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Popular Wireless

and Wireless Review

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EVERY FRIDAY.

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

May 24th, 1924.



The Rt. Hon. J. R. Clynes and his wife listen to 2 L O on a small receiver that has just been installed in their residence.

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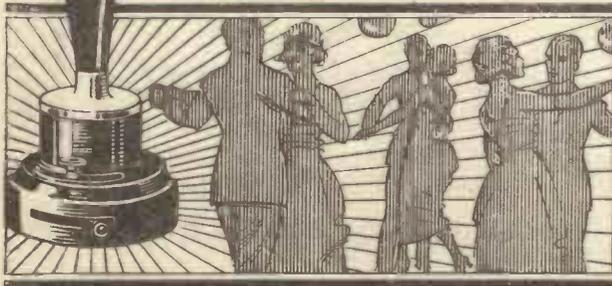
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POPULAR WIRELESS

AND WIRELESS REVIEW.

May 24th, 1924.] THE RADIO WEEKLY WITH THE LARGEST CIRCULATION. [Every Friday, Price 3d.

Technical Editor:
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Editor:
NORMAN EDWARDS, A.M.I.R.E., F.R.G.S.

Scientific Adviser:
Sir OLIVER LODGE, F.R.S.

RADIO NOTES AND NEWS OF THE WEEK.

Marconi's New Experiments.

SENATORE MARCONI is having his yacht "Elettra" fitted out ready for his proposed trip to Western Atlantic, where he will carry out a series of wireless experiments. It is not known how long Senatore Marconi will be away.

* * *

A 2 L O Event.

ON Monday evening, July 7th, a public meeting will be held in the City Temple, which will be addressed by Mr. Lloyd George and Sir Donald Maclean. The speeches will be broadcast from 2 L O.

* * *

Broadcasting for Brazil

PERMISSION has been given to the Brazilian Radio Telegraphy Co. to establish four broadcasting stations in Brazil. The stations will be erected at Sao Paulo, Bahia, Pernambuco, and Bello Horizonte.

* * *

Duke of York Broadcasts.

THE speech of H.R.H. the Duke of York at the Empire Day banquet, at the Hotel Victoria, is to be broadcast at 9.15 p.m. to-night. This will be the first time that the Duke of York has had a speech broadcast.

* * *

Another Invention.

A NEW kind of wireless aerial has been invented, which, it is claimed, will "operate a loud speaker without valves or batteries." I am unable to get any further details at the moment, but the claim is certainly unusual.

* * *

A Lightning Accident.

A BOY listening in at his home was recently thrown across the room when lightning struck his aerial and smashed his crystal set. Apart from the damage to the set and the table the house was not damaged.

* * *

Earth Your Set.

IF summer comes, thunder and lightning will accompany it, and listeners would be well advised to connect their aerial to earth, outside the house, when broadcasting is finished. Do not connect aerial and earth on the set, because lightning may make a short cut to the nearest object in the house.

* * *

When to Switch Off.

IT is not necessary to switch off or disconnect just because you hear storm noises in the 'phones, because the storm may be several hundred miles away, and therefore not dangerous. But if lightning is visible, then it is advisable to earth the aerial.

Dan Godfrey's Cup.

MEMBERS of the 2 Z Y wireless orchestra presented Mr. Dan Godfrey with a silver cup as a token of esteem when he left Manchester. Many letters of congratulation have been received by Mr. Godfrey on his new appointment as 2 L O's conductor. There was a suggestion that a wireless set should be given instead of the cup—but wiser counsels prevailed!

* * *

The B.B.C. and £91.

IN the courts the other day Mr. Justice Romer made an order for the compulsory liquidation of the British Radio Sales Co., Ltd., on the petition of the B.B.C. The debt is £91, and the respondent company, which was formed in 1922, had just established itself. The counsel for the B.B.C. refused to consent to



Mr. B. Honri, of the B.B.C. engineering staff.

any adjournment, and an order was made for compulsory liquidation.

* * *

A Few Items on Relay Stations.

THE Liverpool Relay station will be opened on June 4th. Mr. Cecil Pearson will be the station director, and the position of engineer has been given to Mr. B. A. Vernon, of 2 Z Y.

The suggestion to erect a relay station at Rawdon (which was to supply Leeds and Bradford) has been abandoned, and the B.B.C. have decided to erect a relay station at Leeds and another at Bradford. There will only be one studio which will be connected to both stations.

* * *

Broadcasting Changes.

ON June 1st the broadcasting times will be altered. The most important

change concerns the evening programmes, which will begin and end half an hour later. In addition, an extra half hour will be added to the afternoon concert on three days a week, and one hour and a half on Saturdays. The Sunday times of transmission will remain the same.

* * *

Back to Methuselah.

A LEADING scientist says that sound waves never end. "The recapturing of the voices of the past will be possible in the future," according to this scientist. If sound waves can be caught up again, we may hear Charles the First's last words on the scaffold, or Adam speaking to Eve. How the scientist proposes to prevent the voices of Charles and Eve mixing in the ether is beyond my comprehension. The answer is probably an apple—in the circumstances.

* * *

Statistics!

IT is estimated that there are three-quarters of a million listeners-in who are officially licensed in Great Britain. Each licence holder is entitled to use one hundred feet of aerial wire, which is equal to 14,000 miles of wire. This is sufficient to go more than half-way round the world, and, supposing 250,000 people use valve sets, employing on an average two valves, and then, bearing in mind the fact that electrons are discharged from a filament wire (which has a cross-section of 24 millionths of an inch) at the rate of 7,000,000,000,000,000,000 per second, and supposing that 500,000 valves work on an average two hours a day, can you tell me how many electrons are discharged in one year, and how—? No; I think I will stop there. Again, the answer is a —

* * *

A Cinema Experiment.

AN interesting experiment was tried recently in two well-known London cinemas, with loud speakers in place of an orchestra. From some of the reports I have seen the experiment proved fairly satisfactory. The loud speakers were connected by means of a land-line to another cinema, where they had an orchestra which not only played to an audience, but by means of a microphone close to the conductor, broadcast to the other cinema. From the proprietor's point of view the idea is excellent for economy, but the audience in the cinema with the loud speaker could not be "bluffed." I do not think, however, it is the intention of the proprietors to make this a feature of their programmes.

(Continued from page 45.)

NOTES AND NEWS.

(Continued from page 449.)

Broadcasting "Up North."

EVERY Wednesday at 12 o'clock the Zenith Radio Corporation send out a programme from their station WJAZ, and within a few degrees of the North Pole a small band of men of the "Bowdoin," which is icebound, sit and listen to the concert—the only real entertainment in their monotonous life.

Whitsun Arrangements.

AT Whitsun the children of South Wales and Monmouthshire will broadcast a message of peace and goodwill to all the children of the world. This will be carried out under the auspices of the League of Nations.

An American Invitation.

I HAVE just received a letter from an American reader who says he often gets English amateurs on his five-valve neutrodyne receiver, and he has asked me to put him in touch with a transmitting amateur in this country. If there is a young enthusiast who wishes to communicate with this American amateur he should write to Walter Wohepcil, 3341, West Beach Avenue, Chicago, Illinois, U.S.A.

Empire Wireless.

"IN the course of a month or two we hope to provide an efficient Empire Wireless service," said Mr. MacDonald, at Wembley.

The Donald Wireless Committee has recommended that with the United States, France, South America, and other important foreign territories, the Government should entrust high-power wireless services to the Marconi Company, which is one of the four powerful companies united in the great International Wireless Trust.

A Good Range.

THE King's Wembley speech, which was broadcast in Esperanto from 2 L O, was received in Finland, Tunisia, Switzerland, Germany, Hungary, Sweden, Norway, and Jugo-Slavia. The speech was printed in Esperanto in the Geneva newspapers the morning after the opening of the exhibition.

Quick Work.

AN S.O.S. message sent out by 6 B M recently had an unexpected sequel. It sought relatives in Glasgow of an Italian stated to be ill at Bournemouth. Among those listening was an aliens' immigration officer at this port, who, when he heard the name of the Italian remembered him as a foreigner who had been refused permission to land in England.

He immediately telephoned to the Bournemouth police, who acted with such promptitude that the Italian, was deported a few hours later by a steamer which sailed at midnight!

Medical Aid by Wireless.

THE "San Rosendo," bound from Tampico to Liverpool, asked the surgeon of the "Aquitania," by wireless, for advice in the treatment of a man who had fallen down a companion-way and fractured his spine.

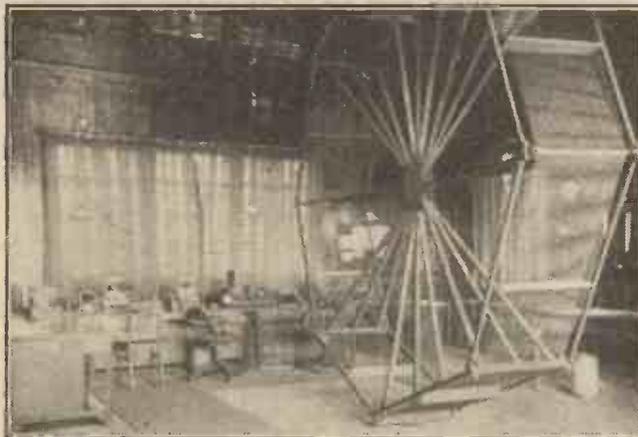
Instructions were duly sent, and the patient is reported to be progressing. Those in charge of the case asked for advice from several liners, until they were out of touch, thus making a chain of medical help.

2 L O to Move.

THERE is a strong rumour to the effect that 2 L O is to be moved shortly to the roof of a big store in Oxford Street. The object of moving is because the aerial is too close to the Air Ministry's aerial, and interferes with regular transmission. It is not known when the moving will take place.

Broadcasting at Wembley.

THE B.B.C. have installed loud speakers in the No. 1 Conference Hall in the Palace of Industry at Wembley. It is claimed that the reproduction of broadcast-



The huge frame aerial employed at the Sanbech, Holland, station for regular reception from Malabar, India.

ing through these loud speakers is perfect. Captain Round, the chief research engineer of the Marconi Co., is largely responsible for the installation. On Thursdays people will be allowed to hear the concert in the Conference Hall, and admission will be free until further notice.

An Aerial Ban.

KNUTSFORD Urban Council has refused to allow tenants of council houses to fix up any aerials on the buildings.

Some of the tenants, however, have disregarded the ban and have erected aerials, so that developments will be worth watching.

Police Wireless.

I AM told that Derby Day traffic will be controlled by wireless again this year.

Two wireless cars will be employed—one of a new type, just built to the design of the electrical engineering staff of the Metropolitan Police. The new cars can employ wireless telephony while travelling at 40 miles an hour, and with a wireless

station already equipped at Scotland Yard the possibilities of the more general employment of wireless in crime investigation and traffic control is being examined.

Dan Godfrey's Gifts.

I MET Mr. Dan Godfrey the other day walking down Fleet Street looking remarkably well. He told me that he had received two gold watches, one a wrist watch, and a loving cup and many other gifts from friends in Manchester, as a token of esteem.

More Relay Work.

LISTENERS to programmes from relay stations seem to want 2 L O's programmes in preference to a local main station's, and to fulfil the wishes of the majority the B.B.C. have arranged to relay 2 L O to all the relay centres.

6 B.M.'s Decision.

BOURNEMOUTH'S refusal to permit open-air wireless concerts will be followed in practically every seaside town. The reason is that the Council depends on the receipts from bands and concerts.

Edinburgh's Aerial.

IN all probability, the aerial of Edinburgh's relay station will be moved from its present position, on account of the metal which has been discovered in the chimney stack, to which it is at present attached. The engineer sent to Edinburgh has instructions not to leave until reception is perfect, and the local listeners are satisfied that things will soon be O.K.

Nerve!

I HEAR that some valve-set owners in Sheffield are complaining that since the increased wattage at the relay station it has become almost impossible to cut out Sheffield, while others consider that the B.B.C.

should refund the cost of their valve installations, set up owing to the weakness of the transmission up to Friday last! Evidently some Scots have crossed the border!

To-Night's Programme.

ONE of the old-type popular "Request Programmes" will be given to-night, the vocalist being Mr. Bryn Gwyn, of "Chu Chin Chow" fame, who will include the "Cobbler's Song" in his "outpnt."

What is more natural and right than that the inimitable John Henry, always in request, should be included in this programme?

At 9.15 p.m. speeches by His Royal Highness the Duke of York and the Right Hon. J. H. Thomas, M.P., will be broadcast from the Empire Day annual dinner of the Royal Colonial Institute at the Hotel Victoria, and at 10 p.m. Act. II of the opera "Ariadne," by Strauss, as produced at Covent Garden in the current international season, will be relayed from 2 L O.

THE CRITICS AND THE "UNIDYNE." SOME CONTRADICTORY STATEMENTS.

By THE EDITOR.

Comments and criticisms in certain of our technical contemporaries have come to our notice, and in the interests of our readers and in order to correct certain erroneous statements and suggestions the following friendly reply to critics by the Editor of "Popular Wireless" is published below.

THE announcements made in the last three issues of POPULAR WIRELESS concerning the invention of the P.W. "Unidyne" Principle have, quite naturally, resulted in much criticism in our contemporaries.

And as the decision of publishing the articles and claims of the inventors of the "Unidyne" receiver in POPULAR WIRELESS, after negotiations with the inventors, rested with myself, I would ask the reader's indulgence in considering this reply to our critics.

The Inventors' Claims.

There is, first of all, one point which I should like to stress. POPULAR WIRELESS has not rushed into this business of the "Unidyne" without exercising the utmost care and the most stringent investigation. No stone has been left unturned to find any flaw in the inventors' claims: test after test was made in my presence before any public demonstration was given. The revolutionary claims of the invention and the interests of readers demanded this.

Therefore, banish the idea that this "Unidyne" invention is a "stunt." It is a serious scientific discovery of considerable importance to all interested in the progress of Wireless.

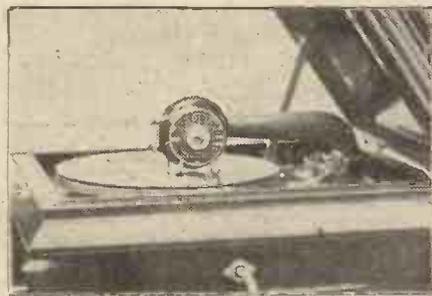
And therefore, both the inventors and myself felt prepared for the criticisms of our technical contemporaries. We welcome them: incidentally they help us considerably and this reply to certain criticisms made in *Wireless Weekly* is but natural in the circumstances. In that journal, dated May 7th, I find this remark in connection with H.T.-less receivers:

"Unfortunately, results hitherto have not enabled any appreciable signal strength to be obtained."

A Revised Opinion.

In the May 14th issue of the same journal, the following is published:—

"Very loud signals have been obtained with this arrangement (the same circuit employing no H.T.)."



An Amplion Gramophone attachment in use.

I would like to draw the attention of P.W. readers to this striking contradiction, which inevitably leaves one with the impression that the first criticism was written not only

in haste but with insufficient data wherewith to provide a *bona fide* criticism of the claims put forward for the P.W. "Unidyne."

Apparently this lack of data had been rectified when the second criticism was written, as the writer is now obviously aware that, even with experimental circuits of an imperfect design, and not embodying the secret of the "Unidyne," "very loud signals have been obtained."

Again, in the same issue of our contemporary, the following announcement appears:—

"... Mr. A. D. Cowper, who has been working independently on this problem... the results he has obtained with his own special circuit are second to none."

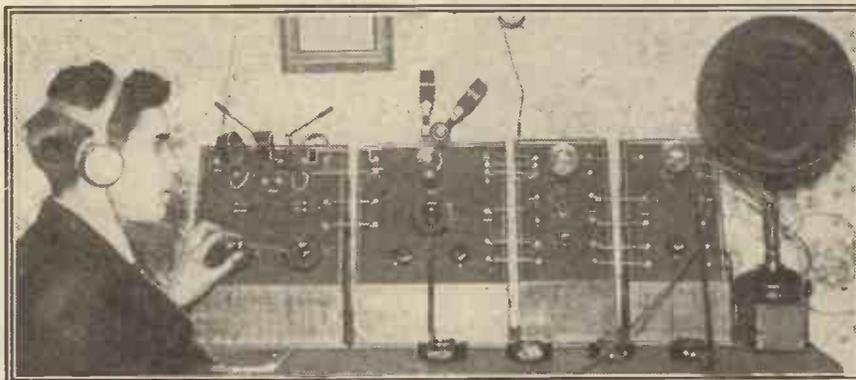
Before dealing with this statement let me refer the reader to the editorial article in the same journal, where it is stated: "At

to such statements in the hope that they will not be unduly influenced. I do not think any one will deny that POPULAR WIRELESS was the first journal in the world to definitely announce the fact that it had secured the exclusive rights of publication of the secret of the "Unidyne," and further, that this journal was responsible for a demonstration which resulted in a wide-spread announcement in the Press that a practical solution to the problem had been solved.

Passed the Experimental Stage.

Naturally enough, we shall encounter those who will bask to their utmost in the "sunshine of our success," and that state of affairs we are prepared for and even welcome.

Quite true it is that the idea of elimination of the H.T. battery is not new in itself:



A very neat unit set constructed by Mr. S. R. Evans, 85, Saltram Crescent, Maida Hill, W.9.

the time of going to press we have not had an opportunity of seeing the circuit of the Dowding-Rogers arrangement."

Readers will at once appreciate the fact that, if the "Unidyne" has not been examined and tested by Mr. Cowper, he has no right to claim that his own arrangement is second to none?

The inventors of the "Unidyne" have already tested every known arrangement for dispensing with H.T. supply, and having evolved the "Unidyne" and demonstrated its possibilities to experts of the trade and the Press, they are in a position to state, with every right, the results and claims of their design. In any case, if Mr. Cowper's results are "second to none," why has he not given amateurs the benefit of his researches? And it is remarkable that he should have made public the result of his experiments only after our announcement of the invention of the "Unidyne," and before he himself had seen the full wiring diagram or tested the circuit by experiment and comparative tests.

An Undeniable Fact.

But in journalism such exuberant confidence is, to some extent, permissible; although it is my duty to draw the reader's attention

many have attempted it; many have secured quite good and promising results; but the "Unidyne" has passed the experimental stage. It is not in embryo; it has been developed until it gives results equal to sets employing H.T. The inventors claim that this has not been done before, and challenge refutation on this point. Further, amplification without H.T. is a new success: other H.T.-less attempts had been mostly confined to detectors, although it is admitted that experimental circuits have already been devised for amplifiers without H.T., but with very little success.

At the conclusion to the editorial in the May 14th issue of our contemporary already referred to, these words appear:

"Although the results obtained with a minimum H.T. voltage, or the complete absence of high-tension battery, may be surprisingly good, yet the set with a reasonable amount of high-tension voltage will always give a greater power output."

I pass no comment on this paragraph, except that I would again refer the reader to the statement in the same article, admitting the P.W. "Unidyne" had not been investigated at the time the article referred to was written.

STRAY CAPACITIES AND COUPLINGS.

SOME REASONS FOR POOR RESULTS.

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

This is the fourth of a practical series of articles specially written for
"Popular Wireless."

IT is pretty well recognised now that distributed capacity in a coil, though not wholly avoidable, is undesirable and disadvantageous. Capacity should be defined and localised, and not smeared about along with resistance and inductance. The turns of a coil are intended to act inductively upon one another by magnetic induction.

Avoidable Interaction.

They do also act on each other by electrostatic induction, which is not wanted. That is what gives distributed capacity, and hence basket-winding and other devices. The separation of the wires diminishes their mutual inductance, which is bad; but it also diminishes their electrostatic or capacity induction, which is good; and the result is a compromise.

But in addition to the recognised coils, there are also capacity and inductive effects between leading-in wires and the ordinary wire connections. None of these is any good at all, and should be kept to the minimum. We don't want capacity in a leading-in wire, we only want conduction.

We don't particularly want inductance in a leading-in wire, though we cannot help it; moreover, it does no harm. But what we certainly don't want is mutual induction and capacity between leading-in wires. And these can both be avoided to a great extent. They are no good, and though they do not do very much harm, they are better away.

To avoid them, the wires from different parts of the circuit should not run close together and parallel to each other. If they have to cross, they might cross at right-angles, being well insulated where they cross. Wires which lead to the legs or pins of a transformer or a valve should not be bunched together, even though perfectly insulated from each other.

Important Considerations.

