

HOW TO MAKE A PRACTICAL CRYSTAL SET.

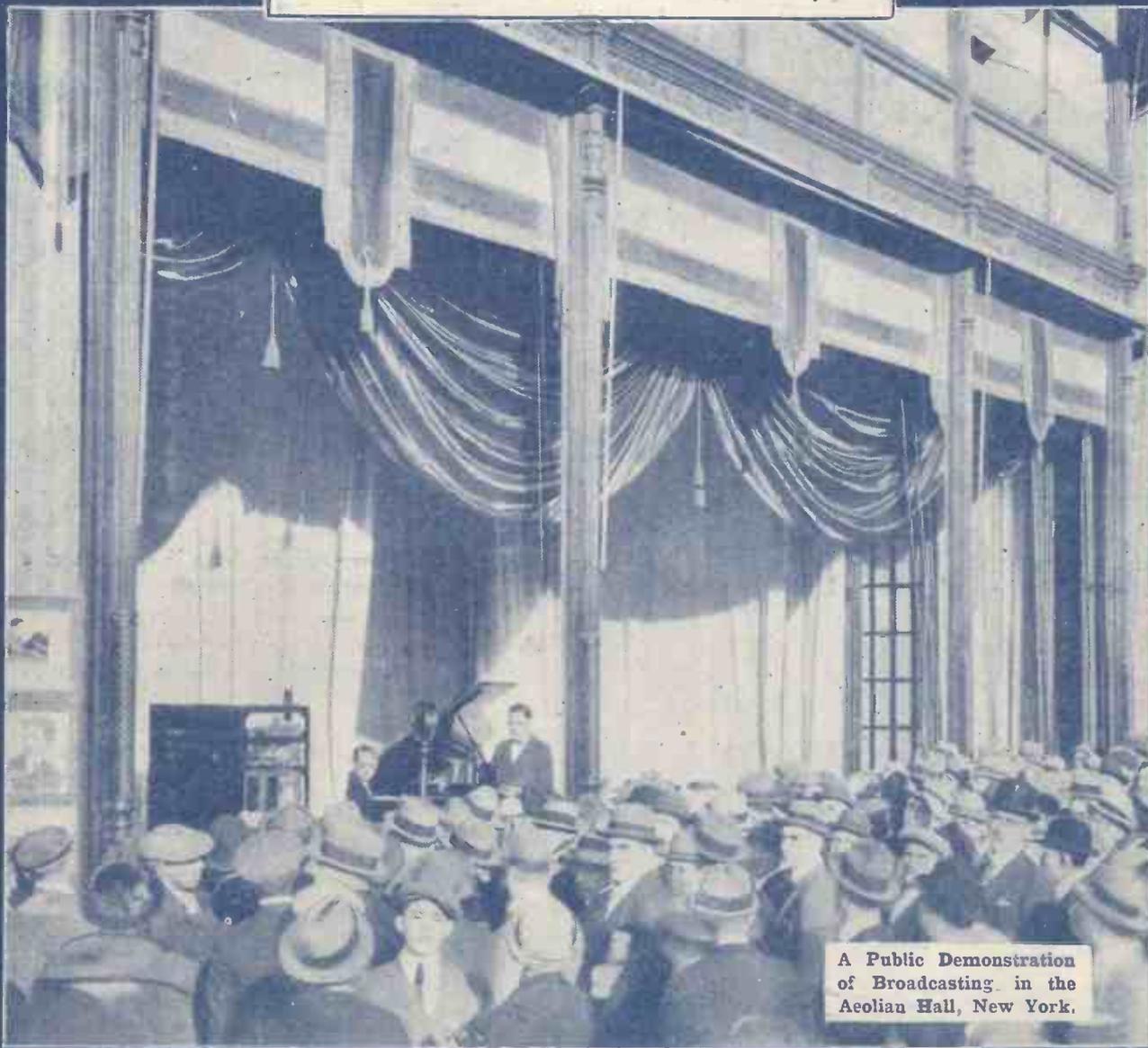
Popular Wireless

and Wireless Review

PRICE 3d.

EVERY THURSDAY.

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



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SPECIAL FEATURES IN THIS ISSUE.

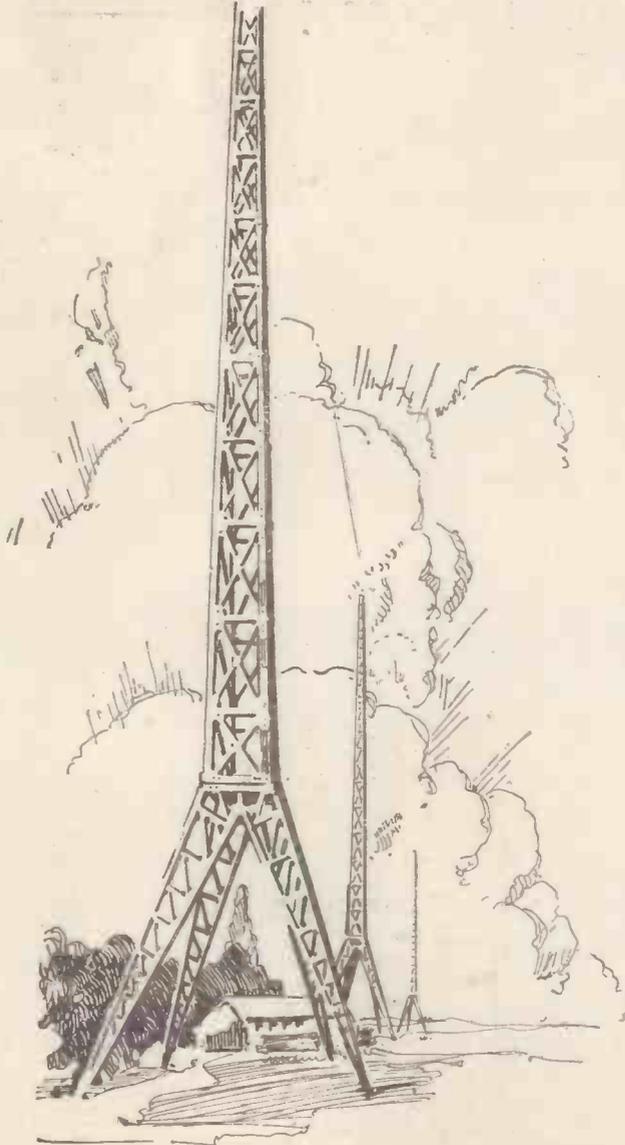
Wireless at Sea.
 Economy in Receiving Sets.
 How to Build a Loud Speaker.
 An Interesting Super.

Preventing Radiation Trouble.
 The Mono Control Receiver.
 Fine Tuning.
 Technical Notes.

HOW TO OPERATE YOUR NEW SET.



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POPULAR WIRELESS

AND WIRELESS REVIEW.

January 3rd, 1925.] THE RADIO WEEKLY WITH THE LARGEST CIRCULATION. [Every Thursday, Price 3d.

Technical Editor :
G. V. DOWDING, Grad.I.E.E.

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Sir OLIVER LODGE, F.R.S.

RADIO NOTES AND NEWS OF THE WEEK.

Belfast's New Land-line.

THE troubles of Belfast caused by a noisy land-line are now to be abolished, and 2 B E's new land-line should place the Ulster station on an equality with the other distant main stations as regards communication with London. The special line will probably be in use by the time this issue of "P.W." appears on the bookstalls.

* * *

Some Set !

WHAT is supposed to be the world's finest radio receiver has just been presented to President Coolidge by a local telephone company in Washington. It is a five-valve neutrodyne circuit, enclosed in a mahogany cabinet which can be used as a writing-desk. All the exposed metal parts are heavily gold-plated, and the panel is inlaid and engraved with gold.

* * *

Those Licences !

IT HAPPENED to be in the House recently when the Postmaster-General, replying to Commander Kenworthy, announced that the Government intends to introduce a Bill in February which will define more clearly the position with regard to the application of the Wireless Telegraph Act to broadcasting.

Whatever may be said about Mr. Ford's agitation against the control of Wireless by the Post Office, I doubt if we should have had a definite promise of a Bill if he had not thrown down the gauntlet to the P.M.G.

"Het" for "Hat."

THE British Empire Shakespeare Society has played a very subtle card against the British Broadcasting Company, by the statement that the voices of certain "uncles" are "affected" and "irritating." A few of them say "het" for hat and "Indyah" for "India," according to the B.E.S.S., but the B.B.C. are quite right in supposing that if Shakespeare himself were able to talk to the public it is probable that nobody would understand much of what he said.

The Multidyne

Very shortly "Popular Wireless" will commence a new series of articles on the "Multidyne"—a new receiver of the greatest interest to every amateur and experimenter.

The "Multidyne" is the easiest and best experimental set ever devised.

G. B. S.

"ONE of the very best announcers that we ever had was Mr. G. B. Shaw," says the B.B.C. But remembering my own efforts to "draw" G. B. S. for the benefit of "P.W." readers, I am inclined to think that his silence is even more remarkable than his speech.

New Swiss Station.

A NEW Swiss broadcasting station is now on the air at Dubendorf, near Zurich. It has been allotted the call-sign HBK, and is testing out on a wave-length of 1980 metres.

in crowding-in to hear the more famous professors will no longer limit the lectures to a small audience.

* * *

Fast Fashions.

THE wireless transmission of pictures has already been taken advantage of to let New York see the latest Paris fashions. Pictures were received in America from Radio House, London, which a few hours before had been in Paris, and which crossed the Channel by aeroplane, and the Atlantic by wireless.

* * *

Swansea's Record.

THE new relay station at Swansea has already one record to its credit—its programme is the most varied one in the country. Listeners at 5 SX will have to learn to recognise not only the voices of their own station's Uncles, but also those of Cardiff and of London, for each of these two stations provides the Swansea programme on three days a week.

* * *

S.S. "Leviathan."

READERS who have listened-in to the concerts transmitted by the U.S. liner, "Leviathan," whilst the vessel is at sea, will be interested to know that the whole of the ships wireless equipment is of the most up-to-date type afloat. A 6 kw. Western Electric transmitter is used, and in addition there is a 2 kw. spark set, an emergency set, and a great variety of receivers and amplifiers.

* * *

Radio Rum-Running.

RUM-RUNNERS of America have recently organised a broadcasting station giving regular programmes with all the usual features, including bed-time stories.

It is, thought that whilst reciting fairy tales certain words are introduced in a pre-arranged order so as to form a code which informs the boot-leggers where shipments are to be made, and the quantity of spirit which is to be sent. So if Chelmsford's call-sign gets mixed up in it, somebody will be wondering who ordered 5 barrels of X. X.

(Continued on page 1072.)



The sitting-room on the s.s. "Mulbera," used by the Duke and Duchess of York.

Broadcasting Sorbonne Lectures.

THE School of Posts station, Paris, has created a bold precedent in broadcasting the famous Sorbonne lectures. At certain pre-arranged times on Mondays, Wednesdays, and Thursdays the actual lectures given to students in the class rooms will be broadcast, and the fact that there was always a certain difficulty

NOTES AND NEWS.

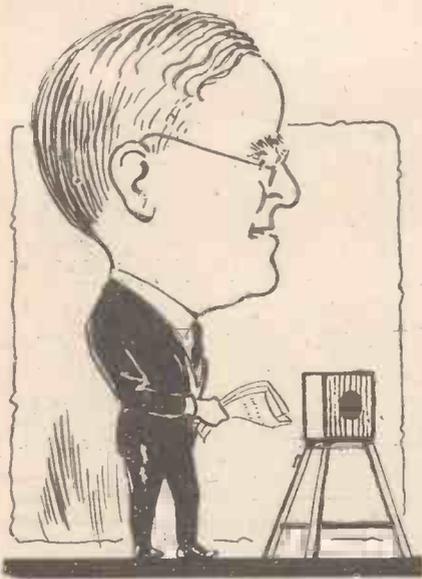
(Continued from page 1071.)

Bolshevist Broadcasting.

I HEAR that the Soviet stations are getting quite active, and I shall be glad to hear particulars from any Northern readers who can tune in short-wave Russian broadcasting. Moscow is now sending a special Esperanto programme on the last day of every month, on a wave-length of 3,200 metres.

South African Record.

JOHANNESBURG has been picked up in France, but, so far as I know, no British listener has succeeded in tuning in to J.B. The short-wave South



MR. PERCY PITT,
Musical Director of the B.B.C.

African tests which Poldhu has been carrying out with Milnertown are continuing at intervals, but on a lower wave-length, that used now being in the neighbourhood of 60 or 65 metres.

Talks on Engineering.

MR. A. S. E. ACKERMANN, B.Sc. (Engineering), who has been announced to give a series of seven talks on "Fallacies in Engineering and Science" from 2 L O in the New Year (beginning on January 13th), is the author of "Popular Fallacies." The B.B.C.'s Director of Education tells me that he feels that engineering topics have been rather neglected over the microphone up to the present, and that a great many listeners have asked for technical-but-not-wireless talks of late.

Breslau's Brain Wave.

THE Breslau station has lately been testing out an ingenious idea, by trying the effect of broadcast music upon factory workers. Not only are special lunch-hour programmes given, but by means of loud speakers experiments are being conducted with a view to seeing if the output of workers doing mechanical duties can be accelerated by suitable tunes! The B.B.C. are not contemplating following this example.

Dublin Calling.

MYSTERIOUS broadcasting has recently been carried out in the neighbourhood of Dublin, generally after 11 p.m., when the B.B.C. stations have closed down. "Hello, everybody, Dublin calling!" is usually the first announcement, and then news, etc., is given out on a wave-length of 480 metres. On one occasion the speaker apologised for not sending out a programme in the daytime, but pointed out that his aerial had to be taken down in daylight, as the authorities are trying to locate him.

A Year's Work.

A FRENCH amateur has recently been going through his log for the past twelve months, and he finds that he has heard amateurs from dozens of different countries all over the world. He has listened to U.S.A. amateurs over 2,000 times, but he only reports 76 English transmissions. Amongst the countries received were Mexico, Japan, Cuba, Hawaii, and New Zealand.

The Gramophone Pirate.

THE super-radio pirate has now appeared in the person of the man who not only listens in without paying a licence fee, but who makes records of the voices of famous singers when they appear before the microphone. He can sell such pirated music much cheaper than the gramophone company, who have to pay a big fee to the artiste for his services; but so far the activities of this form of pirate have not caused anybody annoyance, and probably he only exists in the imagination of some of the B.B.C.'s more virulent critics.

Broadcasting Brain-waves.

SHALL we ever be able to broadcast a Thought? Recent experiments between Lord Balfour and Professor Gilbert Murray have thrown into prominence the idea that thought is in many ways akin to wireless, and it may be accounted for by the disturbance of the ether around us, and by the formation of a kind of ether wave motion. If the B.B.C. ever attempted to broadcast "thought" programmes to "listeners," the latter will automatically become "thinkers," and it is to be hoped that the B.B.C. will know exactly what it is they are thinking.

Wild Fowl and Wireless.

I HEAR that the B.B.C. is shortly sending engineers with a portable transmitter and an expert naturalist up the River Alde, in Suffolk, late at night.

According to the "Daily Mail" the cries of several wild fowl will be broadcast, a description being given of their habits. At the end of half an hour a blank cartridge will be fired, when the air will be filled with the cries of thousands of birds, presenting a very good winter contrast to the broadcasting of the nightingale.

A New Year's Alteration.

FROM to-day the restriction on foreign components used in wireless sets has been withdrawn, and there is now no legal obligation to employ parts of British manufacture when making a set. But broadcasting was set on its feet by member-

firms of the British Broadcasting Company, and these firms will still continue to turn out their sets marked with the B.B.C. stamp. This will be a guarantee to listeners that all the parts were manufactured in this country, and will serve to distinguish them from the imported sets which will soon be on the market.

Savoy Music.

AN American company, Harms Incorporated, recently applied to Mr. Justice Eve, in the Chancery Division, for an injunction to restrain the broadcasting of "Tea for Two" and "I Want to Be Happy" from the Savoy Hotel. It was stated that the play "No—No, Nanette" was due for production in London, and its eyes, so to speak, were

SHORT WAVES.

... It isn't right that the Post Office—or any Government Department—should impose a tax of doubtful legality, collecting it from those fool enough to pay, and leaving the others free. In such circumstances meanness is its own reward. ... The Post Office must treat all alike. And the sooner it puts itself in such a position that it can not only insist on the licence, but can exact penalties for evasion, the better.—"Sheffield Daily Telegraph."

We hear reports of a crime-wave, and a daily paper remarks that "modern criminals are making constant use of wireless telephony." It would be interesting to know what crime-wave length they are using.—"Punch."

... The divine arts of music and musical speech are never more divine than when they soothe and cheer and heal the broken, the weary, the frightened and the sleepless, and wireless can bring them to the neediest ears.—Dr. C. W. Saleeby, writing in the "Daily News."

... Something had been done (by broadcasting), for instance, in endeavouring to establish a relation with children and give to the world the sort of thing that the children liked.

That idea might be extended considerably. We might have an hour devoted to politicians, in which the simple rules of their trade might be expounded, and the possibility of conducting it in an honourable manner explained in simple words.—Mr. G. K. Chesterton.

THIS WEEK'S QUERY.

"I have a basket, but what is the best way to make a large pancake?"

being picked out by the playing of the two pieces by the Savoy bands.

Manchester's Move.

MANCHESTER'S new broadcasting quarters in the Parsonage are much larger than the accommodation formerly provided in Dickinson Street. The convenience of having two studios should obviate those irritating little delays and "Two minutes, please!" which are necessary with limited space. One interesting difference is that the Dickinson Street studio was at the top of a four-storied building, but the new ones are below ground-level.

Sea-Gulls Next.

AN interesting suggestion which has followed on the B.B.C.'s proposal to broadcast the cries of wild fowl from Suffolk is that a microphone should be taken to Ailsa Craig, in Scotland. This is a famous resort and homing-ground for gulls, and I believe the B.B.C. would find no technical difficulties in the scheme, whilst it should certainly prove an uncommon "turn" at the microphone.

ARIEL.

HOW TO MAKE A CRYSTAL SET OF PRACTICAL DESIGN.

By J. F. CORRIGAN, M.Sc., A.I.C.

The receiver described in the following article has several advantages over the usual stereotyped crystal set, as the experimenter can, with its aid, try out many different types and patterns of crystal detectors.

THE crystal set which is to be described in this article possesses several advantages over the general run of receivers of this nature. These advantages lie chiefly in its extreme adaptability, a property which it is very desirable for a radio set to exhibit at the present day.



Fig. 1. The completed set.

The receiver described below makes an interesting piece of apparatus for the experimenter's use. By its aid almost any number of different types and patterns of crystal detectors may be tried out with the same standard receiver, and also different types of tuning may be employed with the same detector.

This is a very obvious advantage to those experimenters who wish to try the effects of different varieties of tuning on the recep-

tion produced by the same crystal contact or combination.

The crystal receiver as a whole also provides for the easy addition of H.F. and L.F. amplification, and, at the same time at which these are employed, the tuning and the detecting portions of the set can be altered in nature.

A glance at the illustration, Fig. 1, which indicates the compact appearance of the finished crystal receiver when contained in a suitable dust-proof cabinet, will indicate to the reader the lay-out of the panel. This lay-out is somewhat arbitrary, and therefore no dimensions are given, for the amateur who undertakes the construction of such a set will have special purposes of his own to fulfil, and therefore he will be inclined to design the lay-out of the components on the panel according to his own particular fancies and needs.

Nevertheless, it will be seen from Fig. 1, and also from Fig. 2, which is a photograph of the back of the panel, that the crystal set may conveniently be divided up into two units, a tuning unit and a detecting unit.

A Detector Selecting Switch.

The tuning unit employs an ordinary one-hole fixing variometer of a standard pattern such as may readily be purchased from any firm of radio dealers, or which may be made at home without much difficulty. A loading coil is provided in the circuit for the purpose of increasing the wavelength of the receiver. This loading coil, of course, may be omitted from the receiver if desired.

Reference to the illustrations will show that two pairs of terminals are provided on opposite sides of the panel near to the variometer dial, and that these are provided with suitable brass straps in order to complete the circuit of the instrument.

In the set depicted there are included three separate crystal detectors and also a pair of smaller terminals, to which may be attached a further detector if required. The detectors provided on the standard instrument consist of an ordinary micro-adjustment perikon detector, an enclosed detector, and also one of the ordinary rough and

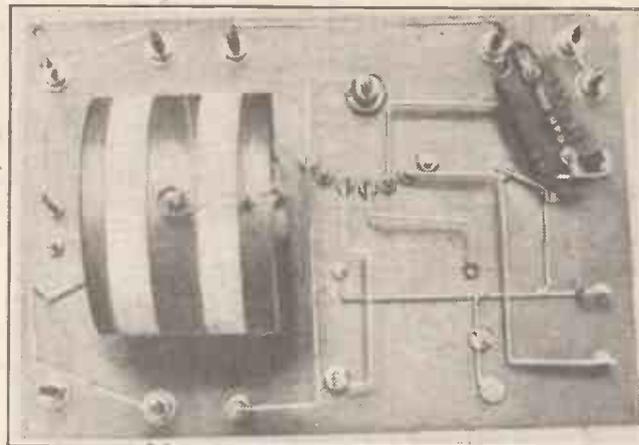


Fig. 2. Showing the back of panel wiring.

ready cat's-whisker type. To the small detector terminals may be attached any sort of improvised or experimental rectifying device, this being a very convenient method of providing for the inclusion in the circuit of such articles which are not intended to be used regularly or to be permanently attached to the receiver.

The selection of the detector to be used in the circuit is made by a contact arm which rotates over a number of copper or brass contact studs. This detector selection arm must be of the very best design and construction. It must rotate faultlessly and evenly over the contact studs, and the wire connection to the underside of the arm should, whenever possible, be firmly soldered, and not merely placed between two washers.

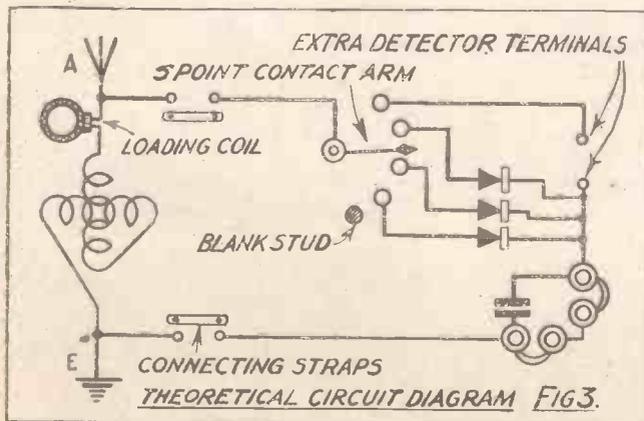
Careful Workmanship Necessary.

The construction of this detector selection arm is worth paying serious attention to, for if any loose or uneven contacts occur at that part of the circuit the reception from the set as a whole will be generally unsatisfactory.

It will be noticed in the illustration that one of the contact studs has no wire connection to it. This serves as a blank, and, although it is not necessary, its inclusion in the receiver is often very convenient.

The 'phone terminals of the set are arranged in series, a brass strap shorting

(Continued on page 1074.)



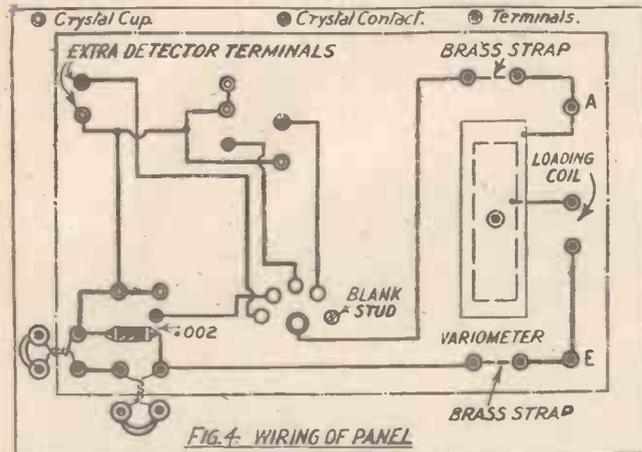
A CRYSTAL SET OF PRACTICAL DESIGN

(Continued from page 1073.)

one pair when it is not required. A telephone condenser (about .002 mfd. capacity) is placed across the first and fourth terminal. This, again, is not essential, but, generally speaking, more satisfactory results are obtained with it than without it.

Valve Amplification.

It will be observed that the pairs of 'phone terminals are placed at right angles to each



other. This arrangement is of very great convenience when L.F. amplification is added to the circuit, for in this event the cabinet containing the L.F. amplifier may be placed alongside the set and its input terminals connected to the pair of terminals at the side of the crystal set, the brass strap, of course, under these conditions, being placed across the terminals on the front edge of the panel. Thus the amplifying unit may be placed in a cabinet which is uniform in appearance with that of the crystal set, and the two cabinets may be placed alongside each other. This arrangement provides for neatness and economy of space.

If the tuning of the set is required to be altered, the two brass straps which connect the opposite pairs of terminals near to the variometer knob are removed, and the tuner which it is desired to use is connected to the two opposite terminals which are nearest to the detector unit.

That is to say, suppose the standard variometer tuning which is included in the cabinet was to be omitted and a loose-coupled tuner used in its place. In this event, the leads from the secondary coil of the loose coupler would be connected to the two opposite terminals which are nearest to the detector unit of the set, the aerial and earth, of course, being attached to the primary coil of the loose coupler.

H.F. amplification is added to the set by removing the two opposite brass straps and by connecting the output terminals of the H.F. amplifier to the two opposite terminals which are nearest to the detecting unit of the receiver, the input terminals of the amplifier being attached to the opposite pair of terminals on the crystal set nearest to the loading coil. And, of course, the aerial and the earth are connected to their usual terminals on the crystal receiver.

Thus, under these conditions, the aerial

current will enter the set via the ordinary aerial terminal. It will be tuned by the variometer, amplified at radio-frequency, and then passed along to the rectifying portion of the circuit.

The H.F. amplifier, like the L.F. one, can be placed in a cabinet which is uniform in appearance with the one which contains the crystal set proper, and therefore if the three cabinets are arranged alongside one another an extremely compact and neat appearance will be presented by the receiving apparatus.

The above crystal set, therefore, is well worthy of construction by the seriously minded amateur. No startling claims are made for the reception which it produces, but, if carefully constructed, it will produce signals which are really strong and clear up to ranges of twelve to fifteen miles from a main broadcasting station. Using the H.F. amplification the distance of reception is, of course, proportionately increased; and with one stage of L.F. amplification loud-speaker work is possible within ranges of four or five miles from a B.B.C. station. The set is chiefly designed for service and

adaptability. It gives consistently good results, and by its use a large variety of "straight" circuits may easily be tried out.

Four Variations.

To sum up, it may be stated that the set provides for:

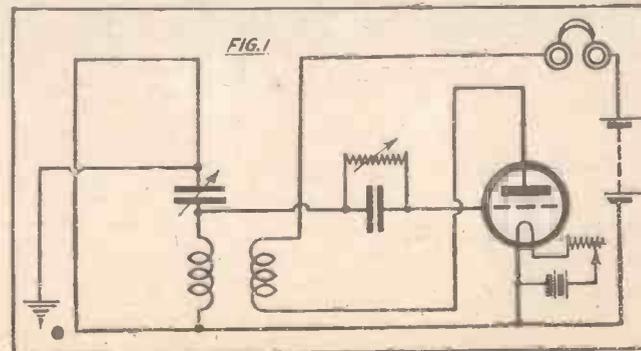
1. Variation of tuning device.
2. Variation of rectifying contacts and combinations.
3. Addition of L.F. amplification.
4. Addition of H.F. amplification.

And, of course, in addition to the above provisions, they may all be combined so that the number of different circuits containing varying tuning and rectifying devices which can be obtained by means of the set is considerably large.

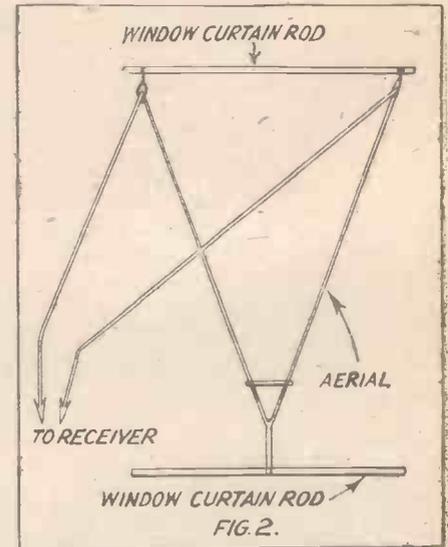
AN INTERESTING "SUPER"

By H. V. BERRY.

THE circuit herein described was developed by the writer whilst experimenting with an indoor aerial. The main advantage is its extraordinary



selectivity, whilst its range of reception is far greater than that of an ordinary single-valve reaction receiver. On it the following stations have been received at fair strength: London, Cardiff, Birmingham, Manchester, Aberdeen, Newcastle and Bournemouth (B.B.C. stations). Several continental stations have also been received, three of these were Hamburg, Berlin and Breslau. The receiver is situated some 25 miles inland from 6 B M, and the writer thinks that this will be admitted to be a fair "bag" for one valve.



With reference to the selectivity mentioned above. This is so great that a vernier must be fitted and this vernier should not be an attachment but a separate condenser having a capacity not exceeding .0001. A separate condenser should be used, as this is less liable to hand-capacity effects.

Novel Aerial.

The circuit is shown in Fig. 1. It will be seen that the aerial has both ends connected to the receiver in the same way as a frame aerial is connected. The A.T.C. (.0005 max.) is in series with the aerial and A.T.I., whilst the earth is connected to the aerial side of the A.T.C. and not to what is called the "earth terminal." The variable grid leak should be a good one, such as Watmel or Lissen. The writer uses the former. The grid condenser should have a capacity between .00025 and .0007, or more, according to the valve in use.

Although not shown in Fig. 1, a five-plate condenser across the reaction coil will help to control reaction if properly handled, but if not it will merely cause oscillation.

The writer strongly advises the use of basket coils for inductances, as these are not only cheap but very efficient.

For maximum signal strength the reaction coil should be tuned to the same wave-length as the aerial coil, but this makes the receiver very prone to oscillation.

Fig. 2 shows the aerial used by the writer. The wire used is 4 p.m. ignition flex, the rubber covering of the wire being the only insulator used, the total length being 43 feet.

THE ECONOMICAL CONSTRUCTION OF WIRELESS RECEIVING SETS.

By E. CHATTERTON, B.Sc. (Eng.)

How to get best results from your new set at the lowest possible cost.

THE question of economy in construction is an important one to the vast majority of wireless amateurs, and the writer is aware, from his own sad experience, of the limitations imposed on the enthusiast by lack of financial resources. It is hoped that the practical hints which are about to be given will assist the amateur who is considering the

diverse components are the best, but it can be definitely stated at the outset that to purchase really good components from reliable manufacturers is usually a very real economy if best results are looked for.

Another method of reducing the cost of apparatus is for the constructor to build as much as possible in his own workshop. Within limits, this is a method of procedure which can be recommended, so long as the constructor does not attempt work which is beyond his ability. For example, the most progressive of radio manufacturers are unable to produce low-frequency transformers which are absolutely satisfactory from the point of view of distortionless amplification, and it is not to be expected that the non-technical amateur will find this within his capacity. It is, therefore, recommended that these and similar items should be purchased, but such items as high-frequency transformers, coils, and fixed condensers can be made cheaply and efficiently.

Repeated warnings have appeared in this journal with regard to faulty fixed condensers, but these items are of such importance and cause so much trouble that stress is again laid on the fact that all fixed condensers should be of good quality.

Question of Design.

It will be apparent that the problem of production of the best possible article at the lowest possible price is one which confronts the radio manufacturer as well as the amateur constructor, for in order to succeed he is forced to place receivers on the market which will compare favourably, in quality and in price, with those of his competitors.

The amateur usually attacks the problem in a more or less haphazard manner, but the manufacturer is wise enough to realise that the only way to arrive at a satisfactory solution of the problem is by giving very careful thought and consideration to the design of receivers which he builds.

In most cases, therefore, a special staff is employed which deals solely with design and research work, this involving the expenditure of large sums of money, which is found to be justified by the improvement in results and reduction in price which are produced. From this the thoughtful amateur will learn a useful lesson, and will realise that it is well worth while to devote considerable forethought to problems of design before construction is embarked upon.

The first step in the process of design is to decide on a circuit diagram which will give the results desired, using a minimum amount of apparatus, and this should be done with extreme care.

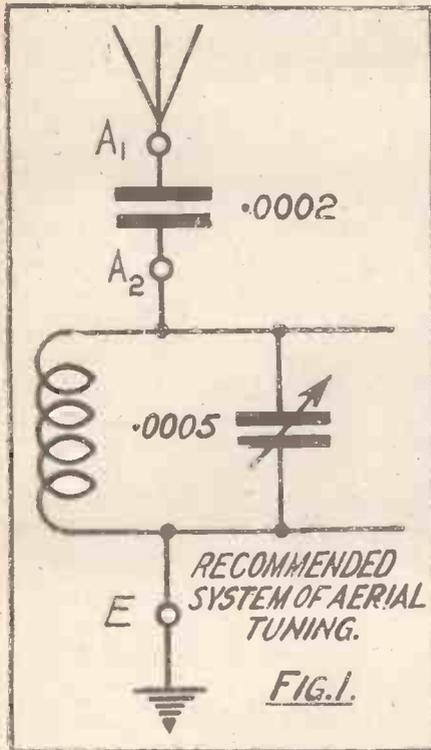
Valve Detectors Preferable.

It is obviously impossible to give a definite circuit which will be satisfactory in all cases, for the requirements of individual constructors vary widely. The most that can be done is to enumerate a few general conclusions to which the writer's experience has led him, and to point out the pitfalls which await the unwary.

Firstly, the great thing to strive for is simplicity, for a complicated circuit diagram invariably leads to a set which is difficult to build and difficult to handle.

The number of adjustments which must be carried out to tune the receiver to any given wave-length should be reduced to a minimum, and no adjustable component should be incorporated unless essential. For example, the writer is opposed to the use of variable grid leaks and grid condensers except in special cases. If the operator is a "strong silent man," who, having determined on the best adjustment for these items, will leave them alone for good and all, they no doubt serve a useful purpose, but in the majority of cases they will merely provide additional exercise in the process of "knob twisting."

(Continued on page 1076.)

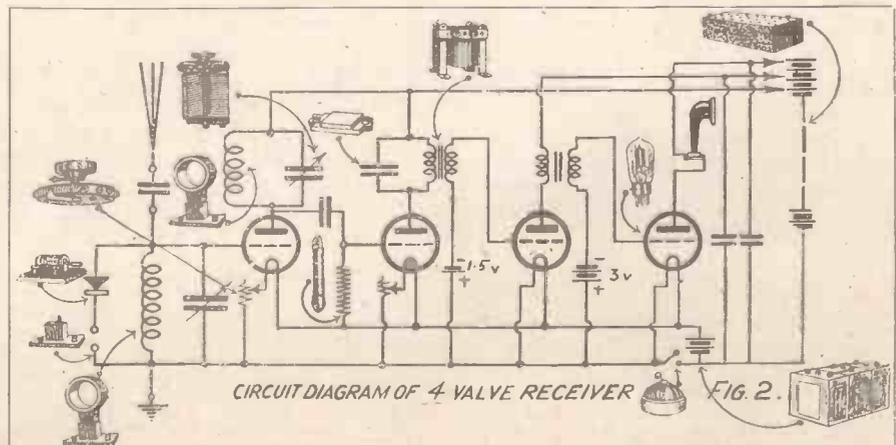


construction of a new receiver to build a really good set with a minimum of expenditure.

It must be understood that these remarks are intended for those who have no inclination to experiment, and who wish to build a "permanent" form of set, which will give consistently good results. It is difficult to give advice to the experimenter, for the cost in his case is limited solely by the range of experimental work which is to be covered.

Quality of Components.

One obvious method of reducing the cost is to use the cheapest possible components throughout, but this is a practice which cannot be generally recommended, for the results obtained from a receiver built on these lines will usually give rise to dissatisfaction with consequent replacement of the parts by those of better quality. It does not necessarily follow that the most expen-



THE ECONOMICAL CONSTRUCTION OF WIRE- LESS RECEIVING SETS.

(Continued from page 1075.)

The same argument may be urged against the use of crystal detectors in valve circuits, and unless a dual amplification circuit is used the valve detector is to be preferred on the grounds of simplicity and consistency in results.

For straight circuits a grid condenser of

series condenser will, of course, be used for reception of waves below about 500 metres.

It is a surprising fact that many amateurs who introduce every available gadget into their receivers, often neglect to incorporate those simple refinements which cost next to nothing, and which make a vast difference to the results obtainable. The vast majority of receivers employ only one high-tension lead which supplies the anode voltage to each of the valves. It is a very simple matter to provide a separate H.T. tapping for each valve, and the results obtained will be considerably improved, for high-frequency and detecting valves require a much lower anode voltage than is necessary for the efficient working of low-frequency amplifiers.

Again, in many cases no provision is made for a grid biasing battery in the case of low-frequency valves, while this item makes an enormous difference to the strength and quality of received signals. It is also advisable to connect a large fixed condenser of about one microfarad capacity across the high-tension battery connections to the low-frequency valves.

Fig. 2 shows a four-valve circuit which is arranged on the principles stated in this article, which shows how the items

mentioned are applied.

It will be noticed that two extra terminals and a crystal detector are provided, which make it possible to use the set as a plain crystal set for reception of the local station. It will also be seen that no filament rheostats are provided on the low-frequency valves. These are not necessary from the point of view of operation, and when four valves are in circuit the current saving effected by their use is negligible.

A single pole switch is provided to break the low-tension circuit.

Cabinet Design.

The problem in cabinet design is to produce a compact arrangement, which at the same time provides ample spacing of components, using a minimum of ebonite, and keeping the woodwork simple. This again will vary according to individual requirements, depending on the external appearance which is desired.

Figs 3 and 4 show a cabinet design for the four-valve circuit previously described. These figures are self-explanatory, and the

same method of construction can be applied with suitable variations to other receivers.

The front panel is of wood, well coated with shellac varnish, only two narrow strips of ebonite being employed.

BROADCASTING FROM BELGRADE.

A MODERN radio broadcasting station has been in operation since May 1, 1924, at Rakovitz, near Belgrade, Yugo-Slavia.

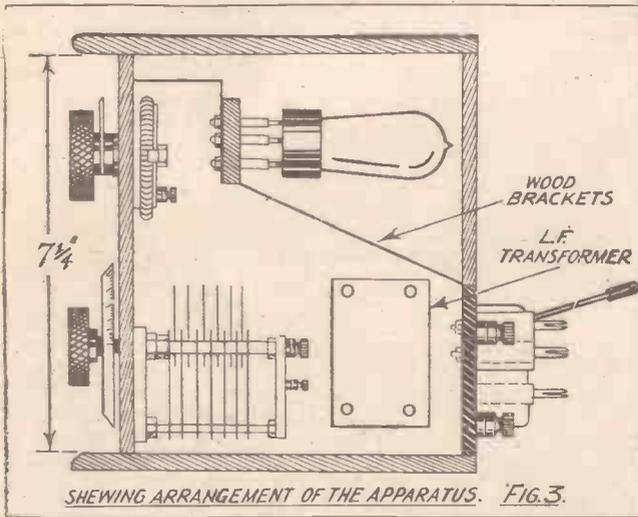
The station was built by the "Radio-Compagnie Generale sans-Fil," with expenses equally shared between the government and the company. Gross returns to the proportion of 30 per cent., and net profits to the proportion of 20 per cent., will be paid to the government.

The concession was given for a period of 30 years, at the end of which the station will become State property. The State likewise has the right to buy up the property at the end of ten years if it so desires.

Quick Work.

The technical personnel and the employees are hired by the company. The technical installation, the tall aerials, the motor sheds and the broadcasting apparatus are all in Rakovitz.

Two motors are used and develop 25 kilowatts, and besides these there is a small station with motors developing 2 kilowatts. Radiograms are sent out from Rakovitz, while the Belgrade Radio-telephone Broadcasting Station, as the central office is known, receives the messages for London, Vienna, Prague, Bern, and Beirut. The wave-length is 1,650 metres. Answers are received from London by radio within two hours of sending, and the cost is no more expensive than that of ordinary telegrams.

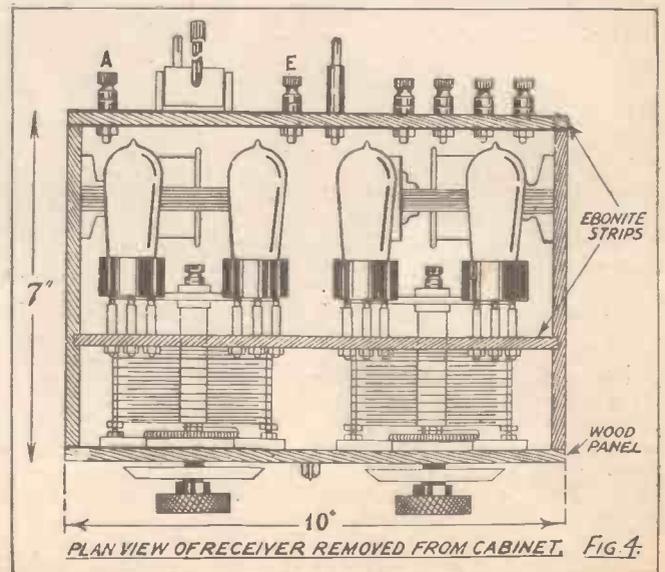


.0003 mfd., in conjunction with a leak of 2 megohms, will always give good results, if the filament and plate voltages are suitably adjusted.

Unnecessary Complication.

It may be advisable to say a few words with regard to the many "super" circuits which are so well known at the present day. Many of these are capable of giving almost incredible results in skilled hands, but they are for the most part dependent on very fine adjustments for their efficient working, and while the results obtainable may tempt the inexperienced, they cannot be recommended for the non-experimenter. These remarks do not apply to many dual amplification circuits which are in use at the present time, which are capable of excellent results even in inexperienced hands. Nevertheless, in no case should more than one valve be used as a dual amplifier, and if more than three valves are to be used, nothing is gained by employing dual amplification at all.

Many receivers are unnecessarily complicated by the employment of coupled aerial circuits. The arrangement shown in Fig. 1 is capable of giving just as good amplification and selectivity as a double circuit tuner, and will be much easier to adjust, in addition to saving half the apparatus. It will be seen that a fixed coil is used, across which is connected a variable condenser of .0005 mfd. capacity. Two aerial terminals are provided, one of which introduces a fixed condenser of .0002 mfd. in series with the aerial circuit. The



HOW TO OPERATE YOUR NEW SET.

CLEAR INSTRUCTIONS FOR THE NON-TECHNICAL READER.

By G. V. DOWDING, Grad.I.E.E.
(Technical Editor, "Popular Wireless.")

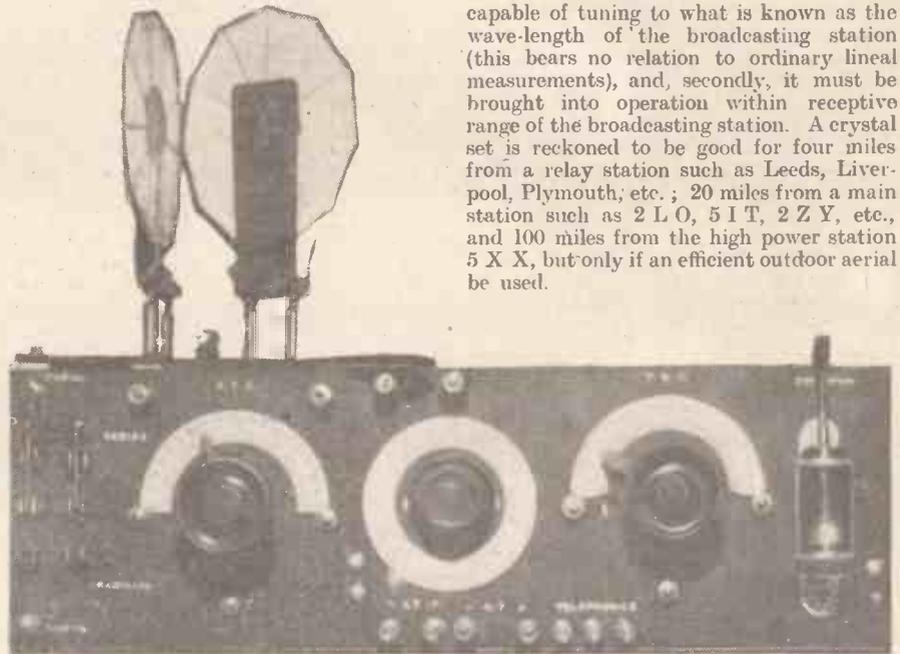
CONFRONTED for the first time by a glittering assembly of black knobs, brass terminals and mysterious-looking "controls," the new owner of wireless receiving equipment may be forgiven if he asks himself "What do I do?" In ninety-nine cases out of a hundred he will ask nobody else, even if knowledgeable ones are available, for the average Englishman prides himself that he can conquer unknown worlds without recruiting outside assistance.

Now this is all very well, and it may be granted that wireless sets can be made to work, and work very well, even by those who go no farther into the depths of the science than to gain an experience of mere "knob twisting," but this experience often proves costly, and no end of damage can be done both to the actual equipment and to other listeners' reception, as I shall later on show, if this knob or that knob be twisted carelessly, or if the various wires are not connected up correctly.

First Considerations.

Operating a wireless set, be it simply a crystal receiver or an elaborate valve set, is an art, and, like singing, an art in which few excel but all can indulge. Therefore in this article I intend to discuss the "notes" on the wireless "scale," so that all may at least learn the first principles of practical radio and get in "tune" without unduly harrowing others' ears. The more advanced reader of "P.W." will not, I fear, find much in it to interest him, but I am sure he will know *someone* to whom it should appeal.

A crystal set is more or less "fool-proof," and the above remarks hardly apply to it, because under average conditions little damage can result, however carelessly it be handled. A number of makes of this type of receiver are accompanied with explicit



The "P.W." Set as constructed by Mr. M. Hirst, 293, Primrose Road, Bootle, Liverpool.

instructions, and I could quote several examples, but this commendable practice is more the exception than the rule.

Primarily, there are two essential conditions that must obtain before good reception results, firstly, the set must be

capable of tuning to what is known as the wave-length of the broadcasting station (this bears no relation to ordinary lineal measurements), and, secondly, it must be brought into operation within receptive range of the broadcasting station. A crystal set is reckoned to be good for four miles from a relay station such as Leeds, Liverpool, Plymouth; etc.; 20 miles from a main station such as 2 L O, 5 I T, 2 Z Y, etc., and 100 miles from the high power station 5 X X, but only if an efficient outdoor aerial be used.

By efficient is meant that it must be fairly high, say at least 30 ft. or so at one or both ends, well insulated and not "screened" by high buildings or trees.

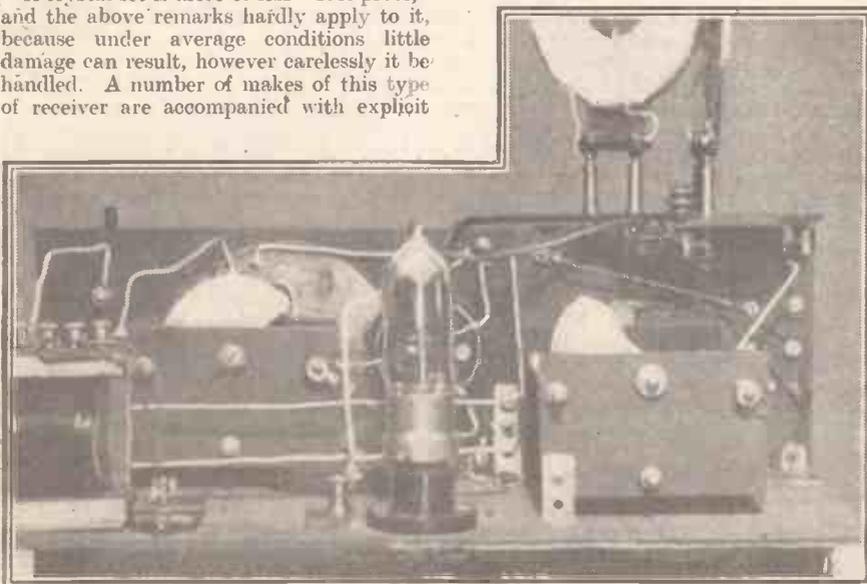
Taking it for granted that the owner of the new set has erected his aerial and taken an earth lead to the water pipe or to a piece of metal buried in the ground, and that he is aware of the instrument's capabilities and limitations, let him connect it up carefully, making sure that the aerial lead-in is attached to the terminal marked "Aerial" (or it may be just an "A"), and the earth lead to the terminal marked "E," or "Earth."

Handling a Crystal Set.

He should, of course, make certain that the ends of these two wires are nice and bright, and that there is no lacquer on those points of the terminals which will come into contact with the wires—if there is, it must be scraped off with a penknife. If it is a crystal set he then attaches the telephone receivers to their terminals and proceeds to "tune in."

As he is no wireless expert his set will not be of an experimental nature, and he will be faced with but one, or at most two, tuning controls. These might take the shape of black knobs fixed to revolving graduated scales, or switches with a number of contact points, or a small handle which can be pulled up or down or in or out.

Whatever it is, it should be moved gently
(Continued on page 1078.)



A rear view of the same receiver, which, as will be seen, is on the American system.

HOW TO OPERATE YOUR NEW SET

(Continued from page 1077.)

throughout its whole range of movement until loudest signals are obtained with the crystal detector roughly adjusted. As a matter of fact, until the tuning has been accomplished, it is as well to adjust the crystal detector simultaneously. Once the wave-length tuning has been "set" the control or controls concerned need hardly ever be touched. They can be left in their best position, and whenever the set is used, only the detector need receive attention.

Modern crystal detectors do not require very expert handling. In most cases what is known as a "cat's-whisker" is used. This consists of a small spiral of wire which is arranged to come into contact with the piece of crystal material. In some cases this contact must be made very lightly indeed to give best results, and in all cases the surface of the crystal must be carefully explored to discover the most "sensitive spots."

It should be remembered that the noise-producing capabilities of the best of crystal sets is distinctly limited, and the listener is warned against developing "scratchitis." The symptoms of this fell disease evince themselves in the form of restlessness in respect of the crystal adjustment, and can only be cured by the employment of will power and mental admonitions.

Dangerous Battery Connections.

If music and speech are clear and careful crystal adjustment or tuning variations fail to increase the volume of sound, settle down and enjoy the concert. Avoid that raised left hand, parted lips, strained expression attitude if you would enjoy broadcasting and not make it a strenuous search after just-a-little-louder signals.

The new owner of a valve set has much more to do—he is the motorist of listeners; while crystal-set people are merely cyclists. He has more controls to handle, and it is within his power to destroy the peace of other listeners. His responsibilities are even greater in this latter respect than is generally realised, and much of the background of peculiar little squeaks and whistles which can always be heard when listening to a wireless concert is due to the mishandling of valve receivers. Furthermore, unless he is careful he can damage his own apparatus very seriously.

For instance, when connecting up a set, if the big dry battery which is known as the "high tension" be connected to the terminals marked L.T., expensive valves will be immediately burnt out and irreparably ruined. The accumulator or, if the new "super dull emitter" valves are used, the 3-volt dry battery, must be connected to the terminals marked L.T. Note also should be taken that the connections of the batteries themselves must be made correctly, and the terminal of the L.T. battery which is marked + or distinctly coloured red, must go to the L.T. + terminal on the set, not to the L.T. - . Such points might not be important when dealing with the front door bell, but they are supremely important in the case of a wireless set.

Never experiment with battery leads—unless you know how to connect them up—leave them alone until you have found out.

Now most valve sets have their controls very clearly labelled, in fact all valve sets manufactured by reputable firms for broadcast reception are "laid out," as we technicians say, in such a manner that very little is left to speculation or chance. For instance, that little knob or knobs marked "fil. resis.," or "on-off," or "max.—min." are for regulating the "light" of the valves. This adjustment corresponds to that of the crystal detector on a crystal set, except that it is more stable and plays little part in the actual tuning of the set.

The Use of Reaction.

It should be remembered that the valves should always be run at their minimum brightness, which in the case of dull emitter valves is sometimes a very dull red indeed. It may not be out of place to say that the valves should be turned on, and if signals are heard, even though the tuning controls have not been accurately set, should not be increased in brightness past that point where the increase in signal strength

directions to trouble other listeners in quite a considerable area and prevent them hearing the concerts clearly.

The correct procedure in tuning a set in after having connected everything up, is as follows. The valves are first of all turned on and then, with the reaction set at its "minimum" adjustment, the main tuning control is adjusted until the desired station is heard at its loudest. The reaction is then brought gradually in until signals increase to the maximum point without distortion; as soon as distortion occurs the reaction should be taken out, for this is the danger point where the set begins to "oscillate" and cause interference.

After the tuning and reaction have been "set" at a not too critical point—that is, so that the music or speech is not just on the verge of distorting—the valves can be turned down as far as is possible without loss of volume.

Later on the listener will learn how to simultaneously adjust the tuning and reaction and work nearer that "danger point," but for the sake of others this should not be attempted at the commencement of his experience.



Testing receivers at the headquarters of the Radio Broadcast Laboratory, New York.

ceases; in fact they should be turned down again as far as they can be without causing a diminution in that respect.

The tuning controls on a simple one-valve set, or a set that does not employ what is known as high-frequency amplification (of this more anon), will be limited to one knob which controls the wave-length tuning, and which will be marked "Aerial Tuning," "Cond.," "Aerial," "Aer. Cond.," "A.T.I.," "A.T.C.," "Tuning Ind.," "Ind.," or just perhaps with a graduated scale in figures and a marking pointer, for unfortunately such indications are by no means standardised. By the way, graduated scales with figures are merely provided so that the setting can be remembered; such figures bear no actual relation to wave-length.

If what is known as reaction is employed—and most valve receivers employ this—the knob which controls it will be marked "Reaction," "Reac.," or "Intensifier." This is the control that above all others must be handled carefully, as it is capable of virtually transforming the receiver into a transmitter, and can cause interfering impulses to be radiated in all

If the set employs what is known as high-frequency amplification another control will be furnished. This may be labelled "Anode Tuning," "Anode," "Anode Condenser," "H.F. Cond.," or something similar. This should be adjusted more or less simultaneously with the main tuning control, and should present little difficulty.

The H.T. battery will in most cases be provided with a number of little sockets into which small plugs are inserted. These should be moved from point to point after the set is tuned in and the effect on the signals noted.

Wave-length Tuning.

If the set has reached the new listener minus valves, he should not purchase same at random, for valves vary very considerably in character, and any particular valve may not prove suitable in any particular position in a set. It would take too long to detail every type of valve and its characteristics in this article, and the valveless new listener will be well advised to take a reputable wireless retailer into his confidence and recruit his assistance in the matter.

(Continued on page 1115.)

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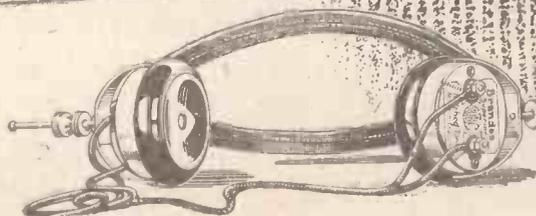
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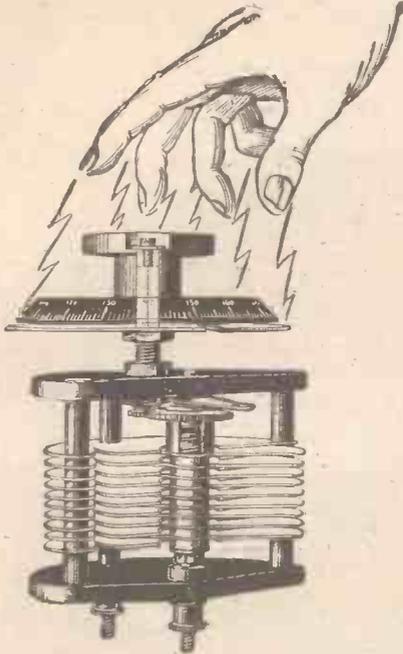
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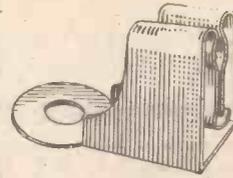
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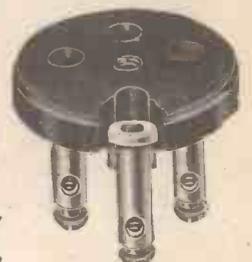
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HOW TO BUILD AN INEXPENSIVE LOUD SPEAKER.

By H. S. M. SMITH.

TO those readers who desire the pleasure of a loud speaker but are unable to afford the expense of one, the following description of a home-made loud speaker which gives surprisingly good results, and



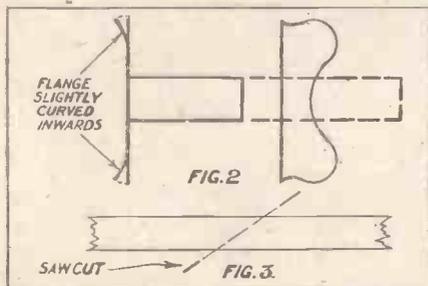
The home made loud speaker complete with stand.

at the same time is not expensive to construct, may be of interest.

A knowledge of soldering is necessary and the only other requirements are: A small file and hack saw; a piece of $\frac{1}{8}$ in. sheet brass about $4\frac{1}{2}$ in. \times 7 in.; 18 in. of very thin brass tubing, $\frac{1}{8}$ in. dia. outside; 6 in. of very thin brass tubing $\frac{3}{32}$ in. dia. outside; a strip 10 in. long of brass, $\frac{1}{2}$ in. \times $\frac{1}{8}$ in.; a wooden base, two terminals, screws, and emery paper and finally the trumpet.

The Earpiece Adaptor.

As will be seen from the first photo, the instrument is really a pair of ordinary headphones adapted to a trumpet by means of a Y-shaped tube, but a special feature is that the 'phones can readily be detached and reconverted to the original headset for use on distance work. Thus for a few



shillings above the price of the 'phones one has a really efficient loud speaker for the local station and also the headset for range. For purposes of comparison, a 12 in. rule is included in one photograph.

The first step is with the 'phones; if the earcaps have the usual one large centre hole, as in Fig. 1 (A), all well and good. (The writer uses Brunet 'phones), but if not a

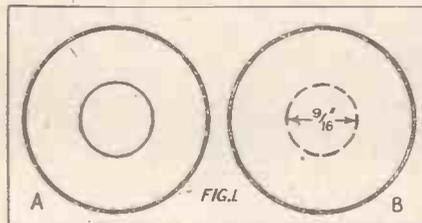
hole must be drilled, as shown by the dotted line in Fig. 1 (B).

Next cut two discs of the $\frac{1}{32}$ in. sheet brass, so that they just fit inside the earcaps, scribe the centre hole in cap with a sharp nail or pencil and cut out hole. This can be done by hammer and nail round the *inside* of the line and finished with the file and emery. Cut with hacksaw two pieces of the $\frac{3}{32}$ in. brass tubing each $1\frac{1}{2}$ in. long, finish off edges and insert flush in hole in cap and solder neatly. file away all surplus solder. We now have two discs which will fit into each earcap, Fig. 2.

Shaping the Trumpet.

The Y tube is our next objective. Cut 8 in. of $\frac{1}{8}$ in. tubing in half (diagonally) as in Fig. 3, finish with emery and reverse one piece so that it forms a V, and solder carefully *all round*.

Enter the point of the V into a piece of $\frac{1}{8}$ in. tubing $1\frac{1}{2}$ in. long, scribe round and cut off point, finish with file and emery until both pieces fit flush, then solder. Our Y piece is made.

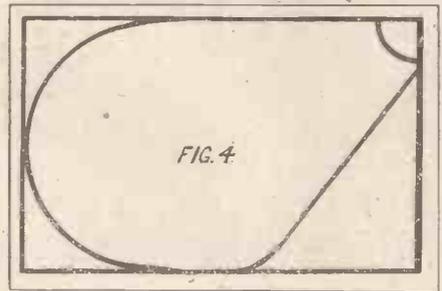


We now come to the trumpet. The writer obtained his from a marine store and rubbish dealer for 1s. 6d., and it is an aluminium phonograph trumpet apparently from an Edison Gem instrument, and this needed no adapting. If a trumpet can be obtained, so much the better, but one was made from a 6d. enamelled tin plate sold by an ironmonger for use behind gas stoves, sinks, etc.

The metal is easily cut with an ordinary pair of scissors, and should be cut to the shape given in Fig. 4 and carefully bent with an overlap of $\frac{1}{4}$ in. and the seam soldered (it was found to be easier to solder on the inside), and into the small end was soldered (as an adaptor) a piece of brass tubing the same size as for the earcap discs.

This gives a trumpet of good dimensions, but not so convenient to mount, owing to its weight. The final stage is to assemble the

parts and mount the instrument on to its stand. This latter is a matter of taste, and no doubt many readers could do better than the writer, whose mount is the brass strip 10 in. long, $\frac{1}{2}$ in. \times $\frac{1}{8}$ in., drilled at each end



with a nail to take the pillar terminals and bent to the shape of a "flat" horseshoe, as in Fig. 5, soldered to another piece of $\frac{1}{8}$ in. tubing, $3\frac{1}{2}$ in. long, which is in turn soldered to the centre of a 3 in. circle of $\frac{1}{8}$ in. brass, and then screwed to a wooden gas bracket wall base (the latter cost $4\frac{1}{2}$ d. at any ironmonger).

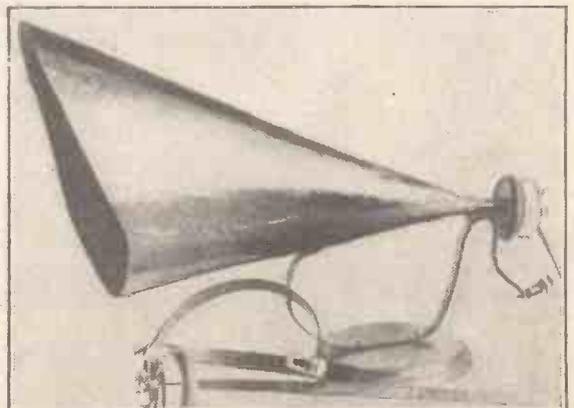
The two ends of the horseshoe support are then twisted so as to be parallel with the two arms of the Y piece. In assembling the pieces, first fit the earcap discs, taking care that they do not touch the diaphragm.

This is avoided by placing washers (usually found in the 'phones) between the diaphragm and the discs.

Next slide the two 'phones into the arms of the Y piece, and then fit on the trumpet.

Mounting Arrangements.

Now comes a difficult part, that is to suspend the loud speaker at its *approximate* point of balance to enable it to be slightly raised or lowered when in use. If it is not to be variable it can be mounted in any convenient manner without much regard to balance.



Showing the shape of the horn when material is cut as per Fig. 4.

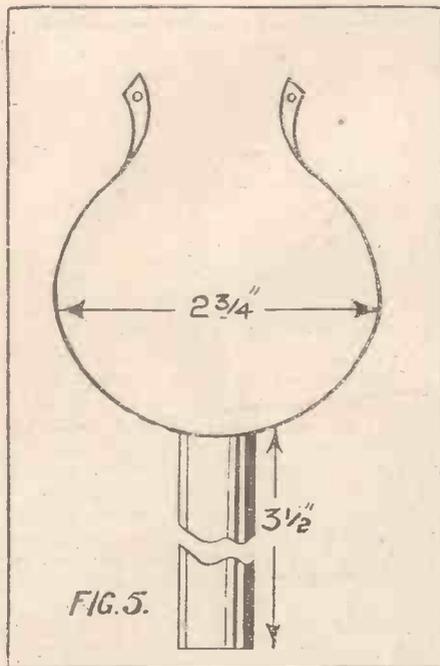
The writer's, however, can be raised or lowered in front by loosening the terminals (Continued on page 1084.)

HOW TO BUILD AN INEXPENSIVE LOUD SPEAKER.

(Continued from page 1083.)

which screw into a nut soldered on each arm of the Y piece. A small rubber washer placed next to the nut prevents any rattle.

For the benefit of those who contemplate making up this instrument, it should be pointed out that no improvement can be



obtained by making the three arms of the Y piece longer. This was tried at first, and the writer gradually reduced the length of them.

Proof of Efficiency.

Two coats of Brunswick black all over will greatly improve the appearance, and the result should be a really smart-looking and efficient instrument, which will well repay the few shillings and time spent on it.

Owing to the success of the instrument above described, the writer was prevailed upon to make another one for use by four

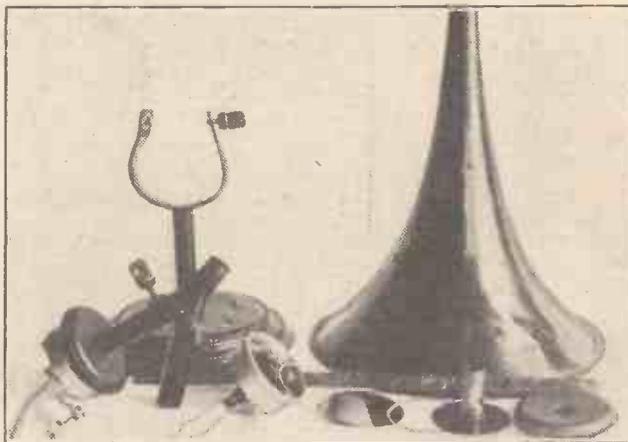
STATION 8 F J.

STATION 8 F J, M. J. L. Menars, of Le Blancat, Gan, B.P., announces that on December 20, 1924, his station will be removed to Longchamp, Bordes-près-Nay, B. P., France.

M. Menars' receiving activities will not be interrupted by this transfer. His new transmitting station will have an input power of 1 kilowatt, fed by alternating current with 50 periods, and will be ready for service in the course of January, 1925 at the earliest.

people (one of whom is very deaf) in another part of the house. It is interesting to note

that only one 'phone is used for a larger trumpet while another remains unaltered for the use of the deaf one, yet all four hear exceedingly well.



The complete set of parts used in the home constructed loud speaker.

In conclusion, it should be added that both the instruments mentioned are operated at the same time, but in different parts of the house, from a 2-valve (straight) set on an H.T. supply from one dozen flash lamp batteries — 54 volts maximum, and the total expenditure on both instruments was under 5s. 6d., above the price of the 'phones.

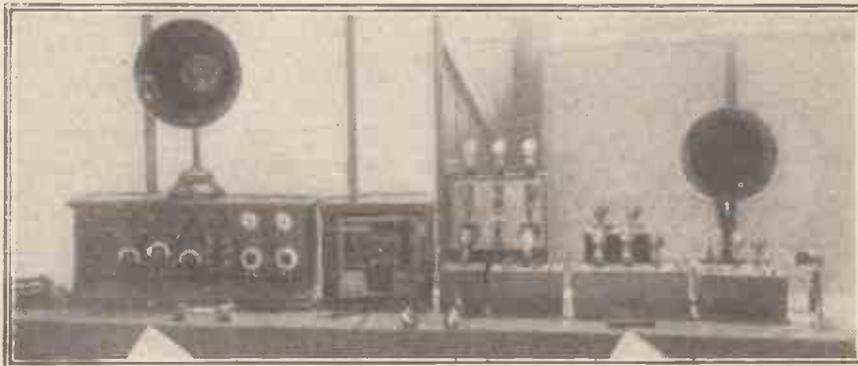
Technical Notes

Conducted by J. H. T. ROBERTS, D.Sc., F.Inst.P.

Square Law.

THE condensers generally used in present-day receiving sets are of the semi-circular type, that is, the vanes are almost exact semi-circles. In such condensers, the capacity varies more or less in the same way as the dial turning, that is to say, if the dial has turned half-way between the minimum and maximum positions, the capacity is about half-way between the minimum and maximum values for the condenser in question. But this does not mean that the

law" condensers which have made their appearance lately, and which certainly aid considerably in selective tuning. In passing, it may be worth while to remark that it is important to use a condenser of about the proper maximum range; if the maximum range is too large, the variation of wave-length with dial setting must necessarily be rapid—too rapid, perhaps, for easy tuning. With a condenser of lower maximum capacity the change in dial setting for a given difference in wave-length



L. to R., a 12-valve "Super Sonie"; at the back, a 2-valve Unidyne, built by Mr. W. Straggett, Hillmolin, near Keighley, Yorkshire.

tuning, in wave-lengths, will be equally spaced round the dial. For it is the square of the capacity with which we are concerned there.

Crowded Stations.

Consequently, with an ordinary condenser of the type just considered, the low-wave stations will be found to be grouped close together on the condenser dial. By making the condenser vanes of a special shape, however, we can make the capacity vary in such a way that the tuning is practically proportional to the dial setting. This is the principle of the so-called "square

will, of course, be greater, with consequently greater facility in tuning.

Short Wave.

In view of the great interest which is now centering on the short-wave region, it is interesting to consider the advantages which short-wave transmission has to offer. There are certain directional properties possessed by the waves in this part of the scale, but that is not what I referred to. Interference, or rather freedom from interference, is an important feature of these waves, and the reason is quite easy to see

(Continued on page 1114.)

HOW TO MAKE THE MONO CONTROL RECEIVER. A Set for Your Local Station.

By LAURENCE J. PRITCHARD.

This receiver will give good loud-speaker strength up to a distance of fifteen miles from a B.B.C. station. The tuning operations are reduced to the minimum and the set is absolutely "fool-proof."

THE two-valve set illustrated in Fig. 1 is intended for broadcast reception of the station nearest to home. It will give loud-speaker strength up to a distance of ten or fifteen miles and good head-

one stage of low-frequency amplification. As the set is primarily designed for reception from one station only the reaction coupling is arranged inside the case. In the majority of cases tuning to a different wave-length requires a different value of reaction coupling. This is easily obtained in the set under construction by placing the aerial tuning coil and the anode coil, to which the latter reacts, towards one of the edges of the panel, the side of the case fitting to the edge of the panel

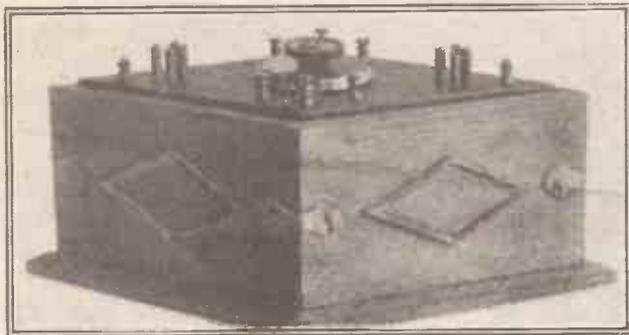


Fig. 1. The Mono Control Set complete.

phone strength, sufficient in fact for the use of a number of pairs of telephones, up to 80 miles or more. The receiver is particularly useful for a family instrument, as the operations of tuning are reduced to an absolute minimum, and at the same time the set is made as fool-proof as possible. As illustrated, the instrument is of an original and attractive design, and it has the advantage of taking up very little space.

The circuit is straightforward and consists of a valve detector with reaction, and

being instantly removable in order that any adjustment of the coupling may be quickly made. This is illustrated in a later photograph which shows at a glance the accessibility of the coils.

As regards the layout of the panel, which, as will be seen is chan-

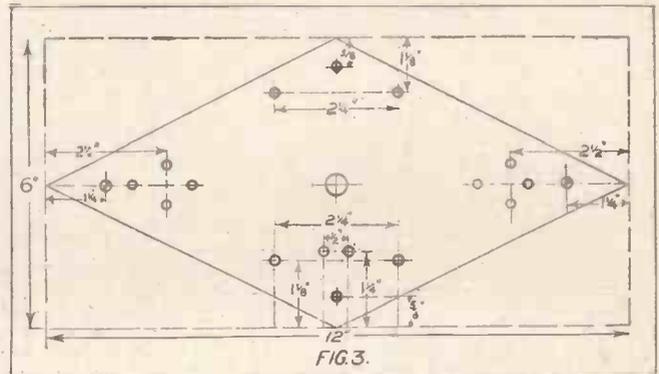


FIG. 3.

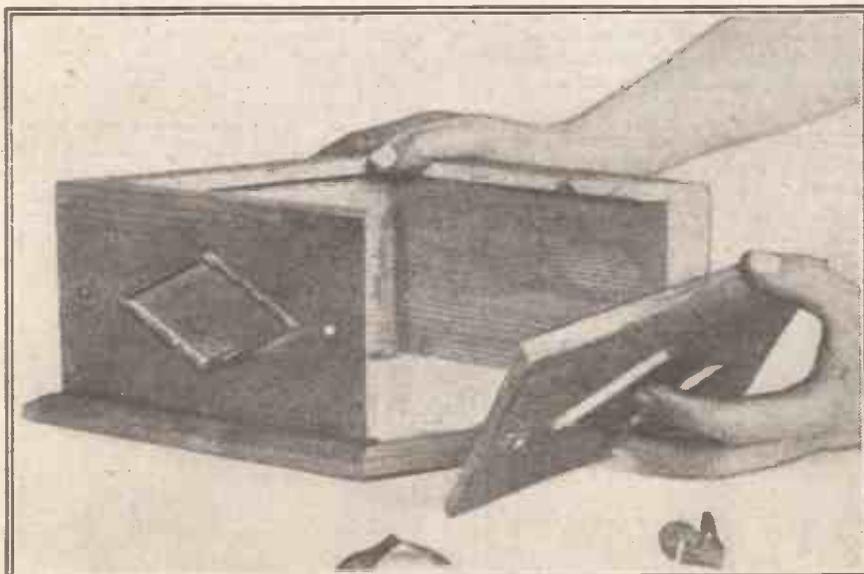


Fig. 2. The completed case, showing removable side and brass clips for fixing it.

MATERIALS REQUIRED.		
1	Ebonite Panel, diamond shape (say)	2 6
1	.0005 var. condenser, dial and knob	7 6
1	Federal No. 226 w. or other small L.F. transformer	1 0 0
2	basket coils or wire for same (say)	1 0
	Resistance wire, 8-valve sockets, 8 terminals, ebonite rod, wire screws, etc. (say)	2 6
	Grid leak and condenser combined	3 6
	Wood for case	2 6
	Telephones high resistance (say)	13 6
	Accumulator	1 5 0
	2 M.O. or other bright emitter valves @ 12 6	1 5 0
	High tension battery and wander plugs (say)	15 0
	Total	£6 3 0

nel shaped, the variable condenser occupies the centre of the panel at the point where the lines joining the diagonally opposite corners of the panel cross each other. In each of the acute angled corners four-valve sockets are placed to form a valve-holder, and a box type terminal to take aerial and earth respectively. Spaced round each of the other corners are three terminals, those on one side being telephone terminals and the other three for connection of the high and low tension batteries.

Constructing the Case.

The case is made from $\frac{3}{8}$ in. wood for the sides, and wood of $\frac{1}{2}$ in. finished thickness for the base. Some care is necessary to make the angles of the case correctly. Starting with the base, which has four equal sides $8\frac{1}{2}$ in. long, a plan on a sheet of paper is prepared to the dimensions. The distance between the opposite corners of the case, which is the maximum width of the set, is $7\frac{1}{2}$ in. A line of this length is drawn across the paper when preparing the

(Continued on page 1036.)

THE MONO CONTROL RECEIVER.

(Continued from page 1085.)



