "Broadcasting" company.

The First Wireless Singer.

MR. EDGAR COOPER, who was the first man to sing "on the wireless" in the days when the Marconi Company were experimenting at Chelmsford, has recently died at his residence in Springfield Road, Chelmsford.

A Lonely Station.

A SMALL island north of Iceland, known as Jan Mayen, is to be let for hunting purposes. It is uninhabited except for a small wireless experimental station. The operator must have a cheerful time, as this island is noted for blue fox and Polar bears.

Wireless for Police.

THE New York police propose to have wireless installations fitted to motorcycles, so that messages can be received by the policemen when the machines are travelling at a high speed.

India and Wireless.

I HAVE received information that broadcasting in India will probably be limited to a single company, composed of British and Indian firms. Non-British firms will not be allowed to participate.

An Iron Aerial Pole.

AN iron pole used as an aerial mast assists in doing away with the danger from lightning. Those who use other types of masts should connect an earth wire from the top to the bottom to act as a conductor.

Wireless for Fire Engines.

MAJOR W. B. ZAPPERT, of the Alexandria Fire Brigade, said he proposes in his brigade to instal wireless telephony apparatus on each engine.

The moment an engine arrived at a fire and wanted help, all the men would have to do would be to run out the aerial and ask for assistance.

"Fete Galante."

THE synopsis of the new opera, "Fete Galante," to be broadcast to-night—June 22nd—will be found on page 698.

By the way, the "July 11th," in the paragraph under the heading "Further Items," of last week's issue of P.W., should have read June 11th.

Miss Ellen Terry.

YOU will be pleased to hear that Miss Ellen Terry, who has now joined the band of listeners-in, may give us the pleasure of hearing her broadcast again from the London station.

Wireless Telephony in Denmark.

A READER of P.W. in Denmark tells me that great advances in wireless telephony have been made in that country. On May 11th a regular tele-

"Haven't You Heard?"

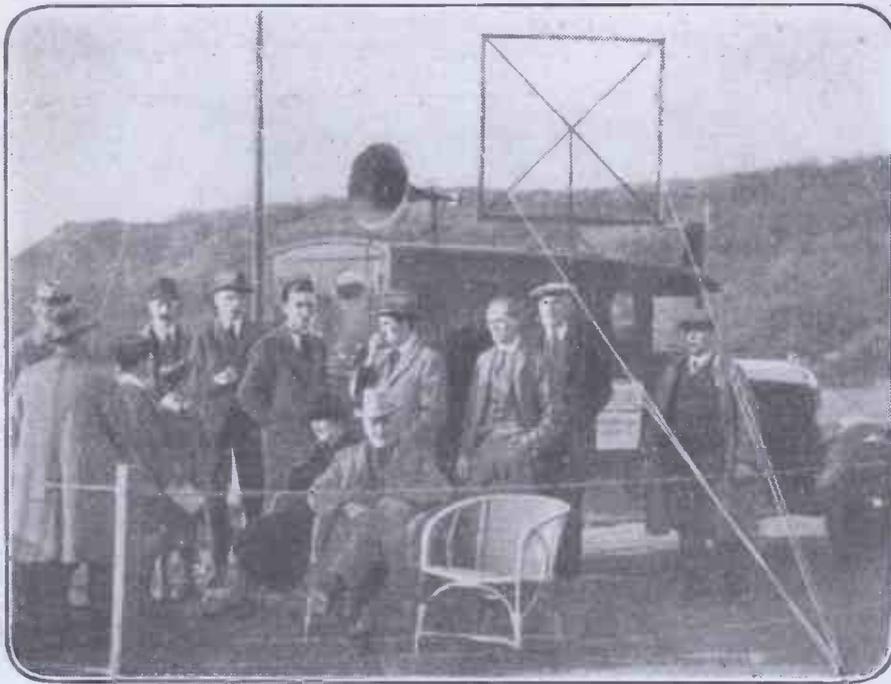
THE technical staff of P.W. are busily engaged with coils and aerials, voltmeters, and ammeters, and gadgets of all descriptions, while the technical editor wears a tired and harassed look. Everyone seems engrossed and preoccupied, and when I inquired the reason, they all said, "What, haven't you heard?"

Carrying Out Tests.

I SAID that I hadn't, and so the editor deigned to explain. "It's the P.W. Combination Set," he said, "a wonderful gadget, specially constructed for P.W., and the staff are busy testing it under all sorts of conditions."

Looks So Simple!

THE constructional details are going to be published shortly in P.W., and we can guarantee that everyone who makes it will be more than satisfied. Up to now it has exceeded all expectations as to its capabilities. So now it's out, and what's more, I intend to tackle the construction of such a set myself—it looks so simple.



A free broadcast entertainment provided by the Marconi Co. at Scarborough.

Amateur Transmissions.

LISTENING to the amateurs the other evening, after 2 L O had closed down, I was surprised at the number of loud signals obtained from stations whose situations could not be traced on any list of call signs. It would be of great assistance to the smaller amateurs—those who experiment on reception alone—if their more advanced brothers would announce their district when they give their call-sign.

Helping the Experimenters.

I WAS trying out a peculiarly difficult circuit at the time, and was rather anxious to see what were its capabilities.

But, though I hunted high and low among many lists of amateur stations, I could not find half of those I had heard working.

No list is issued by the Post Office, and so the lists have to be compiled from information sent in by the amateurs themselves. In this case an announcement, such as "5 CP, Ealing calling," would be greatly appreciated by experimenters.

Coal Miners Listen In.

WILL coal-miners in the near future work to the accompaniment of wireless music? An experiment was carried out at the Dykehead Colliery, Lanarkshire, the other day, with an Ethophone four-valve set, with excellent results.

ARIEL,

phony connection was opened up between three wireless stations (OXE, OXA, OXL), so that any person in Denmark can call up any other person in Bornholm and vice-versa.

New Districts Covered.

CERTAIN difficulties were encountered at the start, but these will be soon overcome. This advancement means that telephonic communication will soon be established over districts where the laying of a cable was impossible.

Wireless Lighthouses.

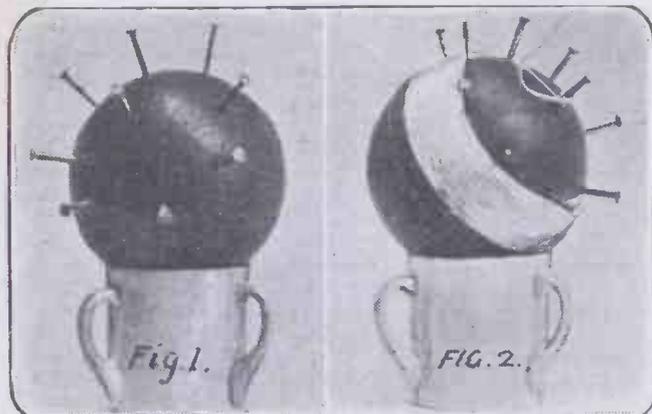
IN the very near future, I am told, we are to expect that most of the lighthouses and lightships will have wireless installations.

THE CONSTRUCTION OF A SPHERICAL VARIOMETER.

By GEO. SUTTON, A.M.I.E.E., F.R.A.

Without doubt variometer tuning is one of the most efficient methods, and is suitable for both valve and crystal work. A reliable instrument of this nature will prove an extremely useful accessory, and in the following article Mr. Sutton details the construction of the spherical type.

ONE type of variometer is made up of two cylinders, one sliding inside the other. But in this simple case, the variations of inductance will not be on a very liberal scale. With the rotating form of variometer, a difficulty may be experienced in making a "wirelessly good" connection between the rotating part and the fixed. But, generally, a flexible wire connection can easily be arranged.



Though there may not be much in it, the writer favours the rotor being connected between the two halves of the stator; where the windings of the latter are, perforce, divided to allow of the spindle to go through to support the rotor. With a spherical rotor and a spherical stator, the maximum capacity of the windings occurs when the direction of the windings imposes the maximum inductance, and so extends the range of wave-length tuning.

Having got so far, some of my readers may ask why go to all this trouble, when we can get quite good results with a sliding tuner and a little variable condenser? The answer is that, properly constructed, the variometer gives better results than the sliding tuner; and is so smoothly variable, that no condenser is needed within the range of the instrument. A condenser may be added in parallel if it is desired to extend the wave-length range.

Tight Fit Required.

Now the question of cost arises. A moulded variometer rotor ball, at the present time, costs 3s. 6d., and the two halves of the stator rather more. The rotor part of a cheap and efficient variometer can be fairly easily constructed. Most of us who have played with children know the kind of ball which is manufactured of spongy rubber and is therefore unburstable.

It is possible to get one of about two and three-quarter inches in diameter for six-pence. Take a metal meat skewer and, starting at a point on the mark which goes round the ball showing where the two halves of the mould met when the ball was made, carefully push the skewer right through the middle of the ball.

If at first you don't succeed, try again. The ball should spin on the skewer as a pivot—without lumping over to one side—if the skewer is straight and goes through the middle of the ball. In a gas flame, heat the projecting point of the skewer and slowly withdraw it into the ball. This operation will make a detestable smell, but it will also make a sticky permanent hole in the ball, through which the penholder—which is to be the spindle of the variometer—will, later on, be pushed.

Pull the skewer out and reverse its direction, so as to burn the hole in the other side of the ball as well. But do not overdo this operation, as the penholder needs to be a tight fit when finally pushed home.

Now, putting a thin splinter of wood as a guide where the penholder will ultimately be, drive another thin metal skewer or knitting-needle through the ball, so as to cross the direction of the first at right angles. And test the accuracy of your work by spinning the ball on the skewer as a pivot, as before. It will save trouble if this skewer also is on the seam of the ball.

Details of Windings.

Now take some one-inch wire nails, and push eight of them half-way into each side of the ball—at an equal distance from the second skewer—so that they form a ring not less than one and five-eighths inches in diameter round the skewer as a centre (Fig. 1). Do this on each side, as the photograph shows. Thread a stout needle with the end of a length of No. 26 S.W.G. double-cotton covered wire, and push it across the cheek of the ball. That is, so that it goes in at the cheek and comes out inside the ring made by the eight nails.

Leave about six inches of this wire threaded through the ball, for the end of the winding. And then start winding the rotor wire round the nails, till you have got about thirty turns on. Then pass the finishing end of the wire temporarily through the pivot hole for safety, while the wire is being shellacked firmly down into its place (Fig. 2). This winding must be begun at each side near the nails, so as to wind "uphill," the only possible way.

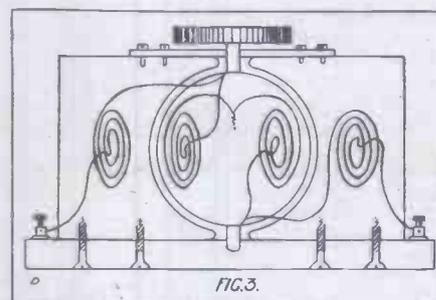
Now procure a hollow rubber ball about two and three-quarter inches in diameter, not too thin in

the walls, as it will have to be stiff enough to support the No. 26 D.C.C. wire which we are going to wind on it. With thin knitting-pins, quarter out this ball, as we did the other, and insert the eight nails in each cheek—being careful not to make too small a circle with the nails (about two inches will do) else it will not be easy to wind the wire on the ball. Wind as before. Twenty-six turns on each side of this ball will be about right. Give the two wire-wound balls several coats of shellac varnish, and they will appear as in Fig. 5.

The Pivots.

The writer tried to obtain hollow cardboard balls, but was unsuccessful. He thought that they would be firmer and possibly cheaper than rubber ones, but the latter have served his purpose.

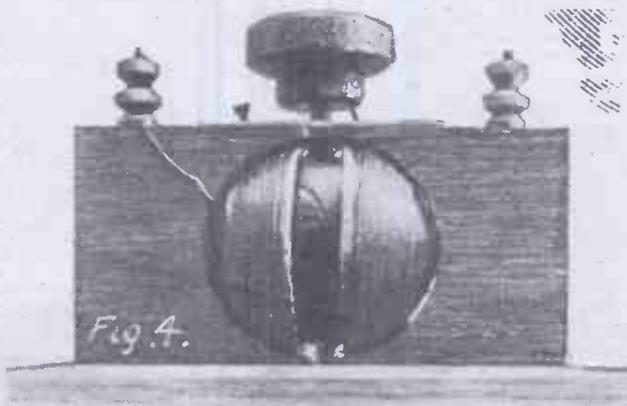
Shape out two pieces of soft wood about one inch thick, square on three sides, and carved out on the fourth side, so as to fit the large hollow ball. That is, so that when



the ball is cut in two, each half may be secured to the wood by a small screw and washer through the plain "cheek" or blank space in the centre of each stator winding.

A strip of brass is screwed down across the top of the blocks, connecting them together, with a hole in the centre of the brass strip through which the penholder can be pushed and form the top pivot hole for the rotor. The bottom pivot drops into a hole in the wooden base of the instrument.

(Continued on page 676.)



WIRELESS IN SUMMER TIME.

A few suggestions regarding the possibilities of fitting wireless up on small boats and cars.

To the keen listener in the summer should offer even greater pleasure than did the winter months. For what could be more delightful than to sit in one's own garden on a summer evening, listening to an extract, say, from Grand Opera. A lead in this case would be taken from the 'phone terminals of the set to a headphone distributor block in the garden, so that several pairs of 'phones could be used; and in the case of a loud speaker, electric lighting flex forms an excellent lead direct.

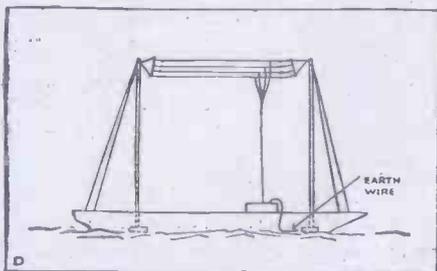


Fig. 1.

To the river enthusiast wireless is a boon, for when once installed in either punt or skiff it has the advantage of the gramophone in this respect—that there is no moving about to change the record, and that it is far more entertaining, as one is hearing the

actual music being played many miles away. How many people stop to think and realise when listening in that there is no actual material connection between transmitter and receiver.

On the River.

Picture a glorious summer evening on the upper reaches of the Thames, with the sun just reaching the end of his journey across the sky, and gradually sinking down, down below the horizon, tinting sky and river with all the gorgeous, ever-changing colours of Nature, and, as one by one the birds cease their singing and all is peaceful and still, out of the silence comes the sound of "The Moonlight Sonata" on a grand piano, not from one loud speaker, but from many on different parts of the river, to the accompanying light of a steadily rising harvest moon, and the lap, lap of the stream as the craft glides slowly along.

For the Motorist

An aerial is easily fitted in either punt or skiff: a six to ten foot pole fastened at stern and bow, with a five-foot spreader either end, but in the place of the two usual wires, four would be used, as per Fig. 1.

The earth is formed by a wire fastened down the side of the boat to a plate below the water-line. The poles would be held in position as shown in the sketch, and would be detachable, the straining wires

having hooks, where they fasten on to the eyes on the boat, (see Fig. 2), and so can be unhooked and the poles taken out of socket, and laid down flat when not in use. The aerial itself would also be detachable from the poles. The type of aerial used would, of course, be judged by the capabilities of the set.

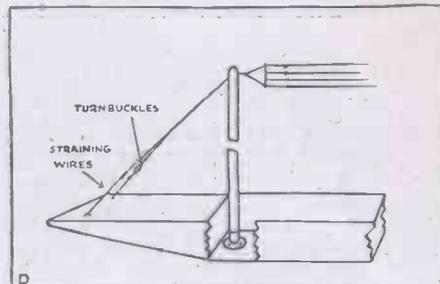


Fig. 2.

To the motorist, music by wireless can always be within his reach wherever he is, and one must admit that a wireless picnic is something of a novelty—to be miles out in the country with not a soul or habitation for miles around, and to hear the well-known voice of, say, 2 LO announcing, "The next item on our programme—"

An aerial is easily connected, say, between the side of the windscreen of the car and the branch of a local tree, the wire being carried coiled on a reel in the car, the earth connection being formed by pushing a copper plate of suitable size into the ground, a lead soldered to the exposed end and taken to the instrument. According to the range and power of the set, so 'phones or loud speaker would be used.

THE CONSTRUCTION OF A SPHERICAL VARIOMETER.

(Continued from page 675).

The two outside ends of the wire wound on the rotor ball are threaded inside and brought up through the spindle hole alongside the penholder and with a piece of thin, flexible wire connected to the outside ends of the wire of the stator. The wires then brought from the inside of the stator coils will be made off on to the terminals of the instrument.

The connections will then be as in the diagram Fig. 3. That is, the left-hand terminal will be connected to the extreme inside wire of the left half of the stator winding; and the last turn of this side connected by a flexible wire to the wire coming out of the top of the rotor alongside the penholder.

The wires of the largest and most equatorial turns on the rotor are joined together, and the ends tucked into the material of the ball, out of the way. To check the wiring: Place the assembled instrument so that one end is towards you. And, assuming that the wire goes from the terminal which

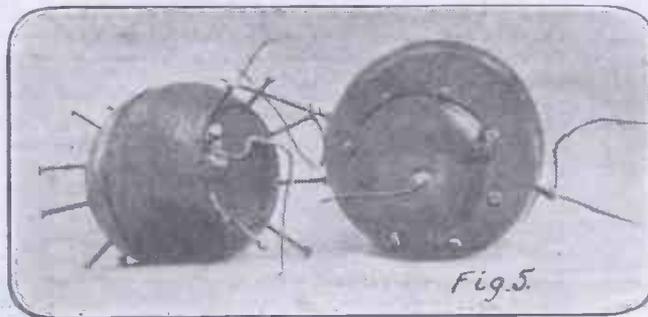
is nearest to you, round the stator in a direction similar to that of the hands of a clock. Turn the rotor so that the windings on it take the same direction. And, finally, the winding on the other half of the stator should run round, still in the same direction, finishing off at the centre with a wire which goes to the other terminal on the base (Fig. 3).

No Condenser Necessary

If you are left-handed, there is no objection to the wire going in the other direction, but all the windings must follow the same way round, otherwise the instrument will not be efficient. Variations of construction may

given, the variometer will tune in its longest wave-lengths. And upon the ball being turned on its pivots through half a circle, the variometer will tune in its shortest wave-length. No condenser is necessary within the range of the instrument, but that range may be spread over a lower series by means of a variable or fixed condenser in series, or lengthened out by a condenser in parallel.

Fixed condensers are, of course, the cheaper—the variations of tuning being left to the variometer. When this variometer was completed (Fig. 4), it was put into the receiving circuit, and the rotor just happened to be in a position—with regard to the stator—to tune in the London Broadcasting Station, which came in with very good volume and clarity.



occur to the ingenious, but if the foregoing instructions are faithfully carried out success is assured.

With the windings following the order

A THIN layer of bicarbonate of soda placed on the bottom of the wooden accumulator carrying box will neutralise any acid that spills, thus saving the bottom of the case from rot caused in this way.

For those who charge their accumulators at home the Simplex Electric Company's "Andy" Fuse Wire Wallets, containing a supply of 5 and 10 amp. tinned copper fuse wire, should be useful. A card of information and fuse wire tables is also enclosed.

MISS ELLEN TERRY AT 2 L O.

NOTE.—A special appeal is being made by "Popular Wireless" in order to obtain assistance for the "Servers of the Blind League." Miss Ellen Terry has promised to send a photograph of herself, autographed in her own handwriting, to every kindly contributor sending remittances of 10s. or over to that deserving charity. Letters should be addressed to "Ariel," "Servers of the Blind League," 3, Upper Woburn Place, W.C. 1.

A FEW weeks ago, on behalf of POPULAR WIRELESS, I had the honour of demonstrating to that great doyen of the English stage, Miss Ellen Terry, the wonders of wireless telephony. For this occasion I used a six-valve Marconi portable set and had no aerials to worry about. All I had to do was to open my magic box, attach telephones, and tune in. Miss Terry was enraptured at the result, and considerably mystified at being able to hear singing and music from Marconi House emanating from this innocent-looking box, without any visible connection from the outside world. Miss Terry's first impressions were duly published in this journal, and also that she expressed the hope that she would be able to broadcast.

A Marvellous "First Night."

That wish, as many of you now know, was fulfilled, when, last week, our beloved Ellen recited to many thousands of listeners in one of the most moving passages of Shakespeare—the scene between Hubert and Prince Arthur. Never have I been so thrilled with the noble lines of our illustrious poet as when I listened to Miss Terry's impassioned reading that night.

From the moment I met Miss Terry as she stepped from her car on that eventful evening, she was full of excitement and high spirits. She could talk of nothing else but her debut before an audience that would have filled many hundreds of theatres. It was a "first night" that was too stupendous to visualise. Could one imagine an edifice a hundred times the size of the Albert Hall, crowded to its utmost capacity, each person present being able to hear every syllable and every modulation of her voice, one can then grasp some idea of the feelings of an artiste sensitive to the presence of so mighty an audience for the first time, as I am quite sure Miss Terry must have been.

A performance was taking place when Miss Terry, accompanied by her daughter, Miss Edith Craig, a friend, and myself, entered the lounge adjoining the studio of 2 L O. Quite a host of distinguished persons had foregathered to meet the great actress, but the silence politely enjoined in the precincts of the studio forbade any demonstrations other than whispered salutations.

During the ordeal of waiting, Miss Terry produced a volume of King John, and in

an undertone rehearsed the passage she was soon to recite. She seemed quite unconscious of her surroundings or of the presence of other people, for she was living a part, throwing out her left arm while she held the volume in her right hand, slightly raising her voice, then restraining it to a whisper.

Miss Terry in Tears.

Intense though the suspense must have been, happily it was not long before Mr. Burrows appeared, and, with his customary courtesy, escorted Miss Terry and Miss Craig into the blue-curtained room of 2 L O. Miss Terry's friend and I followed. Mr. J. C. W. Reith, the general manager, was present also to greet Miss Terry.

When all was in readiness the studio was quickly emptied by special request, only Miss Terry, Miss Craig, Mr. Burrows, and myself remaining.

Miss Terry then sat on the arm of an armchair drawn up to the little polished table, on which a reading-lamp had been placed.

her own eyes were blurred with the tears that genuine feeling can alone provoke. Quickly she took the handkerchief that her daughter gave her, and hastily brushed the tears aside. Fearful lest her mother might waver, Miss Craig whispered the cue.

An Exhausting Ordeal.

At length, and all too soon, Miss Terry's memorable recital came to an end. It had been a remarkable performance, and those of us who were present knew that this truly great artiste was sparing no pains to give of her very best to make it a real success. The nervous strain imposed had taxed even her wonderful vitality, for, directly it was over, Miss Terry rose with a murmur of relief, and sank exhausted into a chair. In a few minutes, however, she had recovered, and listened attentively to her daughter, who read the touching appeal for the Ellen Terry Home for the Blind, in the name of her famous mother, who is its patron.

When Miss Craig had finished, Miss Terry spoke a few more affectionate words of farewell to her many admirers.

I cannot conclude this article without saying a few words of appreciation for Miss Terry's splendid example in coming forward out of her well-earned retirement for no other purpose than to serve her fellow-creatures. Broadcasting is a boon to thousands of folk, and there can be no greater proof of Miss Terry's thought for others

than by the unselfish entertainment she gave to listeners in the other night. If united applause had been possible, London, I am sure, would have echoed with the sound of cheering for miles around.

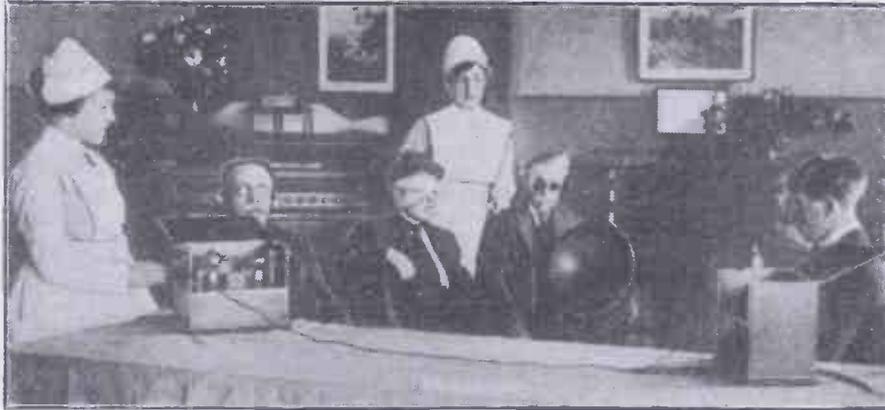
Practical Demonstration of Gratitude.

This, unfortunately, was not possible, but her great audience can show their gratitude in another and more effective way, and that is by responding generously to Miss Terry's appeal for donations to her blind institution.

Contributions should be addressed to "Ariel," c/o "Servers of the Blind League," 3, Upper Woburn Place, W.C. 1.

I hope that money will come rolling in for this charitable institution. Miss Terry will then know that her performance was well appreciated, and will be encouraged accordingly to broadcast again.

"ARIEL."



How wireless can lighten the lives of the blind. Patients and nurses of the Royal London Ophthalmic Hospital listening-in.

The other lights in the studio were lowered, leaving the reading lamp on the table to bathe the central figure in that silent room in a flood of yellow light. How impressive she appeared in her stately bonnet and long cape! She looked around her with a smile, all ready to begin, while her daughter stood just behind her mother, waiting to help her should anything go amiss.

In a few moments the voice that had wrought a spell on playgoers a while ago, a voice that had been heard in company with such famous players as the late Sir Henry Irving, broke the silence. It rose and fell, it quivered and pleaded for the eyes that had done no harm. And presently, when she came to the most poignant lines:

"Have you no heart? . . . Will you put out mine eyes?
These eyes that never did nor never shall
so much as frown on you?"

CRYSTAL PRESSURE.

Describing the method of carrying out, and the results obtained from a series of interesting experiments.

THE results and outline of the following experiments conducted by the writer may possibly be of use to readers interested in crystal reception.

The pressure of the contact required by crystals used in wireless reception varies enormously, and is, of course, very intimately connected with their stability in use.

The whole of the apparatus can be easily constructed at home, with the one exception of the micrometer movement.

This, however, is not absolutely necessary, and readers may find means of modifying the apparatus in this respect.

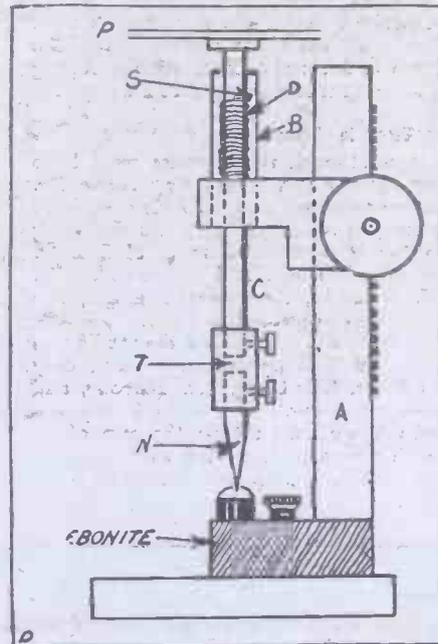
A is an old microscope rack and pinion movement. Into the movable arm a brass tube, B, is screwed, right through which passes a large knitting needle, C.

The Balance.

The tube contains a fine spring, D, made by winding No. 32 S.W.G. German-silver wire round a pencil. The knitting needle is soldered to the top end of the spring at S. To the top end of the needle a disc of cardboard, P, is attached in any convenient manner.

To the lower end a gramophone needle, N, is fixed by a terminal connector, T. This can be replaced by a cat's-whisker or crystal cup if desired for perikon combinations. The method of using the apparatus is as follows:

The detector is connected to the receiving set in the usual manner, and the needle lowered on to the crystal, which is movable in the cup, until signals are heard. A sensitive spot on the crystal is selected,



and the needle then raised above it. The needle is next lowered until it just touches the crystal.

The needle is now raised a definite small distance—3 mm. or $\frac{1}{4}$ in. is convenient—registered by a mark on the upright. Weights are now placed on disc P, and the needle thus depressed.

A Few Readings.

The weights are adjusted until the most sensitive position is obtained. The weight is noted, and when the weight required to depress the spring the 3 mm. or other fixed distance (found by experiment) is subtracted from this, the result is the force with which the contact must press on the crystal for best rectification.

At present only the following crystals have been thoroughly tested by this method:

Zincite-Bornite, 18–25 gm. This weight is fairly critical for best results.

Galena, 1.2–2.5 gm. Critical.

Silicon, 2.6–6 gm. Not so critical as above.

Hertzite, 3–4.5 gm. Critical.

Rectarite, 3–8 gm. Not so critical as Hertzite.

Carborundum gave very peculiar results. A very sensitive position was often found with a pressure of about 20–25 gm. As the pressure was increased the sensitivity usually fell off at first and then quickly increased, never, however, quite reaching its former value. It was still quite sensitive with a pressure of nearly 1,000 gm.

Having considered the above results, the conclusion the writer came to was that for the reception of fairly strong signals the perikon combinations could not be beaten, but that rectarite was slightly more suitable for weak signals.

THE 300-KILOWATT CREED AUTOMATIC TRANSMITTING KEY.

IN a previous article the latest Creed telegraphic apparatus was discussed, so it now remains to describe the Automatic Transmitting Key for high power transmission.

In order that the Creed receiver may function properly, the signals must be transmitted automatically, the reason being that the receiver is only adapted for the reception of signals the speed of which does not vary more than a small percentage in either direction. Moreover, the length of the signals should not vary more than 25 per cent, or one-quarter of a dash length, in either direction. With no greater error than this the receiver actually corrects inaccuracies.

The Last Link.

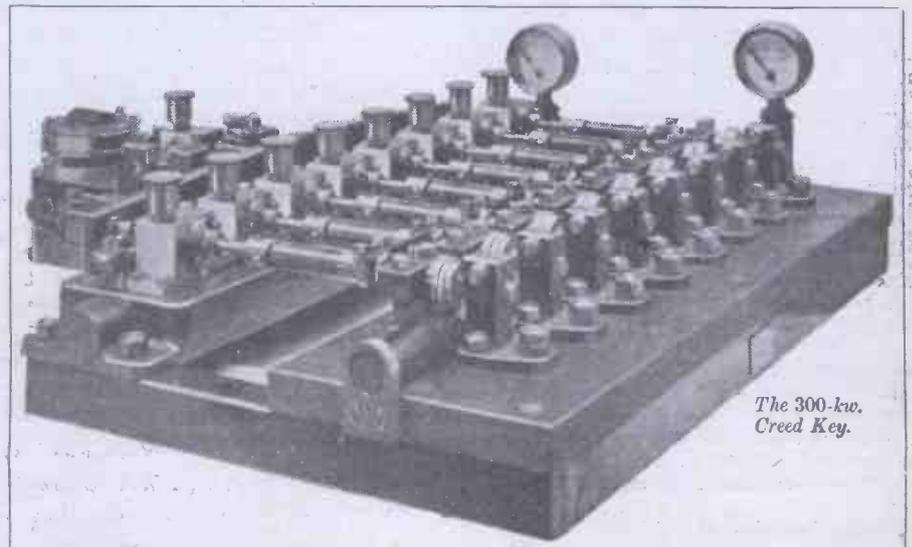
Again, one of the features of the receiver is its high speed of reception, so that, to obtain full advantage of it, it is necessary for transmission also to be carried on at a much greater speed than could be attained by manual methods. That, of course, is all to the good, and of great benefit in commercial telegraphic correspondence, and the

Creed automatic transmitting key is the last link in the chain of automatic apparatus.

As previously described, the message to be dispatched is prepared by a Morse keyboard perforator, the perforated tape being passed on through an automatic Wheatstone transmitter. The transmitter controls a small direct current that serves to operate the transmitting key itself which performs

the necessary switching operations on the heavy currents in the transmitting aerial or in circuits associated with it.

There is practically no limit to the power for which this design of key can be constructed, since it is only a question of a relay of sufficient power, and of a sufficient number of pneumatic motors and contacts.



The 300-kw. Creed Key.



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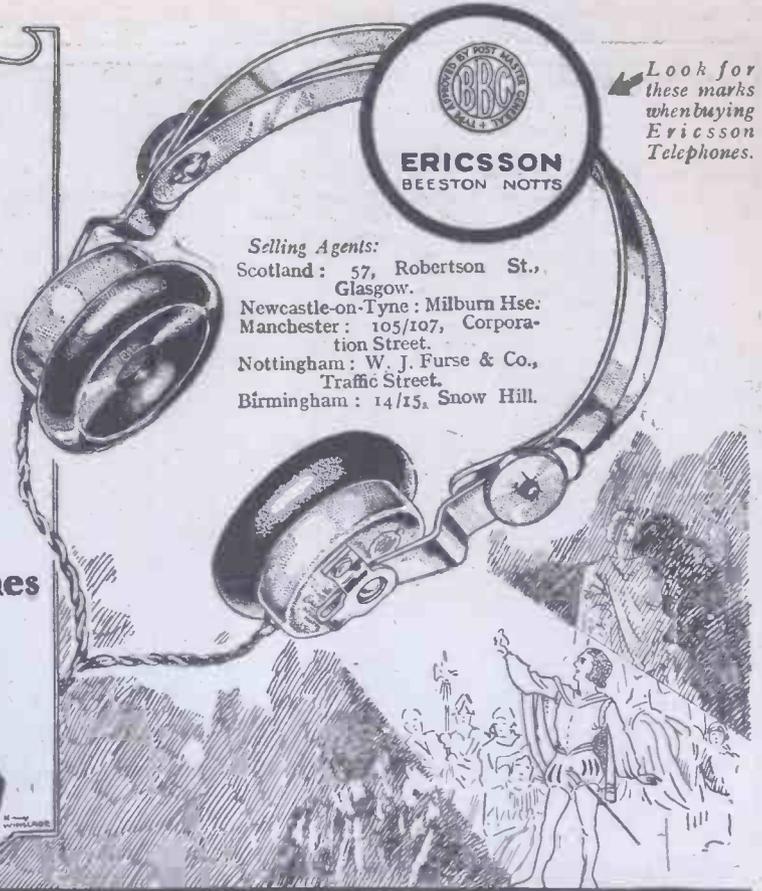
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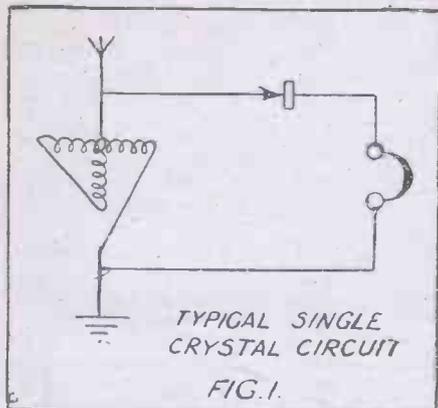
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DOUBLE CRYSTAL CIRCUITS.