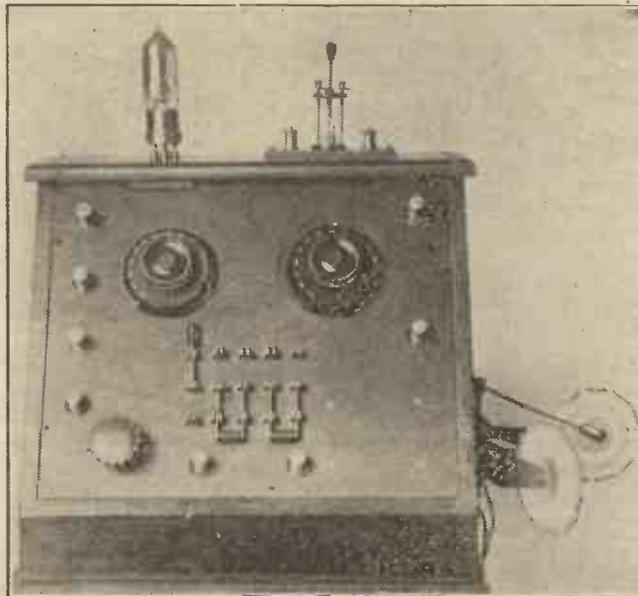
They should be separated. If they can radiate out from each other for a little distance, so as not to be even parallel, so much the better. If they are separated by a few inches, their parallel running will not matter. And some careful people attach internal radiating projections to the pinholders of their valves, etc., so that the wires which lead away from the ends of their projections shall not be close together.

These are to some extent counsels of perfection; but wireless receivers are so nearly reaching perfection, and tuning is becoming

so remarkably accurate, that even these trifles are worth attention. Wires should in fact be not only insulated but isolated. The nearer and more parallel they are to each other, the more they are liable to introduce undesired disturbances and spurious effects. Even insulation is not always attended to as much as it ought to be.

The minor points to be borne in mind in a good wireless set are, then:

- Low resistance and perfect joints.
- Stranded wire in the high-frequency portions.



The "P.W." Combination Set constructed by Mr. H. Mugford, of Great Waltham, Essex. This type of receiver depends largely upon its lay-out if best results are to be obtained.

Avoidance of stray capacities and mutual inductance.

Keeping away earth connected surfaces from the immediate neighbourhood of parts in which capacity is not wanted, such as leading-in wires.

Removal of metallic masses, especially copper plates, from the neighbourhood of coils.

And most especially, good joints everywhere, no leakages or bad insulation, and highest conductivity wire.

Capacity Losses.

Referring back to electrostatic induction; masses of metal near coils are apt to prove very troublesome. When a disc of metal is brought near a coil in which are oscillating currents, the disc of metal is, of course, a closed circuit, and currents—sometimes called Foucault currents—are

induced in it. It acts, in fact, like a single-turn coil of very low resistance. And the currents may therefore be fairly strong, so that if the primary coil were conveying strong currents the disc of metal would get quite hot.

With the kind of currents employed in wireless receivers, there would be no perceptible elevation of temperature unless extremely delicate thermometers were used. But there would be reaction. The disc of metal would be like a secondary coil, and would react on the primary.

Spacing Out Components.

Now, when coils are thus coupled together, the effect is to diminish the inductance and increase the resistance, and therefore to put the coil out of tune if it forms part of a condenser circuit with free oscillations. The approach of the disc of metal leaves the oscillating circuit no longer free. It is virtually coupled to another circuit, and the disadvantages of reaction set in.

Tuning is not only altered but spoilt, for a double note is generated. As was said in another article, it is like coupling two pendulums together, or like a three-legged race.

But it may be asked: Who brings discs of metal into the neighbourhood of a coil?

The answer is: You do, if you are using an ordinary adjustable condenser without precautions. An adjustable condenser consists of metal plates, all parallel to each other. And if they are parallel also to the plane of some coil they will react upon it. Possibly they are not very near, and the reaction will not be very prominent.

But none of such reaction is any use, and whatever there is is bad. What is the remedy? Either to keep the coils and the condensers far enough apart, or to arrange the plane of the coil at right angles to the plane of the plates in the condenser. Or, more accurately, to put them in what is called "a conjugate position," in which the mutual induction is zero, so that currents in one do not induce currents in the other.

There are many such zero positions. A position of zero mutual induction is obtained when lines of force due to either coil do not thread the other—that is, do not pass through the condenser plates, in the particular case under consideration.

Efficiency Decreased.

They may dip into it, but they must rise out again, passing through the plate on both journeys. They must not pass through the plate and then return outside. In other words, they must not effectively cut or thread the plate as if it were a secondary coil.

This is a kind of precaution that ought to be taken by makers of sets. And if they do not happen to be aware of it, they may be arranging metal conductors near coils without realising that they are thereby introducing spurious effects, which anyhow are no good, and which, if strong enough, will do harm.

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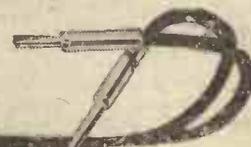
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A "UNIDYNE" L.F. AMPLIFIER.

MAGNIFICATION WITHOUT H.T.

By G. V. DOWDING and K. D. ROGERS.

(Technical Editor and Assistant Technical Editor "Popular Wireless.")

This is the fourth article of a series exclusive to "Popular Wireless," in which full details are given concerning the P.W. "Unidyne" Principle, the revolutionary wireless invention which dispenses with high-tension batteries. The article printed below will enable the amateur to construct a low-frequency amplifier to be used in conjunction with the detector unit described in last week's issue.—Editor.

HAVING described the construction of a one-valve regenerative Unidyne receiver, the next step is to give details of the note magnifier. The construction of this is, if anything, slightly more simple than the ordinary one-valve set, especially if the L.F. transformer is purchased instead of being made at home.

The L.F. amplifier described here is in a handy form so that it can be connected up to the detector unit that we gave full details of last week, and the two together form a very compact receiver, and one that can be used for loud speaker reception within a reasonable range of a broadcasting station.

Clear Loud Speaker Work.

While discussing loud speaker reception it will be noticed by all amateurs who make this set that the usual rushing and often hoarse noises emanating from the loud speaker when attached to a "normal" H.T. set are absent, and that when no speech or music is coming through there is a background of absolute silence.

The speech and music too, is wonderfully clear and distinct, and a great deal of the "throatiness" of loud speaker reproduction is done away with.

This does not mean that there is an absolute freedom from distortion of any kind, for wherever there are L.F. amplifiers and loud speakers as we now know them, there is sure to be a risk of distortion, the first being usually due to the responsiveness of the transformer to certain frequencies more than to others, and the latter to the resonance of the horn or other method used to distribute the sound waves.

As will be seen from Fig. 1 and the photographs the low-frequency unit is not large, and in fact the case shown in the photos is too deep for the instrument—it could be made much shallower.

In preparing the panel for this amplifier the same precautions should be taken as to "scrubbing" as were mentioned in the last article, namely, if the panel is of the polished variety, it should be rubbed down with emery cloth, but in one direction only, not up and down, and, of course, never crossways.

Panel Layout.

After using the No. 0 cloth, the No. double nought (00) should be used, when the panel will show quite a nice matt surface. Having trimmed up the edges and corners the panel is ready for drilling according to the plan in Fig. 1. For all the terminals 4 B.A. clearance drills are usually suitable, but this

depends on the class of terminals used—we prefer those known as the W.O. type.

The valve holes should be made as shown and either an extra hole made or a terminal fitted for the connection to the second grid of the valve. If a five-pin valve is used of course this hole or terminal would be omitted and the connection taken to the fifth socket.

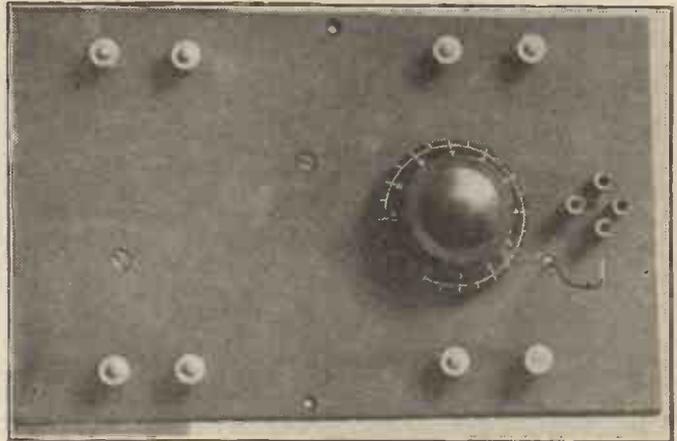
No definite position for the filament rheostat is marked in the figure because this naturally depends upon the type used. This is not important provided the very cheap type of resistance is not employed. By this we mean the type often sold at about 1s. or 1s. 9d., and having a very small total resistance, while anything like critical adjustment and variation of the filament current is impossible.

Choice of Components.

The compression type of rheostat can be used quite well in this unit, but unless the action is smooth and the instrument well made, the set is inclined to become noisy. The rheostat used in the actual set photo-

graphed has a very convenient ball contact, constant pressure being obtained by a small spring inside the contact arm.

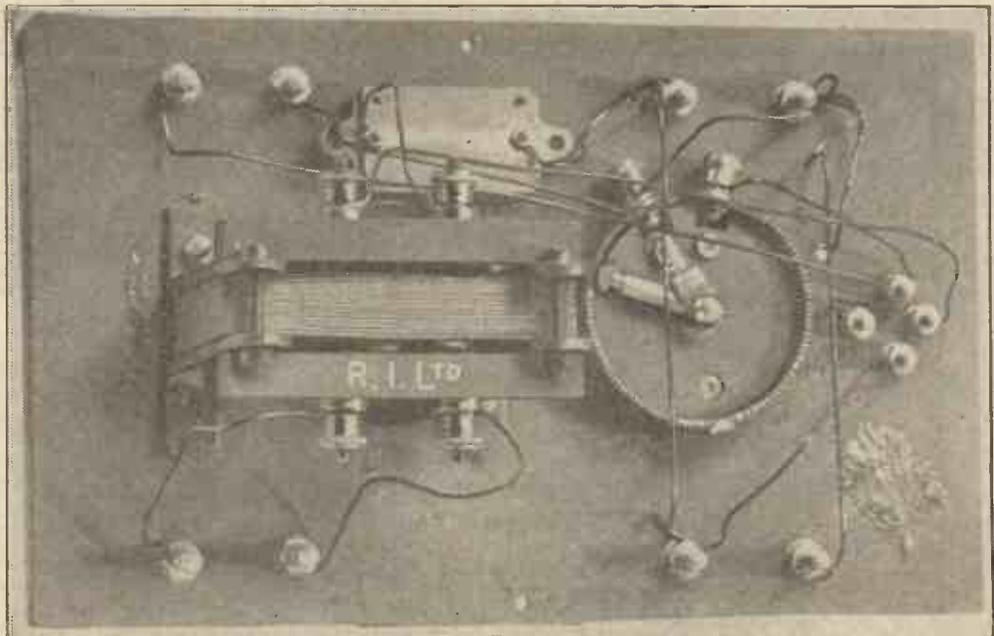
After mounting the rheostat, attention should be turned to the L.F. transformer,



The top of the L.F. Amplifier Panel.

which is of the usual type, preferably with not too high a ratio. In case amateurs care to make it for themselves details of the construction of a suitable transformer are given, while those who do not feel equal to the task of winding "all that wire" are advised to pay a fair amount of attention to the purchase of that part of the set. It is

(Continued on page 456.)

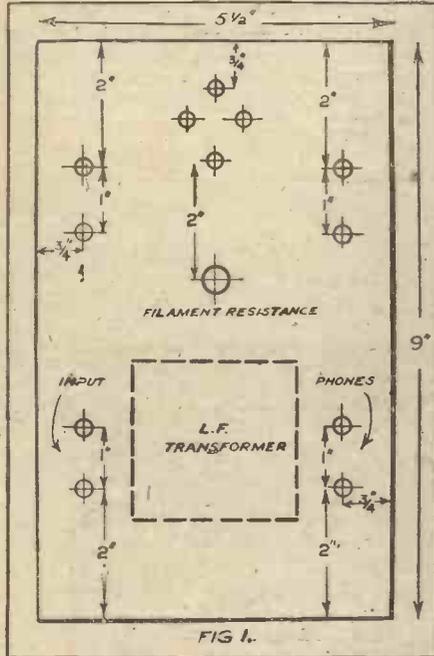


This photograph clearly shows the wiring. Note the pencilled leak across the Condenser.

A "UNIDYNE" L.F. AMPLIFIER.

(Continued from page 455.)

not understood often enough by the average listener—in that the L.F. transformer is the most important part of the L.F. side of the receiver—more sets are ruined and results distorted by the use of poor transformers than is generally realised.



The core laminations present the most awkward proposition to the average experimenter, but these can be obtained from most accessory dealers; as an instance, the Grafton Electric Co. may be mentioned. They should measure 2 1/4 in. by 1 3/4 in., and be a 1/4 in. broad by 10 mils thick, and must be of transformer iron. What is known as "dynamo steel" may be employed if desired, in which case it should be 5 mils thick only; 26 of the iron stampings or 50 about of the "steel" stampings will be required. It will be found that a winding space of 1 1/4 in. by 1 3/4 in. is available, and a bobbin should be made to fit the stampings.

Preventing Eddy Currents.

This is easily constructed from a piece of thin fibre tube, with ebonite or well shellacked cardboard pressed in at either end. This should be covered with several coats of shellac varnish and baked at each application, so as to entirely exclude moisture, and also to ensure a high degree of electrical insulation and mechanical rigidity. Each lamination of the core should be similarly painted with shellac, and a thin strip of tissue paper, cut out so as to completely cover the laminations, pasted thereon.

This will separate individual core stampings electrically and prevent the flow of eddy currents which will distort speech and lower the efficiency of the whole transformer. The primary winding may now be put on to the bobbin which has been made, the beginning being soldered to a length of flexible wire which is bound down to the inside tube with thread and passed through a small hole in one end cheek. The finishing

end of the same winding can be secured in a similar manner, the wire passing out through either end cheek as previously.

A layer of Empire cloth or silk tape soaked in shellac varnish may now be bound over this winding, so as to effectively insulate it from the secondary. The thickness of this insulation should not exceed 5 mils, and it must be complete and carried well into the side cheek to prevent leakage. The secondary winding may now be put on, its ends being treated the same way as the primary winding, and the completed bobbin either bound round with silk tape well shellacked, or impregnated in molten sealing wax. The ends are identified as follows: Inner end of primary (I.P.) goes to anode of valve or input of amplifier. Outer primary (O.P.) will go to L.T., inner secondary end (I.S.) to the negative filament and O.S. (outer secondary) to the grid of the next valve.

The bobbin is placed upon the inner leg of the transformer stampings, and the core rigidly bolted up between ebonite and metal clamps. It is important to see that the clamping screws or bolts do not pass through the core stampings, but outside them. The wire used for P. & S. is 40 S.W.G. enamelled, and number of turns 4,500 and 11,000 respectively. This is equal to 1/2 oz. and 1 1/2 oz. for P. and S. and the ratio is thus about 2 1/2 to 1.

Use of Blocking Condenser.

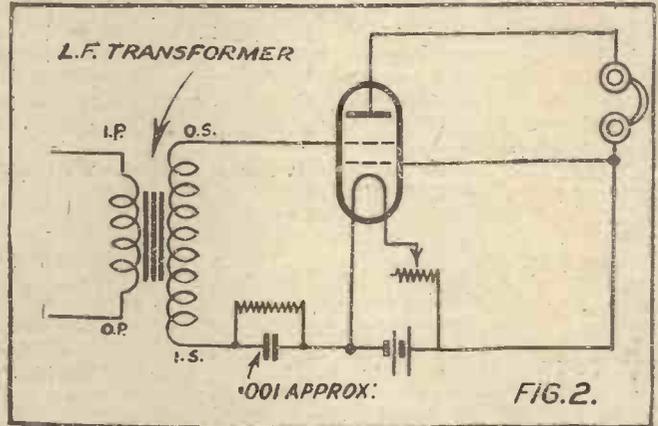
Having made or purchased the L.F. transformer and mounted it in the position shown in the figure by the dotted lines, the next step is to make the leak and condenser shown in Fig. 2 between the secondary of the transformer and L.T. Negative rheostat.

This condenser is necessary if the amplifier is to act up to its name, that is, if it is to amplify at all, for if the secondary of

the transformer is connected to the filament battery the valve merely passes the signals but does not amplify them at all.

The Grid Potentials.

It is obvious that if the two grids are connected together via the filament battery there is a fairly steep potential slope between the two grids, for the inner grid is at full positive potential while the control grid is at nearly the full negative. This result is largely nullifying the effect of the inner grid, and thus upsetting the balance of the circuit and



raising the internal resistance of the valve.

It has been explained before that the inner grid is placed there for the purpose of overcoming the resistance of the valve. This action is important for the successful operation of the valve, and so a condenser is inserted in the grid circuit of the amplifier to "break" the circuit and thus reduce the negative charge of the grid.

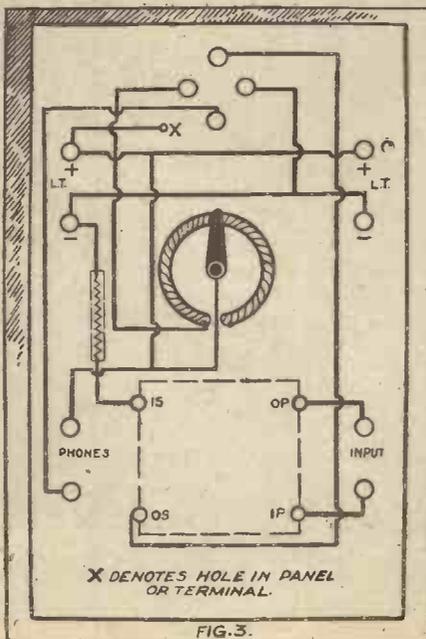
The value of the condenser is not critical, but the one used in the set shown had an approximate value of .001 mfd. Signal purity is also assisted in many cases by the addition of a pencil line across the condenser, thus making it leaky.

In constructing the condenser about 3 foils of about 4 sq. cms. overlap and separated by mica .002 in. thick will be O.K.

The wiring of the panel is clearly seen from Figs. 2 and 3, and this will present no difficulty.

As regards connecting up, the input terminals go to the phone terminals of the detector unit, the left hand side L.T. to corresponding L.T. on the detector panel, the right hand L.T. terminals go to the L.T. battery, and phones or loud speaker are connected to the remaining two terminals.

In next week's issue constructional details will be given for a 2-Valve "Unidyne" Set. The control of this receiver is of ideal simplicity and its compactness and neatness, economy and efficiency will appeal to every reader. Order your next week's "P.W." now.



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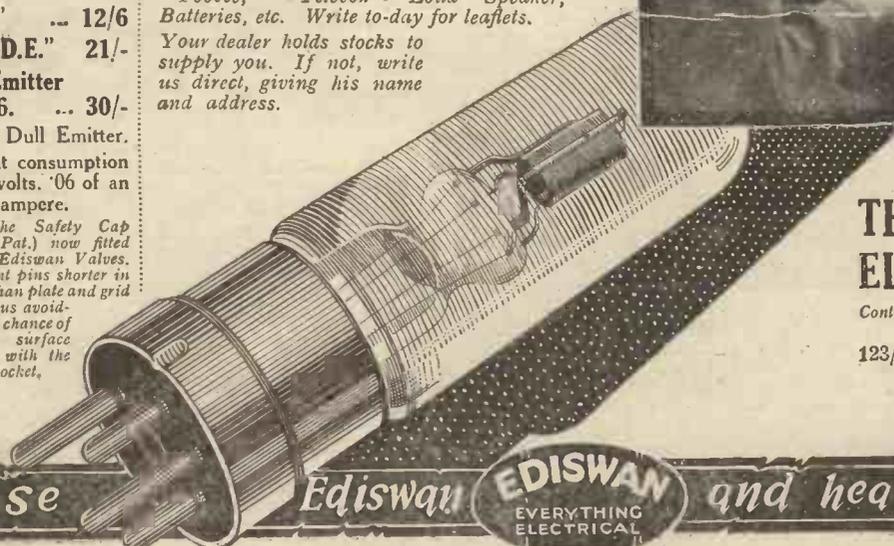
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HOW TO BUILD A THREE-VALVE RECEIVER.

By LAURENCE J. PRITCHARD (Technical Editor of Harmsworth's "Wireless Encyclopedia").

PART III.—Conclusion.

WHEN both variometers have been made along the lines described in the previous article, they should be mounted on the inside of the front part of the case, drilling a $\frac{3}{8}$ in. diameter hole for the passage of the spindle so that no part of the spindle touches the wood. The variometers are secured in their places by means of two small brass screws passed through from the

quality bell wire, and should be left sufficiently long to be connected to the valve terminals.

The other end of the variometer winding is connected to the earth terminal. It will be found advisable to solder the wire to each socket, and to have it of sufficient length to permit of it being connected to other pieces of apparatus. Similarly, connections should be made for the four legs projecting from the valve holder which is fixed into the end of the case. This may be done before the variometers are fixed, as there is then room to manipulate the soldering iron.

Testing the Wiring.

When all the connections are made between the variometers, grid condenser and leak, it is simply screwed to the base of the set and the rest of the parts within the case. The filament resistance and the filament terminals of the valve holders may be wired together, as shown in Fig. 18, after which the grid and plate wires are connected to the three-valve holders, thus completing the internal part of the winding. Tests for continuity should be made in the usual way with dry battery and telephones, to see that the circuit is all in order.