Fig. 4. A "close up" of the battery switch.

plan. A pair of compasses is then set to a distance equalling the length of each side, and with each end of the line as centre for the compasses an arc is struck on each side of the line.

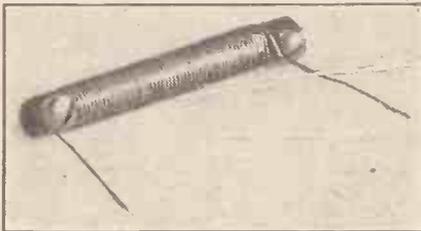


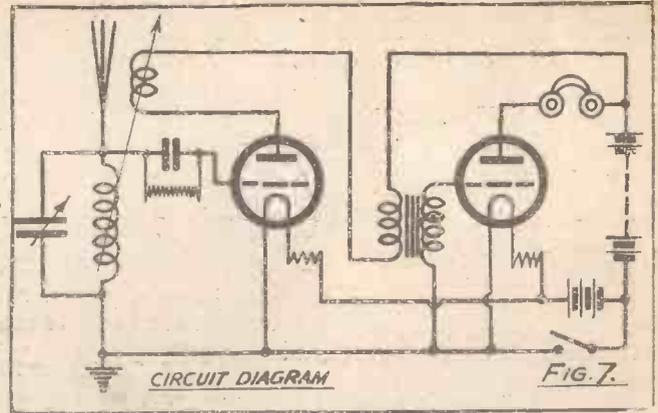
Fig. 5. One of the fixed filament resistances.

The arcs thus made will cross each other at a point equidistant from the ends of the line. Four lines are then drawn from the ends of the centre lines to the points where the arcs cross. The diamond shape is thus



Fig. 6. The set in operation, showing adjustment being made to the reaction coil.

outlined and the base cut to it. To test the accuracy of these measurements the length of the diamond should be measured. It will be found to be approximately $15\frac{1}{2}$ in. The top edges of the base are now marked to show the positions at which the sides are attached. The outer edge of each side comes flush with a line parallel to each edge of the base, the line being $\frac{3}{8}$ in. from it. The external width of each side, as measured by this line, will be $7\frac{1}{2}$ in. Four pieces of wood are, therefore, cut to this dimension, having a depth of $4\frac{1}{2}$ in.



CIRCUIT DIAGRAM

FIG. 7.

reaction coil. Fillets of wood are tacked and glued flush with the top edges of the case to which the panel is screwed when completed.

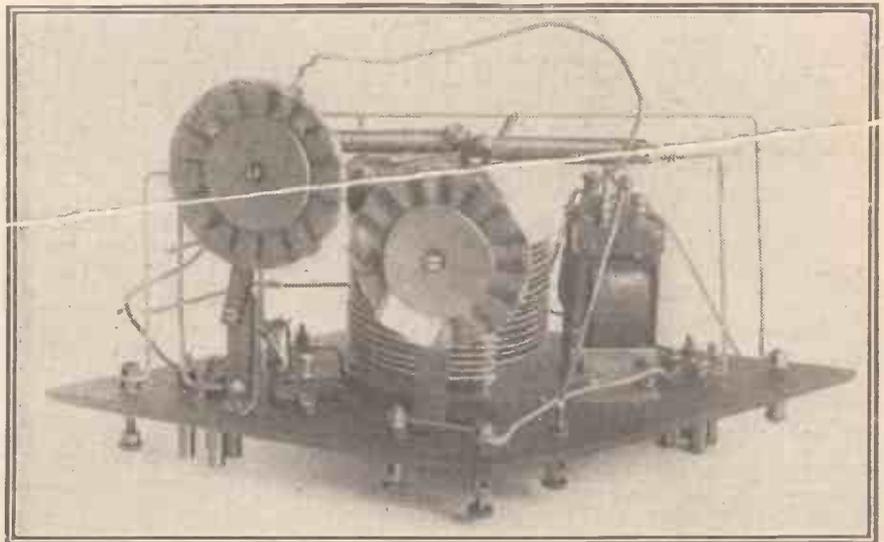


Fig. 8. The underside of the panel, showing completed coils.

By means of a bevel gauge the correct angles of the corners may be found from the plan and the corners carefully cut to these angles by means of a plane. If the angles are correctly cut, there should be little difficulty in glueing and tacking the sides in position on the base. Three sides only are permanently fixed, the fourth side being removable for access to the

A light ornamental moulding is tacked to the centre of each side to give a more pleasing appearance. These details are seen in Fig. 2, which shows a finished view of the case. Brass angle plates are screwed to the fixed sides of the case as shown. Two catches of similar shape, but slotted to slide into two screws fixed at the centre of the edges of the removable side, keep this side in position. These features are shown in Fig. 2, with the brass plates in the foreground.

The Valve Sockets.

The ebonite panel is of $\frac{3}{16}$ in. thickness and cut to overlap the inside edges of the case by $\frac{1}{16}$ in. on each side. The object of the slight overlap is to conceal the joint of the fillets. The top edges of the panel are levelled or rounded over equally on each side. The positions of the terminals, valve-holders and the variable condenser are shown dimensioned in a panel lay-out in Fig. 3.

In fixing the valve sockets, great care should be taken to see that the holes for the sockets are correctly marked out and drilled, as any appreciable inaccuracy will result in the valve fitting very badly. If

(Continued on page 1087.)

THE MONO CONTROL RECEIVER.

(Continued from page 1086.)

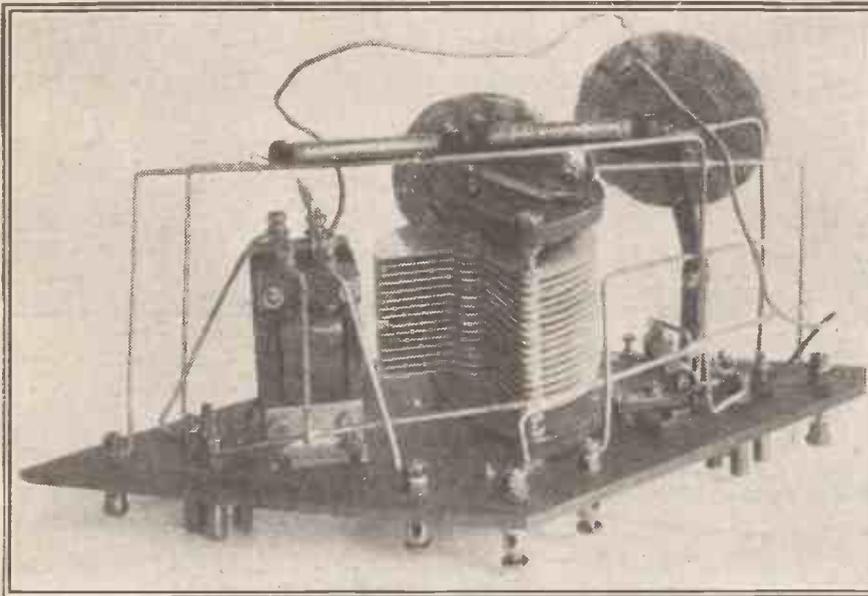


Fig. 9. The set completely wired up. Note position of fixed resistances.

this trouble should be experienced it may be overcome as follows: It should be noted which of the valve sockets is out of position and the hole into which this socket fits must be drilled out with a drill two or three sizes larger. To locate its correct position, a valve should be fixed in the sockets and the nuts tightened up securely before the valve is removed.

Battery Disconnecting Switch.

A special feature of the instrument is a simple battery switch for disconnecting both the high and low tension battery. A close-up view of this is shown in Fig. 4. Two No. 4 B. A. round-headed screws are bolted to the panel half an inch apart, on an arc of $\frac{3}{4}$ in. radius, the arc being formed from the centre of the three-battery terminals. A strip of $\frac{1}{4}$ in. springy brass is sweated under the base of this terminal, so that the brass can be swung round to make contact with either of the round-headed screws. To allow the terminal to rotate, a spring washer is slipped over its stem, when two lock-nuts are tightened against each other to give a stiff turning motion.

Fixed Filament Resistance Used.

The variable condenser has a capacity of .0005 mfd., and is of the single hole centre-fixing type. On one side of the condenser a Federal low-frequency transformer, type 226 W, is bolted by means of countersunk screws passing through the panel. In a corresponding position on the other side of the variable condenser a combined grid leak and condenser is placed. The condenser has a capacity of .0003 mfd., and the grid leak a resistance of 2 megohms.

A six-volt accumulator is very commonly used for lighting the filaments of bright emitter valves, and as no filament resist-

ance of the variable type is employed in this set it is necessary to use fixed resistances in order that the filaments shall not burn too brightly. These resistances can be easily made by wrapping a number of turns of resistance wire round an ebonite rod of $\frac{3}{8}$ in. diameter. The number of

turns required will largely depend upon the type of valve used. For general purposes 50 turns of No. 22 gauge Eureka resistance wire will be found suitable. If the resistance is too much, one or more turns of the wire may be shorted by soldering a short copper wire across them. If a four-volt accumulator is used no resistance will be necessary with the general bright emitter receiving valve. One of the completed resistances showing how the ends of the wire are fixed is illustrated in Fig. 5.

The Reaction Coil.

The aerial coil and the reaction coil may be bought, but if the constructor wishes to make his own coils, a former must be made on which to wind them. An empty cotton-reel of 1 in. diameter is very useful for this purpose. The flange at one side is chipped off flush and 15 holes spaced equally apart are drilled radially round the circumference of the reel. Fifteen $1\frac{1}{2}$ in. nails with their heads cut off are firmly tapped into these holes which completes the former. For the aerial coil thirty turns of number 24 S.C.C. wire will be suitable.

The reaction coil is constructed with the same gauge wire of which 35 turns will be found correct. Before removing the spokes from the former, each coil is immersed in a lake of melted paraffin wax to give it solidity. The aerial tuning coil is mounted at the end of a stick of ebonite, 3 in. long, which is screwed to the edge of the panel adjacent to the removable side of the case.

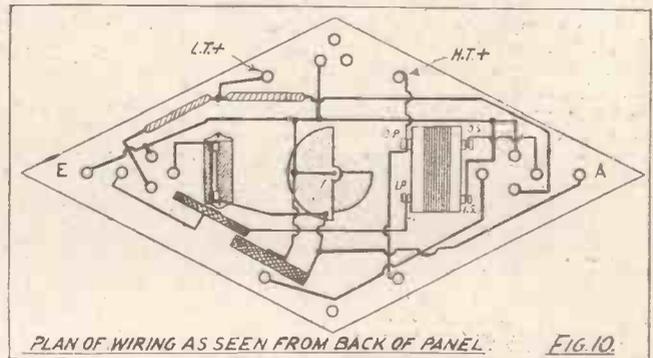
The reaction coil is mounted on two similar ebonite steps, $2\frac{1}{2}$ in. and $1\frac{1}{2}$ in. in length.

The reaction coil is screwed at the end of the longer arm, while the other end is hinged on a 6 B.A. screw and nut to the second arm. This, in turn, is hinged to a piece of angle brass screwed direct to the underside of the panel. The double movement thus provided to the reaction coil enables it to be moved about in a horizontal position to provide a variable coupling to the fixed coil. These features are illustrated in Fig. 6, where the reaction coil is being adjusted, the front being removed for this purpose.

Making the Adjustments.

Wiring is now begun to the diagram given in Fig. 7. Square tinned wire is used for making connexions, with the exception of the wires to the reaction coil, in which case flexible insulated wires are employed. Fig. 8 shows the interior of the set with the wiring completed, showing the arrangement of the coils. Another view taken from the other side is given in Fig. 9. This illustration shows the connection to the battery switch. It will be seen that one of the contact studs is not connected. Fig. 10 assists the constructor in showing the actual wiring to the components.

It must be remembered that some experiment may be necessary to get the reaction coupling the right way round. If the arms supporting the reaction coil are at all slack, they should be tightened.



TWO INTERESTING ITEMS.

EXPERIMENTS have been made with a radio receiving apparatus in a South African gold mine at a depth of 5,500 metres under ground.

Mining experts say that very important discoveries are expected to be made in connection with the reducing of the problems of the mining industry by this means.

A very spectacular radio performance is the claim of an amateur of Regina, Saskatchewan, in the Canadian North West, that he has heard a concert given in Turin, Italy, with a four-valve receiving set.

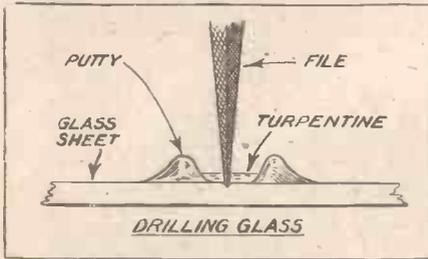
Can any reader of "P.W." equal this?

Constructional Notes

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

Drilling Glass Panels.

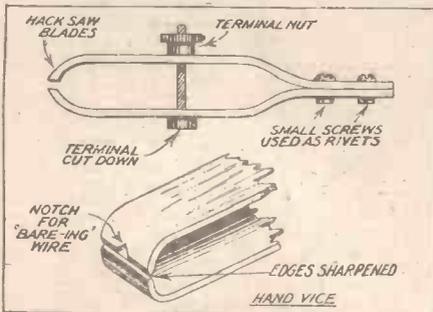
MANY experimenters, anxious to try a glass panel, are put off by the difficulty of drilling the necessary holes. It is usually recommended to use turpentine as a lubricant upon the tip of the three-edged



file, or whatever tool is used; but if the turpentine runs off, or does not get into the working part of the drilling, a crack may be the result, and the whole of the previous work may be lost. The little dodge illustrated herewith, however, ensures the presence of lubricant at the working point. A tiny "cup" of putty is made round the spot where the hole is to be drilled, and into this a few drops of turpentine are poured. Thus the point of the tool is always working in the turpentine, and the danger of an accident is practically eliminated.

Useful Hand Vice.

A very useful hand vice for holding small work, and also for alternative use as tweezers, may be made from a worn-out hack-saw blade. The blade should be broken in two, or two separate blades may be used, and it should then be softened by heating to bright redness in a flame or fire and allowing to cool gradually. It will then be found that the teeth of the saw may easily be removed by grinding upon a stone, or by means of a file. The two portions of



the saw are bent into the shape shown in the figure, and holes are drilled in the positions indicated. Two small brass screws are inserted in the first two holes and hammered over to serve as rivets. A screw terminal,

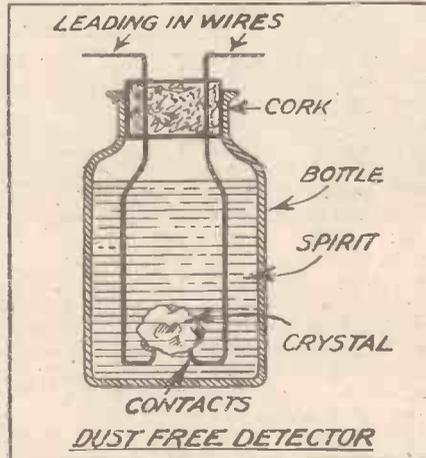
inserted through the third hole, serves to tighten the hand vice, and to hold small work in it as may be required. If the tool is to be used in the form of tweezers, the screw terminal may be temporarily removed; or, better, the nut may be unscrewed so as to leave sufficient play in the prongs.

Removing Insulation from Wires.

If the jaws of the tweezers described above are formed with a "V" notch and then sharpened to a fairly sharp edge, they are useful for baring the ends of insulated wire. The wire is inserted between the jaws of the tweezers and pressure applied, the tweezers being rotated so as to cut round the insulation. A sharp pull will then remove the tubular piece of insulation from the end of the wire.

Dust-Free Detector.

This is the little device I mentioned in "Technical Notes" recently as having been



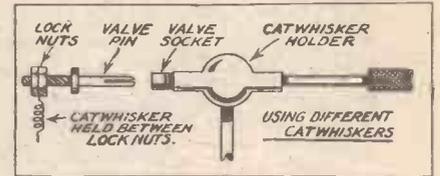
sent to me by a reader. It does two things, it keeps dust from gaining access to the crystal, and it also keeps the crystal free from grease, since the crystal is permanently immersed in a grease solvent.

The arrangement will be clear from the drawing, and hardly requires any further explanation. A small bottle forms the container, and the lower ends of the leading-in wires are turned up so as to form little pillars upon which the crystal rests upon gravity. If the spirit is omitted, the device still forms a dust-protector for the crystal detector. The only point which will require a little patience to get it right is the adjustment of the upturned tips of the leading-in wires. These will need to

be brought to the right distance apart and in proper relation to the wall of the bottle, in order that the crystal may fall properly into position.

Using Different Cat's-whiskers.

When trying out the effect of different crystals, it is very desirable to be able, at the same time, to interchange the different cat's-whiskers you have on hand, as the behaviour of a given crystal will vary very considerably according to the type of cat's-whisker which is employed with it. The accompanying drawing shows a very

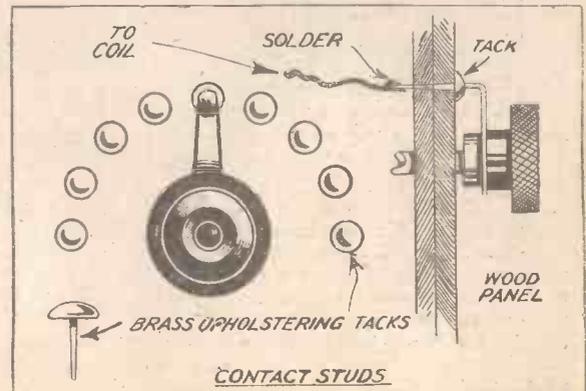


simple way to facilitate the interchanging of the different whiskers—gold, silver, brass, and so on. A number of valve-pins are used, and to each of these a cat's-whisker is permanently attached, either by soldering or by clamping between two small nuts, locked together. A valve-socket tube is permanently secured to the ordinary cat's-whisker holder, and the different whiskers, on their valve-pins, can then be inserted as required.

Contact Studs.

Here is a very handy little article put to a useful purpose. The making of the contact studs for coil tapings usually takes quite a good deal of time if screws have to be inserted, holes drilled, and so on. The dome-headed brass tacks which are used for upholstery work make excellent contact studs, and if the panel or base-board is of a temporary, experimental nature, and of wood, the tacks may be tapped home with a light hammer, thus obviating the need for drilling.

Another important advantage of these tacks is that there is no need to be so particular about the exact adjustment of the contact arm. If the arm drops down upon the baseboard between studs, it will not jamb against the next stud, but will rise up and pass over it automatically, owing to the dome top of the stud. This useful little idea is contributed by an experimenter to "Radio Digest," and although it would hardly look well enough for a nice permanent job its simplicity will recommend it to some experimenters,





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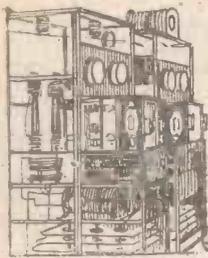
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Artistes of the Aether

By "Ariel"



Some of those who have given you pleasure when listening-in.

IF there is a choice to be made between the "spoken word" and music, most people will vote for the latter, so that the best compromise is often found in opera, where practically both are combined. Opera and wireless have been very good friends from the beginning, and when the first season of the British National Opera Company ended at Covent Garden, another equally famous company took up the running, namely, "The Old Vic." in the Waterloo Road, and from this historic house were broadcast operas, gaining fresh interest for them and success in matters wireless.

"The Old Vic."

The name of the "Old Vic." and Miss Lilian Baylis are indissolubly linked, and additional wireless interest was lent when she herself broadcast recently from 2 L.O. Miss Baylis was the daughter of a musical family, and niece of Miss Emma Cons, a philanthropist and social worker, who first started the good work at the theatre, then joined in with Morley College.

Miss Baylis was brought up with a musical career in view, and early in her teens accompanied her parents to South Africa with a concert party. Returning, she went to stay with Miss Cons, and from that time onward became associated with the fortunes of the enterprise.



Miss Lilian Braithwaite.

Opera recitals were given occasionally, when twenty-six years ago Lilian Baylis first came to the theatre. Now they have their own place in the musical life of London, and seldom is there a Saturday night when not less than a hundred people are turned away because the "house" is full. From opera to Shakespeare was not such a far step as it seems, and since 1914 the "Old Vic." has presented all the plays contained in the national poet's First Folio, as well as "Pericles" and many old comedies and morality plays.

Broadcast Opera.

It is a fitting tribute to Miss Baylis that she has been made an honorary M.A. of Oxford, and she is the only woman outside the University circle, except Queen Mary, to receive the degree.

Miss Baylis believes in the broadcasting of opera, and has given every assistance possible. Early in the month, "Faust" is to be broadcast with a well-known cast.

Amongst the S.B. programmes that stand out prominently mention must be

made of one staged and arranged by Mr. R. E. Jeffrey, under the title, "Rosemary." Remembrance is not a deeply cultivated quality in the human breast of to-day, and therefore a quiet hour that leads to retrospection is to be commended. The play "Retrospective," by Florence Bates, which formed part of the scheme, was distinctive for including the names of two well-known members of the theatrical profession, Miss Lilian Braithwaite and Mr. C. Aubrey Smith.



Mr. Harold Williams.

Miss Braithwaite's first engagement was to tour South Africa with William Haviland's Shakespearean Company, and on her return she joined Julia Neilson and Fred Terry, playing Celia to the former's Rosalind on tour. In London she came prominently to notice in "Sweet Nell of Old Drury," and from that time onward London has claimed her for its very own actress.

As leading lady to George Alexander, she claimed equal honours with him in "The Importance of Being Earnest," "Saturday to Monday," and, best of all, "Old Heidelberg." No one who saw her in that play was ever satisfied with any other Kathie. There is hardly an important play in London since that time that Miss Braithwaite has not played and literally realised the fullest ideal of what that part should be. Her diction and her sheer grasp of every type of character makes her one of the best of all our English actresses.

Actor and Cricketer.

Mr. W. Aubrey Smith, her companion in matters wireless on this occasion, is almost as well known. He comes, too, of an acting family, being brother to the late Beryl Faber (Mrs. Cosmo Hamilton). As sportsman, too, he is widely known since his Cambridge days, and in cricket, M.C.C. and captain of the English teams which visited South Africa and Australia. On the stage he has played in more plays than we dare mention, but best remembered of all his parts is Aubrey Tanqueray, when he played with "Mrs. Pat," and in "The Light That Failed."



Mr. E. Godfrey Brown.

It has long been held that the best work of any artiste is his first-born. The offspring of youth and enthusiasm, untempered by the chill doubts of age, or the caution of maturity. In music, as in all others, this has often been proved.

Very early in broadcast music, two young artistes came to light: one was Maurice Cole, whose ability to play the piano from a wireless standpoint was soon made evident; the other was Michael Head, one of whose compositions he played.

Since then both have gained further successes. Mr. Head has developed a baritone voice of excellent range and quality, and his group of songs at the piano at 2 L.O. recently testified to his powers both as composer and executant.

A Popular Singer.

In Mr. Harold Williams, the B.B.C. has found one of its best vocalists, and he has been broadcasting since last May.

Hailing from Sydney, in New South Wales, Mr. Williams served with the Australian Imperial Forces in France for nearly three years, and on his discharge in London entered the musical profession.

He has been heard at all the leading concerts in London and the provinces, in the Royal Choral concerts, Hallé Society, Leeds Philharmonic, Bradford Festival, Belfast Philharmonic, and Glasgow Choral concerts. All these will give some idea of his success, while the fact that he was the only non-foreign singer to appear with the grand opera season at Covent Garden, as well as in the British National Opera Company's season at His Majesty's Theatre, is still a further tribute to his powers. Over the aether his success is just as great, for his diction is so good, and this lends value to the songs chosen.



Miss Lilian Baylis.

2 B E.

Since its inception, the Belfast Station has set a very high standard of music, and any idea that "any old tune would do" must have been quickly dissipated, especially when Mr. E. Godfrey Brown took up the post as musical director.

One has only to glance at the programme to see how earnest a study is made so as to get the very best and most appropriate choice of entertainment. This is not surprising when one knows that Mr. Godfrey Brown was conductor of the leading musical society in Ireland, the Belfast Philharmonic Society, also conductor of the Belfast Symphony Orchestra.

WIRELESS FOR THE BEGINNER

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

PART 8. A SUMMARY AND SOME HINTS.

IN my preceding articles a brief and simple description was given of wireless waves, how they are made and how receivers work. Before making a few concluding remarks for the especial benefit of those who are intending to adopt radio as a hobby—and a better hobby would be hard to discover—a short but comprehensive summary of this series of articles will be attempted.

Wireless waves, whether those utilised in wireless telegraphy or in broadcasting, are waves or rhythmic disturbances in an intangible and mysterious stuff, called ether, which scientists believe to fill completely the whole universe; so completely, in fact, as to permeate all material things through and through, as water does an immersed sponge. Thus a continuous expanse of ether links country with country, planet with planet, and our solar system with other solar systems, of which there are millions. Theoretically, therefore, an etheric disturbance caused on earth should be observable in Mars or elsewhere in creation after the lapse of a certain time.

Frequency and Wave-length.

So swiftly is this wave-motion propagated outwards from its source that a wireless signal made in England can be detected in Australia about one-fifteenth of a second afterwards, the actual velocity at which the effect travels being 186,200 miles per second. Light, which also is an ether-wave effect, travels at the same speed. Radiant heat is an ether wave too, and travels at the same speed, as do all other waves in ether.

All ether waves are caused by the oscillation of electrons, which are particles of electricity many times smaller than atoms. Only electrons have a grip on the ether. When they move backward and forward they flick electrical power into space in the form of waves which, though unseen and unfelt, can be caused to produce effects—on wireless receivers, for example—which manifest their presence to our senses.

There are three measurements connected with ether waves of special importance to wireless people. First, their velocity, which is 186,200 miles (or 300,000,000 metres) per second; second, their frequency, which is the number of waves per second emitted by the broadcasting station; third, the wave-length, which is the distance, measured horizontally, between the crests of two consecutive waves. This is the simple formula connecting the three measurements.

Velocity ÷ Frequency = Wave-length,
or, put in another way,

Velocity ÷ Wave-length = Frequency.

For convenience we classify stations by the length of the waves they send out.

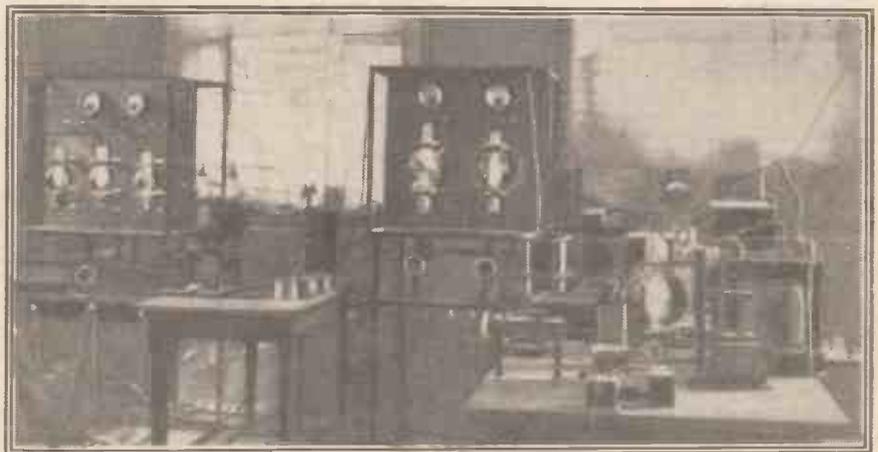
A procession of electrons, which exist in a freely moving state in the interior of metals, is an electric current. When these electrons are caused, as they are caused, by special devices to move backward and forward in a wire many thousands of times per second, the electric current produced is

called a high frequency oscillating current. This is the kind of current set up in the aerial of a broadcasting station.

Connected with this aerial is the microphone, the instrument into which the artistes or orchestra direct their sounds. The sound waves set up by a singer cause the microphone to imprint upon the stream of ether waves leaving the aerial an electrical counterpart of their forms. The function of the receiver is to change back these electrical sound models into sound waves, so that you may hear them.

Wireless Reception.

The receiver, actuated by the receiving aerial, which being hung up in the path of the waves robs them of some portion of their electrical power, has first of all to be



The transmitter at the Hilversum Station.

brought into tune with the waves. That is, the high-frequency oscillating currents set up in the receiving aerial by the passage of the waves across it, have to be provided with a path in which they can oscillate at the same frequency as the wireless waves. The tuning devices on your receiver do that, and they take the form of a variable coil of wire, or a coil of wire and a variable condenser. Tuning is done by ear, the loudest signals being heard when tuning is most accurate.

After this the oscillating current has to be turned into a form in which it can operate the telephones, which cannot respond to current changes so rapid as those existing in the aerial. Hence a crystal or valve is inserted in the circuit between aerial and telephones. The crystal or valve has the property which permits the current to pass when it flows in one direction but not when it flows in the opposite direction. This, therefore, cuts off the oscillations, and the current due to the half-waves is of such a form that as it passes through the telephone these—or rather their diaphragms—vibrate in exactly the same manner as the microphone at the studio and therefore set up

sound waves of the same form. In this way the sound made by the singer is reproduced at the receiving end. As the waves made at the broadcasting station spread out in all directions and travel at such an enormous speed, it is possible for receivers at all points of the compass to respond almost simultaneously, and at distances varying according to the sensitiveness of the receiving apparatus used. A crystal set will respond, say, at a hundred miles, but a set provided with sufficient magnifying valves can respond suitably at any distance from 100 up.

Recent Achievements.

When you consider this marvellous instrument, the ether, so subtle, so eminently capable of bearing messages at the speed of light, you realise that the world is your oyster. You may sling up your aerial and link yourself with the Antipodes. Only the other day an amateur held a wireless conversation with another amateur in New Zealand.

Given skill in manipulation, and the right kind of apparatus, you may eavesdrop over the whole of Europe and even Eastern America, and, descending to telegraphy, you may receive and send Morse signals from and to almost all parts of the world—if so licensed by the Post Office.

Radio provides a hobby embracing the most delicate of mechanical construction, of manipulation; it lands you at once into the most burning problems of the physical scientist and the electrical and radio engineer.

Across the surface of the globe there flit unceasingly those extraordinary ether waves, in lengths ranging from 100 to 25,000 metres, from thousands of wireless stations. The art is bristling with fascinating phenomena and problems and has its future filled with tempting applications. Now is the time to "get into the game," as they say in the States.

First of all, learn to receive—and send—Morse signals. This is easy. Then study electricity and magnetism. Learn the theory of the instruments used in wireless; learn the theory of wireless in detail. Practice the connecting up of components into receiving circuits, comparing the results of them all. Make up your own sets and strive to get the best results, and presently you, too, may be able to say, "I spoke with New Zealand last night." Then the world will indeed seem cramped and you can attend to Mars.

WIRELESS AT SEA.

Some Recent Developments.

By Lt.-Col. CHETWODE CRAWLEY, M.I.E.E.
(Deputy Inspector of Wireless Telegraphy, General Post Office.)

In this article a well-known Post Office Authority on Wireless gives a resumé of the progress and development of wireless at sea during the last few months.

IMPROVEMENTS in the means of communication between ships, and between the shore and ships, must always be of special interest to us, whose very existence depends on our ship-borne trade; and the most important application of wireless telegraphy is undoubtedly its application to what might be termed mobile communications, that is to say, the communications of ships and aircraft, of which, at any rate for many years to come, the ships' communications must take the premier place.

Every British ship registered in this country being a passenger steamer or a ship of 1,600 tons gross tonnage or upwards must, by Act of Parliament, be provided with a wireless telegraph installation and with one or more certified operators and watchers, non-compliance with this Act rendering the master or owner of the ship liable to a fine of £500. There are at present about 3,000 British ships in this category. The nature of the installation to be provided, the services to be maintained and the number, grade, and qualifications of the operators and watchers to be carried are laid down by the Board of Trade in consultation with the Postmaster-General, who is the statutory authority for wireless telegraphy in this country.

Ready for Emergencies.

The installation which is thus compulsorily fitted in ships must be capable of transmitting clearly perceptible signals on spark or I.C.W. from ship to ship over a range of at least 100 nautical miles by day under normal conditions. In addition, each ship must be fitted with an emergency installation, unless the main installation fulfils the emergency requirements. These requirements include an independent source of energy for the operation of the installation, capable of being worked for at least six continuous hours, and giving a signalling range of at least 80 miles for ships which carry 200 persons or more, or 50 miles for smaller ships. These emergency requirements ensure that even in the case of a serious accident which puts the electric power of the ship out of action, wireless communication can still be maintained with other ships up to a reasonable distance.

An S.O.S. Detector.

The number of operators and watchers which must be borne depends on the number of persons carried, and the service on which the ship is employed. Ships carrying 200 persons or more must, as a rule, carry at least three operators, and one of these must always be on watch. Ships carrying between 50 and 200 persons must carry at least one operator and two watchers, the operator being on watch at certain specified times, and a watcher at all other times. Ships carrying less than 50 persons must carry at least one operator, who must be on watch at certain specified times.

The term "operator" in these regulations means a professional wireless telegraphist

who has passed the prescribed Post Office examination; the term "watcher" means a man who has been certified by the Post Office as being able to distinguish the distress and safety signals when heard in the telephones of a receiving installation. The need for watchers would, of course, cease if a satisfactory automatic apparatus could be devised for registering the reception of a distress signal when the operator is not on watch in such a way as to call his attention at once to the fact that this signal is being received. Devices of this nature have been under trial by the Govern-

station at Devizes is used for this purpose, and communication is carried on with these large ships up to a range of about 1,500 miles. Up till now the Devizes station has been equipped, like the ships, for simplex working only; that is to say, it cannot send and receive messages simultaneously. The number of messages to be dealt with has, however, increased so much recently that arrangements have been made to enlarge its capacity by installing a second transmitter at Devizes, and operating both transmitters by distant control from a new operating and receiving station at Burnham,

near Weston-super-Mare. These arrangements will allow of two messages being sent and two messages being received simultaneously, whereas now at any time the station can only send a message or receive a message.

In a few of the large ships, and at Devizes, apparatus is also fitted for automatic high-speed transmission and reception, and on occasions large batches of messages from ships have been relayed through Devizes over the telegraph wires direct to the G.P.O., London, but at present this can only be done under favourable conditions, and the normal practice is to write up the received messages at Devizes and retransmit them by telegraph to London.

The apparatus in these large passenger ships is developing rapidly to keep pace

with the needs of passengers, whereas in the smaller ships, where the number of messages is small, the simple apparatus compulsorily fitted for safety purposes is sufficient to meet all needs.

Lifeboat's Wireless.

Last year, for instance, the Majestic, Olympic and Homeric, of the White Star Line, dealt between them with messages aggregating nearly two million words, and this year the total will be greater.

In the Leviathan, of the United States Line, five aerials are used, three for transmission and two for reception, at least two of the eight operators borne being always on watch. Two of her motor lifeboats are also fitted, and it is already laid down that after July, 1925, all foreign-going passenger

(Continued on page 1094.)



Direction-finding at sea. The wireless set on the cable ship "Cyrus Field."

ment for some time, but none has yet been definitely approved.

All these regulations are made with regard to the safety of life at sea, eleven land stations suitably distributed for this purpose round our coasts, and worked by the Post Office, being used solely for communication with ships, principally for the communications concerning safety of life, but also for the exchange of ordinary commercial messages.

Long-distance Working.

It is now the practice of ship-owners to fit large passenger ships (about 70 are fitted in this country) with long-range installations in addition to the installations compulsorily fitted, and certain land stations are suitably equipped for this long-range working to ships. In England, a

Complaints and Compliments

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I CONSIDER that the 2 L O programmes are A1. I listen every evening for about two hours, and consider the varied programme of music and lectures well chosen. I would prefer more operatic and classical music and more travel talks. Licence holder for 2½ years.

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* * *

What do these B.B.C. critics want? Let us try a little arithmetic. The B.B.C. operates for, roughly, 2,500 hours per year. This costs crystal users, say, 15s. (licence 10s., new crystals 5s.); and average "valver," say, about £5. If only 5 per cent. of the programmes suit their "fastidious" tastes, I still consider they are getting good value for their money, even if they live north of the Tweed.

J. B. COUPLAND.

8, Laburnum Road,
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* * *

Why could there not be at least two broadcasting companies, so that there might be more competition? Nothing will get on without competition. We do not want more than two or three companies, but at least two.—Yours truly,

D. C. G.

Elstree.

WIRELESS AT SEA.

(Continued from page 1093.)

steamers carrying more than ten lifeboats must have at least one of them fitted with wireless telegraphy.

Besides having wireless sets for purposes of communication, more than a hundred British ships are now fitted with directional receiving apparatus, by which they can obtain by wireless telegraphy their bearing from a land wireless station, and a recently published report states that less than 10 per cent. of the bearings taken are more than two degrees in error.

On shore there are two Government direction-finding stations on the east coast and two on the south coast, from which ships fitted with any wireless apparatus at all can obtain bearings by wireless telegraphy, and an additional station for this purpose is to be erected shortly at the entrance to the Bristol Channel.

At the moment experiments are being carried out with a view to providing special transmitting stations on shore which would send out wireless waves in much the same way as a lighthouse sends out light waves. Such stations would be placed to meet the needs of navigation, and would have only a short range, so as not to interfere with other wireless signalling. They could

My complaint centres around Cardiff; their programmes are awfully dull, they are not half as good as they used to be when Mr. Corbett Smith was there. I like jolly concert parties like the Cymradios used to be, free and easy—not these prosy, stodgy, slow-music programmes. I like something with a bit of "go" and fun in it; besides, they close too early; even back in the summer when the closing time was supposed to be eleven. Cardiff used nearly always to close at 10.30. I think all stations should keep open until 11 o'clock every night.

Killhampton.

Conwall.

V. TUGWELL.

* * *

Generally in "Pursuit of Beauty in Music and Poems," wish they could make haste and catch her, then we might get some real

The difficulty of pleasing everybody is recognised, but could we not have a larger proportion of lively music, such as Sousa's marches, Gilbert and Sullivan's operas, popular airs, etc. The "funeral dirge" type of music, of which we get so much, is no doubt very high-class, but does it appeal to the majority of listeners?

J. BROWNING.

Carass, 196, Bedford Hill.

Tooting Bee Common, S.W.12.

* * *

My complaint is on account of so many vibrato singers being broadcast. I am one of the few or many who can't listen to a wobbler, and we have a plethora of these in and around Aberdeen. "Five out of six amateur singers are afflicted with the habit, and it is being systematically taught and patterned by singing teachers." So wrote



Natives from the Congo broadcasting "music" from 2 L O.

entertainment. One cannot hear our next station for howls and squeaks (Bournemouth) when the pursuit is in progress at Cardiff. PRE "B.B.C." WALLER.

Bristol.

be used to assist in the navigation of ships fitted with directional wireless apparatus.

The boom in broadcasting has spread to our ships, and licences to use apparatus for the reception of broadcast programmes are now being issued. One licence suffices for any number of sets fitted in a ship, and the conditions of the licence ensure that no interference can take place with the working of the ship's main installation.

There is now in operation a good wireless service for the distribution of weather forecasts and other messages affecting the navigation of ships. This forecasting is greatly assisted by information supplied by wireless telegraphy by ships in the North Atlantic on a prearranged plan in which some twenty-five large ships are taking part.

Wireless telephony is not yet used for maritime signalling, with the exception of a few installations for communication between lightships and the shore, but the problems which it presents are now being carefully considered and tried out experimentally. Such a service to be of real use must be two-way (like the ordinary telephone), must be connected at the shore end to the land telephone system, and must be clear of any interference to or from the ship's wireless telegraph installation.

These are not problems to be solved off-hand, but there is no reason to suppose that before long wireless telephony will not be extensively used for the communications of our mercantile marine.

an evening paper correspondent. Surely this is a deplorable state of matters for those like myself, who consider "bleating" a nauseate, tardy subterfuge for a bare, scanty voice. If we could only have tremolos by themselves and not as they are, mixed with good singers, it would be a boon to many, or, if this horrible practice was boycotted by others, as I mean to do, it would soon come to a finish.

Aberdeen.

JAS. GRASSIE.

* * *

My local B.B.C. station is 5 W A, the Cardiff station: well, to get on with it, my grievance is this. Other B.B.C. stations manage to have a dance night either once a week or a fortnight. Why can't Cardiff do the same? It is true they used to give half an hour's dance music every night, but that dropped off a few months ago, and now I think we get a dance night once a quarter. Of course, some people might say: "Are you not satisfied with the Savoy Bands?" but observe how late they start, and after you have been at work all day you don't fancy stopping up till 11.30 or 12 p.m.

FRED HEDLEY.

1, Union Terrace, Abergavenny.

* * *

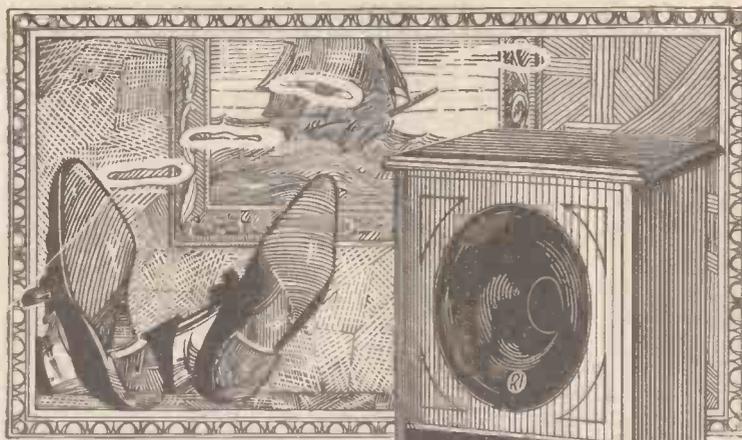
I have a small "grouse"—i.e. our new station, the Notts Relay Station, 5 N G, while reception being very good, and not in any way being the fault of the B.B.C., there is a continual whistle like the top note of a tin whistle, which is apt to get on one's nerves; to my mind it seems like interference from another station. If it could be remedied it would be a great relief to many, I am certain.

N. M. LINDLEY.

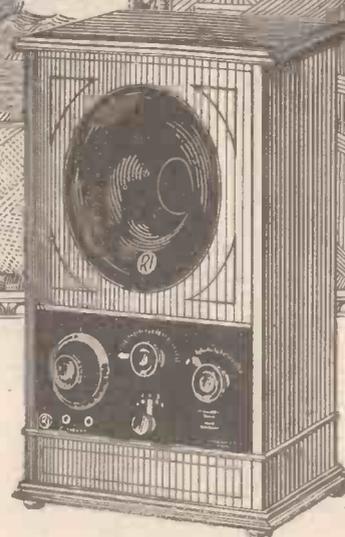
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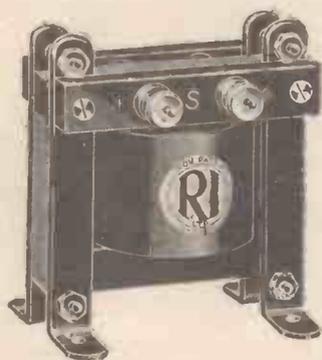
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RADIO IN CHINA

By PERE LEJAY

Here is a brief account of the radio progress made in the "land of the dragon."

ALTHOUGH it is possible that the "almond-eyed Celestial" would not yet have reacted to the lure of radio to any great extent, in spite of the radio waves floating around him, and that he is, indeed, in the darkest of deep ignorance regarding it in the interior of China, radio is taking as firm and fast a hold in a few of the more advanced districts of the nation as it is in any European country.

A great deal is due to the influence of the European settlers and missionaries, of course, one of the most outstanding cases being that of the work being done at the Observatory of Zi-ka-wei, at Shanghai. The observatory was originally founded in 1845 by the Jesuit mission of Kiang-nan, although the present building dates back only to 1875. As the work in the scientific branch of the institution increased, it began naturally to include the study of meteorological conditions, and as soon as radio came to the fore so strongly in this latter work it naturally found its way into the observatory.

Investigating Atmospheric.

At present the station of Zi-ka-wei is one of the most important weather observation posts in the section of China. It has been due to the careful work of the past few years that a remarkable theory has been practically proven conclusively—that

while most storms of the districts are either responsible for, or at least coupled with, atmospheric disturbances (a purely independent check of the recent bu-

reau investigations of France), the famous typhoons of the China Sea are not in any way connected with whatever static is to be observed at the moment.

No Broadcasting.

This has been done with the big mobile frame shown in the photograph, careful observations having been taken, and the frame directed to the approaching storm, away from it, and in every direction. The typhoon has been found to be often the centre of the calmest atmosphere, so far as static is concerned.

The receiving set used, working on either an outdoor or frame aerial, has four stages of radio-frequency amplification, followed by a detector or an audio-frequency differential to eliminate static in general reception. The oscillating circuit is operated by a two-valve heterodyne, with a Baldwin 2,000-ohm headphone. The aerial is 125-ft. long and 100 ft. above the ground.

Other interesting work done by the Jesuit observatory has been in the checking of time signals. As they are just about half-way between Nauen and Honolulu,

they can pick up both stations regularly. By a system of checking, they have found that the Honolulu station is apt to be off as much as five seconds, one way or the other, from the European stations. The Tower, Bordeaux, and, in fact, most of the big European stations, are received on C.W. quite easily, and occasionally on telephony.



The giant frame aerial at the Zi-ka-wei Observatory, China.



Tuning in the seven-valve set at the Zi-ka-wei Observatory.

There is no actual broadcasting station in China yet, though radio sets are for sale in several of the stores in Shanghai.

The incoming ships often favour the inhabitants with concerts, however, and thus have made radio music a not entirely unknown factor. That radio may ever become the craze that it is in the Occidental countries is, of course, very doubtful, due to the difficulties of manufacture and the expenses; though, with Japan so close by, even this is possible.

ROME CALLING

THE Italian broadcasting station I R O in Rome has begun its radio broadcasting service on a 422-metre wavelength with 2 kilowatts aerial transmission power.

The "Radio-araldo" station in Rome is continuing its regular work on 450-meter waves, with an antenna power of 100-500 watts.

"FINE TUNING." HOW TO GET BEST RESULTS.

By J. C. JEVONS.

SO many articles have been written dealing with the subject of tuning, and of tuned anode circuits, that it may be assumed that our readers are familiar with the subject in its broadest sense.

It remains, however, to give details of the relationship that should obtain between the electrical and mechanical construction of our tuning arrangements so that the best results may be secured.

It is not enough to state that a circuit may be tuned by means of a variable condenser connected across an inductance, or by means of a variometer, as mechanical considerations enter into the question in order that our method of tuning may be brought into use in as effective a manner as possible.

Use of Extension Handles.

For example, the troubles of hand capacity effects when moving the hand towards or away from the knob of a variable condenser are well known. This trouble is not only most trying to one's self-control, but also vitiates our efforts to bring in a faint signal. This difficulty may occasionally be experienced when using variometer tuning.

The reader will probably suggest immediately the use of extension handles, and this undoubtedly gets over the trouble in the case of a made-up set, and at the same time allows of the variable condenser being rotated through a very small arc of motion, owing to the greater leverage obtained by the longer handle.

Even with a boxed-up set the mechanical movement of the condenser must be very smooth and even, and the extension handle rigid and free from all whip or spring, otherwise there is every probability of the movable vanes of the condenser moving in small—possibly very small—jerks, and so upsetting that fineness of tuning sought for.

But what about that amateur "hook up," in contradistinction to the made-up cabinet set.

Here we have possibly to deal with boxed-in condensers as separate units, and frequently light in weight and not fixed to any relatively firm foundation as in the case of the cabinet set.

The use of extension handles in this case is frequently a practical impossibility, as the rotational friction of the condenser spindle, is usually in excess of the friction existing between the condenser and the table top on which it is resting.

Mechanical Friction.

This means that when we move the extension handle, instead of the condenser spindle rotating, the condenser rotates on the table top, box and all.

How well many of us know this trouble, especially when working with our apparatus laid out on a smooth table top.

A certain amount of rotational friction is inevitable, and is caused by spring washers, or other spring contact devices in our varia-

ble condensers, quite apart from defective alignment of the spindle in its bearings.

When using vertically mounted variable condensers a considerable amount of this internal mechanical friction may be alleviated, but when the condensers are mounted horizontally on a panel a certain amount of friction to rotation of the vanes is essential, owing to the unbalanced mass of the rotating portion, and how seldom do we find the rotor counter-balanced for the overhang of the moving vanes on one side of the spindle.

If this friction did not exist the vanes would not remain in the position to which they were turned by the knob, but would fall back to the bottom like a loose hand on a clock.

It is at once seen that this trouble may be greatly aggravated by an extension handle, unless the effect of the extension handle is designed to counter-balance the overhanging weight of the vanes.

If the vanes are properly counter-balanced, the friction to rotation may be immediately reduced.

Now these remarks are equally applicable to the case of variometers, with the exception that since their construction lends itself to mechanical balance we may have to counterbalance an extension handle if we desire to reduce the rotational friction when horizontally mounted.

On the Point of Oscillation.

In the case of variometers however, there is one point that wants watching carefully, and that is, the avoidance of stiff connections between rotor and stator, which may give a troublesome clock-spring effect if we reduce the friction to facilitate fine tuning.

It may seem to some that these are relatively unimportant details, but the time has come for us to consider these refinements, and quite apart from this the writer is firmly convinced that much of the oscillation and "nearly but not quite" tuning and other heterodyning effects that nightly pollute the ether is almost wholly due to the mechanical impossibility of tuning some sets with that accuracy that fine tuning warrants.

The tuner reaches out his hand and his signal disappears, he adjusts the knob of the condenser and the signal reappears, he withdraws his hand and the set starts to howl.

He approaches that knob again, and makes a small adjustment in one direction, and on withdrawing his hand the howling is distinctly worse; making a final dash he reverses the previous adjustment, and on withdrawing once more finds the set still

howling, only faintly this time, and as he knows that further efforts are useless, rather than lose his signal altogether he leaves it howling and basks in a little music and a lot of carrier wave. No, reader, this is not a mixed metaphor, the warmth being supplied by his conscience, and that blush that mantles his brow is caused by the thought that he is not beloved of his fellow-listeners. We would fain be charitable and trust that this is so.

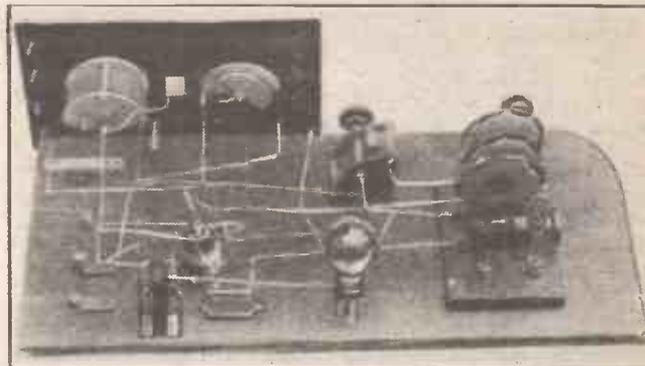
Now this howling is a positive curse to all around, and in the words of the well-known engineer, "Don't, please, do it."

Cease looking for that oasis of a silent spot in the midst of a howling wilderness, get out of the oscillation altogether; if you must play with it, get near to it but never into it.

Incidentally, an unexpected source of considerable irritation of the ether was recently traced to the efforts of the gentler sex to reproduce the dulcet tones in the headphones during the absence of the head of the house—*verb. sap.*

This endeavour to emulate the performance of the master mind should be suppressed if not deliberately thwarted.

To secure this essential fineness of tuning the writer would strongly recommend



The back of the receiving set used by Mr. F. Walker for reception of Australian signals.

the amateur to try the reversal of the customary routine—i.e. instead of tuning roughly with a variable inductance and finishing up with a vernier condenser, try tuning the variable inductance roughly with the condenser and finish off with the variable inductance.

This can readily be accomplished if movable basket coils are used connected in series as a variometer, and mounted in any convenient manner so that their magnetic coupling may be varied by infinitely small amounts in a smooth manner.

NEW SHORT WAVE STATION OPENED.

TUCKERTON, N.J., has just completed its broadcasting station WGH, the first short wave commercial station to be built. It has obtained a licence to operate provisionally on 90, 93, 97, 100 and 103 metres by the Department of Commerce. It is intended for trans-atlantic service, and has a transmitter rated at 20 kilowatts, which is expected to establish auxiliary long distance commercial circuits to Paris, Berlin, and Buenos Ayres.

Take no Chances

—wear British
Ericsson Telephones

EARPHONES AND THE EARS

DANGER THAT LURKS IN FOREIGN GOODS

SOME of the cheap earphones made abroad are dangérous. This fact is revealed by an eminent German medical authority, issuing a warning to listeners-in in Europe to beware of cheap telephones. The habit of listening-in for long periods by telephones, he says, has lead to a serious disease of the ears, caused chiefly by the continuous contact of impure materials with the skin. Many of the cheapest makes of telephones have ear-caps and magnet-cases manufactured from moulded compositions of remarkably poor quality, and it is feasible that impurities in these compositions have a more or less poisonous effect on the delicate skin of the ear. Head telephones of the same make and quality as those which have caused the outbreak in Germany may be imported into England. Listeners-in should, therefore, be extremely careful in buying imported telephones. *The safest plan, of course, is to buy those of British manufacture.*

"Daily Express,"
13-12-24.

"Listeners should, therefore, be extremely careful in buying imported telephones." Take no chances—use Ericsson (British) Telephones.

But be sure they are Ericsson British *not* Continental imitations. Look for "Ericsson" stamped on each headpiece.

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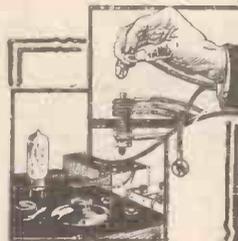


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WIRELESS enthusiasts are loud in their praises of the Newey Snap Terminal, which, with one movement makes perfect connections and certain contact. It can be used in a dozen and one ways—on experimental circuits, for adding headphones to any set as required and, in fact, wherever instant contact is wanted without trouble or fuss. It obviates the screwing of wires, cuts out the soldering iron and minimises the worrying and time-wasting method of making connections with odd ends of wire: Get a box from your local Wireless Dealer or ask us for descriptive leaflet.

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124, Tooley Street, London, S.E.1.



BROADCASTING FROM THE DEPTHS OF THE EARTH.

By OUR YORKSHIRE CORRESPONDENT.

The story of the spectacular broadcast from the bottom of a very deep coal mine by the Leeds-Bradford Relay Station, told by one of the broadcasting party.

IT was a cold, black night. The colliery head-gear loomed up out of the mist like a giant Meccano model. Arc lamps were dotted here and there; the winding engine periodically snorted under its load. At the brink of the black gulf which precipitated to the famous Silkstone seam of coal over a quarter of a mile below stood a group of men, silent, waiting. On one side, in a little hut, was Mr. Bottle, assistant engineer of the Leeds-Bradford Relay Station, his headphone-clasped head cast out in bold relief by the glow of three LS5's in the three-valve amplifier before him.

Into this hut came a land-line from the Leeds-Bradford station twelve miles away, where, at that moment, a professor of Leeds University was giving a talk on coal mining. Suddenly the engineer in the control-room of 2LS told Mr. Bottle that Professor Ritson had finished, then plugged the line through to the transmitter, while Mr. Bottle plugged his end through to a Western microphone which stood at the pit-head.

The "Star Turn."

"I am speaking," came the voice of Mr. G. P. Fox, station director of 2LS, "from the pit-head of the Whitwood Colliery, Normanton, Yorkshire."

And 30,000 listeners wondered when they heard his voice as clearly as if he were in the studio, with a realistic rattle of trucks faintly in the background. Every wireless enthusiast in the West Riding was listening, for this was the night of the broadcasting "stunt" from out of the depths of the earth which proved so successful that the only criticism I have heard was that it was not long enough.

The "star turn" of the evening, Mr. George Lister, a well-known Yorkshire comedian, had wandered off and was having an altercation with a collier as to whether

one was allowed down a mine with spats on, and he had just come to the conclusion that one might go down with such on when he heard Mr. Fox's voice and came stumbling across to the pit-head.

"Short and Sweet?"

"Ooooooh! Is that the pit? What w-would happen if I f-fell down it?"

The kindly pit officials told him that as it was 1,500 feet deep they *might* find the bits at the bottom. He would see how deep it was in a minute when they took him down. They sometimes went down at sixty miles an hour, but out of consideration for him they would go slow. Despite his protests, George was bundled into the cage; while the land-line was switched through to another amplifier which Mr. Lionel Harvey, the engineer-in-charge of 2LS, brought into action in the pit bottom office, another microphone being installed in a working some distance away.

Then they let us down. It was short and nasty. As for slow—we did at least thirty-five miles an hour. The upgoing cage passing us at seventy! Hunched up in our little iron cage, which swayed and rocked and clattered, we gasped for breath as a hurricane tore upwards past us. It was pitch dark; we clenched the bars along the top of the cage like drowning men. Was this the bottomless pit?

What was that? No, this must be heaven! Out of the eerie distance came faint, sweet strains of music. No, it was not heaven, for the cage slowed, we blinked at the glare of arc lamps under which sweltered the Whitwood Colliery Brass Band. And George stepped out of the cage to the strains of "See The

Conquering Hero Comes." In the pit bottom office was Mr. Harvey with the other three-valve resistance coupled amplifier, connected by one of two lines up the shaft to the land-line and the station, which now seemed so far away. The other line was used for speech with the pit-head. Somebody put a loud speaker at the other end of it, and so we were able to listen-in to what was going on not fifty yards from us; but we listened by a circuitous route.

The "Human Woodpecker."

The more George saw of the pit the less he liked it, but the listener heard the pit deputy—a blunt, broad Yorkshireman—bundle the spatted George away to the coal face with a pick. Then came blows at the coal, blows which decreased to taps, feeble taps punctuated with groans and moans and mutterings. George told the listeners all about life in a pit.

"I wonder"—
—biff!—"how much"—
—phew!—"a ton"—
—tap!—"they get for



Mr. Lister, a well-known comedian, broadcasting a "turn" from the coal mine.

this!" he groaned. "Reckon I've got"—
—biff!—"about three-ha'porth!"

During an interval George rendered that diige "Don't Go Down to the Mine, Daddy," with Lister variations; then he got fed-up and clattered off in a desperato effort to find the pit deputy. On the way he passed a miner with a face like the top of a Cossor red-top. This begrimed fellow had nearly spoiled the success of the transmission; his mates had giggled, grinned, hand over mouth, as they stood in an admiring but silent circle round the mike, but he had to tiptoe away and rush down a working, there to burst.

An Immense Success.

George eventually found, and paid a fearful farewell to the pit deputy, who shoved him unceremoniously into the cage and sent him, tired but happy, hurtling to the surface, while the band played Tosti's "Good Bye." The amplifiers were packed up in their portmanteaux—they had been used at Wembley—and a proud party of B.B.C. officials emerged from the colliery. The transmission was an immense success, both technically and from the entertainment point of view, and, in my opinion, quite worthy of "S. B. ing."



The Whitwood Colliery Band "broadcasting" at the bottom of the pit.

PREVENTING RADIATION TROUBLE.

An Automatic "Cut out" for Oscillating Valves.

By SEXTON O'CONNOR.

IN spite of all that has been said and written on the subject to date, the misuse of reaction in valve sets is still a widespread cause of interference with broadcast reception. A little reaction is an excellent tonic for feeble signals. Pushed to excess it converts the harmless amplifier into a raging "oscillator," and fills the ether with streams of cat-calling carrier-waves.

Only Effective Remedy.

In the early days of broadcasting the licensing authorities attempted to eliminate this form of interference by forbidding the use of reaction direct on to the aerial. Tuned anode and inter-valve couplings were the only forms of reaction allowed. It was soon recognised, however, that there was little to choose, so far as "radiation" was concerned, between any of these circuits. The only effective remedy lies in persuading the owners of valve sets to "ca'canny" in the gentle art of coil-swinging and knob-twisting.

Unfortunately persuasion alone, either in the form of Captain Eekersley's emphatic "Don't do it," or his sporting appeal to the spirit of *noblesse oblige*, has failed to keep the ether clear of variegated shrieks and howls. Inventors have therefore turned their attention to finding some means which, whilst allowing the use of reaction within legitimate limits, will make its abuse impossible. The problem has been attacked in several different ways, of which the arrangement shown in the Fig. (Patent No. 218,336) is an interesting and ingenious example.

An Ingenious Principle.

The principle here involved depends upon utilising the change of plate current (which occurs when self-oscillation sets in) as a means of automatically changing the conditions of the set and, in effect, throwing the offending receiver out of operation for the time being.

Two separate and independent reaction coils are provided. The coil A is the ordinary reaction winding variably coupled with the secondary circuit B and aerial D, both of which are tuned to the incoming signal. The other coil, E, back-couples the plate circuit to a special loop circuit, C, which is inserted in the grid, but is tuned to a frequency different from that of the incoming signal—i.e. different from the circuits B or C. Owing to this difference in tuning the coils C, E have no appreciable reaction effect at signal frequency.

A "Swamping" Frequency.

If, however, the coupling between the coils A and B is tightened so as to cause the valve to boil over into self-oscillation (at the signal frequency) a sudden change takes

place in the valve of the plate current, and a corresponding increase occurs in the amplitude of the grid circuit oscillations, which are then rectified and cause the grid to acquire a more negative potential. As the grid reaches a certain critical negative potential, the back coupling between the coils E and C suddenly comes into play and swamps out the existing oscillations with oscillations of an entirely different frequency, determined by the tuning of the circuit C.

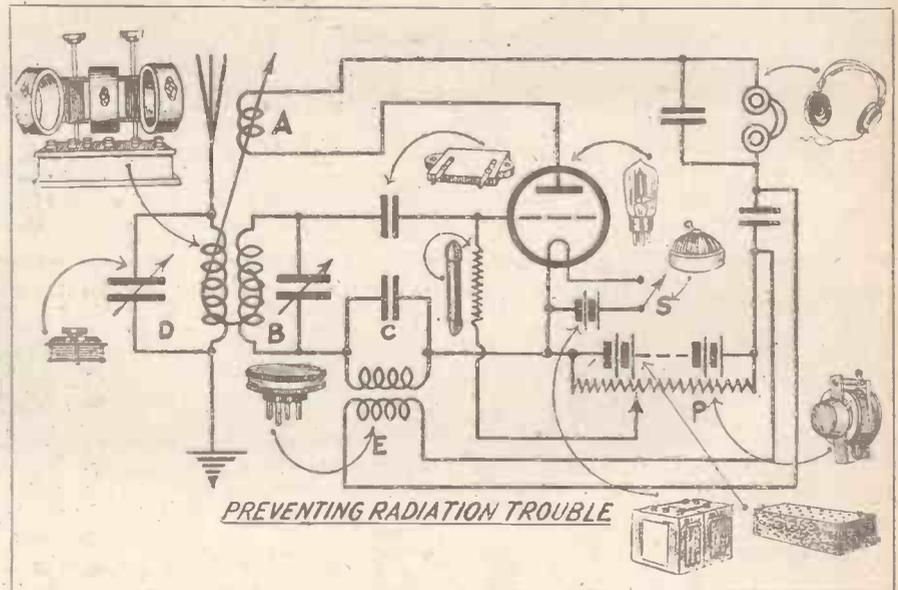
As the second set of oscillations are of a frequency far different from the tuning of

"dud" so far as reception is concerned. Before it can be again brought into operation it is necessary to open the filament switch S so as to quench the second oscillations and bring the whole system back to its original state.

This in itself is sufficient to deter the owner from pushing the normal reaction too far over, as he pays the penalty of losing the original signals until he has re-adjusted the set to its proper condition. In any case, however, his mishandling of the reaction does not result in any form of annoyance to his immediate neighbours.

The Warning Note.

The tuning of the circuit C may be set to an inaudible frequency. In this case as the coupling between A and B is increased the signals get gradually stronger in the ordinary way until the critical point is reached, when a "click" occurs in the telephones, and silence reigns thereafter until the switch S is opened and the circuit re-set. Or the circuit C may have an audible frequency, in which case the "cut out" action will be accompanied by an unmistakable warning note in the headphones of the guilty operator.



PREVENTING RADIATION TROUBLE

the secondary and aerial circuits, they cannot energise the aerial or be radiated from it in an undesired manner—i.e. so as to cause interference. The normal grid potential is initially adjusted by means of a tapping across the H.T. potentiometer shown, so that the change above described takes place practically instantaneously.

In other words, if the reaction coils or other tuning adjustments on the receiver are so carelessly or deliberately moved as to throw the set into oscillation at or near the signal frequency, this "harmful" frequency is immediately swamped out by a second frequency which cannot be transferred to the aerial to cause external disturbance.

Sufficient Deterrent.

The automatic cutting-out of the harmful oscillations by the new oscillations generated by the back-coupling between the coils E, C incidentally renders the whole set

RADIO IN THE ROCKY MOUNTAINS.

THE Goldwyn Cosmopolitan cinema troupe has the honour of having introduced radio to the Rocky Mountains.

In the course of filming "Unseeing Eyes," in which Lionel Barrymore and Seena Owen are playing, the troupe went out to the frozen mountains at Lake Louise, where a radio set was installed to provide recreation during the rest hours.

There were many trappers and Indians in the district who made their first acquaintance with radio in this manner.

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NEW MODEL, TYPE "D."
 Hygienic Horn Head-
 bands. Nickel-plated
 Stirrup. Black and
 White Cord. Each re-
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 4,000 or 8,000 ohms
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"BRUNET" HEADPHONES

have been adopted by the majority of European Governments and Radio Companies as their standard type, and in Great Britain alone there are over 350,000 in use out of a total of over 1,000,000 manufactured since 1914.

In the new model (illustrated) considerable improvements have been made in the head-band to ensure greater comfort; and the cord, of the same first-class quality, has been changed from green to black, striped with white.

"BRUNET" L.F. TRANSFORMERS

enjoy as high a reputation as the famous "BRUNET" Headphones, and many leading manufacturers of wireless sets in Great Britain and Europe have always used this L.F. Transformer owing to its magnificent amplification without distortion, freedom from breakdown, and high insulation resistance.

Over 1,000,000 in use.

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Terminals

FULLY GUARANTEED
 Retailers will supply a new article free of cost should any defect occur due to faulty manufacture.



SHROUDED TYPE

Ratios 1/3 { 5,000 Primary turns.
 15,000 Secondary turns.

Ratios 1/5 { 5,000 Primary turns.
 25,000 Secondary turns.

Price 13/6 each



APPARATUS TESTED

The Technical Editor of "Popular Wireless" will be pleased to receive wireless sets and component parts for test. Reports will be published under this heading.

WE hardly know whether the new crystal, a sample of which has been sent us for test by the Valve Renewal Co., is styled the V.C., or V.R.C., as the little tube in which it is contained bears a label marked with a V, an R in a circle, and then a C. However, whatever its name, it is an exceptionally good crystal, and proves to be both sensitive when used in crystal circuits and stable when employed in valve-crystal circuits. It appears to operate equally well with almost any type of metal contact, and at 1s. per piece there is but little doubt that it will find favour among listeners and experimenters, although it is entering into competition with a rather crowded market.

Messrs. Spencer Sharp, of Hull, have sent us one of the new Colytt variable grid leaks for test. It is unusual in design and is provided with a patent sliding carbon system of resistance variation, and on test we discovered that the claim that it is noiseless in operation and smooth in action

is a just one. A new feature is embodied in that ingenious clips are provided on its sides into which a special fixed condenser can be slipped in a moment, thus making it a combined grid leak and condenser.

It is a one-hole fixing component, and even from this aspect it is novel as the mounting screw passes through the panel into the body of the instrument and acts as the bush for the adjusting screw as well.

In view of its unique design and undoubted merits we predict that the Colytt grid leak will prove popular if retailed at a reasonable price.

Two very interesting items have reached us from the Carpax Company, Ltd., a fixed crystal detector and a valve protecting device. The fixed crystal detector, known as the Rusonite is, we think, one of the best components of this nature we have tested. Used with a "P.W." Ultra crystal set signals proved to be as good as when the more fiddling cat's-whisker type of detector is used. In a reflex circuit it also functioned

as well as the orthodox type. If every Rusonite sold is as good as the one sent to us—and there is no reason why they shouldn't be—we can hardly be too loud in our praises, as unfortunately a number of the fixed crystal detectors offered to the public are anything but satisfactory. We recently had one sent us by a reader which wouldn't have detected a thunderclap (of this, more anon).

The valve protector sent us by the Carpax Co. is not of the fuse type, and when connected in series with the H.T. provides a—we discovered on test—sure safeguard against "burn-outs" by the H.T.

From S. Guiterman & Co., Ltd., we have received samples of several items of interest. These include sets of terminals with engraved heads denoting "A," "E," "L.T. +," etc., which retail at 2s. per complete set of ten, single coil-holders for panel mounting and single coil-holders for under panel-mounting. All are well made and designed with an intelligent knowledge of wireless amateur constructor's requirements.

The Edison Swan Electric Co., Ltd., have sent us an Edison Square Well Variable Condenser. It is a solid well-made component, built evidently to stand hard work and rough handling. It is designed on unique lines and can be mounted either on a base-board or behind a panel. Furthermore—and this will appeal to the experimenter—it can be stood on the table and without any support be brought into service immediately. The action is positive and smooth,

(Continued on page 1106.)



The Old Order Changeth

The latest triumph of wireless research is the



VANELESS SQUARE LAW VARIABLE CONDENSER

The "Radiovox" is a revolution in condenser design. It has an even scale of capacity variation throughout the whole of its range and, owing to the small size of the electrodes, the losses are reduced to a minimum.

The "Radiovox" Variable Condenser is a sound, engineer built component—is entirely enclosed in a strong fibre case and an ornament to any set.

There are no delicate vanes to get damaged or dusty. The movement is firm and smooth and the position of the electrodes eliminates hand capacity effects.

Tuning is exceedingly fine and, although there is only one knob to turn, Vernier adjustment is obtainable over the whole scale. The tuning in of distant stations is simplified.

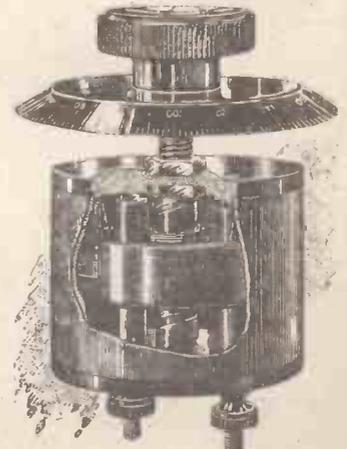
The "Radiovox" is British made and is guaranteed by the makers.

It serves further to demonstrate the superiority of British Radio Components.

The price includes first-class knob and dial.

All orders will be taken in strict rotation and will be dispatched immediately on receipt of remittance.

Many wireless components, useful in their day, are now forgotten, superseded by others more scientific and efficient.



•301
•302
•303

RADIOVOX CO. (Dept. B), 57, Chancery Lane, London, W.C. 2.

PRICE 8'6
Postage 3d. extra



The light car of LOUDSPEAKERS



A MOTORING expert of my acquaintance once told me that he always mentally classified motor-cars in three categories—Cars, Light Cars, and the smaller fry which, he used to say, looked more like motorized perambulators than anything else.

As a Loud Speaker expert it struck me that in this line a very similar state of things existed.

You have the full size loud speaker, the Fellows Junior, and the smaller fry which you can hardly recognise as Loud Speakers and usually consign to the nursery. In fact, the children like them very much.

When I run round to any friends of mine who aren't lucky enough to have wireless, I always take my Portable Three and the Junior with me. Just to give them a bit of a concert.

And unless I tell them, they don't dream for an instant that the Junior isn't a full-sized instrument. After all, why should they?

It's over 18 inches high, it has an adjustable diaphragm, its volume fills any ordinary sized room with ease and its tone is perfect.

Its appearance, too, is just the same as any of the big speakers, and it's not so very much smaller either.

Its price, though, is only 30/-

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E.P.S 96

Sets that are worthy of a splendid Crystal —Neutron

The producers of Neutron Radio Crystal now introduce to the market a series of Crystal Sets, each fitted with a Neutron Crystal. These are designed in accordance with the principles on which hundreds of long-distance records have been established; and each set represents, for its price, the highest possible efficiency in loud and clear reception.

No. 1 Enclosed detector with smooth movement, screw Crystal cup fitted with Neutron Crystal. Variometer tuning, covering 300 to 500 metres wave-length. Extra terminal for use with short aerial. Nickel-plated fittings, mounted on high grade matt ebonite, with polished cabinet, size 5 x 5 x 4 1/2 in. - - - **10/6**

No. 2 As above, but with lid to cabinet. Covered in brown crocodile-grained leather cloth. Also has provision for addition of loading coil, for Chelmsford, or other long-wave stations. Size 5 x 5 x 5 **12/6**

No. 3 A "de Luxe" modification of the above, exactly to same specification as No. 2, but in a larger size—7 x 5 x 5 - - **15/-**

Guaranteed Range—125 miles

No. 4 The last word in Crystal Receivers; guaranteed to receive telephony at 125 miles at least, with a good aerial. Fitted with special detector with newest improvements; tuned by low-loss coil and variable condenser, with knob and engraved dial. Fitted with plug and socket for long-wave coil. This set is exactly as used in regular reception over 200 miles range - - - - **32/6**



These sets owe their efficiency mainly to the fact that each of them is fitted with a Neutron Crystal, exactly similar to the Neutron you buy in the black-and-yellow tin. Your Radio Dealer can supply either Neutron Crystal or the Neutron complete Sets; but if you have difficulty send the price with Dealer's name direct to us, and receive the Set or the Crystal by return post.

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Stocked by the Best Radio Dealers. Packed in tins with silver cat's-whisker. Insist on Neutron in the Black and Yellow Tin— **1/6**

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APPARATUS TESTED.

(Continued from page 1104.)

and its base is very clearly marked with the value of the instrument. The only criticism we have to offer is that it is not fitted with "one-hole" panel mounting—a modern requirement which, with all due respect, we suggest the Ediswan people have not given sufficient attention to in respect of their wireless components.

Messrs. B.T.H., Ltd., have sent us samples of their famous B4 dull emitter valve. It is, however, so well known that comment on our part would almost seem to be superfluous.

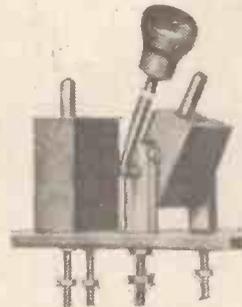
In any case, the B4 stands in a class of its own and in a final stage of L.F. (it takes 25 amps at 6 volts), or in fact in any stage of L.F. it is for both amplification and purity absolutely unsurpassable.

When a great firm such as the G.E.C., who can equip high-power generating stations with complete plant, turns its attention to crystal detectors we can look for something interesting. And when samples of the new Geophone Micrometer Crystal Detector, and the new Geophone "Unit" Crystal Detector were received we were not disappointed. Particularly do we like the former which is compact, neat, and really scientifically designed. One of its outstanding features is that the horizontal adjustment is accomplished without a rotational movement of the cat's-whisker while the

screw that accomplishes this bears a left hand thread, an almost obvious refinement we do not remember having seen before. At 4/6 complete with a piece of Gecosite crystal, we predict that it will achieve immediate popularity. The "Unit" type is rather more conventional being provided with the "ball and slide" method of adjustment. It differs from its numerous predecessors, however, in that the ball and socket are both sprung and this introduces a very firm although perfectly smooth action not usually encountered. An improved crystal holding system is another of the several outstanding improvements worthy of commendation.

Both types are horizontal detectors, well finished in bright nickel, fitted with easily removable glass covers and screw cat's-whisker holders. Altogether they are components of sound design with real instrument finish.