By SEXTON O'CONNOR.

Requiring no local current and on account of its low initial cost, cost of upkeep and ease of manipulation, the crystal detector receiver is to be preferred to a valve set in cases where its sensitivity is capable of covering the range of reception required. Could this sensitivity be considerably increased, the crystal set would no doubt very extensively replace existing valve sets, and in the following article valuable suggestions for research in this direction are given.

THE chief disadvantage of the crystal as compared with a valve lies in the fact that it will not amplify received signals, and so cannot be used to operate a loud speaker. On the other hand, the difference in cost is so much in favour of the crystal that the beginner is usually quite content to put up with the limitation of a single pair of headphones, and to pass them in turn around those of the family circle who are anxious to share the thrill of "listening-in."



With a good aerial and earth circuit it is quite possible to use two pairs of 'phones in series with a single crystal without seriously lessening the audibility of the signals, particularly if one is working within ten to fifteen miles of the broadcasting station. Any attempt to add a third pair is, however, generally accompanied by such a distinct "fading away" that the pleasure of listening degenerates into a strain.

By making use of a second crystal in the manner about to be described it is possible, however, to double the number of 'phones that the set will normally carry without appreciably affecting the strength of reception.

The only extra cost is a matter of three shillings or so for a second crystal and holder, plus the price of the additional 'phones that the set will then carry.

Construction of a Variometer.

As a preliminary it may, perhaps, be helpful to set out the simple principles which underlie the action of the crystal receiver, and to indicate one or two methods in which the theory may be tested in practice by the aid of a second crystal.

Figure 1 represents the simplest receiving set it is possible to make. Apart from the crystal and 'phones, it consists solely of the aerial and a "variometer" made by winding flat coils of wire in and out of radial slots cut in a cardboard disc. Such a variometer can be made from start to finish in a quarter of an hour. For those who have a standard 100-ft. aerial, twenty-eight turns of No. 26 D.C.C. wire should be

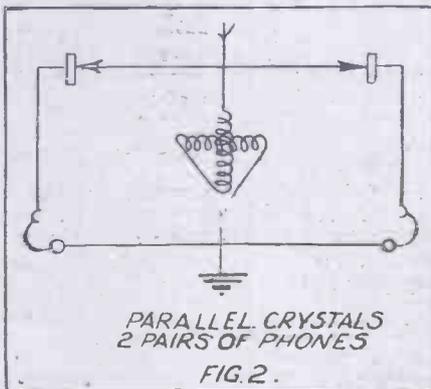
wound in "spiral" layers upon a 4-in. disc, and then joined in series to a second similar disc, likewise wound with sixteen turns of the same wire. This will be found to bring in 2 L O perfectly. The two discs should be placed one on top of the other, and separated by a distance of, roughly, 1/4 in. The crystal and 'phones are wired across the discs from aerial to earth as shown.

The currents picked up by the receiving aerial flow straight through the aerial wire to earth. Many people think that they flow through the crystal. In one sense this may be accepted, but, strictly speaking it is not true.

Operation of Detector.

As will be seen from the figure, the crystal and telephones do not lie in the straight path of the aerial. They form a branch circuit across the variometer. The resistance of the crystal may be anything from 10,000 to 20,000 ohms, and that of the telephones from 4,000 to 8,000 ohms, so that together they make a total high-resistance path varying from 14,000 to 28,000 ohms. On the other hand, the resistance of the wire forming the variometer amounts to less than an ohm. It follows that the aerial currents taking the obvious "line of least resistance" should shoot straight through the variometer direct to earth, leaving the branch circuit containing the crystal and 'phones severely alone.

It happens, however, that the aerial currents are of very high frequency—roughly, 800,000 a second in the case of broadcast signals. Also, the wire of the variometer has been designedly coiled into many turns so that it is endowed with the peculiar electrical quality called inductance, which causes it to offer a high impedance to high-frequency currents.

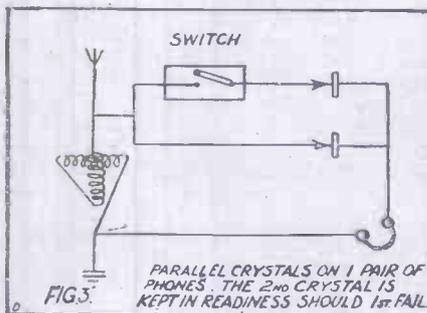


The result is that although the currents "get through" the variometer to earth they have a struggle to do so. The inductance "impedes" them, and tries to thrust them back. This back thrust or "back voltage" effect accumulates, and,

so to speak, spills over from the top of the variometer, finally escaping through the relief path afforded by the parallel circuit containing the crystal and 'phones.

For this reason the crystal is said to be a "voltage operated" device. It is not a "current operated" detector like the older electrolytic devices formerly used in wireless telegraphy. It will now, perhaps, be clear why it is only a half-truth to say that the currents picked up by the aerial pass through the crystal.

It must also be remembered that the aerial currents are oscillatory—that is, they swing to and fro in opposite directions both up and down the aerial. Precisely the same effects will therefore occur at the bottom end as at the top of the variometer.



In other words, the "return half" of each wave received by the aerial finds its upward passage clogged or impeded at the lower or earth end of the coils wound upon the cardboard discs. Accordingly, just as there is a "back voltage" tending to "spill over" through the crystal circuit at the top end of the variometer, so there is a second voltage "bulge" at the bottom which also tries to find relief through the branch channel via the crystal and telephones.

"Paralleled" Crystals.

It is here that the peculiar property of the crystal comes into play. It can pass current in one direction only, and not in the other. Strictly speaking, it would be better to say that it passes far more current in one direction than it does in the other. The result, however, is practically the same whichever way it is put. An excess of current will pass through in the more favoured direction, and it wins through in the form of tiny pulses all aimed in the same way. These combine together and so succeed in vibrating the telephone diaphragm at a rate which depends upon the signal pitch imparted to the transmitter at the broadcasting station. The backward thrusts due to the "return halves" of the aerial current are, in effect, wiped out.

Having explained the simple theory of crystal reception, we will return to a consideration of the possibilities of "double crystal" circuits.

(Continued on page 82.)

DOUBLE CRYSTAL CIRCUITS.

(Continued from page 681.)

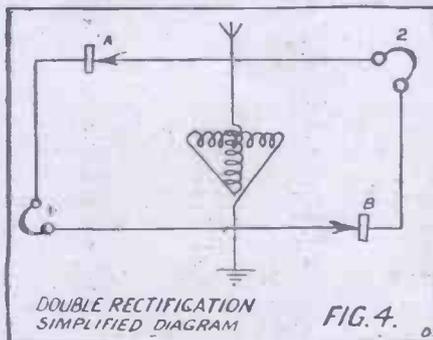
In the first place, it is clearly possible to place a second similar branch circuit, containing a crystal and a pair of 'phones, across the variometer in parallel with the first, as shown in Fig. 2.

Here the voltage "bulge" at the top of the variometer is given an additional relief path. If each crystal is adjusted to maximum sensitivity the "back voltage" will distribute itself equally without favour over both relief channels, and will consequently operate both 'phones. As in Fig. 1, the "return halves" of each aerial oscillation are again "washed out," because owing to the peculiar rectifying action of the crystal combination they are unable to pass from the crystal to the cat's-whisker, although they can readily do so in the reverse direction—i.e., from cat's-whisker to crystal.

At the same time such a circuit would in most cases not result in any appreciable increase in signal strength. If, however, there is an ample supply of "juice" in the aerial, the arrangement will prove superior to the use of two telephones placed in series with a single crystal. By opening out a second relief path, the total resistance of the branch circuits is halved, and each crystal can therefore operate with a somewhat greater efficiency. In short, a greater percentage of the total available energy can be utilised in this manner.

Switching Over.

An alternative method of arranging two crystals in this fashion is shown in Fig. 3. Here both crystals feed the same pair of 'phones. Apart altogether from any increase in signal strength, it is sometimes useful to have a second "adjusted" crystal handy in case the first goes "dud." If fitted for this purpose one of the crystals should be provided with a small switch, which may be left open so long as the first crystal is acting efficiently. Should it suddenly go "off colour" after a more or less prolonged spell of duty, it is a simple matter to switch in the second crystal (which has previously been adjusted to



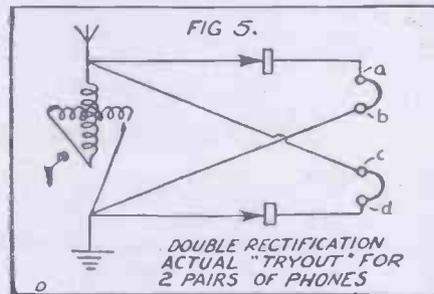
maximum sensitivity) so as to pick up the signals with a minimum loss of time. It is most irritating to lose the best portion of the most interesting item on the evening's broadcast programme because one's crystal

suddenly goes crazy and refuses to yield a sensitive spot promptly on demand. This has been known to happen. But it can be avoided by the simple expedient of keeping a second crystal ready to "take charge."

The most advantageous method of using two crystals is, however, to be seen in the circuits illustrated in Figs. 4, 5, and 6. Fig. 4 is the simplest diagram. It will be seen that here the crystals are placed in "reversed" directions in the two parallel branch circuits. The crystal A, as before, will give a relief path to the voltage accumulated at the top end of the variometer, and corresponding signals will be heard in the pair of 'phones marked 1. The crystal B, on the other hand, will not pass current in the direction "crystal to cat's whisker," and therefore, so far as the voltage pressure at the top of the variometer is concerned, the right-hand branch circuit does not exist. Accordingly, the full amount of available energy passes through the crystal A, and is not "split" between the two parallel circuits as was the case in Fig. 2.

Double Rectification.

It will be remembered that a second voltage "bulge" or pressure is also formed at the bottom end of the variometer coil, which, in the arrangement of Fig. 2, is simply "wiped out" or lost. In Fig. 4 this "lost energy" is now utilised because it can pass through the crystal B from



cat's-whisker to crystal, and so actuate the 'phones marked 2. There is, however, no passage through the crystal A, because the path in that circuit is not open in the direction "crystal to cat's-whisker."

The complete circuit, therefore, utilises the whole of the available aerial energy in the 'phones instead of losing or wasting half of it, as is the case in the ordinary rectifying action of a single crystal. In other words, we are obtaining "double rectification."

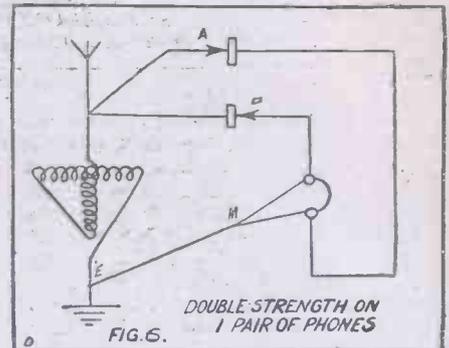
Fig. 5 shows a more convenient lay-out for the set, both pairs of 'phones being arranged on the same side of the panel board. Otherwise it is identical with the circuit of Fig. 4.

Fig. 6 shows an arrangement for utilising double rectification with a single pair of 'phones in cases where, for some reason or other, it is normally only possible to get very poor signal strength.

Double Strength Signals.

Both earpieces of the ordinary headgear are wound in series. That is to say, the current from one terminal, after flowing through one earpiece, passes down a return lead to the junction point of the two flexible leads and then up again to the other earpiece, and so back to the second terminal.

To utilise the arrangement shown in Fig. 6 it is necessary to bare the telephone flex at the junction point M, where the separate leads branch off to the two earpieces, and to connect the "series" wire (joining one earpiece to the other) across to the earth end E of the variometer. The



voltage at the top end of the variometer will then drive current through the crystal A, around the lower earpiece of the telephone, and so through the point M to the earth end E, whilst the "return" voltage at the point E passes via the point M, the upper earpiece of the 'phones, and the "reversed" crystal B, across to the upper end of the variometer.

The signal strength then heard in the 'phones will be that due to the combined effect of both currents—i.e., the double effect of rectifying both halves of the aerial oscillations.

Testing Effective Opposition.

In conclusion it must be added that satisfactory results with double rectification circuits can only be obtained by the exercise of a little care and patience. Unless both crystals are of equal sensitivity and carefully adjusted, some of the current that should pass entirely through the crystal A, Fig. 4, will succeed in getting through the crystal B, thereby lessening the full signal strength obtainable in A. Similarly the crystal A may by-pass some of the "return" voltage that should pass entirely through B. A little care will, however, succeed in reducing this "leakage" effect, which can in practice be measured by tapping the telephonic leads across the terminals, a, d, in Fig. 5. When very little or no sound can be heard with the 'phones across the points, a, d, it is obvious that the crystals A and B are effectively in opposition, and therefore the best results will be obtained from both 'phones when arranged for double rectification in the manner previously described.

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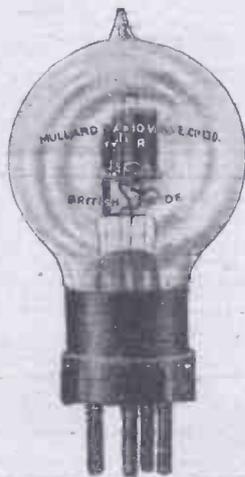
Can you realise how awful it must be to be deprived of Nature's greatest gift—sight? Can you imagine the loneliness of perpetual darkness, the inability to see the green fields, the fruit-trees in blossom, the glorious flowers, and the faces of those one loves? If you can, then you will not hesitate to send a contribution to that deserving charity, "Servers of the Blind League," which is doing so much to alleviate the distress of the blind. A few pence, a few shillings, a few pounds, how little it is in comparison to the good it can do when applied to such a noble purpose! Miss Ellen Terry has promised to send her photograph autographed in her own handwriting to every kindly contributor sending remittances of 10/- or over to "Ariel," c/o "Servers of the Blind League," 3, Upper Woburn Place, W.G.1.



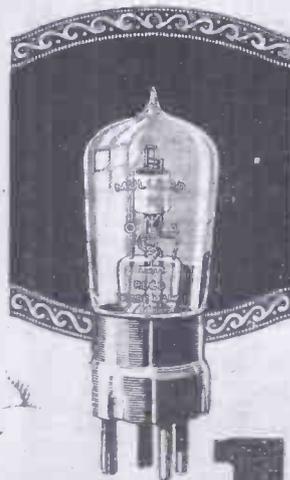
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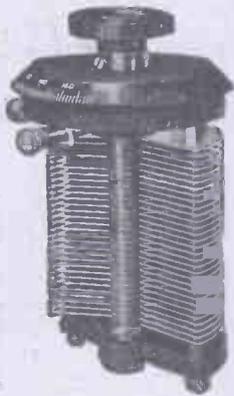
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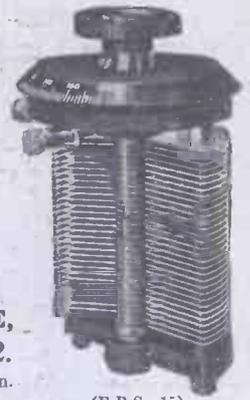


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WIRELESS AS A SOCIAL ASSET.

By THE BISHOP OF BIRMINGHAM.*

THOUGH wireless may be said to be in its youth and will undoubtedly develop in many directions, I cannot but regard it as a most extraordinary feature of the times. Whereas, for example, the cinema does not seem to have realised its possibilities of development, it seems likely that wireless will, and I believe that it



Turning on some music. The set belongs to Mr. R. F. Wanlow, of 179 Moorland Road, Weston-super-Mare.

has a really great future, particularly when to the means of hearing there will be added, as is promised, the means of sight by wireless. I think that broadcasting will be immensely valuable, for one thing, politically. If we can hear a speech by any great politician, any leader of the State, it is bound to be more effective than to read it in the newspapers, though, of course, I know there are men whom it would be better to read than to hear broadcast. It is essential, I imagine, for successful broadcasting that a man should be an orator, and he should always be prepared with what he wishes to say.

"Personalness."

What has struck me from my own experience of broadcasting is its "personalness." When I broadcast a talk from the Birmingham station on Good Friday I was surprised at the result. I received many letters thanking me, letters which came in some places from people I had not seen for years and had almost forgotten. I received from Mansfield, in Nottinghamshire, where I was born, letters from people who told me that they had known my parents and were glad to have heard me. Wireless, to my mind, has possibilities in the matter of familiar-

ising a person of distinction to the people. For example, despite the important place the King occupies in modern life, there are people who never get the opportunity of seeing him, much less hearing him. Yet could they, on some special occasion, say on his birthday, hear his voice by means of wireless, they would get in vitally effective touch with him in that way. There is, of course, more than the mere voice in that aspect. There is the "one's self" in it which establishes the person broadcasting as a real vital personality.

In civic affairs, too, I think it has great opportunities, though, of course, we are only on the threshold of them. When one considers its possible application to the service of religion I can understand one's heart and conscience being influenced by the broadcast address, but I am not quite so sure that it can be used for the worship in which a man may join. I am afraid it would not become the same reality. But the broadcasting of a service to, say, elderly people whom age and infirmity prevent from attending at church, should be useful. The family could be gathered in one room, they could have some kind of service, and then listen-in to the address.

Broadcast Sermons.

To broadcast to a large building in which a great number of people are gathered together is another matter. Without seeing the preacher, would one be able to keep oneself in tune with the service? I am doubtful whether being led in prayer by the priest speaking through the microphone would have the same influence as were he present. There might be so many other things which would distract the attention, whereas the very presence of a clergyman diminishes them. Religious service depends so much upon atmosphere, and though non-attendance at church would not affect the sermon, it would affect the service. When I spoke on Good Friday I stood beside the microphone, and I felt that sermon as much as if I had my congregation in front of me. In a way I was lost to my surroundings. Of course, that may have been due partly to the fact that I had been spending the whole of Good Friday in religious worship. I am led to think that broadcasting might be valuable in a diocese like mine if we had to face the problem, which seems to be becoming more and more serious, of finding sufficient clergy for the needs of the Church. At the present time, with the shortage of supply, this can only be

overcome by fusion of parishes. But few parishes care either to lose their individuality or to give up their church. In some parishes there are only 100 to 150 people, in others, say, 250 to 300, and they may get congregations of 40 and 50. It is difficult to find clergy for each of them. It might be possible, I imagine, to have say, two clergymen to six parishes, to each of which they would go in turn, the others having a sermon broadcast to them.

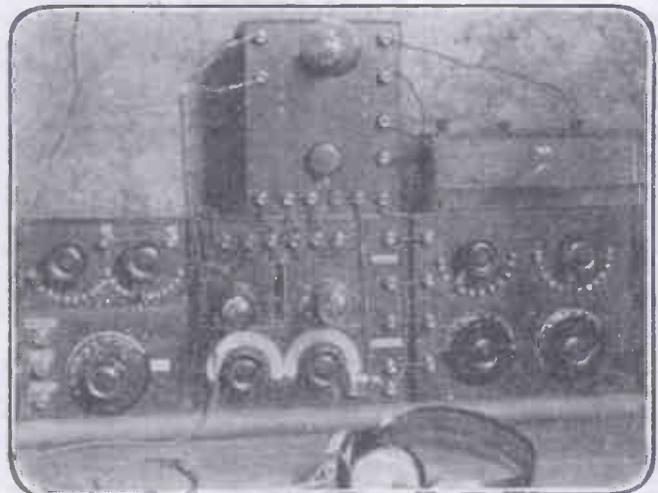
"Court" Concerts.

Considering wireless as a means of social enjoyment, I think it is providing another example of the tremendous simplicity of enjoyment in our English people. In Birmingham you can see it plainly. It is positively surprising at times to go up a court somewhere in the city and see people dancing together. Court concerts in Birmingham have been a great part in their life, and perhaps wireless broadcasting will help, too, in this way. This is really the great requirement of the age—to give joy to life, to give greater contentment and less inclination for class to get against class.

And you cannot do that better than by giving them something wholesome, and that can be given by wireless. Educationally, I think wireless will be useful in spreading the best accurate information. It might be possible for the student, standing before a machine, to be advised and instructed by a teacher before a similar machine miles and miles away. But it is only commencing to serve in our daily life, and its possibilities are immense.

*In an interview.

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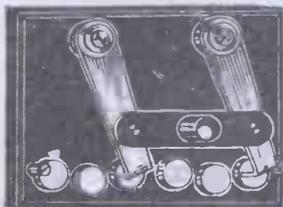


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THE CONSTRUCTION OF AN ACCUMULATOR H.T. BATTERY.

By F. CECIL CONNELLY.

High-tension batteries of the dry-cell type have a very unfortunate habit of developing internal troubles at unexpected times, with the result that reception is impossible owing to a continual grating, crackling noise. The employment of an accumulator H.T. supply will obviate to a great extent such trouble, and will for experimental purposes supply a more steady current.

SEVERAL methods of reviving dry cells for use in high-tension batteries have been described in these columns, but the Leclanché cell—which the dry cell really is—has many disadvantages. Its voltage is low, and it is very messy. An accumulator battery is without both these defects, and is by far the most economical for those with electric lighting

the other limb in the next tube. The sketch of the finished battery will make this clear. The other three long pieces should be bent as in Fig. 3, and placed in the end tubes of the rows so that all the cells are connected up in series. The small pieces of lead are for the two end cells. The corks are cut away at the sides so that they will fit into the tubes when the plates are in position, and a hole is made through centre of each to act as a vent. The corks are then soaked in paraffin wax. Some separators are necessary between the plates; 5-in. lengths of glass tubing will do quite well, or strips of perforated celluloid may be used. The cells are then filled with pure dilute sulphuric acid—density 1.220—and are ready for forming. It is possible to obviate the need for forming by using strips of old accumulator plates instead of lead sheet.

A Small Charging Board.

This appliance will be necessary for forming the plates, but, of course, any accumulator charging apparatus will do. A simple but effective one can be made as follows: Take a piece of hard wood 8 in. by 4 in. by $\frac{1}{2}$ in., and on it screw an ordinary tumbler switch, a "batten" lampholder, and two brass terminals. With pieces of rubber-covered copper wire connect one terminal to one pole of the switch, the other pole of the switch to the one side of the lampholder, and the other side of the lampholder to a length of twin flex, the other wire of which is joined to the second terminal. The other ends of the flex are connected to a lampholder adapter connecting to the mains.

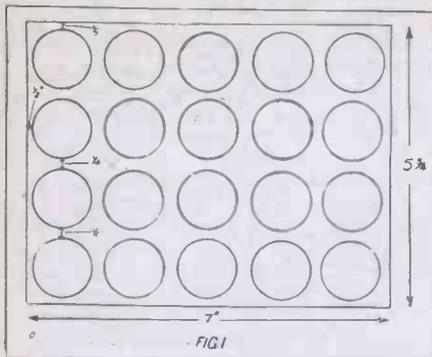
Forming.

A suitable lamp must be placed in the lampholder (200 to 220 volt circuits require a 32 C.P. carbon lamp, while on 100 to 150 volts a 16 C.P. lamp will do). Put the adapter from the charging board into a lampholder, and connect up the terminals to the H.T. battery, and switch on. If the connections are correct the lamp will light up. When it has been alight for half an hour, switch off and leave for a day. Next day reverse the connections between the battery and the terminals, so that the current goes through the battery in the

opposite direction, and charge for half an hour. Repeat this for a week, reversing the connections each day, then continue for another week without reversing the connections, and giving it an hour each day. At the end of this time one set of plates will have a distinctly brown colour and the others a grey colour—the brown ones are the positive plates—and the battery is now ready for use.

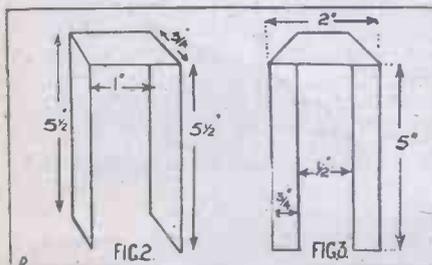
Charging and Forming from Alternating Current.

The previous instructions are, of course, for direct circuits; but by placing a "rectifier" in the circuit the A.C. will be turned into D.C., and the same apparatus can be used for charging. A rectifier can be made as follows: Obtain two lead plates 3 in. by 7 in. by $\frac{1}{16}$ in., and one aluminium plate $3\frac{1}{2}$ in. by 7 in. by $\frac{1}{16}$ in. Two pieces of wood $\frac{1}{2}$ in. by $\frac{1}{2}$ in. by 5 in. are clamped one on each side of the aluminium plate and $\frac{1}{2}$ in. from one end. Then screw the lead plates on to the strips of wood, one on each side of the aluminium. Get a 3-lb. earthenware jam-pot and nearly fill it with a saturated solution of bicarbonate of soda. The metal plates are placed in the solution so that the wood rests on the top of the jar and keeps the bottoms of the plates just off the bottom. Fig. 5 will make this clear. Join the lead plates together and connect to one terminal of the charging board and the aluminium plate to the battery, the other terminal of which goes to the remaining terminal on the board.

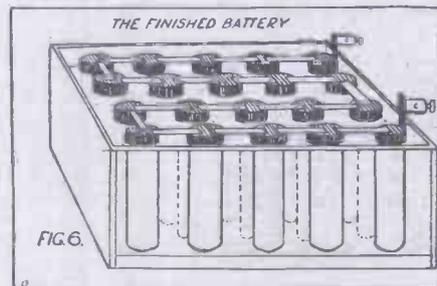
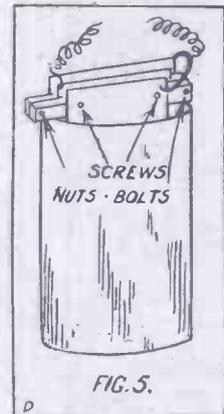
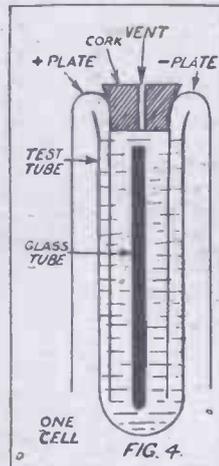


mains in the house. The battery described in this article has given satisfaction for several years, and costs next to nothing in upkeep.

This battery is made up for 40 volts, but the dimensions may be altered to give any voltage, remembering that each cell gives 2 volts. The materials required are 20 chemical test-tubes 6 in. long by 1 in. in diameter, 20 corks to fit, some $\frac{1}{8}$ -in. glass tubing, some $\frac{1}{16}$ -in. lead sheet, and some wood. Take a piece of wood $\frac{3}{4}$ in. by $5\frac{1}{2}$ in. by 7 in., and through it bore 20 holes 1 in. in diameter in the positions shown in Fig. 1. Then get another piece of the same size, but 1 in. thick, and drill 1-in. holes in it in exactly the same positions as in the first board, but only $\frac{1}{2}$ in. deep. Then make up the rest of the frame according to Fig. 6, with pieces of wood $\frac{3}{4}$ in. by $5\frac{1}{2}$ in. by 4 in., and place the test-tubes in position, so that the bottom of each rests in the shallow holes in the bottom board.



From the sheet lead cut 19 pieces 12 in. by $\frac{3}{4}$ in., and two pieces $6\frac{1}{2}$ in. by $\frac{3}{4}$ in. Bend 16 of the long pieces as in Fig. 2, so that one limb of each piece goes in one tube, and



The battery is, of course, charged in the usual way when it requires it. It is an advantage to insulate it on porcelain, rubber, or ebonite legs.

THE B.B.C. PLAYS.

A CRITICISM BY DAME MAY WHITTY, D.B.E.

Dame May Whitty is the principal of the Florence Edinger Theatre School and is therefore an authority on the subject of Shakespearian drama production.

I WAS one of the many thousands who listened-in to Shakespeare's "Twelfth Night" one Monday evening, and a very interesting experience I found it. Unfortunately, I did not hear the commencement, and so missed "the argument," the explanation of plot, etc., and I don't know how far people who did not know the play could follow it, but it all seemed very clear to me; it had been very skilfully arranged, though it rather fell down towards the end. Viola's and Sebastian's fights with Sir Andrew Aguecheek were difficult to grasp—the explanation was inadequate, and it all seemed wound up in a great hurry; and I cannot think that the stranger to this beautiful play—and I suppose such strangers exist—could have possibly grasped "what happened at the end."

Atmosphere and Illusion.

The performance itself was well done, the music delightful; and it was very interesting to me to listen to the spoken word without any personality or appearance to heighten or dispel any illusion. On the whole, the word was spoken very well indeed, and carried with it atmosphere, character, and illusion. I should like particularly to commend the Malvolio. One realised the pomposity and fatuousness of the character, and one saw that painful smile and the yellow stockings cross gartered. The Olivia was satisfying, too. One felt the melancholy, the feeling of weariness and distaste, the gradual quickening of interest in the saucy boy who comes as Orsino's messenger, and the graciousness and simple dignity of the great lady.

The Viola was very pleasing, though her voice struck a more modern note, yet it was attractive. I wanted more life, more sense of fun in the "I left no ring with her" speech, but the love for Orsino was prettily expressed.

Sir Toby Belch was a little blurred. It must be more difficult to convey confused, drunken speech and yet be clear when there's only a voice and no movement to help; and it must be infinitely hard on actors not to have a notion of how it's really sounding. Sir Andrew was good. One visualised the foolish, timorous knight though one could not see him, and that was because the speaker used the upward inflection almost continually.

Maria wasn't as clear as she might have been; again rather blurred, rather too

noisy to convey her mirth with sufficient conviction. I suppose because there was no movement to help. On the other hand, some of the others were so determined to be clear that in one or two instances they over-emphasised and were over-deliberate and slow. And yet it seems to me to be hyper-criticism to find any fault, because the thing was exceedingly well done, and one got a sense of colour and atmosphere, and I believe there ought to be a future for this work.

There are so many people who have never read any of Shakespeare's plays, some who have never seen any acted, and I believe that to hear this great poetry well spoken, with a real sense of rhythm and yet not to lose the meaning, to have the words convey the thought and make that thought clear—not just to roll it out as sound—I think that it would quicken interest, that the listeners-in would want to know more; would look up their Shakespeares—there's nearly



The Marlborough College field wireless section at work.

always one on the shelf, though probably very dusty and neglected—and then, their desire and thirst for knowledge, for further acquaintance with these magical works stirred, they would begin to want to see how they act, and the thought will come, "Well, now let's go to the theatre and see for ourselves."

Shakespeare as Punishment!

I've heard from a very indefatigable listener-in that she sees people sitting with their Shakespeares in their hands following the words which are being broadcast, and being immensely surprised to find how human, as well as beautiful, is this writing which hitherto they've regarded as "too difficult for me." If broadcasting can help and dispel any ignorance of the greatest of all poets; if it can bring home to the people the infinite treasure there lies for all who choose to avail themselves of this knowledge, then it's doing an infinitely good work. A young man to whom I spoke the

other day of "As You Like It," looked very puzzled for a minute, and then said, "Oh, you mean 'As You Were,' don't you?" That was the name of one of those fleeting revues with strange titles that flit through our theatres. Such titles as "Why Did You?" or "What For?" seem equally appropriate to me; but, anyway, whatever the title, it was more familiar to this youth than the loveliest comedy in the world. And several times boys and girls have said, "Oh, no; I got so sick of Shakespeare at school. I had to learn it as a punishment." Think of the colossal stupidity of that!

Just the Voice.

If broadcasting is to help to change such ideas, and I believe seriously it might help, then a great responsibility lies on the speakers and those who are responsible for them. They haven't any accessories; not only not any scenery, but everything on which the actor depends. Gone—his eyes,

which are the mirror to his thoughts, his facial expression, his body, his gestures—just his voice left in which to express all he is feeling, thinking, doing. And in losing all these one is losing so much that no lover of acting could accept what remains as in any way adequate; it cannot possibly compensate for the art of the theatre.

The human voice can be a very beautiful instrument, and there lies a great difficulty. The actor will be necessarily ignorant of how it

sounds to those listening-in, and I gather that there is enormous variety in the instruments used; that while one person using a head telephone gets the voice very clearly, others listening to a horn—I am ignorant of the correct names—the sound is metallic and like a bad gramophone record. I suppose this can, and later on will be remedied, and if then the speaking of fine literature should waken in its hearers a desire to know more and to see the plays, it is surely serving a useful purpose, and should give considerable satisfaction.