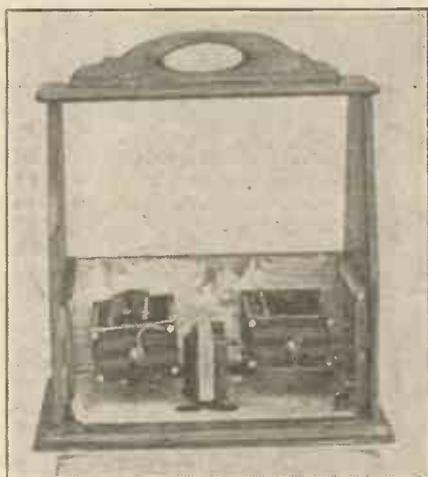


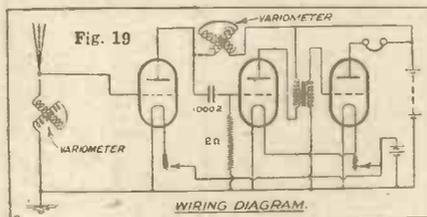
Fig. 17. The interior of the set, showing the variometers and transformer.

front of the case into holes tapped in the ebonite.

The next step is to place a transformer between the two variometers and screw it to the base, the state of the work at this stage being shown in Fig. 17.

Important Work.

Next comes the important part of the work in the wiring, and a theoretical wiring diagram is given in Fig. 19. The wiring may conveniently commence from the aerial terminal, one wire being taken to one side of the variometer and another wire from there to the grid of the first valve. This wire may be flexible or may be a good



The connecting plugs are the next items to demand attention and are readily turned to shape from ebonite rod $\frac{3}{8}$ in. diameter. The rod is cut into convenient lengths according to the available length in the lathe chuck and the outside turned, as shown in Fig. 24, using a very keen tool and running the lathe at about the speed for brass turning. While the rod is in the lathe, drill a central hole to suit the screwed shank of an ordinary valve leg, and counter bore the outer end to permit the flexible wire to pass.

To assemble the plugs pass the single flexible wire, which should be of good quality and well insulated, through

the hole and solder it to the end of the screwed shank. Screw it into the plug and secure it with the lock nut, which should have been placed on it before the wire is soldered.

The ebonite plug is tapped to suit the valve leg, as shown in Fig. 21. The finished plug is shown in Fig. 23, together with the



Fig. 20. Showing how the flex is plaited.

leading dimensions. The high and the low-tension battery leads are also dealt with by a plug-in connector, as shown in Fig. 22. This is made from two discs of ebonite screwed together in the centre. Each disc is $\frac{1}{4}$ in. thick, the smaller is 1 in. in diameter, the larger $1\frac{1}{2}$ in. diameter.

Plug Battery Connections.

The small disc is drilled exactly as if for a valve holder, and a valve leg is fitted to each hole, secured with a lock nut at the back. The larger disc is recessed to allow the lock nuts to sink into the ebonite, and the outer edge of the disc is knurled to provide a secure grip. A single well insulated flexible wire is then connected to each valve leg and passed through holes drilled in the larger disc.

These flexibles have then to be plaited together, as shown in Fig. 20, until within about 8 in. of the end of the wires. The

(Continued on page 460.)

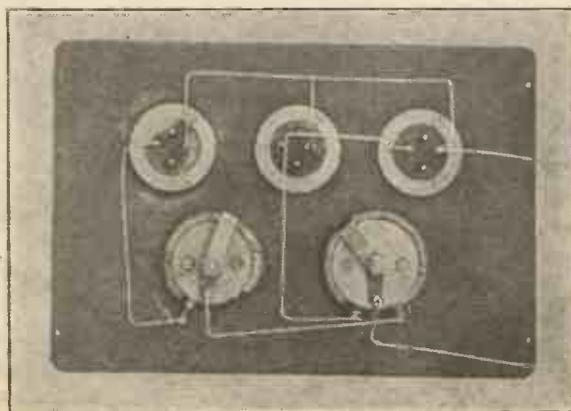


Fig. 18. The wiring of the filament circuit under the panel.

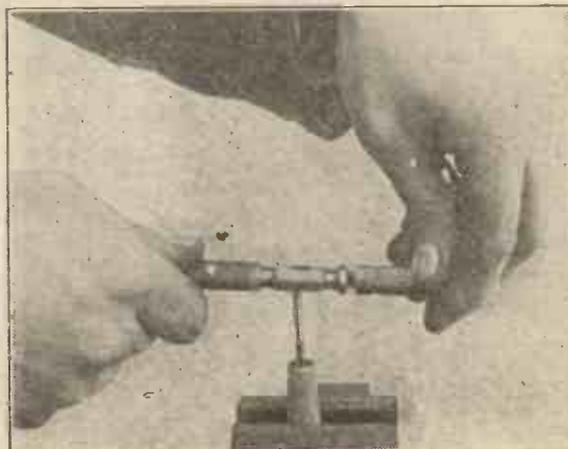


Fig. 21. Tapping the knobs for the plugs.

"FAVOURABLE" CONDITIONS.

The opinions of amateurs vary as to what are the best "conditions" for wireless reception, and in this article a correspondent puts forward and fully discusses his views upon the matter.

THERE is no doubt that for the transmission of ether waves very little is known of the factors which govern atmospheric conductivity. Of course, it is common knowledge that the period of darkness is the most conducive to good reception.

In the British Isles most amateurs with receiving sets are aware of the great difference which exists in receiving distant stations during the evening and receiving the identical stations in the afternoon. The varying peculiarities arising from the atmospheric state are particularly pronounced on long distance reception.

Distant Station Vagaries.

The general impression seems to be that an overcast, rainy or stormy night is one of the best for reception, but from many observations taken, the writer is not at all convinced of these views, as many excellent programmes have been received from America between 11 p.m. and 2 a.m., when the night has been cloudless, with a bright moon.

Every enthusiastic amateur who has built his own valve set has perhaps one evening been greatly gratified by his being enabled to get, perhaps, Aber-

deen, perfectly clearly, and again, Glasgow and Newcastle. (These are mentioned as being the distant stations from London.) Possibly the next evening he will have asked his particular wireless friend to come in and hear the new set, and it so happens that he will perhaps find it extremely difficult to get Birmingham, and not a sound from the other stations.

When Sets Evince "Liveliness."

This, possibly, will be put down to something having happened to the set, and has no doubt been responsible for many tentative adjustments. There will probably be plenty of spark stations and the usual atmospheric "mush" from high-powered arc stations. Even with 2 H.F. probably the station will come in very weakly, and

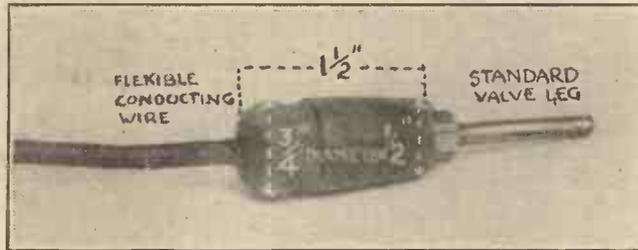


Fig. 23. Dimensional photo of the plug and flex complete (see below)

A THREE-VALVE RECEIVER.

(Continued from page 459.)

flexibles are then bound together to prevent them coming unplaited and the ends provided with wander plugs and terminal tags for the battery connections. To ascertain which wire leads to which socket on the case, place the plug in position and mark on the rim of the plug in pencil the correct values and polarity of the internal connections within the case.



Fig. 22. The battery connecting plug.

Then place one valve leg on the positive terminal of a dry battery, connect one terminal of a pair of telephone receivers to the negative terminal and touch the other terminal of the telephones on to one at a time of the ends of the flexibles. The

wire connected to the plug-in connection with the dry battery will be detected by a decided click in the telephones when contact is made. Test the remainder in a similar manner and distinguish them by different coloured terminals such as a black wander plug for the high-tension negative and a red one for the high-tension positive.

Operating the Receiver.

The advantage of this plug connector is that it allows of all the battery circuits being disconnected at one movement, and also it is possible to leave the filament resistances untouched once the correct adjustment has been found. The set is now completed and ready for a test. The aerial and earth lead-in wires should terminate in plugs so that they can be plugged in when the set is in use and disconnected when not required.

If a small plate of ebonite be provided and screwed to the window frame or elsewhere near to the point where the aerial is brought into the house, and bushed or fitted with two valve sockets connected together with a copper

with half a degree on the condenser, is gone. It is quite certain that through atmospheric vagaries the ether waves tend to flatten at varying ranges. As is well known, the lower wave-lengths are found more suitable for reception, but even with these it is not certain that at any period during darkness they can be received in this country.

On a favourable night, a certain liveliness is, if the expression may be used, felt by the set. In turning the condenser the numerous carrier waves of each signal can be clearly and sharply felt in the telephones as they are tuned over by the condenser, and it is under such conditions that it is worth while to persevere for the long-distance station one is wishing to receive.

If atmospherics are present, little of course can be done to eliminate these, but if the amateur is keen enough to listen to both telephony and atmospherics it is sometimes quite worth while.

"Following Up" "Fading."

Fading is one of the most annoying phenomena, and one which still calls for a large amount of investigation, although there is little doubt that this question is largely involved with that of non-reception of long-distance signals. In many cases this fading can be "followed up" with the reaction coil, but care has to be exercised, otherwise when the signals come in again the set will be forced into oscillation.

It is a curious fact that trans-ocean reception appears to be more regular than for shorter distances overland, and this too comes into the category of "Favourable" Conditions.

wire, the two terminal plugs can be placed into the sockets when the set is not in use. This keeps the wires tidy, and also earths the aerial and is a protection against lightning risks.

To operate the set, place the valves in position and connect a suitable battery according to the make of valve. Then connect the high-tension battery and adjust the voltage to that recommended by the makers. Turn on the filaments until they are properly illuminated and turn the tuning variometer and the tuned anode variometer slowly and simultaneously until signals are heard.

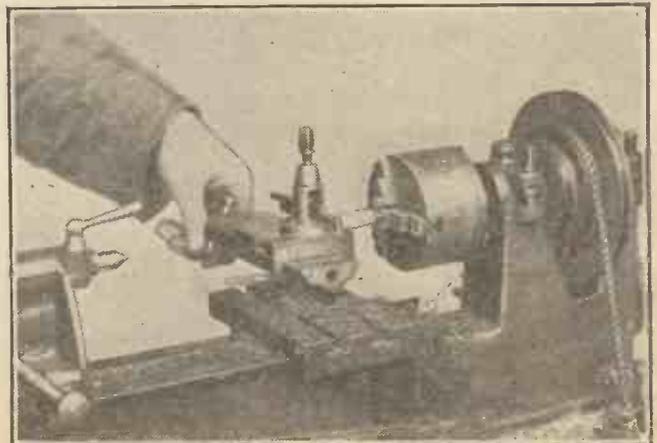
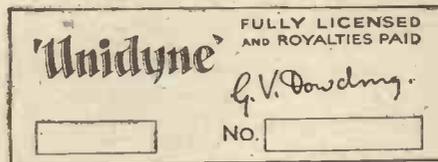


Fig. 24. Turning the ebonite knobs for the connector plugs.

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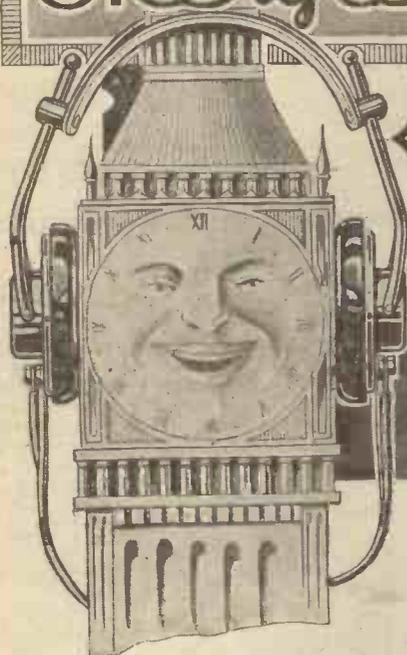


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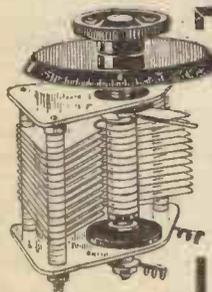
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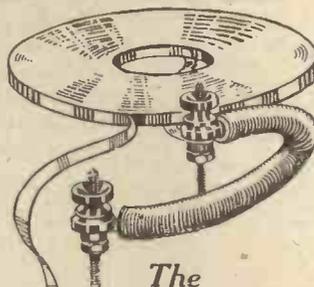
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NOTES ON THE MANCHESTER ETHER.

By "TEN WATTER."

Some facts that will be of special interest to amateurs who listen to 2 Z Y.

THE British Broadcasting Company deserve great credit for the splendid way in which they have developed the broadcasting service. In spite of the opposition of the entertainment industry, they have in a little over a year made their service a very popular form of entertainment. The company owes much of its popularity to its use of a number of low-powered stations.

The individual stations are able to cater for the local requirements in a way in which a single high-powered station could not do, and they also foster what Mr. Honey calls "the personal touch," which shows itself in the interest one takes in the staff of the station and all that goes on there.

Mr. Dan Godfrey, jun., A.R.A.M., the director of the Manchester station, is to be congratulated on the series of symphony concerts and operatic productions which have so delighted the section of 2 Z Y's large audience which enjoys good music. The popular and lighter programmes are equally appreciated by devotees of that kind of music.

Popular Director.

When will listeners generally give up their narrow-minded and selfish view of the programme question? If every listener would take as his motto "Live and let live," and would realise that there are others besides themselves who listen to broadcasting, it would be a great step in the right direction. A moment's thought will convince anyone that the B.B.C. cannot please everybody at the same time; but they can please everybody in turn, and few will deny that they do.

In spite of the programme question, Mr. Godfrey is very popular. When the 2 Z Y orchestra and opera company gave the first public performance ever given by the personnel of a broadcasting station, listeners had an opportunity of showing their appreciation of Mr. Godfrey and his work, an opportunity of which the large audience assembled in the Free Trade Hall made the most. They applauded everything with tremendous enthusiasm, as if they were trying to make up for the times when they had wanted—but had been unable—to give vent to their feelings.

The concert was just as successful financially, for the charity in aid of which the concert was given benefited to the extent of some £360. A similar concert, in which Mr. Robert Radford took part, was quite as successful in every way.

Disjointed Programmes.

These brief notes on programmes would be incomplete if Mr. Victor Smyth's dramatic productions were not mentioned. The two principal plays, "The Butterfly on the Wheel" and "Captain Swift," met

with the success which they deserved, the success in each case taking the form of an unusually heavy and congratulatory mail. Both plays were cleverly selected, as they were easy to follow and very interesting.

The talks which are given in the course of the more popular programmes, though interesting in themselves, seem out of place in the middle of the evening, as they make the programme appear very disjointed. If they were given at the beginning or end, as are the French, German, and Spanish talks, it would be a far more satisfactory arrangement.

Uninteresting Broadcasts.

We are glad to see that the B.B.C. are curtailing the use of simultaneous broadcasting. Given a good land-line, the concerts come through very well; but the

They are always very interesting, and are given in a way that grips the attention of the listener. Under Mr. Honey (Uncle George) the Children's Corner has developed into an amusing and very instructive hour which the kiddies appear to enjoy thoroughly.

Local Criticism.

When Mr. Honey started his fund for equipping the local children's hospitals with receiving sets, the little listeners responded in a way that he must have found very gratifying. Cousin Mollie's songs are one of the most attractive features of this hour, and they are run a close second by Cousin Edward's animal talks.

The Manchester University students' impromptu kiddies' hour on Shrove Tuesday was an exceedingly clever take-off of the mannerisms of the various aunts and uncles, and the subsequent programme which they gave was rich in humour and, as far as we were concerned, was far too short. Some listeners found it far too long, and wrote to complain of the "needless and silly" interruption to the programme.

It was doubtless a person of this sort who took one of Mr. Godfrey's amusing and harmless jokes as a personal insult. Mr. Godfrey's humble apology and elaborate explanation made a fitting end to the incident.

It is a good thing that letters of this kind are not taken seriously; if they were, broadcasting would lose much of its attraction. The opposite extreme was reached by the listener who sent a letter to the Children's Hour. This letter purported to come from a child, and was written in the name of a friend of the writer's. The writer is no doubt proud of the fact that he is one of the few men living who would look upon such a thing as a joke. Mr. Honey's few remarks dealt quite adequately with the matter.

Useful Suggestion.

For a fair period after the erection of the new aerial, 2 Z Y's transmissions were rarely of the same strength for two consecutive nights. After we had overhauled our receiver about half-a-dozen times, we began to realise that it was the station that was at fault; and we were by no means the only listeners that suffered.

If for any reason the transmission is likely to be under strength, the engineers should say so. It would be no trouble to them, and it would save an immense amount of unnecessary worry.

A very useful innovation, and one that would neither cost anything nor waste time, would be for all stations to announce the power in their respective aerials at least once every evening. This would be a great boon to all genuine experimenters.



Mr. A. G. Elliott, of 54, Ravensbourne Road, Catford, with the "P.W." set he has constructed.

B.B.C. were not always given a good line, and the concerts suffered in consequence.

It is a great mistake to S.B. the ceremony at the opening of a new station, especially when it is merely a relay station, as in the recent cases of Plymouth and Edinburgh. The speeches at these functions are doubtless of interest to the comparative few who will ultimately benefit, but sound prosy to the remainder.

The weekly attempts to relay American atmospherics were quite interesting, and, if one had a very lively imagination, it was possible to pick a note of music out of the general racket.

2 Z Y's Children's Corner.

The series of concerts which were broadcast from the Central Hall, Westminster, were very unsatisfactory from the listeners' point of view. They were exceedingly fine concerts, but the acoustic properties of the hall spoil the transmission. We have not yet heard a concert given in this way which has come up to the standard of a studio transmission. Of course, the engineers are not to blame; it is a fault over which they have no control.

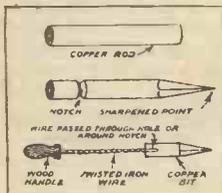
Mr. S. G. Honey's Sunday evening talks to young people are well worth hearing.

Constructional Notes

Conducted by Dr. J. H. T. ROBERTS, F.Inst.P.

Making a Soldering Iron.

If you have the use of a vice and a file, it is a simple matter to make a small soldering iron suitable for the various little jobs involved in constructing your set. Take a short length, about 2 inches, of copper rod, and, placing in the vice in suitable position, file the end, by means of four faces, to a point as shown below. Then file a deep notch round the other end of the rod, and bind some iron wire round the notch, so as to obtain a firm grip, afterwards securing the other ends of the wire in the vice and twisting the copper rod until the iron wire becomes twisted for its whole length, as



shown: a wood handle may then be affixed. If you have the use of a lathe or hand drill, two holes may be drilled through the copper bit at right angles to one another, instead of making the notch, and two iron wires may be passed through, the four iron wires then being twisted together as before.

In using, the "bit" may be brought to working heat in a Bunsen or alcohol flame. It should be removed from the flame when the latter begins to show a yellowish-green coloration, as this is a sign that the iron is getting too hot, and is being burnt. If this should happen, the bit may be cleaned by means of an old file, and freshly tinned. Do not use a good file for the latter purpose, as the solder will fill up the teeth of the file and render it useless.

Trouble with L.F. Transformers.

In a set employing more than one stage of L.F. amplification, it should always be remembered that there is very likely to be interaction between the transformers themselves, particularly if these are mounted in positions favourable to stray magnetic fields from one to another. A few simple precautions will avoid the trouble, if not completely, at any rate to a very large extent. In the first place, the transformers should be placed as far away from one another as the lay-out of the set will allow.

Secondly, they should be mounted so that adjacent ones have their magnetic axes at right angles to one another. In addition to these more or less obvious precautions, the iron cores should be earthed, and, if howling is still persistent, as an extreme measure the transformers, or the whole of the L.F. amplifying unit, may be enclosed in an iron case.

How to Make a Filament Rheostat.

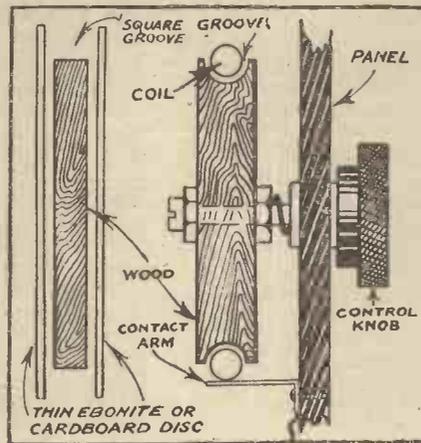
The filament rheostat is one of the most easily made of wireless components, and it is well worth while to have a separate rheostat for each valve. In addition, a vernier rheostat can be made on exactly

the same principle, the only difference being that stouter resistance wire is used in the latter. A coarse adjustment rheostat and a vernier rheostat may be made up into one instrument, or they may be made separately and connected together in series. A simple method of making a rheostat is illustrated in the accompanying figure.