Messrs. N. Heywood, the crystal manufacturers, have sent us a copy of their new monthly production "Krystollus." It is an amusing and instructive little brochure that should prove of interest and assistance to the retail trade among whom it is to circulate.



A panel mounting coil-holder manufactured by Messrs. The Goswell Engineering Co.

We have just tested out one of the low ratio (2.7 to 1) L.F. transformers made by the Marconi Co. under the name of "Ideal" transformers. The various ratios provided by the different models cover all the needs of the amateur, and though we have only been able to test the low ratio type up to now we have no doubt but that all the others are quite as good. As a second stage L.F. amplifier in conjunction with a suitable power valve and grid bias the "Ideal" transformer thoroughly acts up to its name and though its price is high—35/- being the figure asked—we can certainly express the opinion that it is money well spent.

Messrs. the Gilray Radio Co. have sent us a sample 1s. 6d. box of their Gil-Ray crystal. The box contains two specimens which curiously enough displayed almost opposite characteristics on test. One proved to be sensitive but not too stable, and the other stable but not quite as sensitive. If all boxes sold contain a similar pair; or rather if the above is intentional, such is to be highly commended, and should ensure a very brisk sale among both crystal and crystal-valve users.

Messrs. Ericsson also submit a rotary potentiometer. It is provided with a novel yet perfectly simple circular coil and contact which provides an adjustment unique in its smoothness besides being most positive in its action. In a suitable circuit its noiselessness is most marked and to a considerable extent this is due, we should imagine, to a soldered copper spring method of making connection to the revolving contact arm. At 7s. 6d. we consider this component well worth the attention of our readers.

Quality RADIO DUPLEX BASKET COILS.



The most efficient inductance coil made for short waves, mounted on standard plugs. No wax or varnish used.



Number	Mounted	Mounted with Re-action Reverse Switch.	Unmounted.	Number
25	1 6	3 0	0 9	25
35	1 9	3 3	1 0	35
50	2 0	3 6	1 3	50
75	2 3	3 9	1 9	75
100	2 9	4 3	2 3	100
150	3 0	4 6	2 6	150
175	3 6	5 0	2 9	175
200	3 9	5 3	3 0	200

Postage: 3d. each. Set of eight coils post free.

If your dealer cannot supply we send post free if you mention his name and address.

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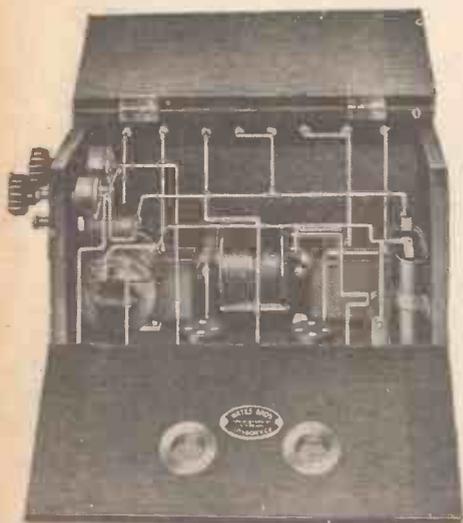
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£4 BUYS THIS 2-VALVE "SUPERATONE" AMPLIFIER:

—It is the most wonderful value-for-money ever offered, and enables you to work a loudspeaker with full and clear



volume direct from your present set. The handsome mahogany cabinet has hinged top and side, and all terminals are mounted on ebonite.

Inside, too, it is a high-grade instrument, the circuit giving maximum amplification with no distortion.

The microstats give micrometer adjustment for each valve (which can be bright or dull emitter) with master pull-push switch.

LEADING FEATURES

2 SUPRA Transformers, 2 MICROSTATS. 83-5-Y Pull-Push Switch, 2 MANSBRIDGE Condensers, Modulating Resistance, Negative Grid Bias.

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2 C.W.4.	2	48		19		9	3
2 C.W.5.	2	60	1	2		9	3
4 C.W.2.	4	24	1	6		3	3
4 C.W.3.	4	36	1	13		3	3
4 C.W.4.	4	48	1	19		3	3
4 C.W.5.	4	60	2	4		3	3
6 C.W.2.	6	36	6	6		3	3
6 C.W.3.	6	48	6	13		3	3
6 C.W.4.	6	60	6	19		3	3
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That's why CLIX, the Electro-Link with 159 uses, supersedes all forms of Plugs, Terminals and Switches and has standardised the wiring of all radio circuits.

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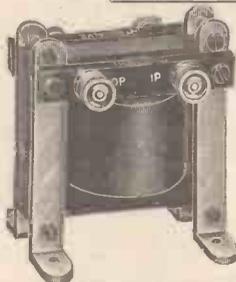
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The popularity which Woodhall Components have achieved is due to their careful workmanship and scientific design; it is a popularity that arises from "satisfaction" rather than from "cheapness."

The WOODHALL No. 1 L.F. Transformer.



Of massive construction produced for high efficiency—it is one of the highest priced, because its production cost is heavy. It is wound with 42 gauge wire wound simultaneously with fine SILK. It shows most marked superiority on 2nd or 3rd stage of amplification, even on 200 or 300 volts pressure giving no trace of distortion, and its amplification factor is decidedly above the average of other good-class transformers. Insulation is perfect between P. and S, and between windings and frame, and the transformer is one specially recommended for S.T.100 and other circuits of the "reflex" type... 23/6

The WOODHALL Vernier Rheostat

Combined plunger and rotary movement. The exceedingly fine adjustments it gives enable you to get the most out of your valves. Push-pull movement for coarse setting; rotary for vernier. Wonderfully smooth movement; best ebonite former; one-hole fixing.

10 or 15 ohms for bright valves
 30 ohms for dull emitters
 2/6 3/-

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AS SHOWN, WITH DIAL, KNOB AND BUSH.
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POST 6d. SET. UNSURPASSED FOR FINE TUNING.

John Blair, Esq., Rexall Pharmacy, Millom, says:-
 Your Condensers are a REVELATION to me as a Dealer. Sept., 1924. G. Walton, Esq., Andover:-
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 With EBONITE DIAL and Two Knobs. Post 6d. Set.



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 Equal units of '00025 or '0003 9/-
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Variable Grid Leak .. 2/6
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 T1 Transformers .. 30/-
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 Coils: 25, 4/10, 30, 35, 40 4/10, 50 5/-, 60 5/4, 75 5/4, 100 6/9.
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 AMPLION BASKET Dragon Fly. 2-way, 25/- 4/11.

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150-300 10/-
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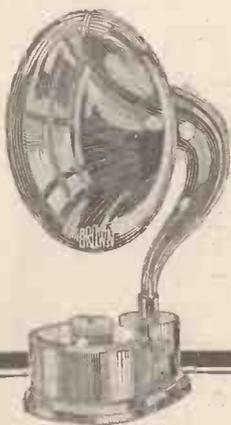
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RADIOTORIAL

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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. Technical queries are answered by post at a charge of 6d. a query, or 1s. for three. All queries must be addressed to the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, E.C. 4, and must be accompanied by a stamped and addressed envelope. Copies of the queries sent should be kept, as the original query cannot be produced in the answer. Cash should be sent in the form of a postal order.

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

“COUNTERPOISE” (Driffield, Yorks).—

What is a “counterpoise” earth, and has it any advantages over the ordinary earth connection?

† The “counterpoise” takes the place of a direct earth in cases where the latter cannot easily be made, or where it is undesirable owing to the presence of earth currents from neighbouring electric power plant.

It generally takes the form of a second multi-wire aerial of similar length to the other, placed directly underneath it but near the ground (say, seven feet high). Insulation should be good, and is quite as important in the counterpoise as in the main aerial and lead-in. It will be found that the counterpoise often sharpens tuning of the set, as well as minimising local interference.

S. T. (Ilford).—When drilling ebonite I find it very difficult to start the drill at the exact point necessary for the spacing of valve legs, etc. What is the best method of ensuring that the drill works exactly from the positions marked.

When the position has been marked off, a small hole should be punched for the drill to start in. All that is necessary is a light tap on the punch, from a small hammer.

S. O. B. (Bromley, Kent).—Should high or low resistance ‘phones be used with a crystal set if a telephone transformer is not going to be included in circuit?

High-resistance ‘phones should be employed in a crystal circuit, and the higher the resistance the better will be the signals received. ‘Phones of about 4,000 ohms are generally used, as they may continue in service with safety when a valve is added. If it is desired to get absolutely maximum results from the crystal set, 8,000 ohm ‘phones will be found to give better results, but these are more liable to get burnt out than the 4,000 ohm ones if a valve is added.

“NEW READER” (Nottingham).—What are the connections for a crystal set employing the following apparatus: A variometer with two terminals for connections, a crystal

detector also with two terminals, and a pair of ‘phones?

The apparatus should be wired up in the following manner: Aerial to one terminal of variometer and earth to the other terminal. The first terminal of variometer is also connected to one side of the crystal detector, while the remaining side of the detector is connected to one of the ‘phone tags. The remaining connection to the ‘phones is taken to the second-mentioned variometer terminal.

D. S. (St. Albans).—With regard to short-wave telephony reception. I have a one-valve set that will bring in K D K A on 65 metres fairly well, but every now and then breaks into oscillation without any warning with a loud “pop.” Music is very distorted, and speech nearly always unrecognisable. Is this a feature of short-wave reception as a rule? Fading is also very bad on K D K A.

Using one valve always means difficulty in reception of short-wave telephony, as you have to keep the set so near oscillation point to enable any of the modulation to be heard.

Without actually examining and testing your set, it is difficult to mention any very necessary suggestions for alterations, but you will be well advised to look over the points mentioned below. See that the coils are well spaced, and of as low a self-capacity as possible, and do not use a reaction coil of more than 24-30 turns. Less if possible. See that your aerial does not sway. This causes a great deal of sudden oscillation bursts on short waves, whereas it may be unnoticed on broadcast wave-lengths. Add an L.F. valve to your set, as at present the main cause of fading is the necessity to keep close to oscillation point, and any slight variation of capacity or inductance due to a swaying aerial, etc., will throw the set off its balance and signals will be lost. The distortion is also partly caused by the nearness to oscillation, and will be decreased by adding an L.F. valve. Another cause of distortion is known as “high-speed fading,” a phenomenon whose true cause is really unknown, and for which no remedy has as yet been devised. Your aerial should be as short as possible, consistent with good results—say 40-50 feet at the outside for a maximum—and should be as high as possible, and “bar taut” while receiving short waves if wind and weather will allow you to keep it taut. This latter is very essential if you are at all screened, or if the aerial has a great deal of horizontal in it. The down lead should also be taut and kept as far away from the building as possible.

A vertical aerial is as good a type as any if it can be arranged, the aerial coming straight into the room and to the set—no switches or any complicated arrangement of lead-in being used. Another point that should be watched is the type of valve used, and the capacities of all the condensers, especially those in the grid circuit and across the ‘phones. The type of valve is fairly important, as should reaction be too sudden, no lag being obtained, it will be difficult to resolve distant low-wave carrier waves into the

(Continued on page 1111.)

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 1110.)

music and speech. Variation of the grid leak and grid condenser, and of the H.T. and filament may bring about the desired conditions, but more probably a different type of valve, or make of valve, will have to be employed. The type will depend upon the physical constants of the actual set and aerial system used, and so cannot be discussed here. We have found dull-emitters preferable, but the make and properties of the individual valve will have to decide upon the detector to be used in the set. Various coils should be tried, of course, but here again local conditions are very important, and will probably determine the type of tuner that gives best results.

C. D. H. (Muswell Hill, N.).—What are the correct connections for an L.F. transformer in a detector and L.F. circuit?

This is difficult to say, as they depend upon the exact type of transformer to be used. As a rule, however, the following can be taken as the connections of the transformer, though they should be varied until best results are obtained. O P to plate (via reaction coil), I P to H.T. plus, I S to grid, O S to filament negative.

A. O. (Staveley).—My set is a 4-valve (1 H.F., det. and 2 L.F.), employing tuned anode H.F. coupling and intervalve reaction. I use a .001 variable condenser to tune the aerial, but some of the plates are bent slightly,

Our Query Department.

In future a charge of Sixpence per Query will be made for answering all technical questions submitted to the Technical Staff of POPULAR WIRELESS. A group of three queries will be answered for One Shilling. Postal Orders must be enclosed with all queries and a stamped addressed envelope in addition.

THIS NEW ARRANGEMENT IS NOW IN FORCE.

Since the inception of POPULAR WIRELESS, readers have had all their problems settled for them free of charge, but with the great increase in the circulation and the corresponding increase in the number of queries sent in, the task of dealing with the latter has become gigantic. A large Technical Staff is now employed answering queries, and it is with the object of relieving the pressure on them that we have decided to make the small charges mentioned.

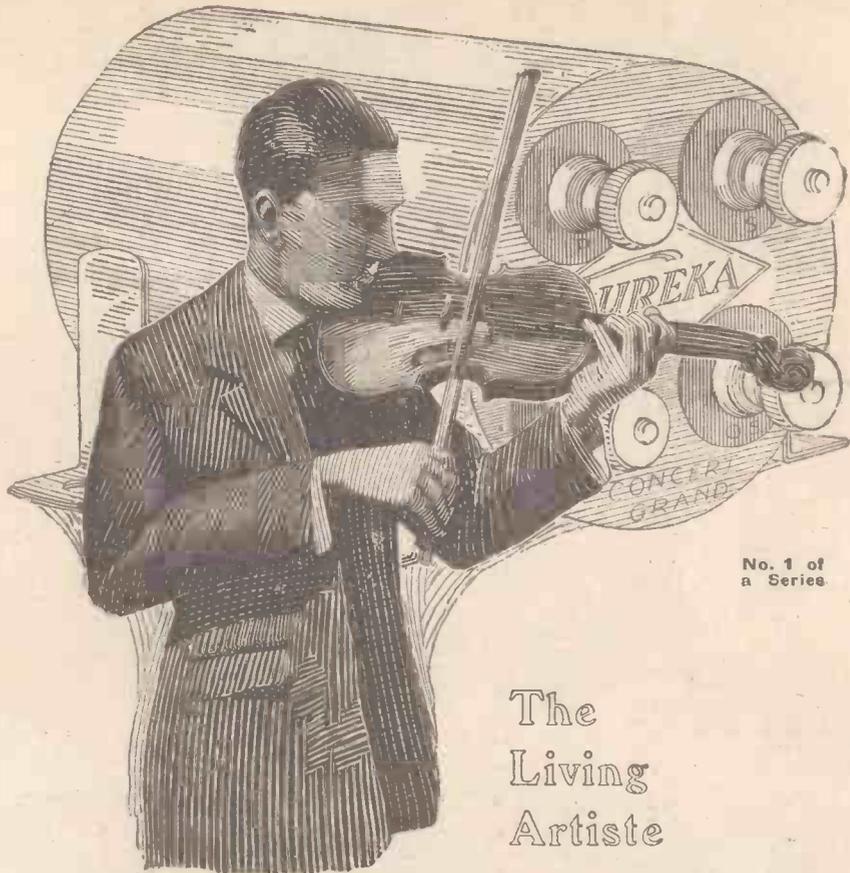
Readers of POPULAR WIRELESS know that the Editor and Staff of this journal have always had, and always will have, their best interests at heart.

and all the moving vanes are not parallel with the fixed vanes. They do not touch, but do these irregularities affect selectivity, as I find great difficulty in getting distant stations, and in tuning out the near ones?

Such irregularities would have a detrimental flattening effect, but this would not be particularly noticeable, and it probably is not the cause of your difficulty.

H. J. J. (Acton Vale, London, W.).—I have started to build the "Family" two-valve set, which was described in "P.W." No. 133, but I am rather puzzled by the diagram of the connections at the back of the panel. On page 931, in Fig. 3, there is an additional terminal shown underneath that marked L.T. +. What is the purpose of this?

The terminal on the left-hand edge of the panel, below the L.T. +, represents a screw projecting from the back of the panel, and acts as a support for the end of the long stout wire leading from the rheostat of the detector valve. This wire is soldered to it, or fixed by nuts, and a more flexible wire runs from it to the tumbler switch. This latter wire should be covered by sleeving where it passes through the wood. Of course, the stout wire may run directly to the switch, but thinner wire is much easier to manipulate through the wood and into the switch socket.



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TELEPHONES RE-WOUND

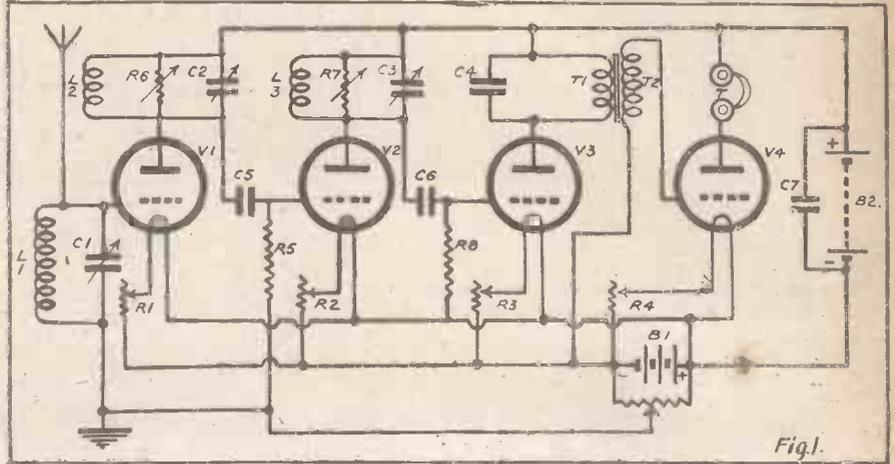
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2nd and 3rd floor. Phone: Central 1950.

Correspondence

STABILISING TUNED ANODE CIRCUITS.

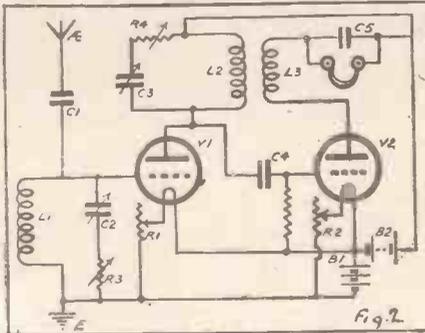
The Editor, POPULAR WIRELESS.
Dear Sir,—I am taking a great liberty in forwarding to you the details of a few experiments I have had with variable resistances, and hope they will be of some use to your readers, especially those working two tuned anode circuits—that is, if you find them worth publishing.
Two anode circuits, although so simple, are very difficult to handle. When operating such a receiver one tries to prevent self-oscillation by using large

and W C A E of Pittsburg. The following stations were logged by me:
1.5 a.m., W B Z (e e)—The announcer said that a soprano and a baritone were going to contribute to the programme.
2.17 a.m., K D K A—This on 326 metres. A band was playing when I picked them up, but later a lady sang. The band was playing again at 2.33.
2.45 a.m., W G Y—A jazz band was playing here.
2.55 a.m., W J Y—At this station someone was speaking, and I decided at 3.0 a.m. to go back to W G Y, and a lady was singing (this time). The band was on again at 3.10.
3.15 a.m., W B Z—Here the announcer said that a lady (I did not understand the name) was going to sing "Serenade."
W G Y was just audible on a small C.A.V. loud speaker, which I think says a lot for the set, and also the sensitiveness of the L.S.
2 LO and 5 X X give ample volume on the L.S. for any average size room.



values of the variable condensers across the anode inductances, and by lowering the filament current or high-tension supply. It is also necessary to keep all the coils well apart, and also the leads which go to the coils. Figure 1 is the diagram of my receiver; the two tuned anode circuits are kept stable by means of the two resistances R6 and R7, which are variable. There are several types of variable resistances of 100,000 ohms which are useful for this. Figure 2

I can therefore highly recommend this set to anyone who desires a good all-round receiver at a moderate price.
I use two Marconi D.E.R. valves, a '0005 condenser with vernier, a Colvren fine tuning condenser across the reaction coil, and an Igranic transformer.
 Hoping that this report may be of some use to your readers who probably thought of constructing this set.
I remain,
Yours faithfully,
W. J. H. CROOK,
71, North View Road, Hornsey, N.8.
P.S.—I wonder how many two valve owners (D. and L.F.) have been able to have their selection of four American stations in one morning!



shows how two resistances, R3 and R4, each of about 30 ohms, are connected in such a way as to enable variable reaction effects to be obtained. The resistance R3 stabilises the first valve, and will prevent it from oscillating. A negative potential may even be applied to the grid of the first valve without self-oscillation occurring. A certain amount of reaction is desirable in the aerial circuit, and the resistance R3 will control it to a nicety. The resistance R4 in the anode circuit is not so much for the purpose of preventing the second valve from oscillating, which it is not likely to do if the reaction coil L3 is not too close to L2, but to enable the reaction effect to be very carefully adjusted.

Yours truly,
R. M. BROADLEY.
16, John Carrick Street,
Springbury,
Glasgow.

THE FAMILY TWO-VALVE SET.

The Editor, POPULAR WIRELESS.
Dear Sir,—I thought it might be of interest to your readers who saw the instructions for making this set, in "P.W." of October 25th, to know of my results with it.
I can get all B.B.C. stations, and many Continental stations. Cardiff and Manchester are the only two stations I have not been able to hear while 2 LO has been working. When I tune in Radio-Paris I get very little interference from 5 X X.
A few weeks ago I received W G Y of Schenectady,

A GENEROUS OFFER.

The Editor, POPULAR WIRELESS.
Dear Sir,—Noticing Mr. Duncenth's letter in your correspondence column of the 6th inst., I am writing to let you know that I have 215 copies of various wireless periodicals, including 117 back numbers of POPULAR WIRELESS and "The Wireless Review." If any of your readers would care to have any of these papers, I shall be very pleased to hand them over free of charge. I have most back numbers of "P.W." and also booklets given away with same.
Wishing your valuable paper every success.
Yours faithfully,
J. L. FULFORD,
91, Richmond Wood Road, Bournemouth, Hants.

A PLEA FOR "VARIETY."

The Editor, POPULAR WIRELESS.
Dear Sir,—I have read many letters in your columns of complaint re the B.B.C. programmes, but up to the present no alteration has been made to provide a programme for us "average" listeners. Is there not some influential body in Britain who can take this matter up for us, or must we grin and bear it? It is certainly time some move was made, as every paper one reads contains letters from listeners who do not like the programmes. A number of my friends all agree that the person of classical taste is kept in luxury with his style of music, and we get only a few scraps as a rare treat.
Lately all the B.B.C. stations make a point of giving us programmes composed of either piano solos, violin solos, songs, etc., for practically a whole night long, and anyone who does not care for either of these might as well close down, as he will be very lucky if he hears anything else to his taste.
Why cannot we have more variety, so that everyone has a chance? Surely this is not asking too much? When broadcasting started we had splendid programmes, and I would not have missed it for worlds, but now the entertainments are not nearly so interesting, and are composed mostly of talks and doleful music.

(Continued on page 1113.)

CORRESPONDENCE.

(Continued from page 1112.)

I feel confident if only someone in authority would be kind enough to put in a word for us "average" listeners, he would have our deepest gratitude.

Yours faithfully,

REGINALD PENNEY.

169, Ombersley Road, Worcester.

THE "CHITTO'S" CIRCUIT.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have used the above circuit ever since it was first published, and have been very pleased with it.

Two of your correspondents suffer from hand capacity, so I hope my method of avoiding this may help.

I found that the grid condenser (.0003 in diagram) scarcely affected tuning, so I tried a fixed one in its place. A .001 condenser did not cause loss of volume, and only altered the main condenser (.0005 in diagram) about four degrees, so I now used a fixed condenser made from pieces of gramophone record, mica, and tinfoil, about .0003 mfd. An ordinary fixed grid leak is suitable.

The fixed condenser should not be mounted flat on the panel, but edgewise. Mine is mounted edgewise on the ebonite end plate of the variable condenser. Do not put it parallel with the plates of the v. condenser.

I have used a Penton low consumption (H.E. 6) valve, also a "Wecovalve" with this circuit, with equal and entirely satisfactory results.

To get best results on weak signals a vernier rheostat, and a very small vernier condenser on the A.T.C. are almost indispensable. I get Stoke about three degrees on the A.T.C., and Aberdeen about 90 degrees, all on the same coil. (A No. 5 "Oojah" basket, about 90 turns, a size smaller for reactance). Apparently the B.B.C. range can be covered with a smaller A.T.I. My aerial is low and badly screened, yet I get stations 100 miles away almost as loud as I received the local one at 22 miles with the parts (which are the same) wired as an ordinary single valve with reaction.

Yours faithfully,

P. PITCHFORD.

5, Regent Street, Nuneaton, Warwickshire.

IN PRAISE OF THE UNIDYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I was strongly advised not to touch the "Unidyne" on the ground that it was very experimental, that it might be all right close to a station, but that a three-valve "Unidyne" was only about equal to an ordinary two-valve set.

Fortunately this influenced me only so far as to induce me to build a "unit" set, so that, in the event of my advisers proving correct, I could easily convert to an orthodox circuit.

Having made and tried the tuner and detector valve units, need I say that I have no intention of making such a conversion. For the benefit of any who have received similar advice, and I think they are probably not a few, I am glad to add my testimony to those which have lately been published in your correspondence columns.

I have had the set in use now for three evenings, and find Bournemouth (26 miles) louder than desirable, London and Cardiff at comfortable strength, Glasgow and Belfast quite clear. Other B.B.C. stations not yet identified. On the Continent, Rome, Madrid, Hamburg, Bremen, and one or two others not identified, vary from clear to really good.

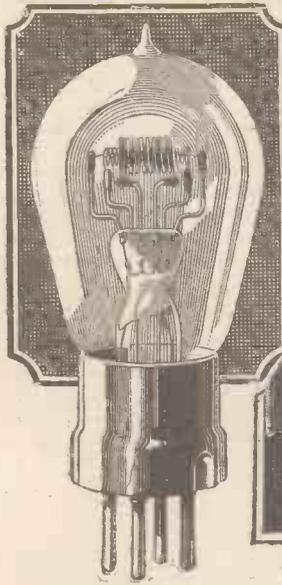
Your various hints and advice for Unidyne constructors rather gave me the impression that there might be difficulties in getting the set going, but I have had none, despite the fact that I am new to the game and that I departed considerably from your lay-out, adhering strictly to the circuit and values given only. All components were home made, with the exception of condenser plates and spacers, Lissen variable grid leak, and filament resistance, and of course the telephones and Thorpe valve.

I consider its simplicity and efficiency make the one-valve Unidyne an ideal home constructors' set.

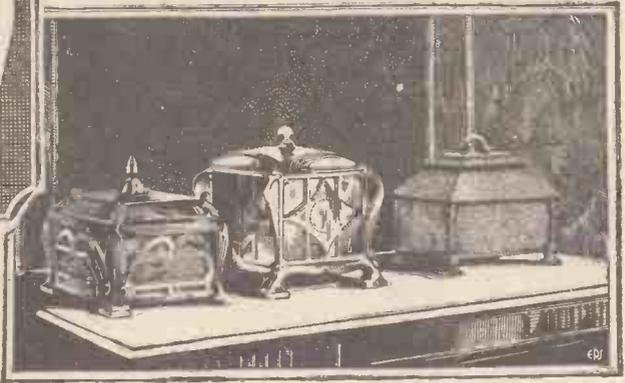
Yours faithfully,

A. W. K.

Weymouth.



Louden



The three caskets

10/-

It was not the Golden Casket that contained Portia's portrait, but the lead; and so it often happens that the most expensive article is not necessarily the one most to be desired.

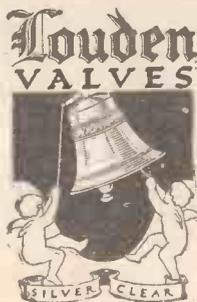
There are many valves more expensive than the Louden; yet there is not one of them that combines all its many advantages.

It uses considerably less current from the accumulators than is usual amongst valves of the bright filament type—a point which needs no labouring to those anxious to keep down costs. It gives a reproduction full in volume and silver clear in quality, and it has a stout filament which is not readily broken.

Further, it only costs 10/-

Four months ago people had not heard of Louden Valves; to-day they are demanding them at the rate of many thousands per week—which is, perhaps, the most striking testimony of all.

See that your next valve is a Louden.



The plain Louden for detecting and Low Frequency Amplifying.
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Articles should deal in detail with the construction of receivers and at least six clear photographs should accompany the MSS. A fee of 10s. 6d. is paid for each photo used. MSS. should not exceed 2,000 words in length and if not typed should be written on one side of the paper only. Diagrams may be submitted in pencil. Accuracy and lucidity are essential in any constructional article submitted.

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A Band in Your Home!

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Gigantic Volume of Perfect Melody. No Distortion. No Blare. No Rattle.

The "P.P.V.4" is the "last word" in wireless. Receives all European Stations on loud speaker and at least one American programme at fair loud speaker strength. One, two, three or four valves can be used at will. Just a few very simple parts. No complicated wiring. Quite easy for any amateur to build.
No Crystal. No H.F. Nothing to Puzzle.
 The "P.P.V.4" is the Queen of all Circuits.

RADIO-PLAN No. 3. Two Shillings.
AMERICA ON ONE VALVE!

This Radio-Plan details the easy construction of "P.P.V.1" the simple super circuit, and the "T.C.I." the most simple and powerful regenerative circuit ever to have been designed.

With either you can tune in all European and one American programme nearly every night. Both are as powerful as most two valve circuits. Both require only a few parts costing a few shillings. One variable and a few fixed condensers, wired in a certain way. Result—miracles.

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TECHNICAL NOTES.

(Continued from page 1084.)

if we think in terms not of wave-length, but of the reciprocal quantity—frequency. Since the velocity of wireless waves is practically constant and independent of the wave-length, it follows that the frequency and the wave-length are inversely proportional to one another. The velocity being about 3 times 10^8 metres per second, the frequency for a wave-length of 300 metres is 10^6 (that is, one million) vibrations per second.

Kilocycles.

As the frequencies dealt with are very high, it is usual to speak of them in kilocycles, a kilocycle being simply 1,000 cycles per second. Thus a wave-length of 300 metres corresponds to 1,000 kilocycles.

Now it has been found that two stations can be separated out in reception if they differ by about 20 to 30 kilocycles in frequency. Suppose we were using a wave of 4 metres; this would correspond to 75,000 kilocycles. A wave of 5 metres would correspond to 60,000 kilocycles. Thus the difference in frequency between a wave of 4 metres and one of 5 metres is some 15,000 kilocycles. If 15,000 is divided by 30 it gives us 500 as the number of stations which could be operated, without interference, between 4 and 5 metres wave-length.

Technical Difficulties.

In fact, it is claimed by some wireless engineers that there is room for all the stations in the world between comparatively narrow limits in the lower band of wave-lengths. There are, of course, many technical difficulties in the way of receiving such very small wave-lengths as those considered above, but there is no reason to doubt that this particular problem will eventually be solved, as so many others have been.

Making Crystals.

My request for readers' experiences in the making of artificial wireless crystals has brought me a large number of letters, which make very interesting reading. I was surprised to find what a large number of experimenters have tried the making of their own crystals, and quite a large proportion report very good success, although a number say they have had certain difficulties. The principal difficulty, as I think I predicted, seems to lie in the reaching of a sufficiently high temperature. Unless this is attained, the mass does not fuse properly, and therefore cannot crystallise out in the desired way.

A Chemical Method.

One method which—although in a sense it is a chemical method—is quite easy to carry out, is sent by a Mr. Westfield for the benefit of any readers who may care to try it. He says: "To a saturated solution of lead nitrate a little silver nitrate is added, and sulphuretted hydrogen (H_2S) is passed through the mixed solution until precipitation of the lead sulphide is complete. The precipitate, which is in the form of minute particles, is then drained and dried; it is next heated, at first gently and afterwards more strongly. Finally, it is heated as strongly as possible in a crucible (preferably by placing with clay lid in a fire) for about

three hours. The whole is allowed to cool, and the mass is then broken apart; and the crystals are ready for use."

Specimen Crystals.

My correspondent also encloses for my inspection two samples of crystals which he has made by this method. These appear to be very good, but I have not yet had time to try them. A further mention of them will be made later on. In the meantime, I am sure readers will be much obliged to Mr. Westfield for his letter.

Another Method.

Another writer, signing himself "Experimenter," says he has obtained crystals which were extremely sensitive in certain parts, although not uniformly so all over. He says: "Take an old iron pan or lead ladle of little value (as it may have a hole burnt in it by the operations) and partly fill with a mixture, say equal parts, of powdered sulphur and finely-divided lead (lead raspings or lead tea-chest lining). Heat this in a good fire until all the sulphur is combined or burnt off; a blackish powder will be the result. Now take some of this powder and mix a little extra sulphur with it, place it in a common crucible, seal with a clay lid and, when the clay is dried, put the crucible in a hot fire and keep at a white heat for 3 hours. Then remove from the fire and allow to cool slowly, the mass being afterwards broken up as required."

Precautions Necessary.

Before leaving this subject, there is one very important precaution which I should urge upon all those who may care to try these methods of making galena crystals, and that is to take great care to carry out the heating of the sulphur mixture in such a way that the sulphur dioxide fumes do not get into the air of the room. These fumes are extremely irritating to the lungs. The heating should, therefore, be conducted in a fire where there is a good up-draught, and the vessel or crucible should not be removed from the fire, under any circumstances, whilst there is any sulphur still burning. I have often noticed references to "heating sulphur and lead together, etc.," but have never seen this important precaution put forward. I may remark, for the comfort of anyone who may possibly (in spite of the above advice) get any undue inhalation of the fumes, that the effect (if inhalation has not been too prolonged) soon passes off, although at the time it gives one the sensation of having been very badly "gassed."

Amplifier Distortion.

When discussing stages of L.F. amplification it is perhaps not sufficiently recognised generally that after two stages the ordinary valve is hardly suitable, as its capacity is insufficient for the third stage. For stages beyond two, it becomes practically necessary to employ some form of power valve. Such a valve can be used with a low-ratio transformer, and is capable of handling a large amount of energy when used with a comparatively high voltage on the plate.

Grid Bias.

An important point to bear in mind when using these valves with extra H.T. is that a grid battery is necessary in order to prevent the grid from becoming charged and

(Continued on page 1115.)

HOW TO OPERATE YOUR NEW SET.

(Continued from page 1077.)

Reflex receivers which employ a crystal detector as well as valves should be handled in exactly the same way as an ordinary valve set, except that, of course, the additional adjustment of the crystal detector calls for attention.

Wave-length Adjustments

Now some sets employ what is known as fixed coil tuning, while others are provided with sockets into which removable coils are plugged. The coils more than anything else determine the wave-length range of a wireless set. A receiver employing plug-in coils can be adapted to receive almost any wave-length, from that of a relay station to that of 5 X X, the high power station; but it should be remembered that this wave-length tuning bears no relation to the size or geographical position of the transmitting station.

Wave-length tuning is merely a method whereby listeners are enabled to pick out the particular station they require. Of course with a set of limited sensitivity the choice of stations is distinctly limited, sometimes to only one, but, on the other hand, some receivers utilising several valves are sufficiently sensitive to allow their owners a choice of a number of stations.

Another point well worth noting is that loud speakers are not more sensitive than telephone receivers. Even if loud signals are being received with that new set it does not follow that they are sufficiently loud to operate a loud speaker successfully. This instrument requires considerable energy, and unless the music or speech can be heard all over the room with the telephone receivers lying on the table it is little use attempting to bring one into action.

An Important Point.

There is a great deal more that the new listener *should* know, but I am afraid he will have to learn most of it by experience, because it is impossible to give complete instruction in respect of all types of receivers without actually demonstrating them. But there are general rules to be observed, such as have been detailed in this article, and for the most part they apply equally to all types and makes of sets.

Finally, it must be understood that all the adjustments require slow, deliberate, delicate handling, and that there is nothing in broadcast radio that flourishes under a heavy hand. Above all others this is almost the golden rule; though of course one must be careful in connecting up those battery leads—valves are expensive items to replace.

TECHNICAL NOTES.

(Continued from page 1114.)

the valve from becoming "paralysed." Usually, indeed, it is very advantageous to provide grid bias for the second stage. The use of a negative grid potential in amplifier circuits is an important factor in obtaining the greatest amplification without distortion, and at the minimum value of the plate current. In fact, it is often most surprising what a reduction in the value of the plate voltage can be obtained by the careful

(Continued on page 1116.)



A new de-luxe Accumulator

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TECHNICAL NOTES.
(Continued from page 1115.)

manipulation of the grid bias, without any loss of volume, and often with improvement in the quality of the reproduction.

Amount of Bias.

The amount of bias depends upon the type of valve and the other conditions, and varies from zero up to 5 or even in some cases up to 9 volts negative. For this purpose flashlamp cells are mostly used, and where the adjustment is critical, or where very low bias voltages are required, a potentiometer may with advantage be used.

Earth Resistance.

I noticed some discussion in one of the wireless journals the other day on the question of the efficiency of the earth lead, in which a method of using a multiple earth was considered. The efficiency of the receiving set can no doubt be materially increased by a good earth, but the suggestion to use several earths, and to tune them separately, seems to me somewhat unnecessary. The following recommendations are quoted from the article referred to. "If two earths are used, the set should be tuned to a definite wave-length, using the earth which gives the highest dial reading on the aerial tuning inductance. Tuning the Earth.

An ordinary single slide coil should then be connected in series with the other earth wire, and the earth terminal of the set and, without changing the dial settings of the receiver, the slider coil should be adjusted for maximum loudness; that is to say, the receiver settings should then be the same when using either earth. When once tuned in this manner, the earths may be permanently connected with the set, and no further adjustment in this respect is necessary. Similarly, if two aerials are employed, the same principle of separate tuning should be followed."

As regards the separate earths, however, I must say that it seems simpler to use a short and low resistance earth lead.

Low-Loss Components.

The regenerative receiver has much to gain from the use of the so-called "low-loss" components which are now gaining favour. By means of low-loss condensers and coils, efficiency is usually increased, not only as regards sensitiveness and output, but also as regards selectivity. It is to be remembered in this connection that high resistance in a wireless circuit results in broader tuning of the set.

Dead Spots.

Screening and the occurrence of "dead spots" on land arc well-known phenomena but, although it is not so well known, such spots also occur at sea. In an interesting paper on this subject recently, by Mr. A. Dinsdale, it was pointed out that no satisfactory explanation for these spots was as yet forthcoming. One theory seeks to account for them as being due to large mineral deposits in the ocean floor, and it is known that the dead regions can often be overcome by using greater wave-lengths. There are several such spots in the different oceans, and at times they are of considerable inconvenience to ships.

Secret Broadcast.

The description "secret broadcast" seems rather a contradiction in terms, but what is meant is a system of broadcast which can only be received by listeners

equipped with a certain kind of apparatus. An ingenious experimenter in Ealing, London, has evolved a method by which to foil the "pirate" (if that ogre still exists to any serious extent), and he claims that by the use of his system only those who have well and truly paid the licence will be able to receive the programmes.

Defective Condensers.

Variable air-condensers frequently get out of adjustment and give rise to a good deal of trouble; in particular, the plates are apt to touch one another, so producing some sort of electrical leakage, if not an actual short-circuit. If there is real contact between plates, this will usually be so obvious, either by the scraping when the condenser is turned, or by variations or disappearance of the reproduction in the 'phones, that there will be no difficulty in diagnosing the trouble. But one test which may be applied easily is this. Disconnect the condenser entirely from the set, then connect an ordinary flashlamp in series with a 2-volt cell and with the condenser. Turn the condenser knob completely round and watch if there is any lighting of the lamp. A short-circuit will soon be discovered in this way.

A Simple Test.

But more usually the trouble is not so serious, and in most cases it amounts to a leak rather than to a short-circuit. Perhaps hairs or dust have accumulated on the plates and formed a high-resistance connection between them. To test for this, charge up the condenser by momentarily connecting its terminals to the full voltage of the H.T. battery (taking care not to touch the terminals of the condenser with the fingers); then leave it for, say, five seconds, and then touch the two 'phone tips against the condenser terminals. If the condenser has not lost its charge, a click will be heard in the 'phones. Try this experiment several times, leaving the condenser, say, 1 second, then 2 seconds, then 10 seconds, and so on. If there is a considerable difference between the effects obtained at 1 second and 10 seconds, it shows that the condenser is leaking. It should then be carefully cleaned out between the plates.

'07 VALVES FOR 12/6

TESTIMONY *Nom de plume, Deansbury.*
The '07 valve received for one returned is giving excellent results on a 1-valve set. Signals are very loud and clear, and it brings in almost all B.C.C. stations at good 'phone strength with inside frame aerial. Unsolicited testimonial:—"I have recommended your valve to all enquiring friends and enthusiasts, and shall continue to do so; it is a treat to work with."
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Phillips 4 Electrode Bright Emitter ... 12/6
(See Correspondence Columns P.W., Dec. 13th, p. 954)
Thorpe K4 Bright Emitter (5 pin) ... 17/6
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N.B.—We now insure valves against all postal damage at customers' request on extra remittance of 9d. per 12/6 valve, 1/- per 17/6 or 25/- valve, the only condition being notification of damage within 24 hours.

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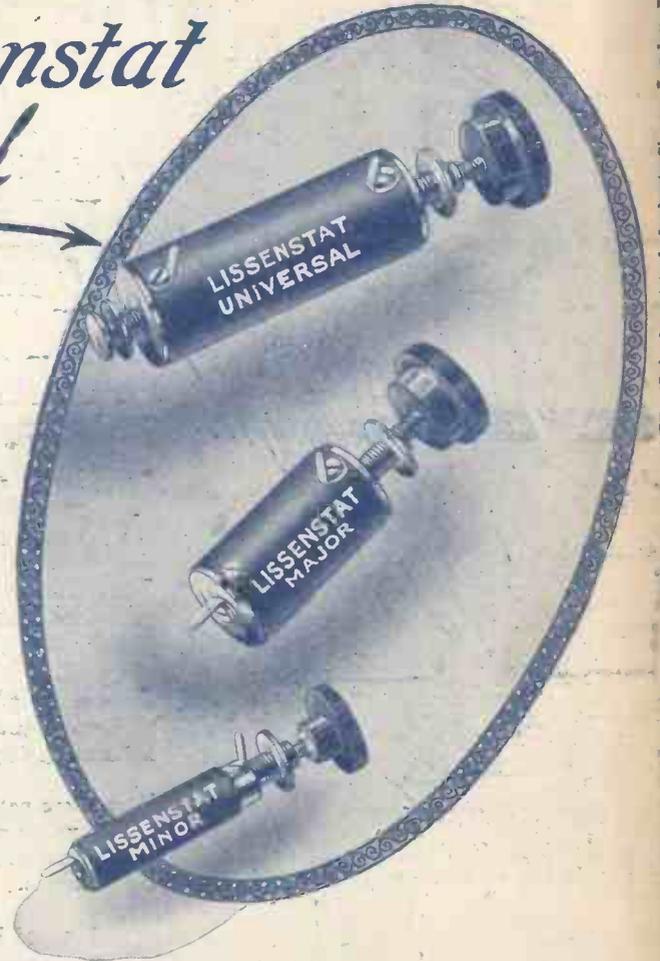
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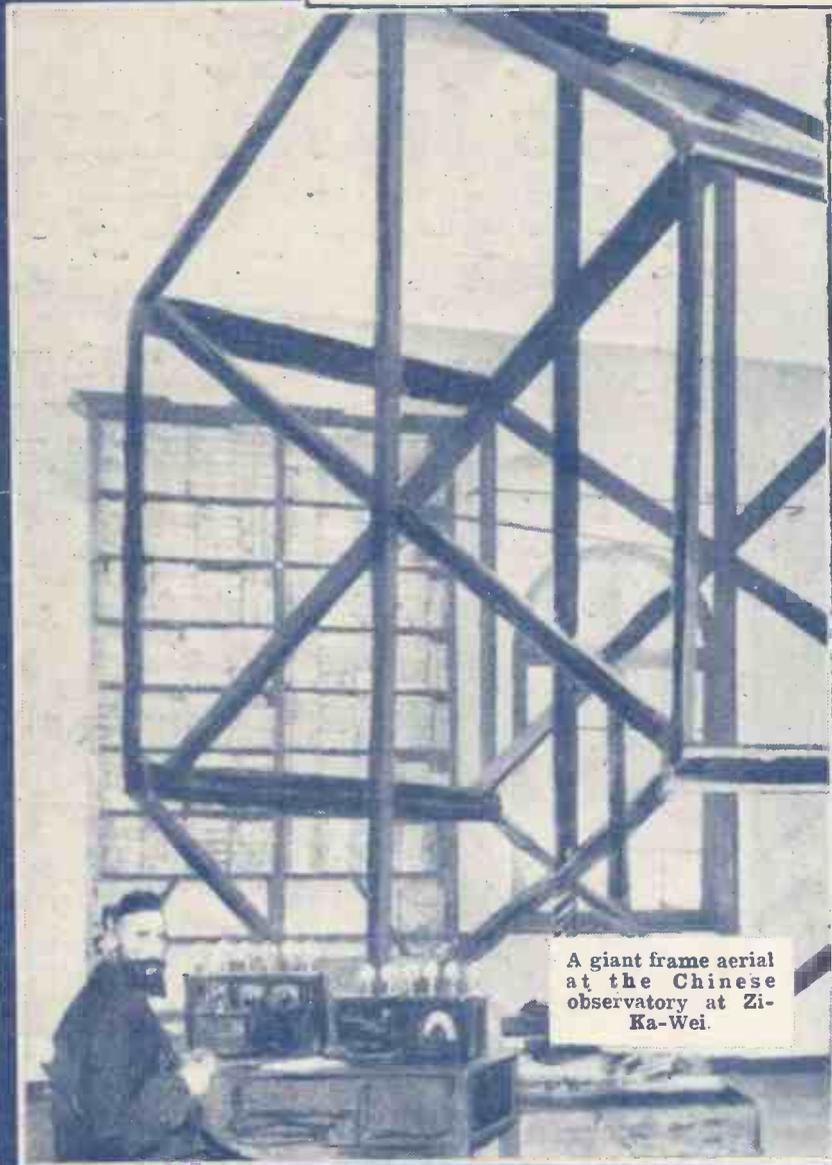
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FEATURES IN THIS ISSUE.

"How to Make" Articles:

A COMPACT CRYSTAL SET FOR LOCAL STATIONS AND 5 X X.

A VARIOMETER TUNED VALVE SET.

CONSTRUCTING A WAVE-METER.

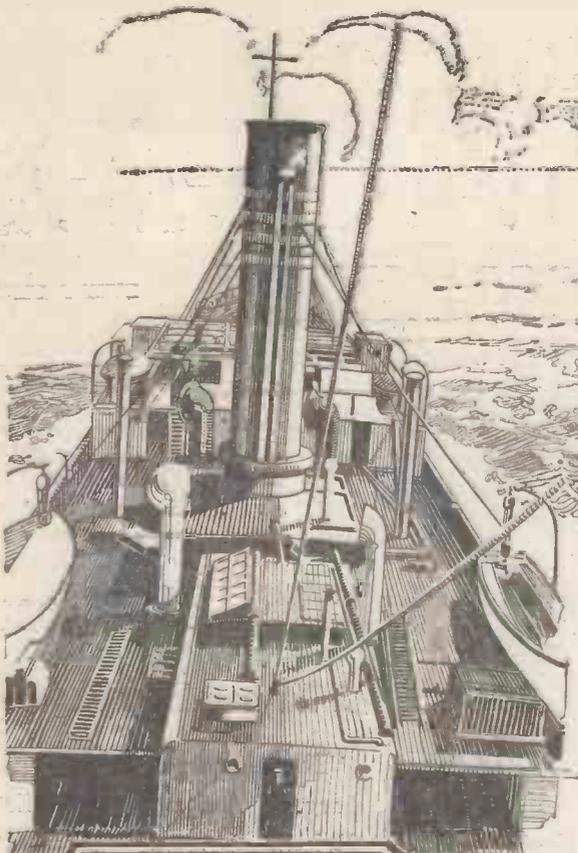
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 clear
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 Back or Stop her =”

*A rule of the road for
 preventing collision
 at sea*



THE “rule of the road” at sea calls upon the officer in charge of the ship in the foreground to “act as judgment says is proper” in avoiding collision with the approaching vessel.

To be able to form sound judgment and act on it promptly is one of the essential qualities of the sailor; and whether one is driving a car, playing billiards, or catching the morning train good judgment is equally necessary.

* * * *

Consider the components you fit to your wireless set.

Upon them depends not only the success of the whole set but also your reputation as a wireless expert.

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The contents of this book include details of how to make various receivers employing one or two valves, including a One-Valve Set on the famous "Unidyne" principle, which eliminates the need of H.T. Batteries. A reliable Two-Valve Loud-speaker Set, a One-Valve Reflex Receiver, and a Two-Valve Reflex Set. This latter set is a most efficient receiver, which will present no difficulty to the careful constructor. Stage by stage instructions and diagrams together with a

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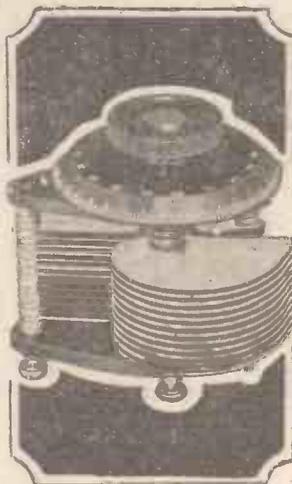
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POPULAR WIRELESS

AND WIRELESS REVIEW.

January 10th, 1925.] THE RADIO WEEKLY WITH THE LARGEST CIRCULATION: [Every Thursday, Price 3d.

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Editor :
NORMAN EDWARDS, M.Inst.R.E., F.R.G.S.

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

RADIO NOTES AND NEWS OF THE WEEK.

Sir Oliver Lodge's Lectures.

ONE feature of the attractive New Year programme which the B.B.C. has arranged, will be of special interest to readers of "P.W." Sir Oliver Lodge's lectures on the Ether of Space would be interesting to any audience, but to a wireless audience they are fascinating; and to a limited degree they place "P.W." readers in direct touch with our Scientific Adviser, who is not merely the greatest British pioneer of wireless, but one of the foremost scientific figures of the age.

New Books Received.

THE following books have been received for review, and will be dealt with in the Editorial columns in an early issue: "Wireless," by P. J. Risdon, F.R.S.A. (with an introduction by Dr. J. A. Fleming), Ward, Lock & Co., 6s. net; the volumes of the new "Broadcast Library," edited by Mr. J. C. W. Reith, and published by Hodder and Stoughton at 3s. 6d. net per volume; "From My Window," by Philemon; "At Home With Nature," by Kay Robinson; and "All About Motoring," by Captain Twelvetees. The McGraw-Hill Publishing Co., Ltd., have sent a copy of "Practical Radio," by Mayer and Wostnel, price 8s. 9d. net, for review; and Sir Isaac Pitman & Sons, Ltd., have sent a copy of their 1925 Radio Year Book, price 1s. 6d. net.

The R.S.G.B.'s New President.

I AM glad to see that amongst his manifold duties and activities, Sir Oliver Lodge finds the claims of the wireless amateur irresistible. He has consented to accept the Presidency of the Radio Society of Great Britain this year, and in lending his prestige and practical support to the R.S.G.B.—which represents you and me—he has made himself the servant and creditor of us all.

Crystal "D X" Work.

LONG-DISTANCE crystal reception is coming in for a good deal of interest these days, and the 110 miles "record" recently claimed by a "Daily Mail" reader produced a big batch of competitors. One of the most interesting claims is that made by a "P.W." reader at Bramhall, Cheshire, who has received Berlin—on crystal only—at a distance of 630 miles.

Not With a Crystal.

ANOTHER remarkable "stunt" reception, claimed by an Addiscombe amateur, is the feat of tuning in five distant relay stations so as to hear five consecutive strokes of Big Ben! This was on an indoor aerial, with no earth connection, and at distances varying from 130

to 360 miles. Needless to say this was not on a crystal. As a matter of fact, a super-sonic heterodyne with three stages of H-F. was employed.

THE "MULTIDYNE."

Details concerning the publication of a series of articles on the "Multidyne" Experimental Set will be given in next week's issue. The "Multidyne" is the most convenient experimental set ever devised. Look out for the first article of the "Multidyne" series.

A "Beam" Offer.

I HEAR that the Indian company which proposed to erect the high-powered wireless station in India has withdrawn its tender, but is offering instead to erect

calm their fears, 5 N G is sending out one-second dots whilst the microphone is otherwise silent, and even the most fidgety cannot fail to be comforted by the "pips."

"Camel."

THE old custom of the Services in giving nicknames to wireless stations seems to be reviving. At one time such a well-known station as PCH was invariably referred to as "Punch"—for obvious reasons. But I must confess the reference to 5 X X as "Camel" puzzled me until I remembered that the tuning adjustment for that station is always characterised by a "double hump."

A New One.

HAVE you heard CNRA? This new station, belonging to the Canadian Railways, is situated at Moncton New Brunswick, and an Irish amateur has



Mr. Leslie Henson, the well-known comedian, listens in with his Geophone set.

a "beam" station for communicating with this country. The offer is being considered by the Government, and is likely to be accepted.

5 N G's Pips.

NOTTINGHAM has hit upon a capital idea to reassure its anxious audience between items and during intervals. This is the time when every crystal-merchant suspects his cat's-whisker of having shifted, and when only the strongest-minded valve-owners can resist twiddling knobs to see if the set is all right. So to

succeeded in tuning it in on a home-made set. By means of this station the Canadian National Railways hope to relay the B.B.C. programmes to the chain of ten broadcasting stations which will supply their expresses with entertainment.

A Correction.

MR. RIDLEY has asked me to point out that in the diagram of the transmitter at G 5 N N (on page 884 of "P.W.," No. 133) there is an error in the position of the

(Continued on next page.)

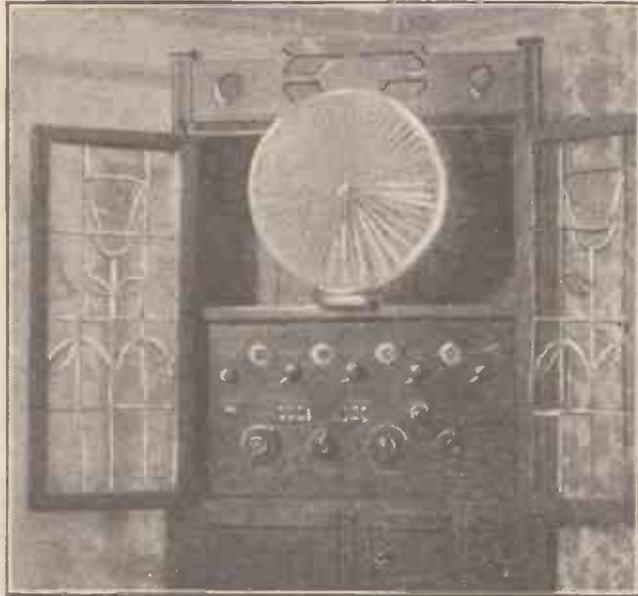
NOTES AND NEWS.

(Continued from page 1121.)

plate-stopping condenser. Instead of being immediately to the right of the plate lead the .002 fixed condenser should have been shown immediately to its left—i.e. in series between the plate and the .005 variable condenser.

Direct from Irak.

TALKING of G 5 N N, the latest feat of Mr. Ridley is a Morse conversation with an amateur in Mosul, Irak, which is over three thousand miles away. On this occasion one valve was used for re-



A photograph of a four-valve receiver, the construction of which was described in a recent issue of "P.W."

ceiving, and despite the fact that the signals made practically an all-overland journey, the transmissions—which were on a wave-length of 89 metres—were quite clear and steady.

C E G.

A CHILIAN amateur who is anxious to get in touch with British transmitters for Morse tests, asks me to give the following particulars to those interested. His station is C E G working on 380 metres, and although using only 50 watts at present, he is shortly altering his circuit to the same power as used by M. Braggio (Buenos Aires), who succeeded in getting in touch with New Zealand. Letters arranging tests should be addressed to M. Edmundo Guevara, Fundo Grecia, Casilla 69, Vilcun, Chile.

Range of Relay Stations.

ONE remarkable feature of International Radio Week, which seems to have escaped general notice, is the performance of the British relay stations. Working on about one-seventh of the power used at the main stations, two of them succeeded in crossing the Atlantic and were heard in America. Liverpool was logged in the U.S.A. on Thursday, November 27th, on a morning when only one of the main stations—Aberdeen—was received there.

Edinburgh's Fine Feat.

BUT although Liverpool and Aberdeen both have good long-distance records, they were equalled on this occasion by Edinburgh. Despite its bad reputation with local listeners, the small Scottish station succeeded where Glasgow failed, and thus two of the three stations were only relays.

Frame Aerial Success.

AN Inverness correspondent has succeeded in tuning in two transatlantic stations on a 2-valve set, using a frame aerial only. He says that whilst W B Z was dead weak, W G Y was really good. W O R, W S A I, and W F I were all logged with an extra L.F. valve, but he thinks his performance on two valves must be nearly a record.

New B.B.C. Premises.

THE past year has been one of steady growth, and in addition to building nearly a dozen new relay stations, the B.B.C. had to expand their accommodation in several places where they were already established. Glasgow, Cardiff, and Manchester moved into new premises, whilst London acquired additional rooms, and will shortly be overcrowded again with the inevitable expansion that is taking place. I hear that 5 I T and 6 B M are both expecting that extensions will be necessary.

That Echo.

WITH furniture out of doors, carpets up, and floors being cleaned, 2 L O appeared in the throes of spring-cleaning recently. Enquiries elicited the fact that this was in connection with the studio echo, the effect of which was to be tried when the heavy felt carpet was taken out, leaving the cork carpet only on the floor there.

An Important New Publication.

THOSE readers who subscribed to the Wireless Encyclopedia—and many who did not—will be interested in the forthcoming issue of Harmsworth's Business Encyclopedia. Just as the earlier work covered wireless in a comprehensive and interesting manner, so will the Business Encyclopedia deal with every aspect of Business and Trade, both wholesale and retail. Published in fortnightly parts, the work will contain a complete Commercial Gazetteer of the World, a Complete Guide to Commercial Knowledge, and many other valuable features, making it an indispensable work of reference. The first part will be on sale on Thursday next, price 1/3.

Tunis Tests.

SHORT-WAVE telephony is being tested by the French military authorities, and the Tunis station (North Africa) is conducting experiments in plain French and

also in music. Reports of reception and particulars will be very gladly received by M. le lieutenant Caillat, chef du service Radiotelegraphique, Tunis. The wave-length varies greatly, but transmissions are made on Tuesdays, Thursdays, and Fridays, at 8.45 p.m. G.M.T.

A Correction.

BY a very unfortunate oversight the cartoon which appeared on page 1072 of last week's "P.W." was entitled "Mr. Percy Pitt, Musical Director of the B.B.C.," instead of "Mr. Percy Scholes, Musical Critic of the B.B.C."

Fortunately, Mr. Scholes and Mr. Pitt are both well known to "P.W." readers, but, nevertheless, we regret that the mistake should have occurred.

SHORT WAVES.

Mr. Clement Jeffery holds that it is as great a crime to empty rubbish into the air as it is into the street. Do the B.B.C. know this? "Punch."

It is feared that the atmosphere of the drawing-room and the merclessness of the loud speaker will not be so charitable to certain singers as the warmth of the auditorium and the glow of the footlights. If that is so the Broadcasting Company are doing a real work of education for which they should be thanked, not criticised.—"The Electrician."

There is undoubtedly a difficulty in separating Glasgow and Belfast, and application has already been made for permission to increase the wave-length of Belfast. Pending an answer to this, however, 15 metres is a sufficient difference to enable a really selective set to cut out one station in favour of another.—The B.B.C.

I personally had the misfortune to be brought up as a perfectly poisonous high-brow—I mean I like Bach and things like that. I can't help it. When I mix (as I do—from choice) in low-brow circles I frequently sneer at Bach out of politeness, but there are very few people I would rather hear; except Leslie Heuson.—D. B. Wyndham-Lewis, writing in the "Radio Times."

Wireless is a great invention. When you've heard a dog barking in Nova Zembla, a mayor sneezing in Wisconsin, a seal barking in Atahua, a cow snoring in Bubamaku, and a shepherd stropping his jack-knife in Bali, you will realise what I mean. In no other age would this have been possible. No, in no other age.—"Daily Express."

For increasing the sum of human happiness through the enlargement of human interests there has been no agency in our time that remotely approaches that of the wireless broadcasting station.—Rev. R. J. Campbell, D.D.

THIS WEEK'S QUERY.

Why can't I cut out 2 L O and get other stations even during his silent period?

The Latest Craze.

THE idea of tuning in to different stations as the hour strikes, so as to hear successive notes of Big Ben wirelessed from all over the country, has caught on in all parts of the British Isles. But dwellers in South London who live close enough to Westminster to actually hear the clock itself have discovered another stunt which is even more "striking." By means of a switch and an open window it is possible to hear the same note twice—once by wireless waves, and a moment later by the more leisurely sound waves coming through the open window. The fast ether impulses are able to travel through space and along wires and to set up sounds in the loud speaker or 'phones well in advance of the air waves which travel direct.

ARIEL.

HOW TO CONSTRUCT A VARIOMETER TUNED VALVE SET.

By G. N. PETERS.

Maximum efficiency at minimum cost is the keynote of this short constructional article, which explains how to make a useful one-valve receiver.

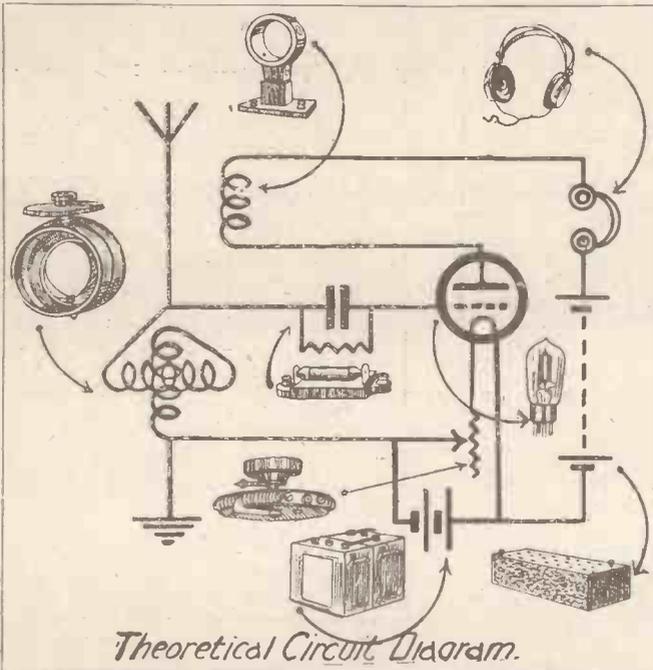
THE single valve set described in this article was constructed with an idea of keeping the cost at a minimum, one of the main features of which

Constructional Details.

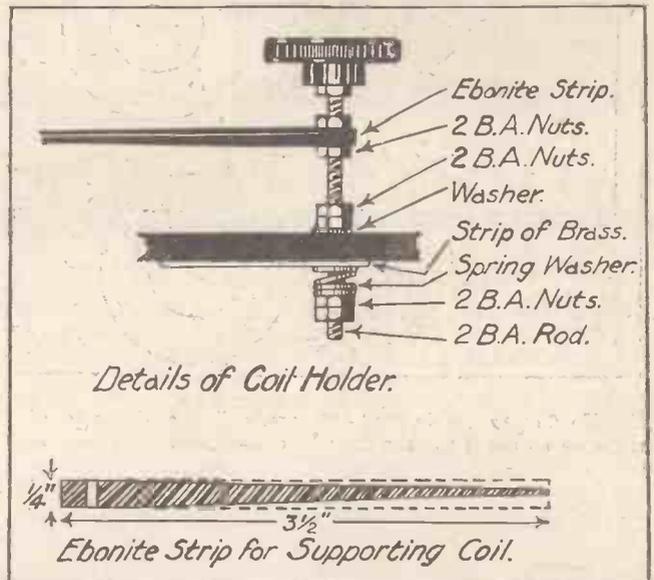
First of all mount the two pieces of 2 B.A. rod, each about 3 in. long, on to the ebonite panel at the top and bottom right-hand end of the set, each in the following manner. Drill a $\frac{3}{8}$ -in. hole to take the rod so that

in exactly the same way on the opposite side of the panel.

Next take the two ebonite strips, each $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. by $\frac{1}{4}$ in., which are to support the two moving coils. At one end of each strip drill a $\frac{3}{8}$ -in. hole so that when required they may be slipped on to the 2 B.A. rod. Then mount on each strip the two coils—



The variometer and coil actually used are shown in the photograph below.



Two moving and one fixed coil are employed with holders as illustrated above.

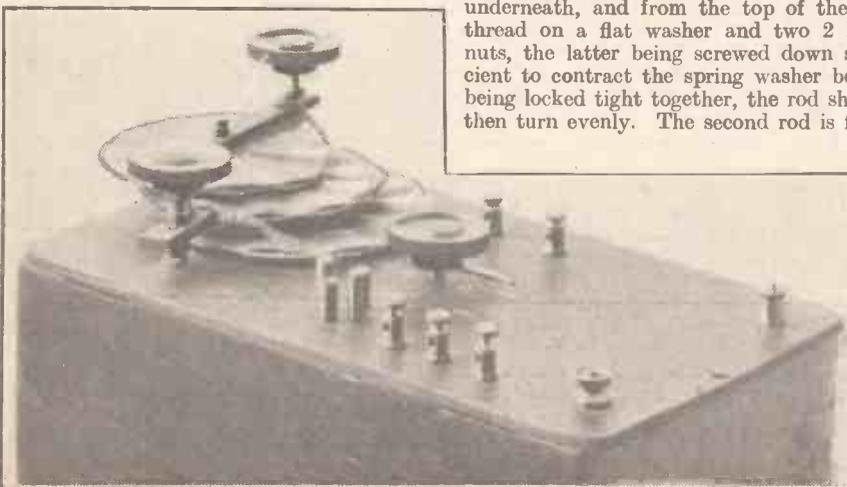
was to dispense with that somewhat expensive instrument—the variable condenser.

The general appearance of this set will be obtained from the photographs, the diagram of panel lay-out, and the theoretical circuit.

it revolves freely, then place in the following order at one end of the rod, a strip of brass an inch long and half an inch wide, having a hole large enough to admit the rod, a spring washer, a flat washer and, finally, two 2 B.A. nuts clamped tight together. These should be at the extreme end of the rod. Now push the rod through the hole from underneath, and from the top of the rod thread on a flat washer and two 2 B.A. nuts, the latter being screwed down sufficient to contract the spring washer before being locked tight together, the rod should then turn evenly. The second rod is fixed

i.e. Nos. 5 and 6, as follows. Take one of the strips and, with the aid of a saw and file, taper it off to a point so that it can be inserted into an air space of the No. 5 coil, passing through the centre so as to support it firmly. The No. 6 coil is then bolted between a cardboard disc and the other ebonite strip by means of a small nut and bolt.

Now fix the largest of the three coils—i.e. No. 7, on to the panel by means of a



A view of the panel showing arrangement of coils.

COMPONENTS REQUIRED.

- Ebonite panel, 10 in. by 6 in. by $\frac{1}{4}$ in.
- 2 Ebonite strips, $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. by $\frac{1}{4}$ in.
- 2 Pieces of 2 B.A. rod, 3 in. long.
- 2 Strips of Brass, 1 in. by $\frac{1}{2}$ in.
- 14 2 B.A. nuts.
- 4 2 B.A. washers.
- 2 Spring washers.
- 2 Ebonite knobs.
- 6 Telephone terminals.
- 2 P.O. terminals.
- 4 Valve sockets.
- 1 Rheostat.
- 1 Grid leak (2 meg.)
- 1 Grid condenser, .0003.
- 1 Box, 10 in. by 6 in. by 4 in.
- 2 Small countersunk bolts and nuts.

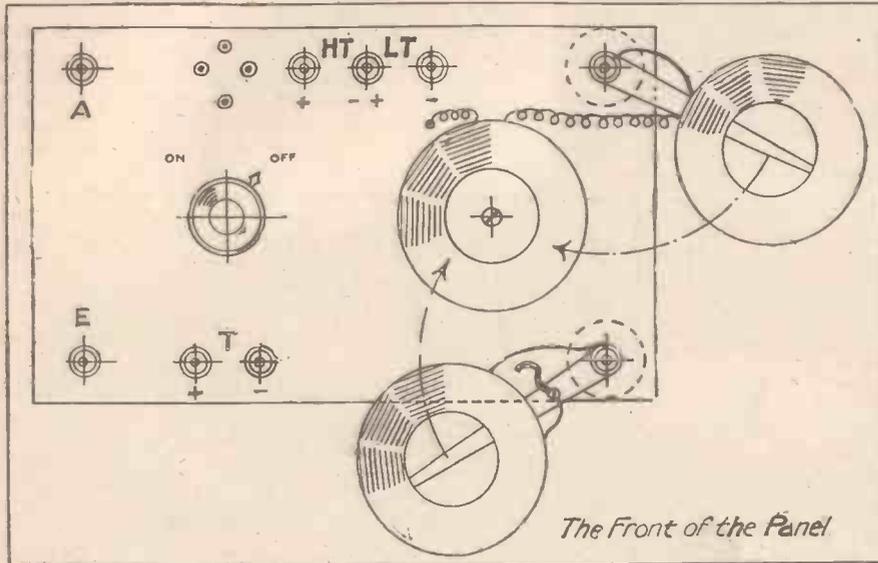
The coils used in the construction of this set were a set of seven TANDCO DUPLEX COILS, the three largest of the set being employed, and are referred to as Nos. 5, 6, and 7, No. 7 being the largest.

(Continued on page 1124.)

A VARIOMETER TUNED VALVE SET.

(Continued from page 1123.)

cardboard disc and a countersunk bolt and nut, and in such a position that when the two coils, No. 5 and 6, are mounted on their respective rods—that is the Coil No. 5 on the rod at the back of the panel and



Coil No. 6 on the rod in front—they may all three be adjusted so that they lie exactly over each other with the Coil No. 6 on the top and Coil No. 7 at the bottom, adjustment of the two moving coils being taken up by means of two 2 B.A. nuts threaded on to the rods above and below the supporting strips.

Wiring Connections.

Now assemble on the panel the valve sockets, rheostat, H.T., L.T., telephone, aerial and earth terminals; then underneath secure the grid condenser with the grid leak bridged across it, after which the wiring may be commenced.

Take one lead of the fixed Coil No. 7, and one lead of the moving Coil No. 5 and, having twisted each into a spiral, solder their ends together so that these two coils now act as a variometer; pass the remaining lead of the fixed coil down through a small hole in the panel and across to the aerial terminal, then take the remaining lead of the moving coil (No. 5) and clamp it tight between the nuts which secure the ebonite strip supporting this coil, so that the 2 B.A. rod acts as a conductor to the brass strip underneath to which is attached a lead to the negative L.T. terminal, rheostat, and earth.

The third coil, No. 6, is the reaction, one lead of which is passed down through a small hole in the panel and along to the anode valve socket; the other lead is clamped between the nuts securing the ebonite strip supporting the coil so as to make contact with the brass strip underneath, to which is soldered a wire connecting up one of the telephone terminals. (If, when testing, there is no reaction

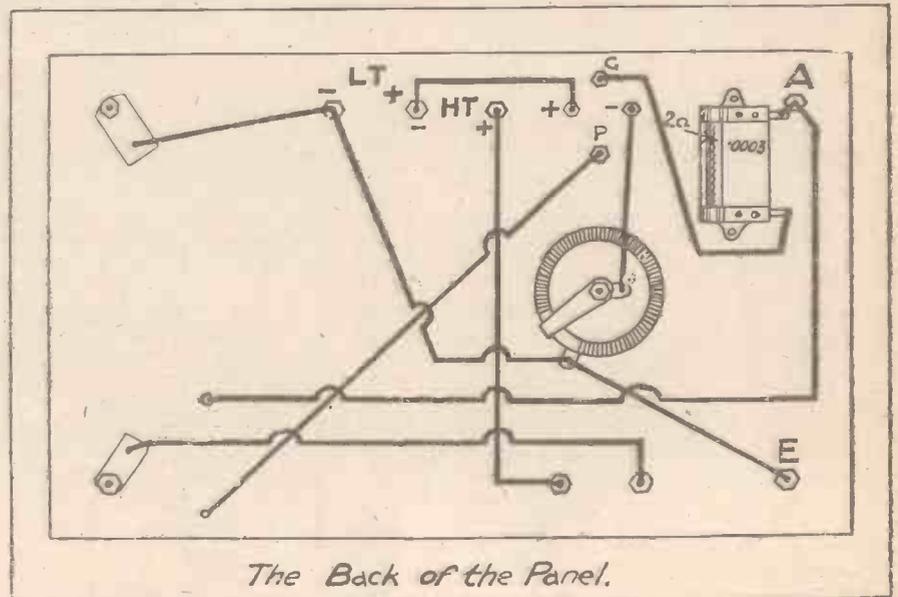
effect, these two leads from this coil will need to be reversed.) The remainder of the wiring may be followed from the diagram, and is as follows: From aerial to grid condenser, grid condenser to grid valve socket, positive L.T. terminal to one of the filament sockets, the other filament socket to rheostat, and lastly positive H.T. to the remaining 'phone terminal.

Results Obtained.

On test with 100 ft. aerial, Chelmsford and Radiola came in at full strength over

a distance of about 50 miles and 175 miles respectively.

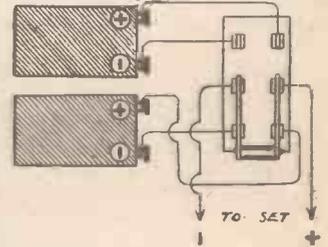
A more elaborate and wider range set may be made if the ebonite strips are



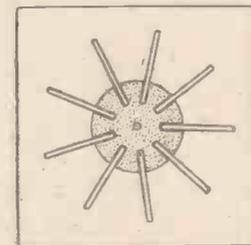
substituted for two ebonite coil holders having a hole drilled through their centres between the plug and socket so as to allow plug-in coils of various sizes to be used, the fixed coil being secured in a coil holder which should be set at one side flat on the panel. However, this, of course, would make the set more expensive to construct.

ODD HINTS.

WHERE a dull emitter valve is run off a single dry cell it will be found most convenient to have another cell as a "stand-by," and connect up the two, via a simple change-over switch, as shown in the sketch. Thus the valve may be quickly changed over from one cell to the other should one fail during the reception of an interesting broadcast programme. If the arms of the switch are left in the "up," or midway position, the valve is entirely cut off from either of the cells.



When purchasing a set of celluloid or fibre card inductance formers, one usually finds that the very small sizes are of little use for general purposes, and the result is that they are put



aside and forgotten; but with the aid of a little seccotine and a few wooden strips they can be made to serve as central hubs for "spider" formers of any desired size. The idea is clearly outlined

in the accompanying sketch.

A great mistake is to colour formers, etc., with black paint or enamel, since the ingredients contained in these act as a conductor rather than an insulator. The best thing to use is a shoemaker's black "heel-ball," which should be broken up, melted in a small tin, and applied with a brush in the usual way.

INTERESTING SINGLE-VALVE CIRCUITS.

“Hook-ups” for the Experimenter.

By G. V. DOWDING, Grad.I.E.E.
(Technical Editor, “Popular Wireless.”)

Here are further one-valve circuits, briefly described by Mr. Dowding, which the amateur will find worth trying out.