IF you have electric bells in your house, it is an easy matter to test if your crystal circuit is O.K., as a buzzing sound should be heard in the 'phones when the bells are rung if all is well. It is interesting to notice that you will hear the buzzing in the 'phones a fraction of a second before you hear the bell actually ringing.

TWO METHODS OF MAGNIFYING SIGNALS.

The majority of readers will understand that H.F. stages of amplification are employed to increase the range of reception and L.F. to increase signal strength, but the "raison d'être" may not be so clear. In the following article Mr. Blake provides a brief but lucid explanation.

THE experimenter having penetrated the ether to the limit of his crystal receiver will, sooner or later, change over to valve working, or at least will add a valve to his crystal in his quest either for more noise or longer distances. For the keen worker there is always that one station which is beyond his reach, and which he feels it imperative to hear, a fact which suffices to keep him tinkering, altering, and augmenting his apparatus without any apparent prospect of ever being satisfied. You may have noticed that motorists and amateur photographers are similarly afflicted with this divine unrest.

The Characteristic Curve.

Apart from the extra range which may be attained by the use or addition of valves, a new and extensive field for experiment is opened up, and many interesting and profitable hours may be spent in trying out the numerous valve circuits. Probably most graduates from plain crystal class to the valve class begin their new studies by introducing a valve to a crystal, and the questions at once arise as to how this new piece of apparatus may be used to the best advantage. I therefore propose to explain the differences between H.F. and L.F. amplification, a matter we will approach by way of the detector unit, which is, of course, essential to the use of either process.

As is well known, the characteristic curve of a valve is similar in form to that of a crystal. An almost ideal detector would produce a characteristic such as is represented by the dotted line in Fig. 1. This would ensure complete and perfect rectification, because if the position of working were adjusted to the point X, the negative half of the oscillation received from the aerial would be completely cut off. In practice these ideal conditions are not obtainable, the curve being rounded off as shown by the full line in Fig. 1.

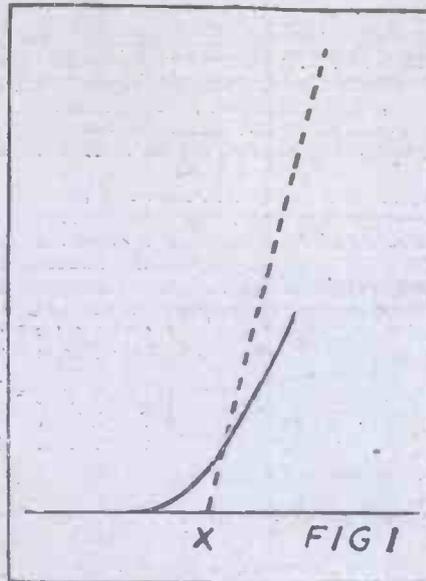
H.F. More Efficient.

It can be proved that the strength of a rectified signal is proportional to the square of the amplitude of the received oscillations, which means that if the amplitude of the oscillations in the aerial are doubled, the signal intensity will be increased fourfold.

Therefore, it would seem that the more efficient method of amplification is that of increasing the amplitude of the oscillations before applying them to the detector, or, in other words, high-frequency amplification; indeed, this is true, and for the following reasons.

Inspection of the curve in Fig. 1 shows that the oscillation to be rectified must attain at least some definite minimum value if rectification is to take place. In fact, a detector will often completely damp out very minute oscillations. Now our receiving aerials are continuously affected by very minute oscillations which, on account of their weakness (i.e., small ampli-

tude), produce no effect on the detector. Here high-frequency amplification comes to our assistance and increases the amplitude of the oscillations until it is at least as great as the minimum necessary for rectification. Hence the signals are "detected," and received in the telephones. The point to be particularly appreciated is that these weak



oscillations were in the aerial circuit all the time, but were not detectable until the H.F. amplifier was brought into play.

Low-frequency (or "note") amplification is the magnification of electrical pulses of audible (called "audio") frequencies, such as are obtained after rectification. It is most usefully employed for the operation of loud speakers. The main object of L.F.

amplification is to render louder or intelligible signals which are weak when delivered from the detector circuit.

The difference between H.F. and L.F. amplification may be usefully explained as follows. Before being rectified the oscillations are really alternating currents of extremely high-frequency which, producing an alternating E.M.F. between the grid and filament of the H.F. valve, cause equal variations of the grid potential on either side of the working point, and thus give rise to similar but larger oscillations in the plate circuit.

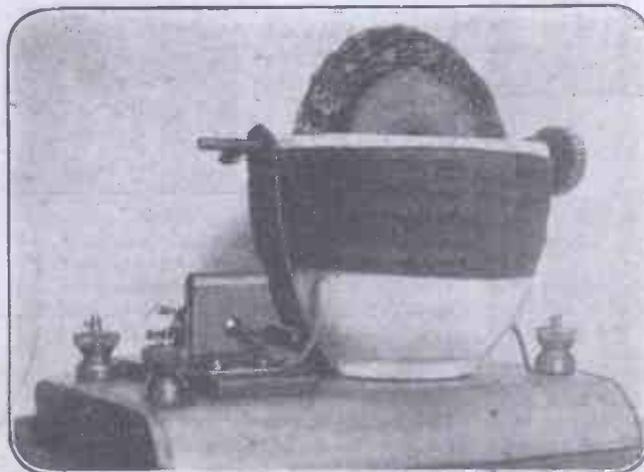
After rectification we have to deal with electrical pulses of low frequencies, and the reader may wonder how these unidirectional currents can act through the transformer separating the detector from the L.F. valve. It must be remembered, however, that although these pulses are always in the same direction, they do not maintain a steady value. A pulsating current is one which although unvarying in direction varies in strength. It follows that if these pulsating currents are fed into the primary of a transformer, they will cause pulses of potential to be induced in the secondary winding as a result of their variations and the varying flux these produce. As the secondary winding is connected across the grid and filament of the L.F. valve, a pulsating potential effect is produced on the grid, and large pulsations of current are produced in the plate circuit of this valve.

Disadvantages of L.F. Amplification.

From what has been said regarding H.F. amplification it should now be clear that L.F. amplification will not greatly increase the receiving range of a set, but will certainly increase the "punch" of any received signal.

Additional amplification after detection is often desirable, for the reason that there is a limit to the number of stages of H.F. amplification which can be used, due to their tendency to self-oscillation.

The transformers for "note" amplification are fitted with iron cores, which are frequently a source of trouble owing to their assistance in picking up and magnifying local and parasitic noises, such as A.C. "hum" from house-lighting circuits. To the experimenter who has but one valve I unhesitatingly advocate its employment as a high-frequency amplifier.



A crystal set constructed, with an ordinary tea-cup forming the stator of the variometer, by Mr. A. Brockhurst, of 4, Thorpe Road, Walsall.

REACTION: ITS USES AND ABUSES.

INVARIABLY the first question a beginner in wireless asks, when he listens-in for the first time and hears the occasional weird shrieks and groans produced by reaction causing oscillation, are:

- "What is oscillation?"
- "How is it caused?"
- "For what reason is it done?"

The first two questions, being inseparable, had best be answered together. In the first place, an oscillatory electrical current in a wireless circuit is one that is surging to and fro at an extremely high frequency. If this is confined to the circuit (known as self-oscillation), the fact is apparent either by an audible note in the 'phones or loud speaker, or by any telephony that is being received being greatly distorted. A means often quoted of determining whether the set is oscillating is to moisten the finger and place same on the aerial terminal, which will produce a "popping" noise in the 'phones.

Experience Required.

Reaction may be introduced into a circuit by various methods, the most popular way, known as magnetic reaction, being of introducing a coil in the anode circuit of the detecting valve and coupling same to the A.T.I., C.C.I., anode coil or plug-in transformer, the last two being in the case of H.F. amplification being employed. Either of these methods will be found extremely efficient, but it must be borne in mind that under the P.M.G. regulations reaction must not be used during broadcasting hours between the wave-lengths of 300 and 500 metres, in such a way as to cause oscillation in the aerial circuit. The use of reaction requires a certain amount of experience. Any child can twiddle a knob and listen with delight to the yells emitted, but to use reaction, gaining its advantages without disadvantages, can only be accomplished by those who have had some practice.

Why Use Reaction?

Perhaps it would be well to see what the advantages of using reaction are; briefly, a great increase in signal strength, the writer would consider the following figures give the approximate comparative value of increase in signal strength with and without reaction, taking the unit of "1" as strength of reception with crystal of London broadcasting:

Crystal	1
Valve detector	1.5
Valve detector and reaction, 3	
Valve detector, reaction and 1 L.F.	10

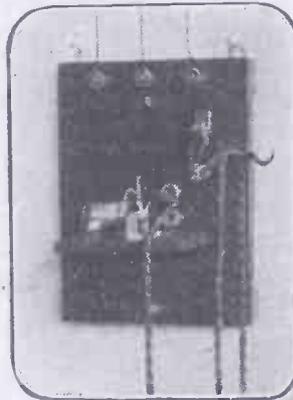
It should be noticed that reaction very largely increases the range of a receiving station. A single-valve set has a nominal range of about 30 to 40 miles for high-power telephony, but the addition of reaction usually doubles these figures.

The question "For what reason is it done?" is then clearly understood when we consider these facts. Reaction is indeed a wonderful discovery, but interference is the bugbear of reaction. Whilst reaction can in

skilful hands be such a valuable asset, in inexperienced hands it can be the cause of interference for perhaps five miles, depending on the H.T. voltage and the degree of coupling. In order to keep within the P.M.G. requirements, reaction cannot be used in conjunction with a single-valve set. Although with a three-coil holder the reaction coil may be coupled to the C.C.I., thereby minimising interference it should be clearly understood that this is illegal during broadcasting hours. With two valves (H.F. and detector) the reaction may be coupled to the anode coil.

PENNY-IN-THE-SLOT RADIO.

ALTHOUGH rudimentary radio-telephonic receiving sets can be erected at a very low cost, "listening-in" to the wireless waves with a really efficient set has hitherto been an expensive hobby. It must often have caused many a man's heart to burn to read in his daily paper



that Miss So-and-So, the famous prima donna, was going to entertain 100,000 people that night, or that Mr.



John Blank, the great virtuoso, would move a great invisible audience to tears and to laughter that very evening, knowing the while that such delights were barred to him because he did not possess a receiving set. Such minor tragedies will, however, soon be a thing of the past, thanks to an ingenious little device which has just been launched on the French market.

It is nothing less than a coin-in-the-slot radio telephone, which has very much the appearance of an ordinary wall telephone. For less than the price of a cup of coffee or of a glass of beer anyone can listen to the news broadcasts or the excellent radio-concerts. Its success at the great sample fair, the Foire de Paris, held between May 10th and 25th, was simply phenomenal, no less than 3,275 apparatus being sold on the opening day. It has even been bought for installation in hospital wards.

HINTS FOR AMATEURS.

IF you have an experimental licence and have been given permission to erect an aerial longer than 100 ft., remember that 150 ft. is the maximum length if you wish to tune down to the 200 metre wave-length.

If you wish to make a really ideal contact between your crystal and cup, fill the air space around the crystal with mercury or tin foil. This often adds appreciably to the strength of signals.

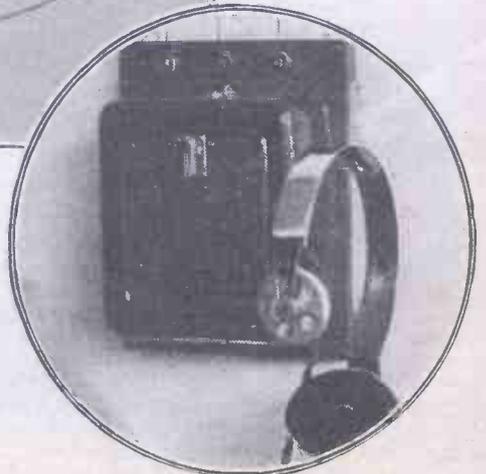
When tuning a set with a loud speaker, it is a good tip to connect a large honeycomb coil to the 'phone terminals and place it over the output terminals of the telephone transformer. It is a matter of experiment to find the right size coil, but the strength obtained by this method should be equal to another valve.

An ordinary pin sometimes makes quite a satisfactory cat's-whisker if you have lost your proper one.

To keep your aerial taut and to eliminate the risk of the ropes snapping, it is a good tip to keep the aerial up, not by the usual method of hauling it up when it becomes slack, but by connecting the free end of the aerial to a weight suspended over a pulley. The weight should be equivalent to the force required to raise the aerial.

Ordinary bicycle valves make good spindles for connecting rotor to stator in variometers, if held in position by suitable nuts or valve screws. Small nuts are preferable as they do not take up so much room.

A successful method of amplifying buzzer tones is as follows. Connect one wire of an 150 ohm ear-piece to the armature of the buzzer, the other wire being connected to the negative terminal of the battery. This should give a magnification of about three times.



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- In 1922.. "AMPLION" standardised by leading manufacturers of radio apparatus.

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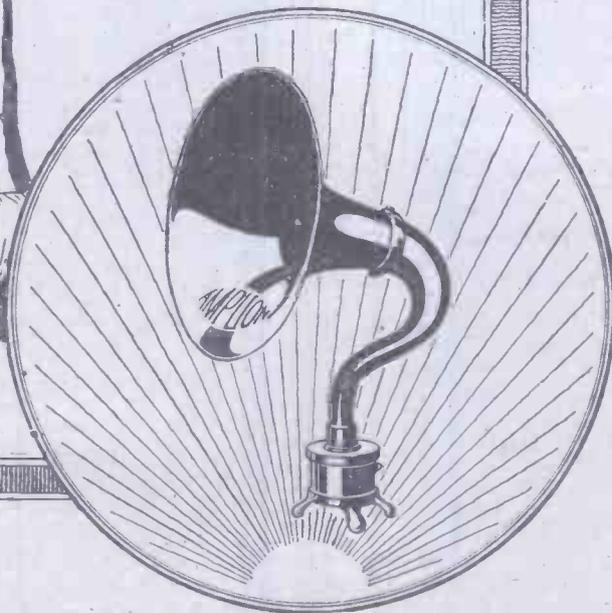
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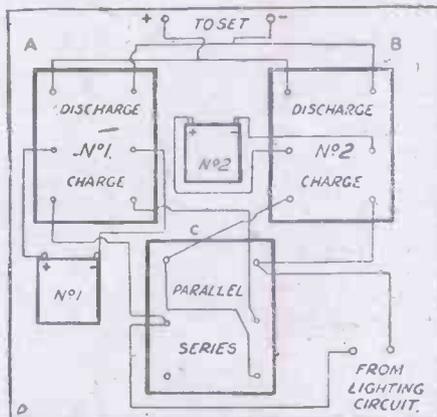
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CORRESPONDENCE.

To the Editor, POPULAR WIRELESS.

Sir,—I note that Mr. Guy Williamson has discovered that it is an expensive matter to charge accumulators through special resistance lamps. Owing to the wholesale way in which this method of charging has been advocated by contributors to the technical Press (this method also includes the use of resistance mats, etc.), I have no doubt that many other wireless enthusiasts are wondering what is the matter with their bills for electricity. They fail to realise that on, say, a 200-volt circuit, for every three-pennyworth of current put into the accumulator they are paying 8s. 4d. This is because they are only actually using about 6 volts of the 200 passing through the meter.



Perhaps a description of the means which I adopted some time ago would be of interest. The main point is that two accumulators are used, so that while one is being used the other is being charged, and when neither is in use both are being charged in series.

I want to labour this last point, as it is generally overlooked. Supposing there are 2 amps. passing through the lighting circuit, and the two accumulators are in parallel, then each accumulator gets 1 amp. only. But if they are in series each gets the full 2 amps.

A Convenient Arrangement.

Of course, connecting them in series like this will cause a bigger drop of voltage in the circuit, and if ordinary vacuum lamps are used they will be dimmed perceptibly, but if gas-filled lamps are used even a 12-volt drop will cause no perceptible dimming.

Now that gas-filled lamps are very little more expensive than the other type, and give nearly twice as much light for the same current consumption, there is no reason why they should not be fitted instead of the vacuum type.

My two accumulators are mounted permanently on a shelf near the main switch, and the charging and discharging are controlled by three double pole double throw switches, so arranged that either accumulator is charged independently or both in series, and that either, or both, or neither can be connected to the set. There is no possibility of a "short" to the set.

The beauty of this arrangement is that,

with not more than two valves in use, your accumulators need never be sent out for recharging unless you are particularly enthusiastic, and use the set for four or five hours at least every day.

Not only will your lighting bills show no increase, but they may show a small decrease if the meter is of the "watt hour" type, as you are using only about 190 volts instead of 200. There is one small point to observe when making the connections.

No Risk of Leakage.

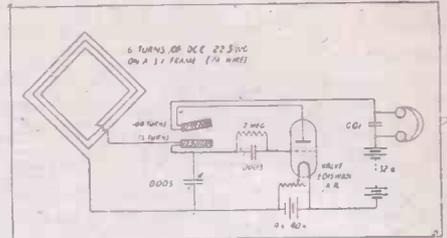
Break the lighting circuit at the minus contact of the main switch. All lighting switches are, or should be, inserted in the plus circuit, therefore if you connect your accumulator in the minus circuit there is no risk of slight leakage taking place from the accumulator when all switches are "off" in the lighting circuit. Many companies "earth" their negative mains, so that if your accumulator is connected direct to the positive main, it will discharge through any defective points in the insulation of the mains.

I am, yours faithfully,
V. PASCOE WILLIAMS
(B.A. Cantab.).

94, Desborough Avenue, High Wycombe.

To the Editor, POPULAR WIRELESS.

Dear Sir,—One often reads articles in which it is stated that satisfaction cannot be obtained by using a frame aerial with one valve, but I myself have actually made three frame aerial sets (all identical) and have tested these ten miles from a broadcasting station with at least 18 single valve



sets, bearing the B.B.C. stamp and using a normal outdoor aerial.

In each case the frame aerial has produced far better results. I have also tested a frame aerial set with a two-valve set (1 Dec. 1 L.F.) with equally satisfactory results.

I contend that the reaction permissible with a frame aerial (which incidentally eliminates all interference) more than makes up for the loss of an outdoor aerial.

These articles therefore strike me as being rather misleading to amateurs who use single valve sets for broadcast reception, especially to those who use sets bearing the B.B.C. stamp.

A diagram of the frame set with values is shown above.

Yours faithfully, G. W. A. B.

A SERIES-PARALLEL SWITCH.

A CHEAP and efficient substitute for the usual series-parallel switch, which has the advantage of taking up very little space on the panel, can be

made by connecting four valve "legs," or sockets, as shown in the accompanying diagrams. Two links which are needed for making the connections consist of valve

pins screwed into a small piece of ebonite with a short strip of copper foil under the nuts on the pins connecting them together

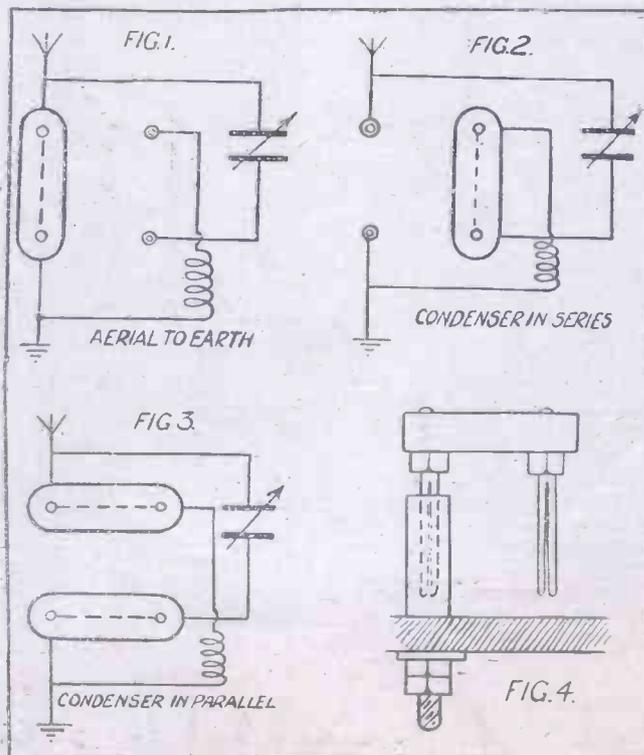


Fig. 1 shows the aerial and earth connected together to protect the set when not in use, while Figs. 2 and 3 show the aerial tuning condenser in series and in parallel with the inductance respectively. The arrangement has been in use on a crystal set for some time, and has been found to be quite as satisfactory, the contacts being very reliable and the connections readily changed, while the small space required on the panel—the whole arrangement might be got into one square inch—make it convenient where space is limited.

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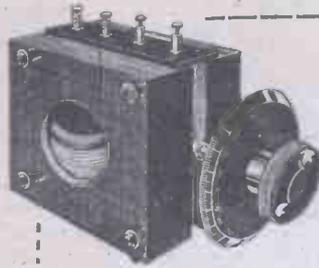
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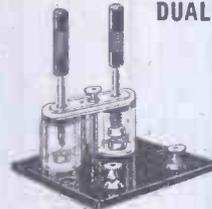
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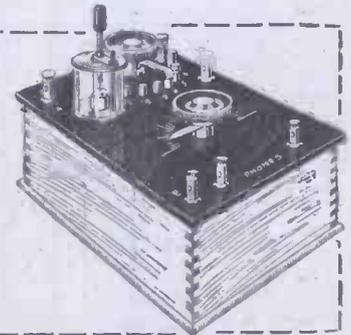
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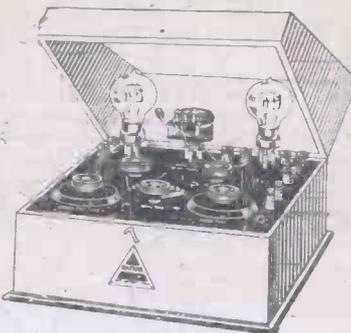
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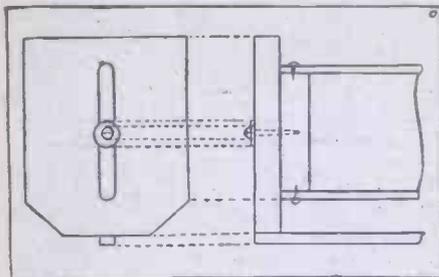
Also at GLASGOW, BIRMINGHAM, &c.

PRACTICAL IDEAS FOR THE AMATEUR.

NOTE.—Readers are reminded that the Editor of POPULAR WIRELESS is always prepared to give special consideration to short constructional articles of a similiar nature to those that appear on this page. Such articles will be well paid for if accepted for publication.

A NOVEL COIL TIP.

THE following is a very useful tip in the making of solenoid coils, and is quite easy to construct. It is a device by which the pressure on the sliding contact can be varied without any alteration to the slider or rod, and also by which coils may be easily interchanged.



In the centres of the ends of the coil two holes are drilled, for which two round-headed brass screws are procured, and in the two pieces of wood which support the coil two slits are cut, the same width at the diameter of the screws.

Next two washers are obtained into which the screws will fit, and which are slightly bigger than their diameter. The washers are put on to the screws, which are then placed through the slits in the wooden supporters and screwed into the ends of the coil.

Useful for Experimenters.

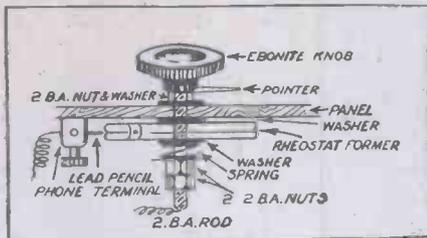
The slits in the supporters may be made by first drilling a number of holes next to each other, and then sawing through these with a piece of a hack-saw blade. The construction will be better grasped from the diagram.

No measurements are included, for one does not know what the amateur has in his workshop, nor the thickness of the material used in making the coil.

This device will be found to be particularly useful to the experimenter.

A VARIABLE GRID LEAK.

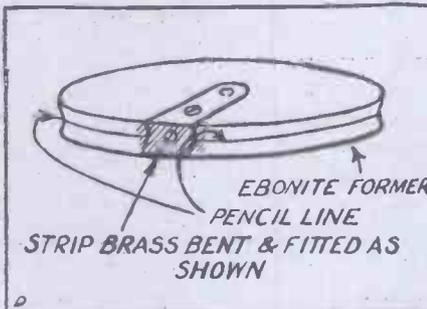
THE following details of a variable grid leak which has proved very successful may be useful to amateurs. The parts required are: 1 rheostat former, 1 ebonite knob, 2-in. length of 2 B.A. rod, 3 2 B.A. nuts, 3 plain washers, 1 spring washer, 1 small phone terminal, small strip 1/4-in.-wide brass, and 2 small screws.



Neat Appearance.

The pencil-line is drawn round the groove of the former, making contact with the brass strip on one side only, the other end of line finishing 1/4 in. from the strip, the shaded portion being filled in level with sealing-wax, which forms a stop. The thickness of the lead pencil line depends on the degree of hardness of the pencil, and is best found by experiment.

This instrument makes a neat companion to the Fil. Rheostat, there being nothing ugly on the face of the panel.



A FEW TIPS.

If you do much experimenting with loose wires on a valve set, it is a good plan to cover the valve sockets with short lengths of rubber tubing. This will tend to prevent shorting catastrophies.

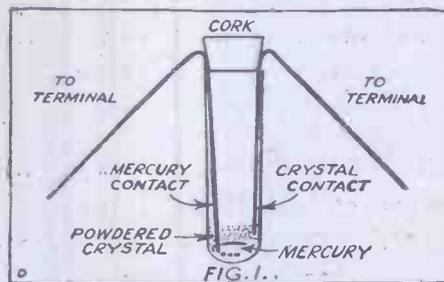
If you are using a double aerial of a fair length, it might be worth while arranging a switch which will automatically cut out one wire altogether when required. The single wire would most likely be more efficient on the low wave-length.

A cheap way of labelling your apparatus is by cutting out tabs from advertisers' announcements and sticking them on. In this way, labels with the words "Phones," "Accumulator," "Aerial," "H.T.," etc., can easily be obtained.

Should your 'phones be inclined to give weak signals, remove the cap and see how many washers there are between the diaphragm and the magnets. If there are two, try them with only one.

SOMETHING NEW IN DETECTORS.

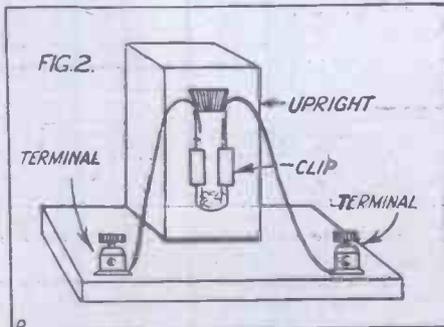
TO construct, purchase at the nearest confectioner's a small glass tube containing eachous, for a copper or so. After emptying the tube of its contents, prepare two 6-in. lengths of bell wire, and bare one end of each for a quarter of an inch.



In one length bend the bared part at right-angles to the insulated part of the wire. Your contacts are now complete. Put the L-shaped wire in the tube and pour in a drop or two of mercury so as to cover the bared part of the wire, as in Fig. 1. The second contact is now put in on the opposite side of the first and bent over the side of the tube so that the bared part rests about one-sixteenth of an inch above the surface of the mercury.

Obtaining Adjustment.

A crystal is then powdered and emptied into the tube. The powder should float on the surface of the mercury and cover the bared part of the second wire, as shown in Fig. 1. Two slits are made on each side of the cork to allow for the outgoing ends of the wires.



An upright is glued to a small base and the tube is clipped to this, as is shown in Fig. 2. The ends are then bared and connected to suitable terminals on the base. Usually there is no need to search for a sensitive point, but if no signals are heard, tap the tube lightly with a pencil, and this will give the desired result. This detector has the advantage of being dustproof and very cheaply made.

BROADCASTING TRANSMISSIONS.

In the following programmes full details of the Continental transmissions are included so that possessors of suitable receiving sets can take advantage of the many interesting items that these stations broadcast. From an educational point of view such material is invaluable, more especially for such amateurs that may be studying one or other of the Continental languages.

GREAT BRITAIN.

Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.
London	2 LO	Usually—5.30-11 p.m.	Musical Items, News, etc.	369	Every Weekday.
Newcastle	5 NO	5.30-11 p.m.	" " " "	400	" "
Manchester	2 ZY	5.30-11 p.m.	" " " "	385	" "
Birmingham	5 IT	5.30-11 p.m.	" " " "	425	" "
Glasgow	5 SC	5.30-11 p.m.	" " " "	415	" "
Cardiff	5 WA	5.30-11 p.m.	" " " "	353	" "

BELGIUM

Brussels (1)	Brussels	11 a.m. (G.M.T.)	Weather report	1100	Working days.
		3.50 p.m.	Aeroplane traffic	1100	Every day
		8 p.m.	Concert	1100	Tuesday & Thursday
		6 p.m.	Concert	1100	Sunday

HOLLAND

The Hague	PCGG	3-5 p.m. (G.M.T.)	Concert	1050	Sunday.
		8.40-9.40 p.m.	Concert	1050	Monday & Thursday
The Hague	PCUU	7.45-10 p.m.	Concert	1050	Tuesday.
		9.40-10.40 a.m.		1050	Sunday.
The Hague (Velthuyzen)	PCKK	8.40-11.40 p.m.	Various	1050	Friday.
Ymuiden (Middelraad)	PCMM	8.40-11.40 p.m.	Concert	1050	Saturday.
Amsterdam	PA5	8.10-11.10 p.m.	Concert and News	1050	Wednesday.

FRANCE

Lavallois-Perret (Radiola)	SFR	2-3 p.m. (F.S.T.)	Music	1790	Sunday.
		12.45-1.45 p.m.	News and Concert		
		5.5 p.m.	Stock Exchange News	1780	Every day.
		5.15-6.15 p.m.	Instrumental music	1780	"
		8.45 p.m.	General News	1780	"
Paris (2) (Eiffel Tower)	FL	9-10.30 p.m.	Vocal and instrumental concert	1780	"
		6.40 a.m.	Weather Forecast	2600	"
		11.15 a.m.	Weather Forecast	2600	"
		3.30 p.m.	Stock Exchange News	2600	"
		6.20 p.m.	Weather Forecast, Concert	2600	"
Ecole Supérieure des P.T.T.		10.10 p.m.	Weather Forecast	2600	"
		7.45-10 p.m.	Radio Concerts	450	Tuesday, Thursday,
		2.30-7.30 p.m.	Radio Concerts	450	Saturday.
Radio-Riviera (Nice)		11 a.m.	News, Concert	460	Every day.
		5-6 p.m.	News, instrumental Concert	460	"
		9-10 p.m.	Latest News, Concert	460	"
Lyons (La Doua)	YN	10.45-11.45 a.m.	Concert	3200	Every day
		3-3.35 p.m.	Financial News and Aviation Reports	3200	" "

GERMANY, CZECHO-SLOVAKIA, AND SWITZERLAND

Berlin (Königswusterhausen)	LR	7-8 a.m. (G.M.T.)	Financial News, etc.	2800	Every day
		11-12.30 a.m.			
Eberswalde		4-5.30 p.m.	Financial News, etc.	2800	"
		6.30-7.30 p.m.	Concert	2950	Thursday.
Prague	PRG	4-7 p.m.	Lectures and Concert	2950	Sunday.
		7-11 a.m. and 3 p.m.	Weather News, General News	1800	"
Geneva	HB1	9 a.m.-2 p.m. & 9 p.m.	Concert	4500	"
		5-6 p.m.	Concert	1200	"
Lausanne	HB2	5-6 p.m.	Concert	—	Every day.

The British Broadcasting Stations transmit on Sundays between 8.30 and 10.30 p.m., and at varying times during weekday mornings and afternoons. The programmes appearing in the daily Press should be consulted for full details.

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

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

SUMMER WIRELESS

Wireless Enjoyment for Summer Campers.

IT is now quite a common sight during the summer months to see the landscape dotted with the white temporary abodes of that annually increasing migratory multitude who seek rest in the lap of simple nature "far from the madding crowd."

As a holiday this sequestration is ideal, and when united to the joys of listening-in, the very site that is most suitable for the camp is perfect for wireless concert reception. To get away from the busy haunts of men is to remove all those energy absorbing buildings and jamming reacting aerials which are the appendages of that human to whom the appellation of "broadcatcher" has been given.

Restful ease beside the babbling brook and listening-in seems a natural union. At camp one spends the balmy summer evenings in calm and peaceful indolence. In nine cases out of ten a camping party takes a gramophone as part of the necessary impedimenta, and one might then go on to describe the pleasant scene of the holiday makers reclining on the green slopes whilst the soft needle gives out the sweetest harmonies on the still air.

In our homes we all of us prefer the "set" to the gramophone. So why not take your set with you on your holiday?

But how shall one bring 2 LO, 5 NO, or any other centre of delight into our midst? Erect a pole in the field where the camp is situated. If a tree is close at hand, a difficulty is solved. So take a couple of insulators and a coil of wire, and there you

are. There is no need to explain any aerial erection. Get your aerial up in the field, with your set in or out the camp, and Elysium is complete. It would be rather an interesting experiment to obtain one or more of those hydrogen balloons so common with children during the summer. With as long a length as possible of the finest wire obtainable, send this floating aerial aloft straight from the aerial lead of your set. This aerial has the merit of being always directional, always in the open away from any chance of lost energy, and can be made of as great a height as possible when the supply of wire is sufficient.