A circular slab of hard wood is obtained, about 2½ or 3 inches in diameter, and about ½ inch in thickness (the exact dimensions, however, are not important). If you have a lathe, this wood disc should have a groove turned in the edge, the diameter of the groove being about an eighth of an inch less than the thickness of the wood.

If, however, means are not available for cutting the groove, the same result may be obtained by attaching to each face of the wood a circular disc of thin ebonite sheet, or even good cardboard will serve quite as well; these two sheets may be screwed to the wood or glued. The diameter of the two discs should be about half an inch greater than the diameter of the wood, so that a square groove is thus formed round the edge of the wood, about one-quarter of an inch in depth.

A hole is drilled through the centre of the wood disc, and a suitable screw-shaft passed through and secured by means of nuts and locknuts. Upon the other end of this shaft an ebonite or wood knob is attached,



spring washers being included for proper fitting in the panel. The resistance coil is made from Eureka wire (about 20-gauge which will be found suitable for general purposes).

Repairing Celluloid Accumulators.

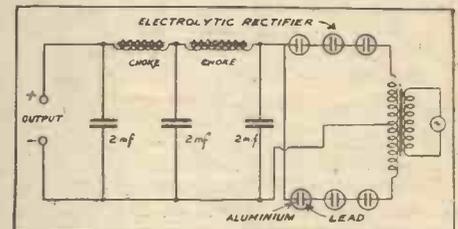
Owing to the bulging of the plates, or to an accident, the walls of a celluloid accumulator case sometimes becomes cracked; this generally happens at the joints. In such a case it is a comparatively simple matter to repair the damage, particularly if it has not been allowed to proceed too far. Empty out the cell, and place it in such a position

that the damaged part is uppermost. Carefully scrape the part clean with a pen-knife, and take a small patch of celluloid from a thin sheet, and clean it in the same way. Now obtain some acetone or amyl-acetate (either of these can be obtained from the chemist) and moisten the damaged part and the patch with the solvent.

As it is becoming "tacky," apply a little more of the solvent, and then place the patch in position and press firmly, maintaining the pressure until there is evidence that the patch is properly adhering: this will take some few minutes, and a little patience is necessary. A little extra solvent carefully run round the edges of the patch will make the work complete. The cell should be allowed at least 24 hours to dry before being again filled up. Of the two solvents mentioned above, amyl-acetate will probably be found most satisfactory, although for rapid work the acetones is quicker drying.

Smoothing Circuit for A.C.

In many cases where an amateur using a straight C.W. transmitter has found himself causing interferences, the trouble has been due to an inefficient filter system, where the interference may be caused by an L.F.—say, 50 or 60 cycles—motor-generator commutator or alternator modulating the output. By means of proper



filters, however, this difficulty can be overcome, and the diagram herewith is that of the "Acme" apparatus, which is claimed to be specially efficient and economical.

The connection for an electrolytic rectifier is also shown. It is essential that the rectifier have sufficient jars (1 per 75 volts), and that it be kept clean at all times. If valve rectifiers are used, the same circuit may be employed, substituting one valve rectifier for each series of jars.

Combined Listening.

There have been a number of devices brought out recently for the purpose of enabling several persons to listen on a set at the same time, without the necessity for having several pairs of 'phones. This is for the obvious reason that extra pairs of 'phones are expensive. Many of the new devices depend upon the use of actual rubber tubes or such-like sound-conducting channels connecting the original pair of 'phones with a series of pairs of ear-caps.

In one device recently patented the 'phone is fitted with a hemispherical air-chamber, upon which are mounted a number of nipples, the rubber tubes being connected to these. It will be noted that this system is similar to that which was employed in the earliest types of phonographs, especially those worked by a coin-in-the-slot system, where several persons were enabled to listen at the same time. The trumpet or loud reproducer was a later development.

SAFETY FIRST FOR VALVE SETS.

A FUSE FOR THE FILAMENT.

By R. A. WATSON.

Amateurs who are constantly experimenting with various circuits should make a point of safeguarding their valves from any possibility of being burnt out through H.T. "shorts" and wrong connections.

NOT many people make use of fuses upon the wireless set, though their presence may save one from those rather expensive misadventures which are apt to occur when a wrong battery connection is inadvertently made.

There are three possible forms of damage that may be brought about by current from the batteries taking a path upon which it has no proper right to be. All of them are costly, and each can be prevented by the use of the simple fuses to be described. In the case of the wireless set, prevention, which is not a difficult business, is infinitely better than cure, which can be brought about only by replacing the damaged parts.

Expensive Accidents.

The first kind of disaster that may result from a wrong connection is the burning out of the filament either of one valve, or possibly of all these upon the set. One high-tension terminal, usually the negative, is already connected to the filament through the low-tension battery. If the other is accidentally brought into contact with it, the valve is instantly ruined to the accompaniment of a blue flash.

What happens is this. The resistance of the filament of an ordinary "bright emitter" valve is usually from 5 to 10 ohms. When this is connected through a rheostat to a 6-volt accumulator, the combined resistances cut down the current to something between .4 and .75 ampere, giving the filament a load which it can easily bear.

But should a wrong high-tension connection be made by mistake, we have a potential of 60 volts or more in circuit with a resistance of, say, 12

ohms. Ohm's law shows us that this would allow a current of 5 amperes to pass.

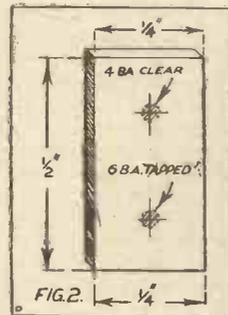
Whether or not the tiny cells of the high-tension battery are capable of delivering this amount even for a fraction of a second, the fact remains that a very high current indeed thus passes, and the filament is burnt out.

Cause of "Buckling."

The second kind of calamity also concerns the high-tension battery. It takes the form of an accidental short circuit of the battery, which may very easily happen if one is careless. Though the valves are not damaged, the battery itself suffers, and even if the short circuit lasts only for a second or two, the efficiency of the battery will be permanently impaired.

If the L.T. is short circuited, the result

will certainly be a ruined battery, and very possibly an equally ruined carpet. The big discharge of current that takes place causes the plates to buckle and, as they do so they often strain the celluloid case so badly that it springs a leak. The accumulator can be damaged not only by a direct short circuit but by an overload. Speaking generally, the load of an accumulator should never



exceed one tenth of its actual ampere-hour capacity, or one-twentieth of its intermittent capacity. Thus the maximum load for a twenty actual ampere-hour accumulator is two amperes, and that for a "fifty," five amperes. If these loads are exceeded continuously, the strain thrown upon the plates will gradually distort them, and the accumulator's life will be very much shortened.

A moment's thought will show how the use of fuses will avert the possibility of any of these mishaps. If we place a .2-ampere fuse in each of the high-tension leads a high discharge can never take place from this battery, since if either a wrong connection or a short circuit is made the fuses will blow before any damage can be done. As they are weaker than the filament they will give out before it, thus saving it from destruction. If an actual short circuit takes place the battery will not be improved by the passage of .2 ampere of current, but it will not be so seriously damaged as would be the case if it were discharged at a much higher rate.

Safeguarding the Valves.

As regards the low-tension battery, we shall be on the safe side if we use in the filament heating circuit a fuse whose "blowing point" is just above the maximum load suitable for the battery. This will give out at once in the case of a short circuit, and should we overload the battery, the burning out of the fuse will give a timely warning. It is much easier than may be imagined to overload a battery unknowingly. Most valves become greedy after a considerable amount of use, and may pass in their old age from 25 to 50 per cent. more current than they needed when new.

The simplest way of guarding the high-tension battery is to incorporate a fuse in each of the wander plugs. Fig. 1 shows how this may be done. Take a piece of 1/4-inch ebonite 1 1/2 inches long and 3/4 inch wide. In one end of it make a 4 B.A. tapped hole to take the shank of a valve pin. Drill and tap a second hole at right

angles to this and running into it. At the top end of the ebonite, drill and tap a third 4 B.A. hole parallel with the second. Now make two small brass strips, as shown in Fig. 2. The 4 B.A. clearance holes Fig. 1. are for the two fixing screws. Into each of the tapped holes is inserted a 6 B.A. screw, which is turned down until its head almost touches the clip. Its shank is then cut off close to the underside of the clip, and riveted by being tapped lightly with a hammer. Insert the valve leg, and attach the H.T. lead, placing the clips under the screws sec (Fig. 1.)

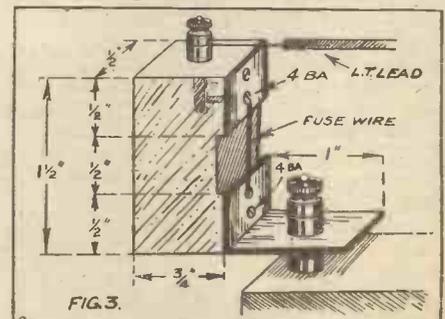
Another useful fuse to insert between the H.T. positive and the set can be devised out of a pocket lampholder and a small 2 1/2 or 3 volt pea-lamp. This, inserted in series with the H.T. supply constitutes a perfectly reliable fuse and will blow long before any harm can come to either valve or battery.

The L.T. Fuse.

Now take a short piece of No. 40 resistance wire and stretch it between the two screws, as shown, working it under their heads and winding the end round two or three times. The safety fuse is now complete and ready for use. To prevent the fine fuse wire from being broken accidentally whilst the plugs are being removed, a guard of thin fibre may be made which is held in place by a couple of screws, or the wire may be placed between two sheets of mica.

Fig. 3 shows a low-tension fuse, which consists of 1/2-inch ebonite cut to a length of 1 1/2 inches and a breadth of 3/4 inch. The clip at the lower end is provided with a hole large enough to allow the shank of the accumulator terminal to pass through it. At the top end is a terminal inserted into the ebonite with which a screw makes contact after passing through a small piece of sheet brass. The surface of the ebonite is cut away to a depth of about 1/4 inch between the two clips, and a piece of standard tin fuse wire is stretched between two screws, as shown.

Wire of a suitable gauge having been chosen, and a fuse fitted to both terminals, the accumulator may be regarded as safe from damage from either an overload or a short circuit.



“ THAT SUPER SET.”

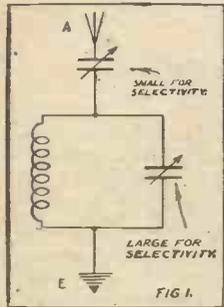
H.F. WORK FOR THE AMATEUR.

By Captain P. P. ECKERSLEY (Chief Engineer, the B.B.C.).

Captain Eckersley has written this article on the difficulties of high-frequency amplification in his usual and inimitable style, and in it the reader will find some technical observations of great value to home constructors.

I AM going to think on paper, and for any who care to read there it will stand—my technical ramblings in all their crudity.

I am going to think about that super set we all dream about; that set which has one knob with a nice movement, and a calibration chart saying: 2° K D K A, 2-5° W G Y, 18° Sheffield, and so on; the set that never distorts; that is sufficient for a station of 10 kw. at half a mile; a set which will cut out that station to get any of the rest. Vain dream, hopeless longing, would not the charm of wireless die before its realisation? But an interesting technical subject to find out how near we can get to the ideal.

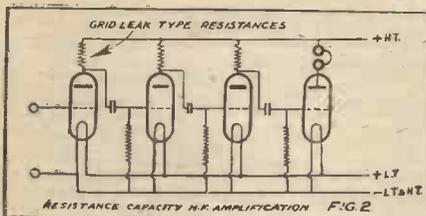


First, I set myself the ideal of simplicity in operation. Yet, there must be reasonable selectivity. I plump for a circuit first shown me by my friend and late colleague, N. Ashbridge, who, as always, hides his very great light under one of the bushiest of bushels. This circuit is shown in Fig. 1.

Surprising Selectivity.

Its virtue is that an amazing degree of selectivity, considering its simplicity, may be obtained. Make the series condenser really small and the parallel rather big, and see. Living at Witham, in Essex, I used to sweep round my parallel condenser and get all the stations as easily as if they were hundreds of metres apart. Add, if you like, a good coupled circuit, and you have a very pretty compromise.

Now, your idea is to go from a few hundred metres up to several thousands, and here comes the rub. For an amateur set I much prefer replaceable coils. All



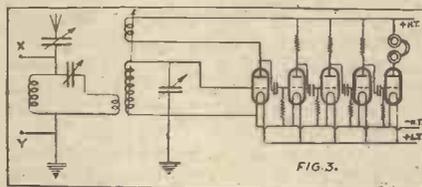
the troubles of end effects die before this simple solution. When I was by way of being responsible for the design of commercial sets, I wasn't allowed to let anyone do these short cuts. No one but a con-

vinced enthusiast who doesn't have to change quickly from station to station would ever take the trouble to operate such a set. But, seeing we are enthusiasts and stay some while at each station, we plump for replaceable coils.

Need for Simplicity.

The difficulties of high-frequency magnification in several stages are pretty acute if we are to go from 100's to 1000's to 10,000's of metres with one system, and SIMPLY. This is the great point I have in mind all the time—*simply*. Simplicity must mean compromise and to an extent inefficiency, but you can't have everything. I am just writing of the set I would have.

Now, high-frequency resistance capacity magnification is very adequate down to 300 metres if proper precautions are taken, although I must admit that at 300 things are getting a bit nasty, and great precautions have to be taken. Never mind, nearly all broadcasting stations that you may want to hear individually are above 350 (below, relays only repeat what main



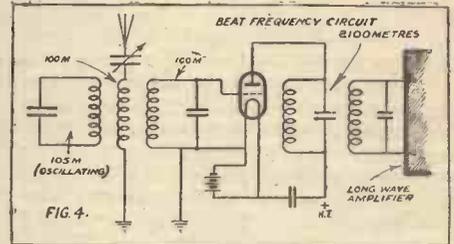
stations are saying). Thus, I plump for resistance capacity; but you must remember two things.

Capacity between anode and earth, even to the extent of a four-pinholder, may ruin everything, and therefore low capacity type valves, short "grid leak" type of resistances *must* be used, and you can spend some ingenious hours planning how to keep leads shorter than 1/4 of an inch in a circuit (resistance capacity) of the type shown in Fig. 2. It can be done, and you will, I hope, try it one day. The intervalve condenser at the last stage wants to be *very* small, when the hiss incident to the use of carbon type leaks will disappear.

The Supersonic Receiver.

Reaction is obtained as shown in Fig. 3, where the two systems are brought together to form tuner and high-frequency amplifier to go from 300 to 5,000-10,000 metres, what you will. I should use two stages of high-frequency magnification, or, if you will, three, but take care, or you may, if you are not careful to space everything out, get howling. Three is certainly a more adequate number. The net result will be little better than a two-valve circuit using tuned anode and

reaction on the shorter waves, but it will score on long waves, and *it will be simpler to use*; it will have an adequate factor of safety. The tuned anode circuit is certainly a fine circuit in many ways, but with reaction I have often found it a little "comic." I prefer my friend above, but do remember this is purely thinking on paper. Don't follow my advice necessarily. I am no genius!

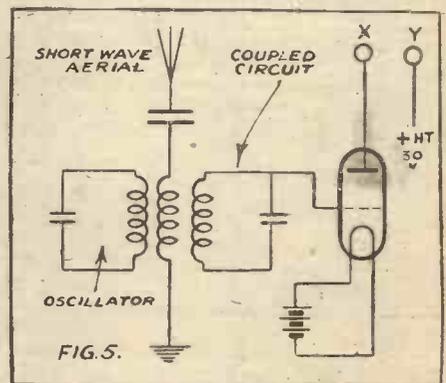


Now, turning to the receiver, for short waves. I am open to correction, but for a really simple set give me the Armstrong supersonic, and therefore our present design adapts beautifully to an attachment for waves below 300.

The Armstrong circuit is shown in Fig. 4. It consists, as you all doubtless know, of an ordinary aerial circuit and another circuit oscillating, inducing into the aerial circuit a frequency slightly different from the received frequency. The difference of frequency is made through a rectifying valve, to yet another circuit tuned to the difference of frequency into oscillations.

Doing it in wave-lengths you receive 100, say; you induce by a separate oscillator 105, say, and you will find that these two produce a wave-length by beating together of

$$\frac{100 \times 105}{105 - 100}$$



or 2,100. This 2,100 wave-length can be amplified at a long wave-length, and no high-frequency magnification at short wave-lengths need be carried out.

"The P.P.E. No. 1."

Fig. 4, the theoretical diagram, I have marked the wave-length of the various circuits. In Fig. 5 I have used my original tuner as the long wave circuit (coupled circuit *must* be used, and my Armstrong attachment is the only extra). It is very clever, and we may call it the P.P.E. No. 1 circuit, inasmuch as it is the first I have ever published belonging to someone else.

Mainly About Broadcasting

by The Editor

THE recent announcements made in this journal about the summer programmes of the B.B.C. have resulted in a revival of heated correspondence between many of my readers concerning the suitability of the B.B.C.'s programmes as a whole.

On an average I receive at least twenty letters a day from readers dealing solely with the B.B.C.'s programmes.

Many of them, I regret to say, are couched in such positive language—the pros and the cons are weighed up with such vehemence—that it is not possible to publish more than a few of them in POPULAR WIRELESS.

Right and Wrong Criticism.

Please don't think that all such letters contain adverse criticisms of the B.B.C. programmes. By no means; it is a case of fifty fifty.

But the fact remains that one of the most burning of all radio questions is the question of the programmes. And so far as I can see it's going to go on burning for as long as broadcasting lasts. The trouble is that the majority of listeners have receivers capable of only picking up concerts from their local station. I very seldom receive letters of dissatisfaction from readers who can switch on to any particular station they wish. In such cases the programmes offer such a variety that high-brows, low-brows, and middle-brows are all adequately catered for.

But when a listener, by force of circumstances, is restricted to the reception of one broadcasting station, then there is a justifiable explanation for the letters I am constantly receiving.

Let me make it quite clear that I can do nothing for such correspondents beyond publishing in this journal a summary of their complaints. I have absolutely no influence with the organiser of programmes; it is entirely out of my province; but I can ventilate the opinions of readers in POPULAR WIRELESS, and at all times am pleased to do this providing such opinions are sent to me in language suitable for publication and providing they contain constructional criticism. Destructional criticism is useless; there is absolutely nothing gained in calling a programme "high-brow" and by pouring scorn on it.

Copyright Music.

One reader suggests in a letter that the musical directors, controllers and critics of the B.B.C. are too cultured and too imbued with the love of classical music to appreciate and understand the needs of a popular public. I cannot agree with this. The reader must bear in mind that a good deal of the present day popular music is copyright and permission to broadcast, even if obtained, necessitates the payment of sometimes exorbitant fees.

A vast quantity of classical music is, of course, out of copyright, and can be played by the B.B.C.'s orchestras.

"Tuneful" Pieces.

Permission has recently been obtained to broadcast excerpts from Gilbert and Sullivan operas, but this concession on the part of the owners of the copyright of the music has not been given without financial consideration. I am inclined to agree with readers who think far too much chamber music is broadcast and that equally too much attention is paid to sixteenth century composers.

There is a considerable amount of classical and semi-classical music which is essentially "tuneful"—a quality desired by ninety-nine listeners out of a hundred.

For instance, there are dozens of pieces by Mendelssohn, Liszt, Grieg, Schumann,

items you like and those you don't like, and see if the two lists you make do not, on a week's average, balance fairly evenly. And if they don't, I would like to hear from such readers who fail to find in the B.B.C.'s programmes at least 50 per cent of entertainment which appeals, and I would like to have the lists they have compiled for publication in this journal.

B.B.C. Revenue.

Questions were asked in the House of Commons the other day concerning profits on broadcasting.

The Postmaster-General, in a reply to a member, said he had no specific information as to whether the proposal to broadcast the King's speech at the opening at Wembley had led to an enormous increase in the sale of wireless apparatus. The B.B.C. did not manufacture or sell wireless apparatus, and he saw no reason why increased sales by other firms should affect the arrangements under which the B.B.C. were licensed to undertake broadcasting in this country. A member asked whether the profits from the B.B.C. were not greatly in excess of the anticipations when the company was formed and another question was whether the Postmaster-General intended to maintain the embargo on foreign sets. The Postmaster-General replied that with reference to the profits under the terms of the licence issued to the B.B.C., the company could not distribute more than 7½ per cent to their shareholders. Any additional profits must be used in developing their service.



Tuning-in on a liner. European signals are coming through whilst the vessel is in New York harbour.

Schubert, Chopin, Saint Saëns, and others, which cannot fail to appeal even to the veriest low-brow. I suppose every patron of a cinema is familiar with "Liebesträume," by Liszt, and the Second Hungarian Rhapsody, and parts of the E flat Concerto, "Peer Gynt," and the A minor Concerto by Grieg are really tuneful, jolly pieces too, and the C sharp minor and the G minor Preludes of Rachmaninoff are both very popular.

Analyse the Programmes.