PROBABLY one of the most popular one-valve “hook-ups” ever evolved is that one which is due to Mr. E. T. Flewelling. In its simplified form, as Fig. 1 shows, it is but a slight

more seriously-used circuit is the Reinartz, which is very popular among experimenters for medium short-wave reception, although it is quite useful for the higher bands. As will be seen from Fig. 2, a rather curious

should be used, and taps taken in the manner indicated in the diagram.

The Reinartz circuit is not difficult to handle, and although it was originally designed as a C.W. receiver it has proved very useful for the reception of broadcast transmissions, but its capabilities in this direction are not abnormal. One peculiarity appear to be very troublesome.

When loading, it should be arranged that about twice the inductance should exist between points 2 and 3 as that between 1 and 2. Any type of coil can be used for this purpose, or even two coils connected together at point marked 2.

Cause of Controversy.

Fig. 3 is almost as well known and popular among readers of this journal as either Fig. 1 or 2. It was evolved by a Mr. H. G. Chitos, a reader of “P.W.,” and has been the cause of considerable controversy. It has been asserted that the circuit is merely a modification of the well-known Colpitt’s oscillator; but as readers have pointed out in the Correspondence columns, this fact does not reflect upon Mr. Chitos, who in his original letter published in “P.W.” asked for any criticism there was to offer, although little eventuated, at least in respect of the capabilities of his interesting “hook-up.”

It has proved to be an excellent circuit, both in point of selectivity and sensitivity, while it is said to be easy to handle and a real “D.X.” hook-up.

It will be noticed that a rather large A.T.I. is employed. Both this and the anode can be basket or honeycomb coils.

(Continued on page 1126.)

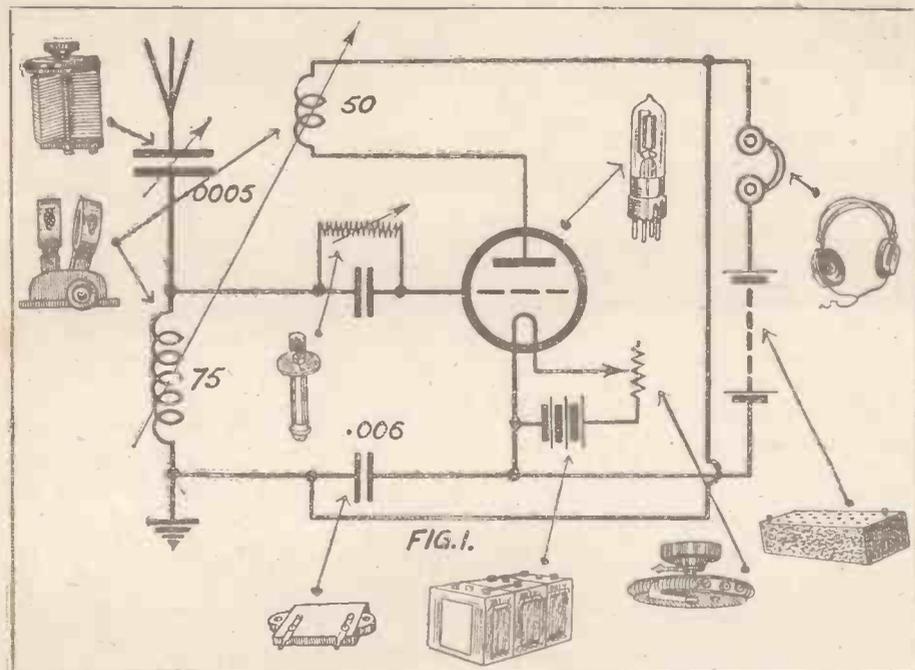


FIG. 1.

deviation from an ordinary detector circuit with reaction. Actually, if the .006 condenser be shorted and the lead from earth to reaction be removed, it does become a “straight” circuit, and for this reason is popular among amateurs, as this slight alteration allows them to get the circuit working well in its simple form before introducing the Flewelling element.

system of tuning is employed. The two coils marked A and B are wound on the same former, which should be about 3 in. in diameter and 2½ in. long; 26 gauge wire

Flewelling and Reinartz Circuits.

This circuit when carefully assembled and controlled is capable of excellent ranges of reception. Generally a very high-pitched whistle is present, and this is very hard to eliminate. Some have found it impossible to do so, while, curiously enough, others have not experienced it at all. However, in most cases this whistle is of such a high frequency that it becomes almost inaudible, and fails to seriously interrupt reception.

Opinions are sharply divided in respect of the Flewelling circuit, and it has never been accorded a really universal reception, partly because it is a circuit that is not only difficult to control, but is rather erratic in its performances, except in the hands of the really advanced amateur.

Another very well-known and perhaps

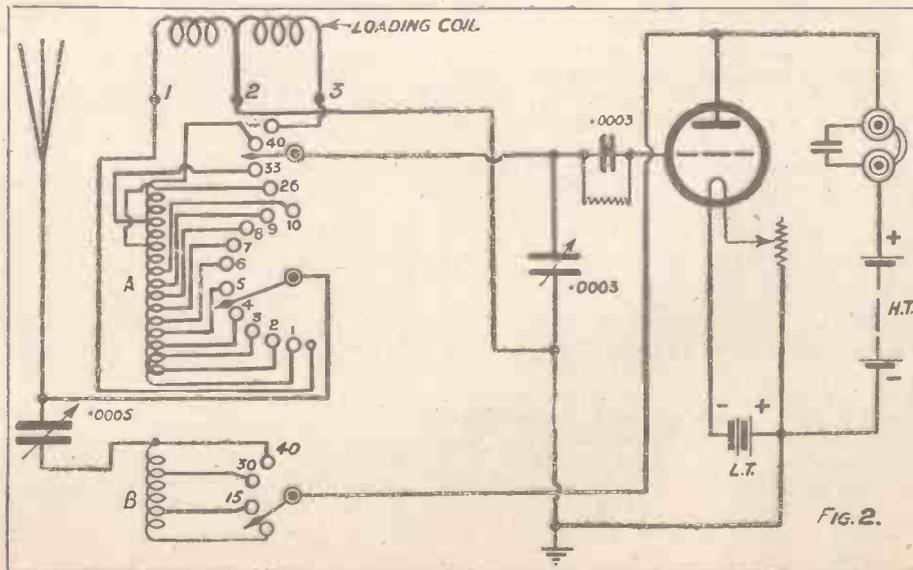
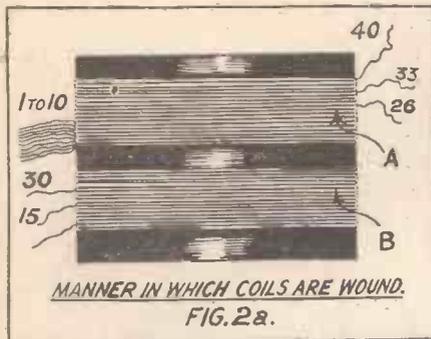


FIG. 2.

INTERESTING SINGLE-VALVE CIRCUITS.

(Continued from page 1125.)

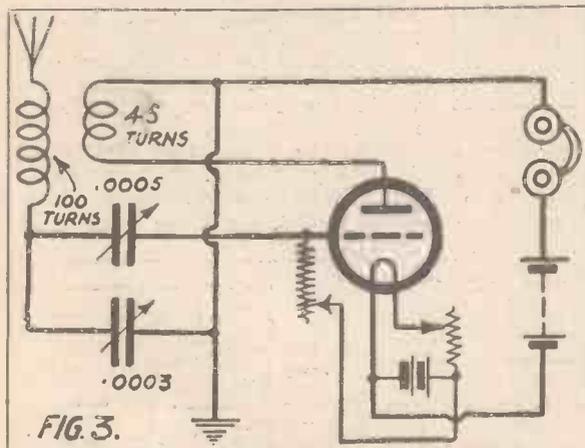
Rather extraordinary performances in respect of this circuit have been recorded by readers. Some have obtained better



results with no earth, others have obtained good results with no aerial, while a few claim to have received really distant stations without either aerial or earth. However, whatever peculiar "stunts" have been accomplished with the Chitos circuit, there appears to be but little doubt that it is well worth trying, and presents very little difficulty in construction or operation.

The Armstrong Circuit.

Probably the only one-valve circuit with which it is possible to operate a loud speaker, using a frame aerial at a respectable distance from a broadcasting station, is the Armstrong super regenerative. As a matter of fact, this circuit is so sensitive that it cannot be used with an ordinary



type of aerial. On the other hand, it is so critical to handle that it sometimes takes an expert a few minutes to tune it in. A skilful juggling with every control is necessary.

A Chance for Experimenters.

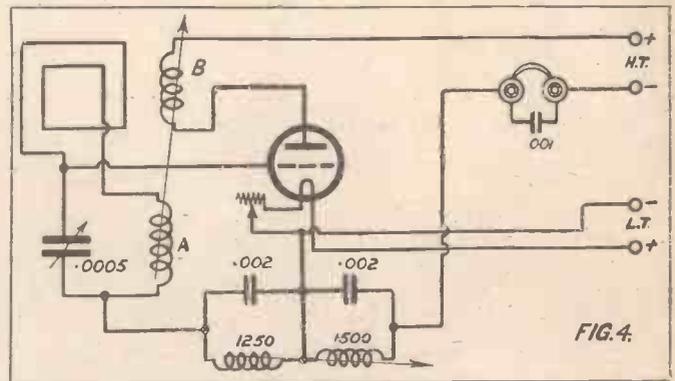
The circuit is shown in Fig. 4. A frame aerial with two foot sides and wound with 13 turns of 24 S.W.G. can be used. The two coils, A and B, should be of the plug-in type, a two-way coil holder being used; 75 and 50 turns respectively is somewhere around the required value. The two large

oscillator coils of the number of turns indicated should also be provided with a two-way coil holder.

It is sometimes necessary to vary the values of the two fixed condensers up to as much as .006, and as a matter of fact it is a real advantage to use variable condensers although it makes the circuit even more difficult to control. A "vernier" filament rheostat is advisable, while it should be remembered that a "hard" valve and about 120-150 volts H.T. is necessary,

It is in many ways a very excellent circuit, but one that can only give of its best in the hands of the absolute expert. One great drawback it possesses is that it invariably proves impossible to eliminate a very high-pitched whistle, and, in fact, this whistle at times becomes a real nuisance and seriously interferes with the reception of signals. The Armstrong super, too, whilst being an excellent volume producer is not of much use for D.X. work, even on a large frame aerial, as it is so sensitive by nature that it tends to collect enormous quantities

of undesired "mush." Nevertheless, it is a circuit that all experimenters should try out, as it provides a most interesting experience and tends to develop "tuning touch," and to train the hands to give that



little extra on the condenser necessary to compensate for hand capacity and body effects.

It is a fact that with experience an Armstrong super can be tuned in so closely that the entrance of another person into the room will suffice, with the upsetting of the carefully balanced circuit, to cause it to emit nothing but "howls," and when an Armstrong super regenerative howls it provides an education in itself of the "noise possibilities" of one valve when so used.

Technical Notes

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

Novel Crystal Detector.

TWO interesting novelties in the way of crystal detectors have come to my notice during the past few days. One is a crystal enclosed in a tiny glass capsule containing liquid—presumably spirit—and the other is an experimental device, very similar, sent to me by "Regular Reader."

Preventing Contamination.

The first device is, I believe, to be put on the market very soon, if, indeed, it is not already offered for sale. The little glass capsule is about half-an-inch high and about a quarter-

of-an-inch in diameter; it is dome-shaped and is secured at its lower end into a little ebonite base, about the size of a halfpenny, making it easily attachable to a panel or baseboard. Terminals are provided, and these connect with two blunt-end electrodes, which just project within the glass capsule, vertically upwards. A third wire is provided, and the crystal fragment, which is quite free in the liquid in the capsule, normally falls to rest upon these three vertical points. One of these, as I have said, is a blank, electrically, although it is necessary for

mechanical reasons, as the crystal obviously could not rest merely on two points.

Miniature Valve.

The whole arrangement looks for all the world like a tiny valve, and is very neat and attractive in appearance.

It will be clear that when the crystal rests upon the two electrodes, we have the ordinary conditions for crystal detection. Moreover, since the crystal and contacts are totally enclosed in the liquid, there is practically no possibility of contamination by dirt or grease.

An Interesting Point.

But what interested me most about this little device was not its neat appearance, nor yet its freedom from interference by dirt, etc. The point that struck me was rather a theoretical one, and one that has apparently an important bearing on the general theory of crystal detection.

Action of the Rectifier.

The action of the crystal rectifier is still very imperfectly understood, although many ingenious theories have been brought forward from time to time to account for it. At any rate, it is evident that one of the contacts, say the cats-whisker, assumes a positive potential, and the other a negative potential. Now, if there is only one point

(Continued on page 1171.)

BEAM WIRELESS.

A Radical Change in Radio Communication.

MR. MARCONI'S LECTURE.

The following is an abridged report of a lecture of interest to all amateurs given recently by Mr. Marconi before the Royal Society of Arts.

ON Thursday, December 11th, Senatore Guglielmo Marconi, G.C.V.O., LL.D., D.Sc., Chairman of the Council of the Royal Society of Arts, delivered the inaugural address for the present session, and chose for his subject a topic that is of great interest to readers of POPULAR WIRELESS, as well as the general public, following the recent developments in wireless research.

Senatore Marconi prefaced his remarks by explaining the difficulty he had in knowing just where to begin and where to finish an address dealing with so wide a subject, and decided to omit any specialised comments on the past achievements in Radiotelegraphy and Radiotelephony, and to deal with some of the difficulties with which the new art has to contend. "In my belief," said Senatore Marconi, "the whole theory and practice of long distance wireless communications is just now undergoing a most important and somewhat radical change, and this, to my mind, only goes to prove that it is dependent upon phenomena in regard to which our understanding, to say the least, has been to a very large degree incomplete."

Mr. Marconi's First Experiments.

The subject is certainly very fascinating for many reasons, but also perhaps because electric waves are so far the only force which can be controlled by man capable of being transmitted and detected over very great distances without the aid of any artificial conductor.

Neither the strongest conceivable light, nor the strongest fog-horn, hooter, syren or loud speaker imaginable, or the explosion of all the explosives in Woolwich Arsenal, could possibly be seen or heard in America or Australia, and the lecturer explained that the reason why wireless waves will travel so far was to be found in various theories.

A few years after Senatore Marconi's first experiments of Radio transmission across the Atlantic Ocean, the late Lord Rayleigh stated in a paper read before the Royal Society that the results obtained showed that the refraction or bending of the waves along the curvature of the earth was very much greater than what could have been expected by calculation.

The Heaviside Layer.

The hypothesis which is now most generally accepted is that the waves are reflected by what is called the Heaviside Layer, which is supposed to be a conducting layer of rarefied and ionised gases, constituting a kind of shell concentric to the surface of the earth and capable of reflecting electric waves. This would go to constitute electrically a kind of curved ceiling, resulting in the electric waves becoming enclosed between two concentric surfaces from which they cannot escape.

Had there been an opportunity for discussion one would have wished to have asked how in view of this theory there would be any possible hopes of communicating with Mars, as so many experimenters endeavoured to do when the planet approached the earth this year.

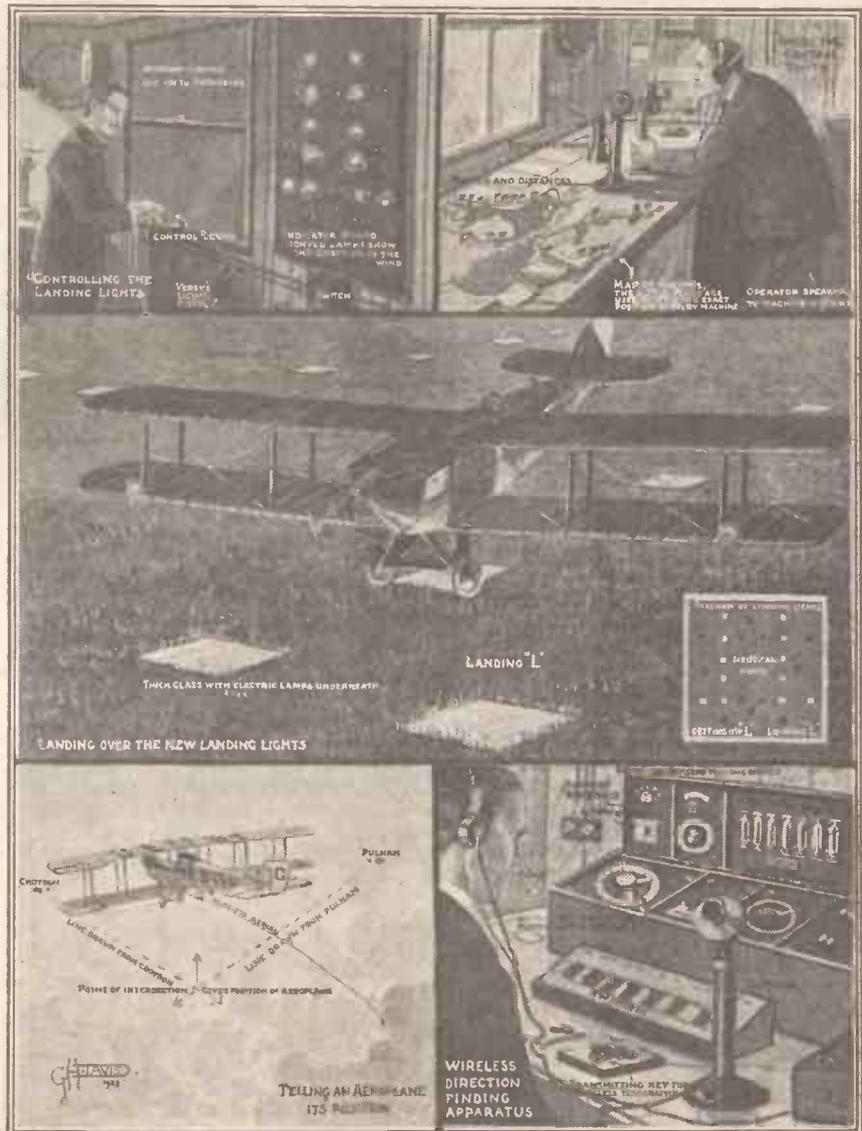
Dust From The Sun.

Another theory mentioned* was that propounded by Professor J. A. Fleming, who stated that the waves are reflected by a more or less sharply defined conducting

upper layer of the atmosphere containing highly ionised dust flung off by light pressure from the sun.

A further explanation was suggested by Dr. W. H. Eccles in 1912. He referred to mathematical calculations which showed that an ionised rarefied atmosphere is capable of increasing the speed of electric waves, so that if ionisation increases from the ground upwards, the top of the waves should travel faster than the foot, and in

(Continued on page 1128.)



Showing how wireless direction-finding apparatus is used to check the positions of aeroplanes during flight. Information respecting landing lights, etc., can also be conveyed by radio to the machines.

BEAM WIRELESS.

(Continued from page 1127.)

due course should actually lean forward, thereby following the curvature of the earth.

"Nevertheless," explained Senatore Marconi, "these theories and hypotheses, together with others not referred to, have never satisfactorily explained why waves of a certain length will cover great distances by daylight, whilst others will only cover similar ranges at night."

A Considerable Difference.

It was during the year 1902 that Senatore Marconi, when conducting tests between the wireless station at Poldhu in Cornwall and a ship in the North Atlantic, that the effects of daylight were noticed on the propagation of waves of about 2,000 metres in length over long distances. At that time during the night it was possible to receive signals up to a distance of 2,000 miles, but during the day reception was uncertain at a distance of 700 miles.

It was subsequently discovered that longer electric waves, of the order of 10,000 metres or more, would on the average work as well by day as by night between England, America and other places, and it was now universally accepted that short waves, whilst often giving extraordinarily long ranges by night, are incapable of being made to cover long distances during daylight.

As an example of this argument Senatore Marconi stated that for a period of about eight years from 1901, the Marconi Company had installed on a considerable number of ships a system of spark transmitters utilising waves of only 120 metres in length, which was referred to as the "Tune A" transmitter. This system, though only utilising a very small amount of energy, was capable of regularly communicating over a distance of 100 miles during daytime, but at night, often exceeded 1,000 miles, although a comparatively insensitive type of receiver was employed.

A Regrettable Fact.

After mentioning the advantages of beam transmission, Senatore Marconi recalled the first experiments with this system, which were carried out as far back as twenty-eight years ago, when it was demonstrated to the late Sir William Preece, then Engineer-in-Chief to the Post Office, that transmission and reception of intelligible signals was possible over a distance of $1\frac{3}{4}$ miles, by means of an elementary beam system employing very short waves and reflectors, whilst curiously enough, it was only possible to get good results over a distance of half a mile by means of the elevated wire or antenna system, utilising much longer waves.

Progress was subsequently made with the non-directional long-wave system, and the results were so rapid that it soon became, as it still remains, what might be called the standard system.

"I feel it is regrettable," continued the lecturer, "that the study of short waves was neglected for a period of years, for these waves, which so far are the only ones that can be confined to narrow beams, are also capable of being employed by the lower frequency system, which up to now

has held the field for long distance communication."

Most people may now agree that wireless waves are far too valuable to be always broadcast in all directions, especially when it is desired to communicate only with one particular place, and Senatore Marconi went on to say that he did not understand why messages intended for Canada or South Africa should be scattered all over the world, not to speak of practically all seas and oceans. He agreed as to the utility of non-directional stations for naval and marine purposes and for broadcasting, but for ordinary efficient communication between fixed places, or between one country and another, he thought the right and logical thing to do, if possible, both from the point of view of secrecy and economy, is to concentrate all the radiated energy into a beam directed towards the place or country with which it is desired to communicate.



A "P.W." Combination Set built by Mr. E. Cooper, of 19, Florence Road, Wimbledon, S.W. 19.

Describing the tests carried out on his yacht "Elettra" in the spring and summer of 1923, Senatore Marconi was able to discover that the short wave then being used could not only cover great distances by day, and much greater distances by night, but that it was also quite reliable, and that, moreover, large parts of continents and ranges of mountains did not materially reduce their working distances.

A series of tests was for the first time carried out with short waves over what might be termed world-wide distances during the winter, spring, and summer of this year, between Poldhu and receiving stations situated on ships at sea and also at such places as Montreal, New York, Rio de Janeiro, Buenos Ayres, and Sydney, New South Wales.

All these tests proved to be successful, including the first telephonic communication with Australia ever realised, although the amount of power utilised at the sending station never exceeded 20 kilowatts. Very strong signals were obtained at all these places during the hours when darkness extended over the whole distance separating each of them from Poldhu, and weaker signals for a few hours when the sun was above the horizon at either end, the intensity of the signals varying inversely in proportion to the mean altitude of the sun when above the horizon.

While this limitation of the period of working to practically hours of darkness constituted an undoubted disadvantage, still, economical advantages, together with the reliability of working this system at far greater speeds than would have been feasible

with the well-known high-powered long-wave installations, were conclusive in proving that the short-wave beam system would be capable of transmitting a far greater number of words per 24 hours between England and far-distant countries, such as Australia, than would be possible by the comparatively powerful, cumbersome, and expensive stations actually in use, or which were planned to be used, for Imperial commercial communications.

It was a matter of satisfaction to Senatore Marconi to be able to state that the stations intended for this purpose in England which are now being erected under contract with the Post Office, and others to be installed in the principal Dominions and far-distant countries, will all be on the beam system.

By means of a further series of tests it was discovered that the daylight range of practical communication over long distances increased very rapidly as the wave-length was reduced, the 32-metre wave being found particularly effective. Comparative tests on different wave-lengths were carried out for a period of over two months in a variety of places, and all observations went to confirm that for waves between 100 metres and 32 metres the daylight absorption decreased very rapidly with the shortening wave-length. During a complete day transmission at fixed intervals carried out last October with Sydney, New South Wales, that station received the Poldhu signals for 23½ hours out of the 24, and a 48-hour test concluded the day before this lecture fully confirmed the result.

The results obtained with the beam transmission have fully confirmed all expectations in regard to the behaviour of various wave-lengths over great distances, and the low cost of the system in both capital and running expenses, compared with that of the existing type; should bring about the possibility of a reduction in telegraph rates for all long-distance communication, besides making direct communication with some of the smaller outposts of the Empire commercially remunerative.

How Amateurs Help.

Already the size and power of some of the most modern long-wave stations is becoming a serious question from a financial point of view. The newly equipped station at Buenos Ayres, for example, which was primarily designed for communication with Europe over a distance of about 6,000 miles, employs 800 kilowatts, and has an aerial supported by 10 towers each 680 ft. high. This station usually works on wave-lengths of about 12,000 metres.

Another example is the British Post Office station being erected near Rugby, which, when completed, will employ 1,000 kilowatts and an aerial supported by 10 towers each 820 ft. high, and a station to be erected in the Union of South Africa is designed on a similarly gigantic scale.

Whilst, explained Senatore Marconi, we have, or believe we have, all the necessary data for the generation, radiation, and reception of electrical waves, as at present utilised for long-distance communication, we are still far from possessing anything approaching an exact knowledge of the conditions governing the propagation of these waves through space. If we had, we might possibly have known before this that a wave about 30 metres long, utilising only 9 kilowatts in an aerial, could travel successfully to South America and Australia during daylight, and there reproduce easily decipherable signals.

According to the latest experiences in operating the beam system, the use of reflectors diminishes fading, and also tends to overcome its effects by enormously increasing the strength and therefore the margin of readability of the received signals. Increasingly large and expensive reflectors could, of course, be used with longer wave-lengths, but the results of all recent tests seem to indicate that the shorter waves present the greatest advantages, one of the most important being that their reception is very much less liable to interference by the effects of atmospheric electrical disturbances.

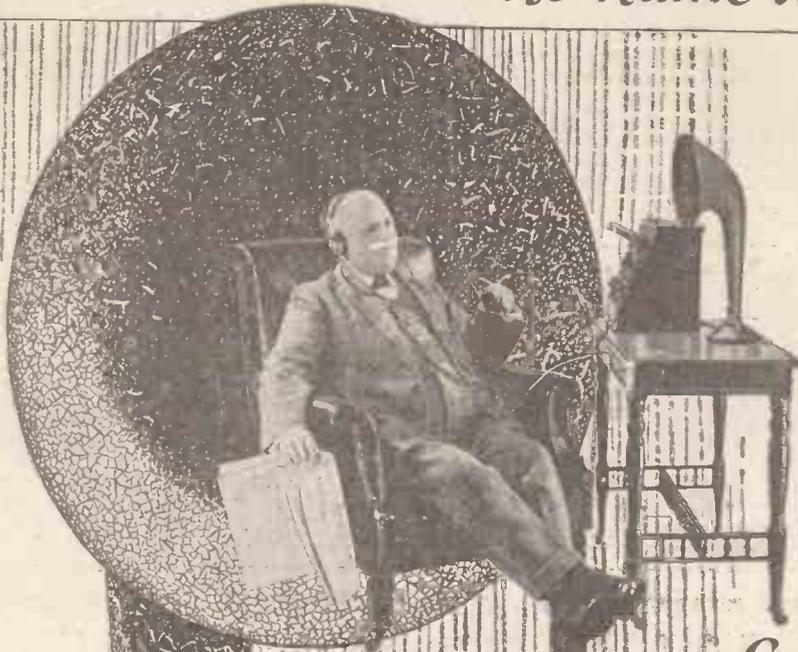
During the lecture some very encouraging remarks were offered concerning the work of amateurs. The results obtained by amateurs have often been of great value in helping experts to come to a somewhat better understanding of the phenomena involved, and the audience was reminded that amateurs have recently been able to carry out two-way communication with New Zealand for brief periods.

At the conclusion of the lecture a hearty vote of thanks was proposed by Mr. A. Campbell Swinton, F.R.S., who happened to be the gentleman who years ago introduced Senatore Marconi to the late Sir William Preece. The motion was seconded by Sir Archibald Denny.

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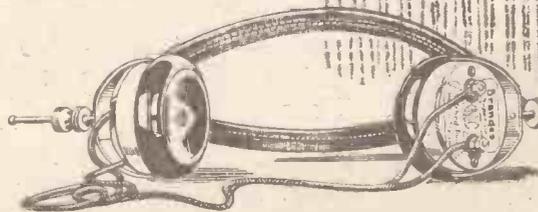
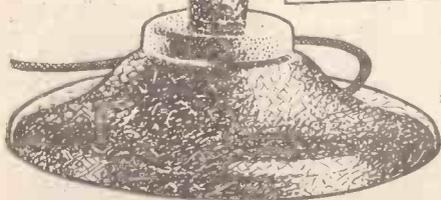
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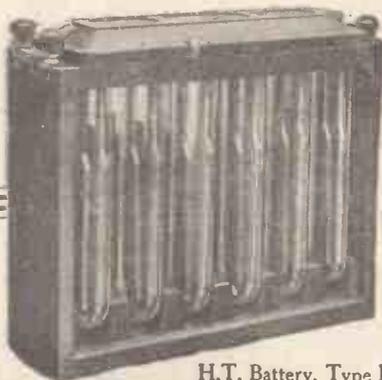
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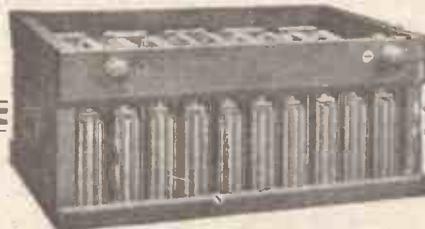
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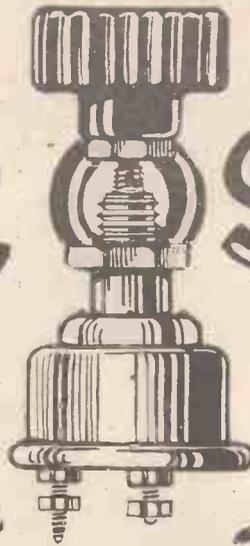
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A SUPER-SELECTIVE CIRCUIT.

By L. W. CORBETT.

Details of a new and very popular American super-selective circuit have been sent to "P.W." by a former member of the staff. This circuit will be dealt with in two articles, the first of which appears below.

THE circuit which I am about to describe is of American origin, and was designed by Paul McGinnis, Radio Editor of the "New York Evening Journal," in which paper full particulars appeared, and by J. F. J. Maher, assistant Editor of the same paper, and gold medals have been

awarded to them for the originality and excellence of design of the circuit. Sometimes in New York there are seven or eight high-power stations broadcasting simultaneously, and selectivity is the main requirement of a good receiver. The ordinary wave-trap, composed of an inductance with a condenser across it placed between the aerial and aerial terminal of one's set, is practically useless under the prevailing conditions in New York, and when such stations as W J Z, W J Y, W E A F, W N Y C, W O R, and W A H G are all on at once, all situated in an area of two or three square miles and all within a band of 250 or so metres, the average American amateur has become accustomed to putting up with such items as "How to Plant Potatoes" by Mr. X. (W E A F), accompanied by the Greenwich Village Inn Dance Orchestra (W J Z) playing a fox trot "It Had to be You," and suchlike. So, prompted by the desire to overcome this state of affairs, these two young inventors set out to design a circuit of super-selectivity and yet one that would be as easy to handle and give equal, or better, results than the conventional single valve receiver. And this they have accomplished after a great deal of experiment.

loud-speaker signals were received from California with this circuit and a two-stage amplifier added—a distance of 3,500 miles—with perfect clarity, and also from station P W X in Cuba, and so I suggest this as an ideal receiver for transatlantic work beyond the advantage of its super selectivity. It

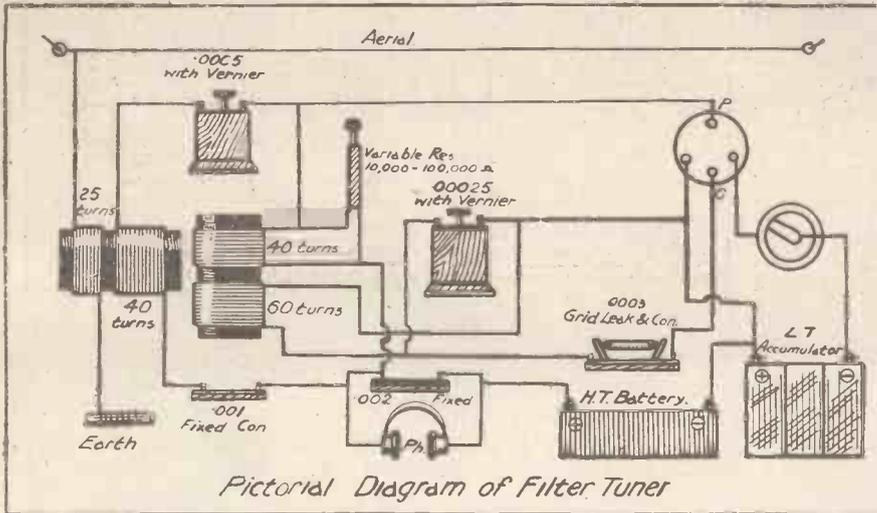
in length, while that for the second filter coil and secondary coil is six inches long. Double cotton covered (don't deviate from this, for it is important) No. 20 (twenty) gauge wire is used throughout for the coils. Both filter coils have forty turns each, while the primary coil has twenty-five turns and the secondary sixty turns. The two formers should be mounted at right angles to each other.

What the Resistance Does.

This is to prevent inductive transfer direct from the primary to the secondary, as this would of course greatly impair the selectivity. I am not going into the matter of the lay-out, and as long as the usual care is taken with the spacing of the wiring, etc., there should be no snags in this direction. The pictorial diagram will give a general idea of how the two cardboard or ebonite formers should be placed.

Connected in series with the terminals of the filter coils are a variable condenser with vernier attachment, and a fixed condenser. The variable has a capacity of .0005 mfd., and the fixed condenser .001 mfd. capacity.

When wiring up be sure to wire the inner end of the second filter coil to the 'phone terminal and see that the outer end connects to the plate leg of the valve. A variable resistance of ten thousand to one hundred thousand ohms is also connected across this second filter coil, as the diagram shows. The maximum figure for this resistance is not very critical, and one of a few thousand



has been designed essentially for broadcast reception, and only two variable condensers are included in the circuit, so it should not present undue difficulties in the tuning.

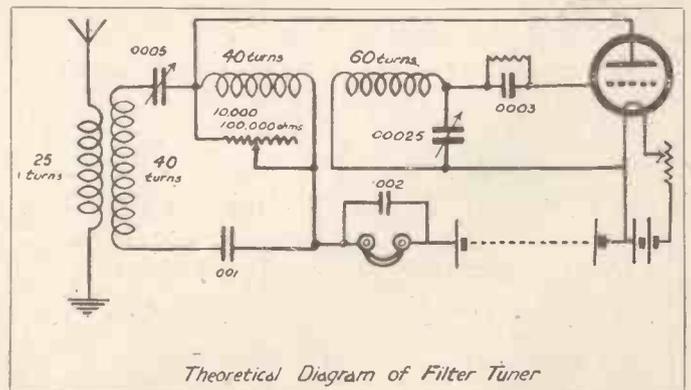
Important Points.

As it will be seen, the signal from the aerial passes through an untuned primary coil and is filtered from other signals by two intermediate or linking coils before it reaches the secondary. Two features of the "Filter Tuner," giving it a unique place in wireless, are the arrangements for reducing the resistance of the linking circuit and for controlling the current used for the purpose.

The increased selectivity without loss of volume is accomplished by the inclusion of one of the linking coils in the plate circuit.

The first thing to do is to wind the coils and bear in mind that only the best material must be used throughout, and the instructions must be followed closely, for the slightest deviation may be the cause of that everlasting complaint—"won't work."

The coils are wound on two cardboard, or preferably ebonite, formers, both three inches in diameter. The tube for the primary and first filter coil is four inches



ohms less than one hundred thousand ohms will be O.K.; but as this instrument plays such an important part in the working of the receiver it should be thoroughly reliable, and no expense should be spared in its purchase. This resistance is utilised to control the strength of the magnetic field produced by the second filter coil, which, in turn, affects the entire filter circuit and controls, to a certain extent, regeneration and volume.

(Continued on page 1134.)

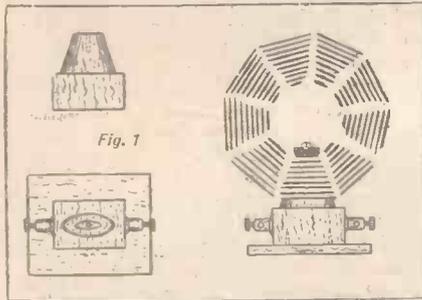
Useful for "DX" Work.

With this circuit it should be possible to cut out a station within a couple of hundred yards or so, and receive other stations on a wave-length only differing by ten or so metres from the unwanted station. And as regards volume and clarity of signal strength, it is even better than the ordinary regenerative single valve receiver. In fact,

MOUNTING BASKET COILS.

By OSWALD J. RANKIN.

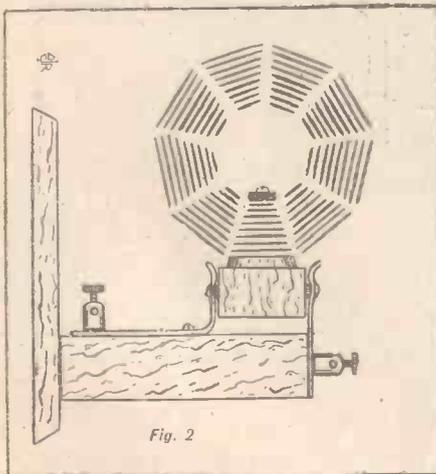
THE accompanying sketches illustrate yet another method of mounting basket coils, and particularly those of the commercial variety having well-spaced windings. A block of good dry hardwood, about 2 in. by 1½ in. by 1 in. is shaped as shown in Fig. 1, the upper portion being



oval in section and tapered off towards the top so that it fits tightly into one of the coil spacings as shown on the right. A small hole is drilled in the top of the tapered portion, the block then being secured to a small baseboard and provided with two wood-screw terminals. The coil is pushed tightly over the tapered plug, and finally secured to same with a small ebonite washer and wood screw which, by means of a screw-driver having a long thin shank, is screwed down into the small hole in the top of the plug. The ends of the coil winding are secured under the shoulders of the terminals.

Making a Coil-Holder.

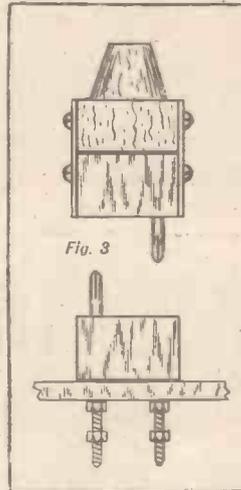
Fig. 2 shows the method of constructing a two or three-coil holder on the above principle. In this case the small baseboard is



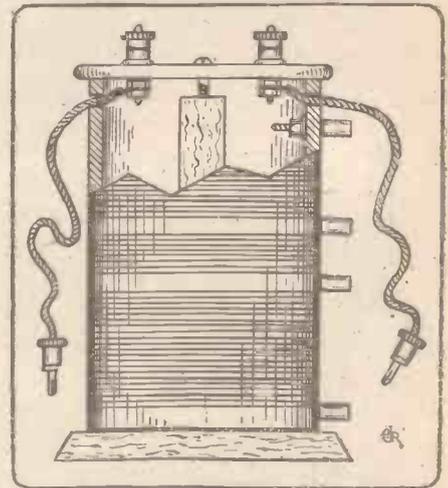
dispensed with, and two round-headed brass screws are fitted in the place of the terminals, the ends of the coil winding being secured under the heads of same. The "socket" consists of two spring brass

clips, these being bunched to receive the screw-heads and attached as shown to an upright wooden support of two wood-screw terminals.

Fig. 3 shows how the idea may be adopted to the standard ebonite coil plug and socket, the wooden block being secured to the ebonite plug by means of two brass strips, and the ends of the coil winding being soldered to same, or secured under the heads of two upper screws.



connected to a series of ordinary valve sockets which are clamped to the side of the former in the manner shown in the sectional portion of the accompanying sketch. This operation is very easily carried out; the wire is bared at the desired tapping point, and at this point a hole is pierced or drilled through the side of the former. The shank of the valve socket is then pushed through the hole and at the same time the bared portion of the wire is looped once round the shank, the socket then being firmly clamped to the former and the winding continued. The beginning and end of the winding are also connected to sockets, and as in the case of the ordinary tapped coil, the tappings should be slightly staggered.



A Useful Size.

An ebonite or fibre disc which is drilled through the centre to take a long wood screw, and fitted with two terminals, forms the top coil support or "panel," this being screwed down to the top of a wooden pillar which is very firmly attached to the small wooden baseboard. The two wander-plugs are connected, via flexible leads, to the terminals as shown, the leads being passed through holes provided in the sides of the former. The number of turns between each socket and the number of sockets employed will, of course, depend on individual requirements. A useful size of coil for experimental purposes may consist of 100 turns of No. 24 D.C.C. wire wound on a 3½-inch diameter former and tapped off at the 25th, 50th, 75th, and 100th turns.

A SELF-CONTAINED TAPPED COIL.

FOLLOWING is a description of a little idea which should appeal to all amateur constructors and experimenters. Instead of mounting a tapped coil in the usual cabinet and joining the tappings to the studs of a multiple switch, the tappings are

A SUPER-SELECTIVE CIRCUIT.

(Continued from page 1133.)

The size of the panel of the original set was seven inches by twelve; but as it is, in America, generally the custom to mount some of the apparatus on the base of the cabinet, a larger panel will be required if the apparatus is all to be mounted on the ebonite.

The two variable condensers should be mounted on opposite sides of the panel, but the two coil formers may be almost touching if, as I mentioned before, they are mounted at right angles to each other. Small brass angles may be utilised to fasten these latter to the panel.

By the diagram you will see that there is no variable condenser either in series or shunt with the primary coil. It is aperiodic—a favourite and advantageous system widely used in the States.

Regardless of the theoretical complexity of the circuit, it can be made and operated by a novice. The operator will develop his own system of tuning the set, but in general

he will find that the two variable condensers tune with about the same settings (with a hundred foot aerial, including lead-in), but stations may be picked up best by advancing the filter condenser (the .0005 mfd.) slightly more than the secondary condenser. A point of adjustment is found on the filter resistance where signals over a given waveband may be received without further adjustment of that unit.

Really Worth Assembling.

The second variable condenser has a capacity of .00025 mfd., and should also have a vernier attachment or have a small vernier condenser placed across it.

Fairly heavy wire should be used for the under panel wiring, such as No. 20 s.w.g. or square wire, which is so much in fashion now and which always makes a neat job. The grid leak and condenser are, of course, of the usual values.

I think that the diagrams are self-explanatory, and no amateur should have any difficulty now in building this "Filter Tuner." It is a good circuit and really worth while building. The fact that many "fans" across the water are discarding their "-dynes" and "-flexes" in favour of it should read as a good testimonial.

THE MAN WHO KNEW NOTHING; OR, THE BIRTH OF A LISTENER-IN.

By G. V. DOWDING.

Here is a new departure in wireless articles which will amuse as well as instruct the general reader. Mr. Dowding has written about an actual experience he recently had with "a man who knew nothing."

THAT is to say, he knew nothing at all about wireless. In other pleasant, and perhaps even unpleasant, spheres, he has probably amassed considerable knowledge. For instance, you have only to murmur "stymied," and he will seize both lapels of your coat with both hands and hiss "My hole!" into your ear.

Unkind? Uncharitable? Not at all. You see, he is an ardent disciple, and I have reason to believe, no mean exponent of that Royal and ancient game, golf, but he knew nothing at all about wireless.

The Awakening.

Radio gear, curious, mysterious pieces of apparatus, the joy and delight of the knowledgeable "fan" were to him but meaningless assemblies of metals and wood; that is, until broadcasting started. When one of the first London broadcasting station programmes, carefully inserted by a great daily paper between a small advertisement concerning a sale of Tolley-Braid golf clubs and a marvellous hair restoring announcement, included some real "Pipers," he became interested, for he is a Scot, and is many miles away from his beloved Highlands.

Thereat he came to me with Lochs and Lomonds blazing from his eyes. "D'ye ken that wireless?" he asked. "Just a little," I replied, endeavouring to remove a spot of accumulator acid from my waistcoat. "Can ye lend me a wee wireless box for the night?"

"Here, just a moment," I said. "A wireless set isn't quite the same thing as a gramophone"; and I endeavoured to explain the limitations of the former as against the adaptability of the latter, in point of bringing music into the home of a wireless "philistine."

Now, this is the surprising part about the whole business: in the space of one day, or thereabouts, wireless had turned a complete somersault in that man's mind, and had become a roaring and concrete necessity of life. He did not, however, want a wireless set in his home so that he could keep the strange contraption under his observation, and in due course become acquainted with its habits and mode of living; not at all, he wanted it merely for what it could do.

After all, there is no reason why he should not approach the subject in this manner. We buy a watch to tell us the time, but few of us consider it necessary to delve into the depths of horology and discover exactly how watches are made or the exact function of a main spring. And so with wireless.

My friend is no exception, and there must be hundreds of thousands of people deeply interested in their wireless sets in respect of the noises and sounds they collect from space, who, nevertheless, don't particularly worry whether there is or is not an ether.

Of course, one great necessity exists, and that is that people who own sets must know how to handle them, just as, to revert to the above analogy, if I can do so without being accused of going to extremes, one must know how to wind up, alter the hands, and regulate a watch if it is to carry out its useful work in the proper manner. Therefore, to get back to the adventures of the "man who knew nothing," I carefully explained how utterly impossible it was for him to borrow a "wee wireless box" and expect to squeeze music out of it unless he was given a few instructions on how to operate it, not forgetting that those little items now familiar to most as an aerial and earth, required to be put into commission.

He left me, an embittered man, with every appearance of having been suddenly whisked a further few hundred miles away

being red hot. Then you just twist this other knob until you hear music. If you don't hear music, or speech," I added guardedly, "then either there isn't any music or the set's broken down."

Rapid Progress.

With these comforting alternatives I left him, and, believe me, except for the matter of one or two burnt-out valves, a little accumulator trouble, and the replacement of an H.T. battery, all went well for quite four months.

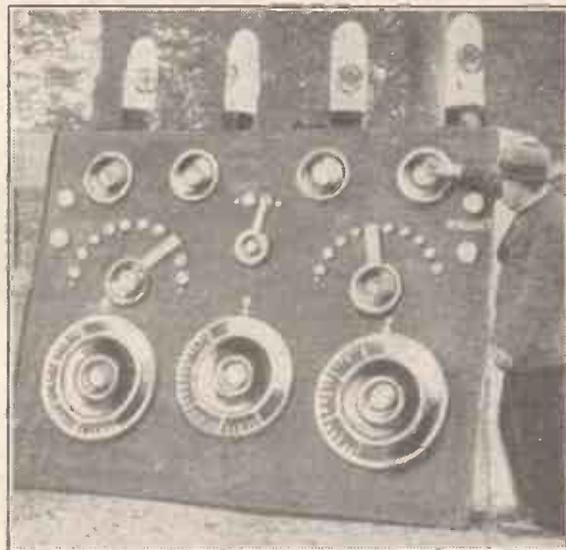
Then the "man who knew nothing" came to the conclusion that more noise was indicated and that even a loud speaker might prove an advantage. I fitted a limited reaction control, and explained how this third knob, by doing something with coils of wire inside the set, would increase the volume of sound obtainable.

He was delighted at this exhibition of the wonderful possibilities of wireless science. He became an ardent listener "fan"! Passed a few more months, a few more valves, a battery or two, and then again he came to me. Noise, more noise was his demand. Whereat I did a certain amount of heavy thinking and designed for him what has become by now a well-known receiver to readers of this journal, i.e. "The Ideal Loud-speaker Set."

Here he had but three controls—a variometer for tuning, a crystal detector adjustment, and the valves—two in number. The circuit in theory is equal to two H.F. valves, one crystal detector, and two L.F. valves; in practice, one can collect quite a nice noise from the local station. With this set the man who once knew absolutely nothing about wireless learnt how to manipulate a cat's-whisker, and how unsuitable such a lot of crystals are when used in conjunction with valves.

He also learnt that to connect up the accumulator leads to those terminals marked L.T. plus and L.T. minus in their reverse order could cause loss of signal strength. He further learnt that to connect up the big dry battery to the above terminals cost 25s. for valve renewals; he learnt this lesson with real Scots thoroughness, proving an able supporter of the valve industry for some considerable time.

For a few months his wireless life was, except for such little lapses as the above, quite eventless. Of course, he had a little



"The Man who Knew Nothing" now dreams of a "wee wireless box" something like this!

from "hame," facing that gigantic problem which recurs with such frequency these days—the problem of equipping an unprepared recruit for the nightly battle with the ether.

Lighting His First "Lamps."

Anyway, in the course of a few days he was fitted up with a two-valve set which had on it but two knobs, the one to switch on the valves, the other, a variable condenser control, to tune in the dulcet waves of 2 L O—his only hope, or rather, his only desire.

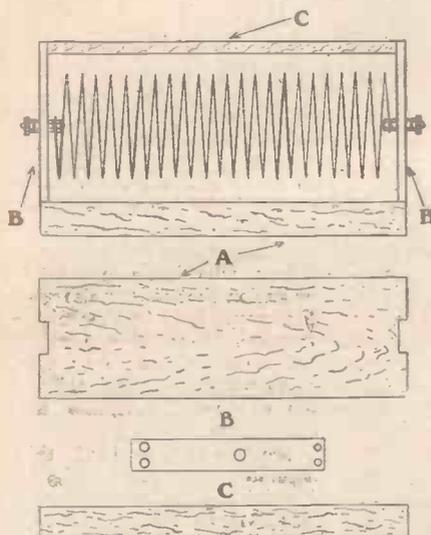
The matter of instruction was simple. "You turn this knob on," I said, illustrating my words with actions. "until those 'lamps' give a bright light—not too bright, mind, just bright enough to miss being accused of

(Continued on page 1136.)

"NO CAPACITY" COILS.

By O. J. RANKIN.

THIS short article deals briefly with the practical side of the anti-capacity coil problem, and although this type of coil is at present merely an experimental "gadget," it may be well to point out that the idea affords much scope for the serious experimenter, and that, properly developed, it may ultimately supersede many of the



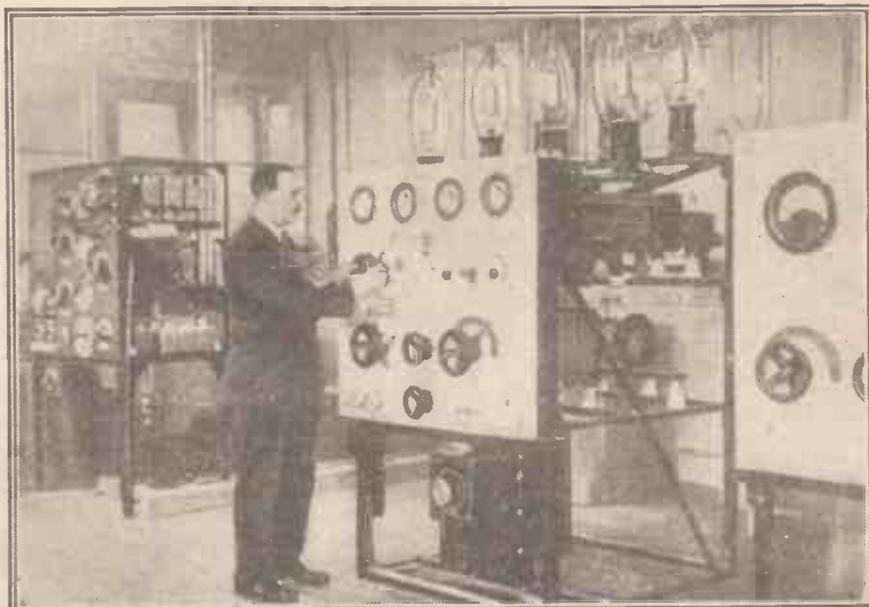
present-day tuning devices. Consisting of a formerless and open-spaced coil of square-section bare wire it is undoubtedly the ideal anti-capacity coil, especially for long distance reception; but, possessing a somewhat clumsy and none too pleasing appearance, it is, for the present, confined to the experimenter's workshop, where it will probably remain until its design is modified to suit the requirements of the greater majority.

Readers who would like to compare the efficiency of such a device with that of their usual tuning coils, may carry out the experiment with the minimum of time and trouble. Obtain a liberal supply of the ordinary square-section tinned copper "bus bar," as used for panel wiring, and wind the required number of turns on a cardboard former, which is a size smaller than usual, keeping the turns very close together in the same way as the ordinary cylindrical coil is wound. Having wound on a sufficient number of turns to cover the wave-length of

the desired station, allow the winding to uncoil, and remove the former. Stretch the coil until the turns are about $\frac{1}{2}$ in. apart, and then suspend it from the ceiling or other suitable support, and see that it is well insulated from same.

Make the connections from each end of the coil and connect the tuning condenser in parallel. Such an experiment will, of course, only apply to single-circuit tuners; but it will be found sufficient to enable the desired comparison to be made.

A simple and effective method of mounting these coils is suggested in the accompanying sketch, where the wire helix is stretched out and supported in a frame which consists of a wooden base (A), two strips of matted sheet ebonite (B), a wooden strip (C), the ends of the coil being connected to terminals fitted to the ebonite sides.



The transmitting station opened at the first German Wireless Exhibition. This station is to remain in permanent use.

THE MAN WHO KNEW NOTHING

(Continued from page 1135.)

battery trouble, and I remember one black week when he purchased three H.T. batteries, a new accumulator, and a dozen or two pieces of crystal. However, in the course of time he again came to me. More noise, more noise, and "awa' wi' the wee crystal!" was his cry. I did some more hard thinking, which eventually resolved itself into a three-valve set employing reaction and two stages of L.F., with each of which was to be used a B.T.H. power valve. Three filament resistances, a tuning condenser, and the reaction control were the adjustable items. I provided combined battery leads with H.T. plugs having within them fuses to protect the valves, which were now to be dull emitters, and very expensive items.

I told him how to handle the set, and sent him on his way rejoicing, convinced that an actual demonstration would hardly be necessary considering his past experience.

When I saw him again, I asked him how this, his latest set, was working.

"Mon, it's terrible!" he said, his usual cheerful countenance clouding with evidently black memories. I elucidated the fact that so far his only results were howls and shrieks of a particularly acute nature.

Practical Instruction.

At his invitation I went home with him to deal with the miscreant personally. Sure enough, when I turned on the filaments the loud speaker caused a fearful din of heartrending howls and whistles. Changing the valves for a D.E.R. and two B 6's, with which I had intended the set to be used, immediately righted matters, and the fact that any old valve that one might purchase is not necessarily suitable for any particular position in any particular valve set impressed my friend considerably.

The careful adjustment of the valve filament controls also interested him who, with all his experience, had thought that it was only necessary to make the "things light" to produce the maximum results obtainable.

"And what might the reaction do?" he asked, pointing to the variable condenser control knob. I carefully explained that the condenser tuned-in the station,

while the reaction control merely made the signals louder, although, when it was adjusted, it was liable to upset the tuning slightly. I also explained how he could cause considerable interference with other listeners by adjusting the reaction carelessly. Then I told him how he could leave the condenser and reaction more or less set, and alter his signal strength by means of the filament controls, but keeping the dull emitters at the most "dull," for he had at last almost noise unlimited, being only 12 or 20 miles from 2 L O.

This is his last, and, I hope, permanent set. In two years he has had two valves with and without reaction, a double dual (inverse reflex), and a detector and 2 L.F., using power valves, and yet he is still, in a sense, "The man who knows nothing."

It is not indicative of lack of intelligent interest in broadcasting; of that I am certain, for he could probably deliver an excellent lecture on the psychological aspects of wireless and its effect on the community; it is simply that to him electrons, ether, inductances, etc., are abstract means (with which he has no time to make himself acquainted) to a concrete end which provides him with agreeable music and interesting speeches in the comfort of his home.

HOW ELECTRO-MAGNETIC WAVES BEND ROUND THE EARTH.

By G. W. De TUNZELMAN, B.Sc.

IN the very early days of wireless telegraphy, when Marconi operators announced the astounding fact that wireless signals emanating from the Marconi station at Poldhu in Cornwall—the first electric wave power station in the world—had been received at St. John's, Newfoundland, the late Lord Rayleigh, one of the greatest physicists who ever lived, promptly asked how could the waves manage to bend round the curved earth to the extent necessary to cross the Atlantic.

The fact that trains of waves impinging upon an obstacle bend round it to some extent was, however, perfectly well known. The effect of this bending may be seen in the apparently clean-cut shadow thrown by an opaque obstacle placed in the path of the rays from a motor headlight, while a much larger obstacle would be required to produce a sound shadow and cut off the sound from the horn.

Effect of Solar Radiation.

The reason for this difference is to be found in the extremely minute wave-lengths of the light rays compared with the immensely longer sound waves. Now, as the reader will be aware, the electric waves employed in wireless telegraphy and telephony are very much longer than those which affect our eyes with the sensation of light.

It was therefore hoped that a solution was to be found in this direction, and difficult and extensive mathematical investigations were made by Macdonald, Nicholson, Poincaré, the great French mathematician, Lord Rayleigh, and others, to elucidate quantitatively the problem of the bending of the waves by a boundary, conducting or dielectric, of continuous curvature. For instance, to determine the maximum bending which could be produced by the grazing of the earth's surface by the electric waves, the earth being assumed a perfectly smooth sphere of perfectly conducting material.

At that time little was known of the actual facts, but this knowledge was rapidly growing by the welding together by mathematical investigations of the result of innumerable observations, and to begin with, it was made quite clear that the bending by grazing, or *diffractive* bending as it is called in optics, was totally incapable of accounting for the observed results.

At this time it had become known, mainly by the observation and interpretation of auroral phenomena, which were seen at altitudes extending up to fifty miles, where the atmosphere must necessarily be extremely rarified, that at these high altitudes the atmosphere must be very highly ionised, that is to say, the atmospheric gases—mainly nitrogen, oxygen, and water vapour—would be broken up into their positively and negatively charged constituents or *ions*, by the incident ultra-violet solar radiation.

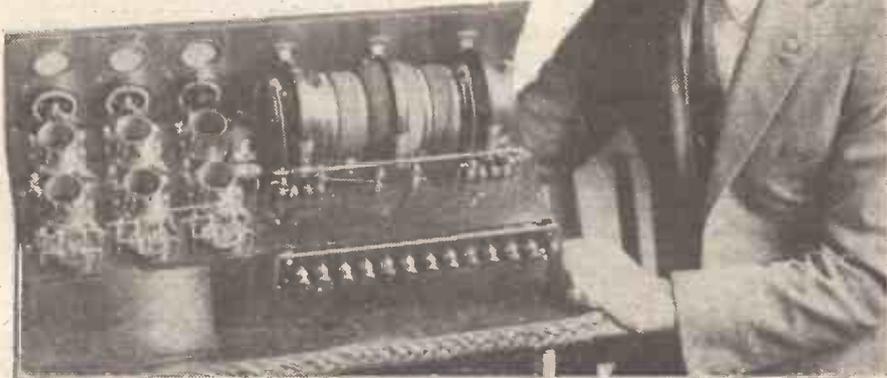
This would convert the atmosphere at

these altitudes into a good conductor like the interior of a highly exhausted vacuum tube, and it was suggested that the electric waves generated within the atmospheric belt bounded below by the earth's surface and above by the conducting atmospheric stratum would be retained always between these boundaries, and could not escape from them, since both are good conductors, and therefore good reflectors.

A most interesting paper by Sir Joseph Larmor, F.R.S., which gives the title to the present article, was read on October 27th at the Cambridge Philosophical Society. In it he points out that a train of radiation travelling along a layer sufficiently conducting to bend the rays would not travel far before becoming extinct by the loss of all its energy. There seems, however, he observes, to be a sufficient cause available for transmission of long waves horizontally round the earth at great altitudes, though the waves travelling at lower heights would soon be quenched. This quenching arises from collision between the particles of the atmosphere which at 0° C. and the pressure

alternating velocity excited in it, and this for a given field intensity is proportional to the period of the waves, so that for long electric waves the effect may be millions of times as great as for short waves—in fact, it involves the squares of the wave-lengths. Shorter waves could travel in a lower layer without excessive absorption, as there a greater number of ions could make up for their weaker oscillatory motion.

It is seen then that almost beyond the sensible atmosphere, but within the auroral domain, there must be a layer in which a sheaf of horizontal electric rays, to use optical imagery, provided they be long enough, will travel without loss by absorption or scattering. Concentration in this stratum being due to the increase in the velocity accompanied by a bending downwards of the rays and a decrease in the static dielectric modulus of the highly rarified air.



A compact 6-valve receiver which uses 3 H.F. stages, detector, and 2 L.F. amplifiers.

of one atmosphere have a mean free path between two successive encounters of nearly one ten-thousandth of a millimetre.

Differences Caused by Wave-length.

At an altitude of 50 miles it would amount to several centimetres, so that in continuous wave transmission the synchronous oscillations of free ions of small mass remain practically undisturbed by collisions, and have time, owing to the long period of the exciting waves, to get up high speed, and in the main swing free under the influence of the exciting waves and thus interact without dissipation of energy; there will thus be an influence on the velocity of the waves without absorption.

To suit the present explanation, the change ought to be a substantial increase, notwithstanding the small number of the ions contributing to it in the ultra-rarified upper atmosphere. The reason is simple. The influence of an ion is measured (jointly with the time) by the mean value of the

all consequent on the influence of the long swing of the ions of small inertia.

The curvature of the horizontal rays in any stratum is shown to be equal to the rate of relative increase of the velocity upwards. The stratum of transmission to great distances is the one for which this is exactly the same as the curvature of the earth. Should any cause, such as the onset of sunlight on the ionisation, alter suddenly the height of an effective stratum in which the strata of equal ionisation are not exactly horizontal the rays will be bent away, upward or downward, and scattered, at the place of dislocation, and may not be able to get adjusted into the new transmission stratum.

If, however, the stratum be thick, the dislocation will be incomplete, extending over a part only. The stratum may be expected to be of varying height, some function of the local solar time; but it is too high for any merely meteorological derangement.

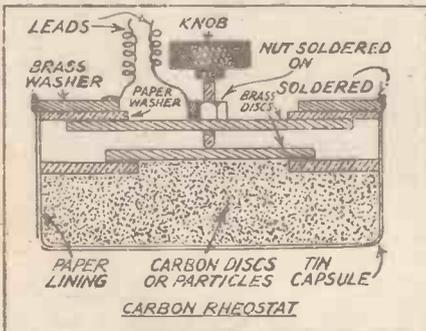
All rays not horizontally emitted are lost; a good local earth would assist the antenna here. We can think of the constituent beam of rays connecting the transmitter with a receiver anywhere along the path; it travels most of the way without loss except by spreading sideways in the effective stratum in which all such beams unite to form a nearly horizontal band of rays in the almost vacuum region above. Each receiver collects from an area around it of the order of the square of the wave-length; it thus appears from numerical estimate that the amount of energy available need not be at all inadequate to account for the now familiar features of free electric transmission round the earth, even to the Antipodes and beyond.

Constructional Notes

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

Carbon Rheostat.

CARBON rheostats are now so cheap to buy that, in general, it is hardly worth while making them yourself. But most of those on the market have a somewhat small current-carrying capacity and are apt to get very hot if used with two or more ordinary valves. If you wish to make your own, the design shown herewith should prove useful. A metal "tin" (after the style of an ointment tin) forms the container. Two brass discs are then obtained, about $\frac{1}{8}$ in. thick, and a little smaller in diameter than the container. In one of these a hole is drilled, through the centre, and a nut soldered over the hole to accommodate a screw-shaft with knob, as shown. A brass ring (or large washer) is now obtained, and is made the right size, in outside diameter, to fit tightly inside the upper rim of the container. To assemble the rheostat, the lower wall of the container is lined with paper (secured by adhesive), the carbon particles are poured in (ground-up arc rods will do), a paper washer is placed on top, then the two brass discs, the one with the nut being uppermost; another paper washer is placed upon this ring, and finally the brass washer is forced into position and soldered round the edge to the wall of the container. The action of the plunger in compressing the carbon particles and the method of taking off the connections will be clear from the figure.

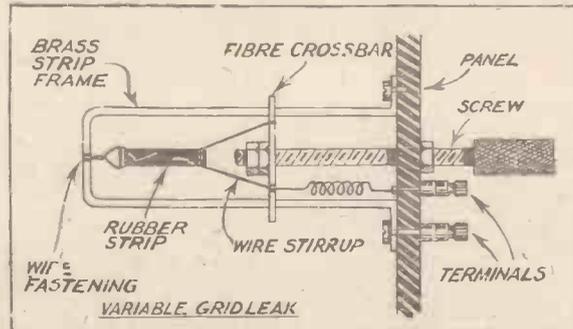


Testing Aerial Insulation.

If reception is not up to standard, and you suspect the aerial insulation, you can very easily test by the following method. Disconnect aerial and earth from the set, and connect them together through an H.T. battery, a voltmeter, and a simple switch. On closing the switch there will probably be a "kick" on the voltmeter (due to the capacity of the aerial system being charged up), but there should not be any permanent reading on the voltmeter. The ordinary voltmeter is really a very high resistance ammeter which operates on a very small current. If you observe a permanent deflection on the voltmeter, it means that current is going to earth; in other words, that the aerial system is not properly insulated.

Variable Grid Leak.

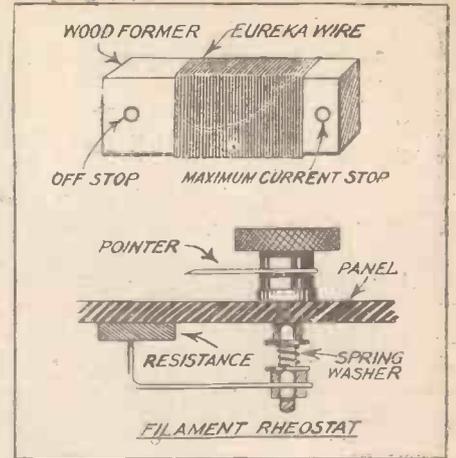
Here is an ingenious arrangement for a variable grid leak which, although not the simplest or easiest to make, employs a somewhat novel principle, and will no doubt appeal to the experimenter who is fond of constructing his own components. The essential feature is a strip of rubber which is coated with graphite. A screwed rod, with knob, passes through the panel in the usual way and carries a locked nut at the other end. By rotating this rod, the extension of the rubber strip may be varied, and consequently the resistance of the



graphite coating is varied. The rubber strip is supported at one end by being tied to a bent brass strip frame, and the other end is secured to a wire stirrup which is attached to a cross-bar of fibre, ebonite, or glass. This cross-bar, which must be of insulating material, prevents the rubber strip from being twisted when the screw is turned. One terminal connects to the brass strip frame and the other to the wire stirrup.

Cutting Large Holes.

In the absence of an expanding "bit," the cutting of large holes in ebonite or wood sheet is sometimes a matter of difficulty. A hack-saw blade may, however, be used for the purpose, by winding it around a circular wood block, of the proper size for the hole to be cut, in the manner indicated in the drawing. The blade should be cut and trimmed to the right length, so that it just meets when wound around the wood block. The temper is taken from the blade at three or four places and holes drilled for the screws which secure it in place. The wood core should be mounted on a short, fairly stout brass rod, and this rod should be turned down at the tip to a smaller diameter, the smaller point being inserted into a hole drilled into the work first and acting as a centre-guide. The brass rod may be held in the chuck or in a hand-brace. In the latter case, if the tool turns too stiffly, a number of the teeth of the saw may be ground away here and there; this will make the tool easier to turn.

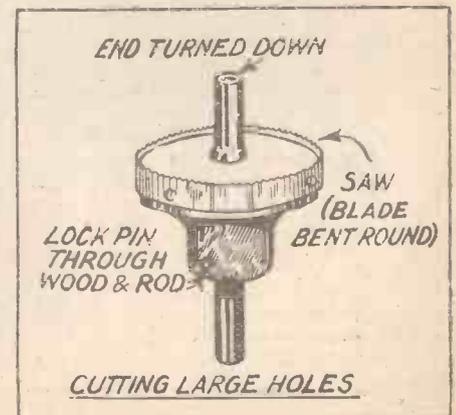


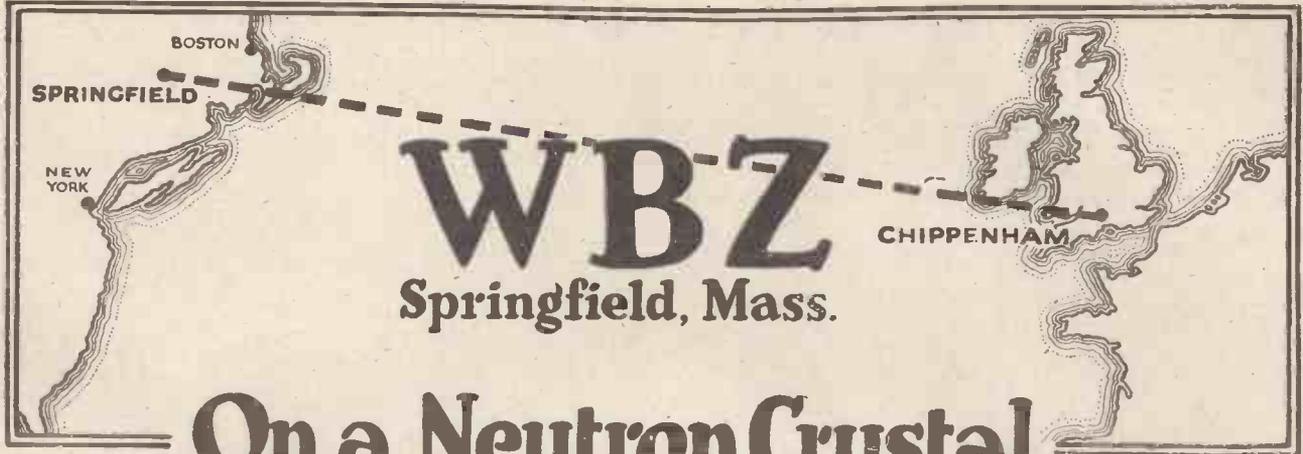
Filament Rheostat.

A useful and easily-made rheostat is shown in the figure herewith. The knob and shaft, with pointer, spring washer and contact-arm under the panel are as in other rheostats, and therefore need no further description. The interesting feature is the resistance coil and the former for the same. The "former" consists of a rectangular strip of wood, upon which the resistance wire is wound, fairly close. Notches may be cut in the edges of the wood for the wire, but certain kinds of resistance wire which become oxide-coated may be wound with adjacent turns in contact. Any covering, whether of regular insulation or of oxide, must be scraped away

over the track of the end of the contact-arm. If different maximum values of the resistance of the rheostat are required for different purposes, different resistors may be inserted. The rheostat is thus readily adaptable for use with dull—or bright—emitter valves.

The size of the wooden former will, of course, depend upon the particular set in use. Where the rheostat is to be a fixture the block may be secured to the panel by means of two fixing screws, but, where it is interchangeable for bright-emitter or dull-emitter valves, strong clips may be used for the purpose. These may be made on the lines of the spring clips in use for grid leaks, or a small bracket may be arranged to slip under a screw terminal.





On a Neutron Crystal with 2 stages of Low Frequency

Chippenham, Wilts.,
December 14th, 1924.

MESSRS. Neutron, Ltd.,
DEAR SIRS,

NEUTRON CRYSTALS.

As an enthusiastic owner of a 5-Valve set, I write to tell you of my surprising results with a small Crystal set. Owning the above-mentioned set and having been connected with Wireless Theory for the last 10 years and actual practice with a set for the past 5 years, I was, as I always have been, very sceptical about results when I bought one of your Crystals a week ago. The results, however, have simply astounded me.

The first night, not having the ebonts ready, I just twisted some bare wire round the end of the detector and across the end of a plug-in (Standard size) Coil block, the other end I connected with a pair of phone tags and condenser, a .0003 mfd. variable condenser for tuning completed my very crude "outfit."

-Coupling up Aerial and Earth I was astounded by easily tuning 5 WA (40 miles), 6 BM (62 or 4 miles). I listened to the latter till close-down, and then picked up Madrid quite easily.

Of course, my mind was immediately filled with theories of re-radiation and such things as that. I will, however, admit that I made frantic haste to have everything properly mounted and soldered the next evening, when I again repeated the same performance. Subsequent tests have proved that 5 XX (100 miles, approx.) is absolutely comfortable strength, and 2 ZY (Manchester) is also audible.

Coupling a 2-valve **LOW FREQUENCY** amplifier to the above-mentioned set at 1.50 a.m. this morning, I picked up Music and Solos (Soprano and Baritone) from WBZ (Springfield, Mass.), and was in good touch for about 10-12 minutes, when the signals faded away.

A continued watch was kept for 1 1/2 hours, during which time I was in touch for about 60 per cent. of the time. Not so bad for the much-despised Crystal. Needless to say, I am now very much converted.

It is my hope now to be able to receive America direct with Crystal only, and with the strength that different stations have been coming in at this address I am feeling quite confident that it can be done. Needless to say, the Crystal will be Neutron.

My aerial is 100 ft. long, 34 ft. high leading-in end, 28 ft. high far end. Please particularly note that all current was switched off from the valve set during these tests, and every precaution taken to give the Crystal a "fair chance."

Very sincerely yours,

(Signed) R. A. H.

P.S.—During reception of Springfield, Mass., I distinctly heard the announcer give the call letters of the station twice, so that there is no doubt as to the accuracy of the reception.—R. A. H.

THIS is, we believe, the record for long-distance broadcasting reception on land.

Note that the only amplifier used was a low-frequency one; interpreted to the non-technical, this means that the signals were actually received and rectified by the **NEUTRON CRYSTAL**, the two valves serving merely as note-magnifiers, and not as "range-increasers."

The original letter, a copy of which is given here, may be inspected at the NEUTRON Offices.

Here is sufficient proof of the super-sensitiveness of **NEUTRON CRYSTAL** to justify you in selecting this as your Crystal. Sooner or later you will come to it, in any case, and in deciding **NOW** for **NEUTRON**, you will easily save the price of another pair of phones, by saving the expense of further tests.

and you can get the same results with a

NEUTRON

TRADE MARK

Concert Tested and Guaranteed.

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SEASONAL VARIATIONS IN LIGHT CONDITIONS BETWEEN LONDON AND NEW YORK.

USEFUL INFORMATION FOR AMATEURS.

By LIEUT.-COMMANDER H. W. SHOVE, D.S.O., R.N.

WE all know that it is far easier to receive signals across the Atlantic in the winter than in the summer, and most of us are aware that the chief reason for this is the variation in the proportions of the lighted to the unlighted areas the waves have to traverse.

There are other causes, notably the increased prevalence during the summer of "statics," or "atmospherics."

But it is the light conditions that are the really deciding factor. And the writer here proposes to give a few facts as to what the seasonal variations in these conditions really are.

Path of Wireless Waves.

Waves travelling between two stations follow what is known to navigators as a "Great Circle" track and that, although New York lies some 10 degrees to the southward of London so far as its latitude is concerned, the actual direction whence wireless waves from New York reach the Londoner's aerial is not to the southward but to the northward of due west.

Thus, if we were to set out upon the track, we should at first be approaching the Pole and so, in the summer-time, the region of the "Midnight Sun" (and, of course, in the winter, that of perpetual night). In the case of stations both in fairly high latitudes, e.g. Christiania (lat. 60 N.) and St. John's, Newfoundland (lat. 48 N.), this "northing" may be very considerable and actually take us within the Arctic Circle. But, between London and New York, the stations we are here considering, it is not so.