Much has been written, sung, and portrayed of the joys of the road, the pleasure of the country and open-air life, so let those who appreciate those daily delightful concerts continue to enjoy the talent provided amidst pleasant holiday surroundings.

Behold!!

V BEST COMPONENTS

HAVING already secured the Manchester business for Components at the right price we have decided to give Amateurs in all parts of the world an opportunity to get them at "V BEST" prices.

WE have organised a Mail Order Department, and can offer all the following goods ex stock.

V BEST PRICES

AERIAL WIRE, 7/22s, Hard-drawn Bare Copper.....	per 100 ft.	2/8
AERIAL WIRE, 7/22s, Hard-drawn Enamelled.....	per 100 ft.	3/9
AERIAL INSULATORS, Reel, each 2d., 2 for 3d.; Strainer, ea.		3 1/2d.
AERIAL INSULATORS, Egg, each 2 1/2d., 2 for 4 1/2d.; Shell.....		6 1/2d.
AERIAL PULLEYS, 2 1/2 in. Galvanised.....	each	6d.
BATTERIES, Flash Lamp, 4-Volt (Make your own H. T.), each		4/6
5d.; per dozen.....		6d.
CONDENSER VANES, Fixed or Moving.....	per dozen	4d.
CONDENSER SPACERS, Accurate. Small, per dozen, 3d.; Large,		5d.
per dozen.....		1/3
CONDENSER SCALES, IVORINE, Engraved, not Printed.....	each	5d.
CONDENSER DIALS, EBONITE, Engraved, beautiful finish.....	each	1/3
CONDENSER SPINDLES, Square Section, Screwed 2 B.A., Vernier		5d.
to .0005, each 4d.; .00075 and .001.....	each	3d.
CONDENSER ADJUSTABLE PIVOTS.....	each	1 1/2d.
CONDENSER TOP BUSH, with flange.....	each	10d.
CONDENSER TOPS & BOTTOMS, drilled for standard fittings.....	ea.	2/-
CONDENSER, Fluted Knob & Dial combined, beautiful finish.....	each	2d.
CRYSTAL CUPS, Fixing Screws, beautifully finished.....	each	10d.
CRYSTAL DETECTORS, Mounted on Ebonite, Adjustable in every		2/-
way.....	each	6d.
CONTACT STUDS, 1 in. x 1/2 in., with Nut and Washer.....	per doz.	9d.
CONTACT STOPS, 1 in. x 1/2 in., with Nut and Washer.....	per doz.	6d.
CORE WIRE, Soft Iron.....	per 1 lb.	1/3
COIL MOUNTING PLUGS, Universal Fitting.....	each	7/6
DUCONS, While they last.....	each	3/6
EBONITE, Don't buy loaded Ebonite. Get maximum area for		2/6
minimum weight (cut to size).....	per lb.	4d.
Manufacturer's scrap pieces, in 1 lb. parcels.....	per lb.	3d.
EARTH CLIPS, Fit on water pipe. Adjustable to any size.....	each	2/6
FOIL COPPER, per sheet, 4d. FOIL TIN, per sheet.....		3d.
FILAMENT RESISTANCES, A real piece of apparatus.....	each	2/6
FILAMENT RESISTANCE, Ebonite dial, engraved.....	each	10d.
FILAMENT RESISTANCE, circular engraved scale.....	each	9d.
FORMERS, PIRTOID, for Honeycomb Coils.....	each	3d.
INDUCTANCE TUBES, specially impregnated, 12 ins. long. 2 in.		7d.
to 4-in. diam., 4d. each; 4 1/2-in. diam., 5d. each; 5 in. to		4 1/2d.
6 in. diam.....	each	4d.
INDUCTANCE SLIDERS, with spring and plunger.....	each	1/1
INDUCTANCE SLIDER ROD, 13 in., drilled.....	each	2d.
INSULATORS, LEAD-IN, sturdy ebonite, terminals each end,		5d.
6 in., 10d. each; 12 in.....	each	1/1
IVORINE TABLETS, Black on white, or white on black. En-		2d.
graved. A nice job. AERIAL, EARTH, PHONES, etc.....	each	5d.
INSULATING SLEEVING.....	per yard	
INSTRUMENT WIRES, A huge stock of specially purchased wire		
in all coverings. Perfect. At bargain prices. Send 1 1/2d. stamp		
for price list.....		
INSULATING SILK SHEET.....	per sq. ft.	1/-
KNOBS, EBONITE, Blind bushed, 2 B.A. One quality only.....	each	4d.
THE BEST.....	each	1d.
MICA, Pure ruby. Pieces 2 1/2 in. x 2 1/2 in.....	each	2 1/2d.
NUTS, Brass, Hexagon, 2, 3, & 4 B.A., per doz., 3d.; 5 &		1d.
6 B.A.....	per dozen	2 1/2d.
RESISTANCE WIRE for filament resistances.....	per yard	1d.
ROUND LOCKING NUTS, 2 B.A., brass.....	each	2d.
SCREWED BRASS ROD, 12-in. lengths, 2 B.A., each 3 1/2d.;		3d.
4 B.A.....	each	6d.
SHELLAC, Flake.....	per packet	1/6
SWITCH ARMS, 4-LEAF, Splendid knob; hefty bush. Beautifully		1/6
polished; with nuts and spring washer.....	each	2/6
TERMINALS—not tinnacks. STANDARD Pattern, according to		1/6
size, per doz., 1/6, 2/6, 2/6. TELEPHONE, per doz., 2/6;		2/6
TELEPHONE, wood screw.....	per dozen	1 1/2d.
WASHERS, BRASS, 2 to 6 B.A.....	per dozen	8d.
WASHERS, COPPER SPRING, each 1d.....	per dozen	1d.
VALVE SOCKETS, with nut and washer.....	each	1d.
VALVE PINS, with nut and washer.....	each	10d.
VALVE HOLDERS, with 8 nuts and 4 washers.....	each	

ON the strength of the above prices you have doubtless already decided to send us your order. But perhaps you want some scientific components also. Then take our advice—Buy the Best, don't be "Penny wise, pound foolish."

WE SUPPLY SCIENTIFIC COMPONENTS.

CRYSTALS (J. L. Cartwright & Co.'s), Carborundum, Copper		
Pyrites, Galena, Bornite, Iron Pyrites, Silicon, Manganese,		
per box, 6d. Best Hertzite or Zincite, per box, 1/-.		WOOD'S
METAL.....		6d.
FIXED CONDENSERS (J. L. Cartwright & Co.'s).....	each	2/-
GRID LEAKS (J. L. Cartwright & Co.'s), 1, 2, 3, 4, or 5 meg.		32/-
HEADPHONES, Western Electric, 4,000 ohms.....	per set	32/-
—Western Electric (while they last), 8,000 ohms.....	per set	15/-
—Special French, very sensitive.....	per set	50/-
LOUD SPEAKERS, Western Electric, 4,000 ohms.....	each	
TRANSFORMERS, High-frequency Binon type (J. L. Cartwright		
& Co.'s) double groove. No. 1, 350, 6/8; No. 2, 550, 7/-;		
No. 3, 930, 7/6; No. 4, 1,400, 8/-; No. 5, 2,000, 8/6;		
No. 6, 3,500, 9/-; No. 7, 10,000, 10/6.		
TRANSFORMERS, Low-frequency (J. L. Cartwright & Co.'s).....	ea.	21/-
—Telephone (J. L. Cartwright & Co.'s), white they last, & each 12/-		
VALVES, Edlewan A.R. Type, each 15/-; Marconi Osram, R.		
Type.....	each	17/6
VALVES DUTCH.....		9/6

CASH WITH ORDER. Money back if not entirely satisfied. Please remit ample Postage, any balance returned.

VICTOR BEST Co.,

The Component King,

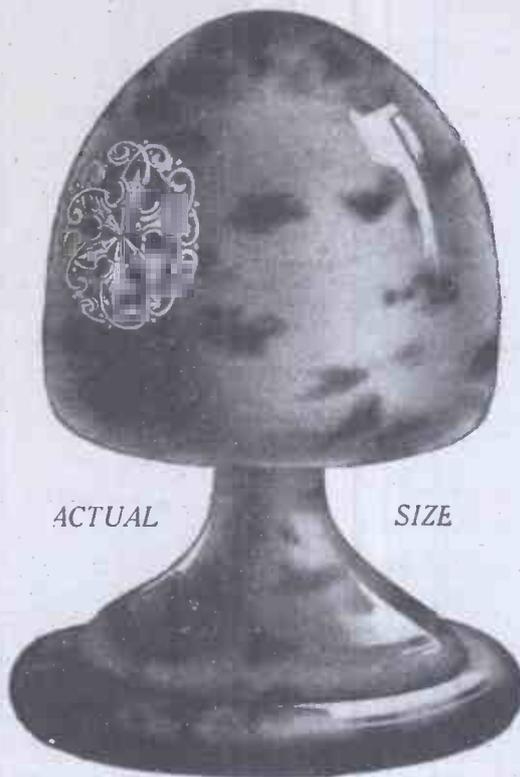
HUGE Dept. P, 24, LONDON ROAD, ADVICE STOCKS MANCHESTER. FREE

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Something New!

THE MAGNORA LOUD SPEAKER



ACTUAL SIZE

No larger than a wineglass — but wonderful to hear

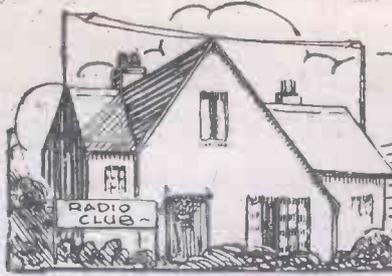
THIS wonderful little Loud Speaker surprises everyone. No grotesque trumpet. No cabinet required. In itself it is a thing of beauty, standing only four inches high, and looking like a small tortoiseshell vase. It floods the room with beautiful melody. No distortion. No vibratory noises. The sound is dispersed in all directions. Spoken words can be heard with wonderful distinctness. Can be fitted to any receiving set in a few seconds. Simple and strongly made. Nothing to get out of order.

POST 35/- FREE

Complete with four feet of flex, and terminal leads. Demonstrations during broadcasting from 5.30 p.m. until 10 p.m.

NOTE: The MAGNORA is only for use with receiving sets which will operate an ordinary loud speaker. It cannot be used with Crystal Sets or Single Valve Sets. People who have heard it used with one detector and two amplifying valves have been amazed at the quality and volume of the tone.

C. HERING Telephone Engineer
WASHINGTON HOUSE 41 CONDUIT ST REGENT ST W



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.

Dewsbury and District Wireless Society.*

Mr. Dransfield will continue his interesting talks on the elementary principles of radio, his subject being, "How to Get the Best out of Your Set." It is hoped that the Central Liberal Club will be occupied by a record attendance.

Hon. sec., Fred Gomersall, A.S.A.A.

South Dorset Radio Club.

At a meeting at the Guildhall, Weymouth, on April 27th, the above club was formed. The business meeting was followed by a special broadcasting programme, which all present enjoyed.

The club has been fortunate in obtaining his Worship the Mayor of Weymouth (Councillor W. J. Gregory) as president.

Weekly Morse Classes are being held, and lectures have been arranged for early dates. Particulars of membership will be forwarded on application to the hon. sec.

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

Hackney and District Radio Society.

There were several interesting items at the weekly meeting of the above society on Thursday, May 31st, at the Y.M.C.A., Marc Street, Hackney, E.8., presided over by the chairman, Mr. H. A. Epton.

Mr. Cunningham reported on the radio demonstration which he had arranged the previous Saturday in connection with the annual dance of the National Cycling Union at Woodford. He stated that the demonstration was a complete success, and that through the instrumentality of the Hackney Radio Society, he had arranged for a speech to be made from 2 L O on behalf of the Cycling Union.

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

Tottenham Wireless Society.

The subject of the meeting held on Wednesday, May 30th, was a debate on high-and-low frequency amplification. The chairman opened by describing the methods of H.F. Amplification, further items being given by Mr. Ellis. Low-frequency amplification was next dealt with, leading up as to what was the correct way of winding the L.F. type of transformer, and the comparison of various makes.

Hon. sec., S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N.17.

The Stoke-on-Trent Wireless and Experimental Society.

At a meeting of the above society on May 24th, Mr. T. R. Clark (vice-chairman) gave an interesting lecture, "Adding a Valve to a Crystal Set."

Mr. Clark declared that for the Pottery district, the results of adding a low-frequency magnifying valve to a crystal detector were not satisfactory, much better results being obtained by adding a high-frequency amplifying valve.

Hon. sec., F. J. Goodson, B.Sc., G.I.Mech.E., Tontine Square, Hanley.

Newport and District Radio Association.

At a general meeting, held at headquarters, Memorial Institute, Queen's Hill, on Thursday, May 17th, Mr. J. T. Gray delivered an interesting lecture on "Aerials."

Buzzer practice for beginners, under the voluntary direction of Mrs. P. Hill and Miss

Brown, takes place at the close of each lecture. Hon. sec., H. W. Winslow, 3, Dock Street, Newport.

North London Wireless Association.*

Mr. V. J. Hinkley gave his "Practical Demonstration of Valve Characteristic Curves." Great interest was taken in the demonstration, which was of considerable length, and each detail was carefully explained.

Hon. sec., Mr. J. C. Lane.

Ashton-under-Lyne and District Radio Society.

The society's meetings during June will be devoted to general discussions and various experiments, and it is hoped that any member who has anything to put forward or any difficulty will bring it along, as it will be of interest to the remainder.

Hon. sec., James H. Marshall, 22, Warrington Street, Ashton-under-Lyne.

Barnet and District Radio Society.

The inaugural meeting of this society was held on Thursday, May 17th, with the president, Frederick W. Watson Baker, Esq., in the chair.

There was a good attendance. After the president's address, the formation of rules and the enrolment of members was proceeded with. When the business section had been disposed of, a demonstration was given by Mr. R. Cook, the apparatus used being an Armstrong super-regenerative set with frame aerial. 2 L O was well received.

Hon. sec., J. Nokes, Sunnyside, Stapylton Road, Barnet.

St. Pancras Radio Society.

A club has been formed under the above title to assist all enthusiasts in St. Pancras and neighbourhood in all spheres of wireless theory and practice.

THE STORY OF "FÊTE GALANTE," which will be broadcast via 2 L O on the 22nd inst.

The new one-act opera, "Fête Galante," described by the composer, Dame Ethel Smyth, as a dance dream, is adapted from a story by the Hon. Maurice Baring, and is not unlike the story of "Pagliacci," though a little more fantastic and picturesque. The scene is laid in a moonlit garden, where "a play within a play" is acted before the King and Queen whilst the Fête Galante is in progress. Pierrot, in love with Columbine, is jealous of Harlequin, and in the play is on the point of stabbing him. He alters his mind and quickly thrusts the knife into his own body. His self-sacrifice is prophetic of what is to be his real fate, for later on he sees the Queen meet her lover in the moonlit garden and he overhears their conversation. Suddenly Columbine enters and imagines that it is Pierrot, her own lover, who is with the Queen, and in her rage and jealousy she rushes off to tell the King. The King refuses to believe that Pierrot is the Queen's lover, and commands him to tell him who it really is. Pierrot will not betray the Queen, and is taken to prison.

The fête proceeds with song and dance, when suddenly the stage becomes dark and there is silence, broken only by the frantic scream of a woman. When the lights go up, Pierrot's body is seen at the back of the stage dangling from a beam, and the opera ends with a "danse macabre."

Harpenden Radio Society.*

By the courtesy of the British Broadcasting Company, Ltd., members were recently enabled to visit the transmitting installation at Marconi House, and afterwards inspected the company's studio at 2, Savoy Hill, where Mr. Arthur Burrows kindly acted as guide.

Other activities of the society have included an expedition to the London Terminal Air Station at Croydon, as well as the regular meetings for lectures and practical work.

Hon. sec. and treas., P. A. Ancombe, Wellington House, Harpenden.

The club has been extremely fortunate in procuring as its technical adviser an expert of very many years' experience. Will all who desire to learn more of this society please communicate with the hon. sec., Mr. R. M. Atkins, 7, Eton Villas, Hampstead, N.W.3.

CATALOGUES, BOOKS, ETC.

THERE are many crystal detectors on the market now that do not need constant adjustment, but one worth mention is the "Perma-Fix," which, while it gives good results, is highly finished and extremely neat. Being enclosed in ebonite, it is perfectly insulated and absolutely dust proof, and will stand the maximum amount of vibration. This little instrument should certainly find its way to all crystal set users.

Messrs. Stanley Paul have just published a very interesting new book on Wireless, entitled "Radio Simplified," written by Lewis F. Kendall and Robert P. Koehler. There are nearly three hundred interesting pages, with nearly 100 illustrations, mostly of circuits, each "hook-up" being printed both diagrammatically and pictorially. It is a book that should appeal to the average amateur, as it gives more details of the American circuits than have hitherto been available over here.

The sole agents for the "Premierphone" receiving sets are "The Lisenin Wireless Co.," from whom we have received an interesting catalogue giving full details of these sets, and also a full list of accessories, all of the highest efficiency.

Well known as the manufacturers of all types of electrical and wireless apparatus bearing the trade mark "Grelco," the Grafton Electric Co. have issued a new 100 page catalogue which deals with every type of electrical contrivance, well made and thoroughly reliable.

Messrs. Burndep't's new catalogue, besides detailing complete installations, also gives a full list of accessories, both for receiving and transmitting. They recently put on the market a very compact portable set, stamped B.B.C., being suitable for the river for tennis parties.

Joseph Hopley & Sons have issued a catalogue of complete receiving sets and amplifiers. Their unit system is specially worthy of note as an additional valve can always be added to an existing set without wiring alterations. Also of special interest is a two-valve "Regenerative Receiver," which is fully licensed by the P.M.G. for broadcast reception.

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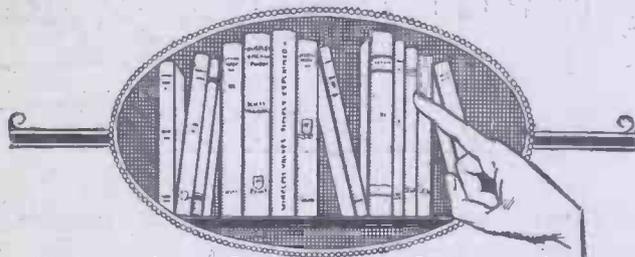
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RADIOTORIAL.

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

In this issue we publish a special interview with Miss Ellen Terry in which she pays a gracious compliment to POPULAR WIRELESS. It was POPULAR WIRELESS that was responsible for the suggestion that Miss Terry broadcast her appeal, and we hope all readers will assist our most loved actress in her noble efforts on behalf of the blind. Arrangements have been made with Miss Terry whereby she will present a signed photo of herself to all readers of POPULAR WIRELESS who subscribe 10/- or over to her fund. Details will be found on other pages in this issue, and I sincerely trust the response will be a great and successful indication of POPULAR WIRELESS readers' appreciation.

Our companion paper "Wireless Review and Science Weekly" has scored yet another triumph. Professor Albert Einstein, the famous originator of the theory of relativity, has agreed to act as Special Physics Consultant to "Wireless Review and Science Weekly," and a special interview with him will appear shortly in that journal. Some of the greatest living scientists contribute popular articles to our companion paper, and you will miss a weekly treat if you fail to secure a copy regularly every Tuesday at the low cost of 3d.

THE EDITOR.

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

Readers are requested to send the necessary postage for reply.

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

QUESTIONS AND ANSWERS

R. F. S. A. (Radlett).—I have often noticed circuits in which a tuned plate is used, probably employing a variometer, but sometimes just a coil and condenser, to give "reaction" effects. Can regeneration take place, as the coils are not coupled to the aerial in any way?

Yes, reaction can be accomplished by this method because regeneration will take place through the grid and plate of the valve, which form, as it were, a small condenser. If you care to work it out you can determine the required plate inductance to cause such an effect. The formula is a little complicated, as you have to take into account the grid-plate capacity of the valve. The formula is as follows:

$$L = \frac{1}{W^2 (C_m + C + C_m)}$$

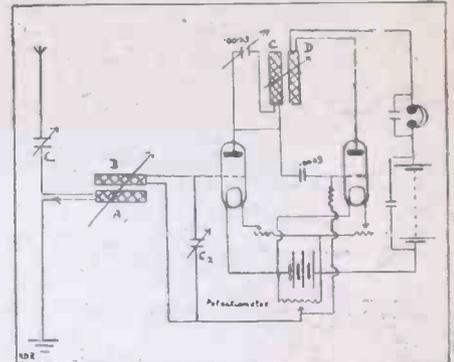
Where $W = 2\pi n$, n being the frequency of the wave it is desired to receive. C = total capacity across the inductance L , including the plate-filament capacity of the valve and the self capacity of the inductance. C_m is the grid-plate capacity of the valve, and μ is the amplification factor of the valve. L and C are given in henries and farads. The method of finding the frequency of a given wave is to divide the wave-length in metres by the speed of the wave, also in metres. As the waves of all wireless stations travel with a speed equal to that of light, that is, approximately 186,000 miles per second, the speed in metres will be about 300,000,000 per second. So that the frequency of the wave will be given by

$$\lambda \text{ (wave-length in metres)} \times \text{per second.}$$

"CASAR" (Milford).—Which is the best two-valve circuit that is not difficult to control

and is permitted by P.M.G. and yet uses reaction? Do you advise the additional valve to be high or low frequency?

This circuit should fulfil your needs. It employs the second valve as a high frequency (H.F. amplifier) and will give greater range than will a low frequency magnifier. We favour the tuned anode coil for the H.F. circuit, and the reaction from the detector valve plate is coupled to this coil. The coils are of the basket or honeycomb type, the latter always being used when working on wave-lengths over 3,000 metres. The coil marked B may be dispensed with (the grid being taken direct to aerial and the potentiometer to earth), but we advise its inclusion. Two double coil holders are required. Should you dispense with the coil B, you cannot couple C and D to A, as this will cause reaction on the aerial. It is advisable to use a potentiometer to control the grid of the H.F. valve, and thus eliminate internal oscillation. It should have a resistance of approximately 300 ohms. The condenser C_1 is .0005 mfd. and C_2 is .001 mfd. The coils, of course, vary for the different wave-lengths, but the following will prove most satisfactory for the broadcasting band of wave-lengths: A, about 50 turns; B, about 75 turns; C, about 75 or 100 turns; and D, about 50 or 75 turns, all wound with 26 S.W.G. D.C.C. Be sure to disconnect the potentiometer when the set is not in use, otherwise the accumulator current will gradually leak away through its windings.



"PLATO" (Hammersmith).—How many plates, moving and fixed, shall I need for a variable condenser of .001 mfd., the diameter of the moving plates being 4 in., and using spacing washers of 1/8 in. thick? Also number of copper foils for fixed condensers of .001 mfd. and .0003 mfd.?

With plates .030 in. thick you will need 16 moving and 17 fixed plates for a .001 mfd. variable condenser.

(Continued on page 702.)

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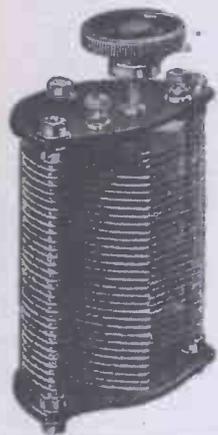
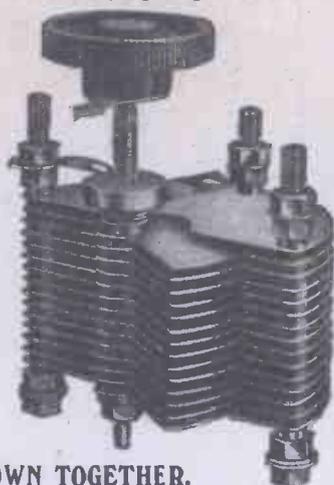
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RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 700.)

For the fixed condensers, using mica '002 in. thick as dielectric, use 6 plates 2 by 1 cms. for '001 mfd., and 2 plates 3 by 1 cms. for '003 mfd.

D. N. (Harrogate).—If I use my reaction coupled to the tuned anode coil or to an H.F. transformer, will I have to vary it at all when I change the wave-length?

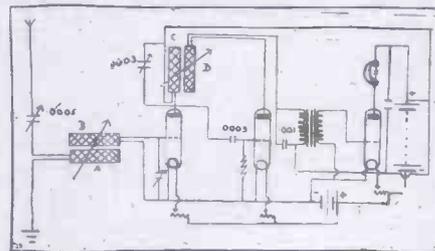
In order to get the best out of your set you will find this necessary, and you should have some method of adding inductance to the reaction coil for use on the high wave-lengths. For this purpose a little experimenting will be necessary before you find suitable values for the reaction coil and the added inductance. Usually about seventy or eighty turns of 38 S.W.G. D.C.C. on a basket former, centre diameter 1 1/2 in., will be a fairly approximate value for the reaction coil itself. This must not be taken as exact, as it will vary considerably with different sets. The anode or transformer will be found to be most suitable if wound basket fashion, and the two or three coils are mounted in a three-coil holder so that the coupling can easily be varied at will.

R. D. K. (St. Albans).—Across which terminals of my crystal set should I place a fixed condenser?

A '001 mfd. fixed condenser can be placed across the 'phones and will often clarify signals considerably. Should you desire to increase the wave-length range of your set by about two hundred metres or so, a small fixed condenser may be placed across the aerial and earth terminals, but a variable condenser is to be preferred in this respect, and '001 is rather a large capacity to use for such a purpose.

"PIP" (Bridlington).—I intend making a valve set that may be used with the promised "Home Constructor's Licence." Presumably I shall be able to make any set as long as it does not cause trouble to my neighbours, and I pay the necessary royalties. Can you recommend a suitable two (or possibly three) valve set that will get all British broadcasting, Paris and the Hague?

The accompanying circuit will enable you to hear all broadcasting, and should get Paris and the Hague quite clearly. Permitted inter-valve reaction is obtained by coupling the coil D to the tuned anode coil, marked C. The coils may be of the honeycomb type, and this type is to be preferred to the basket form, for these latter become too large and inefficient when used on wave-lengths above about 3,000 metres. Under 3,000 metres you will find basket coils just as good. The condenser across B should be of about '001 mfd. The others are all marked. Two coil holders of the double coil type will be found necessary. Potentiometer grid control of the H.F. valve can be employed if desired, the connections being shown in another diagram of this issue.



"VALVE-CRYST" (Brixton).—I have a B.B.C. valve set and want to add it to my crystal set, but making as few alterations as possible. What is the best way to connect the two together?

We presume that the B.B.C. set is a one-valve, with tuning coil, etc., enclosed, and that the crystal set also has a tuning coil covering the same wave-lengths as the valve set. If it covers more—that is, goes higher—so much the better. In the first place, the grid leak and condenser in the detector panel should be shorted or removed, and the grid of the valve taken direct to the aerial terminal. Then, assuming that the 'phones are in series with the H.T. battery and on the positive side, the by-pass condenser across the 'phone terminals should be removed, and the aerial and earth terminals of the crystal set connected to the 'phone terminals of the valve panel. These are all the alterations necessary, but in order to carry

them out you should be in possession of an experimental licence, as they entail structural alteration of the B.B.C. set. To tune in the set, you adjust the crystal as usual, switch on the valve, and connect up the H.T. battery. Then tune the valve set to the wave-length required, and at the same time tune the crystal set. You will probably find that the positions of the tuning arrangements on the crystal set are different from what they were before you added the valve, and they will now read a much higher wave-length. If your crystal set is only provided for the same maximum wave-length as the valve set, you will find it necessary to add a small loading coil in series with the connection between the aerial terminal of the crystal set and the 'phone terminal of the valve set. A coil suitable for this would be one of 40 turns, 24 D.C.C. on a cardboard spider former with 1 1/2 in. diameter centre and nine slots. If the telephones of the valve set are connected to the negative side of the H.T. battery, your best plan would be to short the 'phone terminals and connect the H.T. to the usual terminal, the H.T. + to the earth terminal of the crystal set, and the aerial of the crystal set to the H.T. + terminal of the valve set. In this case it would be necessary to remove the H.T. by-pass condenser from its position across the H.T. terminals.

T. N. K. (Chatham).—It seems to me that there is no reason why a large variety of variable condensers should be made when it is evidently possible to arrive at any value by juggling two or three variables about with two or three fixed. One last point: Is it possible to obtain small value variable condensers by placing small fixed condensers in series with large variables?

The point mentioned in the first part of your question certainly could apply to the experimenter but would hardly be a convenient method to apply to complete sets. The second part of your question brings to our mind a useful arrangement embodying the principle in question. If two condensers are placed in series the resultant capacity will be something less than the capacity of the smaller. Therefore with a variable condenser of '0003 mfd. with a switch so that the smaller fixed condenser could be shorted when not required, the result would be that in the latter case there will be a variable capacity of something up to '001 mfd., but if the switch was opened, and the small fixed condenser brought into series, the greatest capacity value possible would be something smaller than '0003 mfd. '00023 to be precise, and the adjustment of the variable condenser will then be something up to '00023 mfd. That is an extremely useful method of obtaining very fine tuning. In the first case the inductance is varied, and the capacity by means of the variable condenser with the small fixed condenser shorted. The latter value is brought down very low and the inductance increased, and then the small fixed condenser is brought into series so that a wide range of fine capacity tuning is available to obtain the sharpest possible tuning.

What is a Vernier condenser?

A variable condenser with a fine cog and screw adjustment for micrometer capacity tuning. The term is frequently applied in error to variable condensers of small value owing to the fact that the function of these is similar, but the method as detailed in answer to your first question, and placing them in parallel for the same purpose is different.

C. A. B. (Pembroke).—Why is it that carbonium requires a voltage to be applied across it before it will operate successfully, unless the signals are very strong?

This is because carbonium differs from most conductors of electricity in a very peculiar way. If a graph is drawn plotting the voltage against the current, in an ordinary conductor it will be approximately a straight line. This means that the current increases an equal amount for each equal rise in voltage. In the case of carbonium, however, the graph rises slowly in a straight line until it reaches a point called the "critical voltage," when it turns upwards and continues in a steep straight line. At this critical voltage the resistance of the crystal becomes less, and for the same increase in voltage we have a much larger increase in current. When a carbonium crystal is used for rectifying, it is placed so that the aerial voltage will be added to that of a battery which is always applying the critical voltage across the crystal. As soon as this voltage is increased by the slightest aerial voltage that caused by incoming waves—it causes a sudden increase in current through the crystal. This sudden increase produces a sound in the 'phones, and thus the signals are produced. If the crystal has not this critical voltage applied, the small extra voltage from the aerial would only produce a very slight increase in current, which would not be enough to actuate the 'phones satisfactorily.

F. C. (Harrow).—Why is it that upon breaking a circuit in which there is a current flowing, a spark appears at the break?

This phenomenon is explained by what is called the self-induction of a circuit or conductor. When a

(Continued on page 704.)

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RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 702.)

current has been flowing in a circuit, and the circuit is broken, the magnetic field that has been set up by the current around the wire collapses. The collapse of this field will induce a voltage into the conductor, in the same way as the cutting of a coil by a magnetic field will induce an E.M.F. into that coil. For an example, take an induction coil or a buzzer. The sparking across the make and break is due to the voltage induced in the coils by the collapse of the magnetic field around the windings. This induced voltage is always such that it tends to continue the flow of the original current, hence the extra voltage causes the current to attempt the jump of the air gap when the circuit is first broken.

"QUERY" (Harrow).—How is the inductance of a solenoid coil measured? What data is necessary?

The inductance of a solenoid coil is measured in terms of a unit called the "Henry," which is such that the application of a difference of potential of one volt will cause a current change of one ampere in one second. The "microhenry" the one-millionth of a henry, is often used instead of the "henry," which is often too large. You will require to know the diameter of the coil, the length and the number turns. The following formula is an approximate method of calculating the inductance:

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

When:

A is the sectional area of the coil in sq. cms.;

N is number of turns;

l is length of coil in centimetres;

L is the unknown inductance.

To take an easy example:

Given a coil of diameter 10 centimetres; length 100 centimetres and of 2,000 turns.

The sectional area is found by the formula:

$$\text{So that } A = \frac{\pi d^2}{4} \times 5 \times 5 \text{ sq. cms.}$$

$$\therefore A = \frac{500}{7} \text{ sq. cms.}$$

Now substituting for the formula given above:

$$L = \frac{4 \pi \times 22 \times 550 \times 2000^2}{7 \times 100} \times 10^{-9} \text{ henries}$$

$$L = \frac{1930000000}{49} \times \frac{1}{10^9} \text{ henries}$$

$$L = \frac{1936}{49000} \text{ henries}$$

$$= .039512 \text{ henries}$$

$$\text{or } 39,512 \text{ microhenries approx.}$$

(For the sake of simplicity the correction factor has been omitted.)

"HYDROMETER" (Totnes).—I have been advised by a friend not to rely upon my voltmeter for testing the conditions of accumulators, but to use a hydrometer. Why is this? What should the hydrometer give as a reading?

Your friend is quite right. It is always best to test the condition of cells with a hydrometer, because the density of the acid solution is the best indicator you can have as to the state of the accumulator. The more dense the solution is, the higher the amount of charge in the cell, provided, of course, that the right strength of acid has been placed in the cells originally. A voltmeter, however, may give a high reading even when the cells are run down. The voltage is there, but there is no power behind it, and if you attempt to draw current, the voltage drops immediately. The hydrometer readings on an average should be, fully charged, about 1.215, and they should never be allowed to drop below about 1.18. A Hick's suction hydrometer is a very useful type to use with regard to accumulators, and the reading is taken from three coloured beads, yellow, blue, and purple. Yellow floats at 1.17, blue at 1.18, and purple at 1.2.