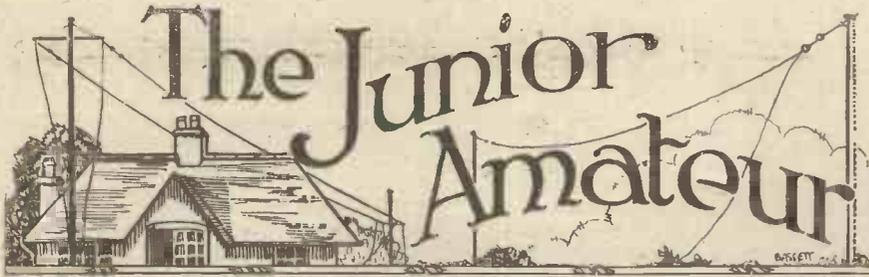
Manchester recently broadcast Franck's "Accursed Hunter," and I think most listeners who heard it will confess it gave them pleasure.

But I do ask readers to take up a copy of the B.B.C.'s official organ and to carefully analyse the week's programmes for their local station and to impartially consider whether or not the B.B.C., on the whole, do not provide a musical fare which is suitable for such a varied audience. Do not pick on one particular item that makes absolutely no appeal to you as an individual, and do not damn the whole programme because of it. Pick out the

Heavy Expenses.

I hope the Postmaster-General reply concerning the B.B.C. profits will amply satisfy those readers who have lately sent me letters suggesting that the B.B.C.'s "vast revenue" is more than they know what to do with, and that the income from royalties and licences is now so large that a reduction in licence fees might be made.

Admittedly, the B.B.C. revenue is very large, but their expenditure in maintaining the best and most efficient broadcasting service in the world is also very large. Private lines from 2 L Q to all the other stations are not lent by the Post Office for nothing. I believe they cost anything from £50 to £80 a night. The many artistes daily engaged to broadcast results in a very substantial weekly bill, and the constant experiments and improvements being made on the technical side—all for the ultimate good of the listener—account for a considerable yearly sum, and I think the majority of listeners will agree with me that the B.B.C. are not making the vast profits some people think they are.



A Section Devoted to the Interests of the Younger Constructor.

THE CONSTRUCTION OF VARIOMETERS.

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

A VARIOMETER consists essentially of a "split" inductance in which two symmetrical windings are so disposed mechanically that they may be placed in varying relationship with each other. Thus we may have a coil the inductance of which is of the value X , and by connecting up a coil of equal value, so that the effect is cumulative, the resultant inductance is represented by $4X$.

On the other hand if the combination is such as to be in *opposition*, the inductive effect is practically nil owing to the action of one coil neutralising the action of the other. From this it will be gathered that if we provide the two coils with a suitable mechanical movement we may vary the mutual inductance within the limits of the device at will.

Fine Tuning Obtained.

The regulation is thus so fine that a condenser may be dispensed with, over average wave-lengths, and the tuning device reduced to comparatively simple terms. The beginner will do well to start with a simple form of instrument, as shown in Fig. 1. This consists of two spider web coils, $3\frac{1}{2}$ in. outside diameter, $1\frac{1}{8}$ in. centre, each coil being wound with 44 turns, 22 turns a side, of No. 28 D.C.C. wire.

The coils are connected in series, viz. "outer" of first coil to "inner" of second coil, and mounted upon hinged panels, which can be opened and closed like a book.



Fig. 1. A simple spider-web coil variometer which is easy to make and provides very efficient tuning.

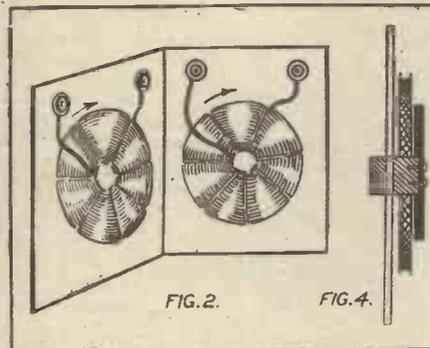
By varying the position of the coils, the inductance, and therefore the tuning, may be regulated at will.

If the windings are brought out to separate terminals, as shown in Fig. 2, a variety of connections may be made and a handy and very compact tuner is the result, well suitable for portable work.

Compact Instrument.

For a tuner of this type, two coils may be made up, one with 30 turns a side, and the other having 40 turns a side, viz., 60 and 80 turns respectively. Coupled in series, a slightly unsymmetrical, but quite efficient, variometer is the result; used separately the larger coil with a .001 condenser in series will make a good A.T.I. with the smaller coil as reaction.

Various combinations may be made where condensers are available, and where these are not to hand, a moment's work changes the device into a variometer.



The writer has one of these devices in constant use, and finds it entirely satisfactory on moderate wave-lengths.

Where a compact form of instrument is desired, as in the case of a portable set, the basket type, as shown in Fig. 3, can be recommended as efficient and quite easy of construction. As basket coils are inherently weak structurally, the great point to observe in this type of variometer is mechanical strength in mounting, and efficient contact between the stator—i.e. the fixed coil, and the rotor, or moving coil.

Constructing the Coils.

To construct this instrument, a "spider" is made by inserting 9 pins, of cycle spoke, 3 in. long, into a cork $1\frac{1}{4}$ in. diameter by $\frac{1}{2}$ in. thick, the pins being set equi-distant round the circumference of the cork hub. Two 25 ft. lengths of No. 26 D.C.C. are measured off, and the winding commenced from the hub of the spider in a clock-wise direction.

To make the coils more compact and robust, the winding is taken over two

spokes, under two spokes, and so on, instead of the usual plan of missing one spoke only. This makes the coil less in diameter, but considerably thicker and much more easy to handle and mount, as when finished it has considerably greater strength than the ordinary pattern.

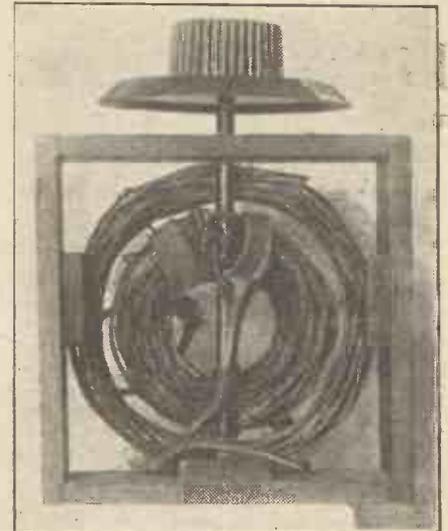


Fig. 3. A useful basket-coil variometer.

Having accounted for the first part of the winding—i.e. the rotor, we wind on a few turns of string, about $\frac{3}{8}$ in. in length, and continue with the second length of wire until the stator winding is complete.

The windings are now lightly treated with rather thin shellac, keeping the string clear of the varnish, and the whole set aside in a warm place until quite dry. When quite dry, the string is carefully cut away, and the pins removed from the spider hub. We now have two concentric coils, which are to be mounted in a wooden frame $3\frac{1}{4}$ in. square, inside, the material being 1 in. by $\frac{1}{4}$ in. thick.

Fixing the Rotor.

The top and bottom pieces should be centred and marked out together, and the top piece bored to take the shaft, which is $\frac{3}{8}$ in. hard wood rod. The bottom piece is provided with a small block, bored an easy working fit to act as a bearing. The stator is fixed by small wooden blocks at the edges, the spindle is placed in its bearings, and the position of rotor marked.

The rotor is now fixed to the shaft by running the latter through a cork, the original hub will do, and the coil having been pressed over, the cork is secured by a piece of wood or thin ebonite pinned through, as shown in Fig. 4.

This is an improvement on the method used in the photograph in which the rotor has been lashed to the shaft with fine cord, and wedged up tight with small



Fig. 5. Cylindrical type.

(Continued on page 470.)

AN AMAZING WORK

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- What is retroaction?
- What do you know about microphones?
- Can you sketch out the circuits of a valve telephone transmitter?
- How does one obtain direct current from alternating current for the plate voltage of transmitting valves?
- How does radiation leave the aerial as ether waves?
- Can you describe the component parts of a wireless receiver?
- How can house wiring be used as a receiving aerial?
- How can you rectify by means of a simple resistance?
- What is Langmuir's theory of the atom?
- Do you know the circuits employed by the leading manufacturers for their crystal receivers?
- What are the sunrise and sunset effects?
- How can one obtain L.T. and H.T. from the house-lighting mains?
- How can one detect faults in a receiver?
- Do you know how to test your receiver?
- What is the best aerial to erect for broadcast reception?
- How should one treat accumulators?
- What testing instruments should be used when overhauling your receiving and aerial circuit?
- If you are in doubt about any wireless terms consult the glossary.

For nearly 30 years the author of this wonderful work has been intimately associated with every aspect and development of Wireless Telegraphy and Telephony. He has "demonstrated" in all parts of the world and, apart from his services to various Governments and to the Marconi Company, since 1915 he has been editor of the **Handbook of Technical Instruction for Wireless Telegraphists**, the standard handbook for training ships' operators. Mr. Dowsett is thus thoroughly equipped, not only because of his scientific training as an electrical engineer, but also by reason of his extraordinary *practical* experience, to produce a work of the highest authority. A glance at the contents of these volumes will show their wide scope, but even a cursory examination of the books themselves would prove they contain a mass of information, of photographs, and of diagrams unequalled in any other work yet produced.

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PLEASE WRITE CLEARLY.

THE CONSTRUCTION OF VARIOMETERS.

(Continued from page 468.)

wooden "keys" treated with thick shellac. The outer of stator winding is left open, and the inner soldered to a few inches of flexible wire, the other end of which goes to the outer of the rotor.

The inner of rotor has a similar flexible connection enabling the circuit to be completed while preserving freedom of movement. A knob and scale fixed with a grub screw completes the instrument, which will cover the broadcast wave-length and prove very satisfactory at a cost of less than half-a-crown. The spindle, where it passes through the bearings, may with advantage be treated with blacklead, which conduces to smooth and silent working.

A More Rigid Type.

Those workers who prefer the cylindrical type, as shown in Fig 5, will find the following dimensions suitable for the broadcast wave-length. Stator 4 in. diameter by 2½ in. long; rotor 3 in. by 2 in., stator 30 turns, rotor 34 turns, No. 24 or 26 S.W.G., D.C.C.

Fig. 6 shows the unwound formers complete mechanically: the work should be satisfactory as to clearance, etc., before any winding is undertaken. The question as to gauge of wire is rather a debatable point.

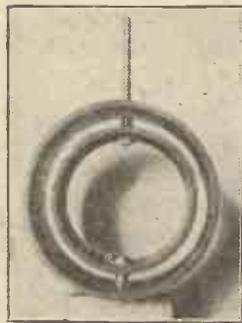


Fig. 6. The unwound formers.

On the one hand, if we use large wire we obtain low resistance—i.e. low ohmic resistance, at the expense of increased distributed capacity, and on the other hand, if we aim at very low capacity we are apt to increase the resistance considerably. As a fair compromise, 24 to 28 S.W.G., D.C.C., will be found quite satisfactory and easy to wind and handle generally; avoid enamelled wire.

The majority of cheap variometers are greatly lacking in mechanical stability, and have faulty connections between the fixed and moving parts. Wires merely hooked under spring washers and nuts so placed as to become loose when rotated are a perfect abomination and a source of endless trouble. The best place for this type of instrument is at the back of the nearest and hottest fire!

Electrostatic Losses.

Metal shafts such as long 2 B.A. rods running right through both stator and rotor are to be avoided as an often overlooked cause of losses. For tuned anode work the variometer deserves to be used far more than is generally the case, particularly in portable sets, where the bulk of variable condensers is an undesirable feature.

The finished instrument may very well be mounted in a cabinet and fitted with a knob and dial uniform with the condenser,

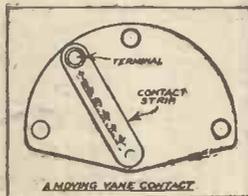
which not only provides proper protection but affords a very pleasing finish.

The range of the instrument may be increased by placing a small fixed condenser across the outer terminals, the value being about .0002 varying, naturally, according to the capacity and inductance of the aerial.

Provided care is taken to ensure good work at all points, highly satisfactory instruments may be made "at home" with the simplest workshop equipment.

VARIABLE CONDENSER CONTACTS.

THE amateur who builds his own variable condensers usually has some difficulty in providing for a reliable contact between the spindle carrying the moving vanes and the terminal from which the lead is taken. The method here described has been found quite satisfactory and, moreover, has the merit of extreme simplicity.

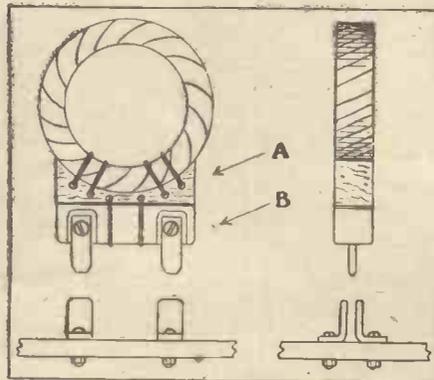


Assuming that the end of the spindle protrudes beyond the ebonite end piece, a length of springy brass of suitable length is taken, and a depression formed in one end with the aid of any round-ended instrument. The other end is drilled to take the terminal.

By laying a nail lengthwise along the brass strip, and tapping it with a light hammer, a corrugation will be formed, thus accentuating the degree of natural spring in the brass. When in position the round depression should be arranged to come over the protruding end of the spindle, the contact thus formed being perfectly satisfactory. The idea is shown in the figure.

A CHEAP COIL MOUNT.

OLD porcelain fuse fittings lying about in the writer's workshop were rated as junk before the conception of the little idea outlined below. Now, however,



they are comparatively important wireless components, serving as plug-in mounts for home-made honeycomb coils.

A small block of wood, A, is shaped as shown, and securely attached to the coil by means of a piece of strong cord.

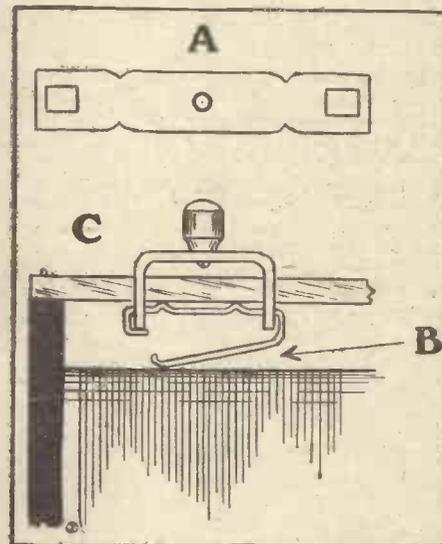
Easily Made Coil Holder.

The block is then similarly attached to the top of the porcelain fuse-holder, B, a little secotone being applied if necessary. The two ends of the coil winding are preferably soldered to the upper portions of the copper clips.

When a single coil is required, as in the case of a loading coil or a simple intervalve coupling, such an arrangement will be found quite satisfactory. The idea might be modified by mounting the sockets on movable members to function in the same way as the usual two or three coil holder.

A NEAT SLIDER.

A VERY efficient little slider for use with a potentiometer or other device where a perfectly smooth rubbing contact is desirable can be easily made up from a few pieces of scrap material in the manner to be described. A piece of sheet

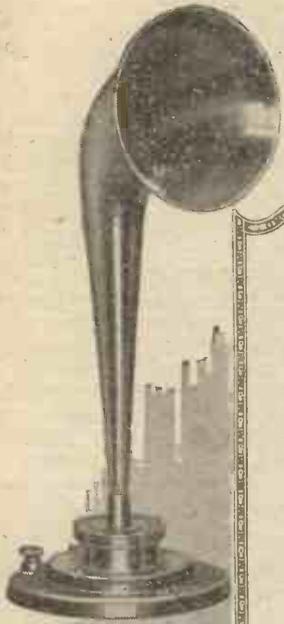


brass about ½ in. in thickness by 2 in. long is cut out as shown at A and provided with a rectangular hole at each end and a small screw-hole in the centre.

The width of the strip will depend on the size of the square rod to which it is to be fitted—i.e. if the rod is ¼ in square section then the rectangular holes will be slightly more than ¼ in., and in this case the strip should be about ½ in. wide.

Smooth Contact Provided.

It is then bent as shown at C and provided with a small ebonite knob. A thin strip of spring brass, B, equal to the width of the slider rod is then shaped and fitted as shown, the two small pointed bends being arranged to make good contact with the underside of the rod and the lower end with the bared portion of the coil winding, and forming an ideal slider.



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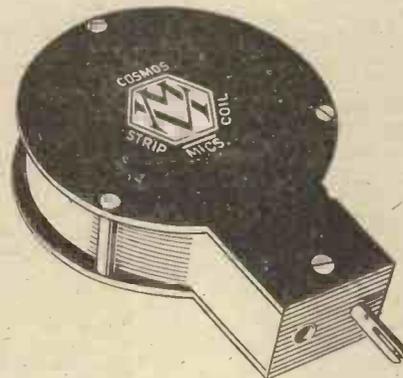
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LONDON: 142, Gt. Portland Street, W.1.
LEEDS: 94, Albion Street.
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- MINIMUM RESISTANCE
- LOW H.F. RESISTANCE
- SOUND CONSTRUCTION
- ENTIRELY ENCLOSED
- NEAT APPEARANCE



The figures given below are the results of tests carried out by the NATIONAL PHYSICAL LABORATORY. Attention is directed to the important fact that the self-capacity is smallest in the coils for short wavelengths.

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			.0001 mfds.	.0003 mfds.	.0005 mfds.	.001 mfds.	
25	25	10	100	165	215	300	4 9
35	50	10	145	235	300	425	4 8
40	100	10	200	335	425	600	4 9
50	150	10	245	410	520	735	4 9
75	300	10	340	575	740	1040	5 0
100	700	11	530	880	1130	1590	6 0
150	1000	16	640	1060	1360	1900	6 6
175	1400	18	765	1260	1610	2250	7 0
200	2500	17	1020	1680	2150	3000	7 6
300	5000	24	1490	2410	3060	4260	8 9
400	9000	28	2030	3250	4130	5740	9 9

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A VISIT TO THE SHEFFIELD RELAY STATION.

(By OUR YORKSHIRE CORRESPONDENT.)

Some additional details concerning one of the most interesting little stations in the country.

IN a romantic old building in the smokiest part of a smoky city one finds the Sheffield station of the British Broadcasting Company: The building is the Union Grinding Wheel, a factory over a hundred years old, from which a piece has been cut off to house the modern wireless wizards and their apparatus.

On entering, one discovers a tastefully decorated office, a studio, and a control room. It is the Children's Hour. Mr. H. C. Head-Jenner, the station director, as "Uncle Herbert," is disporting himself in the studio along with Uncle Harry, Auntie Evelyn, and the Dream Lady. The studio is used nightly for the Children's Hour and for the "local night" every Friday. It is draped with a single layer of green cloth. Experience has revealed the fact that it is best not to eliminate every echo by using several layers, as was done in the early days. A few chairs, a piano, the jazz music outfit, and Mick, constitute the furniture.

Two Microphones Used.

Mick is the microphone, in outward appearance a box on legs. The front of the box is covered with green baize, behind which rest two microphones. The theory is that two microphones give a "stereoscopic" effect and are thus better than a single one, in the same way that two ears are better than one. This is one of those unique features which one continuously comes across at Sheffield. The microphones themselves are unusual, as they utilise permanent magnets instead of electro-magnetic fields.

Sheffield, I understand, is the only station where the transmitting room is also used as the control room, the engineer thus having all the controls and meters under his eye at the same time. The present engineer-in-charge, Mr. Harry Lloyd, M.E., lecturer in wireless at Sheffield University, will be resigning shortly, and his place will be taken by Mr. A. W. Birch, from the Aberdeen station. Mr. Lloyd has supervised Sheffield broadcasting since the days before the present station was opened, when a regular service was carried on from the private residence of the President of the Sheffield Radio Society. The studio was an Army-blanket-draped drawing-room, the transmitter was in the garage, and the amplifier in the stables!

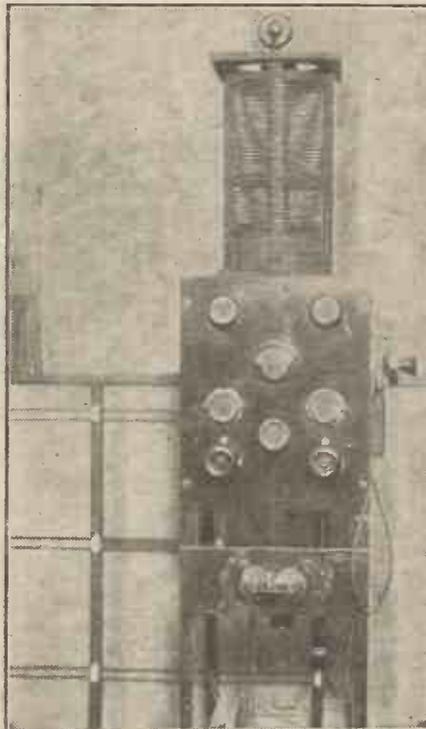
Checking the Transmission.

The Broadcasting Company has not yet stated whether new apparatus is to be installed when the power at Sheffield is increased. A new motor, however, has arrived.