The "vertex" of the great circle only reaches latitude 53° 48' N., that is to say, a distance of 138 geographical, or about 157 statute, miles nearer the Pole than London. This is about the latitude of Leeds, and there is only a maximum difference of 26 minutes in the length at those places of their respective days, the Yorkshiremen, of course, enjoying longer days in summer and having to light up earlier in the winter than the "Cockneys."

The Light "Track."

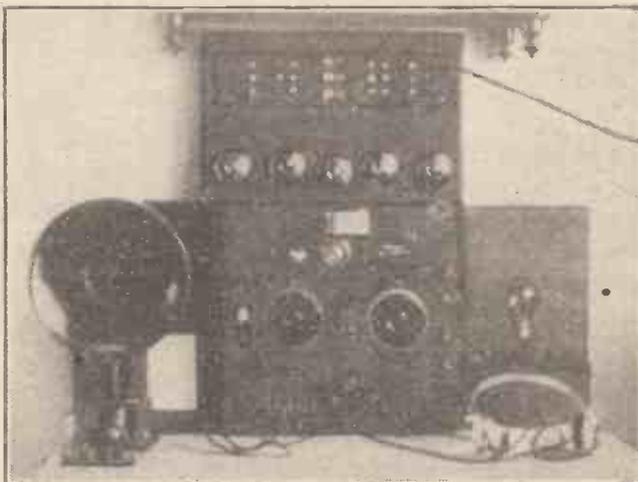
This maximum is only reached on midsummer's and midwinter's days, the difference gradually decreasing from those dates, till at the Equinoxes (March 21st and September 24th) the days are of exactly the same length (as indeed they are throughout the world).

As this 26 minutes is divided equally between an earlier sunrise and a later sunset (at midsummer) at the northern place, and as we have only to deal with one of these at a time in considering our light conditions, it will be seen that the "northing" is not a very serious matter so far as sunrise and sunset are concerned. It is when we have to deal with twilight conditions that it becomes of importance as we shall see later.

The track reaches the vertex in longitude 23° 4' W., the local time at which point is 1 hour, 32 minutes earlier than London.

So that at sunset in London on midsummer's day there is still (allowing the 13 minutes already indicated as due to difference of latitude) 1 hour 45 minutes to go before sunset at the vertex.

From the vertex to New York the track is tending in a southerly direction and the change of latitude is operating to make the local time of sunset earlier. On the longest day the sun sets in London at about 8.13 p.m., and the local time of sunset at New York on the same date is 7.28 p.m., corresponding to 12.24 a.m. in London, and 10.52 p.m. at the vertex. This is the earliest moment at which the sun is below the horizon all along the track. But it is by no means dark.



Mr. F. Sturdy's (of Pretoria, S.A.) set, which receives Johannesburg on a loud speaker at 40 miles.

New York has still 2 hours and 5 minutes of twilight, before the sun is far enough below its horizon to allow of complete darkness. In London, as in all places north of latitude 48° 30', this never happens at all throughout the night. The proportion of the track north of latitude 48° 30', and therefore in the zone of "Night-long Twilight," is 2,212 miles of the total distance of 3,010 sea miles. So that along only 798 miles can it ever be wholly dark and this maximum is reached at the end of twilight at New York—i.e. at 2.59 a.m. in London. But, as sunrise at the latter place is at 3.47 a.m., the dawn is by that time far advanced.

Midsummer Conditions.

The best conditions, when the sun is at its maximum depression from the mean track, are at midnight at the vertex. This is at 1.32 a.m. in London (8.36 p.m. at New York). There is then still nearly an hour of twilight at New York. In London it is 2 hours before sunrise. There is no complete darkness anywhere on the track, but the conditions are slightly better than at the onset of darkness at New York, owing to the greater depth of the twilight over the major portion of the distance. From this time

on till sunrise in London they are getting worse owing to the growing dawn here.

From the above midsummer conditions things gradually improve until on August 1st and May 13th there is an instant of complete darkness (midnight at the vertex) throughout the whole length of the track at 1.32 a.m., London time. This period grows longer and longer, extending both earlier and later, till at the Equinoxes the sun sets at 6.0 p.m. all over the world. On these days twilight ends at New York at 7.36 p.m., local time, equivalent to 0.32 a.m. in London, and from then on till the time of dawn in London (4.1 a.m.) there is no light along the track.

The "Wireless Paradise."

At midwinter we arrive at the wireless paradise, there being a totally dark period of over 7 hours, from 10.40 p.m. to 6.0 a.m., London time. Enough to allow of tuning in with the most super-complicated set!

All the times given above are "apparent" or "sundial" time. As the motion of the earth in its orbit is not quite uniform, there is a correction called the "Equation of Time," varying with the time of year, which must be applied to bring them to "clock," or "mean" time.

This correction is never very large, but may amount to as much as a quarter of an hour. Also, in summer, we must, of course, add an hour to get "British Summer Time."

The table below shows the results of the calculations as to the times of complete darkness between London and New York at the four seasons, viz. Midsummer, Autumn Equinox, Midwinter, and Spring Equinox, reduced to Greenwich Mean Time.

The reader may think that the effect of twilight has been too much insisted upon. Perhaps he reasons that, since it is *sunlight* that is supposed to affect the waves, surely twilight is not important. But the fact is far otherwise. Twilight is caused by the sunlight in the upper regions of the atmosphere, those very regions wherein exists the "Heaviside Layer," which is supposed to be such an important factor in radio transmission. It is there, and not in the earth's surface, that we must seek the adverse effects of the sunlight, and it is there that the sunlight plays during the twilight period on the surface.

TABLE OF TIMES OF TOTAL DARKNESS.

Season.	Date.	Total darkness begins (G.M.T.)	Total darkness ends (G.M.T.)
Mid-Summer	June 22nd	Never	—
Autumn Equinox	Sept. 24th	0.24 a.m.	3.53 a.m.
Mid-Winter	Dec. 22nd	10.38 p.m.	5.58 a.m.
Spring Equinox	March 21st	0.48 a.m.	4.9 a.m.

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A CHILD CAN TUNE IT

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Extract from a recent Test Report—"On test, the capacities came out quite close enough to the nominal for ordinary radio purposes, the .001 μ F nominal samples being about .00103 and .00091 respectively, and the .0003 μ F nominal being actually around .00033 and .00026 respectively. There was observed but a negligible greater high-frequency loss in this type than in a standard air-dielectric condenser . . . An exceedingly strenuous test was applied to one of the samples, which was actually placed in water nearly at the boiling point for the better part of an hour. After this heroic treatment, the condenser showed a capacity which did not differ materially from that shown before, and it was still possible to get a valve to oscillate readily with this as the main tuning-capacity across the grid-tuning inductance."

.0008 to .006 2/6 each. Grid Condenser with clips 2/9 each. Grid Leak 1/6 each.

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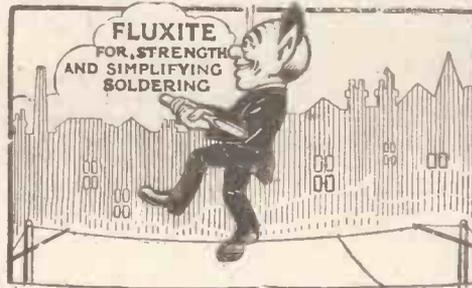
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AND **GUARANTEE** { at least equal efficiency to new valves, to return in seven days, or refund your money without quibble.

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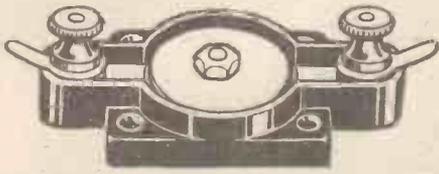
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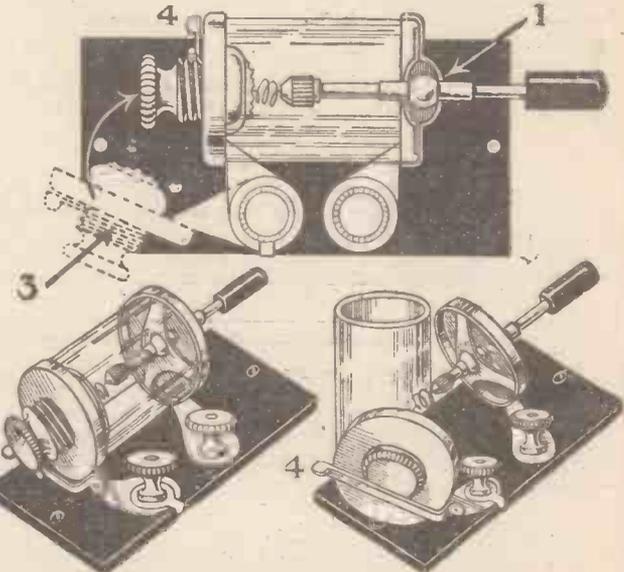
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HOW TO MAKE A COMPACT CRYSTAL SET. For Local and Chelmsford Transmissions.

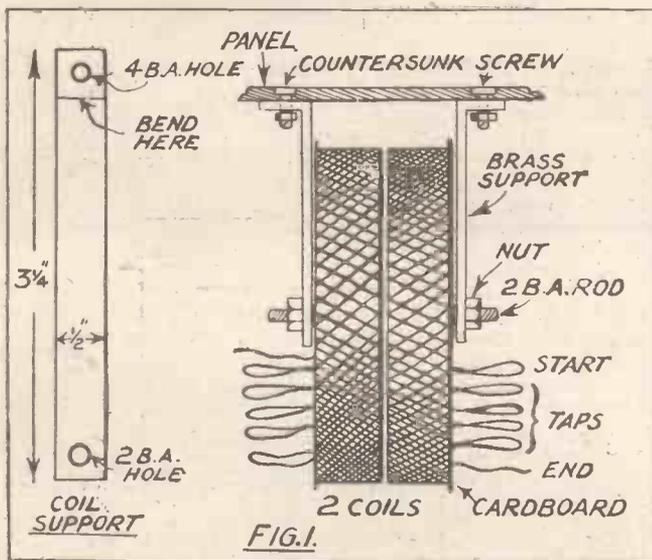
By S. M. KNIGHT.

Some patience is required to get the best out of the crystal set described in this article, but the little extra trouble involved will repay the amateur who sets store by sharp tuning and excellent results generally.

THE circuit used in the set described here is of quite an old type, but for some reason very few amateurs take the trouble to use it. It will be seen from the diagram that this set has two separate coils, one the primary or aerial coil; the

set about to be described is about 2½ miles from 5 I T, and aerial is at right angles to this station, but with slider coil, tapped coil, or variometer with loading coil 5 I T still comes in quite strong on Chelmsford's wave-length. After prolonged

experiment the double circuit set was tried and found most satisfactory; in fact, signals from Birmingham are almost eliminated by turning the condenser knob a few degrees. The set is quite compact, the coils being of the honey-comb type. The panel should be 5 inches by 7 inches and ⅜ inches thick; matt ebonite preferred. A glass covered detector and good crystal should be used, and the .0005 mfd. variable condenser should be of reliable make. On the writer's set small headed contact studs and small home-made switch arms



turns, and is made as follows (Fig. 4): Commence by securing the wire to one of the nails, and call this nail No. 1. Now pass the wire round No. 5 on the other side, round No. 9 on the first side and back to No. 13 on other side, and then across to No. 2. This forms one complete turn.

The Coil Supports.

Keep on winding in the same way, always passing over the nail in front of the one round which the last turn was made. When every nail has one turn on you have made 7 complete turns round the former.

Continue winding and make tapings at the 30th, 49th—you will then have 7 turns on each nail—130th, 150th turns, and then wind on another 10 to make the 160 turns.

The secondary coil consists of 200 turns in all, and is tapped at the 80th, 90th, 170th and 190th turns. Intermediate taps may be made but they are not really necessary.

Large coils such as these must not be removed from the former until they have been strengthened by brushing them over with shellac varnish and baking in the oven for a few minutes to make them hard and rigid.

other is the secondary or crystal coil. The aerial is only roughly tuned, while the crystal circuit is tuned very finely by means of a variable condenser as well as tapings.

Very accurate adjustment and the elimination of interference is seldom necessary when listening to a station a few miles away, but when the amateur desires to get 5 X X or other distant stations, the limits of his set are very soon discovered.

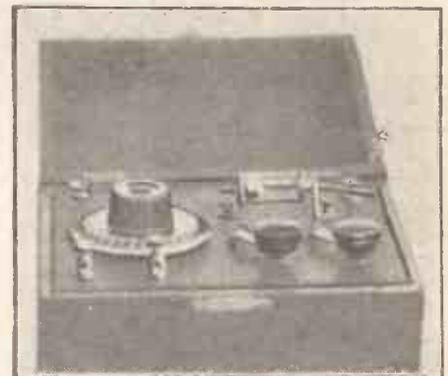
For instance, in Birmingham very few crystal users can get Chelmsford without strong interference from 5 I T.

are used, as they look neater than most commercial products.

Winding the Coils.

First obtain a cylindrical wooden former 1½ inches in diameter.

The circumference of this must be divided into 15 equal parts. The best means of doing this is to wrap a piece of paper 1 inch wide round the former and cutting to make the two ends meet but not overlap. Remove the paper and mark off by means of a ruler the 15 equal parts. The paper may now be fixed to the former with a little gum.



The Complete Receiver.

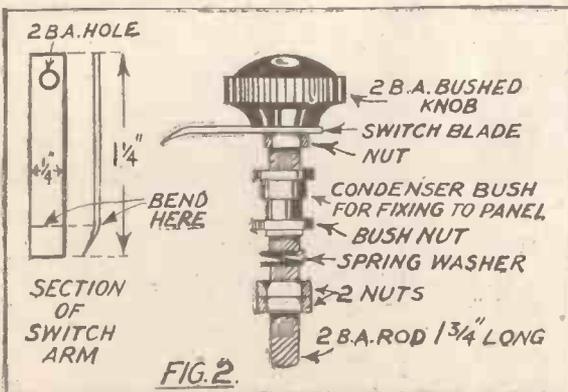
Thirty nails about 2½ inches long will now be required, 15 of these are driven into the former—one at each division on the paper, the other 15 being driven in exactly opposite to the first row but 1 inch away. Take care not to drive them too far as they will have to be removed on the completion of the coil, and see that they are all arranged radially from the centre. Five ounces of 28-gauge D.C.C. wire will be needed for the two coils.

The aerial coil has 160

Remove the nails carefully and slide the coil off the former; if the shellac has caused it to stick, do not force it but carefully ease it with a penknife.

Cut two pieces of fairly stout cardboard the size of the largest coil, and make a hole in the centre of each to take a 2 B.A. rod. Make six small holes, starting about ¼ in. from the centre hole and going towards the edge, and through these draw the ends of the coil and taps, the beginning through the first hole and the end through the last.

When both coils have been treated in the same way, place them on top of one another with the cardboards outwards, and pass a length of 2 B.A. screwed-rod



(Continued on page 1144.)

HOW TO MAKE A COMPACT CRYSTAL SET.

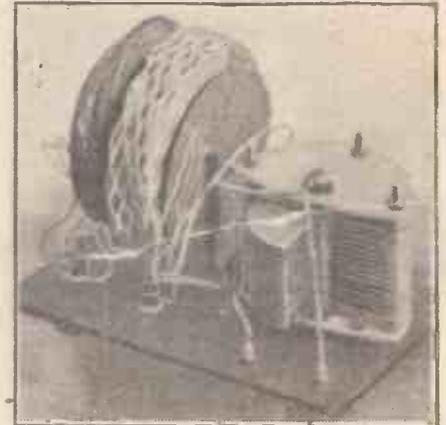
(Continued from page 1143.)

through the centre, tightening up with a nut each side.

The two coil supports are made from fairly stout strip brass about $\frac{1}{2}$ in. wide, and

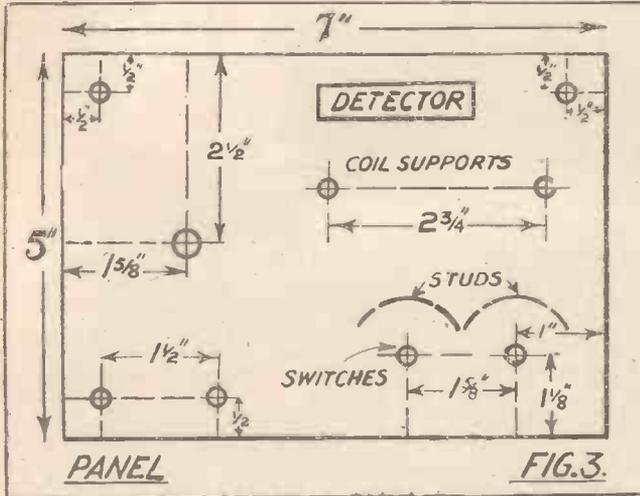
Before making the holes for the contact studs, the bush should be fixed to panel and the switch inserted so that the arm when turned rubs the panel, making a semi-circle. There are five contact studs to each coil, and the centre stud should be exactly opposite the switch bush. When the position for this stud has been marked on the line made by the switch arm, the positions for the two studs each side should be also marked. Make sure that studs are equally spaced. From the centre of one stud to centre of the next should be about $\frac{3}{8}$ in.

Sometimes reception is improved by varying the distance between the two coils, and if this is so in your case, a piece of insulating material may be placed between the coils to keep them in the required position.



The position of the coils is shown by the above.

The working of the set is a little more complicated than most sets, and some patience is required to get the very best out of it.



The Connections.

Be careful in arranging the second row of studs, or they may foul the first set. All the parts may now be mounted on the panels, making sure that the terminals, contact studs, bushes, etc., are all tightened up so that they will not work loose with constant use.

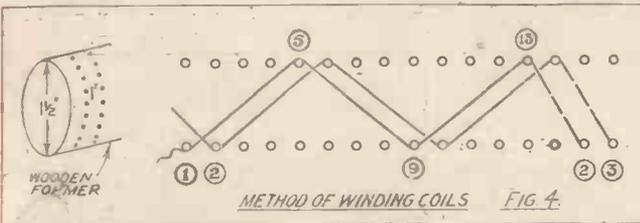
The coils should not be fitted in the supports until all the soldering is finished.

Fixed plates of condenser to switch arm of 200 coil and crystal side of detector, moving plates to one 'phone terminal and end of coil. Contact arm of detector to other 'phone terminal. The other coil is connected one end to aerial, and the contact arm to earth. (See Fig. 5.) Great care must be taken in connecting the taps to the studs.

It is best to so arrange the taps of each coil that both switches work in the same direction.

are easily made as shown by sketches on Fig. 1. If you prefer to make the switches, the type illustrated in Fig. 2 is very simple and neat, and needs no further description. To make the contact arm perfectly tight,

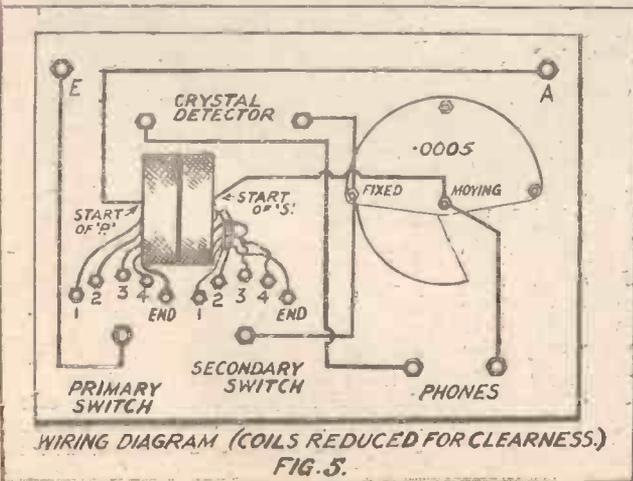
and end of coil. Contact arm of detector to other 'phone terminal. The other coil is connected one end to aerial, and the contact arm to earth. (See Fig. 5.) Great care must be taken in connecting the taps to the studs.



hold the knob firmly between the thumb and finger, and screw the nut which is under the arm upwards until you can hardly move the arm. The panel should be drilled as shown by Fig. 3.

touching another. dimensions should be constructed—preferably with a lid to exclude dust, etc.

Turn both switches to their first studs, adjust crystal, and revolve condenser slowly;



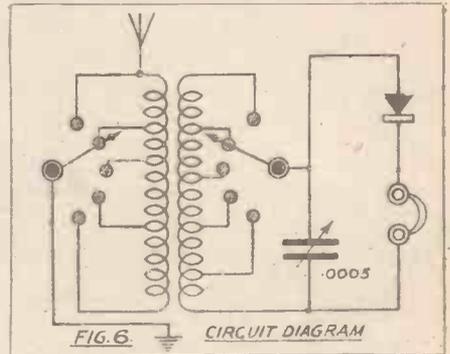
Operation.

The coils may now be carefully fitted between the supports and adjusted so that none of the taps is

A case of suitable dimensions should be constructed—preferably with a lid to exclude dust, etc.

if no result turn switches to second studs, and again turn condenser. If signals are faint try third studs or aerial switch to second stud, and crystal switch to third.

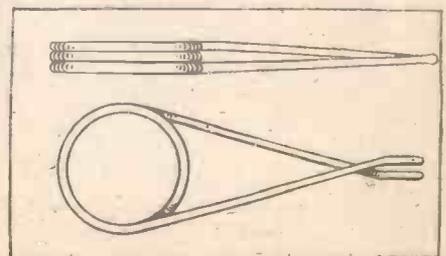
Under certain conditions the writer has found that best results are obtained when one of the switches touches two studs at the same time. Chelmsford should come in on fourth or fifth studs, and should be louder than you have been able to get it on an ordinary set.



It may be mentioned that when only a few miles from a station the set will work without an aerial, though not giving very loud signals.

CRYSTAL TONGS.

THE sketch shows a pair of spring tongs made from a length of cycle spoke. It should be bent three times round a circular bar (a round ruler will do excellently). The ends cut off to same length, and super-imposed and flattened a little. The springiness of the tongs will hold the crystal, and finger pressure is only necessary to pick up or release.



Mainly About Broadcasting

By
The Editor

MY request, in a recent article, that readers of "P.W." should let me know whether they could beat the record set up by Mr. Thomas with his crystal set has resulted in a perfect shower of letters which I find it impossible to deal with individually. Let it suffice that dozens of my correspondents claim to have beaten Mr. Thomas's record.

Several of the letters received will appear in due course in the Correspondence columns of "P.W."; but I would like to take this opportunity of thanking all those correspondents who have written to me on the subject and to inform them that, even if some letters do not appear in "P.W.," it is only because of absolute lack of space. I have been very much amazed at the results achieved by crystal users, and some of the letters have proved extraordinarily illuminating as to the possibilities of a good crystal set in the hands of a really keen amateur.

Once again, I would like to thank my many correspondents for the trouble they have taken in writing to me.

Lunch Hour Concerts.

The B.B.C. announce that they will shortly arrange for another broadcasting "stunt" which should prove even more interesting than their recent experiments in connection with broadcasting the song of the nightingale.

I hear they intend sending engineers with a portable transmitter and an expert naturalist up the River Alde, in Suffolk, which is one of the most popular resorts of wild fowl in the country. There they hope to be able to broadcast the cries of wild fowl, at the same time giving a description of their habits and environment. The conclusion of this "stunt" should prove rather interesting, as a blank cartridge will be fired into the air in order to startle the birds, and it is anticipated that the report of the gun will induce thousands of wild fowl to rise up with a startled flapping of wings and a medley of cries, which should try the microphone to its utmost.

Some of the German broadcasting stations have been trying an experiment lately which has proved exceedingly popular.

Breslau, for instance, recently arranged a special lunch programme every day for the benefit of workers taking their lunch in factories and workshops, and many German manufacturers have installed loud speakers in their works. The idea has proved so very popular, I hear, that several other German cities are following up the example of Breslau. Loud speakers are to be installed and maintained in town halls by the municipal authorities, and admittance to these wireless concerts will be free to the public. This idea might well be carried more into effect in this country. One can imagine that a good lunch hour concert in some of our popular restaurants would be a welcome innovation, though whether people would hurry back to work according to schedule remains

doubtful. Anyway, it is an idea which is well worth trying out.

As these words are being written—some few days prior to the New Year—it is understood that the official ban on the use of foreign-made wireless apparatus is to be removed by the end of the year and possibly by the time these words are read this ban will have been lifted and the British wireless industry will have begun its fight to protect the home market. I have very carefully collected information on the possibilities of an invasion of foreign-made wireless apparatus, and I have come to the conclusion, based on very sound evidence, that, for at least twelve months, manufacturers have absolutely nothing to fear from imported German apparatus.

Foreign Competition.

The Germans have three types of goods which might prove competitive, and they are, dull emitters—which, I hear, might be on sale in this country at the extraordinary low price of five shillings—telephones, and dry batteries; but I feel sure that in the matter of condensers, coils, complete sets, etc., the Germans have a very long way to go before they can possibly place on the market such efficient apparatus as is now supplied by British firms.

There is no doubt, however, that America is in an excellent position to flood this country with American apparatus. But nevertheless I feel confident that the two years' grace given to British manufacturers has proved enough to enable them to build a solid foundation for the new industry, and any foreign competitor will find it exceedingly difficult to get a good foothold in the British market. Anyway, it is up to the British amateur to stick to British goods. I would not recommend this course if British goods were not up to standard, but there can be no doubt that they are, and that when you buy a good British wireless component or a good British wireless set, there is no other market in the world where you can get

such value for your money and such a guarantee for efficiency and thoroughness.

The N.A.R.M.

The National Association of Radio Manufacturers, which has a membership of about 690 manufacturing firms—64 wholesalers and about 100 retailers—has been agitating for a continuance of the ban on foreign apparatus. One of their officials was reported in the "Evening News" the other day as saying: "It is obvious what will happen now. The country will be flooded with cheap foreign stuff and our manufacturers will suffer."

I think this official is unduly pessimistic, and that the Postmaster General's decision that he considers he is no longer justified in maintaining the ban will not prove so deleterious to the progress of wireless in this country. The attitude of the B.B.C. is that British made sets and parts should be preferred to foreign articles, and with this attitude I thoroughly agree.



A new type of ship's lifeboat transmitter, now on view at Baltic House.

MY HOLIDAY AND WHAT CAME OF IT.

By "ARIEL."

JUST after Christmas five learned physicians gathered round my bedside and, with one accord, said, "Young man, if you do not take a holiday, the world will be the poorer for the loss of a great man."

And it came to pass that the next morning I rose from my bed, packed the usual things one packs when going on a holiday, and departed with the fervent good wishes of the editor and staff, in the hope that I should never return, to the balmy delights of Weymouth, and there, having installed myself in an hotel, I began to wonder how I should kill time. Not being a married man I had no wife and children to look after, and so I decided that I would make a few impromptu visits on people in the town over whose houses I should spot acrials.

My first visit was to a gentleman about whom I knew nothing at all. But by careful deduction, my dear Watson, I had satisfied myself that he was the possessor of a "P.W." Unidyne set. In other words, his dealer had told me so.

His Unidyne Set.

This wireless pioneer lived at No. — in a long road, in which all the houses were exactly the same. Having verified the number on the gate by the laborious method of counting the houses as I went along, I knocked at his front door, and just as the sound of his knocker resounded up and down the street, I remembered with dismay that I had really no excuse for calling upon him.

But there was no time for retreat. Before I had even time to frame an opening sentence, a voice behind me remarked, "Yes, what do you want? Is it about the Local Election?"

"But, excuse me," I gasped hurriedly, "I am not—"

"I'll tell you what," he interrupted, patting me on the shoulder. "You go to No. — over there. They are all labour there—as red as lobsters. You tell them what it will mean to them if the Tory gets in, and then you needn't feel you have wasted your afternoon." By this time we were at the gate of his garden, and he indicated No. — across the road.

"But excuse me a moment," I said, as he turned to leave me, "I am a wireless amateur, not a canvasser, and I wanted to talk to you about wireless." I shouted these last few words just in time to prevent him shutting his front door. The expression on his face altered suddenly.

"Oh, so that's what you are!" he exclaimed with relief. "Come in, my friend. Who sent you to me? Tell me, do you know much about wireless?"

"Not very much, I'm afraid," said I with some modesty. (To-day's great truth.—Ed.) "But I came to see you because I heard that you had got a set without batteries. Is that true?"

"Oh, not quite so bad as that," he replied, laughing. "My set works without an H.T. battery. Would you like to see it? It is the Unidyne set, described recently in POPULAR WIRELESS. Do you never see that paper?"

"Yes, I have read it," I replied, feeling a little nervous at my ambiguous position.

"Well, I take it every week," said he, "and my missus likes it, too."

"What?" I exclaimed with astonishment. "Is your wife a wireless amateur, too?"



A meeting of the Mounslow and District Wireless Society showing some of their transmitting and receiving gear.

"Hardly that," he grinned, "but she reads the articles by that bloke called 'Ariel.' I have read some of them myself, and they don't seem to be half bad. But, of course, that kind of thing doesn't interest me much, because I'm technical. This is my missus," he added, as his wife entered the room, drying her hands. "This gentleman is a wireless man," he explained to his wife, "and he has called to see my new set."

His wife muttered a few words about kitchens being untidy on washing day, but it didn't seem to worry her better half. He escorted me into the kitchen, and displayed to me the familiar exterior of the Unidyne.

The Next Step.

"I reckon this is the best set I have had yet," he announced with pride, as he opened the cabinet. "A lot of my pals are making it up, since they saw mine. I tell you I can cut out any ship station, and I can get 6 B M loud—so loud that it would knock your head off."

Unfortunately I could not try the set, as it was too early in the day for any broadcasting to be going on. But I promised that I would, if possible, call again that evening to prove the truth of his words. I

still felt rather uneasy in my mind about the deception I had practised on my new friend, and it was not until I got right out of his street that I began to feel happy again, and could screw up my courage to tackle a few more amateurs.

At last I discovered a promising-looking street, in a very different part of the town. I walked boldly up to the house numbered— and knocked at the door. It was opened by a magnificent lady, who seemed to have been built rather for comfort than speed.

Caught Out.

"Well, my good man, what do you want?" was her disconcerting opening. Again I found myself wishing that such a scheme had never entered my head.

"I—I am a wireless amateur," I stammered feebly. "Could I speak to your er—"

"Don't you come here talking to my Tom about wireless," she snapped irritably. "I get it morning, noon, and night as it is."

In fact, I can't get a word in edgeways when his infernal loud speaker is going. You hop it! Good-morning," and she slammed the door with a resounding bang, leaving me flattened out on the front-door step.

I staggered across the street to No. —, which had an aerial fixed on the roof, and again knocked at the door.

"Good-morning," I began courageously, just as the door opened. "I am—" But a red and angry face shot round the door.

"Not to-day, thank you," and the door banged.

In despair I decided to go back to the hotel, and take a well-earned rest. And I was strolling along the promenade, when I felt a tap on my shoulder. I turned round quickly, and there was my friend from No. —. How I longed for the apparatus of the man who controls life and death, so that I might instantaneously death-ray myself! But unfortunately, Mr. Grindle Matthews was far away.

"Aren't you 'Ariel' of POPULAR WIRELESS?" he inquired. I had to admit that his surmise was correct.

"Well I never!" he exclaimed. "Directly I set eyes on you I thought 'I have seen that chap somewhere before.' But it was the missus who hit the matter on the head as usual. She saw you pick up 'P.W.,' turn over a page, and lay it flat down on the table. So when you had gone, she had a look what it was that you wanted to hide from us. And it was your own photograph. The missus guessed all the time who it was, but she said to me 'He must be up to some stunt, and that's why I didn't ask him at once who he was.' Supposing you tell me the truth about it!"

Having no alternative, I could not but tell the whole story, and seldom have I seen a man laugh so much. As it was at my own expense, I didn't much enjoy the joke.

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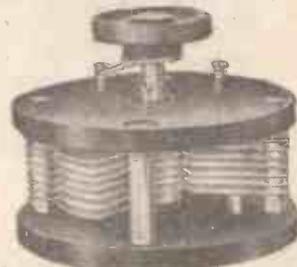
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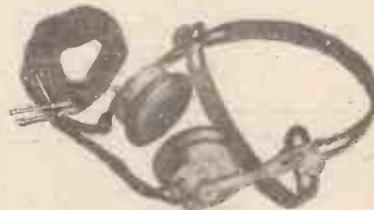
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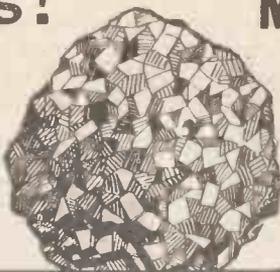
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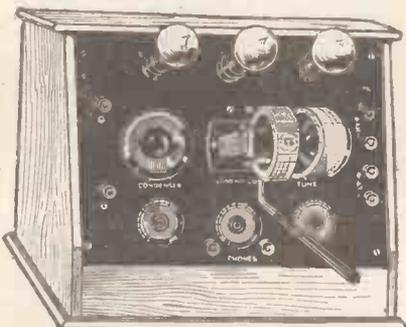
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HOW TO CONSTRUCT A USEFUL WAVE-METER

FROM A CORRESPONDENT.

No real experimenter should be without a wave-meter. In these days of long distance reception of so many different stations, the possession of the handy component described in this article will prove of the utmost value.

THE wave-meter described in this article was made by the writer for a friend with a transmitting licence, who wished to measure accurately the wave-length of both received signals and his own transmission, and who also required some system of "side tone" so that he could listen in to the quality and strength of his speech. Of course, such an in-

which a double-pole double-throw key switch connects either; (a) a high note shunted buzzer in series with a 4½-volt dry battery, or (b) a 'phone jack in series with a perikon crystal detector.

The two photographs, Figs. 1 and 2, show clearly the construction of the instrument, and Fig. 3 shows the circuit.

The writer does not intend to give minute con-

structional details, as these can be varied to suit any

parts the experimenter may have by him. It is important, however, that good quality components be used, especially a good variable condenser, which should be very

rigid, and have thick plates.

The condenser used in the instrument described is a Sterling "square law" type which has the advantage of greatly facilitating the plotting of wave-length charts.

When the wave-length obtained with a given coil and a square

law condenser is plotted against the condenser reading, a straight line is obtained, whereas with the ordinary type of variable condenser a curve results.

When calibrating the instrument, therefore, all we need to do is to find the



Fig. 1. Showing the neat appearance of the completed instrument.

instrument is of greatest use in measuring the wave-length of incoming signals, and for this purpose the keen experimenter will find a wave-meter a necessity.

The instrument consists of a variable condenser connected in parallel with a plug-in coil, constituting the tuned circuit across

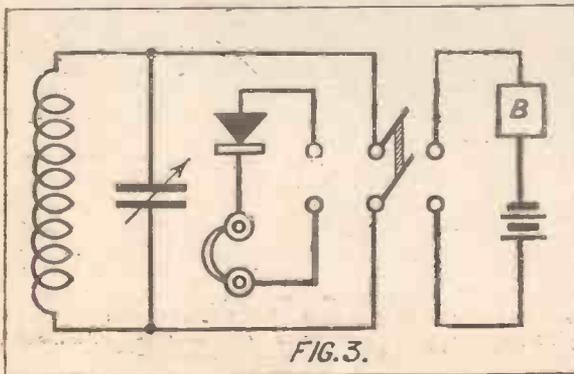


FIG. 3.

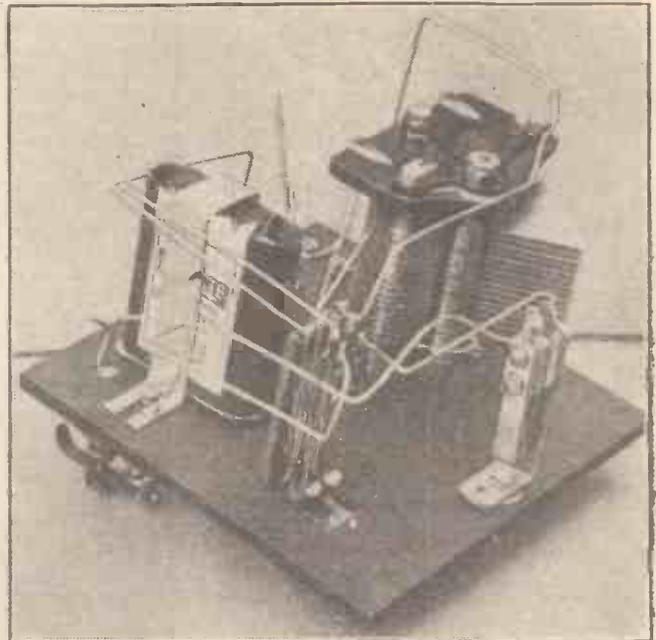
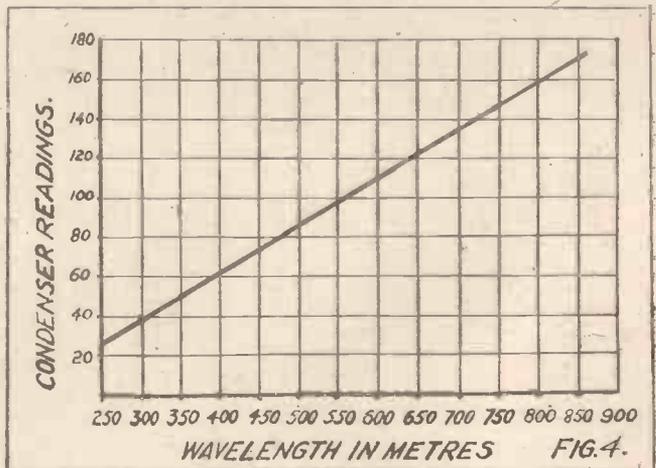


Fig. 2. A view of the under-panel wiring. Note the well-separated, rigid wiring.

wave-length at two positions of the variable condenser (three or four for safety) with each coil, and connect these points on our chart by a straight line. It is advisable not to let these condenser readings lie within the first ten or fifteen degrees of the dial. Fig. 4



shows a specimen wave-length chart, and it should be noted that if these are drawn on large sheets of graph paper more open readings and greater accuracy will be obtained.

Of course, the best method of calibrating a wave-meter is by direct comparison with a standard instrument, but as there are now so many stations transmitting on fixed and

(Continued on page 1150.)

CHATS WITH A PHYSICIST

By Sir J. KENNETH D. MACKENZIE, Bt., F.R.G.S.

"THAT 'Death Ray' controversy, Professor," I said, "about which we heard so much a few months ago, seems to have petered out. Do you think there was really anything in it, or was it merely a journalistic 'stunt'?"

"No, it was not that," my friend replied, "but rather a case of 'counting your chickens before they're hatched,' so far as being able to substantiate the claims made was concerned. Research work is going on in that direction in other countries besides ours, and I think developments are coming which will have far-reaching effects. You haven't forgotten, I suppose, the recent excitement about that 'Ray' which was to be used for bringing down aeroplanes, stopping motor-cars, and so on? Nothing is being said about it now, and wisely, too, I think, for there is nothing to be gained scientifically by publicity in matters of that kind."

How Energy is Wasted.

"Yes," I assented, "there was too much needless alarm only a couple of months ago over Dr. Walls' experiments in Sheffield with the atom. Many nervous folk thought that if he succeeded in 'bursting the atom,' as the papers called it, he might probably blow up the whole world in one blinding flash."

The professor laughed.

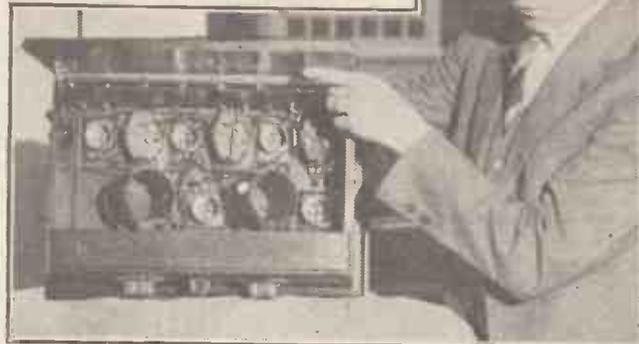
"Yes, I haven't forgotten," he went on; "but that was an atomic matter, not a radio one, though whether they are not ultimately the same thing, perhaps, we shall learn one day. I'm not able to say, for we're really only beginning to learn, and the wisest of us is as yet only a Freshman at the University of Nature. You see, radio, or wireless, is but a newly opened book, and we're only in the first chapter which, however, covers an advance in knowledge more rapid than had been gained in any other branch of applied science in the same time. It is really wonderful when you come to think of it the strides that have been made within the past three years.

"The trouble is that many people have an exaggerated idea of the power or energy involved in 'broadcasting,' the only practical application of wireless with which they have any acquaintance at present, and think that because sounds can be sent and received anywhere within the limits of this world of ours, other effects are being caused by the 'wireless waves.' Even blame for the wretched weather we've had is laid upon wireless; not a few people imagine that the numberless aerials scattered over the country are the cause of so much rain. I wonder what idea they have of the electrical energy picked up by their aerials to work their receiving sets? Has it ever occurred to you that the present system of wireless transmission is the most wasteful distribution of energy that science has yet evolved?"

"Yes," I replied, "I admit it has. The only parallel I can think of is the stupendous energy apparently wasted by the sun, which radiates it in every direction seemingly for

the benefit only of a dozen or so planets and their satellites which revolve round it in practically one horizontal plane. Every transmitting station is doing the same thing, radiating electric energy in every direction as from a common centre to be utilised only in the one plane in which receiving aerials are situated. One hears of a 'Heavyside layer' to account for radio energy being forced to follow the earth's curvature, but that always strikes me as being something like 'cannoning off the top cushion into a bottom pocket'! I've often wondered how many receiving sets could be worked from one transmitting station of a given output. Surely there must be some limit, for one can't receive more than one gives out, even supposing there were no loss in transmission."

"Naturally, but though hundreds of horse-power may be used to transmit sounds from one powerful station, only



A new five-valve Neutrodyne receiver that employs two neutroformers instead of the usual three. Only two tuning controls are provided.

A USEFUL WAVE-METER

(Continued from page 1149.)

published wave-lengths, it is quite a simple matter to calibrate from our receiver. The B.B.C. stations and the harmonics of your local station will prove useful in this connection.

The other components used on the instrument are a W. & M. perikon crystal detector, an Eriesson key switch with contacts arranged as a double-pole change-over switch, and an Eriesson high-note wave-meter buzzer. The owner of the instrument is using a set of Gambrell coils, although the one shown in the photograph is an Igranitic. It must be understood that any reliable well-made components may be used in place of those mentioned.

The Non-inductive Shunt.

In order to sharpen tuning, a 15 ohm non-inductive shunt is connected across the magnet coils of the buzzer. The resistance of the buzzer itself is 25 ohms, and it would perhaps be better if the shunt had a lower resistance than 15 ohms, but then a heavier current would be drawn from the small

billionths of a horse-power are picked up by any one receiving aerial, and thus in one way receivers might be numbered in billions also. But remember that since these receivers are all in one plane of, say, a mere hundred feet in thickness, the proportion of energy radiated and utilised by them is infinitesimal compared with the total output of that station, and so might place some calculable limit to their number.

Power Transmission Possibilities.

"And don't forget, also, that it is only the simple crystal sets which depend solely on the energy received to obtain results which are effective. Directly valves are used or even an amplifier, local power is employed which does the work when they are set in action by what comes from the distant station. It is the local battery and accumulators you rely on to give you what you want, the impulses received from the distant station being merely the controlling influence, though, of course, all-important.

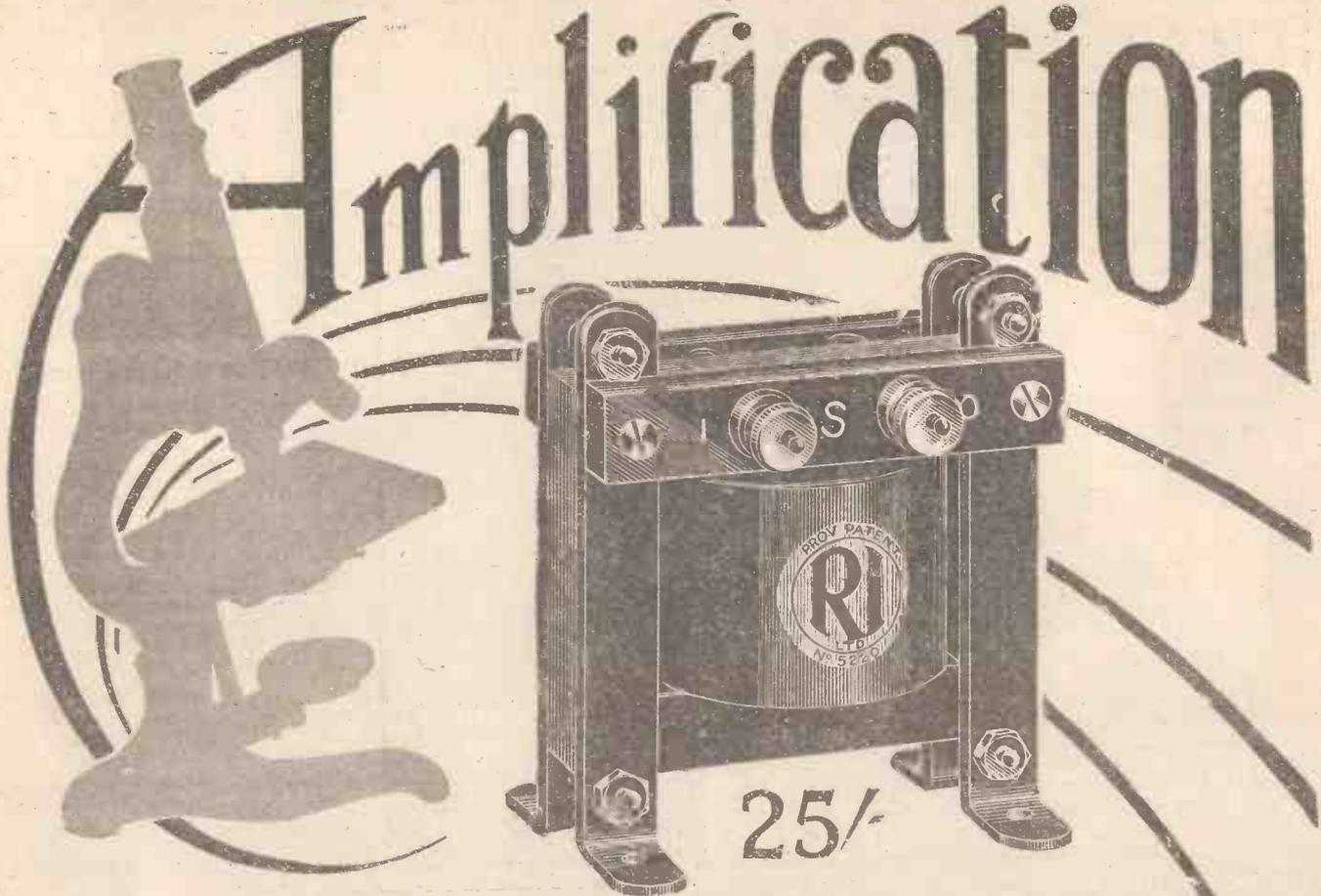
"Undoubtedly 'directional' wireless for long-distance signalling is the coming thing, for in that way concentrated energy can be applied where and how it is wanted, and not flung broadcast to waste an all but infinitesimal portion of it. Perhaps through some means of that kind we may eventually discover how energy of a serviceable amount can be transmitted by radio to do work at a distance directly and without having to employ local power."

pocket lamp type dry battery, which would consequently have a shorter life. The shunt consists of about 10 in. of No. 42 S.W.G. platinum wire, doubled back on itself and wound on a small piece of mahogany.

The 4½-volt dry battery is held in place by a stiff metal spring clip, which in turn is secured to the panel by one of the detector screws. This battery is consequently easily replaced, a touch with a hot soldering iron being sufficient to release the stiff wires which are soldered to the battery contacts. It will be noticed that the instrument is wired with square tinned wire, which as well as being efficient is neat and easy to work. A 'phone jack was fitted to the panel as all the owner's 'phones are on plugs, but it would perhaps be better practice to provide terminals. The oblong hole for mounting the key switch is made by drilling all round the sides with a small drill, and then filing to shape.

Those who never anticipate carrying out any transmitting experiments may leave out the crystal detector and 'phone terminals, and this will, of course, simplify the construction of the instrument.

In conclusion, the writer is sure that anyone making a wave-meter on the lines indicated above will find the instrument of great use in experimental work, and will feel amply repaid for his trouble.



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ROYAL COLLEGE OF SCIENCE,
 Dear Sirs,
 It may interest you to know that I have recently scientifically tested your "GIL-RAY" crystal. Its performance was truly extraordinary when tested both electrically and on a Crystal Set. From its characteristic curves it would appear to be particularly useful in Reflex Circuits.

L. C. — D.I.C., A.I.C., etc.

PRICE 1/6
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THE GILRAY RADIO CO.,
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WIRELESS FOR THE BEGINNER.

Ry E. BLAKE, A.M.I.E.E.

PART 9. CONDENSERS AND INDUCTANCE.

BEFORE leaving our study of electrons and turning to the thermionic valve, a few facts about condensers and tuning coils should be given, as these instruments will be shown and described when valve circuits are explained.

In its simplest form an electrical condenser consists of two conductors of electricity separated by a non-conductor; for example, two sheets of copper separated by a layer of air, or two sheets of tin foil with a sheet of mica, ebonite, or glass between them.

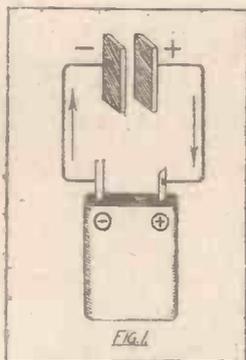


Fig. 1 depicts a battery to each terminal of which is connected a metal plate. Before the plates are so joined to the battery there is a difference of potential between the positive and negative terminals of the battery; this P.D. is equal to the E.M.F. of the battery, and in the case of the common type of "flashlamp" battery is about 4.5 volts. Before the plates are connected up there is no difference of potential whatever between them.

"Charging" a Condenser.

When the plates are connected up as shown in Fig. 1, the effect is simply to make the battery terminals longer; in fact, the plates become the battery terminals and therefore acquire the same potential difference, namely 4.5 volts. The plate which is connected to the negative (-) terminal of the battery becomes negative with respect to the other plate. Now, from what we have learned about potentials, we can see that if both plates started alike and finish by having a potential difference, then the negative plate must have gained some electrons and the positive plate must have lost some, because a negatively-charged body has an excess of electrons and a positively-charged body has a lack of electrons. It is evident, therefore, that when the plates are joined to each other through the battery, a flow of electrons must have taken place from the plate which was connected to the positive terminal to the plate connected to the negative terminal. This current is called the "charging current."

The Unit of Capacity.

The process of withdrawing electrons from one plate and adding them to the other goes on until there are so many electrons on the negative plate that the force they exert in order to try to flow back to make up the deficit of electrons in the positive plate is equal to the force (E.M.F.) of the

battery tending to keep them where they are, and equilibrium is attained. The condenser is then "charged."

The amount of current (or electron flow) required to bring a condenser to a given potential difference is the measure of its "capacity," although "capacity" is measured in units called "farads." The capacities of the condensers usually found on receivers are small fractions of a millionth of one farad, such as, for example, a condenser of 0.001 microfarad capacity.

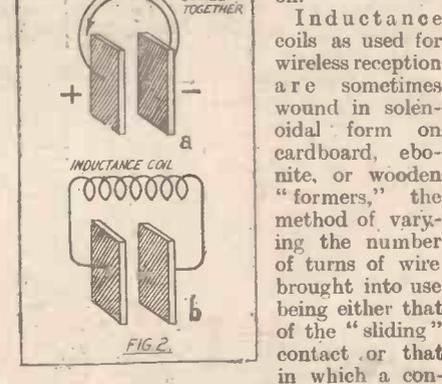
Explaining Oscillatory Currents.

The non-conducting material between the plates of condensers is called the "dielectric." The ordinary variable condenser used for receiving sets has aluminium or brass plates and a dielectric of air; fixed condensers, such as those connected across telephones or used with grid leaks, are often made of tin-foil with a mica dielectric.

beginning to move as a current, and their stoppage, as well as opposing any increase or decrease in their movement. Therefore, when the electrons are flowing from the negative plate to the positive plate through an inductance coil, the process is not brought to an end when equilibrium is reached, because owing to the inductance of the circuit there is opposition to a cessation of the movement of the electrons, which accordingly begin to pile up on the once positive plate, which thus becomes negative, whilst the formerly negative plate becomes positive. Then the discharge starts again in the opposite direction, but again the rush of electrons overshoots the mark and the plates again reverse their polarity. This oscillating discharge goes on until all the electrical energy originally stored in the condenser has been frittered away, some as heat, and some radiated in ether waves.

Different Types of Coils.

An oscillating circuit, then, must contain capacity and inductance. The number of oscillations per second set up in it when the condenser discharges, or, in other words, the frequency of the circuit, depends upon the values of the capacity and inductance; the greater their product the lower the frequency. It will readily be seen that by including a variable condenser, or a variable inductance, or both, in an oscillatory circuit we can adjust the frequency of the circuit to any value we please, within the limits of the instruments. The use of this arrangement will be appreciated later on.



Inductance coils as used for wireless reception are sometimes wound in solenoidal form on cardboard, ebonite, or wooden "formers," the method of varying the number of turns of wire brought into use being either that of the "sliding" contact or that in which a connection is taken from, say, every tenth turn and soldered to a flat metal stud over which a slider passes. This form of coil is perhaps most frequently seen nowadays on the cheaper crystal sets. Coils wound into compact packets, called variously "basket," "honeycomb," "pancake," or "spider-web" coils are largely favoured because of the easy means they provide of avoiding a certain adverse effect ("dead end" effect) met in the use of solenoids, and for other reasons. These coils are not variable, and the adjustment of the circuit is wholly effected by varying the condenser.

GUIDES FOR WIRELESS CONSTRUCTORS.

The "Best Way" Wireless Series.

TWO of the finest books for the Home Constructor will be published on January 15th, price 6d. each.

THESE two 28-page books, first of a "Best Way" series for amateurs, deal respectively with "How to Make Crystal Sets," and "How to Make Valve Sets."

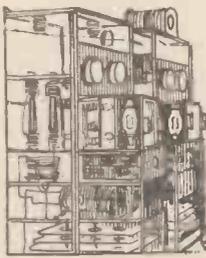
PRINTED on art Paper and with dozens of excellent photos and diagrams, these two books represent high-water mark in wireless publications.

A PICTORIAL blue print is given away with the book on Valve Sets.

ORDER your Copies Now. Price 6d. each.

Reverting to the condenser joined to the battery, it may be now understood that if the condenser is disconnected from the battery it remains charged to a P.D. equal to the E.M.F. of the battery. If the two plates are then connected to each other by a high resistance wire, as in Fig. 2 (a) there will be a flow of electrons from the negatively-charged plate to the positively-charged plate until the deficit of electrons in the latter is made up. There will then be no difference of potential between the plates, and the condenser is "discharged." But if the plates are joined by a coil of wire (Fig. 2 b) and provided the resistance of the whole circuit does not exceed a certain value, there will not be a one-direction discharge current as in the first case, but an oscillating discharge.

The coiling of the wire greatly increases that property of all conductors which is called "self-inductance" or "inductance." This property has the effect of making the electrons act as though possessing inertia; that is to say, it tends to oppose their be-



Artistes of the Aether

By "Ariel"



Some of those who have given you pleasure when listening-in.

THE New Year in broadcasting circles promises well, though from a glance at some of the programmes, probably the "high-brows" will want to sing a paean of triumph, for these show a decided increase on the side of classical items.



M. Ernest Ansermet.

Chamber music has certainly received signal honour by the fact that the most famous body of players, the London String Quartet, consented to broadcast from the 2 L O studio on Wednesday week. Consisting of the four well-known artistes, James Levey (leader), Thomas Petrie (2nd violin), H. Waldo Warner (viola), and the chief Queen's Hall Orchestra 'cellist, Warwick Evans, it was formed some sixteen years ago, but under the leadership of Albert Sammons, the famous violinist.

After two years' rehearsal, their first appearance was made at Wigmore (then Bechstein) Hall, in 1910, and a very uphill struggle it was, for chamber music was then at its lowest ebb. Season after season passed, and the L.S.Q. became more and more firmly established by reason of their series of classical "Pop" concerts at Aeolian Hall. Continental tours were made, and Mr. Sammons, unable to put aside his many other engagements, relinquished the leadership first to Mr. Arthur Beckwith, another Queen's Hall leader, who in turn, during the American tour, yielded it to Mr. Levey.

The Spirit of Christmas.

This was finely maintained at all stations, which for the most part provided their own carol programmes, but 2 L O went to the fountain head by relaying the Royal Choral Society's concert from the Albert Hall on Saturday, 20th ult. With the choir conducted by Mr. H. A. Balfour, and the soloists Mesdames Megan Foster, Olga Haley, Mr. Parry Jones and Mr. Peter Dawson, excellent results were obtained.



Mr. William Anderson.

Miss Megan Foster is one of our best-known English concert artistes, and there are few classical or ballad concerts at which she is not a star artiste. Her own song recitals at Aeolian and Wigmore Halls have placed her on a very high plane of success, for she possesses a voice of great mobility of tone, and perfect diction.

Wireless Pantomime.

A unique innovation was made, up in the North, by the relaying of the entire pantomime "Humpty-Dumpty" from the Palace Theatre, Aberdeen. Frankly, however, I think even the most decorous of youngsters will refuse to regard it as anything but a "make-shift," for after all, three-quarters of the pleasure of pantomime is the spectacle and the excitement of the actual visit. No, I am afraid I join issue with all the kiddies who "go on strike" for a real visible pantomime.



The London String Quartet.

It has been a great disappointment to most opera lovers that the British National Opera Company were unable to have a Christmas season in London. Luckily there has been the "Old Vic," and 2 L O threw itself nobly into the breach with its recent S.B. programme, "An Evening with Grand Opera," supported by the B.N.O.C. stars, among whom were Beatrice Miranda, Constance Willis, Browning Mummery, William Anderson, and the Male Voice Choir of the B.N.O.C.

Well-known Bass.

Mr. William Anderson possesses one of the finest bass voices in the company, and his performances in past seasons, particularly in "La Bohème"—at which royalty were present—added to the entire success. In the studio his voice radios quite well, and noteworthy scenes were those from "Faust" and "The Mastersingers."

Symphony Concerts.

Frankly speaking, from a wireless standpoint only, these concerts are not entirely a success. To get the best results, the studio built for radio purposes must surely be better than any hall, and though Covent Garden Opera House suits a big orchestra quite well when heard in the hall itself, "over the aether" most of the beauty of tone is lost.

Probably fog caused many people to remain faithful to their home sets last month when the first of the new series of International Symphony Concerts was given. The programme was perhaps on the classical side, but some very good work was done by M. Pierre Monteux, the eminent French conductor who has made himself famous for his work with the Russian Ballet all over the world.

For the next at the same Opera House, on Jan. 15th, the orchestra will be conducted by an equally famous Continental conductor, a Swiss, M. Ernest Ansermet. He is well known on both sides of the Channel and has conducted some of the biggest national concerts. The soloist on this occasion will be Mr. Albert Sammons.

Another Popular Band.

The concerts relayed from the Piccadilly Hotel with De Groot have proved so popular that it is not surprising that another big restaurant band has been called into action. This is the Tea Band of the Trocadero Restaurant, and their interpolation between the two talks in the Women's Hour should provide a welcome change.

While on the subject of "talks," many of them probably unlistened-to, did the B.B.C. but realise it, there is one series that rivets attention.

These are the "music talks" by Mr. Percy B. Scholes, which are invariably of high literary value like all his works, and extremely to the point. Would that some other talkers would follow his example.



Miss Megan Foster.

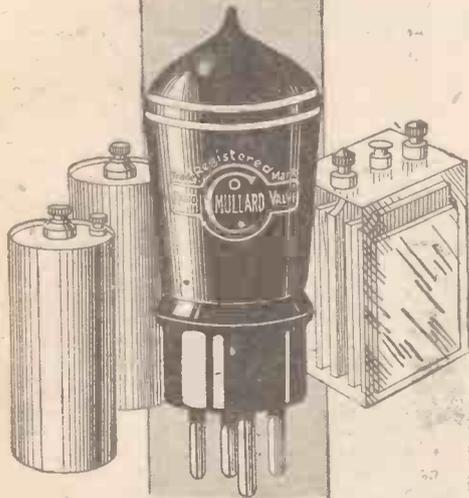


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Here are Master Valves for perfect long distance and pure tone reception.

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Mullard H.F. Double Red Ring Valves for H.F. AMPLIFICATION.

Type D.3 for accumulators - - - 21/- each.

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Leaflet V.R.20 gives full information.

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Mullard D.F.A.O. for 4-Volt batteries - 30/- each.

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Leaflet V.A.4 gives full information.

All these Valves bear the hall mark of

Mullard

THE MASTER VALVE

EXPERIMENTAL TERMINAL BLOCKS.

By OSWALD J. RANKIN.

THE insignificant-looking terminal block is probably the most important adjunct to an experimental outfit. Its function is to provide a convenient means of making efficient contact—to form an "elec-

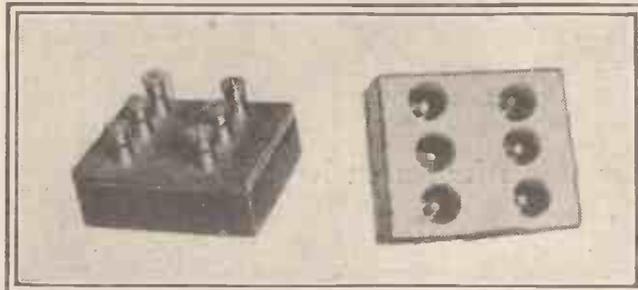


Fig 1—Two groups of three ordinary terminals connected together are employed in this type of terminal block.

trical junction," so to speak—for connecting wires which might otherwise be twisted together in a most unsatisfactory manner. It means, in fact, the difference between chance and certainty, and so it becomes an essential piece of apparatus in the hands of the experimenter who arranges his components on the baseboard principle in order to carry out unlimited experiments.

Two Different Types.

The terminal block illustrated in Fig. 1 is easily and cheaply made and consists of six large terminals, two strips of thin sheet brass each 2½ in. long by ½ in. wide, a piece of ⅜th matted-sheet ebonite 3 in. by 2½ in., a wooden block about ¾ in. in thickness, and two small wood screws. The constructional details are shown in Fig. 2. The brass strips (shown on the left) are first cut out and drilled to take the terminal shanks, these then being used as

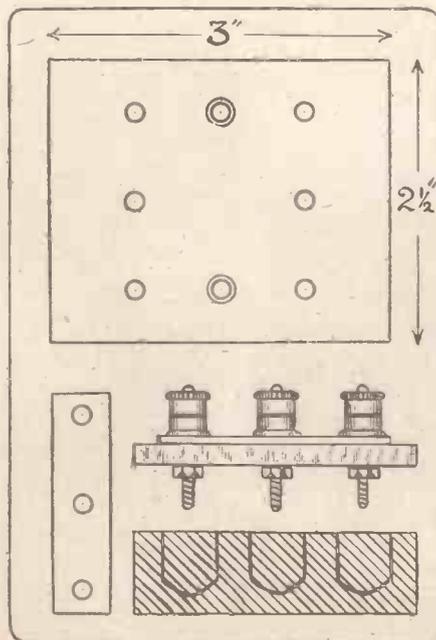


Fig. 2

templates for marking off the holes in the ebonite. The ebonite is then used as a template for marking-off the clearance holes for the terminal nuts in the wooden block which are made by means of a ½ in. or ⅜ in.

auger. These holes may either be bored as shown in the sketch or as shown in the photograph. The latter method is preferable since it is then possible to make any necessary adjustments to the terminal nuts at any time without removing the ebonite panel. Having drilled and countersunk the two holes in the ebonite for the wood screws,

the brass strips may then be placed under the shoulders of the terminals and firmly clamped to the ebonite in the manner indicated in Fig. 2. To complete the device the ebonite is screwed down to the wooden block as shown in the left hand illustration in Fig. 1.

Fig. 3 illustrates another type of terminal block which can be constructed very easily and cheaply. Here a pair of square-section brass rods, each about 2 in. long, are drilled and tapped to form double, triple, or quadruple terminals and then mounted on a

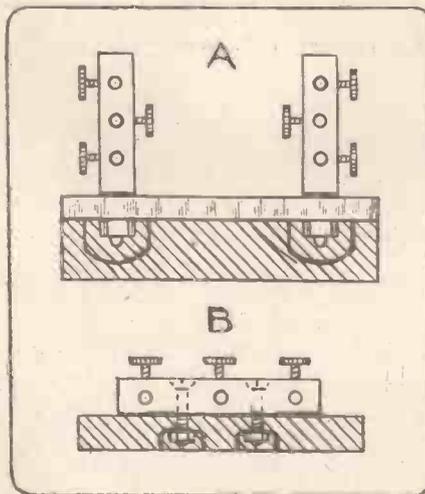


Fig. 3

small piece of sheet ebonite, in either of the methods shown. In diagram A (Fig. 3) a round shank is turned on one end of each rod, this being threaded to receive the nut which clamps the rod to the ebonite. The ebonite is then screwed down to a wooden block which is previously recessed to accommodate the nuts. Alternately, a small hole may be drilled and tapped in the lower end of each rod, the attachment then being effected by means of an ordinary machine screw. In diagram B (Fig. 3) the wooden block is dispensed with, the rods being arranged in a horizontal position and bolted to a piece of thick sheet ebonite in the manner shown.

Although such an arrangement possesses a very neat appearance, the addition of a wooden block is advised since this often prevents connecting wires from making undesirable contact with the table or baseboard. Fig. 4 represents a photograph of two terminal blocks made up on this principle.

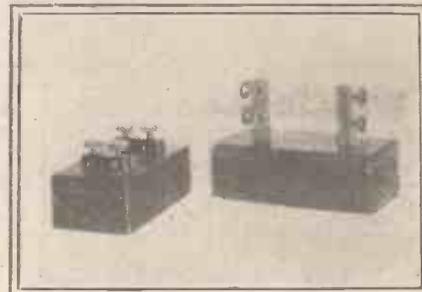


Fig. 4—Two illustrations of another design.

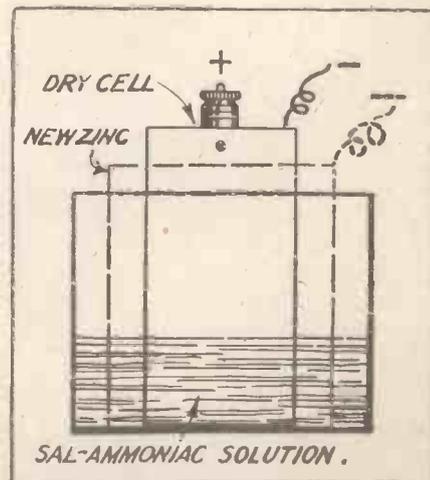
NEW LIFE FOR OLD CELLS

THOSE who use dry cells for running dull emitter valves may often get a new lease of life for their old dry cells by the simple expedient of immersing them in a saturated solution of sal-ammoniac.

If a run-down cell is examined, it will usually be found that the zinc casing has been eaten through in one or more places. The result of this is that although there is still plenty of zinc, the exciting paste has dried up.

In such cases it pays to drill a small hole in the zinc near the top and to stand the cell in a jar containing about two inches of sal-ammoniac solution. The solution will then work in where the zinc has been eaten away and be taken up by the absorbent material in the cell. The hole in the top of the zinc is to allow any air to escape in case the vent is choked.

The mouth of the jar should be waxed for about an inch on either side to prevent any creeping of the salts.



A dry cell treated in this way will often run for months; and when the zinc finally gives out, it can be replaced with a sheet of zinc bent into a cylinder to suit the jar.

The dotted line in the figure shows how the new zinc is fitted. Four ounces of zinc will give approximately ninety ampere hours.

A cell treated in this way is very convenient, for the small quantity of solution in the jar is not easily spilled.



See what you save by building one of these splendid Pilot Sets yourself.

THE Pilot System has solved the problem of the home built Set for thousands of Home Constructors. It has provided the only satisfactory method of getting an excellent Receiver which possesses the appearance of a ready-built Set costing five times the price at the cost of only the components. And anyone can build one of these Pilot Sets without previous experience. All parts are so carefully made that they fit together like a charm. The only tools required are screw-driver and a pair of pliers. Even soldering can be dispensed with if necessary.

Failure quite impossible.

No one has ever been known to fail. Even boys of fourteen have built up some of these well-known

multi-valve Sets and have got perfect results. With each complete set of parts is supplied a blue print containing all wiring instructions. Every step is carefully shown and failure is quite impossible. Even if you should go wrong the Set can be returned to our Service Dept., to be put into working order for a nominal charge. Remember any set of parts includes every possible item (except coils and valves) and is complete down to the last screw.

Send at once for our large Pilot Folder, showing illustrations of all the available Sets and their descriptions. A postcard brings it by return free. Comparison of prices will prove that you can save pounds by getting all your parts from one source of supply.

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Name of Receiver	No. of Valves	Price of Panel drilled and engraved	Kit of Components	Oak Cabinet	Baseboard
Popular Wireless 1-Valve Reflex	1	s. d. 10 6	£ s. d. 3 17 6	£ s. d. 0 7 6	s. d. —
Popular Wireless Ultra Crystal Set	—	5 0	1 1 6	0 7 6	—
All Concert-de-Luxe	3	13 6	4 17 6	0 15 6	1 6
S.T. 100	2	7 0	4 16 0	1 10 0	—
Puriflex	3	12 6	4 5 0	0 15 6	1 6
All-Britain	3	13 0	4 9 0	0 15 6	1 6
4-Valve Family	4	19 6	5 15 6	0 15 6	1 6
Transatlantic V...	5	13 6	5 4 6	0 15 6	1 6

When all components and panel are purchased together a Marconi Royalty of 12/6 per valve holder must be paid.

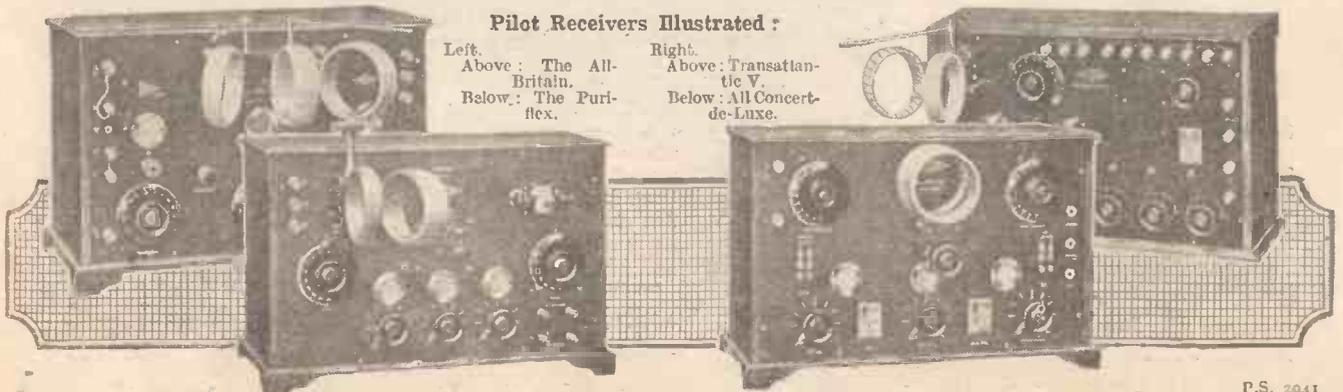
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Sent Free: Unit Folder describing the Peto-Scott Unit System.
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Price 3d.: Peto-Scott's Catalogue containing 4 pages fully illustrated and showing all Components.
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Pilot Receivers Illustrated:

Left. Above: The All-Britain. Below: The Puriflex.
Right. Above: Transatlantic V. Below: All Concert-de-Luxe.





The Technical Editor of "Popular Wireless" will be pleased to receive wireless sets and component parts for test. Reports will be published under this heading.

WE have received from Messrs. Belling & Lee, Ltd., of Queensway Works, Ponders End, Middlesex, a sample of their new, patented indicating terminal. It is well made and possesses several distinct advantages over its several predecessors. We understand a complete range of these terminals is available in quantities.

One of the most interesting instruments we have tested during the past few months is the new Ediswan "Televox" loud speaker, a sample of which was recently sent us for this purpose. An extract from a letter Messrs. The Edison Swan Electric Co., Ltd., sent us follows, and gives a description of the outstanding features embodied in their new product.

"This loud speaker has been carefully designed to give a large volume of sound free from distortion, and with this object in view we have departed from the standard practice in loud speaker design, and have approached the many technical problems connected with the evolution of a perfect loud speaker from a different standpoint. You will notice that the base of this loud speaker is divided into two parts; the upper

half carries the diaphragm, which is rigidly fixed, and the lower half carries the magnets, which are also permanently fixed. By altering the distance of the diaphragm from the magnets a very good adjustment can be made, and to avoid too frequent adjustment a locking ring is provided. After the coarse adjustment has been made by the method provided, modulation of speech reproduction is carried out by means of a patented device, which allows for a small piece of soft iron to be inserted in the existing magnetic field formed by the permanent magnets. This soft iron 'keeper,' or modulator, as it is termed, operates on a sliding movement, and the 'tinniness,' 'rattle,' or 'blasting' usually found in the average type of loud speaker can be totally eliminated. The resistance of the loud speaker is 2,000 ohms and the connections are made to two terminals mounted on ebonite strip. The price of this product is £5 12s. 6d. each."

We tested the "Televox" on a five-valve set which employs two dull-emitter power valves, and it handled the resultant volume more efficiently than any other instrument of this nature we have yet had the opportunity to examine. Notwithstanding the

fact that it can reproduce deafening signals with little or no distortion, it is yet quite sensitive, and easily fills a medium-sized room when used on only a two-valve set (det. and L.F.). Listeners should hear the "Televox" in operation before purchasing a loud speaker.

Owing to a printer's error the new two valve amplifier advertised by Messrs. Wates Bros., Ltd., in the last issue of "P.W." was styled the "Superatone" instead of "Supratone." It will be remembered that a favourable report concerning this well-made little instrument recently appeared in these columns.

Messrs. Radi-Arc Electrical Co., Ltd., have sent us one of their new protective Wander Plugs for test. It is a neat little fitment and one that should figure in the equipment of all radio listeners. In shape it is similar to any other wander plug, but it is coloured a very distinctive red. It forms a complete protection against accidental burn-outs by the H.T. Being, however, of the resistance type of protecting device, its ohmic value being such that the possible current from the H.T. battery is reduced to a very low figure, it is liable to cause L.F. "howling" in certain circumstances. For instance, when used with a multi-valve or reflex set this trouble is likely to be experienced, but not, of course, with a "straight" single or two-valve receiver.

We are informed by Messrs. Wireless Apparatus, Ltd., that their well-known Vertex aerials are to be marketed under the name of Perfix in future owing to a previous registration of the former word.

(Continued on page 1160.)



The LOUD C.A.V. SPEAKER

is made in THREE SIZES
STANDARD - JUNIOR - TOM-TIT

Directly you hear the C.A.V. LOUD SPEAKER, your search for an instrument capable of doing justice to the broadcasted programmes is at an end. Skillful design, sound workmanship and perfect finish are the secrets of its success, and our increased manufacturing facilities now enable us to guarantee **IMMEDIATE DELIVERY.**

A C.A.V. Loud Speaker makes just that difference—the difference between pleasure and disappointment, and we suggest you arrange for your dealer to give a demonstration without delay. Meantime, write for illustrated folder.