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RECENT WIRELESS INVENTIONS.

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

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

196,062.—BRITISH THOMSON-HOUSTON CO., LTD.—SIGNALLING.—

High frequency signalling, in which dots and dashes are of similar length, but different frequency, is effected by connecting the aerial to two different H.F. transformers, either of which may have its secondary short circuited by a tapping key to allow the other to transmit alone. The aerial is simultaneously tuned to the transmitted frequency and mechanical means may be provided for transmitting or receiving the signals.

196,085.—G. P. GRENFELL & J. ROBINSON.—DIRECTION FINDING.—

Bearings may be gauged with ordinary receiving apparatus co-operating with a rotating directional beam, distinctive signals being given when at the cardinal points, either by the beam or another transmitter. The bearings are estimated by observing time intervals or relative intensities.

196,188.—A. W. KNIGHT.—INDUCTANCE COILS.—

A cylindrical insulator is split longitudinally and the two halves are spring pressed apart to grip the inside of a coil. The cylinder is eccentrically mounted upon a pin carried by a rotatable pillar and the coupling between two or more of such coils may be varied by rotating the pillars.

196,273.—MARCONI'S WIRELESS TELEGRAPH CO., LTD.—DUPLIX SIGNALLING.—

Two signals of different frequencies received simultaneously may be passed over a single line, by connecting to the aerial circuit two detector sets which deliver the signals at two audio frequencies (say 700 and 1,200). These are passed to filters of inductances in series and capacities in shunt which cut out all frequencies above 850 for one, and below 1,050 for the other, the signals then passing to the line.

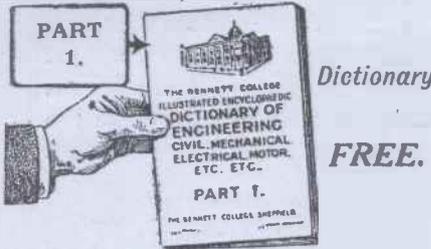
196,295.—GES. FÜR DRAHTLOSE TELEGRAPHIE.—TRANSMITTING.—

The grid circuit of a generating or power valve has two branches, one containing a condenser and coupling coil. The other passes direct current to the filament through an H.F. choke, and may contain a signalling key or a modulator having a condenser-resistance shunt and a microphone to vary its grid potential.

196,308.—S.R. MULLARD.—VALVES.

The tension of a filament is adjusted and indicated by adjusting a spring which carries a hook engaging the filament and co-operates with an indicator. The spring may be helical and mounted with the indicator on the stem of the valve.

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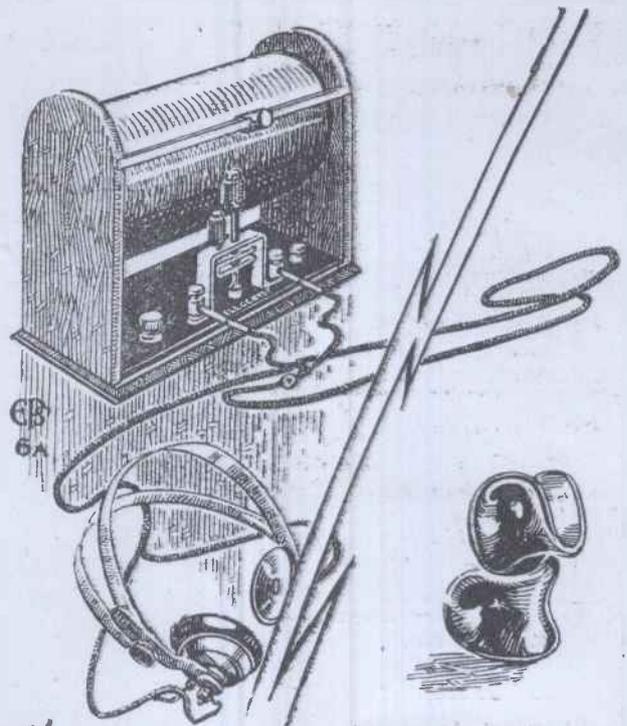
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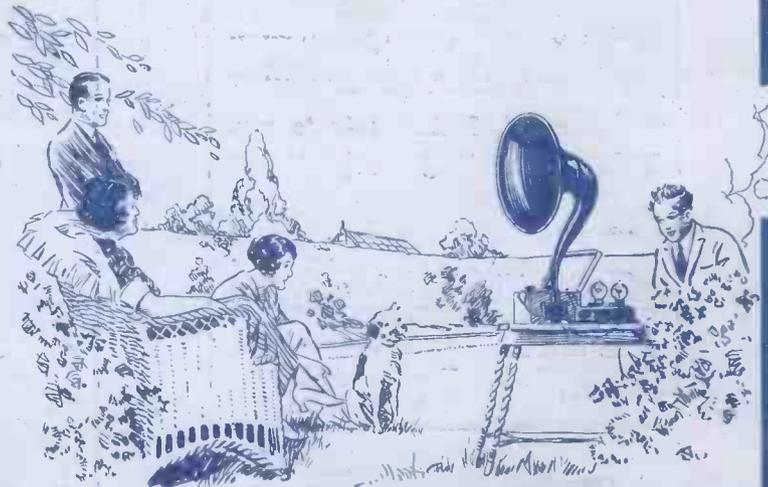
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[Photo by Swaine.]

Mr. Tudor Davies,
as Rudolf
in "La Bohème."

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FEATURES IN THIS ISSUE.

Communicating With Trains.
 A Super-Selective Receiver.
 The New Eliminator.

Some Pictorial Valve-Crystal Circuits.
 Page of Practical Ideas.
 A Chat About Transformers.

And articles by Sir J. Kenneth Mackenzie, Leslie McMichael, M.I.R.E.,
 Rex Palmer (Director of the London Broadcasting Station), John Hope
 Fellows, etc.

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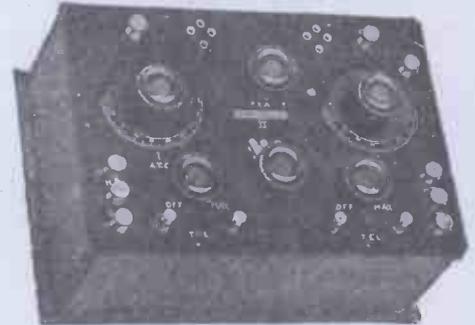
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NOTES AND NEWS.

(Continued from page 705.)

added that of Prof. Einstein, the originator of the theory of relativity. Truly, our companion paper can claim to have the strongest editorial board ever formed.

Wireless Prosecution.

THE first prosecution of its kind was before the Stipendiary Magistrate the other day, when the captain of a vessel was fined for failing to ensure that his wireless operator kept continuous watch on board the ship whilst in Australian waters.

Ellen Terry's Appeal.

I AM receiving letters from all over the country in answer to the appeal for the Ellen Terry Blind Home, but I can still do with many more, so don't fail to send your donation. It does not matter how small it is; every little helps.

2 M G.

I HAVE received a letter from 2 M G, stating that his call sign is being used by a person in Yorkshire. This is illegal, and 2 M G will report this to the P.M.G if the offender does not refrain from using other people's signs. I might say that the location of the person in question is known.

Scotland Yard's Wireless.

SCOTLAND YARD has installed wireless on one of their wagons which is said to be the only one in the world capable of telephoning while travelling at forty miles an hour.

A Novel Set.

ONE of the neatest sets I have seen has been sent to me by a reader of POPULAR WIRELESS for test. It is a crystal slider set enclosed in a doll's piano. Aerial and earth terminals take the place of the usual candlesticks, and 'phone terminals are in the position usually occupied by the pedals.

The Internal Arrangements.

THE keyboard has been replaced by a flat coil and a slider which is operated by opening the lid above the "keys." Inside the piano is the crystal detector and wiring. Tested on my aerial the set gave wonderfully clear results and was quite efficient some distance from 2 L O, easily working two or three pairs of 'phones.

Held Over.

OWING to pressure upon space it has not been possible to include the article by J. Hope Fellows in this issue, and it has been held over until next week.

Forthcoming Events.

THE Air Force Band are due to broadcast from 2 L O on July 3rd, and Paul Specht and his band from the New Corner House on the 4th. On the 6th the Grenadier Guards will play, and "Romeo and Juliet" will be performed on either the 5th or 10th, while "A Mid-

summer - Night's Dream" should follow about three weeks later.

Communication with Australia.

I UNDERSTAND that before long Australia and the Dominions will be able to communicate directly with England by means of wireless. The most powerful station in the world is to be erected in England, with the masts over 800 feet high.

Wireless By-laws.

I AM told that the Wandsworth Borough Council is taking drastic steps with tenants who do not obey the regulations regarding wireless aeriels. One of the laws is that the tenant has to deposit ten shillings, which is returnable when the said tenant gives up wireless. Also the apparatus must be removed, within one week on receipt of notice from the town council.

Further Restrictions.

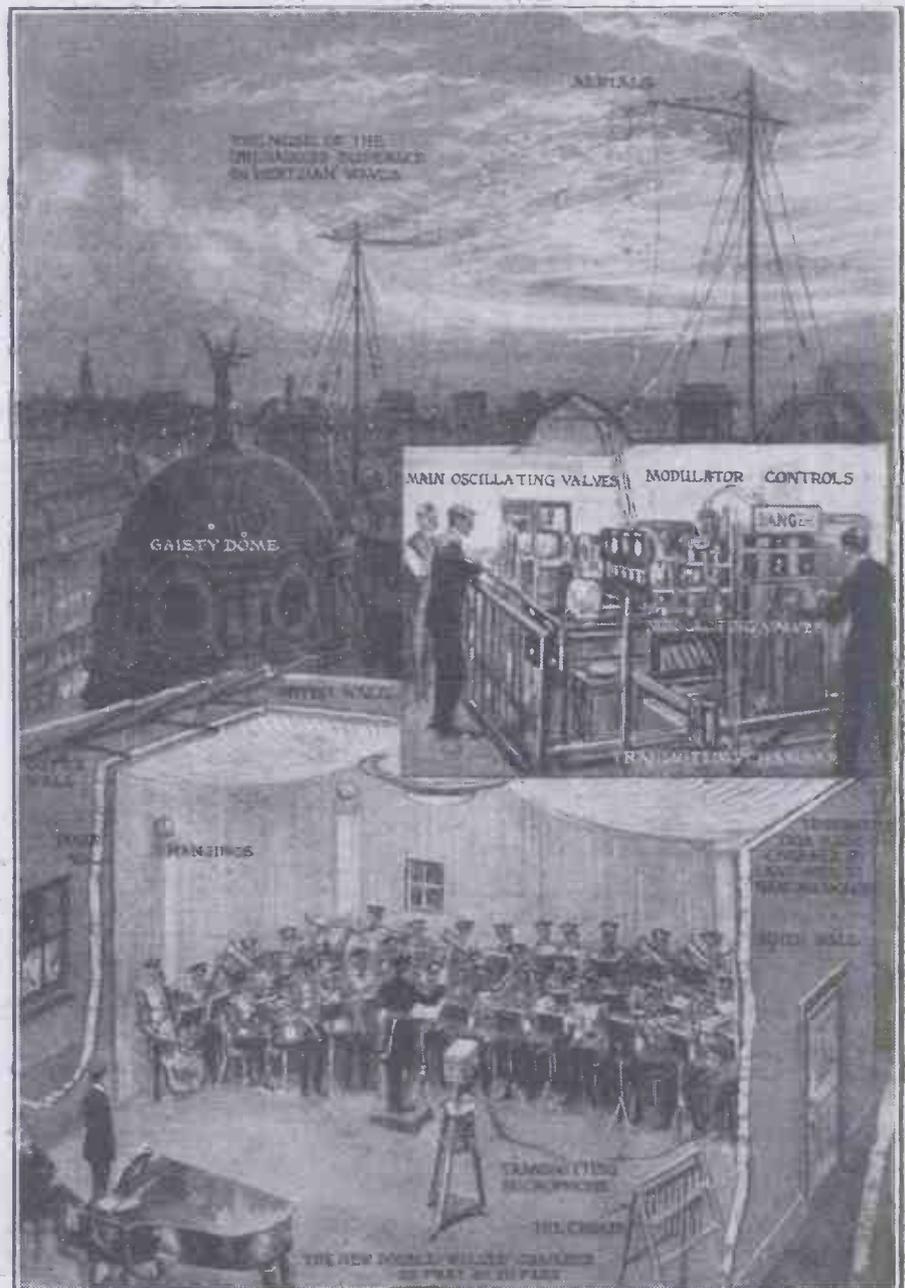
I KNOW of other councils who have made by-laws for wireless apparatus, the L.C.C. having demanded one pound deposit before an aerial can be erected on their estates.

Quick Work.

A PLAYWRIGHT asked a friend who was about to sail to New York if he would take his new play to a well-known producer in New York. The friend, who was also a producer, consented to do this little errand, and asked if he might read the play on the boat. Two days later came a radiogram from the Atlantic: "I'll buy the play myself. What terms?"

The message arrived at three-thirty, an hour after despatch, and the recipient took up his 'phone, called "Telegrams," and dictated a reply. At five o'clock the answer came from the ship, sealing the bargain.

ARIEL.



How 2 L O's band items are broadcast.

SIDE-LIGHTS ON THE INNER-WORKING OF 2 L O.

By REX F. PALMER (Director of the London Broadcasting Station).

In this article "Uncle Rex" tells of the difficulties and criticism that await the organiser of Wireless Programmes.

WHEN listeners sit down to enjoy their evening's entertainment at home, how little they think of all the work that has been done in order to arrange the programme. The entertainment organiser is always confronted by problems of which the public cannot possibly have any idea; but the task before the organiser of an ordinary entertainment is as nothing compared with the difficulties which beset the man who is responsible for a broadcasting programme, every day of the year.

When all the considerations which have to be borne in mind are taken into account, it will be clear that no programme which mortal man could arrange can possibly satisfy every one of the vast audience—an audience which is truly innumerable—by whom it will be heard in all parts of the country.



"Uncle Rex"—
Mr. Rex Palmer.

My sympathy, even as a member of the public, has always been with the entertainment provider. He has done his best, poor chap—a poor best, mayhap, but still his best—and he should be treated tenderly. The wind of criticism should be tempered to the shorn lamb, you know, and even those who have paid for their places, although they are rarely as exacting as the deadhead occupants of free seats, should be lenient. There is much to be said for the plea of the Far West Saloon-keeper—"Don't shoot the bloke at the pianer, he's doing his best."

Suiting Everybody.

Now, to the uninitiated, it might seem that this is all a preamble—an "apologia pro vita sua"—to a confession that the programmes which are broadcast from the London Station of the British Broadcasting Company have not proved to be attractive. But this is not the case—in fact, those who have been responsible for the entertainment feel that they may congratulate themselves upon the success which has been obtained, as shown by the immense number of letters of congratulation which reach the offices every day.

But this is all an unwarrantable digression from the point. This article is intended to tell listeners-in how the programmes which delight them in their hours of rest are arranged by long hours of patient toil—labour which becomes a pleasure owing to the generous appreciation of the vast audience. So to the matter in hand with all seriousness.

The first duty of a programme organiser is to realise that an audience numbering about a quarter of a million men, women, and children has to be pleased. Obviously, every item cannot make an equally strong appeal to every member of this vast host;

and those who prefer a jazz band to a classical orchestra, or a learned lecture to a vocal solo, must bear in mind that the programme has been drawn to interest people of diverse tastes and to appeal to the largest possible number of hearers. The turn of each will come in good time; and the fact that rather more than ninety per cent. of the letters which are received from listeners-in, averaging about a hundred a day, or more, express unqualified approval of the existing arrangement of the items is most conclusive proof that the system of programme-building which has been adopted is sound. Of course, there are critics and criticisms are always appreciated and carefully considered—but when, for example, somebody writes to say that dance music should be cut out and more classic numbers included, there is sure to be somebody else who suggests the exact reverse.

So what is to be done? Why, the answer is simple, the present plan, always with modifications, must be continued while it continues to give pleasure to the majority of those for whom the entertainment is provided, but when this ceases to be the case—and the letters are a fairly reliable indication of public opinion—it may be taken for granted that another formula will be tried. There is nothing cut-and-dried or hide-bound about the system, it is thoroughly elastic, and the fare provided will always be in accordance with the wishes of the majority; for this is a thoroughly democratic organisation.

Colour Scheme.

There is just one little point about which a special word must be said. Broadcasting is only in its infancy, and there is no knowing at present to what dimensions it will grow or in what direction it will develop. Already, however, one thing is certain, broadcasting is not going to be confined to the provision of nothing but what may be described as the lighter kind of entertainment or amusement. In the future it is going to become a mighty force for the spreading of knowledge and for interesting the faculties of the listeners. One word is to be shunned studiously—and that is a good adverb in this connection—"educational." But wireless broadcasting is going to bring about a far reaching revolution, a revolution which has already begun in educational methods; and then it will be found that education is not really anything to be afraid of, but that learning is the most fascinating form of entertainment and amusement, and that learning in the wireless way is not all work but mostly play.

There, I knew it would happen! I am becoming lyrical, if not poetical. So I will now tell you all about the building of that delightful programme about which you have been thinking ever since you heard it.

The performers are selected from a vast number of singers, instrumentalists, entertainers, elocutionists, lecturers, and speakers—including experts on every conceivable subject—whose names, addresses, and talents are fully recorded in the most wonder-

ful card-index you ever saw—and you will never really see this one, for its contents might be either libellous or too laudatory. A wonderful colour scheme has been adopted so that at a moment's notice a rainbow combination of colours can be selected which will produce a perfectly balanced programme. There will be found violinists, violoncellists, and players on outlandish instruments—such as the tom-tom or the bagpipes; while singers of all kinds, tenors, sopranos, basses and contraltos are ready to hand. Lectures on any subject can be produced at will from their own quarters, while humorous entertainers are constantly popping out jack-in-the-box-wise from their hiding places.

Dealing the Cards.

By shuffling the cards and dealing them as they come, an excellent programme in the raw is drawn up. But then begins the real labour of organisation; for the selected performers have to be secured, and a hundred thousand other details have to be thought of and arranged.

When all this has been done, the organiser may think that his task has been accomplished. Optimism of this kind is, however, not yet justifiable, for one soon realises that responsibility does not end until the performer is actually before the microphone. Then, and not until then, the programme-builder, being an acrobat, may pat himself on the back and say, "Well done;" for, bar accidents, he will have arranged the programme and brought his team together, and the rest is a matter which he cannot control. He can only hope that the innumerable listeners-in, seated in the comfort of their own homes—and ready to be kindly or severely critical, as the case may be—will be satisfied. And when he hears that his end has been achieved, he will know that he has succeeded once more, and he will feel amply rewarded for all his labours.

Plenty of Variety.

To have written lightly on this important subject does not mean that the task is regarded flippantly, or that the arrangement of programmes does not entail really hard work. Dozens of letters, for one reason or another, may have to be written before an item on the programme is arranged; and then, at the last moment, the absence or illness of a performer may cause a vacancy which has to be filled without an instant's delay. But all this is part of the day's work; and the reward of popular appreciation, which is always so generously bestowed, is more than a sufficient recompense.

Some day, it may be possible to give a full description of your programme—as it appears to me in the studio. But what I have written is intended to show that the organiser of broadcasting programmes is not likely to get into a groove or to suffer from lack of variety and excitement in his work.

So, now you know something about what has to be done when preparing the programme you will hear when you next listen to "2 L O calling."

A SUPER-SELECTIVE RECEIVER.

By J. F. STANLEY, B.Sc., A.C.G.I., F.R.A.

An ingenious method of eliminating interference and permitting reception through jamming.

NOWADAYS when a Londoner first takes up wireless his main object is to receive the programmes transmitted from the London broadcasting station. So he probably makes or buys a crystal or single-valve set, and is highly pleased with the results obtained.

After a time he gets more ambitious, and tries to receive some of the other broadcasting stations, for which purpose he uses a multi-valve set, and is greatly disappointed with the results obtained. He finds that he can pick up some or all of the other broadcasting stations, while the local station (in our case London) is silent, but that while

the most successful of any, and gave truly satisfactory results. There is nothing strictly new about the circuit, but so far as the writer is aware very few people have thought it worth trying out, and for that reason the following notes are put forward.

Connected between the aerial and earth terminals of the receiver (of the usual multi-valve type) are a variable condenser, C, and an inductance coil, L, as shown in the diagram.

The coil, L, should be slightly larger than the tuning coil in the receiver, and the condenser, C, should be fairly small, say .0003 or .0005 mfd.

The method of operating the set is now as follows:

1. Tune-in the station it is desired to eliminate (say 2 L O) by means of the ordinary tuning arrangements on the receiver.

2. Slowly rotate the knob of the condenser, C, until 2 L O disappears. If 2 L O does not go, it indicates that the coil, L, is not of the right value, and it should be changed for one slightly larger or smaller. When the correct coil has been found, it will be possible to tune 2 L O dead out by careful adjustment of C.

A Useful Addition.

Now tune-in the station it is desired to receive (say Birmingham or Manchester) by

means of the ordinary tuning arrangements on the receiver. It will be found, provided, of course, that the receiver is sufficiently powerful for the purpose, that any other station can now be picked up exactly as if 2 L O did not exist at all.

The writer is situated four miles from the London station, but by using the arrangement just described in conjunction with a 4-valve set (1 H.F., 1 Det., 2 L.F.), all the other B.B.C. stations can be heard on the loud speaker without the slightest trace of interference, while 2 L O is agitating the ether for all he is worth.

It will be obvious that the size of L is not critical, since the circuit, C, L, is tuned by means of the condenser, C. Hence any values of C and L, which, in conjunction with the capacity of the aerial, can be tuned to the offending wave-length, will give the desired selective result.

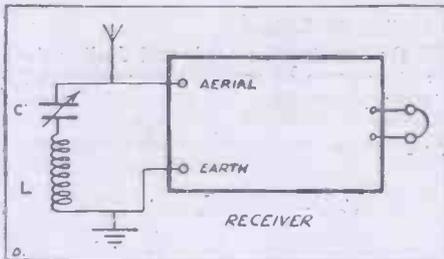
It will be found, however, that if L is small and C large, the signal strength of the other broadcasting stations will be reduced somewhat. This difficulty is entirely surmounted by making L as large as possible and C as small as possible, under which circumstances this arrangement will give every satisfaction.

No Trace of Interference.

No receiving set situated within a few miles of a powerful transmitting station is really complete until it has been fitted with an "eliminator circuit" in this manner. The arrangement is, of course, applicable to any wave-length, and is not confined to broadcasting stations.

By using suitable coils for L, any jamming station can be eliminated; but so far the writer has not had much success with powerful spark stations, since the tuning of the latter is so flat that total elimination is almost impossible. If L is wound with high-resistance wire, better results are obtained, but for C.W. and telephony L should have a low ohmic resistance.

However, "this 'ere progress, it goes on," as Mrs. Wells remarked, and no doubt a perfect spark eliminator will shortly be produced. There is no harm in hoping, anyway.



2 L O is working it is impossible to get rid of him sufficiently to be able to tune-in any of the other stations satisfactorily.

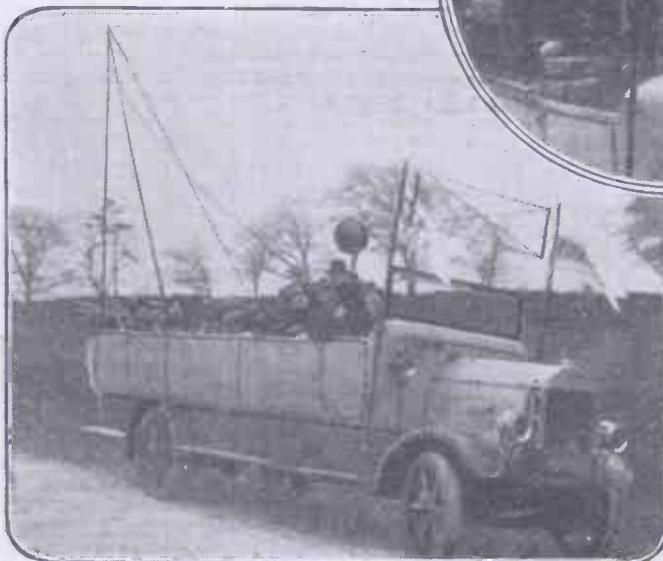
At any rate, that is the conclusion the writer came to after having tried all the usual so-called "selective" circuits, for, although he could receive Glasgow quite comfortably on a loud speaker (using four valves) when 2 L O was silent, yet when 2 L O started up these two stations got hopelessly jammed.

Something had to be done, and, after trying various complicated arrangements the writer tried a circuit which he had at first thought too simple to be effective. However, this circuit proved to be by far



MUSIC ON THE MOORS.

An enterprising Bradford firm offers free listening-in to travellers on their charabancs. The apparatus employed was constructed entirely by Mr. J. Dobson, a member of the local wireless society, and consists of four valves 1 H.F. and 2 L.F., one of the latter being a "power" valve.



PICTORIAL VALVE-CRYSTAL CIRCUITS.

By OSWALD J. RANKIN.

Showing how a crystal detector can be employed for rectification with valves introduced in amplifying capacities.

THERE is little doubt that for good, clear signals without distortion there is, at present, no rectifying device to equal a well-adjusted crystal. Possibly the best combination is a fine gold wire cat's-whisker pressing against a good specimen of "hertzite"; and next to this comes the Perikon combination, where a point of copper pyrites engages a flat surface of zincite. The carborundum type has a reputation for reliability, and is a hot favourite amongst "old timers"; but this requires a potential, which necessitates the use of a potentiometer and battery, and is therefore not very popular amongst "new timers," who are inclined to view the matter from an economic standpoint.

There is a prevailing idea that a crystal detector is a troublesome piece of apparatus. This is purely a misconception. Any other piece of apparatus, however perfect, could become troublesome in the hands of a person possessed of very little skill or patience; and let it be said at once that if any radio enthusiast does not possess a fair share of patience, then he had better give it up and go in for keeping rabbits or some other simple hobby. In the right hands the crystal detector represents what is probably the most important component used in radio consistent with cost and simplicity.

For Weak Signals.

The one real drawback is the fact that it will not amplify signals; but we should consider that its duties are to rectify, and that although the valve will rectify also, it is decidedly more efficient in carrying out its duties as an amplifier, the purpose for which it was originally intended.

If we employ a circuit embodying both we may lose a certain degree of reliability, but we are certainly gaining a few points as far as efficiency is concerned.

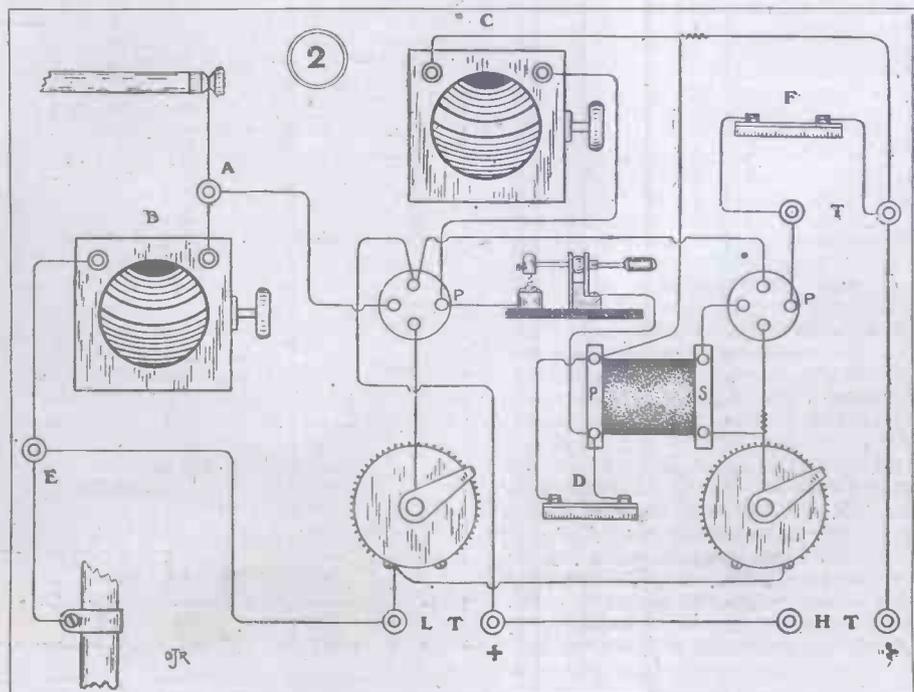
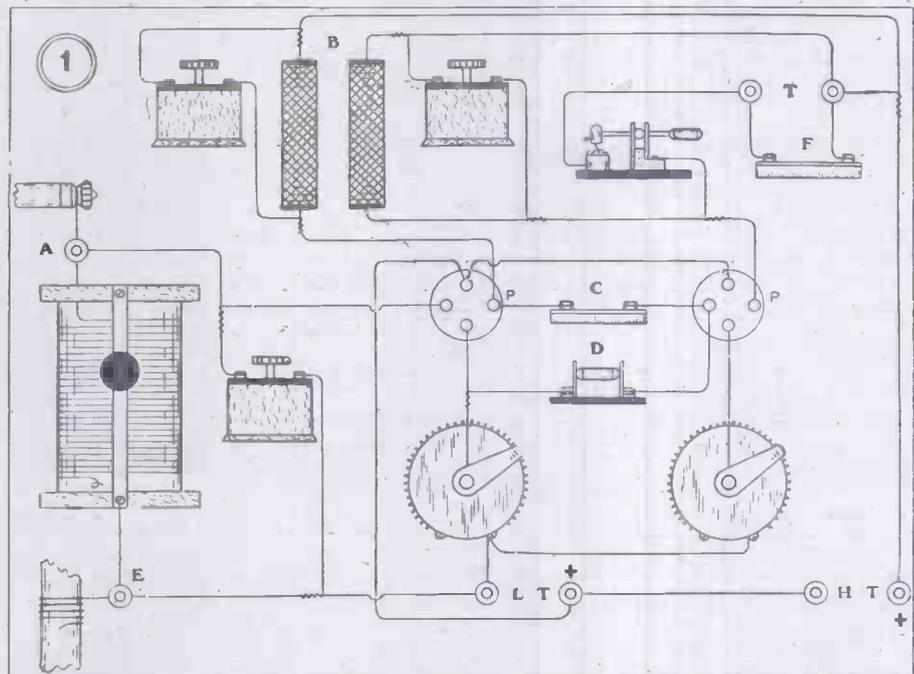
Apparently a few of our manufacturers have realised this, since there are some excellent crystal and valve combinations now on the market. The point is this: why waste that half an ampere of current on a rectifying valve when a crystal detector, which requires no upkeep, will perform the same duties in a much better way? Considering this, and also the initial cost of the valve, against the cost of the crystal detector, crystal rectification appears to be a very attractive proposition. Fig. 1 shows a circuit employing two stages of H.F. amplification and crystal rectification. This arrangement would be suitable where the signals were very weak, and in some cases for frame aerial reception.

A Useful Combination.

The receiving range will be approximately five times greater than by using the crystal set alone, and the volume of sound is also slightly increased. The aerial tuning arrangement may be modified, but, as pointed out in a previous article, if the circuit is new to the enthusiast, it is best to arrange this as simple as possible and modify it, if desired, after becoming thoroughly acquainted with the other tuning

arrangements. Two honeycomb coils, B, are mounted in a standard two-coil holder, and each coil is shunted with a .0003 mfd. variable condenser, so as to form a tuned anode reactance coupling for the valves. The detector and telephones are connected across the plate circuit of the second valve as shown. The .002 mfd. fixed condenser, C, is provided to prevent the H.T. current from affecting the grid of the second valve. D is a grid resistance of about 2 megohms.

Fig. 2 shows a very useful valve-crystal combination in which the first valve acts as a H.F. amplifier, the crystal as the rectifier, and the second valve as a L.F. amplifier. The variometers, B and C, may be of the standard type with ball rotor, or made up in the usual way from honeycomb coils. The inductance value of each should be identical. D is a .001 mfd. fixed condenser which shunts the primary winding of the L.F. intervalve transformer. This is an



"LISTENING-IN"—BUT NOT TO BROADCASTING.

By A WIRELESS OPERATOR.

2 A.M. and several hundred miles from the nearest land. I have just been called to go on watch, and my first thoughts are that a profound calm reigns outside in place of the ceaseless howling of a north-west gale and its attendant sounds of the creaking and straining of the vessel as she labours in heavy seas.

More fully awake, I realise that the "racing" of the engines, caused by the propellor being lifted clear of the water, is absent, and then that the engines are stopped altogether. A breakdown probably. Anyway, I think to myself, better to have an engine stoppage now than during the appalling weather of the last ten days.

The sickening sleepiness that grips one at 2 a.m. is worse this morning, as the calm sea has allowed a real sleep for the first time since leaving England; but, once turned out, the acute cold tends to banish sleep, and I am fully occupied in putting on as much clothes as possible in the least possible time. The steam heater has been broken down for several days, and it is useless to attempt to wash, for the simple reason that the water is frozen in the basin.

Freezing Hard.

As I leave the cabin, the brass doorknob tends to stick to my fingers. Yes, the mercury is lower than usual to-night.

On reaching deck an impressive scene lies revealed. The ship is covered with a level mantle of snow, icicles hang from the

deck-houses and rigging, while the whole is suffused with a ruby glow from two red lamps which hang from the foremast, and this, coupled with the dead silence, lends the scene a weird and almost uncanny air.