The present apparatus works on a modified choke control system. The oscillator valve is fed with 1,500 volts high tension and $9\frac{1}{2}$ volts low-tension current. The two modulator valves are dull emitters. There are nine stages of speech amplification, the first four valves being slung on rubber,

and the others standing on felt in order to eliminate vibration.

The transmission is checked on two crystal sets. One stands on the control table and, needless to say, requires no aerial. It works two loud speakers and a pair of telephones. The other set is at the Mappin Hall, Sheffield University, some



Part of the transmitting set at the Sheffield relay station

considerable distance from 6 F L. This set is permanently wired to an aerial and tuned to Sheffield's wave-length. Its telephone terminals are connected to a land-line. The other end of this land-line is in the control room at the station, and is connected to a pair of 'phones. Thus the engineer can listen on a crystal set some distance away, and ascertain exactly what is going out.

Relaying Paris Transmissions.

Four buttons above the table, with the legends "O.K.," "Come Closer," "Move Back," "Stop," are arranged to light up green, yellow, blue, and red lights respectively in the studio. The director moves the speaker or singer according to the signal given in this way by the engineer.

Primarily, Sheffield is a relay station. On the table stands a private telephone to Birmingham. When the Birmingham programme is to be relayed a switch nearby is thrown over from the "local transmission" position to "relay," and connects the private wire to the input of the transmitter.

Relaying by wireless via the B.B.C. receiving station at Greenhills, near Sheffield, is also carried on, and the relaying of the Eiffel Tower programme during the Children's Hour is a regular feature. The orchestra of the Albert Hall, Sheffield, is also frequently relayed.

The four-wire cage aerial is attached at a height of 130 feet to a factory chimney, and runs to a pole 160 feet away and 60 feet high. Two earths are used—a counter-poise under the roof, and a water-pipe.

The popularity of 6 F L can be gauged by the fact that an average post-bag of one hundred letters is received every morning, and that while nearly six hundred congratulations on the transmission have been received, there have been only five complaints. Some four hundred and fifty children have joined the Sheffield Radio Circle.

Thousands of people stood in the spacious square in front of the Leeds Town Hall on that memorable Wednesday and listened to the King's Speech, delivered to them by fourteen loud speakers placed on the statues in the square.

Technical Notes



CONDUCTED BY J.H.T. ROBERTS, D.S., F.Inst., P.

A Simple Winding for Coils.

A SIMPLE method of winding a coil of low self-capacity, suitable for broadcast wave-lengths, is as follows: A former of suitable insulating material is obtained, which should be about 5 in. in diameter, about $\frac{3}{8}$ in. in width, and say $\frac{1}{4}$ in. thick. The outer edge is marked off with 48 points (this may be easily done by means of a pair of compasses), the radius of the "former" going round the circumference six times.

The six divisions thus obtained may then be further sub-divided into 12, again into 24, and again into 48. If desired, the divisions can be carried to 96. Assuming there are 48 divisions, a slot being cut at each point, the winding is started at one slot, and laid across

the former to slot No. 17, then across the other surface of the former to slot No. 33, then across again to slot No. 2, then 18, then 34, then 3, 19, 35, and so on.

Static Eliminator.

A recent patent for the reduction of the interference due to static makes use of a method of producing a partial separation between signal impulses and static or other strays by using two or more aeriels, one of which is more receptive to the signals, whilst the others are more receptive to the strays. The aeriels are then opposed electrically, so that the effect of the strays in the signal-receiving aerial is more or less neutralised.

(Continued on page 482.)

“UNIDYNE”

ELIMINATE H.T. WITH “SUCCESS”
HIGH RATIO TRANSFORMERS

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 25 to 1 } each

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AN ANNOUNCEMENT of interest to the Trade and Public will be published in the next issue of this journal.

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Artistes of the Aether

SOME OF THE ARTISTES WHO HAVE GIVEN YOU PLEASURE WHEN LISTENING IN



THE news that Mr. Dan Godfrey is to assume control of London's music is highly satisfactory for if we are to judge by the results obtained at Manchester during his directorship, the programmes at 2 L O should be materially improved.



Capt. Herbert Heyner.

varied experience than this famous baritone, who has for many years occupied so important a position as leading concert singer, who has a repertoire extending over a hundred oratorios and choral works. For years, too, he has been acknowledged as one of the foremost vocalists at Albert Hall and Queen's Hall, as well as at the provincial festivals. Captain Heyner studied operatic rôles under Victor Maurel, the great French baritone, and was on the way to becoming a great opera singer, for his Amfortas in "Parsifal" at Covent Garden and the provinces with the British National Opera Company established him as both singer and actor too. But the war curtailed his career and as captain he took an arduous part till severely wounded in 1916; he was in hospital for three years.

The highbrows had it all their own way when the two septettes, comprising Messrs. Elie Spivak, Leonard Rubenstein, Theodor Otcharkoff, Claude Hobday, Frederick Thurston, Frank Probyn, Ernest Hinchcliffe, George Whittaker, and Charles Leggett, played Beethoven's Septet in E flat and Saint-Saëns's in E flat. It was chamber music of the highest kind, but, frankly, the latter alone with solos from the individual players would have been a wiser choice.

2 L O's Popular Light Orchestra.

An ambitious choice was made by Mr. Casson during an evening of plays with Ristand's "Fantasticks," but with Ivan Berlyn and Dorothy Holmes Gore in the cast it was safe to expect satisfaction. We have had better plays from Miss Gertrude Jennings than "Living As We Do." The outstanding success was the fine playing of the 2 L O light orchestra.

Gounod's "Faust" can always be relied upon to appeal widely, and Mr. L. Stanton Jefferies has the support of many of the British National Opera stars, including Messrs. John Perry, Joseph Farrington and William Michael, and Mesdames Beatrice Miranda and Constance Willis. Another favourite singer is Mr. William Anderson, a well-known member of the B.N.O.C.; he has sung in most of the operas broadcast.

The Central Hall Echoes.

Before leaving London, mention must be made of the sixth and last of the present series of Symphony Concerts. It is to be hoped that the next series will be given at some other hall. Not that there is any complaint to be made of Central Hall when the works are heard in the actual hall itself, but "across the aether" the echoes spoil a great deal of the effects, and it has been

she won the senior gold medal of the Associated Board against 4,000 competitors. Since then full honours have been hers all over the world. Her instrument is a Peter Guaneries, presented to her by an American lady, and cost 2,000 guineas.

It has been left to the Northern cities, Glasgow and Aberdeen, to broadcast the big things of the week. Glasgow particularly distinguished itself in a performance of "The Valkyrie" (Wagner), with Messrs. Robert Radford, John Perry, and Miss Mary Blythe, all British National and Carl Rosa Opera stars, as principals. Another fine programme was that promised on their French Composers' Night, and here a wide field was open, for it is safe to say that for modern music few countries have outrivalled the French. Amongst the composers, therefore, were Saint-Saëns, Halévy, Massenet, Berlioz, Chabrier, Bizet, all of whom have written some of the most beautiful music in the world. It was a night of nights.

Old Favourites.

Humour was the aim of 2 B D, and their Repertory Players chose a good medium in Planche's comic drama "The Jacobite," and Harold Chapin's "The Philosopher of Butterbiggins." Later in the week, the evening devoted to Overtures by the wireless orchestra, followed by a talk on its history in music by Professor Albert Adams, F.R.C.O., who gave wide illustrations, ranging from Handel's "Messiah" to Monckton's "Arcadians."

The end of a perfect week saw also Offenbach's finest comic opera, "La Fille du Tambour Major," with the principals from the Lyric Club, Glasgow.

Comic opera also served Bournemouth well, and one might say as fine a selection was made as any possible. Sullivan's



Supplying the music during the children's hour at 5 S C. Left to right : Uncle Alex, Auntie Owen, Uncle Mungo, and Auntie Cyclone.

easier to hear the coughs and, in many cases, the remarks of the audiences rather than the orchestral nuances.

Successful Scottish Programmes.

Of Sir Edward Elgar's work and honours there is little need to dilate. A whole Festival has been given of his works, and few other musical festivals are reckoned complete without at least one of his works. Best known to the general public are "The Dream of Gerontius," first produced at the Birmingham Festival in 1900, and the familiar "Cockaigne" Overture, 1901, and the "Enigma" Variations, 1899, both of which were again broadcast, as well as the almost hackneyed "Pomp and Circumstance" March, and "The Wand of Youth."

The fame of Miss Beatrice Harrison, soloist for Sir Edward's violoncello concerts, has gone far and wide since, at the age of ten,

"Emerald Isle," "La Poupée," "The Little Michus," "Dorothy," with the time-honoured "Queen of My Heart," "Princess of Kensington," "Rip Van Winkle," and "Les Cloches des Corneville," all these must have set the heads a-nodding and hearts a-throbbing of the older generation, as it revived the days of their youth. Bournemouth, too, has a fine singer in Mr. Herbert Smith, who is a well-deserved favourite, and has sung on several occasions.



Mr. Herbert Smith.

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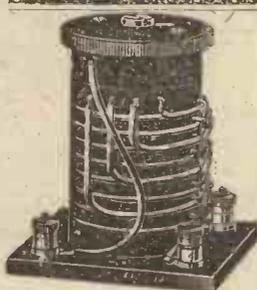
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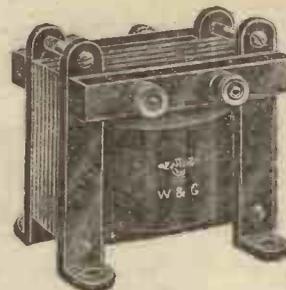
Highly efficient instruments, giving maximum results. No. N54/100, suitable for Panel Mounting, 22/6. No. N54/500, Plug-in Type, fitted with 4-point Double Pole Switch, 24/-. No. N54/200, as illustrated, mounted on Ebonine Base, fitted with 4-point Double Pole Switch, 24/-.


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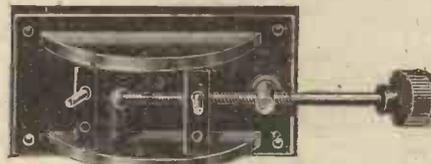
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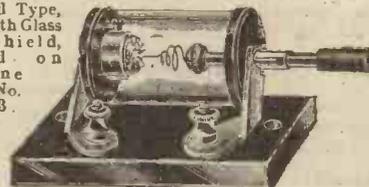


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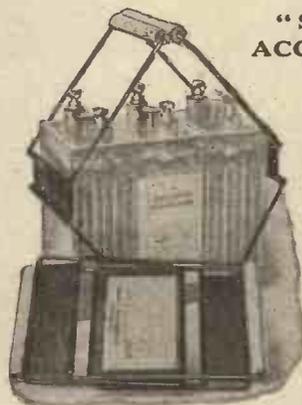
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Valves are returned in specially constructed boxes, ensuring safety in transit. The G.W.I. Service covers every type of valve including Dull Emitter. Volts 4 to 6, Anode Volts 50 to 120.

RENEWAL PRICES

Standard, 6/6; Cossor, 7/-; Dull Emitter Valves (excepting Wecovalves), renewed with H.T. Filament, 6/6; Renewing valves with broken bulb, 1/- extra.

Save 5/- on Every Special Valve you buy. The sum of 5/- net may be deducted from the standard selling price of new valves of the following types, on condition that you send to us your burnt-out valve, which we will replace with a new one. Wecovalves and Dull Emitters. On the same conditions an allowance of 2/6 may be deducted when any standard 12/6 type valve is replaced in this way. Delivery by return.

Send to-day for details of our home accumulator charging apparatus, general wireless accessories and the new plateless valve now ready.

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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 to the Radio Society of Great Britain.

Bristol and District Radio Society.*

Captain P. P. Eckersley recently lectured on "Technical Problems of Broadcasting." Hon. sec., Arthur S. Harvey, 6, Woodleaze, Sea Mills, Shirehampton, Bristol.

Croydon Wireless and Physical Society.*

Recently Mr. G. Hale, one of the members, lectured on "Short Wave Reception." On April 28th, 1924, L. F. Fogarty, Esq., A.M.I.E.E., F.R.S.A., M.R.I., lectured on "Distortion in the Reception and Transmission of Speech and Music." Hon. sec., H. T. P. Gee, 51-52, Chancery Lane, London, W.C.2.

Kensington Radio Society.*

Mr. M. Child gave a lecture on "Detectors for Electric Wave Reception" at the April meeting.

A "Sale and Exchange" was held on Thursday, May 15th, at 2, Penywern Road, Earl's Court.

Hon. sec., Mr. J. Murchie, 33, Elm Bank Gardens, Barnes, S.W.13.

Radio Association (Rugby and District Branch).

Recently lectures to beginners were delivered by Mr. H. W. Gambrell, A.Rad.A.

Hon. sec., Mr. H. W. Gambrell, A.Rad.A., 36, Manor Road, Rugby.

Lewisham and Catford Radio Society.

"Electricity as Applied to Wireless" was the subject of an interesting demonstration and lecture on Thursday, April 24th, by Mr. M. E. Hampshire, of Sydenham.

Hon. sec., Chas. E. Tynan, 62, Ringstead Road, Catford, S.E.6.

The Radio Society of Highgate.*

An extremely interesting lecture was given recently by Mr. G. A. V. Sowter, B.Sc., his subject being "A Practical Heterodyne Wave-meter."

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

City of London Phonograph and Radio Society.

At a meeting last month the secretary submitted a report on low-frequency transformers, and Mr. R. Allison gave a splendid demonstration on loud speaker work.

Hon. sec., J. W. Crawley, 27, Horsham Avenue, N.12.

Radio Association (Mid Lothian Branch).

At a meeting held recently the above branch was formed and officers elected.

Hon. sec., Mr. R. Daniels, 6th Street, Newton Grange.

Tottenham Wireless Society.*

Mr. F. E. Neale gave a most instructive lecture recently on "Interference Elimination."

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

Leyton Radio Association.*

Recent and forthcoming meetings: April 29th. "Brass Finishing." Mr. B. Fistorazzi, Sen.

May 6th. "Morse Code and its Application." Mr. J. Lester.

May 13th. "Combined Transmitter and Receiver." Mr. R. W. Easton.

May 20th. "Selected." Mr. Ingrey.

May 27th. Novel Night.
Hon. sec., Capt. H. Thorley, C.A.S.C., Goldsmith Road, Leyton, E.10.

The Radio Society of Great Britain.

"Duplex Telephony" formed the subject of a discussion opened by Captain Eckersley on May 2nd, 1924.

An informal meeting of the transmitter and relay section of the Radio Society of Great Britain was held on Friday, May 16th, at which Mr. T. E. Goldup opened a discussion upon the "Design of Transmitting Valves."

Barking and District Radio Society.

On Wednesday, the 7th inst., an interesting subject was discussed on "Valves v. Crystals." Hon. sec., A. M. Gibbs, 435, Barking Road, E.13.



A handsome Ediswan "Toovee" cabinet set which can be seen at the Wembley exhibition.

Catalogues Book Reviews Etc.

WITH reference to the paragraph which recently appeared in the "Notes and News" columns of POPULAR WIRELESS we have been informed by the Wireless Supplies Co. of 49, Oxford Street, Southampton, that they are not increasing their prices for accumulator charging, and that their price of 1s. for a six-volt accumulator of any capacity remains unaltered. For the first charge, filling, etc., they make a charge of only 2s. We should like to see a few London firms offer similar terms.

It is interesting to note that the only apparatus used for the broadcasting of

the speeches and music to the 150,000 people in the Stadium at the opening of the Wembley Exhibition was designed, manufactured, and installed by the Western Electric Co., Ltd., and no apparatus of any other manufacture was used.

The makers of the well-known N.S. batteries mentioned in these columns for our issue of the 12th ultimo are the N.S. Battery & Equipment Co., Ltd., 18, Savoy Street, W.C. 2, and not as stated previously.

We have received the fourth and fifth technical letters compiled by the Chloride Electrical Storage Co., Ltd. Traders and garage owners who are not receiving these letters periodically should write to the above firm, who will be pleased to supply them.

APPARATUS TESTED

WITH the advent of the new "Unidyne" circuit and the increasing demand for the four-electrode valve, readers will be interested with some information concerning the new Thorpe K4 valve. We have recently received one of these valves from the Bower Electric, Ltd., and have tested same on the "Unidyne" circuit. It is needless to add that results were very satisfactory, as the inventors themselves used similar valves in their experiments which have met with so much success. The filament voltage is about 4, and the consumption approximately 4 amps.

We have recently tested two new valves supplied by "Radions," Ltd., Bollington, Macclesfield. These were found to be very satisfactory and the current consumption very low, somewhere in the neighbourhood of .25 amps. There are two types—A2 for amplifying, and D4 for detecting. The filament voltage is about 4, while 30-100 volts are required on the plate. The price—10s.—is very reasonable.

Now that warmer weather and holidays are at hand many readers will be on the lookout for a good portable receiver. A useful receiver of this type, employing a crystal detector with two valves, can be obtained from Hopgood and Colbery, of 8, St. James' Walk, Clerkenwell Green, E.C.1. It is entirely self contained, no aerial, earth or accumulator being required.

It is a well-known fact that the efficiency of crystals is liable to be greatly impaired if they are fixed into their cups by means of solder, owing to the excessive heat. The use of Gold Seal Plastic Metal, which is supplied by S. Levy, 53, Ben Jonson Road, E. 1, is advantageous in that it is unnecessary to use much heat to make it plastic, the heat from a match being sufficient to make it pliable enough for use. Gold Seal Plastic Metal is sold at 6d. per packet.

G. Black, of 12, Brougham Street, Edinburgh, has forwarded us a sample of "Ad-dite" for test. On trial we found this crystal very satisfactory, and the specimens forwarded were very sensitive.

CORRESPONDENCE

LONG RANGE ONE-VALVE RECEIVER.

The Editor, POPULAR WIRELESS.

Dear Sir—With reference to the article entitled "A Long Range Single-Valve Set," which I contributed to April 19th issue, the following details should prove of use to those contemplating building same.

Anode-Grid Inductance.—This should be wound with not less than 22 D.C.C. copper wire in the following manner:

(a) 75 turns closely wound on a former 3½ in. diameter and 4 in. long; length of winding 3 in. Middle tapping taken at 38th turn. This coil will cover 250-600 metres with '0004 mid. condenser.

(b) A wooden rod 1½ in. diameter has two rows of ten nails, spaced 1 in. and opposite nails "staggered." A coil is then wound "double basket" fashion, until there are eight turns counting up any two pins.

Two coils so wound will cover the same band as above.

R.F. Choke.—As the impedance of this choke is dependent upon so many variables, it would be easier to find the correct impedance by using the following apparatus:

On a basket coil former cut from cardboard, with fifteen slots, and centre 2 in. diameter, wind 100 turns enamelled 36 S.W.G. wire.

When this coil is shunted by a '0003 or '0005 variable condenser, the correct value can be found by varying the capacity of condenser. Once found, it can remain set.

Telephone Transformer or H.R. 'Phones.—4,000 ohms 'phones may readily be used in place of T. Trans. and I.R. 'phones. Should more than one pair be used, the R.F. choke impedance will need readjustment.

General Remarks.—There seems to be some confusion as to which is the R.F. choke and the anode-grid inductance.

There are three inductances:

(a) The aerial variometer, which controls reaction. In place of this a fixed coil may be used, say 60 turns 22 D.C.C. on a 3½ in. diameter former, with '0003 variable condenser in series with the aerial.

(b) Anode-grid inductance with '0003 condenser in parallel, which controls tuning.

(c) R.F. choke, which prevents the oscillating potentials in anode-grid inductance from leaking away through 'phone circuit.

Also, the transformer used with low-resistance 'phones is a telephone transformer and not an L.F. intervalve, as some appear to think.

From the point of view of ease of operation, the best results are obtained using an "R" valve with 40 volts H.T., 6 volts L.T., and grid leak of 1-2 megohms.

Yours faithfully,
G. E.

Walthamstow.

CORRESPONDENCE REQUIRED.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have one hundred and ten American young men between the ages of eighteen and twenty-two years (some are transmitters, others broadcast listeners). These desire to correspond with British amateurs and transmitters, and on receipt of letter with stamped addressed envelope I will return same with letter from one of my above radio friends to any British amateurs.

I am,
Yours truly,
A. M. GIBBS.

"Bramber," 435, Barking Road, Plaistow, E. 13.

OUR SCIENTIFIC ADVISER REPLIES TO A CORRESPONDENT.

Sir Oliver Lodge, London, England.

Dear Sir,—I hope you will pardon my writing to you. The reason is, I have exhausted all the knowledge of my radio and electrical engineering friends. These are the facts. On the 11th, using a crystal set without batteries or tubes, I was listening to a radio concert from Calgary, 85 miles distant, and experiencing considerable static; this was at noon, and a fall of snow was occurring. The announcer at Calgary mentioned that the weather was clear there. On disconnecting the wires I received a slight shock, so held the lead-in wire to the ground wire, and found a spark that was steady at a ¼-inch gap. This went on for about five minutes. By that time my wife had brought me a coil used on the ignition of a Ford car. I don't know what I intended to do with it exactly, but before I could discover anything my wife and myself received so many shocks even before touching the coil, that I let the lead-in go out of the window. As I said before, it was snowing at the time, but thawing as it fell. Consequently everything outside was quite damp. I next went outside and tried picking up the lead-in wire, but received so many

(Continued on page 480.)