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120 ohms.	£4 15 0
2,000 "	£5 0 0
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A special feature has been introduced whereby all valves are carefully tested for performance and distinctively marked as follows :

High Frequency Red Spot
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The operating characteristics remain as before and the current consumed is 0.25 amps at 1.1 volts.

Recommend Weco valves for :
 Long Life Sturdy Construction
 Stability Sensitiveness
 Silence in operation and Low Self capacity.

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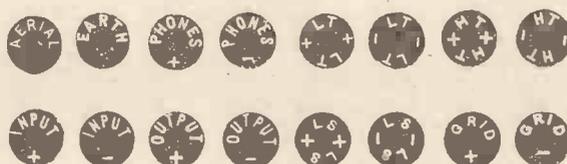
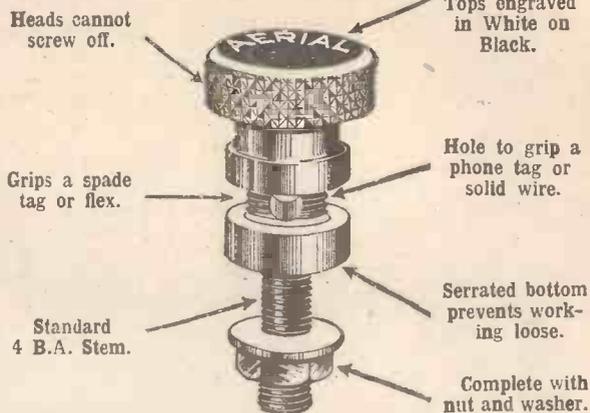
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"BELLING-LEE" INDICATING TERMINALS

Patent No. 5807/24



Brass 3½d., Nickel 4½d. each.

"BELLING-LEE" CRYSTAL RECEIVERS

Price
25/-
 each.

Phones and loading coil extra.



These Receivers embody : (1) Our own Variometers, with SOLID hardwood Rotors. (2) Our own ROTATING DETECTOR, which enables the cats-whisker to engage practically every point of the crystal (3) Our own patented SELF-SHORTING PLUGS AND SOCKETS, which take the various standard loading coils for reception from 5 X X The switch closed gives reception from local stations without the inconvenience of removing loading coil. (4) Our own Multiphone Terminals, accommodating 6 pairs of phones. (5) Our own INDICATING TERMINALS. (6) Our own INDICATING KNOBS. (7) Our own highly polished and artistically finished Mahogany Cabinets.

Ask your usual dealer to let you listen-in on one of our Receivers, or if you wish to build your own set, ask for our components. In case of difficulty write to

BELLING & LEE, LTD.,
 Queensway Works, Ponders End.

APPARATUS TESTED.

(Continued from page 1158.)

From Messrs. Lissen, Ltd., we have received samples of push-pull switches of new design. They are of the double-pole double-throw type, and can be used in place of the conventional D.P.D.T. for all purposes. The outstanding advantage the push-pull type possesses apart from simplicity of operation is "one hole mounting," a great reduction from the "six hole mounting" usually necessary for D.P.D.T's.



A "Revophone" Crystal set, one of the numerous products of the Cable Accessories Co., Ltd., Tipton, Staffs.

These new switches are well made and designed in accordance with Messrs. Lissen's usual practice, and are of low capacity and make smooth and positive contacts. As this type of switch is so greatly in advance of the usual knife type in operation, appearance, etc., we predict considerable popularity for Messrs. Lissen's latest products.

Mr. Stacey Hooker, who for over 23 years has been associated with the Sterling Co., has joined the board of Messrs. C. A. Vandervell & Co., Ltd. He will take a large and responsible part in the management of this well-known Acton firm.

Respecting the new Mullard dull-emitter valves, samples of which were recently sent us, we have now completed our practical tests, and can confirm our preliminary remarks regarding them. They function well in their particular positions, are less microphonic than most dull emitters, and appear to be mechanically robust. The D.06 H.F. requires rather careful handling, and is apt to lose its dull-emitter properties if an excess of L.T. is employed. It is, however, a better H.F. valve than the Mullard single red ring (bright emitter) in our opinion, although there is little to choose between the two types of L.F. Mullard valves.

Well known as manufacturers of wireless sets, apart from their other electrical branches, the Fellows Magneto Co. have recently taken up the production of radio valves. Two of these, under the name of the Loudon valve, have recently been



Two of the very neat little B.T.H. amplifying units plugged together.

tested by us, with the following results: Both the "plain" and "blue" valves were found to give quite good H.F. amplification, and the latter was quite good as an L.F. amplifier; better than the "plain" one, which could only be classed as a moderate L.F. amplifier. Both valves oscillated in the detector stage, but appeared to be slightly lacking in "punch," signals coming through a little weaker than was to be expected, judging from their behaviour in other places on the set.



A "Revo" Loudspeaker. Messrs. Cable Accessories Co., Ltd.

Yet again we feel it our duty to warn readers of the tremendous amount of "junk" that is being sold as wireless "apparatus."

In the case of coil holders, apart from rocky mountings, poor ebonite, and outside sockets, the main source of trouble is due to the cheerful way in which manufacturers (names never stamped on the coil holder) supply terminals and screws which do not even pretend to make contact with the brass socket or plug of the holder. Readers are therefore advised to keep to the well known or guaranteed makes of all wireless apparatus, or, if they must buy the cheaper articles, to insist on a test before taking the goods. The cheap components, if found to be "dud" afterwards, will rarely be exchanged when taken back to the dealer who supplied them.

**HUNT'S
NEW MODEL
HEADPHONES**

Codeword:—
"GOODTONE"
4,000 OHMS.

per **17/6** pair

"Powerful...
and Clear
Reproduction"



Fig. No. 1312

SOLID NICKEL SILVER headbands and supports with slides. Adjustable in every direction. Highly polished finish and very strong HYGIENIC & CLEAN. No webbed or fabric band to collect dirt or germs.

A. H. HUNT, LTD.

(DEPT. 12a), H.A.H. WORKS,
TUNSTALL RD., CROYDON.

"KEYAGE, CROYDON" ADDISCOMBE 1584-5

**"TANGENT" TUNING COILS
AND SELECTIVITY**

If you would choose your station and SELECT your programme without interference from other stations—

You will choose "Tangent" Coils because of their SELECTIVITY. Their low self-capacity ensures fine SELECTIVITY.

Incidentally, there is no more efficient coil on the market.

Our motto is UNSHROUDED EFFICIENCY.

COMPLETE SETS—

- 4 Complete Coils (Nos. 25 to 75) 16/- the set.
- 11 Complete Coils (Nos. 25 to 500) 67/- the set.

Your dealer stocks them—
Accept none other.

GENT & CO., LTD.,
Est. 1872.

**Faraday Works,
LEICESTER**

LONDON:
25, Victoria Street, S.W.1
NEWCASTLE-ON-TYNE:
Tangent House, Blackett St.



UNSHROUDED EFFICIENCY



RIGID AS A MOTOR WHEEL.

ROSEBROS

GUARANTEED
RADIO
COMPONENTS

EBONITE PANELS RADIO QUALITY

Size.	Price.	Size.	Price.
6½ × 5½ × ¼	1/9	10½ × 8½ × ¼	5/3
6½ × 6½ × ¼	2/-	12 × 10 × ¼	7/3
8 × 6 × ¼	2/3	14 × 12 × ¼	10/-
8 × 6 × ¼	2/10	16 × 12 × ¼	11/6

Other sizes to order.

THESE PANELS are of Finest Quality Ebonite. Matt finish and with square edges. Each panel is sent out in a priced envelope and ready for use.

Delivery from Stock Guaranteed.

ROSEBROS COILS

No. of Coil.	Wave-lengths in metres when shunted by '001 Var. Cond.	Retail Price.
25	160 to 350	3/9
35	250 to 500	3/9
50	350 to 750	3/9
60	400 to 850	3/10
75	500 to 1,150	4/-
100	600 to 1,650	5/6
125	700 to 2,000	5/9
150	850 to 2,500	6/-
200	970 to 3,400	7/-
250	1,300 to 4,500	7/6
300	1,900 to 6,000	8/-
400	2,600 to 8,000	9/6



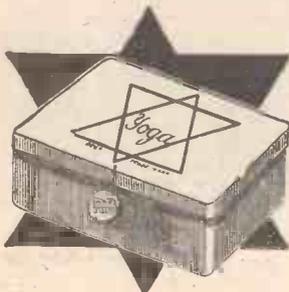
THE IDEAL CRYSTAL

For Distance, Volume or Reflex Circuits

A Spiral Contact of a special alloy is included

A Super Crystal.

Triple Tested.



Loud, Clear.

Everlasting.

Sealed Boxes

2/6 each

Trade enquiries invited.

ROSE BROS.
Electrical Co., Ltd.

London : 25, Milton St., E.C.1.
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Manchester : 25-27, Miller Street.
Bristol : 83a, Redcliffe Street.

FELLOWS WIRELESS



A busman's holiday

Eight hours to-day in the works, and when I do get home you still find me tinkering about with wireless apparatus.

Well, there are worse ways of spending an evening, quite apart from the fact that it's both instructive and interesting.

Besides, I might easily run across some wonderful circuit that even my very clever engineers down at the works haven't discovered. Who knows?

Anyway, it's a very pleasant pastime, and inexpensive so long as you don't have to keep on renewing your components, and my Fellows components seem to last me for ever.

My Intervalve transformers and condensers must have been put into at least a dozen circuits, and my filament resistances and switch arms serve me time and again. Fellows coils are, of course, quite standard for all sets and, even though I say it myself, they represent exceptionally good value for money; as you know, whatever the product, Fellows' policy always is

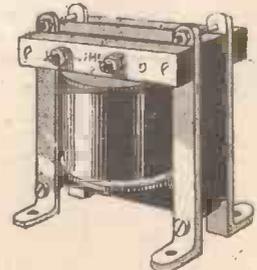
Quality Apparatus at Low Cost.

Mulla Fellows

Low Frequency Intervalve Transformer. Accurate and distortionless. 20/- each.

Fellows Coils. For all purposes. Standard non-reversible pin contacts. 4/3 to 10/-

Filament Resistances. 5 ohms, for panel or cabinet mounting. 3/-



Transformer - 20/-
Coils - 4/3 to 10/-
Filament Resistances 3/-

HULLO EVERYBODY!!

All these Goods sent by Post. Foreign Packing and Post extra. Orders in Rotation.

POST FREE COLUMN

SORBO RUBBER EARCAPS	pair	1/8
2-WAY EBONITE COIL STANDS		3/6
2-WAY EBONITE EX-HANDLES		4/3
2-WAY CAM VERNIER		5/6
2-WAY GEARED		5/11
AERIAL, 7/22 100 ft., and 6 INSULATORS		3/6
BASKET COIL HOLDERS, EBONITE.		1/6
MURRAY VALVE HOLDERS		1/6
EBONITE SOLID ROD HOLDERS		1/3
LEGLISS ANTI-CAP. HOLDERS		1/3
GOSWELL DITTO		1/9
TWIN SILK MINIATURE FLEX	doz. yds.	2/-
RED AND BLACK TWIN FLEX	12 yds.	2/6
EBONITE VARIOMETERS, BALL ROTOR		5/11
PATENT BATTERY LINKS	doz.	1/4
"KENITE" RADIO PANEL	8 x 6	1/6
"	9 x 6	1/9
"	10 x 8	2/3
"	12 x 9	2/8

(Above fine value, easily worked.)

D.C.C. COIL, 1,600 metres		
72 in. 'PHONE CORDS, best quality		2/3
DIAMOND WEAVE (5) COILS		3/6
(equal 25, 35, 50, 75, 100 honeycomb.)		
GOSWELL INSULATED VALVE LEGS, Set		1/3
BRUNET SHROUDED L.F. TRANSFORMER		13/6
MANSBRIDGE CONDENSERS, 1 mtd.		3/6
DITTO, 2 mtd.	4/3. 25 mtd.	3/6
D.C.C. 16 gauge	1 lb.	3/6
NEUTRON CRYSTAL AND WHISKER		1/6
RATIO MICRO '06 VALVE		13/11
SIMPLEX LEAD-IN		1/9
REACTONE T.W. INDUC. COILS	5 for	4/6
DITTO. FOR CHELMSFORD		2/6
T.C.B. 6, 13, 30 ohms.		4/-
T.C.B. POTENTIOMETER, 300 ohms.		5/-
MYERS UNIVERSAL VALVES		12/6
MYERS D.E. VALVES		21/-
PHONES, TELEFUNKEN TYPE (4,000)		10/11
N. & K. MODEL (4000)		9/11
RAYMOND FIXED CONDENSERS		
001 to 0005		1/2
002 to 006		1/3
01 and 02 each		1/9

(Terminal Connections)

EBONITE PANELS, 8 x 6 and 7 x 5, each		1/8	
8 x 6 and 9 x 6	2/6	10 x 8	3/6
12 x 9	5/-	12 x 12.	6/-

(Stock Sizes.)

NEUTRON CRYSTAL SETS	10/6	15/-
COPPER TAPE AERIAL 100 FT.		3/3
BURNDIPT CRYSTAL DETECTOR		5/6
SET OF 7 TWIST DRILLS		2/-
SOLDERING OUTFIT (for petrol)		3/6
TELEPHONE TERMINALS	doz.	1/9
SLEEVING. 6 yds.		2/3
1/16 SQUARE BUS-BAR HANK FOR		1/-
2 VOLT 40-AMP HART ACCUMULATOR		15/-
ALLEN VARIABLE GRID LEAK		1/9
D.P.D.T. PANEL SWITCHES (nickel)		1/9
S.P.D.T. PANEL SWITCHES (nickel)		1/4

The Only Way to Save Money
CALL AT RAYMONDS.

RAYMOND VARIABLE CONDENSERS HIGH QUALITY. NEW PRICES.

"DE LUXE" MODEL

AS SHOWN, WITH DIAL KNOB AND BUSH.

001	6/11
0005	5/6
0003	5/-
0002	4/9

POST 6d. SET.
UNSURPASSED FOR FINE TUNING.

NEW MODEL

With Knob and dial.

WITH VERNIER.

001	8/9
0005	6/11
0003	6/9

WITH EBONITE DIAL and Two Knobs. Post 6d. Set.

No. 3 CONDENSER

WITH KNOB. POST 6d. SET.

001	6/11
0005	4/11
0003	4/6

NEW MODEL SQUARE LAW

With Vernier. With Knob and Dial. Aluminium Ends. Ebomite Ends.

0003	8/6	10/-
0005	8/11	10/6

Post 6d. Set.

TWIN CONDENSER SQUARE LAW

EBONITE ENDS

00025	12/6
0003	12/6
0005	18/11

TWIN (Ordinary)

Equal units of 00025 or 0003 9/- Complete with Knob and Dial. Post 6d.

LONDON'S LARGEST Stockist of
JACKSON BROS.

"J.B." Variable Condensers, Complete with Knob and Dial.

SQUARE LAW	STANDARD
001 9/6	001 8/6
0005 8/-	0005 7/-
0003 6/9	0003 5/9
0002 5/6	0002 5/-

Other sizes as advertised by "J.B." Post 6d.

ALL VALVES ON POST SENT AT PURCHASER'S RISK.

VALVES

THORPE R4 (5-pole) 17/6
PHILLIPS 4 ELEC. TRODE 12/6
(Both for UNIDYNE.)

BRIGHT EMITTER 12/6 each

B.T.H. R. Type
Ediswan A.R.
Marconi-Osram R. or R 5 V

Mullard-Ora P.1
Cossor P.2
Cossor P.2
Mullard H.F. (Red Ring)
Mullard L.F. (Green Ring)

HEADPHONES

We can recommend these as being excellent Headphones, with a great reputation.

B.T.H. 4,000 ohms. 25/-
G.R.C. 4,000 ohms. 20/-
BRANDES 4,000 ohms (Matched Tone) 25/-
BROWN'S 4,000 ohms (featherweight) 25/-
STERLING 4,000 ohms 25/-

ALL POST FREE.

ACCUMULATORS FOR CALLERS ONLY at present. See Callers' List.

GOSWELL ENGINEERING

Patent Valve Holder 1/6
Goswell 2-way Vernier Coil Holder 9/-
3-way Coil Holder 7/6
2-way Panel Mounting 3/-
3-way Panel 5/-
Goswell 3-way Cam Vernier 12/6

DULL EMITTER

2/- each Type

B.T.H. B.3
Ediswan A.R.D.E.
Marconi-Osram D.E.R.

25/- each Type

B.T.H. B.5
Ediswan A.R.O.6
Marconi-Osram D.E.3
Mullard D.F.Ora

Genuine DR. NESPER HEADPHONES

Adjustable diaphragm, detachable receivers, double leather-covered head-springs, long flexible cords, nickel plated parts. Very comfortable fitting to the head.

LOOK FOR THE TRADE MARK.

4,000 ohms. 13/3
Post 6d. pair.

Formo, open 12/6

Bucks "Powquip" 12/6

Manchester "Powquip" 15/6

Ormond 14/6

LISSEN

Variable Grid Leak 2/6
Anode Resistance 2/6
Lissen Minor 3/6
Lissenstat. 7/6
Do. Universal 10/6
2-way Switch 2/9
Series Parallel 3/9
T1 Transformers 30/-
T2, 25/-; T3, 16/6
Coils: 25, 4/10, 30, 35, 40 4/10, 50 5/-, 60 5/4, 75 5/4, 100 6/9.
5 point switch 4/-
Lissen choke 10/-
Aux. Res. 1/3

DULL EMITTER POWER VALVES

For use with A.R.D.E. and D.E.R. Valves.

Marconi-Osram, Type D.E.6, 2-25 volt. 25 amps. 25/-

DULL EMITTER POWER VALVES

For use with '06 Valves:

B.T.H. Type B.6 35/-
Marconi-Osram Type D.F.A. 2 30/-
Mullard, Type D.F.A. 2 30/-

Genuine N and K 17/6

No. 3. Latest Model

New 3-pole Laminated Magnets, which ensure an even magnetic pull and still greater volume. Windings well insulated. Large size earpieces and leather headbands of standard design. Technically, "N & K" Headphones represent the last word in Wireless Reception.

IMPOSSIBLE TO EQUAL FOR CRYSTAL SETS.

Shrouded Powquip, 18/-

Standard Powquip, 14/6

DUBILIER

001, 002, 003, 004	
005, 006, Fixed	3/-
0001, 0002, 0003, 0004, 0005	2/6
Type 577, 01	7/6
Grid Leaks, each	2/6
Anode Resistance 50,000, 70,000, 80,000, 100,000, on stand, complete	5/6

POWER VALVES

For use with Bright Emitters

B.T.H. B.4 35/-
Marconi-Osram D.E.5 35/-
Mullard D.F.A.1 35/-

Phillips' "R" 6/11
French "R" 8/11
'06 Valves 12/6 & 13/11
Dutch "R" 5/11
Metal '06 15/11

Post 6d. each.

RIGHT OPPOSITE
DALY'S
GALLERY DOOR

K. RAYMOND

27, LISLE STREET,
LEICESTER SQUARE, W.C.2

No responsibility accepted on post orders unless cheques and postal orders are crossed and made payable to the firm. Money sent must be registered

HOURS OF BUSINESS:
DAILY - 9 to 7.45
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Phone: GERRARD 4637.

HULLO EVERYBODY!!

SUNDRIES

Post free.

Neutrodyne Vernier	3/6
Independent Vernier (Colvern)	2/6
Shipton Rheostat, 30 ohms	3/3
Shipton Rheostat, 60 ohms	3/3
Shipton Potentiometer, 600 ohm	4/6
Edison Bell Variometer	10/6
Polar Micrometer Condenser	5/6
Mansbridge, 2 mfd.	4/3
Mansbridge, 1 mfd.	3/9
Mansbridge, .25	3/6
Success 2-way Cam Vernier	5/6
Success L.F. Super Black	21/-
Eureka Concert Grand	30/-
Eureka 2nd Stage	22/6
Igranic New Model	21/-
General Radio	15/-

(Also see illustration)

T.C.B. 6, 13, 30 ohms	4/-
T.C.B. 300 ohms Potentiometer	5/-

IMPORTANT NOTICE

Manufacturers of sets can be supplied with most proprietary lines at trade counter.

NO TRADE ORDERS SENT BY POST.

Good stocks of Edison Bell, Dubilier, Polar, Lissen, Igranic, Cossor, Ediswan, Marconi Valves, etc. usually kept. No responsibility for delay in delivery by makers.

CRYSTAL SETS

Wonderful little set extra. Fitted for Chelmsford. Complete with crystal.

Post free 10/-

RE-ECHO (genuine) SUPER SET.

Sloping cabinet, extra Chelmsford fitting.

Post free 17/11

L.F. TRANSFORMERS

Eureka Concert Grand	30/-
2nd Stage	22/6
Igranic New Model	21/-
General Radio 83	15/-

Also see illustrations.

LOUD SPEAKERS

Postage 1/- each.

Dr. Nesper	21/-
Sterling "Baby"	55/-
C.A.V. Tomtit	30/-
Amplion "Junior"	27/6
"Ultra"	27/6

BRUNET 'PHONES

Latest Model now Ready.

(Not the one with green cords). Beautifully made. Very Comfy.

Per pair 16/6.

Postage 6d. per pair.

PARTS FOR 2-VALVE UNIDYNE

2 Thorpe K4 Valves, terminals, 2 microstats, 1 var. grid leak, S.P.D.T. Switch, .0005 var. Condenser with vernier. Cam vernier 2-way stand, 2 5-pin valve holders, 2 fixed Condensers, G.R.C. Transformer, tinned copper wire nuts, screws, etc. The lot for **£3 : 15 : 0**

Carriage paid. All best quality.

POLAR

.001 var. Condenser	10/6
.005 " "	10/6
.0003 " "	10/6
Cam Vernier 2-way Coil Holder	11/-

STERLING SQUARE LAW

with Vernier.

.001	30/-
.0005	25/6
.00025	23/6

CALLERS! THESE 4 COLUMNS FOR YOU

Warning! Note name RAYMOND on shops. You will not be able to buy these goods otherwise. Nearest Tube Leicester Square. This address is at the back of Daly's Theatre. Open Weekdays 9 to 8, Saturdays 9 to 8.45, Sundays 10 to 1.

SUNDRIES

Lead-in tubes: 6d., 7d., 8d.	
Valve Pins and Nuts 2 a 1d.	
Stop Pins and Nuts 2 a 1d.	
Nickel Terminals	2d.
Nickel Contact Studs	2 for 1 1/2
Nickel Switch Arm	1/-
(one-hole fixing)	
Voltmeter	4/6
Gamages Permanent	1/-
Condenser Brushes	6d.

RAYMOND FIXED CONDENSERS.

.001-.0001 to .0005	10d.
.002-.003-.004	1/-
.006, 1/3; .01 1/9; .02 1/9	

ACCUMULATORS

No Post Order at present

2 v. 40 amps.	9/6
4 v. 40 amps.	18/6
4 v. 60 amps.	18/6
4 v. 80 amps.	23/6
6 v. 60 amps.	27/6
6 v. 80 amps.	33/-
6 v. 105 amps.	36/6

Hart's Stocked. All High Quality.

Microstat	2/6
Switch Arms 8d. to 1/-	
Flex (Red and Black) per yd.	3d.
Shellac	5d.
Loading Coil and Plug	8d.
Contact Studs 4 for 1 1/2	
Nickel ditto 2 for 1 1/2	
Nickel Switch arm	1/-
Sorbby Ear Caps pair	1/4
Tumbler Switches	1/4

'Phone Cords 6 ft. 1/-	1/3
Nugraving	6 1/2
Empire Tape 2 yds.	1d.
Allen Var. Grid Leak	1/3
Best Sleeving 3 yds.	10d.
Rubber Lead-in 10 yds.	1/-
Thick ditto, 1d., 2d., & 3d.	
Aerial, 7/22 100 ft.	1/10 1/2
Ditto, Extra Heavy	100 ft. 2/3
Anti Cap. Handles	8d.
Tumbler Switches	1/-

NOTE!

Our Wonderful Micro-meter Adjustment Glass-enclosed Detector. Why pay more? **1/9**

5 Waxless Coils 203/2000	1/5
5 equal 25 to 100	1/11
5 ditto, Extra Air Space	2/3
6 waxed 200/3600	1/8
7 waxed 150/3800	1/11
Chelmsford D.C.C.	1/-, 1/3, 2/6
Basket Holders 9d.	1/- 1/3
Switch Arm 12 Studs, 12 Nuts, 12 Washers.	

Lot 10 1/2d.

VERY SPECIAL OFFERS

Crystal Set fitted for Chelmsford	7/11
RE-ECHO set, worth 25/-, for	15/-

SPECIAL To callers only. To customers purchasing 20/- worth of our own goods we supply a first-class pair of 4,000 ohm 'phones for 5/- as an advertisement only.

REACTOR COILS STOCK.

For Chelmsford	2/8 set
for Broadcasting	4/8 set

HONEYCOMB COILS.

No dead ends. High-class make.

25 .. 4- .. 200 .. 7/-	
35 .. 4- .. 250 .. 7/3	
50 .. 4-2 .. 300 .. 7/4	
75 .. 4-5 .. 400 .. 8/3	
100 .. 5-8 .. 500 .. 8/6	
150 .. 6/4	

Legless valve holders 1/-	
ANTI CAP valve holder	1/-
2 mfd. Mansbridge	3/9
1 mfd. Mansbridge	3/3
.25 Mansbridge	2/11
Colvern Vernier	2/6
Neutrodyne ditto	3/6

Radio panels "KENITE" (stand 5,000 volts), 6 x 6, 9d.; 7 x 5, 9d.; 8 x 6, 10d.; 9 x 6 1/2; 10 x 8, 1/-; 12 x 9 1/2; 12 x 12, 2/3. Above 3/16 in. thick. 1/2-in. also stocked.

Legless Valve Holder	1/-
Solid Rod Ditto.	1/-
Under Panel Ditto.	1/6
Ebonite Dials .. 8d.	
Valve Templates 2d.	9d.
Electron Aerial	1/3 1/2
Adhesive Tape Rod	2 1/2d.
Copper Foil per foot	2 1/2d.
1 in. Fibre Strip 3 ft.	2d.
Insulated Hooks 4 for 3d.	
Ditto Staples	5 a 1d.

Twin Flex 4 yds.	6d.
Twin Silk Small 6 yds.	8d.
D.C.C. Bell Wire 10 yds.	5d.
Knobs, 2 B.A. 2d. 3d. 4d.	
Small Knobs 6 B.A.	3d.
Small Knobs 4 B.A.	3d.
Wander Plugs pair	3d.
Egg Insulators each	1d.
Tape Aerial 100 ft.	2/-
Valve Windows 4d. to 9d.	
Mica	2d.

RAYMOND CRYSTAL SETS

7/11	9/11	12/11
2 B.A. rod per ft.	2 1/2d.	
4 B.A. Rod per ft.	2d.	
Basket Holders	8 1/2d.	
Also at 10d., 1/-, 1/3, 1/6		
2-way Coil Stands	1/11	
3-way ditto	4/3	
2-way with ex handles	2/11	

2-WAY COIL STANDS	1/3, 1/9
VARIOMETERS	1/-, 1/3
DUTCH VALVES	4/3
LARGE DETECTORS	11d.
5 WAXLESS COILS	1/3
Do. EXTRA AIR SPACE	1/8
'PHONES 4,000 OHMS	6/11
N. & K. PATT. 4,000 OHMS	8/11
VARIABLE GRID LEAKS	1/2
VALVES FOR UNIDYNE	12/-
5-PIN Ditto.	13/11
PORCELAIN S.P.D.T.	1/4
Ditto S.P.D.T.	11d.
L.F. TRANSFORMERS	8/11
SPECIAL BASKET HOLDERS	8 1/2d.
Ditto for Chelmsford Coils	9d.
SINGLE COIL formers with spokes	8 1/2d.
BRUNET 4,000 ohms, NEWEST MODEL	15/6
SAMSON ACCUMULATOR CARRIER	2/9
FLUSH PANEL sockets complete.	4 for 5d.
EBONITE BUSHES	1d. dozen 10d.

C.W. BATTERY LINKS	2 for 1 1/2d.
"LEDION" sets of 5 COILS	1/8 and 2/6
GEARED 2-WAY COIL STAND	5/3
CAM VERNIER ditto.	4/6
CLIMAX U.F. VALVE HOLDERS	1/2
RHEOSTAT for D.E. or R. VALVES	2/8
2-WAY COIL STAND, ex handles	1/11
Ditto nickel fittings	2/9
Half opal and ebonite enclosed DETECTOR, worth 2/-, my price.	1/4
TAPPED COILS for CHELMSFORD	1/6
Ditto for Broadcasting	1/-
GRID LEAK CLIPS, pr. 1d.	
Valves "PHILLIPS "R" type.	6/11
Valves "FRENCH METAL "R"	6/6
Valves "DUTCH (good)	11/-
Valves "DUTCH DETECTORS" 4/3 and 4/9	
Valves "DUTCH "R" TYPE	4/11
Valves "FRENCH METAL .06	12/11
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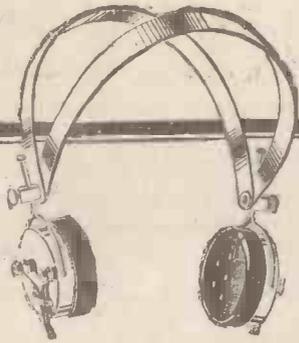
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The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and concerns the most recent developments in the Radio world, some of the arrangements 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.

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,



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Questions and Answers

"CRYST" (Bedford).—I have a simple crystal set tuned with a solenoid coil and slider which has a maximum wave-length of about 900 metres. Is it possible, without altering my wiring, to add an L.F. amplifier, an H.F. amplifier, and a valve in dual capacity? If so, what are the simplest connections?

Providing the coil in the crystal set is large enough to act as an anode coil when an H.F. is added, either of the above may be added without any alteration whatever to your crystal set. It will be seen that it does not matter what form the inductance in the crystal set takes, as long as it is large enough. Fig. 1 of the accompanying diagram shows the connections of the crystal, while in the second diagram an L.F. amplifier is added to the telephone, or output, terminals of the crystal set. In Fig. 3, where an H.F. stage is added, it will be seen that an extra inductance is required, as the slider coil is now employed as an anode coil for tuned anode coupling. This extra inductance, or A.T.I., as it is termed, is shown in the diagram as a variometer, but, of course, it may take any desired form, but should have a natural maximum wave-length of approximately 200 metres less than the maximum wave-length of the anode coil. To this H.F. and crystal circuit an L.F. amplifier may be added as shown in Fig. 2, if desired. The fourth figure shows how an L.F. transformer may be included in Fig. 3, to make the valve work in a dual capacity, both H.F. and L.F., with the crystal as detector.

E. S. (Bath, Somerset).—What are the details of the wireless invention

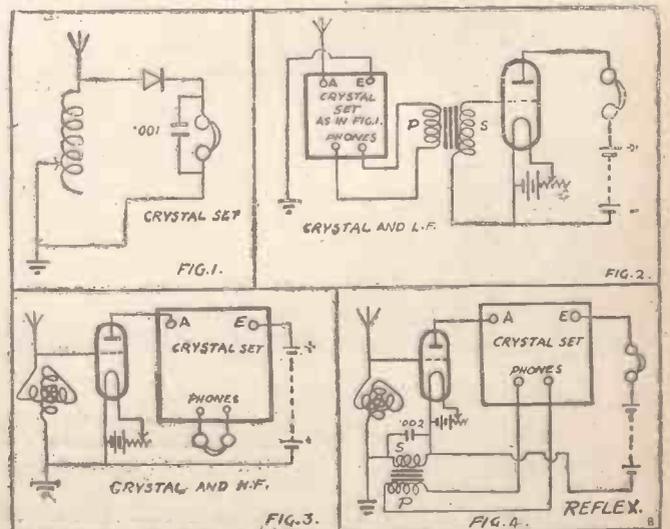
which is capable of transferring thoughts without the use of speech or any visible means of communication?

As yet no such invention exists, to the best of our knowledge. Even the famous illusionists or "thought readers," such as the "Zanzigs," used speech in code form to convey their "thoughts," though it appeared to their audiences that real thought reading from mind to mind was taking place.

G. A. (St. Leonards-on-Sea).—What alteration to my crystal set will be necessary in order to add an H.F. amplifier to increase its range?

If the following connections are made, there will be no necessity to alter any of the connections in your existing crystal set, as the inductance included in it can remain to act as a tuned anode coil, as this method of coupling the H.F. to the crystal is to be used. Connect aerial to one end of the new aerial tuning inductance and other end to earth—or slider to earth if a solenoid coil with slider is to be used. A variable condenser of 0005 mfd. capacity is connected across the A.T.I. if a plug-in coil is utilised. The aerial also goes to grid of valve, while the plate goes to the aerial terminal of your original crystal set. The E terminal of crystal receiver should go to H.T. + and

(Continued on page 1167.)



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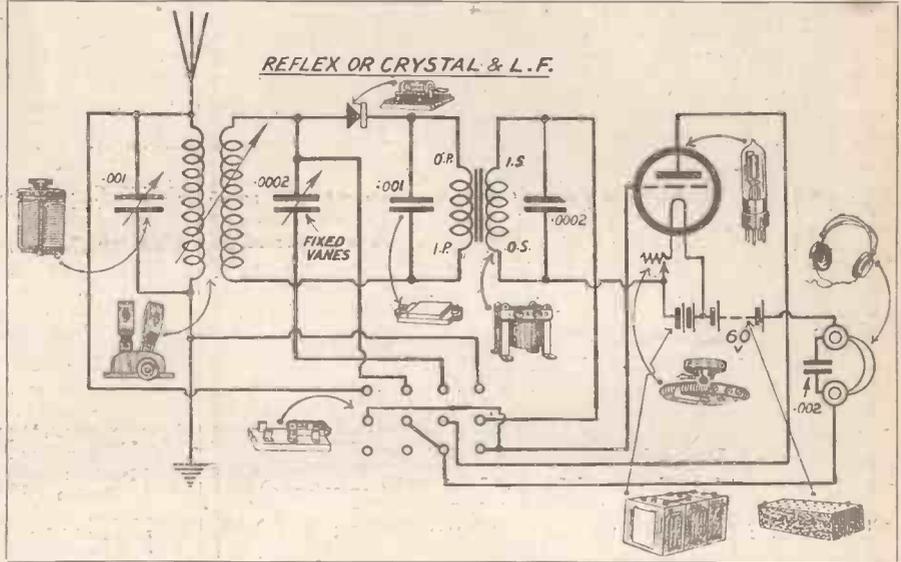
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Correspondence

A REFLEX CIRCUIT WITH SWITCHING

The Editor, POPULAR WIRELESS.

Dear Sir,—I am enclosing a diagram of a circuit which may interest you and some of your readers. As you can see, it is a crystal circuit with valve amplifier, but by a combination of switches one can make it into reflex. Living about five miles from 2 I.O., I found that reflex and one-valve amplifier



worked a loud speaker, but there was a certain amount of distortion with it, so I devised this circuit for loud-speaker work. I find that crystal and two-valve amplifier is much clearer, but not so loud as reflex and one-valve amplifier. The switching arrangement is very simple—all switches up reflex, all switches down crystal and one-valve amplifier. Trusting this will interest you, I am, yours faithfully,
 FREDK. W. WORTH,
 41, Elm Road, Queen's Road, Battersea, S.W.8.

THE DET. AND L.F. UNIDYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—Just a line of congratulation. I have been using for about 10 weeks now a two-valve Unidyne set (detector—low frequency). Here are a few results obtained. I receive all the broadcasting stations in England—and up to the present one relay (Leeds and Bradford) Brussels—I listened to opera for two hours on Tuesday night, Dec. 9th, 1924—Breslau, School of Posts, Paris, Leipzig, (Frankfurt-on-Main, especially loud and clear, and also on any night I like), Berlin, and about half a dozen more foreign stations I have not yet managed to get their call sign. But the culminating point was reached when on Sunday morning, at 12.42 a.m. until 2.40 a.m. I heard W.B.Z., Westinghouse Company, Springfield, Mass., U.S.A. I have some of the names of the singers—there were very few atmospherics—the only trouble I had was with fading, and some oscillation from unknown operators. The strength was very good on the 'phones and very readable, especially the last item I heard, which was a lady speaking about golf and sports for women.

My set has 2 Thorpe K4 valves, vernier coil holder and variable condenser; my grid leak is a Bretwood. I am using Reactone coils. My aerial is a cage 30 ft. high, with 66 ft. of Mars aerial wire on it, and lead-in of 34 ft.

When I received America I had 90 in the reaction and 65 in the aerial. Congratulations to Mr. Dowding and Mr. Rogers for their wonderful invention.

Yours delightedly,
 H. V. SIMPSON.

4, Westbrook Villas; Darlington.

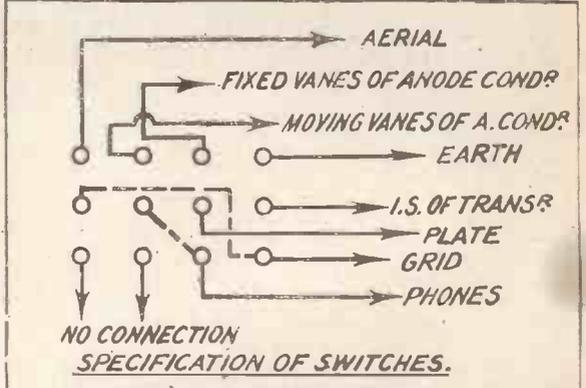
CONCERNING CRYSTAL RANGES.

The Editor, POPULAR WIRELESS.

Dear Sir,—My sole excuse for troubling you with this is your remark that "No one seems to have beaten the plain crystal set achievement of Mr. W. H. Thomas, of the Swansea Radio Society, who heard Bournemouth, 110 miles away."

On the night that Mr. Asquith's speech was broadcast during the General Election, I listened to Mr. Asquith on my crystal set, and then went out, leaving the set connected. Returning home at 11.15 I picked up the telephones and heard the local station testing. In a minute or so they closed down, and I then turned the condenser knob slowly round the scale on the chance of picking up some Morse, when to my surprise I heard telephony. At first I supposed I had struck some local amateur, but presently the sound of applause told me that I was listening to a concert in a public hall. I held on from 11.15 to midnight, and although the signals were very faint I recognised items that were in the Bournemouth programme for that night. Later I read in the wireless press that Bournemouth was giving a "birthday" programme on that date, and that because of the interruption of Mr. Asquith's speech it was continued

until (if memory serves) one o'clock the following morning. At midnight I thought it time to go to bed, but as a last attempt to improve signal strength I tried readjusting the crystal, which so far I had left



severely alone. No sooner had I touched it than I lost signals altogether, and was unable to recover them. My distance from Bournemouth as the crow flies is about 200 miles.

I recognise that this was purely a "freak" reception, and for some time doubted whether it was really direct reception, but wireless friends of greater experience have told me that it is unlikely that I should be able to hold on to a station for so long if I were getting it through the re-radiation of a neighbouring valve user. The only other long-distance telephony I have had is Manchester, 35 miles away. When I received Bournemouth I was using a two-circuit tuner consisting of home made basket coils, the primary tuned by a Polar .001 condenser, the secondary untuned, and I found signal strength best when the coils were practically touching, although on the local station a separation of some inches gives the best results. The crystal detector was a Burdemp. My aerial is the last word in inefficiency—a 30 ft. twin "T" with a 25 ft. lead in, about 30 ft. high at one end and 20 ft. at the other, directions east and west. On the other hand, I believe my earth to be very good; it consists of a galvanised iron plate buried in clay, and the lead to it is only some seven or eight feet long.

Yours faithfully, W. HARBIT.
 69, Cecil Avenue, Bradford; Yorks.
 (Continued on page 1168.)

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 1164.)

H.T.—betaken to the earth terminal of the new A.T.I. which is also connected to one of the filament leads, and to L.T. —. The remaining filament is connected through the rheostat to L.T. +. The phones remain in their old position on the crystal set. It may be found necessary to connect a small fixed condenser (say, '0002) across A. and E. of crystal set to load up the coil before it will act as an anode coil. See also reply to "Cryst" (Bedford).

D. S. (Dulwich Village, S.E.).—In the case of a loose coupler, when loading coils are added in both circuits to increase the wave-length, should coils of similar size be placed in both circuits, or should the secondary circuit have larger coils than the aerial circuit? I notice that instructions for making secondary coils generally give them as being much larger than the coil on the primary of the same set.

The coils should be loaded in the same proportion and if the inductance of one circuit is increased by a No. 50 coil, the other circuit will need a similar coil to bring it into tune.

The reason that the original primary and secondary coils are of different dimensions should be apparent if it is remembered that the aerial itself is connected to the aerial coil, and therefore a smaller coil in the aerial circuit will be required in order to give the same wave-length as the secondary circuit, which has no aerial.

Once the circuits have been brought into tune in this way they will need equal loading in order to remain in tune with each other.

B. A. E. (Erdington, Birmingham).—I have a one-valve Reflex set from which I expected loud-speaker results, but I can only get signals at a little more than crystal strength. What is likely to be the fault? (Diagram enclosed.)

If connections are correctly carried out according to the diagram (which is O.K.) you are probably using a faulty or unsuitable component. Try the effect of removing the condenser across secondary of L.F. transformer, and also of increasing its size up to, say, '002.

Reverse the leads to the primary of the L.F. transformer and also those to the L.T. battery. Also try the effect of a different crystal—the one you are using may be a good rectifier, but unsatisfactory when used in a dual circuit. A larger aerial coil (60 or 70 turns), with its condenser in series, might be found advantageous.

B. E. M. (Radlett).—Having just completed the construction of a three-valve set (detector and 2 L.F.), I find that on loud signals it distorts rather badly. Various means have been tried to stop this, such as grid bias and separate H.T. on both L.F. valves, various transformers, loading transformers with resistances across the secondaries, and also large primary and telephone condensers, but the distortion, though lessened, is not eliminated. Can you suggest anything else that can be done to help in this matter?

Probably the cause of distortion is mainly due to two things: First, a transformer of too high a ratio in the second L.F. stage (3—1 is ample here); and, second, the use of unsuitable valves. This is the cause of unsatisfactory results, distortion, etc., in a great number of cases, and too few amateurs pay attention to the types of valves, apart from the makes, which they employ in the various stages of their sets. Because one valve, say the detector, is of such and such a make and type, and is very good, it does not say that two more of the same type and make should be used in the 2 L.F. stages. Such a procedure is sheer folly, and is bound to lead to disappointment. Valves should be chosen according to the tasks they have to fulfil, and in your case you will probably find an improvement if you use a power valve (of same voltage as your others) in your last stage, with suitable bias and H.T. voltage.

I have also a great deal of 28 D.C.C. wire on hand, left over from a crystal set I was making. Can this be used for tuning coils successfully?

Yes, this is O.K. for coils for higher wave-lengths, though we would not advise its use for wave-lengths under 600 metres. It might be used successfully for reaction coils, as in this case the thickness of the wire is not so important as in tuning coils.

T M C

CHI VALENTE VA SANO.

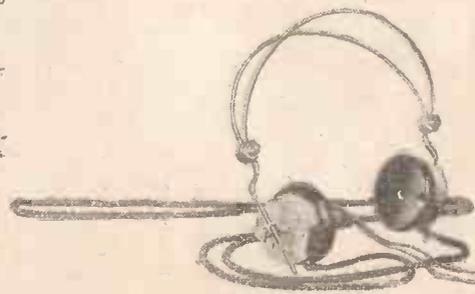
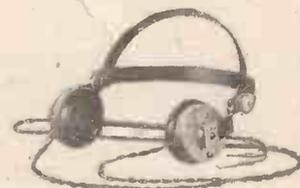
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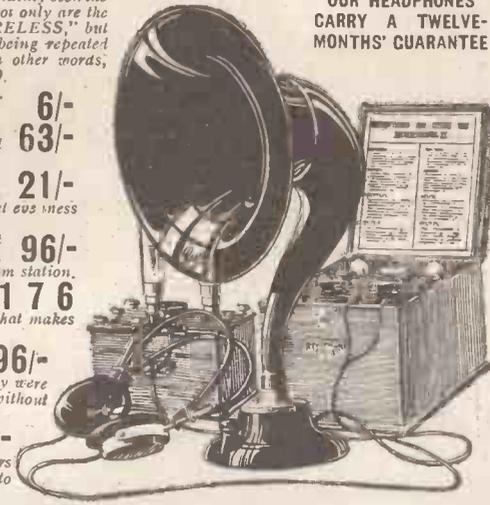
THE WAVES THAT ARE TIRELESS

“REVO”
FOR WIRELESS

It has been said that when a man or firm makes something better than their fellows, the world will make a path to their door, wherever that may be. This has certainly been the case with Revo Wireless Apparatus, for not only are the British Isles saying “REVO FOR WIRELESS,” but this slogan has spread overseas, and is being repeated all over the world. Have the best—or, in other words, see the trade mark is REVO.

- REVO LITTLE GEM CRYSTAL SET - - 6/-
Not a toy. Works perfectly.
- REVOPHONE CRYSTAL SET - - - - 63/-
The incomparable. The set that started half Britain listening in.
- REVO LICHTWEIGHT HEADPHONES - - 21/-
Light of weight, but full of tone. Each earpiece specially tested and selected to get you the best of tone. The phones ladies prefer.
- REVO CRYSTAL-VALVE SET - - Without valves and royalties. It's a marvel. 96/-
Works Revo loud speaker seven miles from station.
- REVO TWO-VALVE SET - - - - £11 7 6
Without valves and royalties. In handsome mahogany case. The set that makes listening-in worth while.
- REVO ONE- & TWO-VALVE 54/- & 96/- AMPLIFIERS - - each
These amplifiers accomplish what they were designed for—amplification of music without distortion or noise.
- REVO LOUD SPEAKERS 48/- & 80/-
Complete with cord. Experts say: “They are the best speakers made.” You should hear a Revo to appreciate wireless.

OUR HEADPHONES
CARRY A TWELVE-MONTHS' GUARANTEE



IF UNOBTAINABLE LOCALLY PLEASE APPLY DIRECT TO —
WIRELESS DEPARTMENT THE CABLE ACCESSORIES CO. LTD. TIPTON, STAFFS.
LONDON DEPOT: 28, SHOE LANE, E.C. 4.

OMNIPHONE
NORTH-WHILE
WIRELESS

AMERICA every NIGHT with a simple one- or two-valve set, on the short wave. KDKA, Pittsburg, now on 68 metres, comes in regularly from 11.30 onwards. The simplest, easiest, and most certain method of receiving these and other short-wave transmissions is to use the OMNIPHONE LOW-LOSS COIL, 60-120 Metres, which is unique in design and construction. Price, with helpful Pamphlet, 7/6 (Post 5d). OMNIPHONE WIRELESS CO., 24, Warwick Street, Regent Street, London, W.1. Phone: Regent 3345

Be sure to mention POPULAR WIRELESS when replying to Advertisements

TELEPHONES RE-WOUND

to 4,000 ohms. Guaranteed. All makes 5/- except Brown “A” 6/- and Sullivan, Wax filled, 10/- per pair. Ex-army converted to high resistance, 2/6 each ear-piece. Re-magnetising 9d. per ear-piece. Postage extra 6d. per pair. W. JOHN MILLER, 68, Farringdon St. E.C.1. 2nd and 3rd floor. Phone: Central 1950.

Charge Your ACCUMULATOR

at Home with the TUNGAR BATTERY CHARGER. Simple, Safe, and Economical. No moving parts. Requires no attention. No Garage, Owner-Driver or Wireless Enthusiast should be without one. Will charge from 1 to 10, 6-12 volt batteries at a time. Delivers from stock. Descriptive Booklet free on application. The Tungar Battery Charger is suitable for use on Alternating Current supply only.

Obtainable from your Garage or Electrician. THE BRITISH THOMSON-HOUSTON CO., LTD. Mazda House, 77, Upper Thames St., E.C.4.

‘07 VALVES FOR 12/6

TESTIMONY *Nom de plume, Deesbury.*
The ‘07 valve received for one returned is giving excellent results on a 1-valve set. Signals are very loud and clear, and it brings in almost all B.C. stations at good phone strength with inside frame aerial.

I have recommended your valve to all enquiring friends and enthusiasts, and shall continue to do so: it is a treat to work with. Unsolicited testimonial. Fil. volts 2-3, max. con. ‘07, anode 40-80. Concert tested and sent with instructions for use, post free on 24 HOURS' APPROVAL.

P.W. UNIDYNE D.E.'S.

Since its innovation we have advertised and stocked Phillips 4 Electrode Dull Emitter, so creditably mentioned in the Nov. 22nd issue of “Popular Wireless,” page 714.

- Phillips 4 Electrode D.E. 1.8 volt, .16 amp. 25/-
- Phillips 4 Electrode Bright Emitter - - - - 12/6
- (See Correspondence Columns P.W., Dec. 13th, p. 954)
- Thorpe K4 Bright Emitter (5 pin) - - - - 17/6
- Concert tested, post free, 24-hours' approval.
- N.B.—We now insure valves against all postal damage at customers' request on extra remittance of 9d. per 12/6 valve, 1/- per 17/6 or 25/- valve, the only condition being notification of damage within 24 hours.

ANELOY PRODUCTS (Dept. P.25). Eton Works, Upland Road, London, S.E.22.

PANELITE.

Will withstand 5,000 volts. Black finish. Will not fracture. 6 x 6 x 3/16, 1/-; 7 x 5, 1/1; 8 x 5, 1/2; 9 x 5, 1/4; 9 x 6, 1/8; 10 x 9, 2/2; 12 x 10, 2/9; 14 x 12, 4/6 post paid. Other sizes and thicknesses pro rata.

RADIO PANEL CO. (Dept. “P”). 143, Fetter Lane, London, E.C.4.

—AMPLIFIERS!—

Without valves, transformers, accumulators, buttons, etc. The “Varex” (Pro. Pat.) Amplifier amplifies crystal (or valve) reception 3 to 5 times, with one Leclanché cell. Interesting and cheap to make from our full-size instructional blue prints of amplifier circuits, etc., 2/6, including “Carbex” electrodes and steel reed.

Debenham & Co., Lewisham & Blackheath. Letters only to:—6, Loampit Vale, S.E.13.

THE SUPER CRYSTAL FIVEX

GET CHELMSFORD AS WELL AS YOUR LOCAL STATION. PACKED IN A SEALED TUBE, 1/3.

FIVEX SUPER CRYSTAL (POST FREE) 85, HATTON GARDEN, LONDON, E.C.1

CORRESPONDENCE.

(Continued from page 1166.)

THE “P.W.” ULTRA.

The Editor, POPULAR WIRELESS.
Dear Sir,—In a recent issue of “P.W.” you ask for crystal records for long distance work to beat Mr. Thomas, who heard Bournemouth 110 miles away. Here you are.

My set is a “P.W.” Ultra for 1,600 metres, and I am always enjoying 2 L.S. on three pairs of headphones, and speech is very fair. On one pair of phones it is, of course, fine.

On the anniversary night at Bournemouth I heard the announcement given that Bertram Fryer, station director, would say a few words, and all present joined in singing “For He's a Jolly Good Fellow!” I also heard the end of an orchestral item followed by the National Anthem, just after the B.B.C. extra turn, and can only put that down to Bournemouth. I have also received Scotch dances from Aberdeen, and heard 2 L.O. direct on the occasion of a speech by Lord Balfour.

These are what I call a fair test, as they are all just ordinary stations, and not high-power like 5 X X or Radio, Paris.

I can switch over to 5 X X at will and have speech as powerful as 2 L.S. Bournemouth is about 270 miles, I believe.

Hoping this will be of interest to you, as the set is a “P.W.” circuit—and I don't wish for anything better.

Yours sincerely,
HAROLD O'CONNOR.

17, Tanfield Road, Birkby, Huddersfield.

SINGLE VALVE RESULTS.

The Editor, POPULAR WIRELESS.
Dear Sir,—Being a “single valve merchant” myself, perhaps the following report might interest one or two of your many readers.

The other evening I tuned in the following stations: 5 W A (R.4), 2 L O (R.4), 2 Z Y (R.5), 6 B M (R.7), 5 N O (R.4), 5 I T (R.4), 5 S C (R.3), 2 B D (R.4), 5 X X (R.6), Radola (R.4), and five foreign stations. Early on Friday morning, December 12th, I also logged: K D K A, W B Z, W G N, and W G Y. I have also heard one or two B.B.C. relay stations, Liverpool being the strongest.

I have been a reader of POPULAR WIRELESS ever since it first came out, and wish it every success.

Yours truly,
A. T. S.

“The Glen,” Caesars Road, Newport, I.W.

THE “HOPWOOD” CIRCUIT.

The Editor, POPULAR WIRELESS.
Dear Sir,—I wish to express my appreciation for the “Hopwood” circuit, re POPULAR WIRELESS. I can get all the B.B.C. stations, also lots of Continental stations, and the following American stations: W G Y, K D K A, W H A S, W E E I, W B Z, also W B D. I think it is an excellent performance for a one-valve set. Wishing your paper every success.

Yours truly,
G. H. BLANCHARD.
17, Albert Terrace, Albert Street, Grantham, Lines.

MUSIC-HALLS AND RADIO.

The Editor, POPULAR WIRELESS.
Dear Sir,—As an old subscriber and reader, I was naturally interested in Sir Oswald Stoll's interview with “Aerial,” and one would come to the conclusion that two separate audiences existed, one for the Music-halls, Theatres and Concerts, and one for the Radio. This is a fallacy. Take the case of my own circle. I have been the means of creating a large number of wireless friends, who more or less work together in things Radio, and yet, in spite of the pleasure we get from it, I know for a fact that we all go to the local music-hall, and just as often to the West End to see a “show,” as before.

Any unbiased person will instantly agree that the so-called monopoly of the B.B.C. is necessary to prevent “ether chaos,” and the well-known monopoly of the heads of the theatrical, music-hall and musical worlds is slowly but surely being nullified by the general public, which is taking up Radio to such an extent that the demand for first-class artistes for radio is certainly creating the supply.

This is automatic, and as Sir Oswald Stoll says he will not lift a finger to help the B.B.C. (which means us, the general public), it seems to me that we should simply ignore the old interests and support the new form of interest and amusement, and let the matter take its natural course, and all the boycotting of the B.B.C. and the public in this matter will inevitably settle down to a common-sense solution, which will be forced by circumstances over which the leading luminaries of the interests concerned will have no control.

In the meantime the attitude of the B.B.C. sets a good example to these three great interests in good form and public service, and we, the public, will continue to pay for the amusement we prefer, as and when we wish.

Yours, etc.,
B. W. KING.

34, St. Mary's Grove, Chiswick, W.

(Continued on page 1169.)

CORRESPONDENCE.

(Continued from page 1168.)

"CARRIER CATCHING."

The Editor, POPULAR WIRELESS.
Dear Sir,—Can any reader beat these results of mine, using a one-valve (reaction on aerial) set? Twenty-two stations in fifty-five seconds, every one outside the British Isles, logged at 19.45 Sunday.

Readings of Condenser.	Results.	Approximate Wave-lengths.
2°	Pianoforte Solo	270 metres.
7°	Sermon	300 "
10°	Only Carrier	320 "
21°	" "	350 "
30°	" "	365 "
36°	" "	372 "
43°	Violin Solo	380 "
50°	Orchestra	400 "
52°	Orchestra	410 "
55°	Recitation	418 "
60°	Orchestral	425 "
65°	Announcing in German	430 "
69°	Man singing	440 "
72°	Sermon	443 "
77°	Baritone	454 "
80°	Only Carrier	460 "
86°	Speaking	470 "
88°	Violin and Piano	480 "
90°	Woman singing	485 "
92°	" "	490 "
98°	Only Carrier	505 "
100°	" "	510 "

I am using No. 75 Honeycomb in A.T.I., No. 50 Reaction, .0005 mfd. Polar condenser in series; 80 ft. twin aerial 40 ft. high.

Yours sincerely,
G. W. APPELYARD.

92, Day Street, Hull.
P.S.—Time checked by witness.

SIGNALS FROM MEXICO.

The Editor, POPULAR WIRELESS.
Dear Sir,—I note in a recent issue of "P.W." a claim by Mr. Ridley to be the first to receive signals from Mexico. I am afraid this is far from being the case. I know of several amateurs who have received these stations for some months. As far as I am aware, the first occasion was in April, 1923, when I received station B X, of which report I have his acknowledgment, and many times since then signals have been heard from that country.

It may possibly be of interest to you to know that my signals were heard by Mr. Hughes, the president of the Transvaal Radio Society, in Johannesburg, in early October of this year, which I believe to be the first occasion a European amateur was heard in S.A. My power input was 80 watts on a wave of 100 metres, in an aerial 50 ft. long and 15 ft. above a roof.

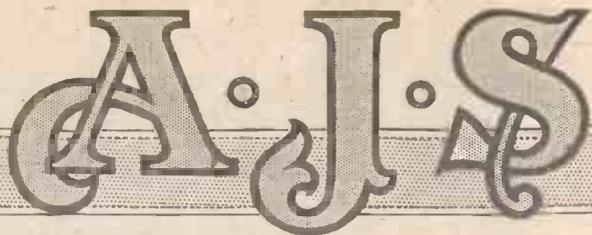
Yours faithfully,
FREDERIC L. HOGG,
G 2 S H.

37, Bishop's Road,
Highgate, N.6.

THE THREE-VALVE UNIDYNE.

The Editor, POPULAR WIRELESS.
Dear Sir,—As an old reader of your paper may I be allowed to tender you a brief account of the success I have had with the Unidyne? I have a three-valve, H.F., Det. and L.F. I wired this last July. At first I had a little trouble, but after persevering I got it in first-class order. I have received on the detector valve alone all the British stations, including the following relays: Hull, Liverpool, Sheffield, Nottingham, Leeds. Also the three Paris stations, Madrid, Hamburg, Berlin, Copenhagen, Brussels, and four unknown. I have not yet tried America, but judging by the strength all the stations I have got come in, I have no doubt that under favourable conditions the U.S.A. could be got also. I have read every article on the Unidyne, and every letter in POPULAR WIRELESS. A few nights ago I had been experimenting with a wave trap. After a while I disconnected this, and began hunting around for a few stations. I received 2 Z Y, 2 L O, 5 N O, 5 S C, and 2 B E, also Hamburg and Berlin. Later on in the evening I found out I had been using no earth wire. This was an accident. The following night I tried a few stunts. First of all, I disconnected the aerial, and used the earth wire in its place. Manchester, our local station, twelve miles away, came in excellently. I then switched on the L.F. valve and got Bournemouth very well indeed. Next I hung a piece of wire 5 ft. long on a bird cage suspended from the ceiling. I used no earth. 2 Z Y came in loud. I have heard of many who are having difficulties with their Unidyne. But if those people would see to it that their parts are of first-class make, and follow carefully the particulars you have so often given, they should have no difficulty. I have had considerable experience in valve sets, having wired up quite a few different kinds, but in my opinion the Unidyne is far superior to any I have heard. I have also wired up the Neutrodyne Unidyne Reflex. This also is a very

(Continued on page 1170.)



THE HALL MARK OF RADIO PERFECTION

NEW MODELS

A.J.S. LOUD SPEAKER

Accurately proportioned non-resonant horn, giving correct acoustic properties. True reproduction and extreme sensitivity without distortion.

With metal horn and plated fittings, £4 15s.
With oak or mahogany horn and plated fittings, £5 10s.

A.J.S. 4-VALVE RECEIVER

Polished walnut cabinet, plated fittings, filament resistance to each valve and switch for L.F. valves. Complete with four valves, 100 v. H.T. battery, 8 amp. hour 6 v. L.T. battery, lead-in tube, aerial wire, insulators and Brandès "Matched Tone" headphones. Complete set, £27 5s. Panel only, £20 5s.

IN CHOOSING A.J.S. you choose the product of a great manufacturing house with a name and reputation far too highly-prized to be staked on any but the most thoroughly tested instruments.

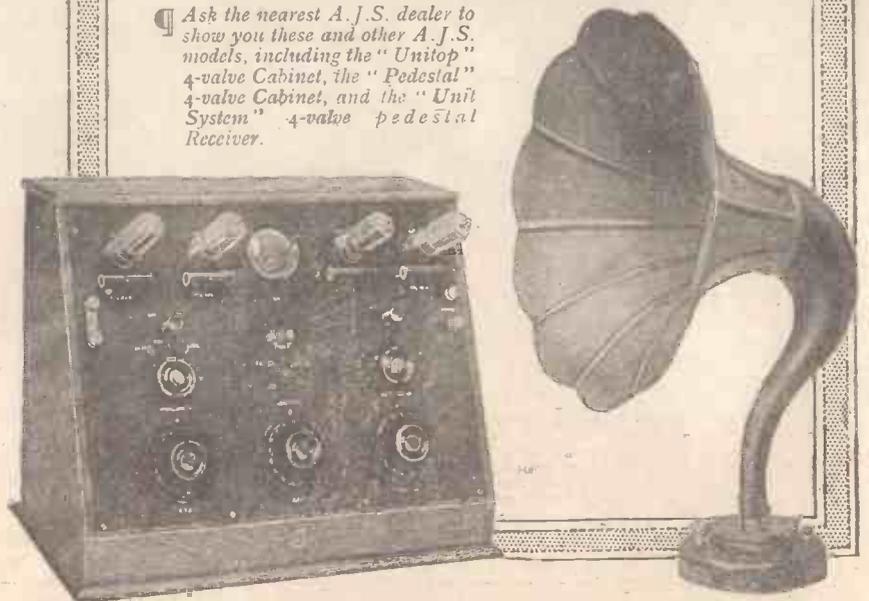
Thus, when you buy A.J.S. you secure not only an instrument that for design, efficiency, simplicity and handsome appearance is second to none, but one that can be relied upon implicitly to stand up to the inevitable knocks, and to yield long and trustworthy service.

Let us send you our free Illustrated List

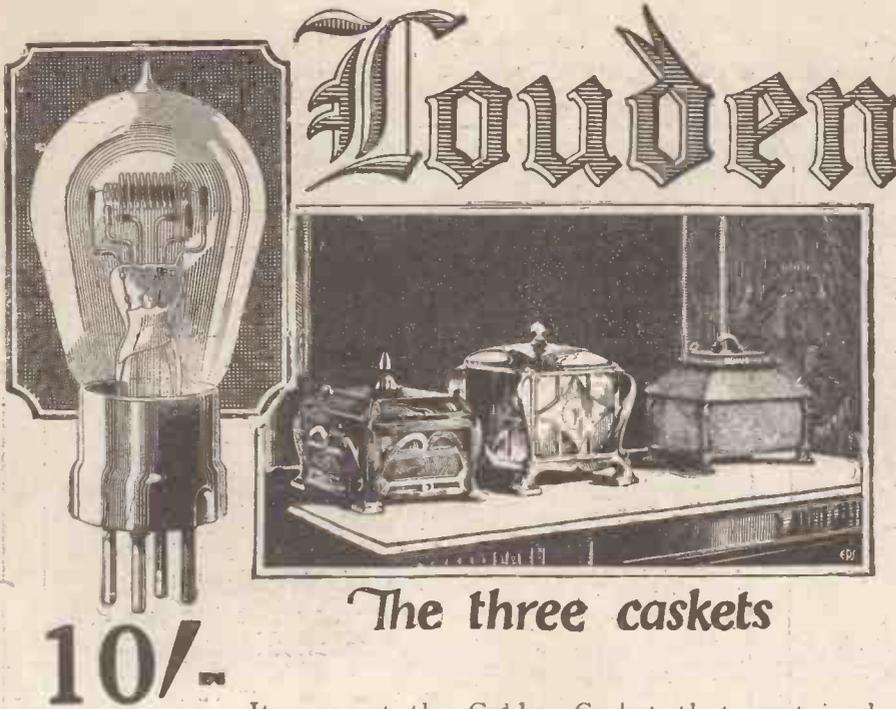
A. J. STEVENS & CO (1914) LTD
WIRELESS BRANCH
WOLVERHAMPTON

'Phone—7350., Wireless Call Sign—5RI. 'Grams—Reception, Wolverhampton.

Ask the nearest A.J.S. dealer to show you these and other A.J.S. models, including the "Unitop" 4-valve Cabinet, the "Pedestal" 4-valve Cabinet, and the "Unit System" 4-valve pedestal Receiver.



CORRESPONDENCE.
(Continued from page 1169.)



The three caskets

10/-

It was not the Golden Casket that contained Portia's portrait, but the lead; and so it often happens that the most expensive article is not necessarily the one most to be desired.

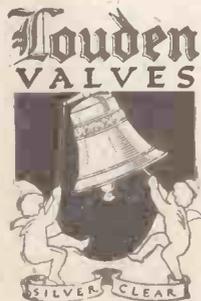
There are many valves more expensive than the Louden; yet there is not one of them that combines all its many advantages.

It uses considerably less current from the accumulators than is usual amongst valves of the bright filament type—a point which needs no labouring to those anxious to keep down costs. It gives a reproduction full in volume and silver clear in quality, and it has a stout filament which is not readily broken.

Further, it only costs **10/-**

Four months ago people had not heard of Louden Valves; to-day they are demanding them at the rate of many thousands per week—which is, perhaps, the most striking testimony of all.

See that your next valve is a Louden.



The plain Louden for detecting and Low Frequency Amplifying.
The Blue Louden for H.F. Amplification. Filament Volts 4-8-3. Filament Amps. 0.1. Anode Volts 40-80.

FELLOWS WIRELESS

Manufactured throughout in Great Britain. All Loudens are Silver Clear and free from "mush." The current consumption is very low and the life long.

Louden Valves - Silver Clear

good receiver, but requires careful handling to get good results. In conclusion, I, like many others, tender my thanks to the inventors, Messrs. Dowding and Rogers. I should think myself that any reader of your splendid paper who has not got good results will persevere all the more after reading so many letters, like this one, for instance.

Yours sincerely, EDWARD HEWKIN.
Platt-Lane, Dobeross,
Near Oldham.

"D X" RESULTS IN GERMANY.
The Editor, POPULAR WIRELESS.
Dear Sir,—I think that some results, on both my crystal and valve set, might be of interest to you, as they give a good idea of receiving conditions in this part of the Continent (Frankfort-O.M.). On my crystal set, consisting of tapped inductance (basket coils) and condenser in series, I am able to get the local station (15 miles) on the L.S. audible through two rooms easily. Frankfort O.M. has an energy of 0.8 kw. Chelmsford, Bournemouth, and London I can pick up any evening without amplification of any sort. Ecole Supérieure, Hamburg, and Radio Paris I have had on various occasions.

On my valve set, home-made (1 Det. and 2 L.F.), I can get any B.B.C. main station on the L.S., 5 X X without any reaction at all. With one valve and reaction I have tuned in 5 X X and Aberdeen quite clearly on the L.S., so that signals were readable 5 yards off.

I have tried for America four times, and have each time been successful. K D K A on 327 m., W B Z on 338 m., and W G Y on 380 m. are very good. With two pairs of phones every word spoken is clearly to be understood. Besides these, I can hear two more stations; however, they are too weak to read.

I can understand speech from W G Y on one valve and reaction, provided that the weather is not unfavourable. I must add that my aerial is extremely good, being 75 ft. high and 230 ft. long. It is a single wire aerial, the lead-in being taken off in the middle.

Hoping these results may be of interest,
I am, Yours truly,
HENRY HERZ-MILLS.
Frankfort o.M.,—(An ardent reader of "P.W.")
Wilhelmstrasse 20.

CRYSTAL "D X" RESULTS.
The Editor, POPULAR WIRELESS.
Dear Sir,—Seeing in your excellent book that Mr. W. E. Thomas had got Bournemouth at Swansen, a distance of 110 miles, I thought you might, possibly be interested to know that I have beaten this record. On Saturday, December 13th, I picked up Bournemouth at 8.15 p.m., when it was raining very slightly. The distance as near as I can judge is 205 miles.

I might mention that Colmer is about 7 miles north of me. I am using a plain crystal set, which I made myself to get 5 X X, which comes through very plain indeed, at about 88 miles. I might mention that I have also got Continental stations as well, but where from I do not know. Twice on two Sunday nights I have heard a Continental station at 10.30 to 11 p.m.—once November 23rd, and once December 7th. I think according to your time-table in your issue of November 22nd, that it must be Radio, Paris.

Yours truly, B. H. DAY.
Aldborough, Norwich, Norfolk.

AN ENCYCLOPEDIA OF BUSINESS.

A NEW work of the utmost importance to those already engaged in business, to those just embarking upon a career, or to parents faced with the problem of starting their children in life, is to be published on Thursday, January 15th. HARMSWORTH'S BUSINESS ENCYCLOPEDIA will form a complete guide to all commercial and business careers, and for every branch it will supply everything necessary to study and advancement. It is the most complete work of its kind ever attempted.

It will be richly illustrated, the contents will be arranged alphabetically, and its long list of contributors contains names of Cabinet Ministers, Treasury Officials, and famous business and financial magnates. It is to be completed in about 36 fortnightly parts, 1s. 3d.—a price equivalent to only just over 1d. per day. Part 1 contains a remarkable and inspiring introductory article by Lord Birkenhead. It will be on sale at all newsagents and bookstalls.

TECHNICAL NOTES.

(Continued from page 1126.)

contact, namely, that between the cat's-whisker and the crystal, and the other contact is of large area (as when the crystal is embodied in a crystal cup of Wood's metal), it is reasonable to assume that the fact that the action takes place only at the point contact is sufficient to account for the direction of the rectified current, or the polarity of the rectifier.

Two-Point Contacts.

But where there are two-point contacts, as in the device under consideration, it is difficult to see, at first sight, why there should be any polarity at all. Perhaps this will be made clearer by means of an example. Suppose you place a zinc and a carbon plate in sal-ammoniac solution: the carbon assumes a positive potential with respect to the zinc. Suppose now you introduce into the solution another zinc plate, and connect to these two zinc plates, instead of to one zinc and one carbon. The net result will be that you will not get any potential difference at all, since what is gained between one pair is lost between the other. Similarly with the crystal contacts. Let us call the metal wire A and the crystal B. Then suppose the contact rectifies in such a way that A is positive with respect to B, that is, the contact allows current to pass when A is positive with respect to B, but not in the opposite direction. It seems fairly clear that where the current has to pass through two contacts in series, that is, through an AB contact and then through a BA contact, it should be impossible for any current to get through at all, since the contacts rectify in opposite directions, and what can get through one cannot get through the other.

Different Metals.

Of course, this is all on the assumption that the two cat's-whiskers are of the same metal. But if different metals are used with the same crystal, then there is a possibility of getting the desired result. At any rate, the device referred to above certainly works, so it is evident that the theory must be adjusted to conform with the facts. Readers' views (or experiments) on this point would be very interesting.

Crystal in Bottle.

The second device, sent me by a reader, is very similar to the one I have described, except that a small bottle is used, filled with spirit, and wires are passed through the cork and turned upwards at the lower ends, the crystal being dropped in in the same way. But I am afraid I have already spent so much space on this matter that I shall have to postpone further description of it until later. Perhaps the best thing to do will be to give it in "Constructional Notes," with diagram, which I will do as soon as possible.

Loud-speaker Hint.

It is not perhaps commonly known that the tone of a loud speaker can often be considerably improved by connecting a small fixed condenser across its terminals.

The value of this condenser, that is, its capacity, can only be determined by trial, as it depends upon a large number of factors.

(Continued on page 1172.)



No. 2
of a
Series.

The Living Artist

THERE'S nothing more distressing than to hear a piano solo travestied by wireless. And nine times out of ten the fault lies not in the Loud Speaker at all but in the use of an unsuitable L.F. Transformer.

A good Transformer is something more than a bundle of laminations and a few thousand turns of fine wire. If it is to function correctly it must be designed according to definite scientific standards and not according to hit-and-miss methods.

Before a single Eureka Transformer was placed on the market many hundreds of pounds had been spent in research work. It was not a case of following current practice and adding one more to

the many already available. The designers of the Eureka began where others left off. They ploughed a lonely furrow—but they won through.

Eighteen months ago unknown, today the Eureka is recognised as being the country's finest L.F. Transformer. Its handsome appearance would certainly add an air of distinction to your Set, while its immense volume of superb tone would be a revelation to you.

Concert
Grand 30/-

Portable Utilities Co., Ltd.,
Fisher Street, London, W.C.1.

Eureka 22/6
No. 2.
(For Second Stage.)

Supreme **EUREKA** for Tone

CABINETS for Wireless CONSTRUCTORS

PICKETT'S
HIGHLY POLISHED
CABINETS
from 1/6 each.
They're good value.

Send for constructors list free
PICKETT'S CABINET WORKS
BEXLEYHEATH S.E.

Send for Constructor's List (P.V.) FREE.

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PATENTED. Trade Marks and Designs Registered.
Particulars and consultations free.
BROWNE & CO. Patent Agents,
9, Warwick Court, Holborn, London, W.C.1.
Established 1840. Telephone: Chancery 7547.

INVALUABLE TO ALL WIRELESS CONSTRUCTORS
ONE GROSS OF ASSORTED
B.A. SCREWS, NUTS, 2/-
AND WASHERS,
J. H. BENNETT, STATION ROAD,
WILLESDEN JUNCT.
Everything for Wireless.

HEADPHONE REPAIRS
Rewound, re-magnetised and readjusted. Lowest prices quoted on receipt of telephones. Delivery three days.—**THE VARLEY MAGNET CO.,** London, S.E.18. Phone 888-9 Wooditch. Est. 26 years.

THE NATURAL CRYSTAL
ETHITA
TRADE MARK

IS SECOND TO NONE & UNBEATABLE AT ANY PRICE. 5 sizes, but one quality. 6d. to 1/6. Props.: The Bright Co., London, N.8. Sole Wholesale Agent for London & Home Counties: A. J. Conway, 86, Green wood Road, London, E.8.

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PANELS IN LARGE OR SMALL QUANTITIES ENGRAVED BY **SUGDENS, 57, FARRINGDON ST., E.C.4.**

GUARANTEED 'PHONES.
A FEW OF "OUR" PRICES.
Genuine Telefunken (the World's best) 17/-
" Dr. Nesper's (adjustable) 12/6
" Ericsson's (Continental No. 10) 11/-
Post Free.
Price List of other brands on application.
We save you money on all 'Phones.
RUST & CO., Reavill's Yard, Foreman Street, NOTTINGHAM.

REDGATE Regd. 705178.
FLUSH-MOUNTING
Low Capacity
VALVE LEGS.
Beauty and Efficiency
1/- set of 4, Brass. 1/2 set, Nickel Plated. With drilling template.
From all the best dealers.
REDGATE MFG. CO.,
32a, Wesley Gate, Nottingham.

Publishers require representatives in certain districts to call on Radio enthusiasts and owners of receiving sets. State previous occupations. Must have good knowledge of wireless and suitable connections. Write to Box 201, Sell's Advertising Offices, Fleet Street, E.C.4.

P.W. UNIDYNE
ASTOUNDING RESULTS!
Extract from report of "Popular Wireless" of December 6th, 1924:
"WE CONSIDER THIS DULL EMITTER VALVE A VERY INTERESTING AND EFFICIENT PRODUCT." During the test 9 B.B.C. stations were received on a Philips 4-Electrode Dull Emitter Valve. Philips' Tested 4-Electrode Dull Emitter Valve.
Valves, 1'6-1'8 volts, 15 amp. 25/- each
Philips' Tested 4-Electrode Bright Emitter Valves, 3'5 volts, 5 amp. 12/6 ..
ALL POST FREE.
These valves fit ordinary 4-pin holder.
E. GEORGE, 70, Hailsham Avenue, Streatham Hill, London, S.W.2

TECHNICAL NOTES.