Plenty of Variety.

At the foot of a companion ladder I meet an apprentice, whose breath freezes on his big coat.

"Why is she stopped?" I ask.

"We've run into an icefield and there may be bergs about," he replies, and then: "The first night we've had weather to allow a little speed, too."

And muttering things about the sea, and the North Atlantic in particular, he passes on to fetch the second officer's tea.

Running up the companion-ladder I enter the wireless cabin. Under a shaded light sits the operator on watch, writing in the log.

"Much doing?" I ask.

"Not much," he replies; "but the old man wants ice reports from eastbound ships. By gum, I'm tired to-night; you're welcome to the

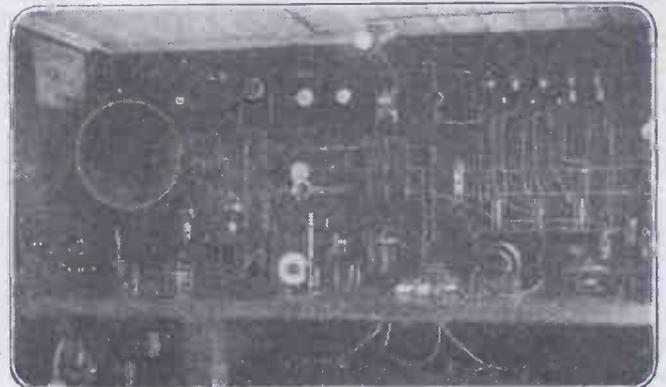
early morning watch," and, handing over the phones, he passes from the cabin.

Putting on the telephones, I settle down to a six-hour vigil and reflect upon the vagaries of an operator's life. Six weeks ago I was sweltering under the hot sun of a Nigerian creek, with the bush spreading over the decks. To-night I await the grey dawn of the Newfoundland banks.

NEXT WEEK.

there are several important features appearing in "POPULAR WIRELESS" which no one interested in matters radio can afford to miss. There will be a special interview with SENATORE MARCONI, in which he describes the results of his latest experiments, articles by Sir Oliver Lodge, F.R.S. (our Scientific Adviser), and Lt.-Col. Chetwode-Crawley (Deputy Inspector of Wireless Telegraphy, G.P.O.). The latter deals with the ever-absorbing question of "Monopoly in Wireless."

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5 C P the experimental station belonging to the Fellows Magneto Co., Ealing.

PICTORIAL VALVE-CRYSTAL CIRCUITS

(Continued from page 709.)

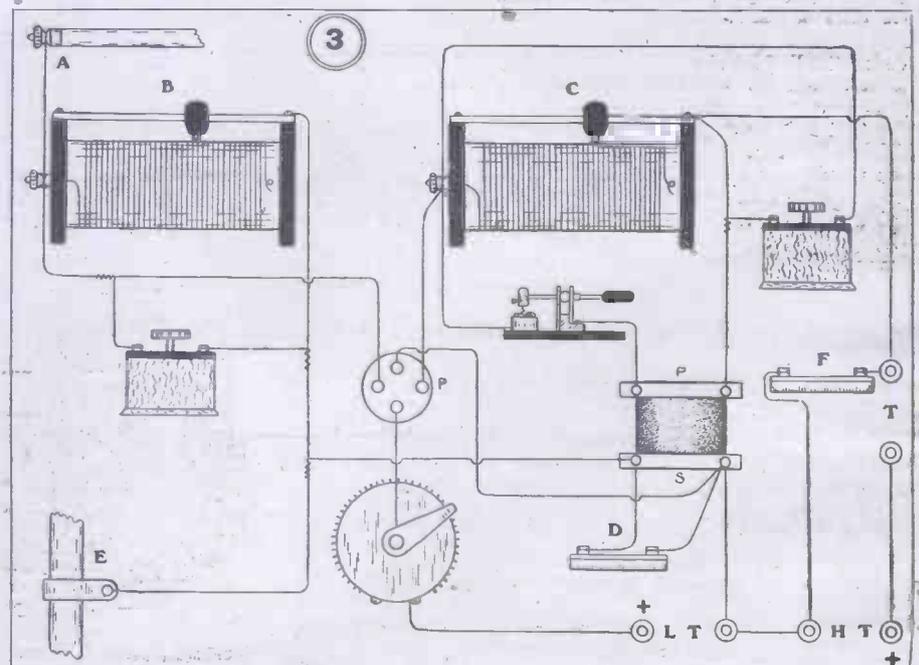
excellent circuit for use in conjunction with the broadcasting. No variable condensers will be required unless the variometers are replaced by ordinary tuning coils.

Dual Amplification.

A rather unusual circuit is shown in Fig. 3. Here the valve is made to function as a H.F. and L.F. amplifier simultaneously, rectification being accomplished by the crystal detector. The results from this will be at least equal to two valves arranged in the ordinary way. In conventional circles it would no doubt be rated as a "freak," but this is not very disturbing when the actual results obtained leave nothing to be desired. The tuning coils, B and C, are identical, since both are tuned to the same frequency. These should be "a job"—i.e., they should be constructed with the greatest care, the ends and the formers being made of ebonite if possible. A suitable size coil for the broadcasting wave-lengths is 6 in. long by $3\frac{1}{2}$ in. in diameter, wound with No. 22 enamelled copper wire. The sliders should be of the best quality, and preferably of the flat spring type. It will be necessary to shunt the anode coil, C, with a .0003 mfd. variable condenser, and advantageous to

connect another of .0005 mfd. capacity across the aerial coil, B. A .001 mfd. fixed condenser, D, is in shunt with the secondary winding of the L.F. intervalve transformer; and another, F, which has a

capacity of 0.01 mfd., shunts the telephones and high-tension battery. The tuning of this circuit will be fairly critical until the operator is well acquainted with the adjustments.



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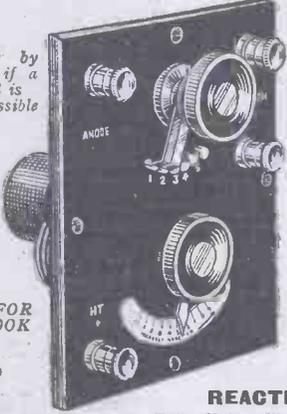
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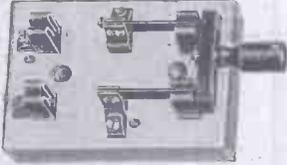
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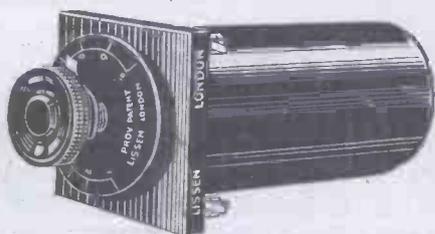
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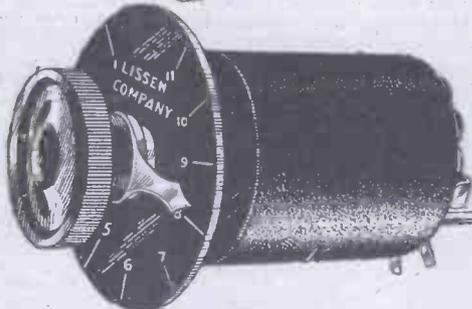
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A CHAT ABOUT TRANSFORMERS.

By C. E. FIELD, B.Sc.

This is the first of three articles, each complete in itself, dealing with the various types of transformers employed in wireless receiving sets. The author, in his usual interesting manner, combines both theory and constructional details.

I.—GENERAL PRINCIPLES.

TO many of us there is an element of mystery about a transformer. It appears in various parts of our receiving sets, and takes a great variety of forms, and it is difficult sometimes to see exactly what purpose it serves. Let us see, first of all, what a transformer is, and how it works, and then we will consider its applications in wireless work.

Most readers will be aware that when an electric current flows along a wire, the wire becomes surrounded by what is called a magnetic field. It is rather difficult to get a mental picture of a magnetic field, but we can imagine it to be a current of magnetism flowing in circles round the wire. This "magnetic current" is referred to as "magnetic flux" in order to distinguish it from electric current.

Production of Magnetic Flux.

As this magnetic flux is produced by the electric current in the wire, its size and direction of flow will depend upon the size and direction of the current.

If, now, we bend the wire into the form of a loop, it is easy to see that all the flux flowing round the wire must flow through the loop in one direction, while if the wire is wound into a spiral the flux will pass through each loop composing it, in the same direction, and so will flow up the centre of the spiral from end to end. Since the flux flowing through the spiral is made up of the sum of the fluxes flowing through the individual loops, the total flux produced will depend upon the number of loops or turns of wire.

We see then that when an electric current is sent round a spiral of wire, a magnetic flux is sent along the axis of the spiral, depending for its value upon the size of the electric current and the number of turns of wire. The amount of flux also depends upon the diameter and length of the inside of spiral, just as the flow of electricity in a circuit depends upon the diameter and length of the wire of which the circuit is composed. It has been found that if, by any means, the amount of flux flowing through a coil of wire is changed, a voltage, or electrical pressure, is produced in each turn of wire in the coil, the value of the voltage depending upon the amount of flux changing in a given time. The voltages produced in the individual turns of wire all act in the same direction, so that the total voltage across the ends of the whole coil depends upon the number of turns with which it is wound.

The Transference of Energy

Now let us see what happens when two coils of wire are placed end to end, or better still, one inside the other as in a loose coupler, and an electric current is sent through one coil. If the current is supplied from a battery, and so flows always in the same direction, a steady magnetic flux will

flow along the axis of both coils, but no effect will be produced on the coil which is not supplied with current. If, however, we send an alternating current through the first coil, it will produce an alternating flux—that is, a flux which, after attaining its full value in one direction, falls to zero, rises to its full value in the opposite direction, and falls to zero again, repeating this cycle at the same frequency as that of the current producing it.

Concerning Ratio.

We saw that when the flux through a coil changes in value, a voltage is set up in the coil. This alternating flux produced by the first coil, therefore, since it flows also

can summarise the action briefly as follows: Alternating voltage is applied to the primary winding; this drives an alternating current through the winding, which, in turn, causes an alternating magnetic flux to pass along the axis of both windings. The alternating flux produces in the secondary winding an alternating voltage, which bears to the applied voltage the ratio of the numbers of turns on the two windings. This ratio is called the "ratio of transformation," and a transformer is known as a "step-up" or a "step-down" transformer, according as the secondary (output) voltage is greater or less than the primary (input) voltage.

It must not be thought that when we increase voltage by means of a transformer we are getting something for nothing. We are not, for if we connect the secondary (high-voltage) winding of a step-up transformer to an electric circuit, the current which flows will be *decreased*, compared with the primary current, in exactly the same ratio as the voltage was *increased*.

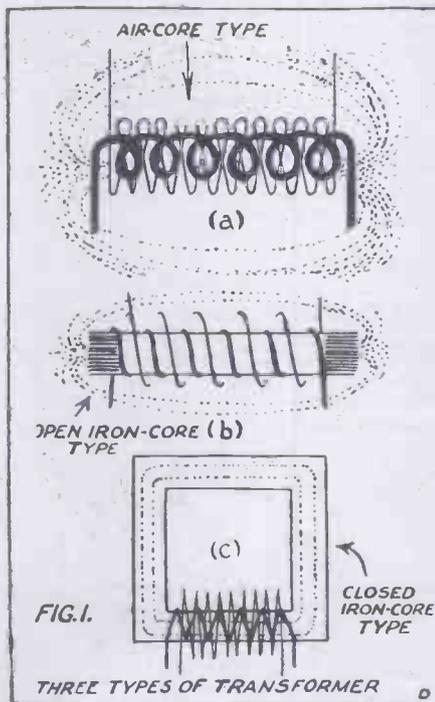
If the windings of a transformer are wound round an iron core, a very much greater amount of flux is obtained for a given winding, because iron is a much better conductor of magnetic flux than is air. Hence, by using an iron-core, the dimensions of a transformer are very much reduced, and for all ordinary purposes iron-core transformers are invariably used.

Three Principal Types.

These may be of two types, known respectively as "open-core" and "closed-core" transformers. In the former type the iron lies only along the axis of the windings, and the flux must complete its circuit through the surrounding air. In the latter type there is a complete iron circuit round the windings, so that the flux has an easy path for the whole of its course. Fig. 1 shows diagrammatically the three principal types of transformer—air-core, open iron-core, and closed iron-core—the dotted lines in all cases representing the path taken by the magnetic flux.

In a wireless receiving circuit transformers are used in conjunction with low-resistance telephones, as couplings between low-frequency valves, or as couplings between high-frequency valves. These three cases will be considered more in detail in subsequent articles.

(To be continued.)



through the second coil, will produce in the latter an alternating voltage, which will depend for its value upon the size of the flux and the number of turns of wire in the coil. If the number of turns in the second coil is equal to the number in the first coil, it can be shown that the voltage produced is the same as the voltage applied to the first coil in order to send the current through it. If there are twice as many turns on the second coil as on the first, the voltage produced will be twice as great as the voltage applied; in fact, the voltage will be altered in all cases in the exact ratio of the numbers of turns on the two coils.

These two coils make up a transformer, of which they constitute respectively the primary and secondary windings, and we

Readers are invited to submit the results of their experiments in the form of short constructional articles. If accepted for publication they will be paid for at our usual rates.

THE WRONG WAVE-LENGTH.

It does not do in these enlightened times to take ignorance on matters wireless as granted when one entertains a stranger.

"YOU'RE fed up with wireless?" said Henry to the quiet young fellow whom I had brought round to dinner with him.

"Bored stiff," admitted the young man dejectedly. "They talk wireless all day at the office—I simply can't get away from the wretched stuff."

"And I daresay," said my brother, "that not knowing too much about it all, you're naturally a bit prejudiced."

"I don't know too much about it," the other acknowledged. "There's so much to learn, isn't there?"

Henry laughed.

"Oh well," he said kindly, "there is, and there isn't. But look here—my set's in the next room—come along through and see it. Once you get a grip of things, you'll be as keen as the rest of us."

Waste of Current!

The young man smiled sceptically. When he saw the litter of paraphernalia that constituted Henry's receiver, his face fell a full five points, with a tendency to go still lower.

Henry caught his eye and roared.

"Crying before you're hurt," he chuckled, "like the rest of them. Everybody, of course," he went on expansively, "knows what wireless is."

"I'm afraid I don't," said the young man miserably.

"Never mind," encouraged Henry. "It isn't really necessary. Now you see this switch thing here? That's the aerial. Watch—I put it across like that." He moved a black lever by the window. "Now it's on."

"What's on?" demanded the other with interest.

"The switch," said Henry cautiously. "Here's another switch," he continued.

"I turn it—like this—and those little globes light up."

"A waste of current," said the young man pertinently. "A nice light evening like this, too."

"On the contrary," retorted Henry, in high glee. "If they weren't alight, the wireless fairies would never be able to see their way in. You ought to listen to Uncle William explaining it all to the kiddies!"

"Uncle William?" repeated the young man blankly.

"You'll hear him presently," Henry explained. "He's the M.C. up at the broadcasting station, you know."

He slipped a pair of headphones over his ears, and turned his attention to the glowing bulbs.

"If you'll keep quite quiet for a minute or two," he said, as if he were promising a dog a biscuit to stop barking, "I'll see if I can get on to the London station for you."

The pupil lit a cigarette and relapsed into moody silence. For a full five minutes, not a sound was heard but the occasional click of a switch as Henry fumbled amongst a forest of them.

And then: "Nothing yet," reported Henry tensely.

Ten more minutes passed in deathly silence.

"Can you hear anything?" whispered the young man unsteadily.

A Tense Moment.

"Ssh—ssh—ssh!" came from a corner of Henry's mouth. "I'll have it in a moment."

"Good!" said the other doggedly, lighting a large pipe, and subsiding into an armchair.

Another ten minutes, entirely without incident, ticked slowly past. Then Henry turned to his visitor.

"It's no use trying to-night, I'm afraid" he apologised at last. "The thing seems

absolutely dead—Come round another evening, old chap. I'll—"

"Never mind," said the young man cheerfully, rising and walking over to the apparatus. He regarded the instruments with a certain languid interest. Then he stopped, seemingly fascinated, at the switch which Henry had first exhibited to him.

Coming Through Fine!

"Let me see," he said thoughtfully. "What did you tell me was the use of this little gadget here?" He clicked the switch across with idle curiosity. "I fancy—"

Like a flash, Henry leapt into the air as one possessed of an infernal legion.

"Quick! Quick!" he jerked. "Put on these headphones, man. It's coming through fine now. I must have had that aerial switched off all the time."

I saw Henry in his garden the next evening. "Well," he said cheerfully, "I fancy I've altered your young friend's opinion of wireless. He seemed to enjoy himself mightily last night."

"He did," I agreed. "And he needs a little recreation, now and again. By the way," I added casually, "did I mention to you that he is 'Uncle William' of the broadcasting station?"

Henry bared his teeth with a horrible and most unbrotherly expression.

"No, you didn't!" he said savagely, reaching for a brickbat; and I haven't seen him since.

"Wireless Review & Science Weekly"

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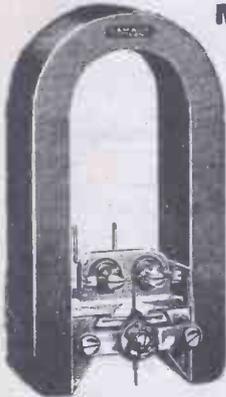
Wireless picnics will prove a very popular feature in the coming summer months. This photograph shows a group of Cardonald youngsters being entertained with a 3-valve loud-speaker set.

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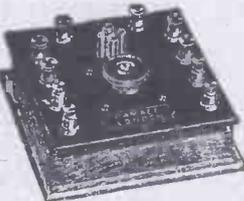
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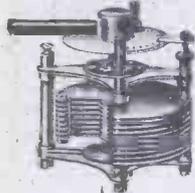
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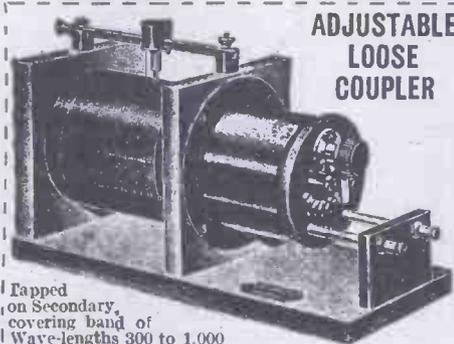
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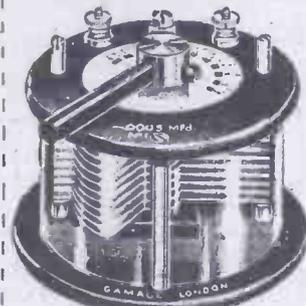


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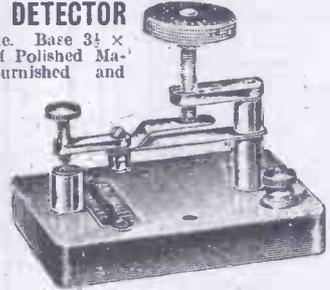
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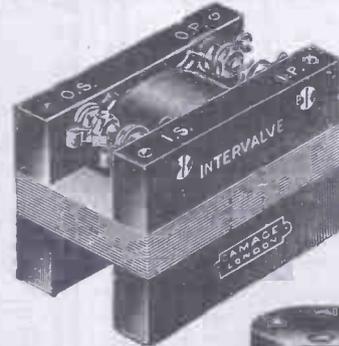
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COMMUNICATING WITH TRAINS.

(By Dr. A. NEUBERGER, our Berlin Correspondent.)

Although in Great Britain, on account of the comparatively short railway journeys that exist between the important towns, a means of communicating with trains is not felt to be very essential, it is a different matter in other countries, where a business man travelling by rail from one point to another may be cut off from the outside world for several days. How the Germans solved the problem by means of a system of wired-wireless telephony is fully explained in the following article.

AS soon as radio-telephony was successfully accomplished, people began to try telephonic communication from trains. They succeeded, it is true, to a certain extent, in speaking from the larger stations to the train, but communication in the reverse direction failed. The cause of the failure was that the trains could not carry the powerful apparatus necessary, and with small-powered plant it was impossible to transmit over large distances.

It was only by the construction of new amplifiers, that depend on the principle of cathode tubes, that success was achieved. These amplifiers are like electric lamps, and are exhausted as far as possible. Now, at last, in Germany the first train has been provided with instruments that allow transmission from the running train, and passengers on the train can receive calls during the journey. The trial train runs between Berlin and Hamburg, and was arranged by the society for radio-telegraphy, Dr. Erich F. Huth at Berlin. The train is a D train, as corridor trains are called in Germany, in the midst of which there are two third-class cars. Both cars are used for usual communication, taking passengers like any other car. Only one of the compartments at the front has been fitted up as a wireless cabin. Here is the telephone in a telephone box, and at the side of it a room for the official that controls the apparatus.

"Train Stations."

This official might be dispensed with as regards the wireless service itself, communication being accomplished without him. But his presence is desirable for other reasons, especially for payment and for informing the passengers that are called for that they are "wanted on the 'phone."

On the roof of the two cars is the aerial, consisting of a number of arches on which the proper sending wires and receiving wires are fastened. One of the cars has no telephonic apparatus at all, but is only carried along to prolong the aerial by using

its roof. This antenna consists of six parallel wires that cover each of the two roofs, a length of 16 metres being obtained, so that the whole length of the wire is 192 metres. The communication is carried out by the usual apparatus in quite the same manner as from any ordinary telephone in any house. The wireless waves pass from the antenna to the wires of the telegraph that run along the railway. The waves do not enter into them, however, but only slip along the surface of the wires and are not disturbed by telegraphic communication taking place in the wire at the same time. At Bergedorf, near Hamburg, and at Spandau, near Berlin, there are two new offices that are called "train stations." They

perform the connection with any subscriber wished for in the same manner as any other telephone station. By a corresponding switching they make connection between the waves coming from the train and the common inter-urban telephone lines.

Has its Disadvantages.

There can be no doubt that the new "train telephony," by which the understanding is a perfect one, represents an important progress of traffic.

Perhaps many a person will greet this wonderful triumph of modern science with mixed feelings, as being so absolutely disengaged from the ordinary surrounding, was a benefit to them. That is naturally the reverse of the medal. But, after all, you are not obliged to divulge the train you intend to go in to your creditor or to your mother-in-law.



The two bottom photographs show the aerial in position on the roofs of the carriages. Above, a passenger being "put through" by the attendant. It is possible to obtain a call through any of the telephone exchanges by this means.

A VISIT TO A RADIO FACTORY.

ATTRACTED by a large aerial on the roof of a factory bearing the name of a well-known engineering firm, it was not long before I was in the presence of the manager, who kindly offered to take me over the works. The General Radio Company's apparatus is so well known to many people that it should be interesting to read how it is made, and judging by the output, some six hundred sets every week, the apparatus must be giving entire satisfaction to the public.

It is interesting to note that all the apparatus, even the 'phones, is made at the G.R.C. works at Harlesden, no foreign apparatus being used, and British labour only being employed. First of all, we come to the cabinet-making room, where the cabinets are assembled, to be polished later in another department.

Detection of Flaws.

After these cabinets have been varnished and highly polished and fitted with various gadgets, they are passed on to have their ebonite panels fitted. By this time the panels have been drilled, polished, lettered, and wired, all the wiring, of course, being soldered.

One man, of course, is not responsible for

the whole of the wiring and assembling, the various parts being assembled by one-hand, the wiring by another, and so on. And, again, there is a special section devoted to the construction of variometers and variocouplers. These are not wound on formers, as is usual with this type of instrument, but are moulded and are extremely light, and are nevertheless quite as efficient as the more common type.

Later we came to a large shed where the metal turning is carried on.

There is a special X-ray installation for the detection of flaws, only perfect material being used. The G.R.C. sets have, I note, been redesigned to give greater selectivity, and are tested at Harlesden to cut out London and receive other broadcasting stations.

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 SPON END WORKS - - - COVENTRY
 Enquiries Invited. Trade terms on application.

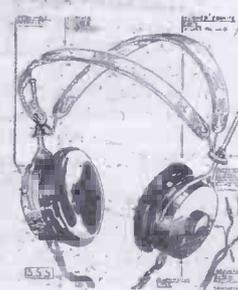
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Guaranteed made from pure Shellac. A saturated solution in the cold. Perfect for all insulation work. Enquiries invited from the trade.

6d. and 1/- Bottles. Also in BULK.

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 Scientific Basket Coils (set of six) with Calibration Tables (suitable for all Broadcast Wave-lengths). 150 to 4,000 Metres, 2/6. Postage 3d.
 Coil Holders for Basket or Slab Coils, to fit in Standard Plug-in Tuning Stands, 1/6 each. Postage 3d.
 47 S.W.G. 3/4 oz. Bobbins D.S.C., 1/0. Enam. 10d.
 Double quantity (Enam. only) 1/6. Postage 2d.
 High-Tone Reed Type Buzzer, 2/9. Postage 6d.
 Grid Leaks, 2 meg., 9d. each.
 Fixed Condensers, all capacities, 1/0 each. Postage 2d.

Scientific Supply Stores,
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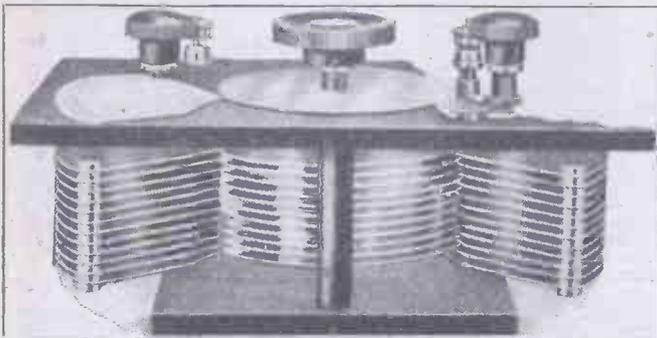
THE NEW ELIMINATOR

Describing the wonderful "three electrode" variable condenser, and how it eliminates "jamming."

FOR some time a great deal of research work has been carried out with a view to eliminating interference of all kinds. Amateurs living in London have been unable to tune out the London station and receive other broadcasting stations, whilst those situated in the other broadcasting centres are similarly affected.

Not Fully Realised.

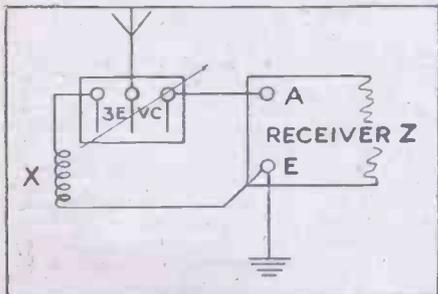
Perhaps the chief sufferers from interference are those situated on the coast,



The Three Electrode Condenser.

where it is almost impossible to tune out the ships that vigorously transmit spark on 600 metres. There are many who have found it necessary to give up wireless altogether for this reason after having experimented and utterly failed in cutting out this interference.

The "Three Electrode" variable condenser (Messrs. Autoveyors, Ltd.) has been on the market for some six months now,



X. To wave-length of offending signal.
Z. As necessary to receive station desired.

and judging by the complaints received daily by POPULAR WIRELESS of people unable to tune out various stations, the public have not yet fully realised the value of this instrument.

The Eliminator, as it is called, is really capable of eliminating jamming, and is also very useful for cutting out statics. It comprises three sections, each consisting of a tier of rotary or semi-rotary parallel plates of one-third disc area.

At a Demonstration.

Whilst providing all the essentials of the ordinary two-electrode condenser, it has the all-important addition of the coupling of the third electrode, which may be employed in a thousand and one applications.

At a demonstration the other day, everything claimed for the 3 E.V.C. was proved thoroughly. At the showrooms, situated about one mile from the London station, a four-valve set was in operation, working a large loud speaker at full power.

Cuts Out "Statics."

In the ordinary course of events, it would be impossible to tune out 2 L O and receive other stations, but with a variation of about five degrees on this wonderful instrument Birmingham came through clearly and without interference, and later a clear item from Cardiff. It has been tested with perfect results as near as ninety yards from 2 L O. Nearer than this, of course, results cannot be expected to be good, as the wave has not time to form properly, having to go a quarter of its own wave-length before being perfect.

As a static eliminator the instrument has been tested where conditions are reputed to be worst in this respect, namely in Africa, and found to give results hitherto unobtainable.

In the diagram a method is shown whereby the 3 E.V.C. is connected to an existing set for selectivity.

This arrangement, however, is only suitable in such cases where the desired station's wave-length is greater than the wave-lengths of the stations that are "jamming"; a different scheme being necessary in other cases. It is, however, quite possible to extend the usefulness of the three electrode valve to the latter.

A PORTABLE FOLDING TABLE.

THE illustrations show an ingenious new folding table that should be useful to wireless operators, both amateur and expert, as well as for a considerable variety of other purposes. It can be made in any size, but the standard size, when set up, measures 5 feet by 14 inches, and stands about 27 inches high. When folded the overall measurements are 30 inches by 14 inches by only 1½ inches, the legs folding inside and flush with the table top. Thus it occupies a minimum of space, and can be conveniently carried, for instance, beneath the cushions of a motor-car. From the closed position it can be opened and set up in two seconds, and folded again in four seconds. There are no nuts or screws to manipulate, and no loose parts to adjust.

For Many Purposes.

To prevent the two leaves of the table top from sagging where they are hinged at the centre, a light, triangular truss is provided, which automatically opens as the leaves are hinged apart, and automatically closes when they are brought together again. The weight is less than 14 pounds. The table should prove of great use for wireless sets—especially when used out-of-doors—as well as for picnics, in camp, for surveyors, and shooting parties. It can be employed as a bed table, spanning right across a double bed and resting on its legs on the floor. It can also be used in a motor-car by leaving the legs folded inside and spanning across in front of the back seats, the ends resting on the side doors of the car.



These photographs clearly show the three positions that should be taken when opening the portable folding table.

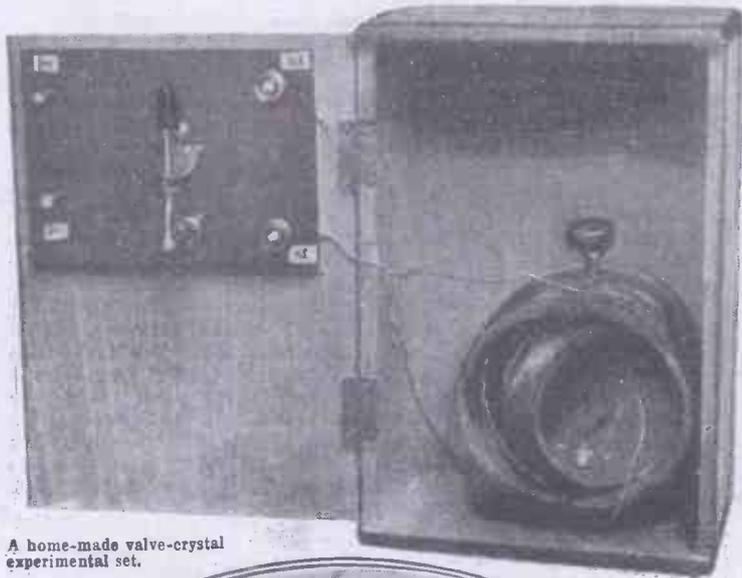
Note the simplicity of the operations involved indicating the rapidity with which they can be carried out.

Such a table should prove very useful for those wireless amateurs who take part in out-of-door demonstrations, its compactness and adaptability will be apparent from the accompanying photographs.

SOME INTERESTING AMATEUR PHOTOGRAPHS.

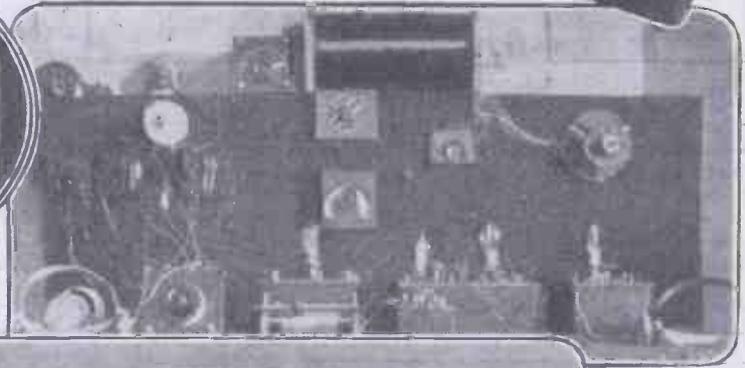
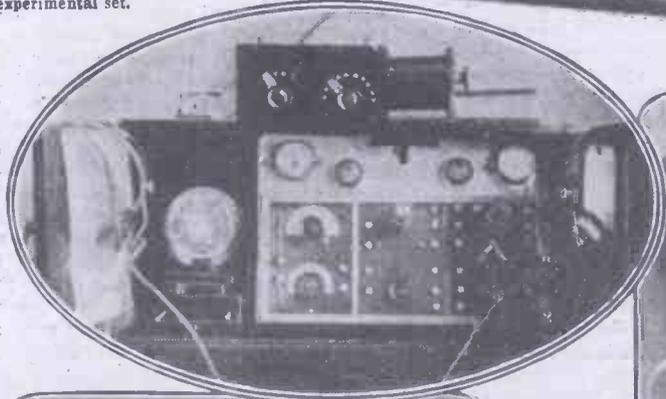
A neatly arranged transmitting and receiving station mounted on a desk.

A variometer crystal set built into a cigar-box measuring 7" x 4 1/2" x 3" by Mr. R. Beesley, of St. Bees School, Cumberland.