From a popular viewpoint, probably the best known of Wagner's operas is Tannhäuser, while his most stupendous work is Der Ring—really consisting of four operas to be performed on successive nights. All these and many others, including Lohengrin and Die Meistersinger, are invariably broadcast during the Covent Garden Season.

Master Musicians No. 2.

Richard Wagner

NO one reading the story of Wagner can fail to be impressed with the tremendous difficulties the great composer had to overcome, not only in his early years—when often he was almost reduced to starvation—but right up to his death in 1883.

Wagner was a reformer, and for many years he ploughed a lonely furrow. In his hands the Opera was changed from a disjointed affair of separate airs, duets, and finales and developed into a magnificent dramatic spectacle, co-ordinated by one master mind.

Such innovations naturally created intense controversies in musical circles and although the great composer reached the allotted span of three score years and ten he did not live to see a single one of his operas attain any real degree of international fame.

The Loud Speaker reception of Wagner's operas brings forth this peculiar point: since augmented orchestras are required to obtain such majestic effects, there is a danger of the Loud Speaker being over-loaded and the music being confused.

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shaped aluminium diaphragm is anchored to a tuned reed and therefore attracted in one central position only.

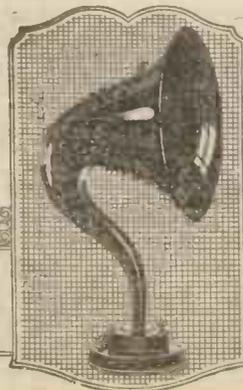
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Loud Speakers

RADIOFORIAL

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

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The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All contributions to be addressed to The Editor, POPULAR WIRELESS and WIRELESS REVIEW, The Fleetway House, Farringdon Street, London, E.C.4. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

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.

PATENT ADVICE FOR READERS.
The Editor will be very pleased to recommend readers of POPULAR WIRELESS who have any inventions to patent, or who desire advice on patent questions, to our patent agent. Letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers.

Questions and Answers

T. H. M. (Denny, Stirlingshire).—What are the best switching arrangements for a four-valve set? (2 H.F., det., and L.F.). I wish to use the following circuits: 1. Detector with reaction; 2. Det. and L.F.; 3. H.F. and det.; 4. Two H.F. and det. The aerial condenser to be switched either in series or parallel, and the aerial circuit to be placed in "tune" or "stand-by" positions as required. It is desired to incorporate two single-pole double-throw switches and one barrel switch now in my possession, and to arrange so that when any valve is not being used its filament supply is automatically cut off.

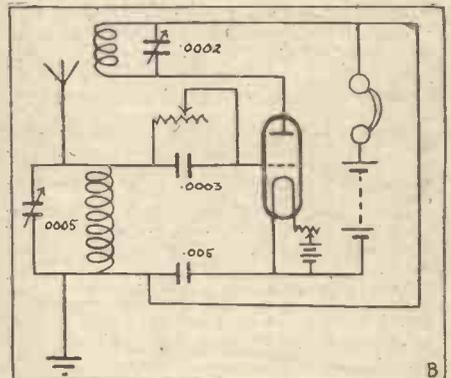
The design of complicated switching arrangements for use on a particular receiver and not of general interest or utility does not fall within the scope of the queries department. All the standard requirements of the amateur in this respect are covered in the back numbers of this journal or in any good book of circuits. An examination of the principles adopted there will show how they can be applied to any special needs which may arise. It is then a simple matter to utilise any switches on hand to the best advantage, but it should be remembered that there is always a certain loss in switches, and they should be avoided whenever possible, especially in H.F. circuits.

F. S. G. (Much Hadham).—I am using a three-coil holder for my four-valve set (H.F., Det., and 2 L.F.). What should be the relative positions of the aerial, secondary, and reaction coils for the most selective results?

Reaction upon the secondary coil is the best arrangement, so the order of the coils should be: (1) aerial, (2) secondary, and (3) reaction.

Q. E. V. (Luton).—What are the connections of the modified Flewelling circuit as mentioned in the correspondence columns of POPULAR WIRELESS No. 98, for April 12th?

This diagram gives all the connections, and shows the valves of the condensers, etc. The original letter and circuit appeared in POPULAR WIRELESS for



November 10th. The coils may be wound in basket fashion on 14 in. centre diameter formers. The aerial coil should have about 35 turns of 24 S.W.G. and the anode coil about 95 turns of 36 S.W.G.

G. ARMSTRONG (Thorpe Hesley, nr.Rotherham).—I wish to change over from ordinary R valves to those of the dull-emitter type. What changes shall I make in the set, and are the three-volt '06 type of dull-emitters good valves for "all-round" use?

No alteration in wiring is necessary, but a battery of the voltage and capacity recommended by the valve-makers should be substituted for your present accumulator.

If, however, it is decided to use a battery of rather higher voltage in order to keep some power in hand to cover depreciation, etc., it becomes essential to use a special filament resistance. The ordinary rheostat has a resistance value of only seven or eight ohms, but to control one of these valves from a 4-volt or 12-volt battery it is necessary to use a resistance of about 30 ohms. Such rheostats are now obtainable cheaply, and when using them great care is necessary to keep the filament current at the lowest value which will give good reception.

The valves are equally suitable for use as detectors or amplifiers, and you will find that excellent results are obtainable with correct values of H.T. and L.T. voltage.

F. R. C. (Brixton).—Re the diagram of the Flewelling circuit, which appeared in POPULAR WIRELESS, No. 102, should not a variable condenser be connected across the A.T.I.?

Yes, this is so. A variable condenser of about '0005 mfd. should be connected in parallel with the A.T.I. and the line shown connecting the left hand end of grid condenser to earth, of course, omitted.

A. M. C. (Montreal).—What number of foils are required for the '006 fixed condensers in the Flewelling circuit, mica to be used as dielectric. What is the dielectric constant of mica? What is the result of using different thicknesses for the dielectric?

(Continued on page 479.)

POSSIBLE EFFECT OF B.B.C.'s SUMMER POLICY.



RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 478.)

You will require eleven foils with an overlap of 2 by 3 cms, mica .002 in. thick being used as dielectric. If you double the thickness of the dielectric you halve the capacity and vice versa. The dielectric constant of mica is approximately 6.

R. C. (Duoflex).—I have a single-valve set employing two variometers for tuning, one as A.T.I. and the second in the plate circuit to obtain reaction. What are the connections for adding a crystal to this circuit without any additional apparatus if possible.

The connections are very simple. Proceed as follows. Omit grid leak and condenser, taking aerial straight to grid of valve. Connect crystal detector directly between plate and H.T. positive. Other connections remain unchanged. In this circuit the valve will act as an H.F. amplifier and the crystal as the rectifier.

R. J. W. (Abingdon, Berks).—I have a two-valve set (H.F. and detector) and contemplate adding a stage of L.F. by means of a switch. I am told that I shall need to control the grid of one or more of the valves for best results, and to stop howling, but am uncertain as to whether a potentiometer is necessary or whether I can use dry cells without a potentiometer. Please give diagrams showing the different arrangements that are possible.

The efficient control of grid potential was dealt with in an article by "Variotron," which appeared in POPULAR WIRELESS for April 5th (No. 97). There are diagrams showing a number of different arrangements for various circumstances, which can be applied to other circuits as may be necessary.

Back numbers of POPULAR WIRELESS may be obtained from "The Amalgamated Press, Back Number Dept., Bear Alley, Farringdon Street, E.C.4." Price 4d. post free.

N. L. (Sheffield).—I have in my possession a .0005 variable condenser, an Ediswan A.R. valve, accumulator, and H.T. battery. Can these be used in the modified ultra-audion set which is described in POPULAR WIRELESS, No. 93 (March 8th)? If so, what would be the size of the basket coils, and the values of the grid leak and condenser?

Although it is not generally advisable to vary the values given in the description of circuits of this kind, you will probably find that the .0005 condenser will function satisfactorily in place of the .0003 shown in the diagram.

The value of grid leak and condenser are as shown, and basket coils having 75 turns each (on a 1½ in. centre diameter) will be found satisfactory in average circumstances.

"NEW READER" (Dartford) requires details re number of turns for aerial and anode tuning variometers, dimensions of rotor and stator being given.

For the aerial tuning variometer wind about 30 turns of 26 S.W.G. on both rotor and stator. About 50 turns on each should be sufficient for the anode variometer.

M. T. (Deptford).—What size Igranic coils should be used for A.T.I., anode and reaction, for the new 25 kw. station? I am using a .0005 mfd. aerial condenser and a .0003 mfd. anode condenser.

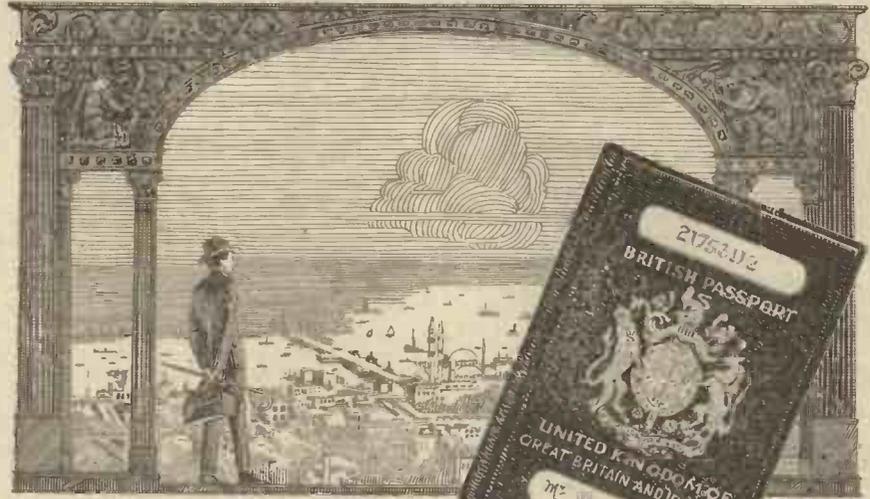
The following coils should be used (the A.T.C. being placed in parallel): Aerial, No. L 150; Anode, No. L 200-250; Reac., No. L 75-100.

A. M. S. (Wembley).—I have seen ebonite advertised at so much per pound. What weight shall I require for a sheet 12 in. by 12 in.?

This depends on the thickness of the ebonite. That generally used for panels is ¼ in. The weight of 1 sq. ft. of ¼ in. is 19½ ozs.

T. T. W. (Aberavon).—I have just finished building a single-valve set with reaction, and find that when using long 'phone leads of about 30 ft., my signals increase in strength. How can I remedy this and make the loud signals permanent when using short 'phone leads?

A .002 fixed condenser across the 'phone terminals will probably have the desired effect.



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CORRESPONDENCE.

(Continued from page 477.)

shocks that I disliked the job, so waited for a few more minutes, by which time it had gone back to normal. My aerial was 80 ft. high, and about 160 ft. long, counting the lead-in as aerial—this between porcelain insulators. At one end I have a separate wire about 200 ft. long, in order that I may utilise a gully to give my aerial more height. A wooden mast at each end, without guy ropes or wires. This winter has been very dry; in fact, the past four years have been so. I mention this, as I understand anything may become charged in this atmosphere. My receiving set at that time consisted of spider-web coils, a 23 plate variable condenser, a fixed condenser, and a galena crystal. I intended trying the charge on a 9-18 volts light bulb, but did not think of it in time. No doubt I would have just burnt it out, as the solder on the wires and the rubber insulation were burned. I had an engineering friend—a great admirer of yours, by the way—ask the radio expert at the broadcasting station about it. His answer was that he had never heard of it before. I will not expect an answer to this letter. You may, however, be able to use some of the facts. If one could transmit power this way, it would be fine. Another fact I expect I should mention, I live on the Red Deer River of dinosaur fossil fame, which in this district has banks about 100 feet high composed of shale and coal, no minerals that ordinarily affect electricity.

Sincerely Yours,
W. G. HODGSON.

Dorothy, Alto, Canada.

Copy of reply sent to Mr. Hodgson by Sir Oliver Lodge, F.R.S., D.Sc. (Scientific Adviser to "Popular Wireless").

Dear Sir,—The atmosphere during the snowstorm must have been in a high state of electrification, and with your large aerial you ran some risk when you touched it. Fortunately, it only collected quietly from the potential gradient, without there being any disruptive discharge in the atmosphere. This is often the case during a heavy thunderstorm or a snowstorm; but in this country the atmosphere is seldom dry enough to produce such striking effects as you noticed. Similar phenomena have been noticed before with lightning conductors.

There is nothing new in it; but I propose to send your experience to the Editor of POPULAR WIRELESS, in case he likes to publish your account.

Yours faithfully,
(Signed) OLIVER LODGE.

To Mr. W. G. Hodgson.

AN EFFICIENT "CAT'S-WHISKER."

The Editor, POPULAR WIRELESS.
Dear Sir,—I was very interested in the article on cat's-whiskers which appeared in your issue of the 19th inst., for to my mind the soul of a simple crystal receiver, whatever its wiring or its A.T.I. may be, is in the cat's-whisker, or the crystal, or both; and sooner or later something will be evolved which will revolutionise crystal reception.

I thought perhaps you would be interested to hear of a novel cat's-whisker, or to give it a better name, "contact point," which gives surprising results. I have tried most of the crystals and cat's-whiskers on the market, and several of the latter that are not on the market, without noticing much difference, until a brother experimenter recommended me to try a broken or discarded gold watch finger. The immediate result was at least 50 per cent better than anything I had previously tried. The only difficulty was that it was almost impossible with a horizontal detector arm to obtain the right tension with a rigid point. This was very satisfactorily overcome by soldering on to the watch finger a piece of an ordinary gold cat's-whisker. Several are now in use among my friends with the same good results in each case.

I am,
Yours faithfully,
JAS. JONES.

39, Ryebank Road, Chorlton-cum-Hardy.

"P.W." ULTRA-CRYSTAL SET.

The Editor, POPULAR WIRELESS.
Dear Sir,—I feel I must congratulate POPULAR WIRELESS on their "Ultra-Crystal Set," which you described in your valuable paper last week.

I have made the same in a few hours, but made a coil on a 3-in. former with 26 enamelled S.W.G., and the same number of turns as described on a 4-in. with 24 D.C.C.

I might say that I am more than pleased with the results, 2 L O coming through as loud as H F and crystal on my POPULAR WIRELESS Combination Set. In fact, I can hear quite plainly on my loud speaker all over the room.

It is, as you say, the simplest "super" crystal set yet evolved, and I might say one of the best, as I have tried several crystal circuits on a loud speaker, but the results on this circuit are the best I have had.

Thanking you and your staff for your valuable paper, and wishing it every success,
Yours faithfully,
GEO. PEPPER.

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THE WEEK'S BROADCASTING PROGRAMMES.

LONDON (2 L O, 365 Metres).
 Sunday, May 25th.—The Luton Red Cross Silver Prize Band. The Rev. T. Carter, Address. De Groot and Piccadilly Orchestra.
 Monday, May 26th.—Chamber Music Evening.
 Tuesday, May 27th.—Shakespeare Night.
 Wednesday, May 28th.—Popular Programme.
 Thursday, May 29th.—Operatic Night.
 Friday, May 30th.—Miscellaneous Popular Programme.
 Saturday, May 31st. Massed Bands from Wembley.

BIRMINGHAM (5 I T, 475 Metres).
 Sunday, May 25th.—Orchestral Programme. Service from St. Chad's Cathedral.
 Monday, May 26th.—Popular Programme.
 Tuesday, May 27th.—Miscellaneous Items.
 Wednesday, May 28th.—Classical Programme.
 Thursday, May 29th.—A Night of Song.
 Friday, May 30th.—Miscellaneous Programme.
 Saturday, May 31st.—Concert Party Programme.

CARDIFF (5 W A, 353 Metres).
 Sunday, May 25th.—The Cory Workmen's Silver Band. Dr. H. M. Hughes, Address. Modern Light Italian Evening.
 Monday, May 26th.—Art Programme.
 Tuesday, May 27th.—A Programme of Comedy and Music.
 Wednesday, May 28th.—The Magic Carpet.
 Thursday, May 29th.—Shakespeare Night.
 Friday, May 30th.—Choral Night.
 Saturday, May 31st.—Popular Night.

MANCHESTER (2 Z Y, 375 Metres).
 Sunday, May 25th.—Manchester Postal Military Band. The Rev. G. H. Charnley, Address.
 Monday, May 26th.—Besses o' th' Barn Band. Orchestral Concert.
 Tuesday, May 27th.—Popular Orchestral Night.
 Wednesday, May 28th.—Classical Concert.
 Thursday, May 29th.—Orchestral and Miscellaneous.
 Friday, May 30th.—Orchestral Concert.
 Saturday, May 31st.—Dance Night.

BOURNEMOUTH (6 B M, 335 Metres).
 Sunday, May 25th.—Nomad Male Voice Prize Choir. The Rev. A. H. Baverstock, Address.
 Monday, May 26th.—Miscellaneous Programme.
 Tuesday, May 27th.—Mainly from London.
 Wednesday, May 28th.—Popular Night.
 Thursday, May 29th.—Orchestral Concert.
 Friday, May 30th.—Orchestral Concert.
 Saturday, May 31st.—Popular Classical and Operatic Night.

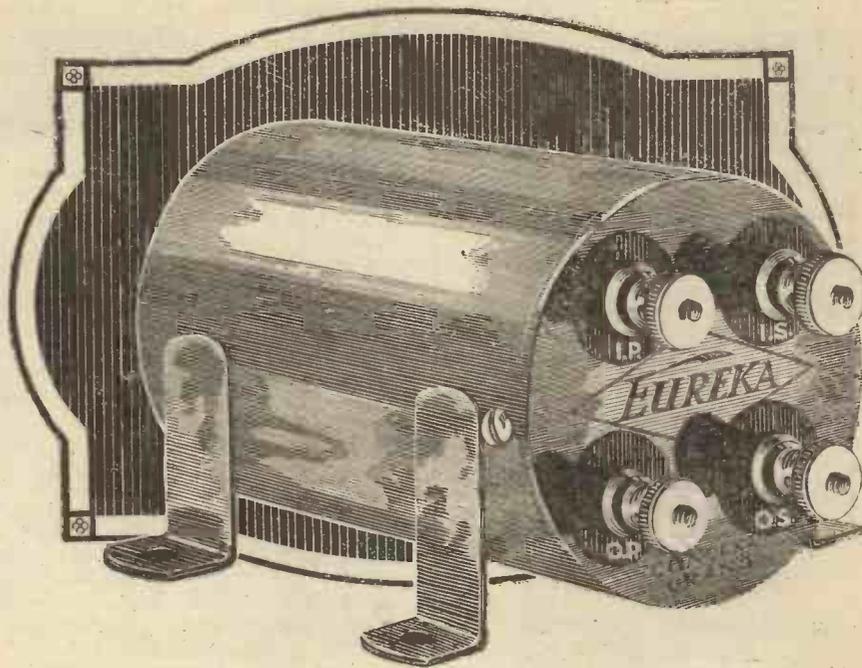
GLASGOW (5 S C, 420 Metres).
 Sunday, May 25th.—Orchestral Concert.
 Monday, May 26th.—Children's Evening.
 Tuesday, May 27th.—Play Night.
 Wednesday, May 28th.—Maurice Cole, at the Piano; Wagner Night.
 Thursday, May 29th.—Request Night.
 Friday, May 30th.—Orchestral Concert.
 Saturday, May 31st.—Operatic Night.

ABERDEEN (2 B D, 495 Metres).
 Sunday, May 25th.—Orchestral Concert. Religions Service from North U.F. Church. The Rev. Andrew Dickson, Address.
 Monday, May 26th.—Students' Night.
 Tuesday, May 27th.—Classical Night.
 Wednesday, May 28th.—Dance Night.
 Thursday, May 29th.—Operatic Night.
 Friday, May 30th.—Popular Night.
 Saturday, May 31st.—Everybody's Programme.

NEWCASTLE (5 N O, 400 Metres).
 Monday, May 26th.—Countryside Night.
 Tuesday, May 27th.—Mainly from London.
 Wednesday, May 28th.—Pleasant Recollections Evening.
 Thursday, May 29th.—Operatic Night.
 Friday, May 30th.—An Evening of Variety.
 Saturday, May 31st.—Dance Night.

SHEFFIELD RELAY STATION.
 Sunday, May 25th.—From Birmingham.
 Monday, May 26th.—From Manchester and Birmingham.
 Tuesday, May 27th.—From Birmingham. Organ Recital from Albert Hall.
 Wednesday, May 28th.—From Birmingham.
 Thursday, May 29th.—From Birmingham, and Organ Recital from Albert Hall.
 Friday, May 30th.—From Manchester and Local Programme.
 Saturday, May 31st.—From Birmingham.