(Continued from page 1171.)

In some cases it may be found that there is no advantage, but there are few cases in which some improvement will not be noticed when the correct capacity of the condenser has been found, and in many cases a very considerable improvement can be effected.

Fading.

The peculiar variations in the strength of signals, classed under the general name of "fading," are due to a very great variety of causes. Many of the causes are of natural origin, and are not understood, much less capable of being controlled. One interesting cause of peculiarities in reception, however, is the smoke from large chimneys. There are many towns, particularly in industrial centres such as Lancashire (where a good deal of my time happens to be spent) where chimneys are much more plentiful than sparrows. In these districts quite considerable variations in strength of reception is noticed, due to the smoke from the chimneys. It will be remembered by the reader that gases which have passed through a fire are heavily "ionised," and therefore form electrically conducting layers or regions when they pass out into the atmosphere. These electrically conducting regions are very disturbing to the passage of electrical waves, and give rise to various kinds of deflections and absorptions, which are interpreted in the final receiver as "fading."

The Hushaphone.

It is difficult to please everybody. The experts of W B Z, Springfield, Mass., thought the listeners to a boxing match or other public affair would prefer to hear the announcer's voice undisturbed by the roar of the cheering crowds, and they accordingly set to work to devise a special type of microphone, by which this result could be attained. The microphone was called the "hushaphone," and by its aid the announcements were transmitted with an almost entire elimination of the "background." To their surprise, however, the engineers learned that considerably more than fifty per cent of the listeners preferred to have the background transmitted, as it helped them to form a mental picture of the scene. Personally, I am not surprised; this is, in fact, exactly what I should have expected, but it emphasises the difficulty of pleasing everybody, especially in wireless broadcasting.

Oscillating.

Now that reaction on to the aerial is permitted, many ingenious circuits and other devices have been produced, having for their object the prevention of radiation and consequent interference with neighbouring receiving stations. One arrangement depends upon a special placing of the aerial, plate and grid coils, so that it is impossible to energise the aerial, even if the set oscillates. Another clever device causes the energy which is fed back into the aerial to be divided into two equal but opposed parts, so that they balance each other's effect. A third method employs a subsidiary circuit which becomes active when the aerial is oscillating, and which then throws the receiver out of action.

No doubt many other methods will in course of time be evolved, and these are always useful, as there must always be a percentage of beginners who, however unwittingly, are the cause of much profanity in their neighbourhood.

Local Interference.

Whilst on the subject of interference, I think it may be interesting to mention a peculiar case of local interference, cited by a correspondent of "Radio Digest," in which the trouble was found to be due to a defective battery-charger nearby. He says: "I tried for a solid week to determine what it was that made even local reception impossible with a five-valve neodyne set, going carefully over all the usual possibilities, such as arc, transmission, etc., until eventually I found that in a local garage they were using a battery-charger of the vibrating-reed type, which was not properly adjusted. This was set properly, and immediately the interference disappeared entirely."

If any readers are troubled by what seems to be similar interference, possibly this information may put them on the right track.

Grid Potential.

Sufficient attention is not given by many beginners in wireless to the important question of grid bias. In many sets, no allowance is made for applying negative bias to the grids, although in many cases, if not indeed in most, considerable improvement in reception can be attained by proper adjustment of grid potential. A potentiometer is desirable for the purpose, as by this means an exact adjustment may be obtained, but in the absence of a potentiometer, or in a made-up set where there is not room for the inclusion of a potentiometer, one or two small dry cells may be used, generally with advantage. These remarks apply particularly to the L.F. valves.

A Book Bargain

The Home Radio. How to make and use it. By Verrill. For those interested in improving their sets or installing more efficient ones. Published 3/6. Offered, now, for 1/9, post free. Quote offer 120.
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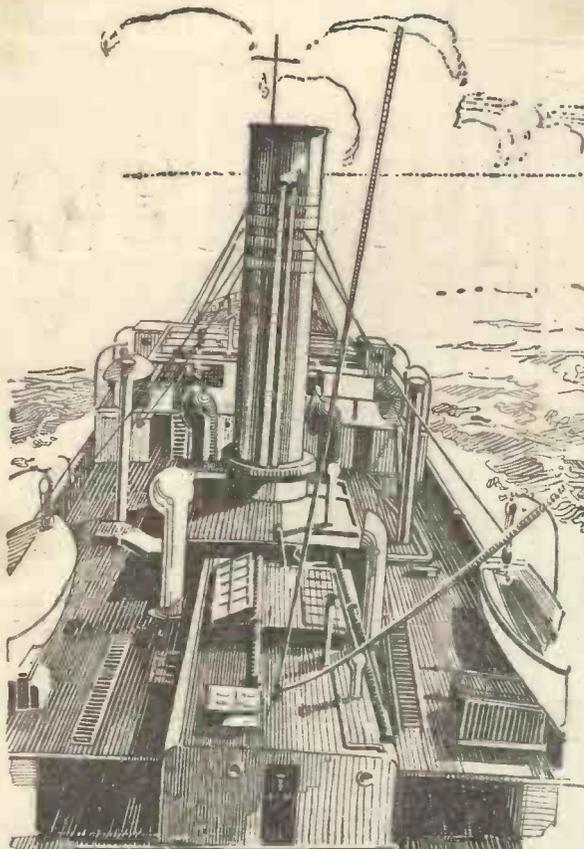
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“If to my Starboard
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It is my duty to keep
clear.
To act as judgment
says is proper
To Port or Starboard.
Back or Stop her—”

*A rule of the road
for preventing
collision at sea.*



THE “rule of the road” at sea calls upon the officer in charge of the ship in the foreground to “act as judgment says is proper” in avoiding collision with the approaching vessel.

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* * * *

Consider the components you fit to your wireless set.

Upon them depends not only the success of the whole set but also your reputation as a wireless expert.

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It is a mistake to suppose that one make of condenser is much the same as another, and it is a mistake to believe that your set can give the best results if your condensers and resistances are of the just-as-good variety.

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NATURE'S WONDER CRYSTAL

"Uralium" is put up in neat little boxes with a silver cat's-whisker. The price is 1/6.

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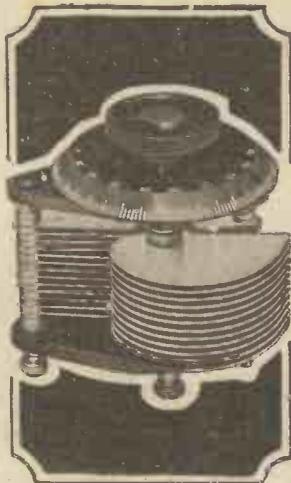
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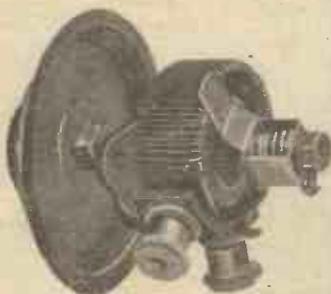
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The former is constructed from a fire-proof material. Each turn is rigidly supported.

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Felix stops perambulating!
Why stands he thus, hand elevating?
—Pose emphatic, eyes ecstatic—
Is that master mind debating
Schemes for which the world is waiting?

Felix stops perambulating!
And the world, no longer waiting,
Shares the pleasure of a treasure.
See his hand an ear caressing,
And his whiskers crystal pressing!

Felix stops perambulating!
From waves ethereal emanating,
Sounds entrancing, joy enhancing,
A message clear proclaims with might
The wondrous power of Tungstalite.

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RADIO NOTES AND NEWS OF THE WEEK.

The "Multidyne."

A SERIES of articles under this title are now in active course of preparation, and will shortly be published, week by week, in P.W. The "Multidyne" is an ideal set for the experimenter, enabling him to utilise an almost unlimited number of circuits by a simple plug-in arrangement which does not necessitate the dismantling of any component parts. The "Multidyne" does not claim to be a new invention: it is, however, a very meritorious improvement in experimental design, and as such it will be presented at an early date to P.W. readers.

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THE "Best Way" book, No. 162, also contains a large Pictorial Blue Print; and No. 161, "How to Make Crystal Sets," will supply a long-felt want among crystal set enthusiasts. Both books can now be purchased at ANY bookstall or newsagents, price 6d. each.

* * *

Lifting the Ban.

THE removal of the ban on foreign apparatus, which became effective on January 1st, has not had time to affect the British market yet, but developments are being eagerly awaited. Whilst there is a natural disposition to support home industries, the average listener does not overlook the great discrepancy in price between some Continental and similar British products. There is a feeling that the coming competition will ginger-up the tendency to reduce prices which seems to have halted during the past few months.

The Government's Bill.

ANOTHER feature of the New Year which is being watched with interest is the Government's promised radio Bill to regulate the position of licence holders. The G.P.O. is commendably prompt in sending out requests for renewals, but threats of dire penalties are quite out of place in view of the P.M.G.'s failure to prosecute Mr. Ford, at his own request. What will the Government do with "pirates"?

* * *

Cold Filament Reception.

AN Edinburgh correspondent informs me of an experience he had recently whilst experimenting with a one-valve set, which should be of interest to all experimenters. The L.T. cells were run down and were disconnected, and the filament resistance arm was off the wire, but 50 to 60 volts

Another Super Station.

MR. WILLIAM WRIGLEY—the "chewing-gum king"—and other prominent American business men are planning to erect the largest building in the world at Chicago. It is to be a "temple of agriculture," and amongst the latest scientific equipment it will house a super broadcasting station, which it is expected will be heard in this country. A broadcasting tower, modelled on the Eiffel Tower and rivalling the great European erection, is included in the plans.

* * *

"Corking" the Aerial.

HAVE you "corked" your aerial? Serious damage is being done to pigeon-breeders through valuable birds flying into wireless aerials, and as pigeons as well as wireless rendered great service during the war, it is only fair and humane that the lives of the birds should be safeguarded by the simple precaution of fixing corks to the wires every three or four feet, so that the pigeon in flight can see the obstruction.

* * *

No Trouble, No Danger.

FOR the benefit of those who live near pigeon-breeding-grounds it may be as well to point out that the placing of corks along the aerial to make it more easily visible has no harmful effect whatever upon reception. Both the cost and trouble are negligible, and I am sure that once the danger to

the pigeons or other birds has been pointed out, there is no amateur who will not try to make the air safe for them.

* * *

Guiding Pilots.

AS forecast in "P.W." some months ago, beam wireless has been adapted to guide aeroplanes during low visibility. The recent flying fatality near Croydon would probably not have been avoided by such a scheme, but there is no doubt that in the past an invisible ether line along which to fly in bad weather would have saved more than one fatality. During tests at Dayton-Ohio it was found possible for

(Continued on page 1178.)



The main studio at W E A F, the well-known station belonging to the American Telephone and Telegraph Co., New York.

H.T. were plugged in. Despite the cold filament, 2 E H could still be heard, as if the oscillations were building up and broke through, coming loud with a jerk and then dying into nothing. Have any other readers had a similar experience?

* * *

2 L O at Sea.

I HEAR through one of the wireless operators of the s.s. Leviathan that 2 L O is regularly received on board at distances up to 1,000 miles, and 5 X X up to 2,000 miles. The vessel carries eight wireless operators, and by means of specially-balanced aerials they are able to handle spark and continuous-wave transmissions simultaneously.

NOTES AND NEWS.

(Continued from page 1177.)

a pilot to keep a perfectly straight course on a hazy day, unaided by landmarks, by listening in to a kind of radio beam.

W S A I's Claim.

THE Cincinnati station (W S A I), which has been coming over very well during the last month or so, claims to have the finest chime-concerts in the U.S.A., which it broadcasts from a nine-story bell tower. The station is owned by a playing-card manufacturer, and its programmes consist

SHORT WAVES.

"... wireless has this advantage over the schoolmaster: what it says never comes in at one ear and goes out at the other. Not when you use headphones."—*"Daily Herald."*

"... Solomon said there was nothing new under the sun, but he didn't say it by radio."—*Mr. Thomas Jay, of "Punch," speaking at Bristol.*

"... Broadcasting has come to stay, and even allowing for a certain waning of nightly enthusiasm on the part of listeners when the first novelty has worn off, it is likely to become and remain part of the equipment of the majority of households. We shall get used to broadcasting as we get used to everything else; but the chances are that we shall have to listen when there is anything irresistible on the programme."—*"The Times."*

"If you are a pirate, wend your conscience-stricken way to the nearest post office and deposit 10s. and receive in return a little slip of paper which will go a long way towards making a respectable citizen of you."—*"Manchester Evening News."*

"... It is clear that wireless in coming days will touch the whole of life and compete more and more powerfully with other interests for the leisure time of the people."—*"Sunday School Chronicle."*

"Broadcasting the image of a clock-face so as to show the exact time is now perfectly feasible, and the only reason why it is not being done is that most people are still satisfied with the audible time-signals we get every night."—*Dr. Fournier d'Albé, in a message to the "Daily News."*

"... Like several other men, I, myself, was once a small boy, and I can only say that an invention which has brought headphones into well-nigh every house, thereby rendering it less necessary than ever to wash behind the ears, is deserving of every encouragement."—*Dudley Clark, in "The Passing Show."*

mainly of local musical talent, drawn from the city's glee-clubs, orchestras, and College of music.

Help Wanted.

A WILLESDEN GREEN reader asks if there is anyone in that district who would be willing to co-operate with him in practising the Morse code? Enthusiasts who favour the idea should write to Mr. E. W. Luff, 38, Strode Road, Willesden Green, London, N.W.10.

To-night's Concert.

T O-NIGHT and on subsequent Thursdays during 1925 the programme from the high-power station will not be provided by the B.B.C. artistes, but will come from some outside source such as a well-known hotel orchestra or famous concert. The popularity of the Hallé concerts has already been enhanced by broadcasting, and it is likely that they will be drawn upon frequently under the new scheme. Other

provincial music which has been inadequately recognised outside its own locality should find a new lease of life through 5 X X.

1925 Prospects.

THE most eagerly awaited development of the New Year is the permanent establishment of the B.B.C.'s high-power super station in the Midlands (just outside Daventry). With this station sanctioned by the Government the scheme of dual entertainment can be pushed to its logical conclusion, and I think that 1925 will see the provision of alternative concerts to practically every section of the B.B.C.'s audience.

The Leeds Exhibition.

I HEAR that bookings for the Leeds Wireless Exhibition are very good, and that the organisers are anticipating that a thoroughly fine show will result. The "Leeds Mercury" is offering prizes to the value of £75, and some interesting competitions for constructors have been arranged. The Exhibition will be open from Tuesday, January 20th to Saturday, January 31st, at the Fenton Street Drill Hall, Leeds.

Radio for Surveyors.

SURVEYORS who are mapping the less-thickly populated surfaces of the globe are finding wireless time-signals of the utmost assistance in fixing longitudes. Mr. Blanchet, who is surveying the Great Slave Lake, in the Mackenzie River district, uses a portable receiver to listen to European and American time-signals. On one occasion the wire placed between two paddles on a 16 ft. canoe acted as aerial, and the midday time signal from Annapolis was caught as the canoe swept along the Great Slave Lake.

Hilversum Increases Power.

HILVERSUM, the Dutch station which is just starting broadcasting on high-power, is an old friend of the British listener. Formerly the tuning-in of the station on a single-valve circuit was not at all common, but with the power increased ten-fold, reception on the simplest circuits should now be an easy matter. The wave-length is 1,050 metres, and the call-sign H D O.

Concerts from Holland.

I HEAR that some first-class artistes have been engaged to appear at the Hilversum studio, and that in framing the programmes, the listener in this country has been borne in mind and well catered for. Two steel masts, two hundred feet high, have been erected to support the aerial; and the well-known Dutch valve-manufacturing firm who will operate the station inform me that they will relay the famous Mengleberg orchestra from Amsterdam every Tuesday evening.

Ultra-short Waves.

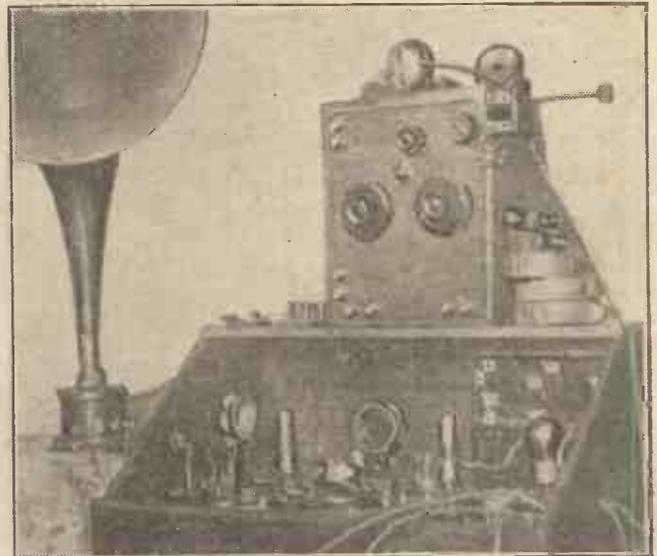
FOLLOWING similar tests in France, the Germans claim to have succeeded in producing ultra-short waves having a frequency of more than 300,000,000 per second, which corresponds with a wave-length of less than one metre. Although at present a laboratory experiment, it is quite likely that such results will greatly affect broadcasting, and the fact that American radio fans are already down upon the ultra-short waves reminds me that if any British amateurs are similarly engaged they are keeping very quiet about it!

Radio Travels.

SINCE the daily Press has given prominence to long-distance wireless "tours" a great deal of interest has been shown in these radio travels. Amongst the very interesting lists I have received in this connection is one from a Cleckheaton correspondent, who gives details of thirty-four different stations received between 7 p.m. and midnight, including broadcasting from Holland, France, Belgium, Germany, Sweden, Austria, Spain, and the United States.

"Mr. Dooley" may be Broadcast.

THERE is an interesting piece of gossip going round to the effect that we may hear "Mr. Dooley" through the microphone soon. The rich Irish-American humour of the stories about Mr. Dooley and



A Preston reader's 4-valve set (1-v. 2) and a super 1-valve set, both built from instructions given in "P.W."

his friends of the bar-room should be extremely effective "on the air," and although they are not as well-known over here as in America, they have plenty of British admirers, amongst them being Mr. J. R. Clynes. It is just possible that the B.B.C. will persuade Mr. Clynes to read them for the benefit of listeners—he is fond of doing so to a select party of his friends.

New Station for Norway.

NORWAY is contemplating the erection of a high-power broadcasting station, with an energy of 15 kilowatts. Such a station would be heard in this country easily. I hear that a company has already been formed for the project, and is being well-supported by the public as regards capital and subscriptions

ARIEL

TWILIGHT AND THE HEAVISIDE LAYER.

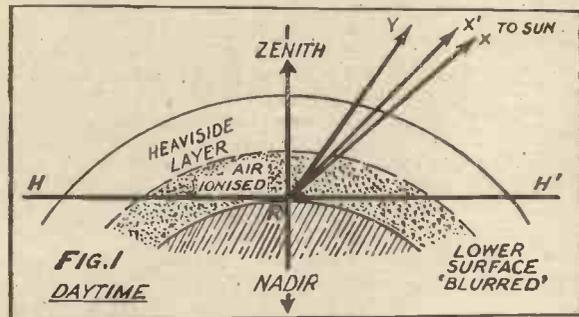
“ WIRELESS SUNSET TIME.”

By Lieut.-Commander H. W. SHOVE, D.S.O., R.N.

Why do wireless waves “ carry ” best after sunset ? Why cannot “ DX ” amateurs achieve sensational results in the daytime ? A well-known contributor to “ P.W. ” explains these interesting problems in the following article.

THE reflecting effect of a conductor is, of course, the principle used by Senatore Marconi in his “ Beam ” system of directional transmission. But,

the immediate vicinity of the receiving station ; but it must be understood that the conditions may vary at different parts of the wave-track, according to the local time at each spot, and that therefore the final result will be a mean of the different conditions. In Fig. 1, RX is the true direction of the sun, the sun, RX' the path of a ray of sunlight falling upon the observer at R, RY, a tangent to RX', the direction in which the observer sees the sun, the “ apparent ” direction.



whereas he is forced, by practical considerations of the size of his apparatus, if for no other reason, to make use of very short waves, in order to be able to concentrate them by the use of any system of conductors of reasonable proportions, the “ Heaviside Layer,” as it is called, being of unlimited extent, reflects all rays of whatever length.

Thus the path of wireless waves is more or less confined to the space of about 50 miles between the Heaviside Layer and the earth's surface, and the effect of the reflection is to concentrate and throw down waves which would otherwise be dissipated into space, so that they can affect receiving apparatus in addition to those travelling directly along the surface from the transmitting to the receiving station.

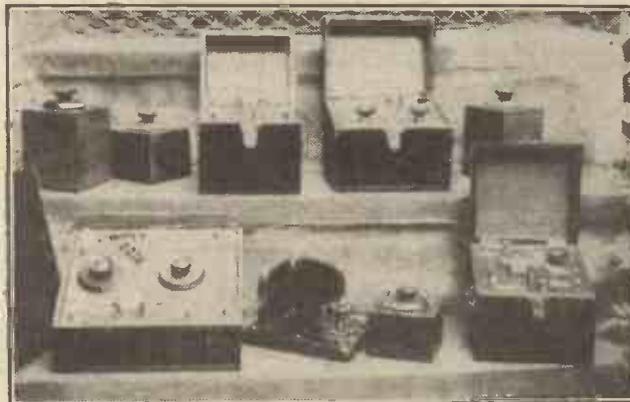
When Light Bends.

The air, from the earth's surface to the Heaviside Layer has, normally, practically no conductivity. But the influence of light upon this air is to cause more or less “ ionisation.” It is outside the scope of the present article to discuss what “ ionisation ” actually is, but it may be stated at once that its effect is to make the air more or less conductive.

The conductivity never, at any point near ground level, amounts to very much, but it is sufficient to “ blur ” the under surface of the Heaviside Layer, causing the line of demarcation between the conductive and the non-conductive strata to become less well defined, and in bright sunlight, which at that height means throughout the day—for it is far above the highest clouds—to prevent the reflection at that surface. This is the probable reason for the very marked difference in the “ carrying ” powers of wireless waves through lighted and unlighted areas. And, owing to the height of the Heaviside Layer the effect persists long after sunset.

Fig. 1 represents (not to scale) the daytime conditions over a portion of the earth's surface and in the superincumbent atmosphere. For simplicity we will only consider

The curve in the path RX' is due to the effect of the atmosphere in bending a ray of light passing through the strata of different density of which it consists. This phenomenon is known as “ refraction.” The bending will be greatest when the sun's rays have to traverse the



The P.W. “ Ultra ” Combination, “ Unidyne,” and other sets, made by one of our readers who forgot to send his name and address !

greatest thickness of air to reach the observer—i.e. when the sun is on the horizon at sunrise and sunset. When, as at noon on certain days in the tropics, the sun passes through the zenith, the refraction vanishes and RX' becomes a straight vertical line.

Explaining “ Twi-Light.”

The refraction always bends the ray towards the earth, so that its effect is always to make the sun appear higher in the heavens than he really is. Thus, at apparent sunset (see Fig. 2) the sun is already really below the true horizon of the observer at R (the line RH). So refraction tends to prolong the day. But after sunset another phenomenon occurs.

It is a matter of everyday knowledge that it does not suddenly become dark at sunset. The reason for this is that all the

lower part of the atmosphere is full of small particles of matter in suspension, “ the motes that people the sunbeam.” These particles all reflect light, and it is the light from them that causes what we know as “ twilight,” which is really exactly analogous to moonlight ; but in twilight we have an infinite number of tiny moons, too small for our eyes to distinguish individually and all comparatively close to us, instead of the one great, distant, silver disc which is the obvious and visible source of moonlight.

The “ Fall ” of Darkness.

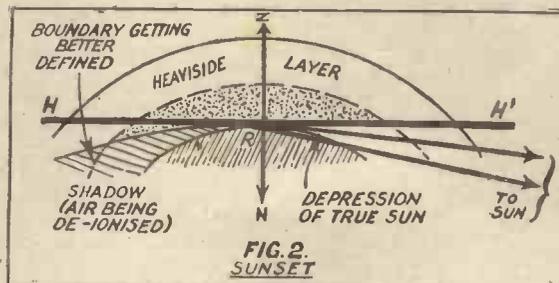
It will be readily understood that, as the air becomes more and more rarefied, so it becomes less and less able to support the “ motes ” that give us our twilight, and that the higher up we go the lighter and consequently the fewer must be the floating particles.

As the sun sinks below the horizon and the earth's shadow eclipses first the lower, heavier, and more numerous “ motes ” in the lower atmosphere, and then the lighter and rarer ones higher up, twilight gradually deepens into night, the shadows falling faster at first, since more of our tiny moons are being eclipsed each instant, and more slowly later on, as the last glimmers of twilight fade into the complete darkness of true night.

But, even then, as we gaze upwards to the dark sky, we are actually looking through the sunbeams which are passing far above our heads between us and the twinkling stars.

Only we cannot see the sunbeams, for there are no more tiny “ moons ” to reflect them to us.

This condition of things supervenes when



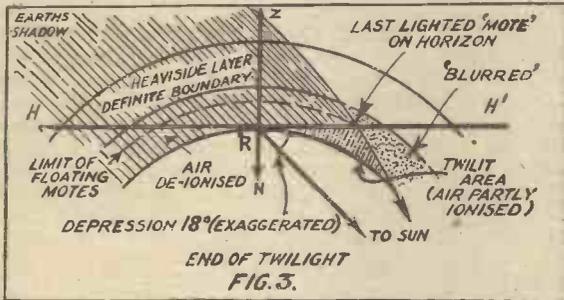
the sun has reached a depression of 18 degrees below our horizon, as shown in Fig. 3.

Along with the gradual extinction of sun- (Continued on page 1180.)

TWILIGHT AND THE HEAVISIDE LAYER.

(Continued from page 1179.)

light has gone on a process of "de-ionisation" of the air, and the absorption of wireless waves has been gradually getting less and less, higher and higher up in the atmosphere. When the line of the earth's shadow reaches the Heaviside Layer above us all ionisation due to direct sunlight ceases.



It will be seen at once that this time is considerably after sunset at the observer's position on the surface. Of course, the fading light and consequent de-ionisation does operate (in the lower layers) immediately after sunset to begin to improve reception. But it is not till the shadow reaches the Heaviside Layer that we are free from the effects of direct sunlight. We may call this time "Wireless Sunset" (see Fig. 4).

The "Wireless Sunset."

The calculation of the exact time of this occurrence is complicated by the difficulty of making an accurate allowance for the refraction in the upper atmosphere and also by the fact that the height of the Heaviside Layer is not certainly known. But, assuming the latter to be 50 miles up, "Wireless

Sunset" will take place when the sun is about 10 degrees below the horizon. Thus it is intermediate in time between the observer's sunset and the end of twilight. But "Wireless Sunset" does not mean the end of all sunlight effects.

Marked Seasonal Variations.

The reflected twilight will still continue to have its ionising effect until, as previously stated, the sun is 18 degrees below the horizon. Since, at that time, the earth's shadow extends at least 150 miles above the observer's head the under surface of the Heaviside Layer is now evidently free from any interference which could cause the "blurring" referred to early in this article. From "Wireless Sunset" onwards the improvement in signal strength should be rapid, but it is not until the end of twilight that "True Wireless Night" sets in and we get the full benefit of the Heaviside Layer in aiding the carrying power of the waves.

As twilight lasts all night long in England at midsummer and it is only between July 22nd and May 23rd that there is any period of absolute darkness in London, it is not to be wondered at that seasonal variations in the case of distant reception should be so marked.

A Useful Table.

For the benefit of those who may be sufficiently interested in the subject to make a few experiments in this fascinating branch of wireless study the approximate time of "Wireless Sunset" in London in the winter months is given in the table, assuming the lower boundary of the Heaviside Layer is 50 miles up and making a rough allowance for refraction. If it is found that a marked improvement in signal strength of the local station takes place earlier than the times given, it would seem to indicate that the Layer is lower than we have assumed, and if later, of course, the opposite. The writer would be glad to hear from anyone who cares to experiment in this direction.

TABLE

showing (in G.M.T.) the approximate times of "Wireless Sunset" for each month of the year between September and April. Calculated for the latitude of London (51° 30' N.) and on the assumptions made in the text.

September 15th ..	6.55 p.m.
October 15th ..	6.13 p.m.
November 15th ..	5.7 p.m.
December 15th ..	4.43 p.m.
January 15th ..	5.16 p.m.
February 15th ..	6.19 p.m.
March 15th ..	6.23 p.m.
April 15th ..	7.18 p.m.



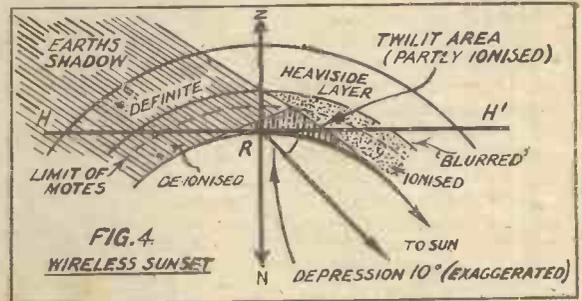
The microphone at the Brussels Broadcasting Station.

"ONE-HOLE FIXING" TRANSFORMERS.

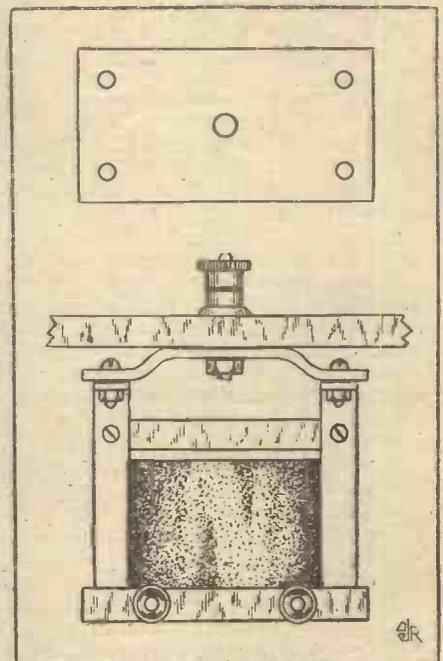
By O. J. R.

AN ordinary terminal, even if quite useless for electrical purposes, is certainly more pleasing to the eye than four screw-heads countersunk into the face of a panel; but when this terminal can be used both mechanically and electrically, then surely the idea is worth consideration. Here, then, is the idea, and it is hoped that it may prove to be yet another definite step towards improvement in receiver design.

A small brass plate is bent and drilled as shown in the sketch, and bolted to the four legs of the L.F. transformer. The bending will not be necessary if countersunk screws are used, or if the enthusiast should feel energetic enough to solder same to the transformer legs. The next step is obvious, an ordinary terminal being used as a bolt for securing the transformer to the under-side of the panel. The terminal, being in contact with the frame and core, may conveniently be used to earth the



core, if desired, and should a metal shield be used, this can be easily attached to the four corners of the plate by means of a little solder.



OR

HOW TO CONSTRUCT A "FOUR-CIRCUIT" TWO-VALVE SET.

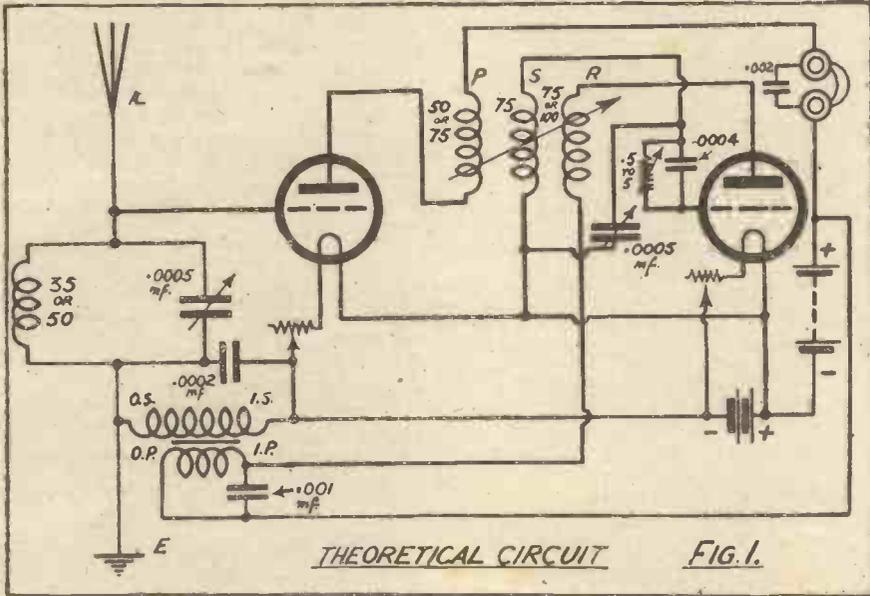
By M. C. PICKARD.

Here is a set which should interest every wireless experimenter. Reliable and efficient, it offers many opportunities to the amateur not merely content with "listening-in."

THE following article describes the construction of a two-valve receiver which should prove extremely popular, both on account of its simplicity and its extreme efficiency.

First, the method of H.F. coupling employed is by far the most efficient yet brought out for a reflex circuit, consisting of a loose coupled transformer with a semi-periodic primary, and tuned secondary

1 Coil plug	0	9
2 .0005 mfd. variable condensers (Raymond)	10	0
2 Dials (Raymond)	2	0
2 Extension handles for above (Raymond)	2	0
14 Terminals	2	4
1 Medium-sized D.P.D.T. switch	2	6
1 Medium-sized S.P.D.T. switch	2	0
4 Edison Bell fixed condensers .0002 mfd., .0004 mfd., .001 mfd., and .0002 mfd.	5	0
1 Ferranti transformer	17	6
Sundries, screws, etc.	5	0
Total—£4	2	3



The above prices are approximate only, except where the actual make is stated, and here the reader should purchase only these makes as they have been found best in practice; especially does this apply to the transformer and variable condensers.

The two switches should be as large as convenient, those on small bases being used remounted on the panel, as the type usually sold for panel mounting are too small.

The extension handles are a really useful investment, as they eliminate hand capacity troubles when tuning for long distance stations.

The type employed and the method of fixing them in place of the knob is shown in Fig. 3.

The switching arrangements have been chosen with great care, so that no loss of efficiency shall occur through them, and so that they shall perform their duty in the best possible manner.

They consist of one D.P.D.T. switch and one S.P.D.T. switch of the knife variety,

loose coils in a two-coil holder are used, so that by plugging in suitable coils any wavelength can be received.

Extension Handles Advisable.

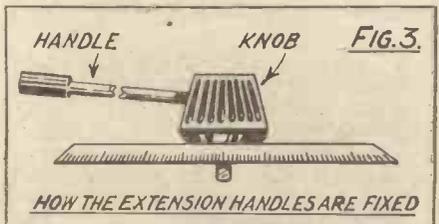
The primary, for the most stable results, should be one size smaller than the secondary, and should be fairly tightly coupled.

This transformer coupling eliminates practically all the troubles usually laid at the door of reflex sets, and the set is quite as stable as an ordinary straight two-valve set.

To prove this the theoretical reflex circuit (Fig. 1) was wired up roughly on an experimental panel, no care being taken as to spacing of wiring, etc., and the results were even then extremely good.

The components required to make up this set are as follows:

1 Sloping front cabinet to take panel	s.	d.
12 in. by 10 in. (see Fig. 2)	8	6
1 Ebonite panel 12 in. by 10 in.	5	0
2 Igranic filament resistances	9	0
1 Watmel variable grid leak	2	6
2 Valve holders (loose sockets)	0	8
1 Three-coil holder (with extension handles)	7	6



The cabinet need not, of course, be made absolutely in accordance with Fig. 2, and a bought one can be used provided it has the right panel size.

Drilling the Panel.

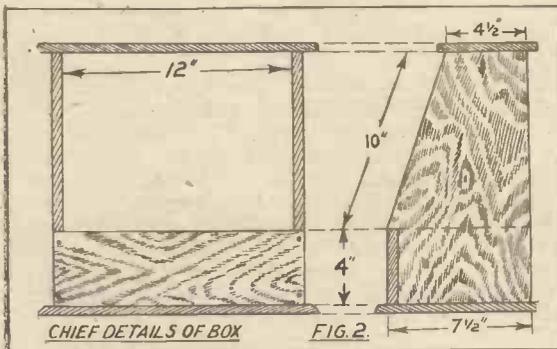
On no account should the set be modified to build it into an existing cabinet, as any change in the lay-out may result in a loss of efficiency.

It is obviously impossible to give all measurements for drilling here, but a good idea of the lay-out and spacing of the components can be gathered from Fig. 4.

The panel is first squared and trimmed up with a file, then with a scriber or other sharp instrument mark the panel out into compartments, as shown in Fig. 4, allotting a suitably sized space to each component.

When this has been done, the holes to be drilled for the components are marked on

(Continued on page 1182.)



and enable any of the following combinations to be used at will:

1. Detector with reaction.
2. Ditto with note magnifier.
3. H.F. and detector.
4. H.F. detector and L.F. (dual).

The first three combinations require no comment, but perhaps a short account of the chief virtues of Combination 4 would be of value here.

HOW TO CONSTRUCT A "FOUR-CIRCUIT" TWO-VALVE SET.

(Continued from page 1181.)

from actual measurements of the components themselves, or in the case of the rheostats, by means of the templates given with the instruments.

When this has been done, mark the centres for drills with a centre punch, or a sharp nail, and carefully drill out all the holes,

Great care must be taken to see that all screws are tight, the terminals, etc., are secured in place by one nut, and another is then threaded on to secure the wire.

The fixed condensers are held in position by gauge 18 wire, which also connects them into the circuit in their respective positions; this is ample support for a condenser.

Wiring Up.

The constructor will find very little difficulty in wiring up by following carefully Figs. 6 and 7. The latter gives the directions taken by all wires, as well as the terminal to terminal connections of the receiver.

same as the order of the terminals, namely, primary at one end, secondary in the middle, and reaction at the other end.

When wired, the panel must be fitted into the cabinet and secured by four screws.

Referring to Fig. 5, the switching for the different combinations is as follows:

- Circuit.
1. Detector with reaction.
 2. Detector with L.F. amplifier.
 3. H.F. amplifier and detector.
 4. H.F. detector and L.F. (dual).

D.P.D.T. Switch.

1. "Detector."
2. "Detector."
3. "Amplifier."
4. "Amplifier."

S.P.D.T. Switch.

1. "Detector."
2. "Amplifier."
3. "Detector."
4. "Amplifier."

The operation of the set is by no means difficult, but if it is your first-valve set it requires care and patience until you have got into the way of it.

The Set in Operation.

To receive your local station, place both switches into the "detector" position and plug a 35 coil into the secondary socket of the coil holder, or if the wave-length of the station is above 380 metres, use a No. 50 coil. In the reaction coil socket plug a 50 or 75 turn coil.

Now, leaving the coils well apart, and screwing the grid leak about three turns from the minimum position, turn on the detector valve alone, and rotate the handle of the condenser, which tunes the secondary, until something is picked up. Tune the signal to its loudest and bring the reaction coil nearer; if signals grow fainter instead of louder, reverse the connections to the reaction terminals, and repeat the process. When you have brought the signals to their greatest intensity without making the set howl, retune slightly. Now by lighting up the second valve and switching the S.P.D.T. switch into the amplifier position; on slightly retuning and readjusting the reaction coil, signals should be some five to seven times louder.

Now try replacing the secondary coil by a No. 75 and placing a 50 in the primary socket. The former aerial coil must be placed in the aerial socket on the panel.

Some Results Obtained.

Place the D.P.D.T. switch into the amplifier position and retune with both condensers, loosening the reaction coupling considerably. The signals will not be very much louder than before on a near station, but long distance stations should be comparatively easy to receive.

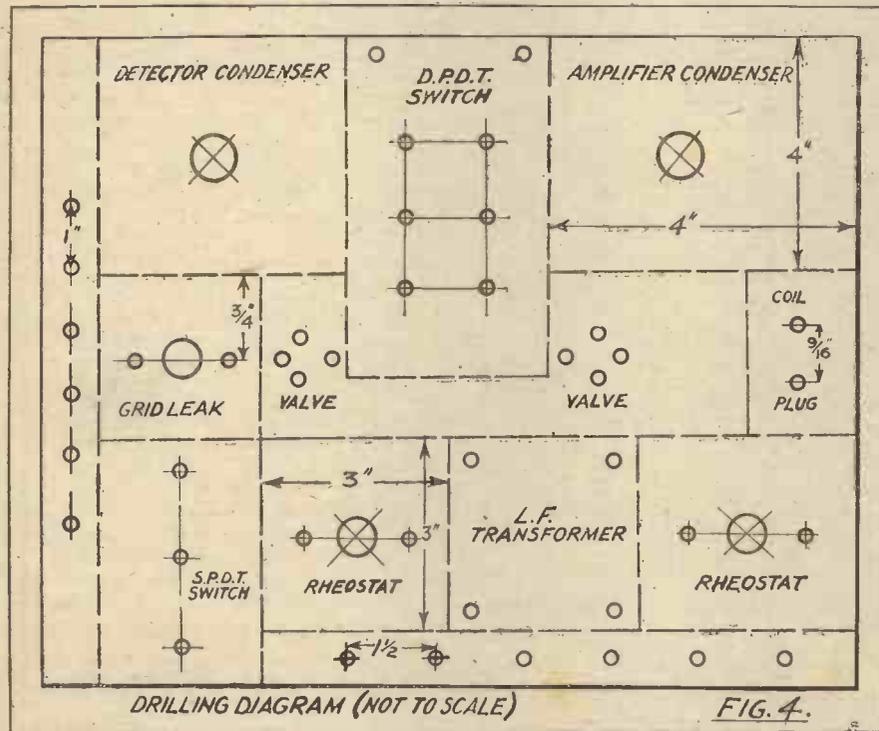
No constructional article is complete without an account of the actual results obtained with the receiver described.

This set is very stable on all wave-lengths, and will tune down to 100 metres with care, and if a variable condenser is inserted in the earth lead.

On a good aerial in Sheffield the set brings in the Sheffield Relay Station (200 watts only) loud on the loud speaker, using the set as a "dual" or as detector and L.F. amplifier.

Manchester is quite loud on the loud speaker, as is Birmingham after dark, and

(Continued on page 1183.)



drilling a small hole first if the hole required is above 1/8 in. in diameter.

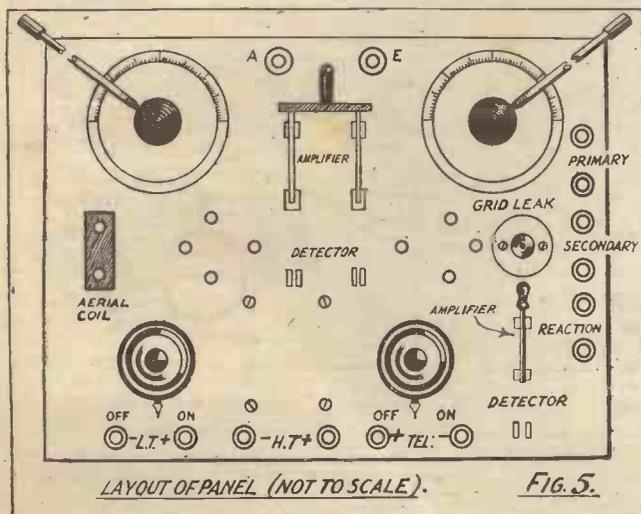
The polish on ebonite is a source of leakage, therefore, unless the ebonite is of a guaranteed brand all polish must be removed with emery paper.

The space allotted to the different components can be readily seen from Figs. 4 and 5, the latter being a top-of-panel view of the finished set.

The connections for the fixed condensers are as follows:

- 0002 mfd. across IS and OS on the transformer.
- 001 mfd. across IP and OP on the transformer.
- 002 mfd. across the telephone terminals.
- 0004 mfd. grid condenser across the Watmel grid leak.

All connections made with No. 18 S.W.G. bare-tinned copper wire are best soldered, but if you are not really proficient in the art of soldering, do not attempt to do so, but make use of the binding screws, as there is no more common fault in a wireless set than a badly soldered joint.

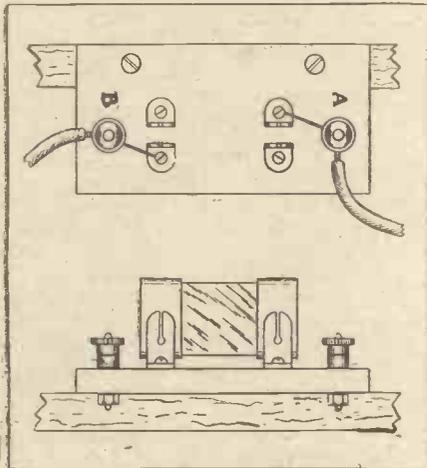


The connections to the three-coil holder, which is mounted on the end of the cabinet are made by flexible leads taken from the terminals on the end of the panel marked P, S and R in Fig. 5. The order of the coils in the sockets is the

THREE USEFUL HINTS.

A Fixed Condenser.

A SMALL fixed condenser, the capacity of which is usually found by trial, will invariably add to the general efficiency of a crystal receiver when connected in series with the aerial lead-in, and where it is not convenient to mount the condenser on the panel or baseboard of the set, a separate fitting may be attached to the window-frame, or operator's table, in the manner shown in the sketch. This consists of a piece of matted ebonite, about 3 by 2 by $\frac{1}{4}$ in. in thickness, which is fitted with two

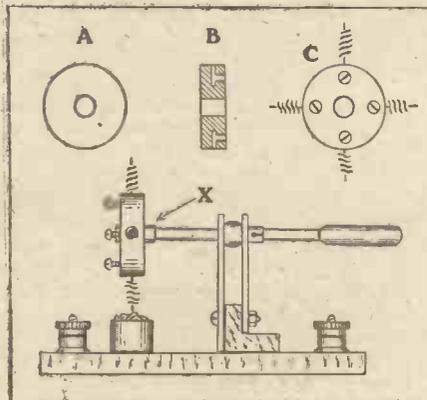


pairs of clips to take the interchangeable type of condenser. Two terminals, A and B, are connected to the clips as shown, one being joined to the aerial lead-in and the other to the aerial terminal on the receiver.

With such an arrangement a short circuiting or continuation link is, of course, desirable. This can be easily made up from a piece of thin board to which is attached a strip of sheet brass so arranged to make good contact with the slips when replacing a condenser. Alternatively, a simple "on and off" bell switch may be fitted between the clips. * * *

Multiple Contact Holder.

A simple holder, accommodating four different kinds of tentacles or "whiskers," and which can be easily made and fitted to any existing crystal detector of the type shown in the sketch, consists of an ordinary brass bush, A, as used for variable



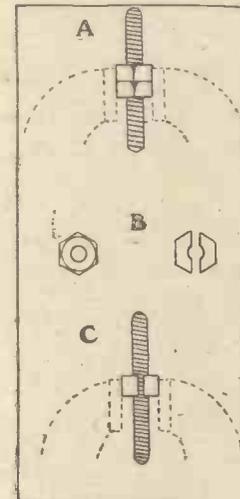
condensers, etc., which is drilled and tapped in the manner shown at B, and provided with four small clamping screws as shown at C.

The periphery of the bush is first marked off into four equal parts, four very small holes then being drilled down towards the centre of the bush to a depth of about $\frac{1}{4}$ in. The four holes on the side of the bush are then drilled to meet the smaller holes, these being carefully threaded by means of a plug tap, which, of course, should correspond in size with the screws to be used.

Usually, the hole through the centre of the bush is rather too large to fit tightly over the end of the detector spindle, and in most cases it will be necessary to provide a small brass sleeve, X, which should be soldered to the end of the spindle and then tapered off towards the end, so that it fits very tightly in the bush.

A Clamping Device.

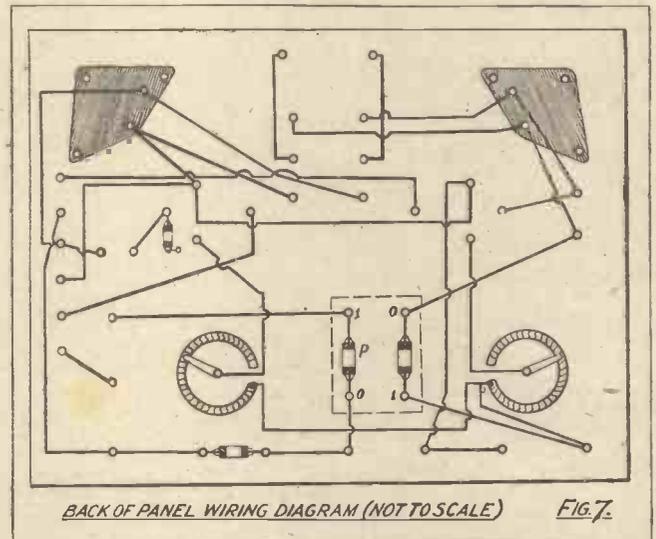
It often becomes necessary to place a length of B.A. screwed brass rod in the vice for cutting, filing, or re-threading, and to prevent the threads from becoming damaged some sort of clamp must be provided.



The most usual method is indicated in diagram A where two lock nuts are tightened up on the rod and gripped in the vice. For the larger size rods this is usually quite satisfactory, but the threads of small rods are invariably strained when the nuts are tightened up, and to avoid this it is best to split a nut by means of a hacksaw and use this as a clamp as shown at B and C.

HOW TO CONSTRUCT A "FOUR-CIRCUIT" TWO-VALVE SET

(Continued from page 1182.)



BACK OF PANEL WIRING DIAGRAM (NOT TO SCALE)

FIG. 7.

Chelmsford in all atmospheric conditions.

After dark all the B.B.C. stations can be received well in the 'phones and occasionally well on the loud speaker.

Radio - Paris and Brussels (265 m.) are always very good in the 'phones after dark and many of the German stations can be easily picked up, results varying, of course, with different conditions of the ether.

As a general guide, however, any station that can be heard on a crystal set will give good loud speaker reproduction on this set from the same aerial.

In conclusion, a word of warning as to modifications of design and so-called improvements. As Captain Eckersley says about oscillation, "Don't do it," that's all.

You cannot hope to get the best results unless the original design, which has received every attention possible, is strictly adhered to.

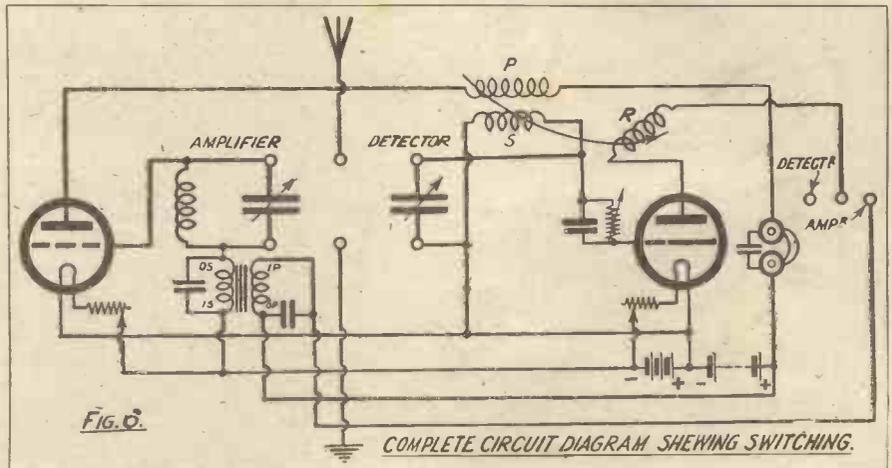


FIG. 8.

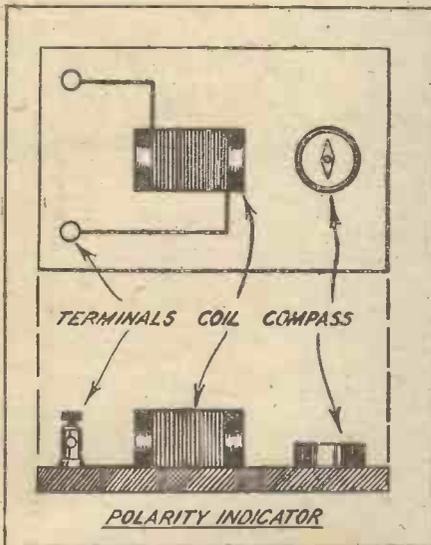
COMPLETE CIRCUIT DIAGRAM SHOWING SWITCHING.

Constructional Notes

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

Polarity Indicator.

THE experimenter continually finds the need for some simple and ready device for determining the polarity of current supply terminals. There are many such devices, some of them depending upon electrolysis, but perhaps the simplest, and certainly one which, when once made is of permanent use, is the one shown in the drawing. It will be seen that this consists in effect of a rudimentary galvanometer, a solenoid being secured to a small wooden baseboard and an ordinary compass-needle being placed in such a position that it is affected by the magnetic field from the solenoid when current passes through the latter. The solenoid can be secured to the baseboard by means of a strip of wood or cardboard, and the compass by means of a little Seccotine. An accumulator is connected momentarily to the terminals of this device, with such polarity that the north pole of the needle turns towards the solenoid, and the positive and negative terminals of the device are then permanently marked accordingly. For subsequent use, any leads whose polarity is to be determined may be momentarily connected to the terminals



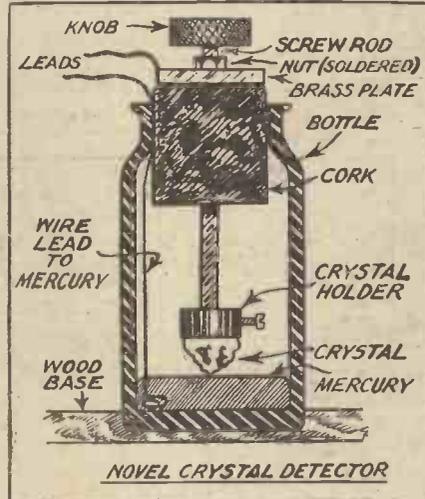
of the device, when the direction taken up by the needle will at once indicate the polarity. If desired, the solenoid may be made of fairly fine resistance wire, say any gauge between 30 and 40, or a resistance may be included in series with it, so that the current passing through the instrument shall not be large enough to cause damage to small dry batteries, for example.

Novel Crystal Detector.

Here is a crystal detector which is quite a departure from those generally in use. The principal feature of this detector is that

it makes use of mercury for the contact to the crystal, in place of any form of wire or strip cat's-whisker. This in itself is equivalent to a large number of cat's-whiskers in parallel, since the mercury touches the crystal at a large number of points, in fact over a considerable area.

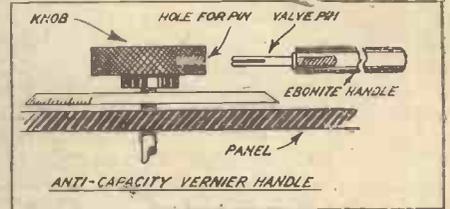
For the actual design of the device the details are not important, but the arrangement shown in figure is convenient. By



using a small bottle for the container, there is no danger of the mercury being upset or lost, and if any shaking occurs, as it is bound to do, the mercury automatically runs back into its proper place again. Only a very small quantity of mercury is required—a globule about the size of a shilling. A wire lead will be needed to pass alongside the cork, to make contact with the mercury. The crystal should be secured in the crystal holder preferably by means of a screw, as if Wood's metal or other such alloy is used the mercury will almost certainly attack and dissolve it in time. A small metal plate is shown at the upper part of the cork, with nut for making contact with the crystal control shaft, but actually this is not necessary. For the adjustment of the crystal, the motion of the screwed rod through the cork will be found to be sufficient. When completed, the device may be secured to its baseboard by means of a small piece of wood, in which a hole is cut, large enough for the base of the bottle to make a tight fit. The rest of the work may be completed by means of a little Seccotine judiciously applied.

Anti-Capacity Vernier Handle.

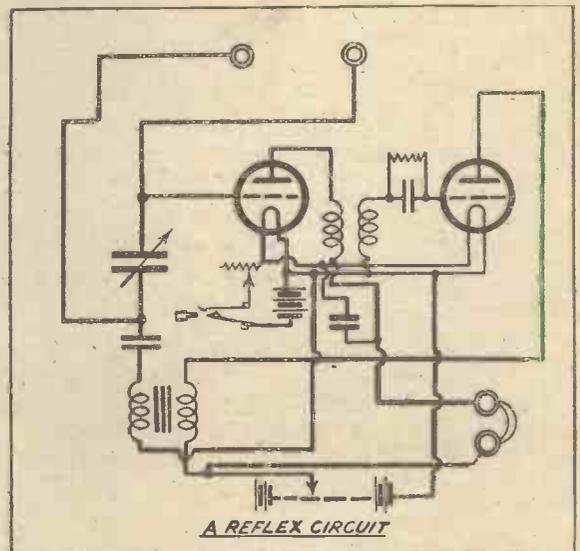
The annoying effect of hand-capacity with a variable condenser is well-known, and for this reason an anti-capacity insulating extension handle is often very useful. Furthermore, if the tuning is critical, the anti-capacity handle may also be arranged as a vernier adjuster. It is also useful if the extension handle can be readily attached and removed. For this purpose, the valve pin, which can be applied to a surprisingly large number of useful pur-



poses, comes in very handy. As will be seen from the illustration, a valve pin is screwed into a hole drilled in the end of an ebonite rod, the latter being, say, 6 in. in length, and $\frac{3}{8}$ in. in diameter. A hole of appropriate size is drilled in the side of the control knob of the condenser. The extension and vernier handle can then be inserted or removed as desired. In case this extension handle fouls any of the other controls on the panel, it is useful to drill three or four holes, at equal distances around the condenser knob, the extension handle being inserted into whichever hole is most convenient.

A Reflex Circuit.

The theoretical circuit shown in the accompanying diagram, which is taken from patent 18,937/23 (Sharman), illustrates an interesting system of dual-amplification. The principal feature of the circuit is the small blocking condenser in the grid-filament circuit, which insulates the grid from the grid-coil, and adjusts it automatically to the correct negative potential. This system can be applied to any number of valves, even where common high-tension and low-tension batteries are used, and it is claimed that there is no tendency to howl.



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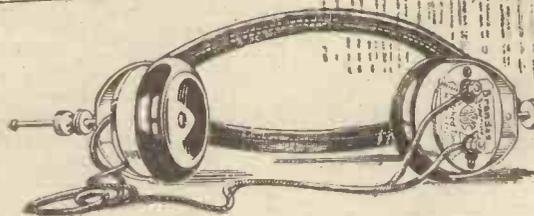
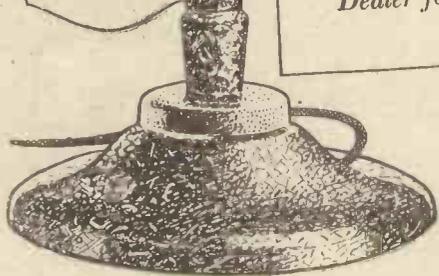
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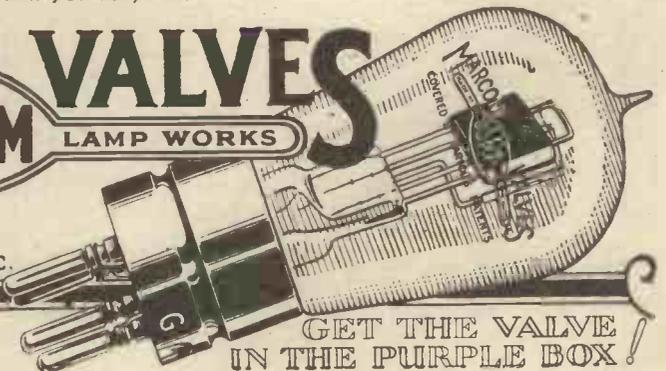
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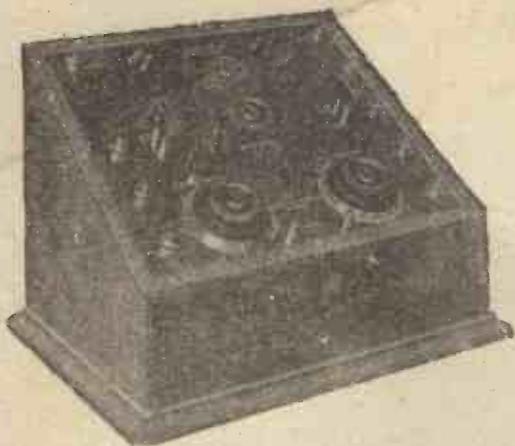
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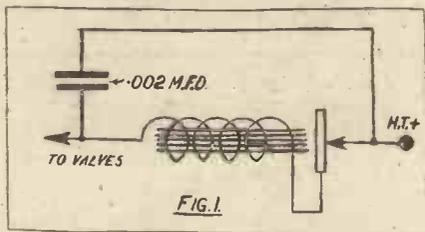
PRACTICAL IDEAS FOR EXPERIMENTERS.

An "Overload Release" for H.T. Batteries—Controlling Reaction—Accumulator Fault Hunting—Engraving Metal Parts.

By B. F. SHORTT.

NEARLY every experimenter boasts a fuse in the H.T. circuit of his valve set in order to prevent mishap to his valves.

In a great many cases this takes the form of a small flash lamp bulb which at the best of times is inconvenient. Generally the fuse is the last thing one thinks of inspecting when the set goes off after messing about. A novel arrangement that is "ever-ready" is depicted in Fig. 1. This is nothing more elaborate than a small



buzzer such as a Townsend, shunted by a .002 block condenser and inserted in the positive H.T. lead.

If a valve happens to have the filament accidentally placed across the H.T. battery a warning buzz is emitted, reminding one to be careful.

As the inductance of the buzzer is appreciable the current never rises to a value sufficient to burn out the valve. As a matter of fact the filament is barely red-ened.

The purpose of the block condenser is to act as a by-pass for high-frequency current, although if desired this may be omitted as it is not essential. The normal H.T. current is not sufficient to operate the buzzer and thus firm contact is maintained.

Controlling Reaction.

From time to time several methods of controlling reaction and self oscillation in regenerative receivers have been put forward, including damping plates, potentiometers, choking coil resistances, etc., all of which are successful.

Perhaps the method illustrated in Fig. 2 is not known, the writer having only recently tried it out.

Looking at Fig. 2, it will be seen that instead of using the usual grid condenser as a means of imposing changes of potential on the grid of V2, a different system is adopted.

A tuning plate, P, is made to slide over the tuned anode coil B, so that the plate coil itself forms the other. In this way the transference of energy from V1 to V2 may be controlled in such a manner that reaction becomes a real joy. On very short wave-lengths it will be found that a reaction coil becomes unnecessary.

An Interesting Experiment.

If the anode coil B is of the basket or honeycomb type, it is an easy matter to make a plate of brass or zinc the same size and to arrange it to either slide over the coil or swing in and out like a door.

When B takes the form of a cylinder, however, the plate must be made to fit half way round it and the same length.

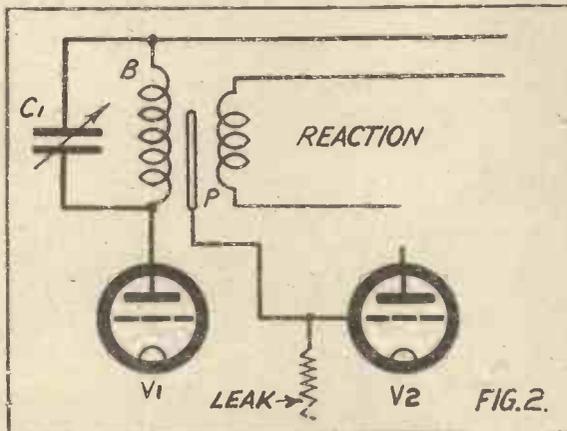
It will be noticed that altering the position of the plate P necessitates a further adjustment of condenser C1. It must be remembered, of course, that when the Plate P is all in it reduces the wave-length range of coil B and condenser C1, and for that occasion it may be necessary to add a little extra inductance to the circuit.

It is an interesting experiment, and should prove useful in multi-valve sets employing several stages of high frequency.

Although in Fig. 2 the plate is shown interposed between the tuned anode coil and the reaction coil in order to simplify the diagram, it is much better to place it on the opposite side to that to which the reaction coil is coupled.

Accumulator Tests.

For those who do not possess a voltmeter the following is a very easy way of finding out the condition of an accumulator. Provided a battery which is known to be fully charged is at hand all that is necessary is one of those small one or two-volt bulbs used for tie-pins, or the like. For instance, looking at the diagram Fig. 3, if battery A (let it be six-volt) is known to be fully charged, and battery B, also a six-volt, is doubtful, then by connecting the two bat-



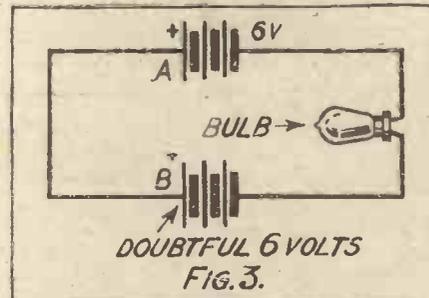
teries and bulb as shown, the brilliancy of the bulb is a good indication of the condition of B.

The explanation is, that since the two batteries are connected in opposition, the back E.M.F. of the discharged battery is not sufficient to counteract the E.M.F. of the charged battery, and hence a certain amount of current flows in the circuit, the amount of which is shown by the bulb. It will readily be seen that the lower the E.M.F. of one battery in respect of the other the brighter the bulb will be. It is absolutely essential to connect the two positive poles of the batteries together, and as a suggestion the two negative poles might also be connected together. Then

instead of using a bulb, a small pocket compass placed over one of the wires would show by the deflection of the magnetic needle the strength of current flowing, or in other words the state of the battery which is run down.

Engraved Tabs.

It is sometimes desired to make and engrave metal tabs for certain purposes, but most amateurs are at a loss as to how to



accomplish the task. The following description of two successful ways of doing it may therefore be of assistance.

By either of these methods it is possible and even simple, to engrave terminals, battery connectors, name plates, and a hundred and one different things. All

that is necessary is a glass or earthenware jar, some copper sulphate crystals (which can be obtained at any chemist's), a battery, and some shellac varnish or paraffin wax.

The principle of the operation is that copper is electrically deposited on the material in such a way that one can have copper letters on, say, an aluminium background, or aluminium letters on a copper background. Brass, owing to its similarity in colour to copper, does not exhibit quite as good a contrast when finished as a brighter metal like aluminium or zinc.

The Process.

Let us take the first method and suppose a small tap is to be made for an accumulator case with the letters L.T. + engraved on it.

Procure a piece of zinc sheet, which is an easy metal to work. Having cut it to the required shape, thoroughly clean it by sand-papery, and finish off with the finest grade of emery cloth, so that it will present a smooth polished surface.

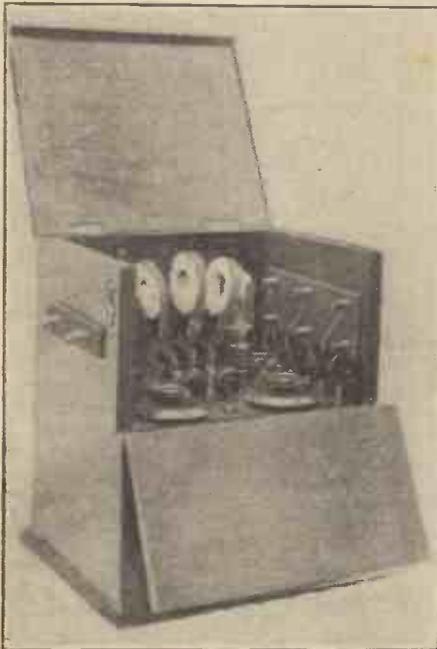
A copper wire connection must now be attached to one end, after which the whole is immersed in molten paraffin wax. Carefully drain off any superfluous wax and allow the zinc to cool, when it will be

(Continued on page 1190.)

A USEFUL SLIDE INDUCTANCE.

By O. J. RANKIN.

THE experienced enthusiast, having passed through the radio mill and having accustomed himself to the many rapid changes in the design of receiving apparatus, is very strongly inclined to regard the humble slide inductance as an obsolete tuning device; but there is no doubt that if this instrument is properly constructed, and used in its proper place, it still remains one of the most useful gadgets an experimenter can possess. A few points in its favour are: (1) It is simple in construction and use; (2) it is not expensive; (3) it is an ideal tuner for the beginner; (4) no tuning condenser is



A compact 2-valve set made by Mr. L. R. Eversard, "Fernlea," 70, Waterhouse Street, Chelmsford.

required; (5) it is the equivalent to a tapped coil which is tapped at every single turn; and (6) it is a very useful "gauge" for ascertaining the correct number of turns required for loading coils or for coils to be made up on the unit principle.

Easily Constructed.

The instrument shown in the accompanying sketch was designed for use as a general purpose experimental coil on the broadcasting wave-lengths, and as such it has always given entire satisfaction. The two coil ends are cut out from $\frac{3}{8}$ in. sheet fibre, the dimensions being as given in the figure.

The cardboard former is 7 in. long by 3 in. in diameter, and, after being well impregnated with melted paraffin wax is given a coat of thick shellac varnish and then wound with No. 24 enamelled copper wire, a space of about $\frac{1}{8}$ in. being left at each end. The wire should be wound on when the shellac is in a semi-dried condition, and thus only about one-third of the former should be coated at a time.

If this operation is carried out in the proper manner, it will not be necessary to shellac the whole winding when the coil is complete. Having prepared the two end supports, fit an ordinary terminal to each and connect one end of the coil winding to the left-hand terminal, as shown in the sketch. The other end of the winding is, of course, left open, this being tucked away inside

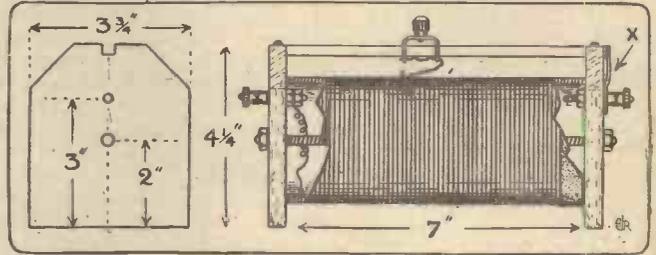
the former, as far away from the right-hand terminal as possible. The coil may now be temporarily clamped between the two supports by means of a 2 B.A. threaded brass rod and two nuts, a short strip of copper tape (X) being first clamped under the shoulder of the right-hand terminal.

Fishing Off.

This forms the connection between the slider bar and the terminal, and is after-

wards bent out clear of the fibre support, soldered to the end of the slider bar, and cut off flush with same. This operation should be carried out before screwing down the bar. A stout wire helix may be used in place of the copper tape, and, although this will not present such a pleasing appearance, it may be found a more convenient method of making the connection.

The slider bar is let in flush with the tops of the supports, as shown, and the slider is preferably of the flat spring type, as



described in a past issue of POPULAR WIRELESS.

Before finally tightening the nuts on the central rod, the coil should be adjusted so that the slider makes a perfectly smooth yet firm rubbing contact along the whole length of the winding.

The instrument is completed by binding a length of "Empire tape" round each end of the coil, the ends being secured by means of a little seccotine.

PRACTICAL IDEAS FOR EXPERIMENTERS.

(Continued from page 1189.)

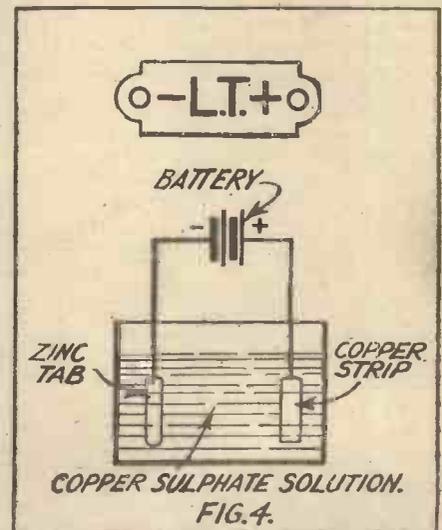
observed that it is covered all over with an insulating film of wax. With the aid of a pencil or sharpened match stick the letters can be inscribed through the wax, leaving the bare metal exposed underneath. The letters must be clear and distinct, and the brass which is visible must be clean in order to facilitate the copper plating which is the next part of the operation to be performed.

Copper Plating.

Pour enough boiling water into a glass jar as will accommodate the article to be plated. Mix the crystals into the water and dissolve sufficient to make a strong solution of copper sulphate. The liquid must now be allowed to cool until it is tepid. A piece of copper is next attached to the positive pole of either a 4-volt accumulator or a small flash lamp battery. If a piece of copper cannot be obtained, a length of heavy copper wire bent up will serve the purpose quite well. The tab is likewise connected to the negative pole and both placed in the solution about $2\frac{1}{2}$ in. apart. If allowed to approach each other too closely the tab will become coated with a black scaly substance which easily peels off. When plated properly, however, it will assume a bright yellow colour on the letters. Half an hour is long enough to leave the tab plating. It must then be taken out, dried well, and the paraffin wax melted off. Copper letters will be left on the zinc, and the whole tab must be polished up with fine grade emery cloth again.

The second method is much more easy to carry out, and might be said to produce a better finish than the one described above.

In this case bright zinc letters are shown against a copper background. The zinc is cleaned thoroughly as before, but the letters this time are written in an insulating substance, like thin shellac varnish. The writer has found shellac varnish to be the best and simplest insulating liquid to use.



When the necessary writing has been carried out the varnish is allowed to dry—heating will cause it to dry rapidly. The copper plating is then carried out exactly as before. When a sufficient amount of copper has been deposited, the zinc must be dried and then immersed in methylated spirit for a little while, so that the shellac becomes dissolved off the zinc.

MORE INTERESTING VALVE CIRCUITS.

By G. V. DOWDING, Grad. I.E.E., A.C.G.I.
(Technical Editor "Popular Wireless.")

AT one time there was a great deal of interest displayed by amateurs in connection with "aerialless" circuits, but that was before it was discovered how really useful an indoor aerial can be if properly erected, and perhaps before it was

while it will be noticed that no grid leak is used. Some amateurs, however, have found that the insertion of this is essential for best results, and that such should be connected with the grid and L.T. battery minus. Others have found that a .002 mfd. fixed condenser across H.T. and 'phones tends to improve reception.

Seekers after selectivity, and readers who suffer badly from local jamming should give the circuit shown in Fig. 2 a trial. Range of reception and signal strength do not exceed ordinary one valve and reaction results, but it has been proved to be very selective when handled carefully. Basket or spider wound coils should be used, although some readers have discovered that the ordi-

nary plug-in type are just as good for the

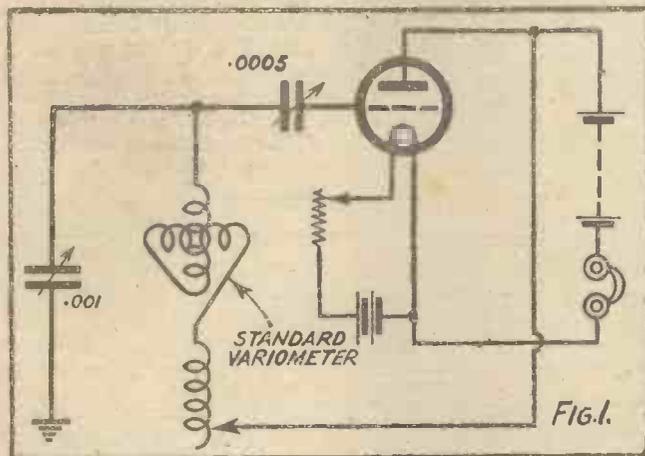


FIG. 1.

realised that an outdoor aerial of most modest pretensions would in many cases give really good working results with conventional apparatus.