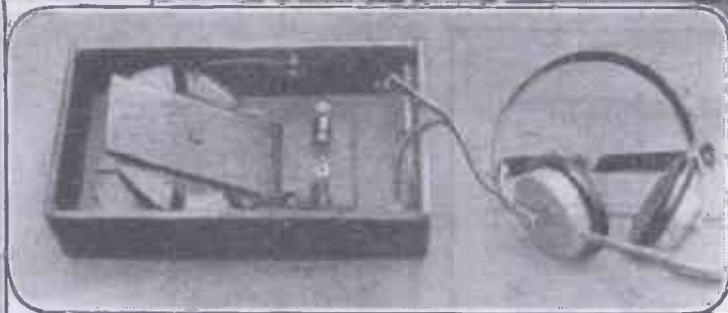


A home-made valve-crystal experimental set.

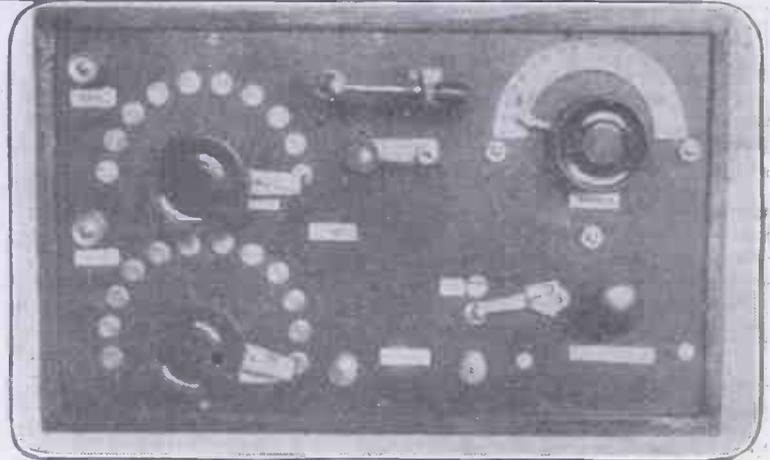
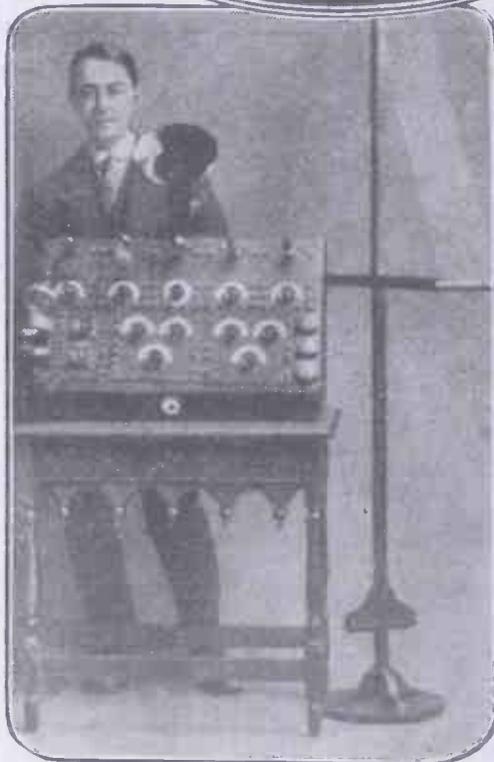
An experimental unit system receiver with easily accessible wiring. Assembled by Mr. G. Tombs, 78, Maldon Road, Brighton.



Another "cigar-box" receiver constructed, on lines suggested by a recent article in "P. W.," by Mr. F. H. H. Peate, of 90, Portelet Rd., Stoneycroft, Liverpool.



A crystal receiver with tapped coils employing alternative detectors. This neat-looking set was made by Mr. M. Hirst, of 283, Rimrose Road, Bootle, Liverpool.



This highly efficient receiver brings in most of the B.B.C. stations on a frame aerial.

WIRELESS WORRIES.

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

This is the first of a short series of articles written specially for "POPULAR WIRELESS" by Mr. McMichael, dealing with the problems that beset the new recruits to the ever-increasing ranks of listeners-in.

1. CHOOSING AND PURCHASING A SET.

ALTHOUGH wireless in this country is becoming increasingly popular every day, there are still thousands of people who have yet to hear a wireless concert, especially in the smaller towns and in the country districts.

At the advent of something new and wonderful, the public, as typified by "the man in the street," is strangely reserved in its immediate adoption, whether it be something merely useful or whether it be something which will give him pleasure and amusement at leisure, in the comfort of his own home.

Discussing Various Sets.

Such has been the case at the coming of wireless. The whole country was taken by storm. People who had dabbled in wireless before went wireless mad; their enthusiasm was infectious, and spread to others, so that at the present time there are thousands of people who hold licences to receive the regular broadcasting entertainments, transmitted through the British Isles and the Continent.

But "the man in the street"—he still holds back. He is almost afraid of that wizard wireless, and is still waiting for his neighbour to stretch a wire over his roof in proof that there is a "wireless" in situ, before he decides to follow suit and add to his own enjoyment by installing a wireless set. Then his difficulties commence. He has never heard a wireless concert; he does not know what type of set he requires. He has heard his friends talk about licences, and it frightens him. How does he get a licence, and what kind does he want? He begins to think that wireless is absolutely beyond him. Why? Because he has not been educated to know the proper procedure to follow in order to give himself quiet and well varied wireless enjoyment.

As far as "the man in the street" is concerned, wireless did not come gradually. It was thrust upon him well advanced, with the inevitable result that he was absolutely bewildered.

Therefore, in order to guide him so that he may enjoy the pleasures of listening-in, a few remarks on the choice of a set, erection of aerial, etc., will probably be helpful. Firstly, however, it will be advisable to explain

briefly the difference between crystal sets and valve sets of different sizes.

When voice energy is sent into the transmitting aerial of a broadcasting station, it is transformed, simply speaking, into wireless waves. In order to hear this voice, it is necessary to re-transform these waves into speech, such as is heard in the headphones. That part of a wireless set which effects this transformation is called the "detector," because it "detects" the waves and changes them back into audible and intelligible sound. Therefore, every set must have a detector, one detector only being necessary. The detector takes the form of a crystal or a valve, and sets using a crystal or one valve as detector are called crystal sets and one-valve sets respectively.

Now, in order to magnify the sound which the detector passes through, valves can be used as low-frequency amplifiers. These

frequency amplifiers, detector, and low-frequency amplifiers. An excellent combination of the functions of these valves is a four-valve set, where, as a rule, there is one high-frequency valve which magnifies the incoming signals, a detector, and two low-frequency valves, which amplify the energy passing from the detector.

Points to Consider.

When about to purchase a set the man in the street must satisfy himself as to exactly what type of set he requires by answering the following questions:

(a) Which stations do I want to receive? That is, is it the local broadcasting station only which will satisfy him, or does he want to receive farther afield?

(b) How far do I want to receive? That is, is he content with B.B.C. concerts or does he want to receive Paris and The Hague as well?

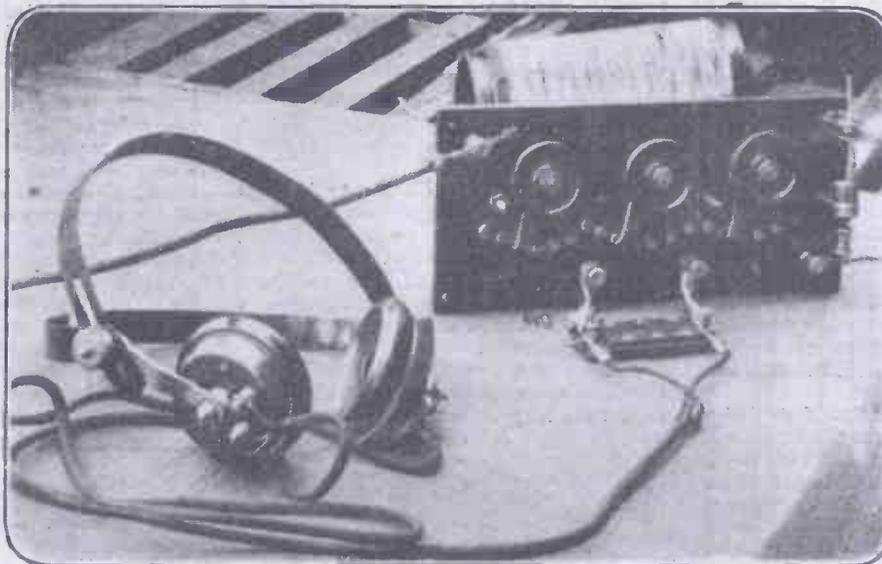
(c) How far am I from the nearest broadcasting station and, lastly, how much can I afford to spend?

Having satisfied himself on these points, the prospective buyer should go to a good firm and explain to the salesman exactly what he wants to receive, what volume is required, and a brief description of the conditions of the locality where the set is to be used. These facts help the salesman enormously to satisfy him in every way with an instrument which will answer every requirement. When this set has been found a demonstration should be asked for, and this should

enable the buyer to choose the instrument which, from his own idea of finish, operation, and results, will best serve his purpose.

Prospective buyers should clearly understand that "wave-length" has no connection with distance in miles from a broadcasting station, and has no connection with the volume of sound obtainable from any receiver. Distance from a broadcasting station, however, has a great deal of effect on the volume of sound to be obtained. Therefore, if the proposed locality of the receiver is, roughly speaking, more than thirty miles from the nearest broadcasting station, it is always advisable to have at least one high-frequency valve in the receiver, for this will strengthen the incoming waves.

(The next article will deal with the erection of the aerial.)



This photograph, taken by Mr. G. W. Nicholls, of 331, Cavendish Road, Balham, S.W.12, shows the layout of a tapped coil crystal set.

valves merely magnify or make loud signals which have already been detected by the detector valve or crystal.

The Use of Valves.

When signals are transmitted from a station the waves become weaker and weaker as they travel farther and farther away, or, as the radio engineer terms it, they become attenuated. In order to magnify or strengthen these weak waves so that the station appears to be near, valves can be used as what is known as high-frequency amplifiers. Used in this manner, the valve magnifies the incoming waves, before they reach the detector so as to make them easier to detect by the detector valve.

Thus we see that we can easily have a set with combinations of valves acting as high-

MAKING WIRELESS POPULAR.

By Sir J. KENNETH MACKENZIE, Bart.

Once the delights of broadcasting are extended to secluded "out-of-the-way" villages, wireless will gain a permanent position in the country as a "monotony breaker." This article discusses the possibilities of such an extension.

WIRELESS, or indeed even ordinary telegraphic and telephonic communication with the outer world does not seem to appeal to everybody. There are folk who, happy in their own immediate surroundings, shrink from being brought into closer touch with strangers, and have no desire for their isolation to be disturbed or broken into unless and until their personal necessities overcome this repugnance; or the desire for exclusiveness brought about by their location has been gradually removed by causes over which they have no control.

Completely Isolated.

Such appears to be the case at present with the 75 inhabitants of the lonely little island of St. Kilda, who refused to take advantage of the telegraph station built there during the war by the Admiralty, and even now have declined with thanks a wireless one which has been offered them. One would have thought that people so completely cut off as they are from the rest of the world would have been glad to get into touch with their fellow-creatures; but such is evidently not the case, although they have no other means of doing so effectively. For the past nine months they have been completely isolated, no communication with the mainland having been possible because of weather conditions. This I can well understand, remembering how, in the summer of 1884, when cruising off the west coast of Scotland in a friend's yacht, we thought we would go to St. Kilda to see the island and its inhabitants. Its inhospitable, rocky coast-line looked drear enough as we approached, but the seas then running made all attempts at landing impossible, and we had to return with our curiosity unsatisfied.

It is probable, however, that their desire for seclusion from the rest of the world will have to give way to the necessities of others. For, owing to its situation, St. Kilda forms a most useful point from which weather reports can be received and notice given of depressions approaching from the Atlantic.

Scope for Publicity.

Whether due to innate "conservatism" and dislike of "new-fangled" inventions, or to simple apathy, it is hard to say, but I have found in some parts of the country that the idea of wireless broadcasting does not appeal to some people, and more specially to the women folk, who, one would have thought, would have been the first to welcome such an opportunity for breaking the dullness and monotony of their lives. To most of the "out-of-the-way" villages of the United Kingdom the telephone has now found its way, and facilities for communicating with neighbouring towns exist; but they are chiefly used by visitors, and rarely by the natives, and then only in cases of sudden emergency.

The fact seems to be that they do not understand what "broadcasting" means; they have no idea of how simple it is to

obtain the enjoyment of something they have only probably heard of in the way of concerts, vocal and instrumental, to say nothing of recitations or Grand Opera. One may try to explain to them what it is, but only by actual experience gained through hearing a good receiving set at work are they likely to become eager to avail themselves of the opportunities now offered. To effect this will require a more active propaganda on the part of makers of radio receiving sets, who now mainly rely on advertisements in the technical Press.

To get such customers, travellers should be employed who would tour, preferably by car, through outlying districts of the country, and give evening exhibitions with a portable set in each village visited, either in the village school, or out of doors in the summer-time. They would explain how simple a matter it is to erect and work a suitable set, how inexpensive such a thing is compared with the pleasure to be obtained from it, and generally "spread the gospel" of wireless to the advantage of all concerned. Nor need such a method of radio propaganda prove costly, as a small charge or collection could be made at each such village demonstration, and there is no doubt that good audiences would be got wherever it were held.

Joint Ownership.

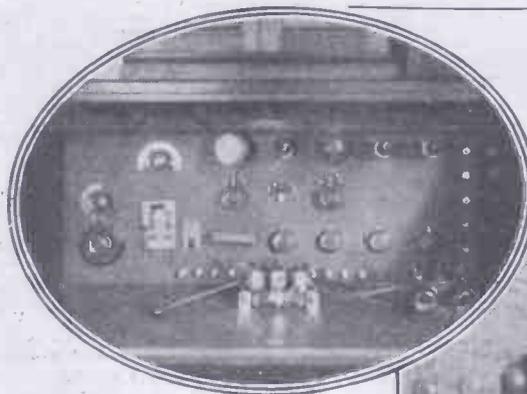
But there is one difficulty to be considered which may suggest itself, though, without doubt, it will not be long before it is overcome if it really exists. That is the question whether crystal sets could be employed for such purposes, and the use of valves not rendered obligatory, as may be the case at present.

Not many villagers could afford valve sets, nor be capable of using them efficiently even were they able to buy them. Some

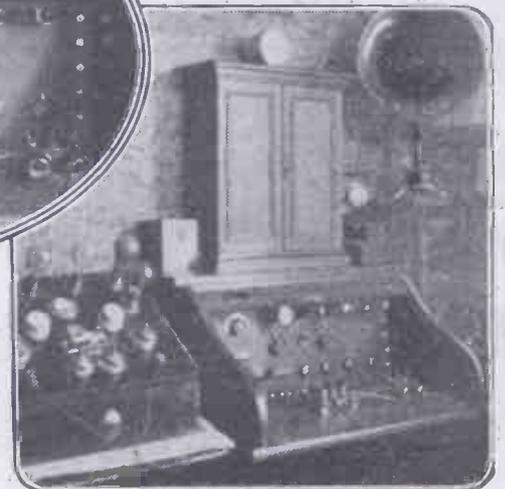
sets being used. So the question of making reliable crystal sets capable of receiving over a radius of a hundred miles or so must be solved before such places as these can be supplied with what would be most suitable. There is no doubt this difficulty will be overcome quickly if the progress made during the past twelve months in wireless is maintained, and new and extensive markets will then be open to those who can supply them. I have in mind many villages in Devon and Cornwall where such a method of propaganda would yield much financial profit to those who undertook it systematically, as well as intellectual benefit to those who would avail themselves of what was offered them.

Opening for Young Men.

Nor need this be confined to villages only, for, apart from the smaller towns, there are many country houses widely separated from each other, to whose occupants should be brought the knowledge of what pleasure and enjoyment they would derive from the possession of a wireless receiving set. If this were done by the right kind of agent, one who was able to get into touch with such people privately, and who knew his work properly, it is certain much good business now lying begging would result. Here is an opening for many young men at present unemployed who socially and technically should be capable of handling it properly. In the early days of electric lighting much profitable work was done on these lines with regard to country houses, whose owners had practically to be taught what it meant, and convinced of the advantages of that method of illumination before they would place an order for an installation. The same thing applies to wireless now, though, of course, a practical demonstration is ever so much more easy and simple.



The efficient receiving station assembled by Mr. F. Worrall, of 51, Hilden Street, Bolton. (Left) A closer view of the tuning panel.



kind of joint ownership might be arranged, of course, and an efficient agent might be able to do this on the spot with knowledge of the local conditions. The mere fact of such villages being in out-of-the-way districts presupposes the remoteness of any broadcasting station, and consequently the necessity of sufficiently sensitive receiving

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THE "FOREST" PORTABLE CRYSTAL RECEIVER has a guaranteed range of 30 miles from any Broadcasting Station, is highly efficient and can be carried with perfect ease in its neat and handsome case. Ready for use any time, anywhere, being only a matter of seconds to fix the aerial to the nearest edge, bush or tree.

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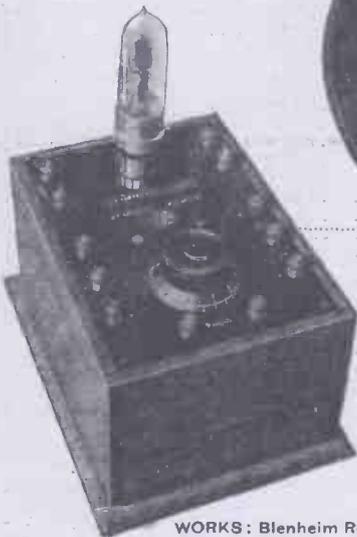
Accumulators, H.T. Batteries, Headphones, Valves, Ebonite, Brass Parts, etc., in stock for immediate delivery.



THE "FOREST" VARIOMETER.

Stoutly made, constructed of fibre tubing, this Variometer is the most practical one for making your own Receiver. Suitable for Crystal or Valve Receivers, having a wave-length range of 300 to 900 metres.

Complete with engraved dial and knob, ready for use . . . Price **8/6**
With knob only **6/6**
Postage 6d. extra.



THE "FOREST" L.F. AMPLIFIER.

(Passed by G.P.O. No. 3359.)

In handsome polished mahogany case, with engraved ebonite panel. Guaranteed efficient. Added to your Crystal or Valve Receiver, greatly increases the volume of sound. Extra units may be added at will. Maximum range and perfect reproduction guaranteed.

PRICE . . . **£2-5-0**
Stamped B.B.C. 10/- extra. Valve 15/- extra.

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ROTARY SERIES, PARALLEL, SWITCHES for Panel mtg. **2/6** each
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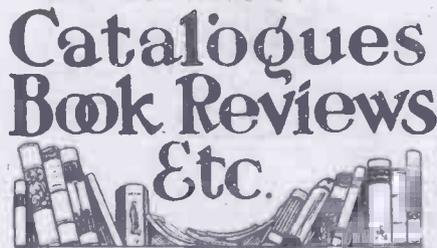
In the following programmes full details of the Continental transmissions are included so that possessors of suitable receiving sets can take advantage of the many interesting items that these stations broadcast. From an educational point of view such material is invaluable, more especially for such amateurs that may be studying one or other of the Continental languages.

			GREAT BRITAIN.			
Station.	Call Sign.	Hours of Transmission.	Items Transmitted.	Wave-length in Metres.	Remarks.	
London	2 LO	Usually—5.30-11 p.m.	Musical Items, News, etc.	369	Every Weekday.	
Newcastle	5 NO	5.30-11 p.m.	" " " "	400	" "	
Manchester	2 ZY	5.30-11 p.m.	" " " "	385	" "	
Birmingham	5 IT	5.30-11 p.m.	" " " "	425	" "	
Glasgow	5 SC	5.30-11 p.m.	" " " "	415	" "	
Cardiff	5 WA	5.30-11 p.m.	" " " "	353	" "	
BELGIUM						
Brussels (1)	B A V	11 a.m. (G.M.T.)	Weather report	1100	Working days.	
		3.50 p.m.	Aeroplane traffic	1100	Every day	
		8 p.m.	Concert	1100	Tuesday & Thursday	
		6 p.m.	Concert	1100	Sunday	
HOLLAND						
The Hague	P C G G	3-5 p.m. (G.M.T.)	Concert	1050	Sunday.	
		8.40-9.40 p.m.	Concert	1050	Monday & Thursday	
The Hague	P C U U	7.45-10 p.m.	Concert	1050	Tuesday.	
(Laboratorium Heussen)		9.40-10.40 a.m.	" " " "	1050	Sunday.	
The Hague (Velthuyzen) ..	P C K K	8.40-11.40 p.m.	Various	1050	Friday.	
Ymuiden (Middelraad) ..	P C M M	8.40-11.40 p.m.	Concert	1050	Saturday.	
Amsterdam	P A 5	8.10-11.10 p.m.	Concert and News	1050	Wednesday.	
FRANCE						
Lavallois-Perret (Radiola)	S F R	2-3 p.m. (F.S.T.)	Music	1780	Sunday.	
		12.45-1.45 p.m.	News and Concert	1780	Every day.	
		5.5 p.m.	Stock Exchange News	1780	" "	
		5.15-6.15 p.m.	Instrumental music	1780	" "	
		8.45 p.m.	General News	1780	" "	
		9.30-10.30 p.m.	Vocal and instrumental concert	1780	" "	
Paris (2) (Eiffel Tower) ..	F L	6.40 a.m.	Weather Forecast	2600	" "	
		11.15 a.m.	Weather Forecast	2600	" "	
		3.30 p.m.	Stock Exchange News	2600	" "	
		6.20 p.m.	Weather Forecast, Concert	2600	" "	
		10.10 p.m.	Weather Forecast	2600	" "	
Ecole Supérieure des P.T.T.		7.45-10 p.m.	Radio Concerts	450	Tuesday, Thursday.	
		2.30-7.30 p.m.	Radio Concerts	450	Saturday.	
Radio-Riviera (Nice)		11 a.m.	News, Concert	460	Every day.	
		5-6 p.m.	News, instrumental Concert	460	" "	
		9-10 p.m.	Latest News, Concert	460	" "	
Lyons (La Doua) Y N		10.45-11.45 a.m.	Concert	3200	Every day	
		3-3.35 p.m.	Financial News and Aviation Reports	3200	" "	
GERMANY, CZECHO-SLOVAKIA, AND SWITZERLAND						
Berlin	L P	7-8 a.m. (G.M.T.)	Financial News, etc.	2800	Every day.	
(Königswusterhausen)		11-12.30 a.m.	" " " "	2800	" "	
Eberswalde		4-5.30 p.m.	Financial News, etc.	2800	" "	
		6.30-7.30 p.m.	Concert	2950	Thursday.	
		4-7 p.m.	Lectures and Concert	2950	Sunday.	
Prague	P R G	7-11 a.m. and 3 p.m.	Weather News, General News..	1800	" "	
		9 a.m.-2 p.m. & 9 p.m.	Concert	4500	" "	
Geneva	H B 1	5-6 p.m.	Concert	1200	" "	
Lausanne	H B 2	5-6 p.m.	Concert	—	Every day.	

The British Broadcasting Stations transmit on Sundays between 8.30 and 10.30 p.m., and at varying times during weekday mornings and afternoons. The programmes appearing in the daily Press should be consulted for full details.

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

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



MANY causes of failure have been traced to faulty connections so Fluxite, Ltd., have placed on the market a very handy little soldering set, entirely complete in-itself, which should find its way to every wireless den. This set is very reasonably priced, and by the use of this solder, a home-made set has a much greater chance of functioning first time than if wires are loosely connected.

There is a distinct advantage in the H.T. battery with replaceable units over the ordinary type, and all amateurs should make a point of seeing J. F. Smith's new leaflet describing the "Sure-a-Lite Everlasting" batteries.

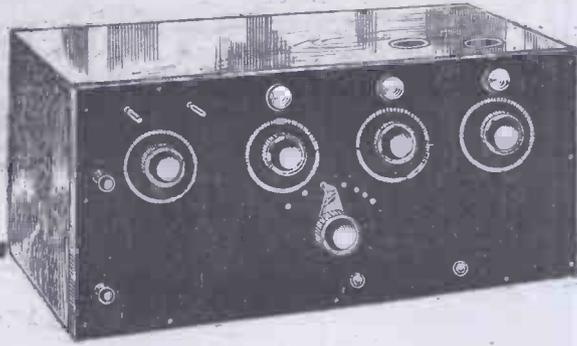
Another unit H.T. battery lately placed on the market is the "Seddon." With the ordinary type of H.T. if one section goes dead the whole battery is practically useless, so it will not be long before this type of battery is universally used.

We have received from G.W.I., Ltd., two interesting leaflets. The first deals with the repair of wireless valves and ordinary electric light lamps, and the second with an efficient little rectifier, and a very excellent transformer, by means of which all accumulators can be charged at home.

An interesting catalogue of complete sets and high-class accessories has been distributed to some 4,500 clients by L. McMichael, Ltd. They have also published a leaflet descriptive of the new "Eiffel Tower" Wireless Masts.

The Electrical Depot, Ltd., have placed on the market a very neat little battery charging panel, the "Cressall." By means of this instrument accumulators can be easily charged at home off the D.C. Mains.

Ashdown, Ltd., have forwarded us an interesting brochure descriptive of their B.B.C. valve sets. These instruments, while giving maximum results, are perfect in workmanship and detail. The catalogue ends up with a list of broadcasting stations and a complete list of the Morse alphabet, figures, and punctuation.



The Best Finish for Radio Cabinets

With Johnson's Wood Dye you can finish the cabinet of your Radio Outfit as well as an expert cabinet maker, and in any colour you wish, to harmonise with your other furniture. It comes in fifteen different beautiful shades, all of which can be lightened or darkened—full directions on every label. Johnson's Wood Dye is easy to apply. It penetrates deeply and brings out the beauty of the grain without raising it—it dries in four hours.

JOHNSON'S WOOD DYE

is used and recommended by most cabinet makers. They know that there is nothing that can equal it for a rich, everlasting finish.

JOHNSON'S POLISHING WAX

An occasional application of Johnson's Polishing Wax over the finish of Radio Cabinets, whether bought sets or home-made, will always keep them looking new, and gives a beautiful polish that will not collect dust or show finger prints. It will improve greatly the appearance of all cabinets.

Renovates Ebonite

Johnson's Prepared Wax is an ideal preparation for restoring ebonite panels and other instrument boards as used on wireless receiving sets. Furthermore, panels treated with Johnson's Prepared Wax resist acid fumes given off from the low-tension battery, and prevents that thick film of acid which you have no doubt noticed covering the whole of the ebonite panel, and causes a terrific leakage and bad results.

Give Johnson's Prepared Wax a trial. You will be surprised at the wonderful clean appearance it gives, and the better results you will get.

S. C. JOHNSON & SON, LTD.,
"The Wood Finishing Authorities,"
WEST DRAYTON, MIDDLESEX.

FREE BOOK ON WOODFINISHING

To all who write for it, we will gladly send our illustrated book on the Proper Treatment of Woods. It explains how to obtain the best possible finish on all kinds of wood, and it will be a great help to all those who are making their own outfits.



S. C. JOHNSON & SONS, LTD.
"The Wood Finishing Authorities."
(Dept. P.W. 6), West Drayton, Middlesex.

Dear Sirs, Will you please send me your illustrated book, which explains the best way for finishing Radio Cabinets.

My Name
My Address.....

“ WIRELESS REVIEW AND SCIENCE WEEKLY ”

No. 5 of our great companion journal is now on sale, price 3d. In it will be found an important announcement concerning Professor Albert Einstein, the famous originator of the theory of Relativity, and one of the world's greatest physicists. Professor Einstein has accepted the post of Chief Physics Consultant to “Wireless Review and Science Weekly”—a sure sign of the esteem in which the journal is held by scientists.

No. 5 also contains articles by Professor A. O. Rankine, D.Sc., Dr. N. W. McLachlan, M.I.E.E., and Mr. P. J. Risdon, F.R.S.A. A splendid long illustrated article on the Helicopter forms another attractive feature.

No. 6 of “Wireless Review and Science Weekly” will be on sale on Tuesday, and will contain a very important interview with Sir J. J. Thomson, O.M., F.R.S., the Master of Trinity, Cambridge, and discoverer of the Electron.

Sir Joseph tells the fascinating story of this discovery in language everyone can understand and appreciate.

Future attractions will include articles by Sir Ronald Ross, K.C.M.G., F.R.S., the world famous medico-scientist, whose researches into the cause and cure of malaria have earned him the gratitude of the world. Other articles by Sir Oliver Lodge, Professor J. Arthur Thomson, Captain Round, Sir Frank Dyson, and Professor Einstein will appear in future issues.

ORDER YOUR COPY NOW and become a regular subscriber to the most authoritative and most popular Wireless and Science Magazine in the world. “Wireless Review and Science Weekly” has taken premier place and stands alone, unique and unchallenged.

Remember:
EVERY TUESDAY. PRICE 3d.

PRACTICAL IDEAS FOR THE AMATEUR.

CALCULATING THE HEIGHT OF AN AERIAL.

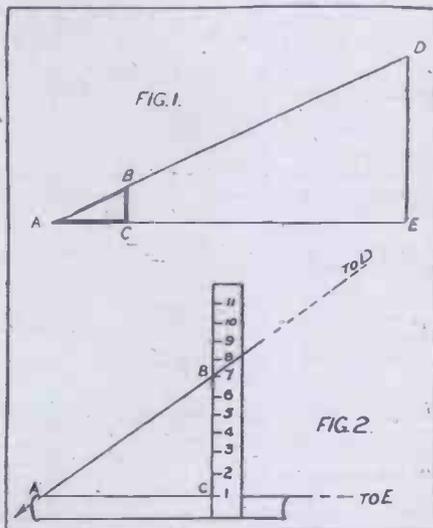
"IF the angles in one triangle are equal to the angles of another triangle, then the triangles are similar and their corresponding sides are proportional."

This geometrical proposition enables you to calculate the height of your aerial quite easily.

In Fig. 1 the small triangle A, B, C, is similar to the large triangle, A, D, E; consequently, if D represents, say, the chimney to which you wish to attach your aerial you can form the triangle A, B, C, and calculate the length of the line D, E, representing the height of your aerial.

Obtaining Measurements.

There are many simple ways of forming the small triangle. Two rulers or sticks



held on a table will serve for the lines A, B and B, C, the table top forming the line A, C; but perhaps the simplest method is as follows:

Place a large, stiff covered book on a table and hold a ruler upright by its side. Raise the cover of the book until, when looking along it from the back, it is in line with the point D (your chimney, for instance). Observe the distance between the fly-leaf of the book and the point where the cover intersects the ruler—this is the line B, C. Measure from the back of the book to the edge of the ruler, which will give you the line A, C.

All you have to do now is to measure the distance from the back of the book to the base of the chimney, and you have the line A, E, and all the figures necessary for your calculations.

The formula is: $AC : AE :: BC : DE$.

Supposing BC was 6 in. ($\frac{1}{2}$ a foot), AC 8 in. ($\frac{2}{3}$ of a foot), and AE 40 feet, then:

$$\frac{2}{3} : 40 :: \frac{1}{2} : DE,$$

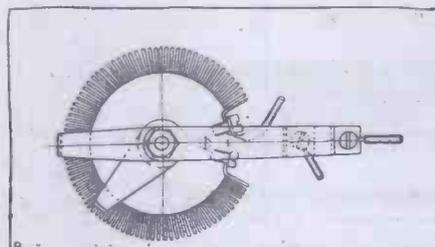
So that $DE = 40 \times \frac{1}{2} \times \frac{3}{2}$, or 30 feet.

This is the height of D above the surface at which the measurements were taken, so you must add the height of the table and the thickness of the book. Supposing they were 2 ft. 6 in. and 1 in. respectively, then the total height above ground level of your aerial would be 32 ft. 7 in.

FILAMENT RESISTANCE FOR CONTROLLING TWO VALVES.

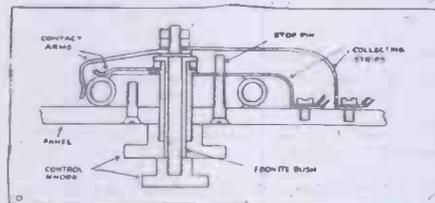
THE sketch explains the idea without an elaborate description. The principle points in its favour being:

1. The saving of space on one's valve panel.



2. Costs less to manufacture one resistance of this type than two single valve resistances.

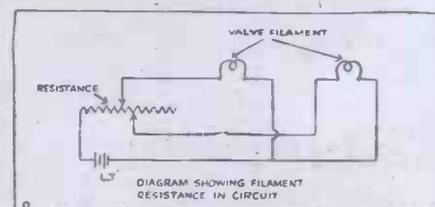
Each contact arm is controlled by a separate ebonite knob, and the contact arms



are insulated from each other by an ebonite bush.

Neater Connections.

One of the screws securing the resistance unit to the panel is extended and acts as a stop for both contact arms in the off position.

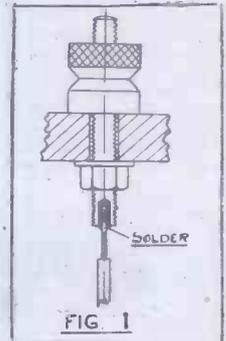


Brass strips are used to collect the current from the contact arms, thus avoiding any trailing wires.

TERMINAL CONNECTIONS.