PLYMOUTH RELAY STATION.
 Sunday, May 25th.—From London.
 Monday, May 26th.—From London.
 Tuesday, May 27th.—From London.
 Wednesday, 28th.—Bijou Light Orchestra.
 Thursday, May 29th.—From London.
 Friday, May 30th.—From London.
 Saturday, May 31st.—From London.



**—2¼ miles of wire on a
Eureka Concert Grand**

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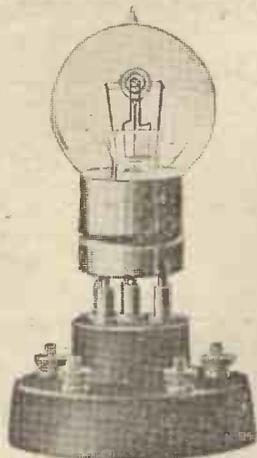
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TECHNICAL NOTES.

(Continued from page 472.)

Wave Traps.

There must have been a great variety of wave traps proposed for use in reducing or eliminating unwanted signals, but unfortunately many of them eliminate the desired station together with the interfering ones. The following arrangement, however, is worth trying, and has been forwarded to me by a correspondent. It consists in "splitting" a variometer and putting across the rotor a variable condenser of say 23 to 43 plates, and putting the stator in series with the aerial. If the type of variometer permits, a centre tap may be tried, as in some cases a lower inductance in the aerial circuit may be an advantage.

The trap is used in this way. First, tune in the interfering station, then parallel the windings of the variometer and adjust the variable condenser until the interfering station is very weak. Now turn the rotor slightly until the interfering station fades out entirely. Then proceed to tune the receiver to the desired station in the usual way. My correspondent states that he has obtained very satisfactory results with this form of trap.

Crystal Set Aerial.

In these days of indoor aerials, loop aerials, and, in fact, no aerials at all, inquiries are frequently made by crystal users, particularly by beginners and prospective beginners, as to whether "stunt" aerials can be employed with a crystal set. Of course, there is no doubt that very satisfactory results can be obtained with a crystal set, using a good indoor aerial within a reasonably short distance of a transmitting station, and we all know the amateur who obtains wonderful results from a crystal set, at a hundred miles from 2 L O, with an aerial which is conspicuous by its absence.

The fact is, however, that a crystal set is entirely differentiated from a valve (amplifying) set in that the latter has a local source of energy available in the shape of the H.T. battery, whereas the crystal set has no such local input of energy, and the energy represented in the reproduced sound in the telephones is derived entirely from the electro-magnetic radiation, or wireless waves, picked up by the aerial. It will be evident, therefore, that it is particularly important to have an efficient aerial with a crystal set, and for the best results every effort should be made to use an aerial as large and high as possible (having regard to the well-known limits imposed), and to avoid any leakage of the incoming energy between the aerial and the set.

Analysing Static.

A large number of observations upon the wave-form of static disturbances in a wireless receiver have been made at Cambridge by Watson-Watt and others, and the results have now been subjected to mathematical analysis by E. B. Moullin, the well-known mathematical physicist. Moullin has found a formula which fits the experimental curves well, but he finds that the actual effect of static is more troublesome than the theory would seem to indicate. This he attributes as applied to telephony, to the presence of short waves

superimposed on the main wave in the static disturbances, like a kind of ripple.

In a telephone receiver this ripple accounts for the hiss, the main waves being responsible for the clicks. It seems probable that the clicks are relatively unimportant, the principal offenders against clear or intelligible reception being the hisses, and efforts are now being concentrated upon the study of the latter, in order to see whether Watt's experimental curves point to any method of eliminating or reducing the hisses.

It is to be hoped that these efforts will be successful, even if only in part, as there is hardly any branch of wireless research where success would be more welcome or more valuable than in the reduction of atmospheric interference. Moullin's work is described in a paper before the Institution of Electrical Engineers, February 14th, 1924, entitled "Atmospherics and Their Effect on Wireless Receivers," which will be found reprinted in the Proceedings.

A Curious Short-Wave Phenomenon.

A remarkable fact has been discovered in connection with short-wave—about 100 metres—transmissions, during experiments between KDKA and KFKX at Hastings (Nebraska) and 2 A C Manchester (Eng.), carried out by Messrs. Little and Fulknor, and published by the Westinghouse Electric Co. (U.S.A.).

In deciding on the exact wave-length to be used for the relay link between Pittsburgh and Hastings, observations were first made upon the variation in signal-strength on different wave-lengths in the region of 100 metres. It was found that below 90 metres the signal-strength was greater in the daytime and weaker at night, whilst at wave-lengths between about 90 and 100 metres the reverse effect was obtained.

An intermediate wave-length showed considerable constancy in strength, but its average strength was less than the daytime maximum of the waves below 90, and also less than the night-time maximum of the waves about 100. The actual wave-length eventually decided upon for the greatest constancy was 94 metres. This effect is most curious, and probably very important, but as to its explanation, no satisfactory theory appears yet to have been put forward. The authors themselves have no explanation to offer, although they are positive that the effect is quite definite. For the present it remains one of the "unsolved mysteries" of wireless transmission.

Polishing Panels.

After a set has just been assembled, the panel is usually found to be badly finger-marked, and may even have traces of soldering paste and other substances adhering to it. All these, apart from their effect upon the insulating properties of the panel, make it unsightly and should be carefully removed. The safest way to remove grease from a panel is to rub the part carefully with a piece of rag, moistened—not saturated—with alcohol or methylated spirit—preferably the former—afterwards finishing off with a soft, dry cloth.

If the panel is not likely to be exposed to dust, the cloth which is used for occasional rubbing over may have a few drops

(Continued on page 484.)

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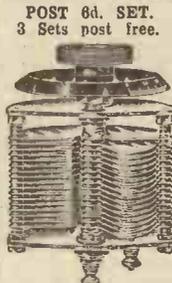
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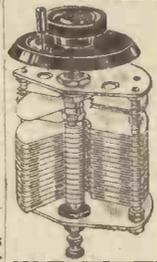


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TECHNICAL NOTES.

(Continued from page 482.)

of oil upon it, which improves the appearance of the panel without interfering with its insulation; but if there is any danger of dust adhering, this little refinement had better be foregone. Slate pencils, used often for charging-board, switchboards and so on, may be cleaned by means of a little ammonia solution.

Whenever the bright metal parts are polished, the slate panel should be cleaned up in this way. In polishing an ebonite panel for the first time, sandpaper and raw linseed-oil may be used, followed by pumice and oil, the finishing off being done with a few drops of clean oil and a soft cloth.

Shielding Transformer Winding.

An interesting and simple arrangement for shielding a transformer from interference by short waves is due to H. J. Round, and consists in placing around the secondary of the coupling transformer a metal shield. This shield is formed by bending a metal sheet into cylindrical form, the straight edges not quite touching, however. This straight "slot" in the cylindrical shield then comes opposite to the primary of the transformer. The secondary of the coupling-transformer is wound for minimum self-capacity. It is said that the arrangement described greatly diminishes interference from short waves, for example, interference from the engine ignition in aeroplane wireless sets.

Reliable Soft Valve.

Everyone knows the merits of the old "Round"—soft—valve, and what excellent results could be got from soft valves generally if it were not for their unfortunate capriciousness. The "hard" valve, of course, has everything in its favour as regards reliability and steadiness. Efforts are now being made, however, to place upon the market a new type of soft valve, which shall have the sensitivity of the earlier types, and yet shall be steady and dependable in operation.

The secret of success, it is stated, is the replacement of the residual air in the bulb of a soft valve by an inert gas such as argon, helium, or neon. The bulb is first exhausted to a "hard" vacuum, and baked in the usual way, as though it were to be a hard valve, the correct trace of gas being afterwards introduced. An anode voltage of only about 20 to 25 volts is required with this valve, and the characteristic curve gives a sharp rectification bend and a steep amplification slope. It will be interesting to see whether the valve does all that is claimed for it.

Permanent Grid Leak.

A very simple way of making a grid leak is to connect the grid socket and the positive filament socket together by means of a tracing of lead pencil. In order to accommodate the graphite, a groove may be cut or carefully scratched between the metal parts of the sockets mentioned, either above or below the panel, and the graphite rubbed into the groove.

The valve should be inserted, and the set put into operation. The graphite should be laid on until the signals cease to be improved by the addition of further graphite.

If the best condition is passed to any extent, some of the graphite may be rubbed or scraped away until the best value is again obtained.

When this has been satisfactorily accomplished, the graphite tracing may be rendered permanent and protected from injury by carefully coating over with shellac varnish. Care should be taken that the graphite is got into good contact with the metal sockets.

Finding Aerial Wave-length.

The following simple rule for finding the natural wave-length of an aerial has been sent to me, and I pass it on in case those of my readers who know the natural wave-length of their aerial, or have other means of finding it out, may care to test the rule and see if it works. Add together the length of the aerial, the lead-in, and the earth-lead, and if there is more than one wire, add one-third of the length of the aerial.

This is in feet. Divide this total by 2, and add the result to the addition just made—that is to say, add half as much again to the original addition. This gives the approximate wave-length in metres. Example: twin aerial 65 feet long, lead-in 20 ft., earth 12 ft.; total 97. Being double-wire aerial, add one-third of aerial length, say, 22 ft.; total 119 ft. Add half as much again, say, 59; total, 178; which is the natural wave-length in metres. Let me know if it works on your aerial.

Cage Aerial.

There are various forms of aerial wire, including plain single wire, stranded wire, strip, and braided strip, the latter form having several advantages claimed for it. A somewhat new form of aerial is that shown in the accompanying figure. This consists of a kind of "cage" made up of two spirals, one within the other. It may be placed anywhere, either indoors or outdoors, and has the obvious advantage that it is extensible. It is claimed that it gives greater distance, fuller tone, freedom from static and interference, and that it is very selective and permits of close tuning—a fairly comprehensive list of claims. It is difficult to say what is the "length" of this aerial from the point of view of the P.O. regulations.

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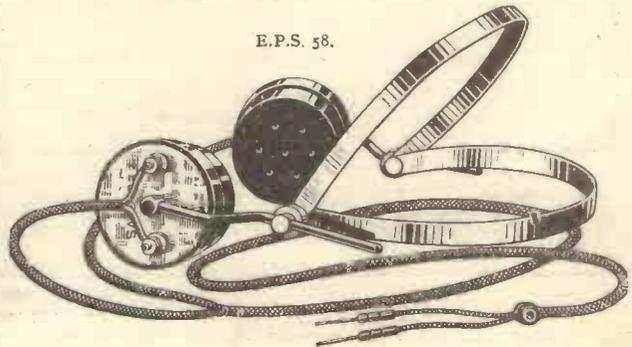
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Burnt-out valves are an expensive item—but here is a way to save money without loss of efficiency.

Send your burnt-out valves to us. We will repair and return them speedily. You will find them equal in every way to new valves and the cost is exactly half. A valve repaired by our patent process (Pat. No. 198247/1922) is hard to distinguish from a new one. It has a new lease of life, an unblemished appearance and its efficiency is as perfect as when new. Send no money. Take no risks. Valves broken in process are replaced by us whenever possible. Our guarantee of best workmanship goes with every valve we repair. As we repair every kind of valve with the exception of the "Dull Emitter" type thousands of wireless enthusiasts use our service—send those burnt-out valves to-day.

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Renew valves the
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Winning Parts

There are winning parts and losing parts! They are distinct in one particular phase. You build with the former knowing that your finished receiver will be a thing worth having—those who build with the latter build hoping that something will happen. You will understand that where mixed parts are specified in an article this is done because it is impossible for the writer to confine himself to parts of one make because it would imply an undue preference. **BUT NO SUCH CONSIDERATION NEED APPLY IN YOUR CASE.** You can be sure that assorted parts will never give you the same results as the finished instrument built with all LISSEN Parts. There is a LISSEN Part for every vital place of a receiver. If you build with ALL LISSEN PARTS your receiver will be far above the average. In this way also you can easily fix responsibility for the results you get—**FOR WE GUARANTEE EVERY LISSEN PART TO SATISFY YOU PERFECTLY—WE EXPECT TO HEAR FROM YOU IF YOU ARE NOT SATISFIED.**

MAXIMUM TRANSFER OF ENERGY.

Your aerial picks up energy—your induction builds up the voltage which will operate the grid of the first valve. **DO THE COILS YOU USE MAKE A MAXIMUM TRANSFER OF THIS ENERGY,** or is there any minute loss which weakens the strength of your detection? The magnetic linkage between LISSENAGON COILS is such that a transfer of energy will be effected even though the coils are comparatively a great distance apart. The further coils can be kept apart the sharper and more selective tuning becomes. It is partly due to the strong magnetic field between LISSENAGON coils and partly due to the negligible losses in the coils themselves that LISSENAGON COILS will oscillate easily though at a considerable distance apart, as there are practically no damping losses to be overcome even on the extreme low wavelengths, **WHERE IT IS PARTICULARLY IMPORTANT TO ELIMINATE ALL LOSSES.**



HOLD A LISSENAGON COIL UP TO THE LIGHT!
LISSENAGON TUNING CHART. Note the Intermediate Coils: 30, 40, and 60.

No. of Coil.	TABLE I. Wavelength range when used as Primary Coils with Standard P.M.G. Aerial and .001 mfd. condenser in parallel.		TABLE II. Wavelength range when used as Secondary Coils with .001 mfd. condenser in parallel.		PRICE.
	Minimum Wave-length.	Maximum Wave-length.	Minimum Wave-length.	Maximum Wave-length.	
25	185	350	100	325	4/10
30	235	440	130	425	4/10
35	285	530	160	490	4/10
40	360	675	200	635	4/10
50	480	850	250	800	5/-
60	500	950	295	900	5/4
75	600	1,300	360	1,100	6/3
100	820	1,700	500	1,550	7/7
150	965	2,300	700	2,150	8/5
200	1,885	3,200	925	3,000	8/9
250	2,900	3,800	1,100	3,600	9/2
300	2,500	4,600	1,400	4,300	



DRY CELLS ARE DESIGNED FOR INTERMITTENT USE.

Say you are using .06 valves. These take about 24 volts. Two dry cells when new only give 3 volts. Continuous discharge of dry cells quickly lowers the voltage. Directly the working voltage of the cells falls below say 2.75 volts, they are almost useless, as owing to the volt drop through the wiring and the rheostat the actual voltage across the filament is not sufficiently above the minimum required by the valve to allow a margin for efficient control through the medium of the rheostat. Dry cells were designed for intermittent use, and **HAVE NOT ALTERED IN THEIR CHARACTERISTICS SINCE THEY WERE FIRST INTRODUCED FOR BELL WORK.** For this reason it is a distinct advantage to work off two sets of batteries, and by switching over every half-hour with just a gentle pull or push of the LISSEN two-way switch each set of cells will be given the opportunity to recuperate, and the voltage will be maintained in a way otherwise impossible with only one set of cells. Other convenient uses of this handy little switch will readily suggest themselves. It takes up hardly any room—**LISSEN ONE-HOLE FIXING, OF COURSE.** ... **2/9**



MAKE YOUR COILS COVER—a double band of Wavelength.

Many work with their condenser either in series or in parallel. It is an advantage to provide for alternative use, and it is quite easy to do this by fitting the LISSEN Series Parallel switch (prov. pat.). Say the coils most used with the condenser in series are 50, 60 and 75, and say that the coils most used with the condenser in parallel are 25, 30 and 35. Now by fitting the LISSEN Series Parallel switch the coils would cover a double band of wavelength. That is to say the 50, 60 and 75 coils would tune down to the range of say, the 25, 30 and 35 coils with the condenser in series and with the condenser in parallel would cover the higher limits of the broadcasting band and the 600 metre traffic. While in the case of the 25, 30 and 35 coils with the condenser in series it would be possible to get down to, say, 100 metres in which a good deal of American telephony is transmitted, and also to receive the usual amateur telephony, while with the condenser in parallel the coils would cover the lower broadcasting band. It is quite a useful thing therefore, to fit the LISSEN Series Parallel Switch. It takes up hardly any room. **LISSEN ONE-HOLE FIXING, OF COURSE.** ... **3/9**

THE LISSENSTAT AS AN AID TO TUNING.



In tuning, particularly in long distance work and also where extreme selectivity is desired, there is always one spot which will give the best results. LISSENSTAT control makes it possible to regulate critical electron emission to correspond exactly with the degree necessary for perfect detection. There are three types of LISSENSTAT control. THE LISSENSTAT (prov. pat.)—this is the super filament control, ideal for dull emitter and all valves ... **7/6**

LISSENSTAT MINOR (prov. pat.)—there must be many hundreds of thousands of inefficient rheostats in use. This latest development provides something of the beautiful LISSENSTAT control at a popular price. For dull emitter and all valves (the LISSENSTAT is a still better control) ... **3/6**
THE LISSENSTAT UNIVERSAL (prov. pat.)—A minimum resistance can be left in circuit to protect expensive dull emitter valves. Full resistance is 50 ohms. **10/6**
TO THOSE WHO MAKE THE MISTAKE OF THINKING THAT LISSENSTAT CONTROL IS THE SAME THING AS AN ORDINARY RHEOSTAT—LET THEM TRY THE DIFFERENCE.

OVERLAP—the explanation of an Unstable Set.

One of the troubles often met with in reaction circuits is that reaction is not even and gradual. For instance, as the coupling is increased the set will suddenly burst into violent oscillation, and as the coupling is decreased the oscillation will continue beyond the point at which it started. This condition is known as OVERLAP, AND IS A VERY BAD FAULT WITH A REACTION COUPLING, as in practice it means that the oscillation point can never be reached without the set becoming unstable. THE CONSTANTS OF THE LISSEN REGENERATIVE-REACTANCE (prov. pat.) are so arranged that there is a perfect reaction coupling over the whole range covered. There is NO RE-RADIATION either. There is NO OVERLAP (providing the correct values of anode and filament voltage are used.) There are other advantages in using the LISSEN REGENERATIVE-REACTANCE—it takes the place of plug-in coils. If plug-in coils are used to provide reaction in a tuned anode circuit, only one stage of radio frequency amplification can be used, because it is next to impossible to control two stages of radio frequency amplification with plug-in coils. With the LISSEN REGENERATIVE-REACTANCE in the first stage, however, other stages of H.F. can be added as desired, and easily controlled, each stage adding immensely to the sensitivity and range of a receiver. Selectivity is also greatly increased—nearby broadcasting stations can be tuned out and the others brought in with full built-up strength. Much American telephony has been received on two valve sets. Then again, a set of plug-in coils to cover the same wide range would cost more than the LISSEN REGENERATIVE-REACTANCE—no coil holder to buy with the latter, either. This LISSEN part is provided complete with internally connected switch already mounted—no soldering—no complications—blue print with each shows easy connections.

LISSEN ONE-HOLE FIXING, OF COURSE. 150-4000 metres. ... **£2 12 6**
Tune always with a vernier—preferably the LISSEN Vernier, specially designed for fine tuning in H.F. circuits (barely 1 in. diam., length 3 1/2 in.) **12/6.**

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TRYING TO IMPROVE LOUD SPEAKER REPRODUCTION.

While the greatest use for the LISSEN Variable Grid Leak is to obtain correct grid potential under all conditions of valve and circuit, an interesting use is across the loud speaker itself, or across the secondary of a transformer, where its effect will be to suppress any tendency for the disproportionate amplification of the higher notes of the musical scale. LISSEN ONE-HOLE FIXING, OF COURSE—POSITIVE STOPS BOTH WAYS ... **2/6**
LISSEN Variable Anode Resistance, same outward appearance as the LISSEN Variable Grid Leak, 20,000 to 250,000 ohms. ... **2/6**



BOLTS THROUGH TRANSFORMER LAMINATIONS.

A good transformer never has a bolt running through the laminations. Because of its skilfully balanced design the LISSEN T3 Transformer actually compares with many expensive transformers—it is one of the best light transformers made—AND IT HAS NO BOLT RUNNING THROUGH THE LAMINATIONS ... **16/6**

AUDIO FREQUENCY IN REFLEX CIRCUITS.

It has been found that the LISSEN T2 Transformer gives fine results in these circuits, including the ST100, where it yields very pure and powerful amplification ... **25/-**

MAKES ELIMINATION EASY.

How often have you wished you could eliminate that nearby Broadcasting Station or Morse which entirely spoils your reception? THE LISSENCEPTOR will eliminate any broadcasting station, and also 95 per cent. of Morse, and subdue the other 5 per cent. to the extent that it does not matter. THE LISSENCEPTOR is quite a useful thing to add to any receiver. It needs a separate condenser to tune it—preferably it should be a low-loss condenser such as the LISSEN Mark 2 Mica Variable Condenser (prov. pat.) ... **17/6**
LISSENCEPTOR Mark 1 type for broadcasting ... **7/6**
600 metres ... **7/6**
LISSENCEPTOR Mark 2 type for broadcasting and 600 metres combined (this type has a switch for more selective tuning) ... **15/6**

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