WHEN wiring up a set the problem of soldering connections to terminals is often one that gives a great deal of trouble, and there is usually some refractory point at which the solder refuses to take. Again, when connections are made by giving the wire a turn round the shank of the terminal and securing with a lock-nut, as shown in Fig. 2, the application of heat due to soldering usually has a slackening effect, and one is faced with the difficulty of being unable to tighten up satisfactorily.

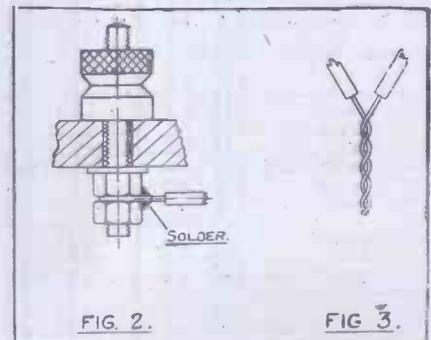
The writer offers the following method, which was found to give greater ease and certainty, as well as making a much neater and workmanlike job, together with another advantage mentioned later.



Drill a small hole about $\frac{3}{16}$ in. in dia., or larger if necessary to suit the wire in use, about $\frac{1}{2}$ in. deep, as shown in Fig. 1. Next bare and clean the wire, applying a little

Two-Way Connections.

Drill a small hole about $\frac{3}{16}$ in. in dia., or larger if necessary to suit the wire in use, about $\frac{1}{2}$ in. deep, as shown in Fig. 1. Next bare and clean the wire, applying a little



flux in the shape of powdered resin or Fluxite. After heating the soldering-iron and loading with solder, rub the wire through the solder and an efficient tinning will result.

Add flux to the hole in terminal and apply the iron; with very little trouble the hole will fill with solder, and while in a molten state insert wire and hold in place until set.

It will be seen from Fig. 1, which shows the finished article, that any slackening of the terminal can be adjusted without disturbing the connection.

A two-way connection is simply made by twisting the two wires together, as shown in Fig. 3, and proceeding as before.



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.

Tottenham Wireless Society.

The meeting of the above society, held on Wednesday, June 13th, was devoted to the demonstration of members' instruments.

A number of sets were displayed and tested, ranging from a one to a five-valve R.I. set, including the society set.

Interesting results were obtained from a Flewelling circuit and from an interference eliminator.

Arrangements are being made to set aside one meeting per month for further displays.

Those interested in wireless will be assured of a hearty welcome at any of the society's

a welcome to new members, briefly outlined the object of the society, and pointed out that through amateur efforts many important discoveries in the field of wireless telegraphy may happen.

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

Leyton Radio Association*

At the fifteenth meeting of this association an instructive discourse on Cabinet Construction by the treasurer, followed by the demonstration of Mr. A. T. Billingsley's 3-valve unit set, entertained the members.



Interior of wireless controlled model boat. Towards the bow can be seen the coherer and relay; in the centre the selector, accumulator, rudder controls, switches, etc.

meetings, there still being plenty of room for new members.

Hon. sec., Mr. S. J. Glyde, 137, Winchelsea Road, Bruce Grove, Tottenham, N. 17.

Streatham Radio Society*

On June 13th the chairman, Mr. H. Bevan Swift, A.M.I.E.E., gave a most interesting lecture on "The Romance of Radio." Dealing with the history of transmission and reception in its early days, the lecturer described the various kinds of detectors and transmitters used and demonstrated on the blackboard the circuits then in vogue. After describing the Poulsen arc method, electrolytic, chemical, and crystal detectors, he mentioned the first reception of music, by means of radio, in his experience. This was the melody, "I dreamt I dwelt in marble halls," sent by means of a tuned buzzer to each note. Shortly afterwards, the music from a gramophone record was transmitted through the medium of the singing arc lamp. Dwelling on the possibilities of radio, the chairman considered that the transmission of vision and power would soon be accomplished on the large scale.

Hon. sec., S. C. Newton, A.M.I.E.E., 5, Pendennis Road, Streatham, S.W. 16.

North London Wireless Association *

The evening of the 132nd meeting was set aside for general discussion among members.

Many interesting questions were asked and answered.

The experiment proved so successful that it is intended to keep regular evenings for exchange of views and solving the many problems encountered by amateurs.

Hon. sec., Mr. J. C. Lane, Physics Theatre, Northern Polytechnic Institute, Holloway Road, N.

Honor Oak Park Radio Society.

The society held its second meeting on June 13th, at St. Augustine's Hall, Honor Oak Park. The chairman (Mr. W. J. Pollard), in giving

receive broadcasting from America, lectured on "The Reception of American Broadcasting." Sec., Mr. C. H. P. Nutter, F.R.A. (5 D B), Radio Corner, 243a, Selhurst Road, Norwood Junction, S.E. 25.

The Beckenham and District Radio Society.

A very successful meeting of the above society was held at Manor House, the new headquarters, on Thursday, May 31st, at 8.15 p.m. The new set under construction was brought along, so that members might help, and also note progress made.

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

High Wycombe and District Radio Society.*

The first summer meeting of the society was held at Polmark, Napihill, the station of a member (Mr. E. H. Milner), and proved an unqualified success.

2 OD (Mr. E. J. Simmonds, Gerrards Cross) kindly provided a transmission, and the scientific department of the Royal Grammar School, under Mr. J. Hurn, demonstrated transmission and reception on the O.T.C. Mark III. Trend set.

Hon. sec., A. C. Yates, 30, High Street, High Wycombe.

The Thornton Heath Radio Society.

A very successful preliminary meeting was held on Tuesday evening, June 5th, for the purpose of forming a radio society in this district.

Officers were elected, a committee appointed, and preliminary arrangements made.

Meetings will be held fortnightly and membership is extended to all ladies and gentlemen interested. Communications should be addressed to the Hon. sec., R. S. Keeler, 72, Bensham Manor Road, Thornton Heath.

The Leeds and District Amateur Wireless Society.

An instructional meeting was held on May 25th, Mr. T. Brown Thomson lecturing upon "The Electron Theory."

The thirty-sixth general meeting was held on June 1st, Mr. A. F. Carter, A.M.I.E.E. presiding. During the course of society business, the hon. sec. announced that application had been made for transmitting and receiving licences, and that apparatus would very shortly be placed at the disposal of the members. Mr. S. Kniveton, F.R.Met.Soc., then delivered a very instructive paper entitled "Wireless and Weather Forecasting."

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

The Sydenham and Forest Hill Radio Society.

An interesting lecture was given on May 4th before the above society by S. C. Tucker, Esq. (vice-president of the society), starting with an ordinary crystal set, and using a galvanometer in place of the headphones to show how it was possible to get the most sensitive spot on the crystal before fitting headphones.

May 28th, 1923. A lecture was given on Elementary Electricity by W. V. Pegden, Esq. (chairman).

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



Mr. R. Fuller, of 2, Leinster Square, Rathmines, Dublin, carrying out manoeuvres with his wireless controlled model electric launch.

*Where Performance
Equals Ambition*



To produce a loud speaker which is worthy of the artistes who nightly broadcast has been our ambition. A loud speaker which reproduces the fulness of the violin, the delicacy of the flute, the blare of the trombone and the characteristic quality of the voice, that has been our ambition and that is the guaranteed performance of

TMC

Loud-Speakers

Obtain one from your usual stores, electrician or wireless dealer, and judge for yourself. We are confident your verdict will be



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"True Music"
PRICE £6 10s.

and now let us have Quality

THIS insistent demand comes from thousands of experimenters who now, after the first few months' experience of inferior "parts," are realising that they must have *dependable, guaranteed* Components ... goods with a name behind them.

It is this demand for *Quality* that is causing the greatly increased popularity of Woodhall-Wireless Components in all parts of the country ... They are goods designed, manufactured, and guaranteed by a Firm who embody *precision, efficiency, and value*, in each of their products.

WOODHALL Guaranteed Variable Condensers



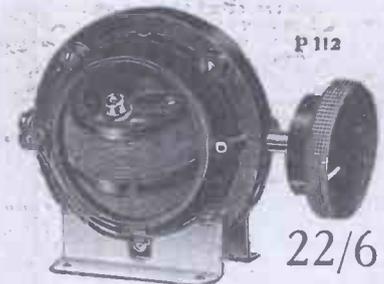
Assembled complete as shown, with aluminium end-plates and ebonite bushes, for panel mounting. Adjustable bearing, accurate and spacing; aluminium 22 gauge vanes; attached to panel by drilling *one hole only*.

P 114	5 plates	...	5/6
P 115	9	...	6/-
P 116	15	...	6/6
P 117	25	...	8/-
P 118	31	...	8/6
P 119	43	...	10/6
P 120	57	...	12/-

Knob and Dial 1/0 extra.

WOODHALL Guaranteed Moulded Variometers

Extremely close coupling (approx. 1-16th between windings). Internal winding firmly fixed by special process. Eliminates dead-end effect and capacity losses. W.L. with 100 ft. aerial, 250/750 metres. For A.T.I. as supplied, or can be used with small basket-coil in series for anode tuning inductance. With massive ebonite knob and terminals, as shown. Brackets moveable for panel or table mounting.



P 112

22/6

P 121



WOODHALL Guaranteed Paxolin Variometers

Constructed of Paxolin tubing (not cardboard); equal to ebonite in insulation, and more rigid. The $\frac{1}{8}$ walls allow close coupling, and the bearings are accurate and robust. Wound with S.C. wire; attached to panel by drilling *one hole only*; complete with terminals, and fitted with knob and dial.

10/9

Trade enquiries invited.

The WOODHALL Filament Rheostat

A more efficient rheostat at little more than the price of the old style. Spring plunger contact; smooth and constant. 7 ohms resistance; winding mounted on core; "off" position; two terminals; engraved dial and knob. Attached to panel by drilling *one hole only*.

P 122

5/6

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Ask your Dealer for Woodhall-Wireless Components. If he does not stock, order direct by post from us, and if you give your Dealer's name and address we supply goods post free. Money back in 7 days if dissatisfied.

The Woodhall-Wireless Manfg. Co.,
15, FURNIVAL STREET, LONDON, E.C.4.
Telephone: Holborn 5919. Radio Call Letters 2 H P.

RADIOTORIAL.

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

At the moment of writing no details are to hand in respect of the activities of the committee of learned gentlemen who are presumed to be investigating the position of broadcasting, more particularly in respect of licences. The decisions arrived at by this committee may be momentous, startling facts may be brought to light, beneath its seeming tranquillity. Revolutionary fire may be seething, but in the interim wireless "pirates" are increasing in numbers, amateurs are throwing all prospective ideas of "constructor's" licences to the board and openly and defiantly hoisting the radio "skull and crossbones." These officially appointed committees do not seem to hurry themselves—possibly they adopt the relativists' view of time and regard just a few weeks, a few months, or a few years, as but a few moments relatively to the significance of the results achieved.

One cannot criticise their actions because one knows nothing of what is proceeding behind the stout walls of official silence, but it is to be hoped that shortly the committee will issue forth from its dignified seclusion and lay before the P.M.G. decisions worthy of the time they are taking to prepare. Time is money to both the Post Office and the B.B.C., and both interests are losing heavily during this quiet, in my opinion, avoidable delay, in issuing a licence suitable for the man who desires to construct his own set.

THE EDITOR.

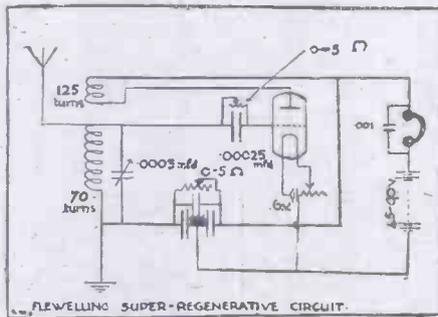
Owing to the enormous number of queries received daily from readers of POPULAR WIRELESS, I have temporarily decided to limit the number of questions sent in by one reader to three. Readers are asked to keep their questions as short and as concise as possible in order that the minimum of delay can be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

Readers are requested to send the necessary postage for reply.

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

QUESTIONS AND ANSWERS

A. P. (Rugby).—Can you give me details of the Flewelling Super Circuit?



The diagram shows the connections of this circuit and the condenser values. The aerial should be a small, straight wire of about 4 ft. in length. Do not use the ordinary outside aerial, as the set reacts very strongly and will cause interference over considerable distances.

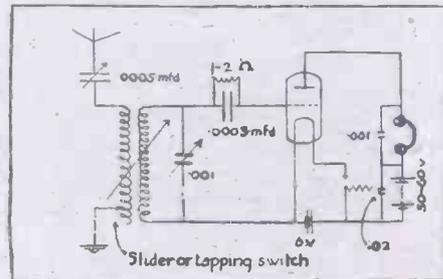
The bank of .006 mfd. condensers should receive attention, as these condensers should be fairly accurately made. Experiments should be carried out, using different capacities, however, for we have found that sometimes a larger condenser across the leak is desirable. The coils have 125 and 70 turns, as shown, the 70-turn coil being tapped at 20, 30, 40, 50, and 60 turns. A former of 3 in. diameter will be quite suitable and the coil should be wound with stout wire, say, 18 or 20 D.C.C., or enameled. The reaction coil can be of the spider variety, rotating inside or up against the other coil.

The circuit is by no means perfected as yet, and you will find the tuning very critical. The position of the reaction coil is also very critical, while the two variable leaks should be carefully adjusted for best results. Up to the present the shrill, high-pitched whistle has not been entirely eliminated, and so a certain amount of distortion of speed is bound to occur. For C.W. reception the circuit is very good, but altogether the set is well worth a little time and trouble, as it is a most interesting circuit. You may find that a variometer placed in series with the reaction coil will assist in tuning out the whistle, though it may cause a slight diminution of signal strength before you are able to cut out distortion. As regards valves, the ordinary R type will be quite suitable.

"HONEYCOMB" (Bexhill).—What size former, number of spokes, wire and turns, etc., shall I require for honeycomb coils for primary, secondary, anode, and reactance to tune to the broadcasting?

Wind the coils with 26 D.C.C. on formers 2 in. diameter, with 15 spokes each side and 1/4 in. in width. Primary, 50 turns; secondary, 75 turns; anode, 75-100 turns; reactance, 50 turns. Note that honeycomb coils are the subject of letters patent, and permission should be obtained from the patentees before constructing.

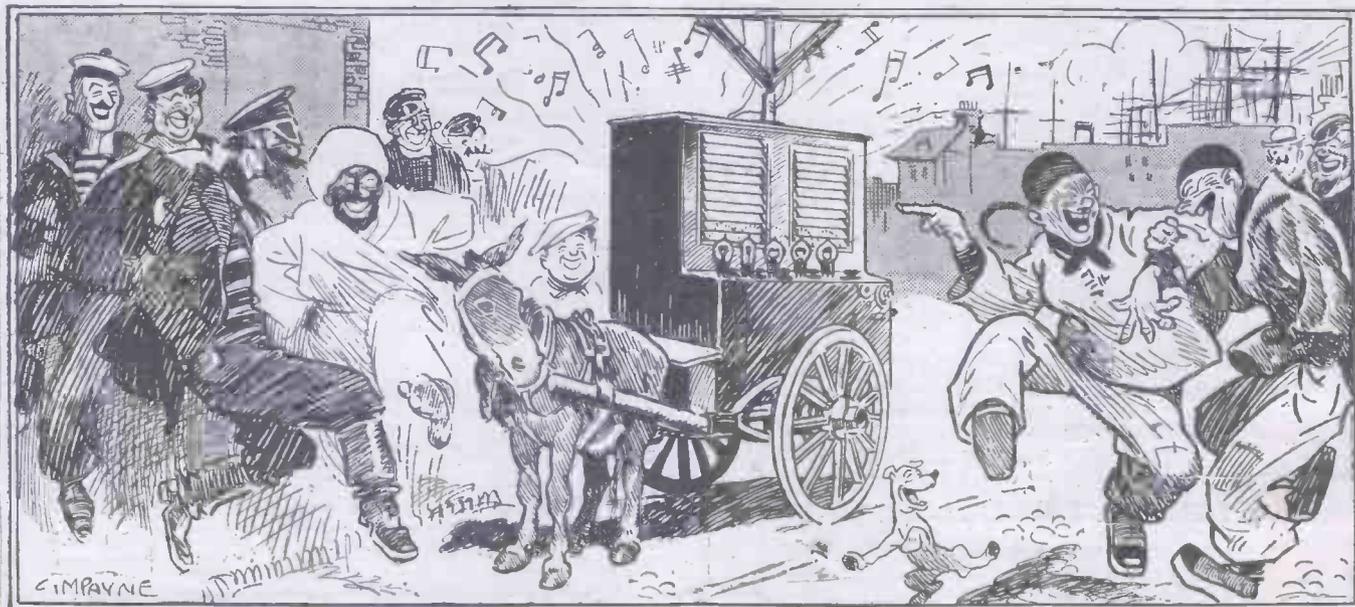
F. S. N. (Booker).—What do you consider the best single-valve circuit for use in conjunction with a loose coupler? Can I use a variable grid leak?



This circuit should give good results with the loose coupler. The .005 mfd. condenser in series with the aerial may, of course, be omitted, as a slider is used for tuning. If you intend keeping to the same circuit and using the same valve, a variable grid leak will be unnecessary, but this type of leak is very useful when the valves are being constantly changed, as different valves usually need different values of leaks. This circuit sometimes works quite well when the high-tension battery is cut out.

D. S. (Croydon).—Can an ordinary two-slide coil be used in conjunction with a valve
(Continued on page 732.)

CHASING AWAY THE "LIMEHOUSE BLUES."



RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 730.)

as detector? I only want to get London. I may mention that the coil is giving quite satisfactory results with a crystal receiver. I intend using a Cossor valve. What plate and filament voltage will it take? Can I use ordinary torch batteries connected in parallel for either filament or plate supply? I should prefer a circuit that does not contain any variable condenser. What is the probable range and cost of such a receiver? What is the best circuit to use, cutting out all unnecessary apparatus? Shall I be able to use it under the new home constructor's licence when it is issued? When is this licence to be issued?

A two-slide coil should give quite satisfactory results at your range. You will get London broadcasting, and probably Croydon aeroplane traffic telephony, if your coil will tune up to 900 metres. You may also hear some local amateurs on the 400-metre band of wave-lengths. The Cossor valve takes 3½ to 4 volts on the filament and 20-80 volts on the plate. You cannot use torch or any dry batteries for the filament unless you use a Dull emitter type of valve. Torch batteries connected in series (not parallel) will make quite an efficient H.T. The cost will be about £3, excluding aerial, coil, and 'phones, which you doubtless already have. You will be able to use this set with the home constructor's licence as far as reaction is concerned. We cannot say when the new licence is to be issued. As regards the circuit you wish to use, the following connections will be quite O.K.: Aerial to one slider, end of coil to earth; second slider to grid leak and condenser of valve; the grid leak and condenser to grid of valve; plate of the valve to 'phones and 'phones to H.T. +; H.T. - to L.T. +, L.T. - to earth. Also L.T. + to the centre of the filament resistance and the end of the resistance wire to filament. The other side of the filament, of course, goes to L.T. -.

D. S. N. (Latchmere).—I have a three-valve set, one detector and two low-frequency amplifiers. When I switch on the two-valve amplifier it becomes very noisy, and sets up a howl which I cannot prevent unless I reduce my high-tension current to practically nil. This stops the howling, but signals die away. How can I prevent this? I am using separate high-tension batteries.

As the two-valve amplifier is run from a separate high-tension battery, see what happens when the negative of this battery is connected to earth. If this fails try reversing the connections to the primary windings of the transformers, one at a time. It is worth trying to earth the iron cores of the transformers. If the above suggestions fail to stop the howling, disconnect the windings of the secondary transformer from the low-tension negative, or positive, as the case may be, and connect them to the negative pole of a four and a half volt pocket-lamp battery. Connect the positive of this pocket-lamp battery to the negative of the low-tension battery. In this manner the grids are always given a fairly strong negative potential, which should certainly prevent the amplifier from breaking into continual self-oscillation.

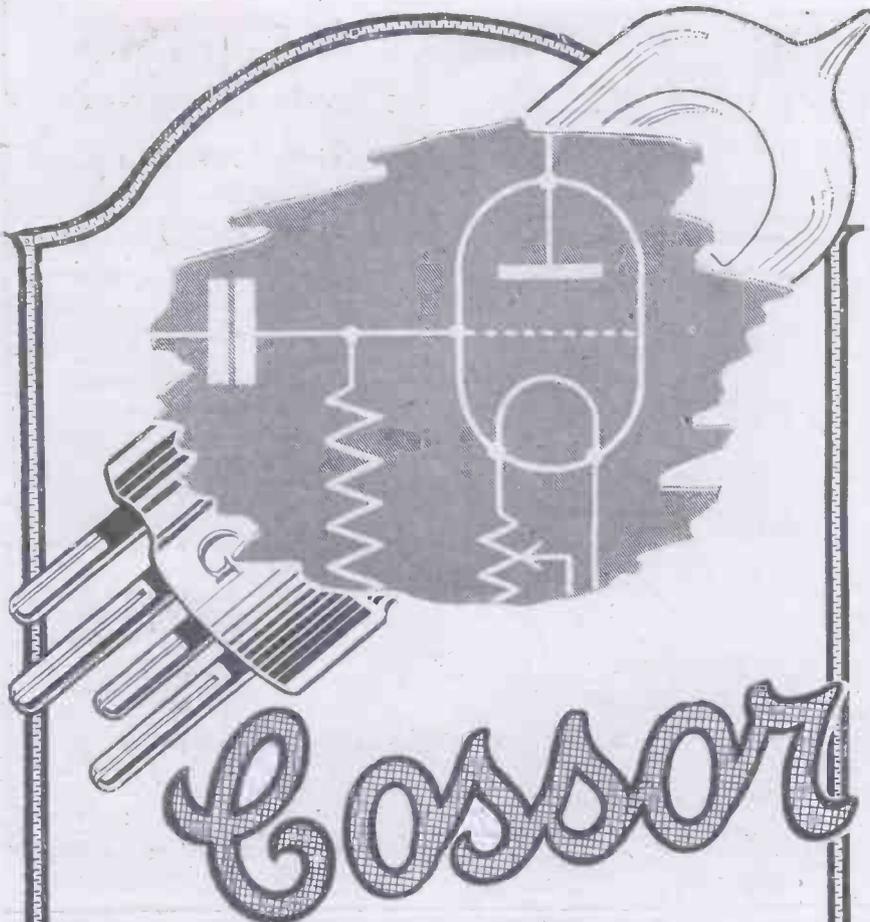
Q. P. R. (Coventry).—What is meant by absorption modulation?

The term absorption modulation refers to the process of varying the amplitude of a radio-frequency alternating current in accordance with any desired wave form. It is accomplished by systematically absorbing energy from the A.C. circuit in an element of a circuit which serves as a conveniently variable resistance. This will be more clearly understood if an example is used, for instance, using the plate circuit of a three-electrode valve as a variable resistance, and varying such resistance by means of suitable voltages impressed on the grid, or by coupling such a variable resistance to the aerial circuit of the transmitting set.

"AERIAL" (Morecambe).—How can I calculate the effective height of my aerial?

The effective height of an aerial is the product of the form factor, and the height from the earth to the highest point of the aerial. The effective height of the aerial can be determined by measuring H, the average height of the main elevated portion of the aerial; calculating C, the capacity of the same portion, disregarding the effects of the masts, trees,

(Continued on page 734.)



—the heart of
the Circuit.

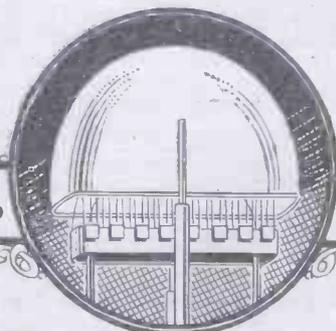
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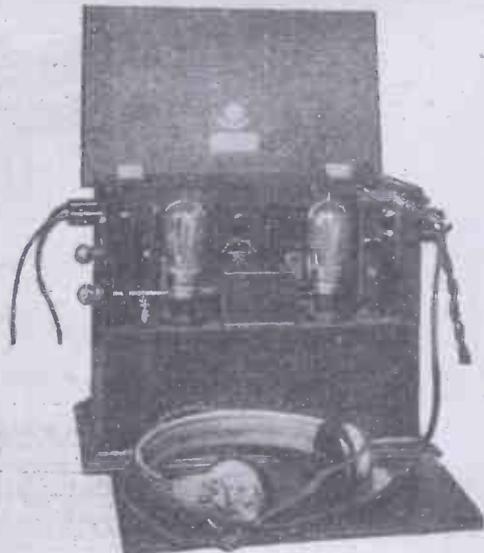


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RADIOTORIAL QUESTIONS AND ANSWERS.

(Continued from page 732.)

screening effects, and suspension; and measuring C_2 , the actual capacity of the aerial at low frequency.

The formula for the effective height is then

$$EH = H_1 + \frac{C_1}{C_2}$$

"ST. GEORGE" (Missenden).—What is a retractor circuit, and to what use is it put? Can I use wood or slate for a panel in place of ebonite?

A retractor circuit is a tuned circuit composed of an inductance and a variable condenser, which is shunted across a portion of the receiving circuit. The circuit is so tuned that it will not respond to the desired signals, but will act as a by-pass to all other signals of near wave-length which would be likely to cause interference. Two or three retractor circuits can be included in the receiving circuit so as to cut out interference as completely as possible.

We do not advise the use of either wood or slate as a substitute for ebonite, though they may give quite satisfactory results if treated well first. In the case of the wood, it should be dried in the oven, being left there for a few days to do away with any possible dampness. It should then be removed and allowed to soak in paraffin wax for several hours. This completes the treatment of the wood. Slate should also be well dried, and should be coated with a thin layer of shellac. The shellac helps to prevent any moisture from condensing on the surface of the slate. The slate is preferable to the wood, especially for use as valve panels. In any case, the expense saved by using wood will not compensate for the loss of efficiency that is likely to occur.

B. L. N. (Canterbury).—How can I find the sensitive point on my crystal set with the aid of a buzzer?

The two terminals of the buzzer are attached by short lengths of wire to a dry battery of about 44 volts. As soon as the buzzer is operating well, connect a short length of insulated copper wire to the terminal of the buzzer, say about three feet, and hang it over the back of a chair, or anywhere convenient. Now place the 'phones on your head, and the buzzing should be heard in them. Adjust the crystal until the loudest buzzing is obtained. It is not necessary to vary the tuning of the set in any way. The buzzer should be about three or four feet away from the set. Another method is to place a coil—spider-web type—in series with the buzzer and the battery, and to couple the coil closely to the aerial tuning inductance. This will introduce H.F. impulses into the receiving set, and the crystal can then be adjusted as before.



To the Editor, POPULAR WIRELESS.

Sir.—I have read the majority of opinions on the B.B.C. programmes, and feel fairly well convinced that ninety per cent. of the trouble is the fault of the complaining listeners-in. Some years ago a friend of mine received an invitation from his brother (the manager of a West-End theatre) to "trot along when he liked" and enjoy a free stall. More fortunate than many he also received the "open sesame" to a cinema. For the first month he could always be found at one or the other after 8 p.m. Suddenly one evening he changed his mind about the merit of West-End theatres, expressing them as giving very monotonous programmes. I suggested that he would be doing a wise thing to give them a rest, but coming from the land of Haggis and whisky he couldn't see the logic of missing something for nothing, the consequence is, that you couldn't get him inside of any sort of theatre now without the assistance of a stout rope.

The same applies to the owners of the B.B.C. licence who grumble. These things are "on tap" every night, and the trouble is that listeners won't give themselves a chance. Instead of listening twice per week, some of them are doing their best to qualify for corn plasters on their ears, through listening for about three hours each night of the week, to the same "theatres." They are just suffering from surfeit of "too much of a good thing."

The fault of the B.B.C. is that they haven't taken this point fully into account. If they try the system of allotting to each night a certain class of music, then those who like Greig, Chopin, etc., can feast themselves once per week on Mondays; others who like being "whirled into happiness" could have such a feast each Tuesday, etc.; this would ensure a certain amount of freshness and eagerness. I very much admire the principle of the "P.W." editorial staff on these subjects, because they give equal publicity to all comers, and as a "Readers' Parliament" I think "P.W." is second to none.

Yours faithfully,

EDWARD A. ARNOLD.

4, Steele Road,
West Ham, E.15.

To the Editor, POPULAR WIRELESS.

Sir,—In a recent issue of "P.W.," Mr. P. Morris writes criticising the Sunday broadcasting programmes, decriing the brevity of the entertainment provided, and pointing out what he considers to be the need for "an interlude of a jolly, rollicking order." On behalf of the many "listeners-in" who sincerely appreciate the distinction made by the British Broadcasting Company between their Sunday and week-day programmes, may I suggest that one evening in seven devoted solely to music of the higher order cannot be considered excessive, and does much towards raising the standard of musical taste throughout many sections of the community, at the same time giving genuine pleasure to all music-lovers.

Surely, with the excellent broadcasting which provides us with so much variety each evening, we can rest content with a curtailed programme of really good music on one day of the week, simultaneously permitting the staff of the B.B.C. a few hours additional relaxation on a day primarily intended for rest.

Yours faithfully,

E, STANLEY SKIPPER (Capt.).

To the Editor, POPULAR WIRELESS.

Sir,—Might we ask through your paper, if something could not be done with regard to Sunday evening broadcasting; the present transmission is very little, one hour and a half, of which about fifteen minutes news items, and fifteen to thirty minutes talk by the preacher; there is not much left for music. Sunday evening is the one evening at home for many thousands of business people, when the family is gathered together and friends drop in. A full evening programme would be very acceptable. The percentage of church-going people is very small, and there is very little doing on Sunday evening. The B.B.C. might easily close down, in turns, one or two week nights, and give their staffs a night off, this would not only give them a rest but

(Continued on page 736.)

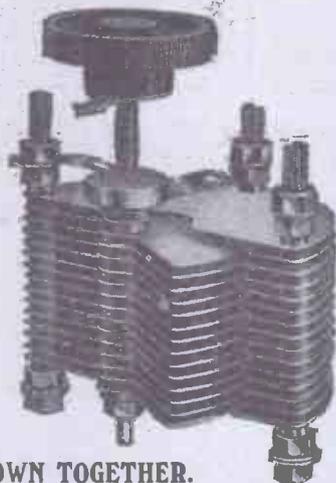
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THANKS!**CORRESPONDENCE.**

(Continued from page 734.)

would save expenses and give those with more powerful sets a chance to get other stations. I have spoken to many "listeners-in," and I can assure you this is a very popular opinion.

M. G. Ross.

Birmingham.

The Editor, POPULAR WIRELESS.

Sir,—How long is radio going to emulate Rip van Winkle? We flatter ourselves we are modern, alive; in our secret souls we consider we are brainy. What happens? Whilst our accredited agents, the B.B.C., put up a good fight, we switch over to "stand by" and wait.

Sooner or later we shall have to either learn Morse or back up the B.B.C. The latter is easier, more pleasant, and altogether better. I'm conservative enough to hate "direct action" and boycotts, but it's got to be done in self-preservation, and the sooner we begin the better, before "Uncle" Arthur and his merry men die of broken hearts. We are a goodly number, and can affect box-office returns and music sales, either for good or evil, by supporting or not supporting certain firms and societies just in the same measure of reasonable dealing as they hand out to us. Put the "listeners-in" cipher on goods from firms who allow their samples to be broadcasted, and make a black list of those who try to starve us out. When commerce realises that it is a paying proposition to be civil to radio, then shall we get a wondrous civility; and we can do it if we only go to those theatres who let us hear part of their show, and buy the music that bears the name of firms who are pally to us.

We do not expect to get "owt for nowt," but we want reasonable treatment to our supply stores, the B.B.C. The cheapest advert. in the world and a good, honest proposition to those who avail themselves of broadcasting their goods, and all we get is the frozen mitt.

The Queen's Hall affair shows us the spirit we are up against, and ought to prove conclusively that it's no use arguing unless we have weight behind it; for surely no firm can claim copyright of the words of our Royal Family. Let's get together and show them that we resent unfair treatment, and don't mean to swallow it. Let it be as business-like as they please, so long as it is reasonable. Show our appreciation of the B.B.C., and say in no doubtful terms that radio will back them up in the fight to the last man and the smallest crystal set.

Meanwhile, Messrs. Chappell might do worse than study heraldry. The motto of the Prince of Wales would be awfully good advice to them before next they attempt to stand between his Royal Highness and the public who love him.

Yours faithfully,
JERSAISE.

Croft Cottage,
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**A SPECIAL INTERVIEW WITH
SENATORE MARCONI WILL
APPEAR IN NEXT WEEK'S
"POPULAR WIRELESS."**

**RECENT WIRELESS
INVENTIONS.**

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

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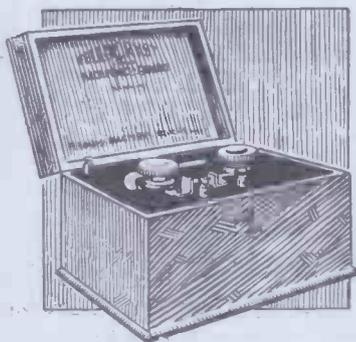
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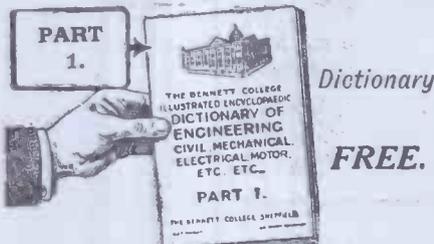
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