However, a circuit that will function well with only an earth connection can prove very useful, as it is possible to move a receiver constructed on such lines from room to room, obtaining earths on gaspipes and fireplaces.

The circuit shown in Fig. 1, which was initially described by that well-known contributor, O. J. Rankin, in "P.W." some long time ago, has been credited with interesting performances.

In series with the variometer a coil is shown. This consists of 60 turns of 26 D.C.C. wire on a 3-in. former tapped at every fifth turn.

Two variable condensers are required,

Another selective circuit which is capable of greater ranges of reception is shown in Fig. 3. It will be seen that it is provided with capacity reaction, and that its tuning controls include three variable condensers.

It has been recorded capable of receiving all the B.B.C. stations with clear-

ness in different parts of the country, but in no instance has it proved capable of even small loud-speaker work. The reaction control is provided by the condenser C2, while C1 is the actual wavelength tuning condenser. The filament control has been proved to be rather critical, so that in the manipulation of the circuit no less than five adjustments have to be attended to. The aerial coil can

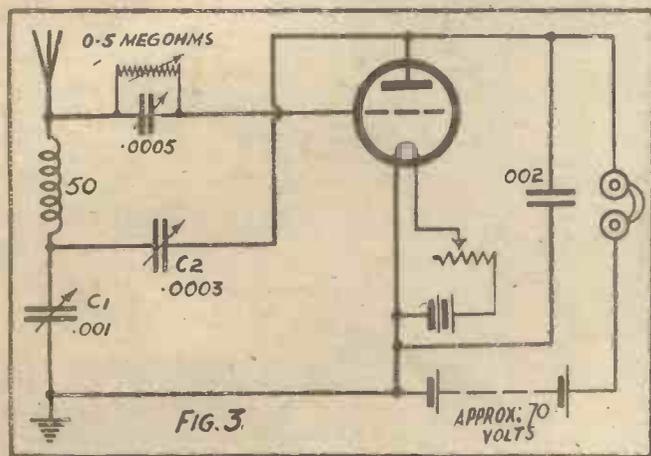


FIG. 3.

APPROX. 70 VOLTS

consist of either a 50-turn basket or honeycomb, while, as is indicated, a hard valve with a fair amount of H.T. should be used.

Once more we must stress the fact that most of the "interesting" one-valve circuits are only suitable for the use of amateurs who have had previous valve experience, as they are nearly all users of "fierce reaction," while the results claimed for them will only be obtained in fairly expert hands. Another point well worth emphasising is that in few cases can stages of H.F. amplification be added, or even L.F. unless separate batteries throughout are used. Therefore they are circuits that stand alone on their merits, and do not lend themselves to extension without modification and this latter generally tends to make the circuits assume orthodox powers.

NEXT WEEK.

Another supplement will be given away with every copy of next week's "P.W." "Nineteen Pictorial Circuits" is the title, and amateurs will find these specially drawn circuits of great value and assistance when "trying out" various "hook-ups."

Order your copy of Next Week's "P.W." now.

Before concluding, readers will probably appreciate a few words in respect of suitable components for such circuits as have been detailed, or which will be dealt with in future articles. In general, "hard" all-purpose valves should be used; for example, the Marconi "R," B. T.-H. "R," Ediswan A.R. are bright emitters which generally function well in almost any "super."

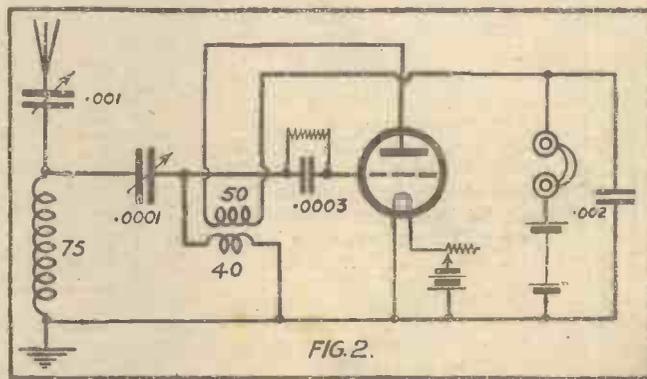


FIG. 2.

Among the dull emitters those taking .25 or so amps., such as the D.E.R., should be favoured, although there are several dull emitters among the B.T.-H. range which, taking considerably less, behave well in most such circuits.

Important Points.

Variable grid leaks, even where not specified, are generally a useful addition, while the carbon type of filament resistance, such as the Lissenstat, would in every instance prove an advantage.

Extension handles to all tuning controls are to be advised, while variable condensers with vernier attachments are distinctly to be recommended. Attention should be paid to wiring and component spacing, the wiring especially being arranged as non-capacitively and non-inductively as possible.

HOW TO MAKE A TELEPHONE DISTRIBUTOR BOARD.

FROM A CORRESPONDENT.

This easily made component is one which every owner of a wireless set will find constantly useful.

WHEN one wishes to use three or four pairs of 'phones, the best way is to use a terminal board. The one illustrated will be found very simple to make, but serves the purpose admirably.

There is provision for four pairs of 'phones in series, and with a length of twin flex may be taken to any room in the house.

When less than four pairs of 'phones are being used, the spare terminals should be shortened with a U-shaped piece of wire.

Soldering is Advisable.

The ebonite is 6 in. by 3 in. by $\frac{3}{16}$ in. thick, and the end pieces are $\frac{1}{2}$ in. square, mahogany, fixed with two screws.

The drilling and wiring can be followed from the sketch and photos.

Eight telephone terminals will be required, and two W.O., or similar type, the latter being for the leads from the set.

The ebonite panel should be good quality, and unless guaranteed against surface leakage, should be rubbed down with fine glasspaper. Do not use emery cloth as the cutting material in this is a conductor, and a certain amount of the grit is sure to be left embedded in the ebonite, thus making a good leakage path.

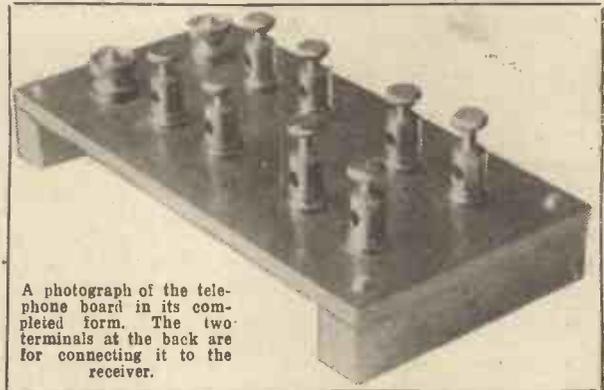
The holes are all $\frac{3}{16}$ in., with the excep-

tion of the four screw holes at the corners, these being $\frac{1}{2}$ in. Four brass button-headed screws $\frac{1}{2}$ in. long are used for fixing the two wood end pieces.

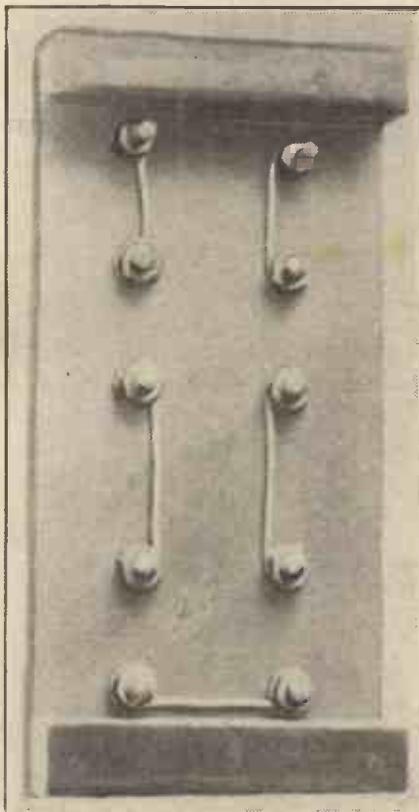
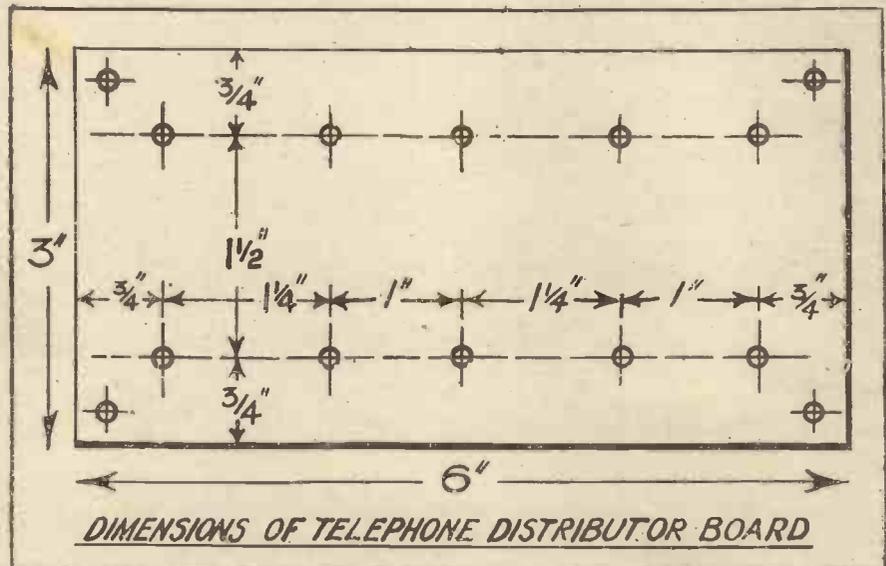
In the photograph the wiring is shown clamped under the terminal nuts, but these connections would be better soldered. Tin the ends of the terminals after tightening up and then again tighten them before soldering the connections.

The end pieces may be given a coat of varnish or polish and a hook may be screwed into one of them so that the board may hang up in any convenient place.

For a minimum expenditure we have a substantial article with no complicated switch, and quite easy for the most elementary amateur to construct.



A photograph of the telephone board in its completed form. The two terminals at the back are for connecting it to the receiver.



Showing the terminal connections under the panel.

Technical Notes

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

Eliminating Spark Interference.

SO many experimenters, particularly in coast towns, suffer from spark interference, that the following brief summary of the methods by which it can be overcome, from the "Irish Radio Journal," seems well worth quoting:

"The best method of eliminating bad interference with broadcast reception by spark transmissions is to employ a two-circuit tuner, such as a loose-coupler, or by

constructing plug-in coils in such a manner that one of the coils, together with the aerial and the earth, forms the aerial circuit, whilst the remaining circuit is formed by connecting the second coil to the L.T. of the first valve and to its grid. This will give a closed inductance circuit.

Loose Coupler.

"If a loose coupler is employed, a variable condenser of about .0005 mfd. should be
(Continued on page 1222.)

Mainly About Broadcasting

By
The Editor

A REMARKABLE illustration of the effect of broadcasting on theatres is reported from the United States, where, quite recently, a crisis in the amusement world arose through the action of certain famous singers in giving a free broadcast concert. John McCormack, the famous tenor, and Lucrezia Bori, a soprano of the New York Metropolitan Opera House, decided to broadcast a concert to be relayed from seven different broadcasting stations. The American Press estimates that something like six to eight million people heard the concert.

What Will Happen ?

On the night of the concert theatre managers were dismayed to find their theatres practically empty. In fact, the only house to do any business was the New York Metropolitan Opera House. The theatrical managers immediately entered a protest against the McCormack-Bori concert. They declare that such concerts seriously threaten their business, and the fact that the theatres in New York were half-empty on the night of this special broadcast concert proves, in the managers' opinion, the desire of the public to stay at home and listen to concerts.

It is difficult to say what will happen if other famous "stars" decide to broadcast special concerts like this. But at the moment it seems hardly likely that many other stars will follow in this direction, because, in the present stage of radio development, it is impossible for big singers to obtain the fees by broadcasting which they obtain by giving concerts, etc., in the theatres and concert halls.

The Savoy Orpheans.

Recently, for the first time in history, the Queen's Hall, London, found itself in the hands of an American syncopated orchestra. I attended the concert given by the Savoy Orpheans, the Savoy Havana, and the Boston Orchestra. The Queen's Hall was packed from floor to ceiling. There was not a single seat vacant, and a more enthusiastic audience would be hard to find. One finds almost excessive enthusiasm at some of the Promenade concerts, but the Savoy Orpheans received this at the Queen's Hall almost to a pitch of frenzy.

I saw several famous music critics sitting in the hall with a puzzled look on their faces. No doubt the Savoy Orpheans had given them a severe jolt, and some of the high-brows must have been comparing the classical concerts given in the famous hall to the items played by the bands which every listener-in is familiar with. But say what you will, the Savoy Orpheans gave a thoroughly entertaining concert; there was not one dull item in their programme, the audience being kept at a high pitch of excitement throughout the evening, and such applause has, I should say, seldom been heard in the Queen's Hall.

I hope the Savoy Orpheans will give another concert. I am quite sure if they

took the Albert Hall and allotted the majority of the seats at very reasonable prices they would fill it many times over.

The "Manchester Guardian" announces that preparations for elaborate researches into the effects of a solar eclipse on wireless transmissions are being made in the United States. The "Scientific American" is primarily responsible for these researches. It is expected that, by means of coupons containing seven questions relating to various phases of the eclipse on January 24th, when filled in by listeners who participate in the tests, will result in a collection of

result of this test, much useful data which will throw light on the mysteries of "fading."

Sir Oliver's Lectures.

I have been receiving many letters from listeners-in asking me to convey to our scientific adviser, Sir Oliver Lodge, their good wishes for the New Year and their congratulations on his forthcoming series of broadcast lectures on "The Ether of Space."

Sir Oliver asks me to mention in this issue that he very much appreciates the messages of goodwill sent to him from readers of



The Reception Room at the broadcasting station W E A F, New York.

facts which will materially help to solve some of the problems of radio transmission which at this date remain clouded in mystery.

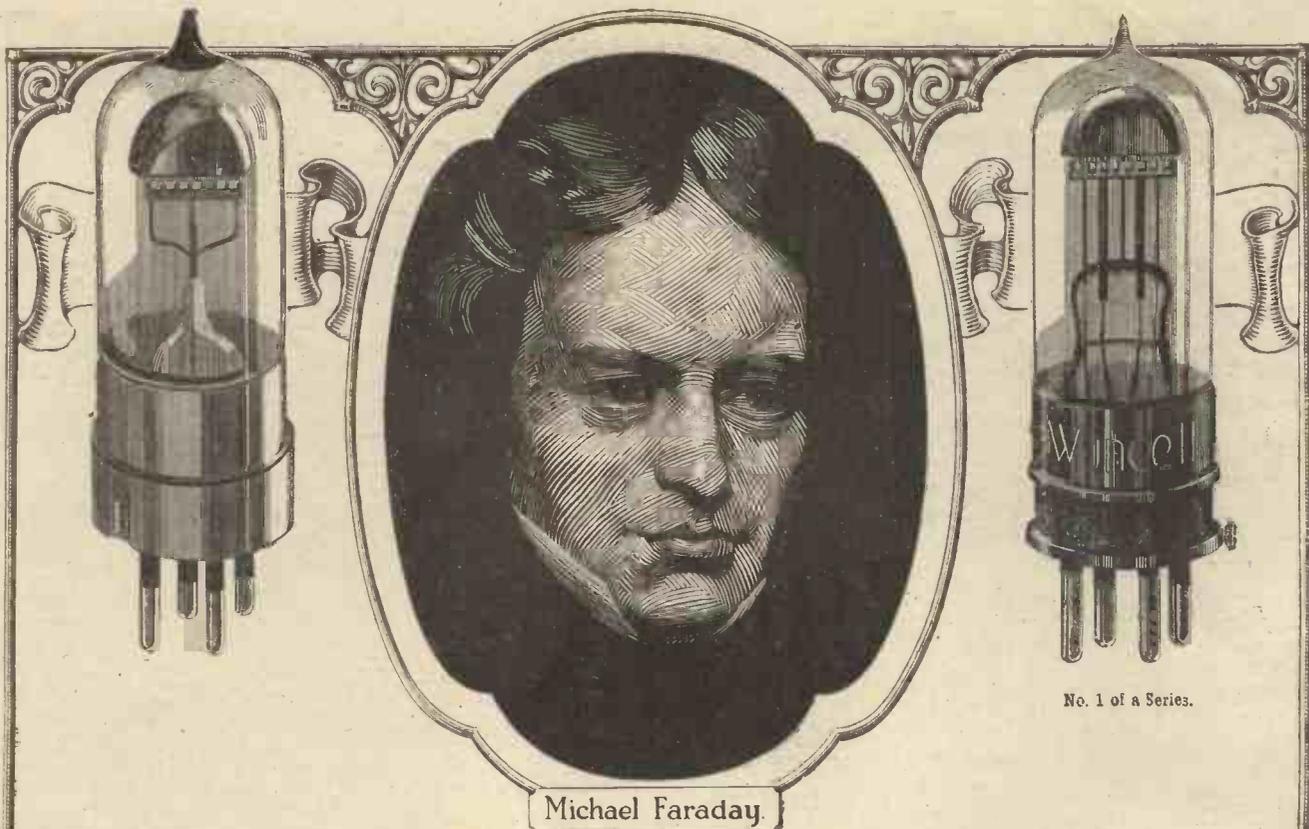
Listeners to Help.

Preparations are also being made for a number of very comprehensive studies of wireless conditions during the eclipse, and automatic recorders will be erected at several points in the shadow path for obtaining accurate records of the signal strength of certain broadcasting stations before, during, and after the eclipse. Listeners-in are being asked to note what is read out from certain broadcasting stations, and to report to officials any change in intensity in signals. They are also asked to report at what precise word in the speeches they notice any difference in signal strength—whether the signals fade or become stronger.

The National Research Council of America, and other bodies, anticipate, as a

POPULAR WIRELESS, and in a letter to me he says: "Please thank my kindly correspondents for their good wishes and prospective interest. It is indeed pleasing to know that so many readers are looking forward to my lectures."

Listeners-in for Continental broadcasting stations will shortly be able to tune-in the Hilversum station in Holland with greater ease, for alterations at that station are now nearly complete, and it will begin transmission on high power very shortly. Until lately Hilversum has not been very easy to receive, but with its power to be increased tenfold it is expected that its broadcast concerts will be picked up by simple valve sets. Hilversum is to have two 100-ft. aerial masts, and the wave-length will be 1,050 metres with the call-sign H D O. And the programmes are being framed to interest British listeners, and I hear that some world-famous orchestras and artistes have been engaged to broadcast from the station.



No. 1 of a Series.

Michael Faraday.

The birth of a great idea

TO Michael Faraday we owe the discovery of induced currents. From his first simple experiment of winding two lengths of silk covered wires around a wooden cylinder, and placing in circuit with the one a simple battery and between the ends of the other a galvanometer, has sprung most of the great electrical achievements of to-day.

Without Faraday's masterpiece there could have been no electric motors, generators or transformers—in fact the whole structure of electricity is closely interlocked with the corner stone of electro-magnetic induction.

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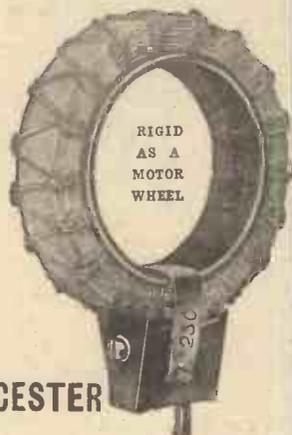
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No. 949)

TRANSMISSION OVER LAND AND SEA.

FROM A CORRESPONDENT.

Here is a clear and interesting explanation of a well-known phenomenon, full of interest to every reader of "P.W."

NEARLY everyone interested in wireless is aware that communication is more readily established over an intervening sheet of water than when the portion of the earth's surface between the stations consists wholly of dry land. Impure water, and especially sea-water, is a first-class electrical conductor. Curiously enough, absolutely pure distilled water—not tap water, which is anything but pure—is quite a good insulator. Such water, however, almost never occurs in nature, and for all practical purposes we may assume that the presence of moisture in or upon any substance increases its conductivity, usually to a very considerable extent.

The surface of the sea below, and the Heaviside Layer above, provide then two conductive surfaces between which the ether waves are, so to speak, guided on their way from the transmitter to the receiver. But besides being conductive, the sea is very nearly homogeneous—that is to say, its electrical properties vary little as between different parts of the ocean. It is also, of course, practically smooth.

When Conditions are Varied.

No doubt this latter statement will accord ill with the unpleasant reminiscences of some of my readers. But the "seas mountains high" of which one gets the impression during a heavy gale are really of negligible height compared with a slight swell in the ground ashore. Very few would overtop an ordinary house. Indeed, the greatest recorded height of a storm wave from trough to crest is only about 60 feet. And such waves are exceedingly rare.

When we come to land, however, the conditions are not only far less favourable to effective transmission, but far more varied. In the first place, no land surface is nearly so conductive as sea-water. Even a fresh-water lake or marsh offers a higher resistance than water of greater salinity. If there were, anywhere in the world, an area whose surface consisted wholly of metal—unmixed with the foreign substances present in ores—it would, of course, provide a conductor of almost infinitesimal resistance. But such surfaces do not, so far as any rate as we know, exist anywhere. Even metalliferous ores rarely occur in any quantity actually upon the surface, and where they do they are more often a hindrance than a help to efficient reception (probably owing to magnetic properties).

Very Bad Areas.

Ores are also generally interspersed among rocks, and a hard rock, owing to its imperviousness to moisture, is one of the worst conductors we have to deal with. Probably the most unpromising regions of the globe from a wireless, as from many other points of view, are the great sandy deserts. Rocky, mountainous districts are not generally absolutely devoid of some overlying soil which, however thin, is yet sufficient to retain a modicum of moisture, as is evidenced by their ability to support some kind of vegetation. But in the deserts

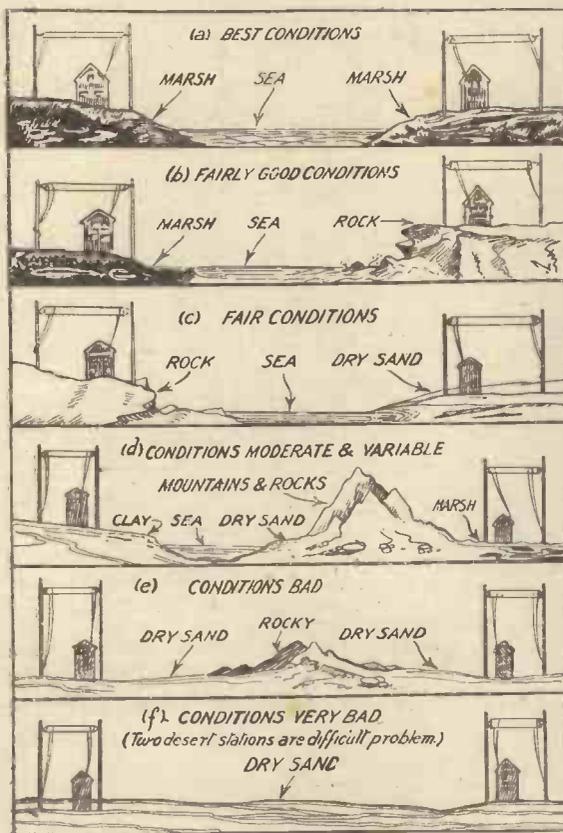
the surface is entirely and permanently dried up. Apart from the difficulty of getting a good "earth" at the actual stations, a difficulty largely superable by the use of an effective "counterpoise," the range obtainable with a given power in, or over, such areas is found to be very much curtailed.

Effect of Rain.

Ordinary soils vary much in their characteristics. At one end of the scale we have the ever-moist swamps and fens, affording, besides good "earths" at the stations, a highly conductive path for the signals. At

whole district seems to go more or less "dead" in a dry season, while in a wet period it is first-class.

Although the local effects of these soil variations are pretty well known, many people do not seem to realise that it is not only the conditions at the ends of the line of communication that have to be considered. Both stations may be in excellent districts themselves, but if a desert or rocky region covers any large part of the intervening space the communication will be hampered thereby. Conversely the stations themselves may be badly placed; but if situated, say, on opposite sides of a marshy region, or of the sea, very excellent results may often be obtained. Various possible combinations of conditions are shown in the diagram.



Mountain "Shadows."

The effect of mountains and inequalities in the earth's surface is to absorb some of the impinging waves. But the loss from this cause, though much more serious than the negligible one due to the waves at sea, is still surprisingly local. There seems to be a kind of "shadow" of the mountain range, extending some distance in the direction of travel of the waves, but beyond this very limited area the mountains (unless they actually overhang the transmitting station) are of comparatively little account. This is understandable when we realise that the waves we receive are largely "reflected" waves from the Heaviside Layer, the height of which above the earth—about 50 miles—is vastly greater than that attained by the highest mountains. The writer hopes to return to the subject of mountains in a future article.

Enough has been said here to indicate that, whereas over-

sea transmission is likely to be fairly easy and constant—apart, of course, from atmospheric and light conditions—that over land, besides being more difficult, will be much more variable. A heavy rainfall or long drought in some area between stations may make a great difference. And, unless the topography and geological formation, as well as the climatic conditions, over the intervening country are accurately known, it will not be easy to predict the "range" of a given transmission or reception. Even with the fullest information much will still depend on temporary and local conditions. It is thus not possible accurately to compare the decrease in amplitude—and consequently in signal strength—of waves as they

are received. The effect of wet or dry spells can be readily noticed, even if one is very careful to preserve the actual local earth connection. The

sea transmission is likely to be fairly easy and constant—apart, of course, from atmospheric and light conditions—that over land, besides being more difficult, will be much more variable. A heavy rainfall or long drought in some area between stations may make a great difference. And, unless the topography and geological formation, as well as the climatic conditions, over the intervening country are accurately known, it will not be easy to predict the "range" of a given transmission or reception. Even with the fullest information much will still depend on temporary and local conditions. It is thus not possible accurately to compare the decrease in amplitude—and consequently in signal strength—of waves as they

(Continued on page 1198.)

A VALVE-OPERATED D.C. MOTOR.

By S. J. M.

MANY enthusiasts whose first acquaintance with wireless dates from the inception of broadcasting, may be interested in the device described below, which was originally brought out some time ago, although very little concerning it has been published.

It is an electric motor which employs a three-electrode thermionic valve instead of the usual commutator, and is due to Messrs. W. H. Eccles, D.Sc., and F. W. Jordan, B.Sc., who described it in a paper read before the Physical Society of London.

How the Power is Obtained.

The connections of the motor are shown in Fig. 1, from which it will be seen that it is really an application of the well-known three electrode ionic relay. The principle of working is as follows:

A constant E.M.F. is applied between the filament F and the plate P and causes a steady stream of electrons to flow from the filament to the plate. Now, if a control voltage is applied between filament and grid the anode current increases if the grid is made positive relative to the filament, and decreases if the grid is made negative.

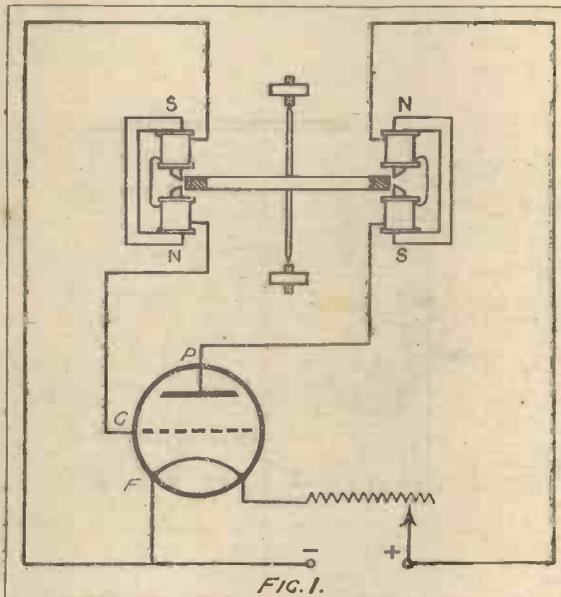
For example, in an ordinary receiving valve the anode current may be about 1.5 milliamperes when the grid is at the same potential as the negative terminal of the filament, and 2.5 milliamperes when the grid is at +5 volts, and 0.4 milliamperes when at -5 volts. The current flowing into the grid in the former case is 150 microamperes and in the latter zero. It will readily be understood, therefore, that if an alternating voltage is applied to the grid circuit, an alternating current is supplied at the anode superposed on the normal steady plate current. This alternating current is capable of doing work and the power thus made available is much greater than that which is expended in the grid or control circuit. This fact, of course, is implied when calling the valve a relay.

In the motor in question a number of iron teeth are carried by the rotating portion past an electro-magnet which is connected into the control circuit, and these teeth generate in the windings of the electro-magnet an alternating E.M.F. which is impressed on the grid of the valve. The corresponding alternating E.M.F. which appears in the anode circuit is passed through another electro-magnet placed near the rotor, and its position so adjusted that it tends to accelerate the movement of the rotor.

Not Difficult to Make.

The passage of an iron tooth, therefore, in front of the control magnet applies an E.M.F. to the grid that produces a current in the second electro-magnet in such a direction as to pull forward the tooth just approaching it. As may be expected, the speed of the rotor gradually increases until frictional and other losses consume all the energy of the battery in the anode circuit.

The motor may take any form desired by the builder. That shown in the sketch consisted of an ebonite disc $\frac{1}{2}$ in. diameter, mounted horizontally on a vertical spindle. To this are fixed twelve iron teeth at equal distances around the periphery. The electro-magnets were taken from a pair of 4,000 ohm Brown telephone receivers. Naturally,



a motor of this type develops very little power, but apart from its interest, it can be used in experimental work, especially in physical laboratories where sometimes a wheel or disc has to be spun round with absolute freedom from sparking, which occurs even in the best of ordinary D.C. motors.

TRANSMISSION OVER LAND AND SEA.

(Continued from page 1197.)

travel over equal distances by sea and by land.

TABLE OF DISTANCES (IN GEOGRAPHICAL MILES) BETWEEN LONDON AND VARIOUS STATIONS ABROAD.

Station.	Total Distance	Over Sea.	Over Land.	Remarks.
Brussels	170	105	65	Track passes down Thames estuary (considered as sea).
Paris	185	57	128	(See Brussels.)
Berlin	480	150	330	Crosses Bay of Biscay (see text).
Madrid	650	290	360	Passes N. of Thames estuary and inland from Frisian coast.
Hamburg	375	150	225	Crosses Channel near narrowest part (Dover-Ostende). Practically no land except across British Isles.
Vienna	720	90	630	Crosses Africa and the Sahara. The worst case considered.
New York	3,010	2,710	300	
Cape Town	5,200	400	4,800	
Dunedin (N.Z.):				
(a)	10,500	5,060	5,440	Eastern route, across Europe, part of Asia, and Australia.
(b)	12,000	11,850	150	Western route. Only intervening land Panama Isthmus and short distance from English coast (see text).

NOTE.—The above distances are approximate only, being taken merely from an ordinary large-scale atlas.

But the annexed table may provide food for thought. At the most conservative estimate oversea transmission is at least three times as effective as overland. The table shows, in geographical miles, the mileage oversea and overland between London and some well-known stations abroad. The B.B.C. stations are not included, as in all cases the distance is almost wholly overland. An outstanding feature is the very considerable proportion of the distance of Madrid, which is oversea. This may most likely account for the phenomenal strength with which this station can be received in England as compared with other much nearer ones. Another interesting point is that the table brings out the very strong probability that the recent signals from New Zealand came "the long way round."

"BEST WAY" GUIDES FOR CONSTRUCTORS.

THE first of a new series of "Best Way" wireless books have been received for review. One is entitled "How to Make Valve Sets" and the other "How to Make Crystal Sets," and at the low price of 6d. each they easily represent the best value in wireless books ever offered to the amateur. These "guides for wireless constructors" supply a long-felt want, and we have little doubt that they will prove enormously popular.

Printed on art paper, the text is beautifully printed and illustrated with dozens of

photographs and diagrams.

"How to Make Crystal Sets" ("Best Way" Series, No. 161) contains very detailed articles on how to make "The Home-Constructor's First Crystal Set," a "Reliable Crystal Receiver," a "Two-Circuit Crystal Set," two articles on the construction of one and two valve L.F. amplifiers, and a most informative and practical article "All About Crystals."

"How to Make Valve Sets" ("Best Way" Series, No. 162) contains constructional articles on building a One-Valve Set, a "Unidyne" Set, a Two-Valve Loud-speaker Set, a One-Valve Reflex Set, and a Two-Valve Reflex Set.

A large Pictorial Blue Print is given away with this book on valve sets.

HOW TO CONSTRUCT A FOUR-VALVE "EXPANDING" SET. An Excellent Unit Receiver for Experimenters.

Built and Designed by J. LAURENCE PRITCHARD.

PART I.

Any number of circuits or arrangement of valves is possible with this set, specially constructed and described for "Popular Wireless" by one of the best known Radio constructional experts of the day. This article will be concluded in next week's issue, but the details given in the following first article will enable the amateur to plan out the set and collect the necessary materials.

THE four-valve set illustrated in Fig. 1 makes a special appeal to the wireless experimenter. By placing each valve on a separate panel, any number of circuits or arrangement of valves is possible

The panels are screwed to an open wooden framework which allows instant accessibility to the valves and the components at the back of the panel. The complete framework is illustrated in Fig. 2. It is

and back. The inside edges of the front of the framework are tapered slightly to give ample clearance to the terminals at the edge of the panel. To reduce the front edges of the framework to $\frac{3}{8}$ -in. width will be sufficient.

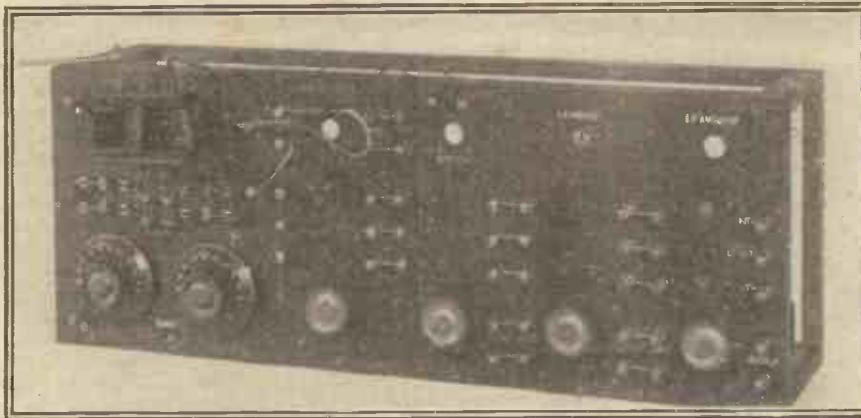


Fig. 1. Showing the completed and finished appearance of the unit set.

without soldering or materially altering the wiring of the set. The set may be started as an efficient single valve receiver and enlarged without any alteration to the existing units.

This unit type of receiver is probably the easiest for the beginner to tackle, as the wiring, which is his greatest stumbling

block, is carried out in stages easy to follow. Again, the terminals are arranged on each side of the panels so that it is impossible to connect them up wrongly. In the tracing of faults the set has distinct advantages, as the amplifiers can be quickly omitted from the circuit, when trouble with the tuner and detector alone will not be difficult to locate. If these units should be in order, the amplifiers may be added one by one until the fault is traced.

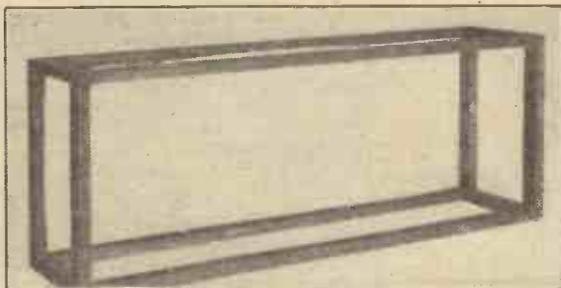


Fig. 2. The framework to which the panels are secured.

flat oblong frames, the $\frac{3}{8}$ in. side forming the inside and outside edges of the frames. The upright pieces are then glued and screwed between the top and bottom frames at the extreme corners, so that the $\frac{3}{8}$ -in. edges are to the front

and back. The inside edges of the front of the framework are tapered slightly to give ample clearance to the terminals at the edge of the panel. To reduce the front edges of the framework to $\frac{3}{8}$ -in. width will be sufficient.

Universal Tuner Switching.

The tuning unit, which occupies the extreme left side of the case, embodies an open and closed aerial tuning circuit, either circuit being selected by the switching arrangements of a double-pole double-throw switch to the extreme left of the panel. A similar switch placed in a corresponding position on the right of the panel enables a variable condenser of .001 mfd. capacity to be wired in series with or in parallel to the primary aerial tuning inductance. When an H.F. amplifier is introduced or withdrawn from a circuit, it is necessary to reverse the leads of the reactive coil. This is provided for in the tuner by a switch placed between the switches in the aerial tuning circuits.

Fig. 3 shows a front view of the tuner panel after completion. The panel measures

(Continued on page 1200.)

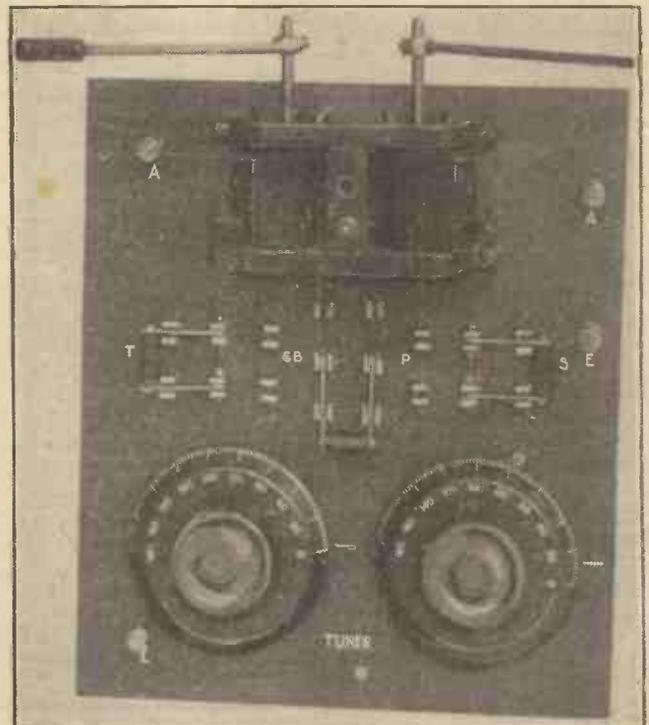


Fig. 3. Front view of the tuner, showing the lay-out of components used.

A FOUR-VALVE "EXPANDING" SET.

(Continued from page 1199.)

18 in. long and 9 in. deep. A 3-coil holder in which the aerial primary and secondary coils and the reaction coil are mounted, occupies the centre of the top of the panel. The second tuning condenser, of .0005 mfd. capacity, is attached to the bottom left side of the panel, with the largest condenser to the right of it. Each condenser is 2 in. from the side of the panel to which it is adjacent, and in each case is 2½ in. from the bottom edge of the panel. The positions of the coil holder and the three double-pole double-throw switches vary, but the switches should be of the miniature type, which are specially made for panel mounting. The aerial and earth terminals occupy the top and bottom left corners of the panel. These connect to the valve units, and are placed ⅜ in. from the right edge of the panel, being respectively 3½ in. and 1½ in. from the top edge of the panel. Two terminals are screwed to the back of the panel at the top end connecting wires and lead to the reaction coil. Thus, where reaction is required, two terminals placed on the front of the detector panel may be quickly connected to the terminals.

"Anti-Capacity" Wiring.

The wiring diagram of the tuner is shown in Fig. 4. It is drawn as the actual wires

appear, where the tuner panel is viewed from the back. The switch positions are marked in this illustration, and it will be found convenient to mark the front of the panel correspondingly, remembering that the switch positions will appear reversed when

MATERIALS FOR EXPANDING SET

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Ebonite for panels and valve shelves		9	0
3 Coil Holder		6	6
3 Duolateral Coils @ 5 - each ..	15	0	0
3 Miniature Switches @ 2 - each		6	0
1 .0005 mfd. var. condenser ..		7	6
1 .001 mfd. " " ..		8	6
4 Filament Resistances		2	0
4 M.O. Valves @ 12/6	2	10	0
1 H.F. Transformer		4	6
20 Valve Sockets		1	6
4 doz. Terminals, telephone type		6	0
Wire, Screws, etc.		2	3
Wood for Framework		9	9
H.T. Battery	13	6	0
6v. Accumulator	2	0	0
1 Pair Telephones		1	0
2 L.F. Transformers @ 15- each		1	10
2 .001 Fixed Condensers @ 2- each		4	0
	£11	7	0

the panel is viewed from the front. Wiring is done by the anti-capacity method, using 1/16-in. square tinned wire. The end of each contact should be tinned with solder before any wire is connected. After this it will be found that many of the contacts have become loose. This is due to the partial

melting of the ebonite under the heat of soldering. The loose contacts should be securely tightened up before proceeding. In connecting the wires to these studs, the operation should be performed with a minimum of heat. The cooling of the contacts is assisted by blowing on them immediately the soldered joint is set.

Detector Panel Lay-out.

A back view of the tuner with the wiring completed is illustrated in Fig. 5. Connecting wires to the aerial primary coil and the reaction coil are made with flexible insulated wires. Electric lighting flex with the outer cotton casing removed will be found suitable, as it is less likely to break under continued movement.

The detector panel, also cut from 3/16-in. ebonite, measures 4 in. wide and 9 in. deep. A panel lay-out showing the exact positions of the terminals is given in Fig. 6. The exact position of the terminals is important, as they will be required to register with the terminals on the high- and low-frequency amplifier. The position of the valve shelf will be made more clear in subsequent photos. The shelf is cut from a piece of scrap ebonite, and measures 2½ in. by 2½ in. In the centre of this shelf, four valve sockets are screwed to form a valve holder. A bracket of right angle brass secures the shelf to the main panel. A front view of the detector panel, with input and output correctly lettered, is illustrated in Fig. 7.

The Battery Connections.

The wiring diagram given in Fig. 8 represents, in the same way as the tuner, the actual wiring of the detector panel from the back. This will be seen by comparing it with the back view of the detector panel shown in Fig. 9, with the wiring completed. The positions of the grid leak and condenser should be noted. The former has a resistance of two megohms and the latter a capacity of .0003 mfd. The tuner and detector valve now finished, they may be mounted on the framework for a test. If it is intended to use the set in its present state of construction for any length of time, the two panels may be attached to the centre of the framework. The blank spaces either side may be filled in with figured wood panels stained or polished as required. Short connecting strips of stout wire are screwed in the aerial and earth terminals to the top right-hand side of the tuner, and join the two input terminals of the detector panel.

As shown in Fig. 8 high-tension positive is connected to the top of three battery terminals and low-tension positive at the bottom. The middle terminal is joined to high tension and low tension negative. In the case of each unit, battery terminals are connected to each side of the panel so that when other units are added they are quickly supplied with battery current by connecting strips of wire to the adjacent terminals on the panel already fitted.

The panels for the H.F. and L.F. amplifiers may be cut and matted at the same time, as with the exception of the positions of the input and output terminals they are the same. The sizes given for the detector panel may be used for the amplifying panels to a large extent. The positions of the valve shelf, filament resistance and battery

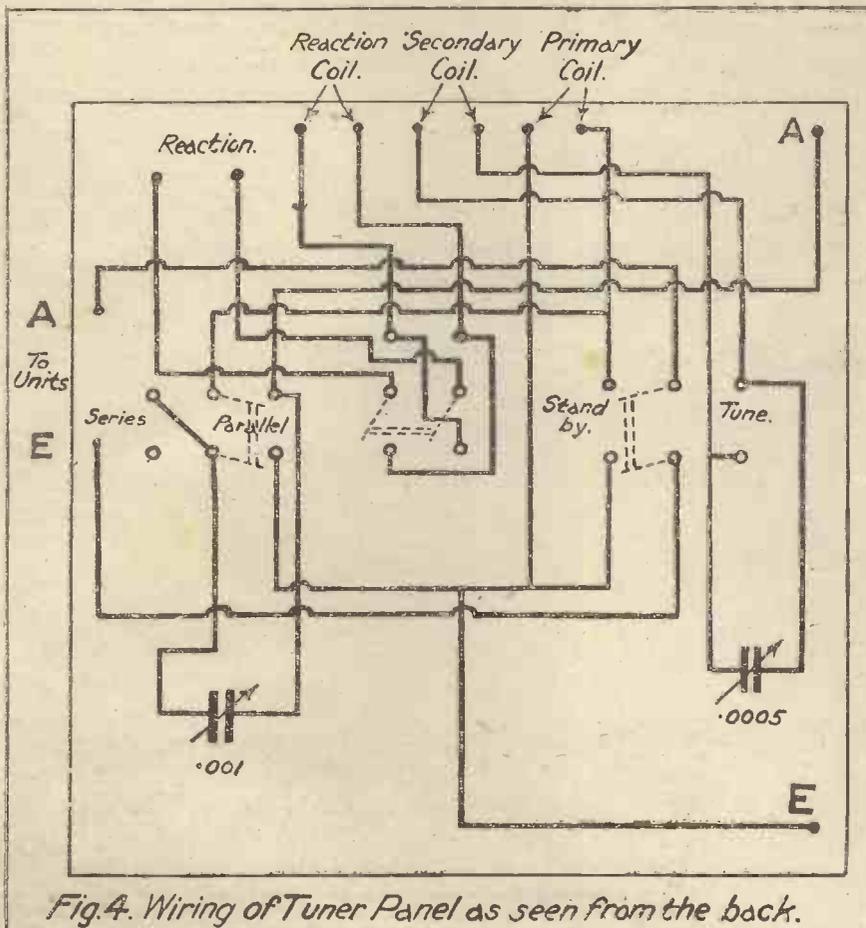
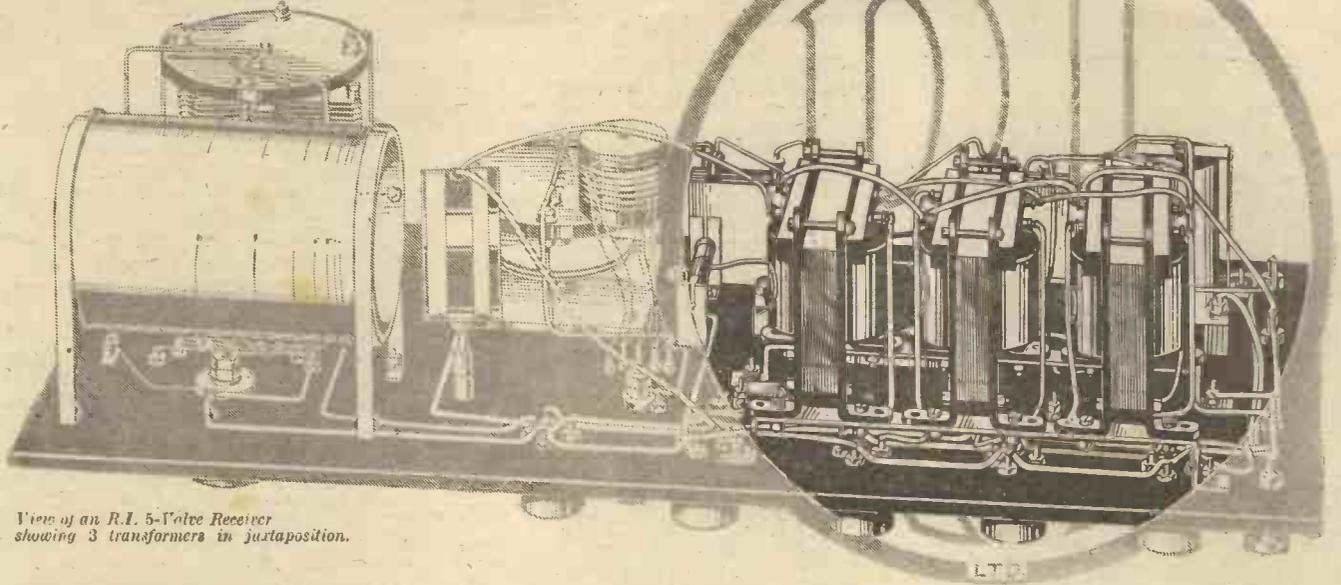


Fig. 4. Wiring of Tuner Panel as seen from the back.

(Continued on page 1205.)

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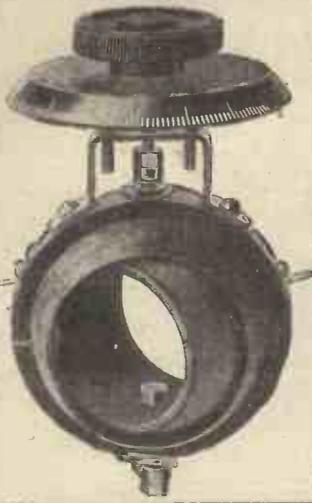


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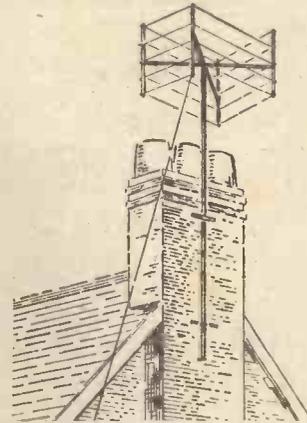
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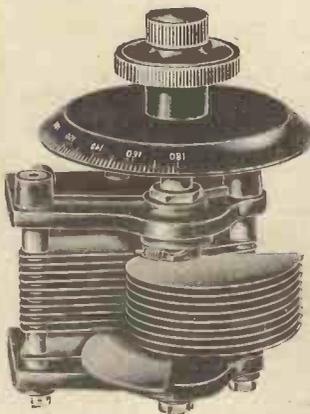
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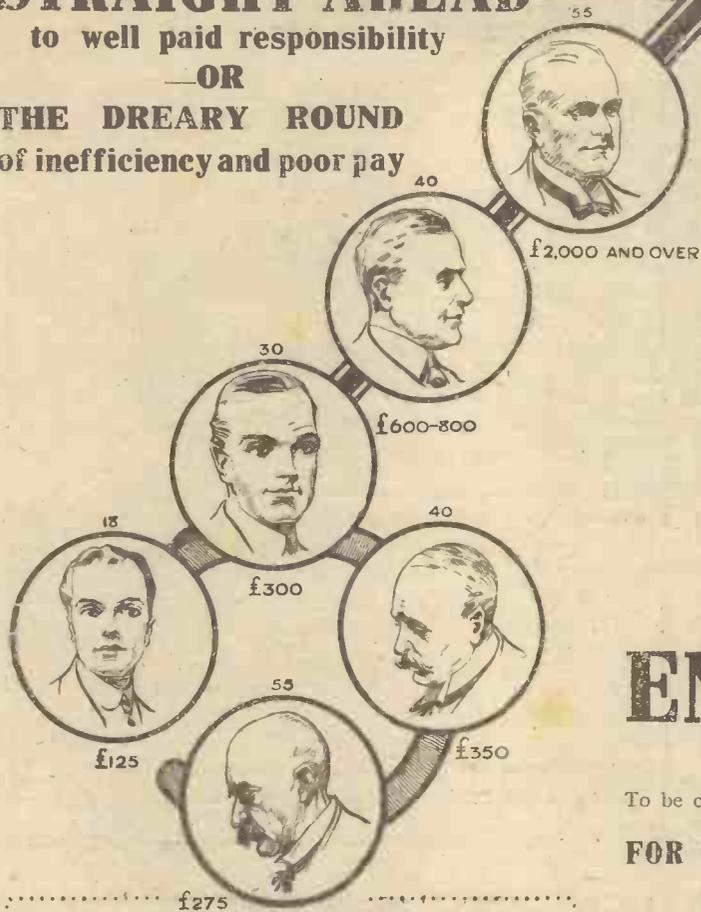
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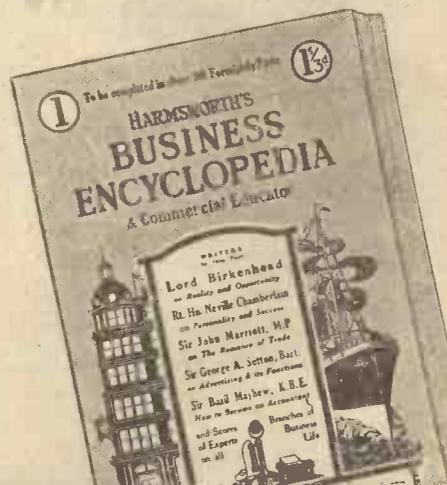
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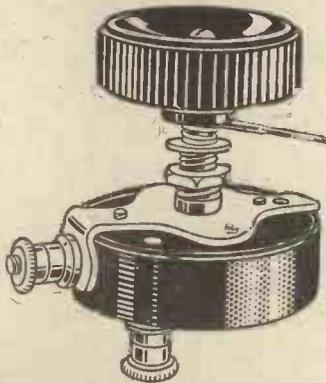


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Standard 4 B.A. Stem.

Serrated bottom prevents working loose.

Complete with nut and washer.



Give just that expert finish to a set.

Brass 3½d. each; N.P. 4½d. each.

Sole Manufacturers and Patentees:

BELLING & LEE, LTD.,
 Queensway Works, Ponders End.

A FOUR-VALVE "EXPANDING" SET.

(Continued from page 1200.)

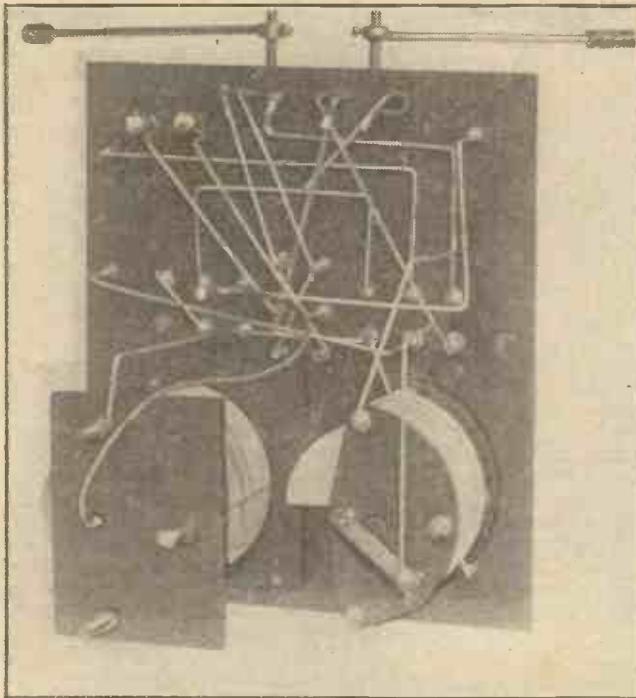


Fig. 5. The back of the tuner, showing wiring completed.

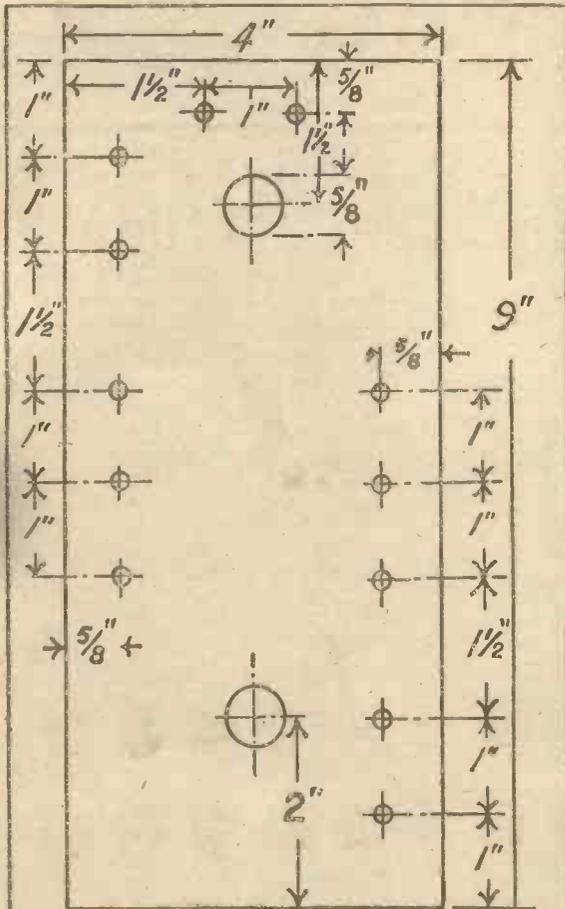


Fig. 6. Detector Panel. Lay out Front View.

terminals are identically the same in the amplifying panels.

Dealing first with the high-frequency amplifier, input and output terminals are arranged on either side of the panel at the top, in line with the input terminals of the detector. The H.F. amplifier is primarily intended for transference coupling, a set of four valve sockets being attached equidistant from the sides and 3 1/2 in. from the top of the panel. From there four valve socket connections may be made to incorporate resistance capacity or tuned anode coupling. A front view of the panel showing the position of the H.F. transformer sockets is illustrated in Fig. 11. The wiring is carried out in the same way as the wiring of the detector panel, the hints on soldering to avoid loosening the terminals and valve sockets being borne in mind. The wiring diagram representing the back view of the actual wiring of

the panel is given in Fig. 12.

A back view of the wiring in which the connections to the transformer sockets are clearly shown is provided in Fig. 13. The correct way of making the connections to the transformer socket should be noted. Viewed from the back of the panel the top socket, which would be the grid socket of a valve holder, connects to the a node of the valve. Similarly the lowest anode socket joins the high-tension positive terminals with which it is in line. Of the two intermediate or filament sockets the one to the left, viewed from the back of

This article will be concluded next week. The diagrams and photographs mentioned in the text on this page will be given, together with a résumé of the references made.

the panel, joins high- and low-tension negative, and the lower of the input and output terminals. The remaining socket is connected to the upper output terminal.

To test the set the tuner unit is removed from its central position so that the H.F. amplifier separates it from the detector unit. The connecting wire from the aerial terminal on the right of the tuner is coupled to the upper of the input terminals of the H.F. amplifier, by means of a flexible insulated wire with Wander plugs attached. All the five terminals on the right side of the first valve unit are coupled to the corresponding terminals of the detector. Battery wires are connected as before to the terminals on the right of the detector, the telephones being attached to the output terminals. The object of the flexible lead is to cut out the high-frequency valve if desired.

(To be concluded next week.)

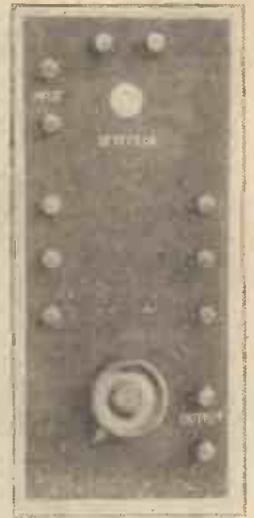


Fig. 7. Front view of the detector panel.

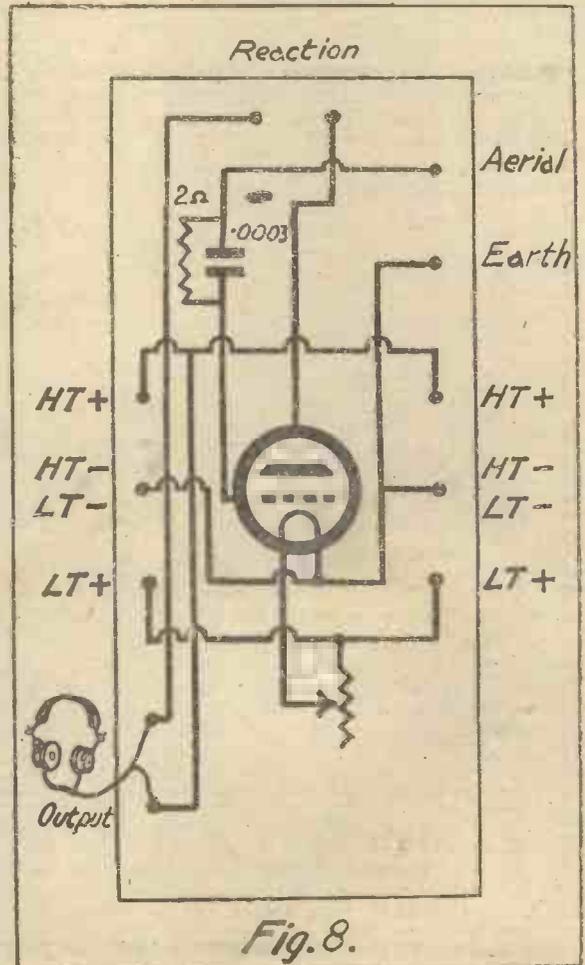


Fig. 8.

WIRELESS FOR THE BEGINNER.

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

PART 10. THE THERMIONIC VALVE.

CONDUCTORS of electricity harbour within their inter-molecular spaces electrons which are free to move about, in addition to those which are more or less fixedly associated with atoms. There are reasons to warrant the assumption that these free electrons behave in some ways like the molecules of a gas. They are in constant motion, continually colliding with the metallic molecules and other free electrons;

to the number which re-enter it, and a permanent cloud of electrons hovering in space like the permanent cloud of vapour which hangs over Niagara in summer.

If the rheostat now be varied so that some resistance is removed from the path of the current, the filament will become brighter, more electrons will be shot out per second, the cloud of electrons in space—known technically as the "space charge"—will become larger, and finally equilibrium will again be reached. The preceding statement holds true for any further increase in the filament current or, what is the same thing, increase of filament temperature—unless the temperature is raised so high that the filament is burnt, an experience which most of us have suffered.

Now suppose that we place within the glass bulb of our lamp a metal plate (Fig. 1 (b)), and suppose also that we charge this plate positively. Knowing what we do about the habits of electrons we shall not be surprised to learn that the

electrons in the "space charge" make a bee-line for the positive plate in order to remedy its deficiency of electrons. So that we now have a stream of electrons from filament to plate—and that, as you know, is a current of electricity. The positive plate is a kind of a store for the electron output of the filament. But it is not of unlimited capacity—it can only hold so many. If it has no distributing agency to pass the electrons out again it will simply end by becoming negative, and then it will not only be unable to take more electrons but will actually repel them. Fig. 2 shows how this difficulty can be, and is, surmounted.

Overcoming the "Space Charge."

We make the plate positive by connecting it to the positive terminal of a battery, and we connect the negative terminal of the battery to the filament. The result is a circular tour for the electrons; they reach the plate, pass through the battery, re-enter the filament from the outside, and line up, as it were, ready to go into the front line and be pushed out again into the No Man's Land of the space inside the bulb, where once more they make for the plate, which being thus relieved of surplus electrons is kept positive.

The battery which heats the filament is the low-tension battery, and that which is connected between plate and filament is our old friend the high-tension battery. The current, which flows through the "plate circuit" (that is, from filament to plate to high-tension battery to filament) is called the plate current. It is limited by several conditions; for examples, the material and size of the filament. The

maximum plate current which will flow under a given set of conditions is called "saturation" current, and this characteristic of a valve is due to the inability of a given area of the filament to shoot out more than a certain number of electrons at a certain temperature.

The "space charge" still plays an important part in the scheme of things, even after the introduction of the positive plate. Consider the situation of any one electron midway between the filament and the plate. It is subjected to two influences. Firstly, there is the attractive influence of the positive plate; it wants to get to that plate, which is a sort of "spiritual home" for any unattached electron. But secondly there is the malign and repulsive action of all the electrons between it and the plate

Action of the Grid.

Our electron's chance of reaching the plate depends upon which is the stronger, the repelling influence of the intervening electrons or the attraction of the positive plate. It is like the gang of bad boys trying to keep the good boy from Sunday school. If the delights of street-running prove in the end more attractive than the peace of a good conscience—and the possibility of being included in the "school-treat"—the boy does not reach Sunday school. Similarly our electron must be more attracted by than repelled from the plate, if there is to be a plate current. We arrange matters accordingly, and make the plate very positive by making the high-tension battery of sufficient voltage.

Continuing our useful—not to say moral—analogy, let us suppose that whilst the good boy is hesitating between the blandishments or threats of the gang and the remembered injunctions of his mother,

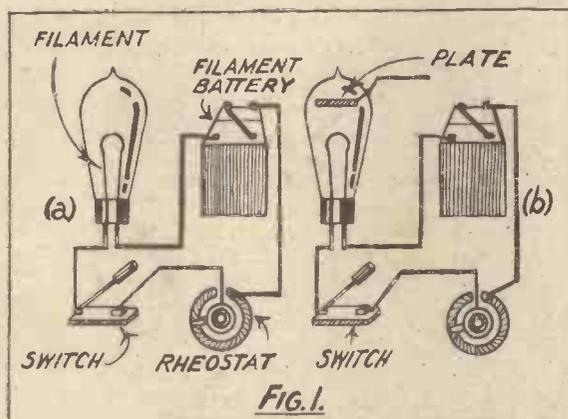


FIG. 1.

the velocity of their motion increases with increase of temperature, as also do their mean free paths. If the temperature of conductor reaches a certain value the surface tension is overcome and electrons leave the conductor. This effect may be compared to evaporation and we may regard the electrons as boiled out of the conductor.

Origin of the Valve.

Fig. 1 (a) depicts an electric lamp; the filament is, we will say, of tungsten, and the lamp is connected to an electric battery, a switch by means of which the current can be switched on and off, and a variable resistance (a rheostat) by means of which the amount of current passing through the filament can be varied.

Consider that the resistance is adjusted so as to let as little current as possible flow. The filament glows dull red. Now, electrons are already escaping from the surface of the filament, and the space around the glowing wire is a cloud of negative charges, and we may picture the electrons as a swarm of flies hovering over a pot of jam. But as the electrons repel each other—on the principle that like repels like—a number of them are knocked back into the filament, and as the filament, when it loses electrons, thereby becomes positive, as explained in a previous article, it raises no objection to the re-entrance of these electrons. Therefore there is on the one hand the glowing filament flinging out electrons, and on the other a cloud of electrons trying to knock back all new-comers. Eventually a sort of equilibrium or stale-mate is arrived at, the number of electrons leaving the filament being equal

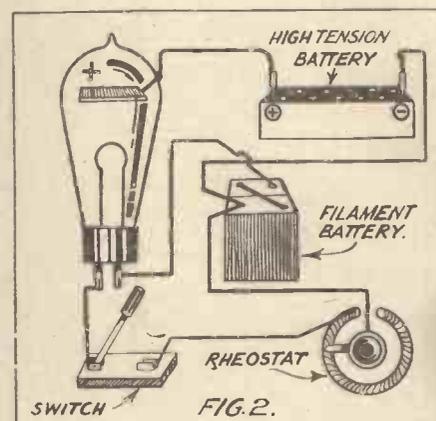


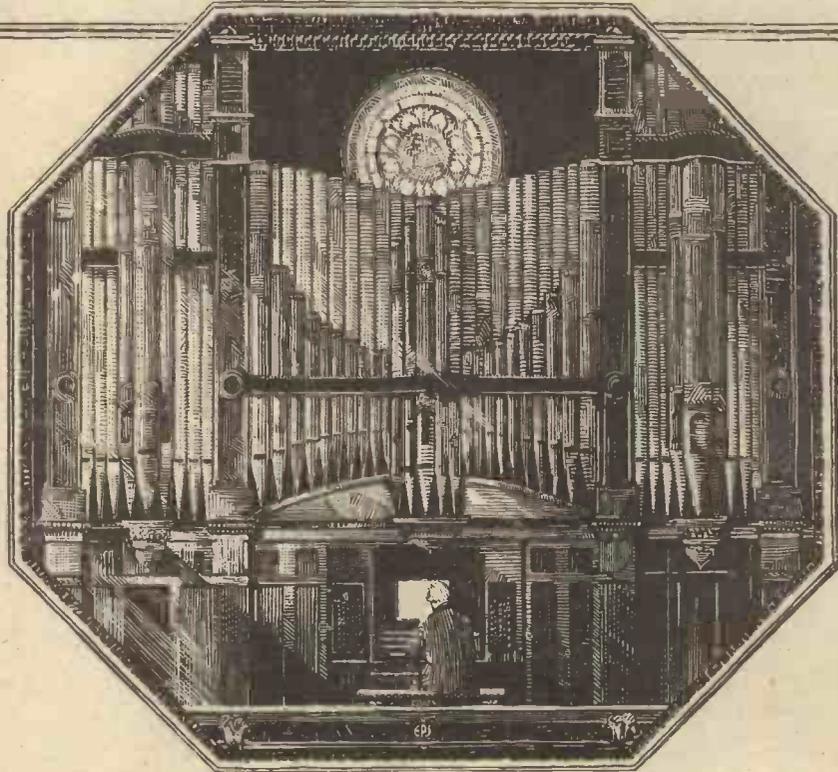
FIG. 2.

there happens along the school teacher. What a changed state of affairs! The teacher is bound to control the situation. He can gently lead the good boy to school, or he can pass by with a look of pain on his face. Upon his attitude depends the size of the Sunday school class. Coming down to more mundane affairs, namely, a valve receiver, we find that there is in the valve a similar controller. It is called the grid, and upon the part it plays depends the value of the plate current. It can cause the plate current to increase, to decrease or to stop altogether. And on the changes in the plate current depend those vital processes, rectification (or detection) and amplification of wireless signals.

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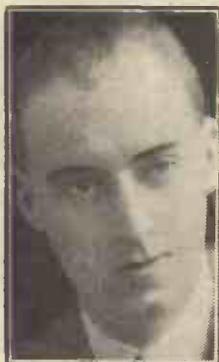
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Artistes of the Aether

By "Ariel"

Some of those who have given you pleasure when listening-in.

A CAREFUL study of broadcast music reveals many interesting facts. One amongst them is that the stranger or more unlikely the instrument, the better it appears to radio.



Mr. John Huntingdon.

Few people would have deliberately chosen the bagpipes, the ukulele or the balalaika, to say nothing of the harp or the banjo, yet one and all when handled by real artistes of their craft have become powerful mediums. A recent performance extraordinarily

successful was the playing on the harpsichord, the forerunner of the piano, by Mrs. Gordon Woodhouse, who, incidentally speaking, has made a life study of ancient instruments, and also the solos on bells by Miss Nellie Norway.

This artiste will be remembered by every faithful adherent of Maskelyne and Cooke's Hall of Mysteries, for Miss Norway has been one of its chief artistes there. Her table of silver bells was always one of its great features, and another recent performance there but a few weeks back only served to reveal fresh nuances. When heard again also at 2 L O recently, her bells radio'd exceedingly well, especially when towards the end her table was moved nearer to the microphone.

The Musical Event of the Week.

Chief musical interest of last week has been centred on the second of the International Symphony Concerts at the Opera House, Covent Garden. Mr. Ernest Ansermet, the famous Swiss conductor, has been intimately connected with M. Monteux, who conducted the first last month, and he was indeed leader of the Kursaal Concerts d'Monteux, in Paris. Mr. Ansermet has allied himself with the interests of the Russian Ballet of Serge Diaghileff, and toured the United States and South America with it.

During these tours he directed a number of new works of Stravinsky and Manuel de Falla, so it



Claude Debussy.

was only natural that the B.B.C. programme should include such well-known foreign composer's names as Debussy and Stravinsky, the latter being represented by "L'Oiseau de Feu," and the former by his popular "L'Après Midi d'Un Faun." This work, though in reality one of the slightest of the composer's works, seems to have impressed itself more on the public mind than any other of his numerous compositions.

Famous Violinist.

It is a piece of sheer musical impressionism, an attempt to depict the dreams of a faun slumbering at midday. Of a far higher standard is his opera "Pelleas and Melisande," which took nearly thirteen years to complete. His death in 1918 robbed the French world of one of its chief musicians, and the inclusion of his work again at the concert testifies to his popularity in this country. The English element was, however, admirably supplied by the engagement of Mr. Albert Sammons for Elgar's violin Concerto. For the third of the series next month, Herr Bruno Walter, the German conductor, will lead.

The B.B.C. has striven nobly to give all-round satisfaction, and few people realise the magnitude of the task, but I think the maintaining of two different programmes at the London and Chelmsford stations is the solution of most problems. Their first experiment when "Prince Igor," the Russian opera, was broadcast from Brussels Opera House through 5 X X, while from 2 L O a fine musical comedy programme was given, was sufficient proof that both "high-brow" and "middle-brow"—if I may use the term—can be satisfied at one and the same time.

Some Clever Singers.

2 L O may be said to make a special "bid" for good singers, and it would be hard to find better voices than those heard at some of the S.B. programmes. One of the most popular is Mr. John Huntingdon, a singer who has figured prominently in most of the provincial concerts of note as well as in London. He has a baritone voice which radios well by reason of its sweetness of tone as well as virility, and his songs are always well chosen.

Another singer heard not only in the

operatic but in the solo recital programmes is Miss Sybil Maden. She is one of the most promising singers also in the Manchester district, where she has established herself very firmly in popular favour. Originally a member of the Stockport Maia Choir, she took a scholarship at the Royal College of Music, subsequently training in Paris under Mme. Jeanne Brola. Her rich contralto voice lends itself particularly well to operatic music, and in the recent studio performance of Humperdinck's "Hansel and Gretel," she took the part of the Sandman most daintily.



Mr. Roy Henderson.

Bournemouth.

Some of the best music of the month has been heard from 6 B M, especially during the recent Symphony Concert, the seventeenth of the series. There is always a tendency to give the more familiar and oft-times hackneyed words of each composer, and the idea therefore of hearing the more rarely performed works lent a freshness to the scheme highly acceptable.

As an instance was the overture, "Children of the King," of Humperdinck, instead of the inevitable excerpts from "Hansel and Gretel," and the "Don Juan's Serenade" of Tchaikowsky. Another good point is the breaking up of the lengthy symphonies, thus obviating boredom, only natural when a work takes nearly an hour to play.

Amongst the soloists announced were Miss Marjorie Hayward, the soloist and leader of the Vituoso Quartet, and Mr. Roy Henderson, a clever young baritone, whose recitals in Edinburgh last year and at Wignore Hall last month resulted in much favourable notice.

Mr. Henderson has a baritone voice of flexibility and power, and these qualities lend themselves well to the needs of the microphone. As some proof of his abilities may be mentioned his interpretation of difficult arias of Bizet and the "Song of the Flea" by Moussorgsky.

I hope we shall soon hear some more from him via one or other of the stations.



Miss Sybil Maden.



Miss N. Norway.

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APPARATUS TESTED

The Technical Editor of "Popular Wireless" will be pleased to receive wireless sets and component parts for test. Reports will be published under this heading.

THE first stage of L.F. amplification can be more or less satisfactorily carried out with any type of L.F. transformer of approximately the correct ratio, but the second stage calls for something a little better than the majority if distortionless reproduction is to be obtained. Recently we had sent us a Eureka Concert Grand, and although this is recommended for first stages and a special Eureka produced for seconds, something in the appearance of its solidity determined us to try it out in the last stage of a five-valve set employing power L.F. valves. Results were excellent, and using an Ediswan Televox, the absence of extraneous noises and the general purity of reproduction was remarkable, and far superior to any other we have yet heard considering the extent of the volume. This provides clear proof that it pays to employ first-class components, and as a matter of fact, few transformers would stand the heavy potential that the Eureka has to deal with without completely breaking down.

From Mr. S. Lyons, of 119, Clerkenwell Road, E.C.1, we have received samples of

the "Lion" Crystal-valve combination, which retail at 2s. 3d. per pair post free. The combination consists of Tellurium and Gillingham crystals, the latter being of a bright yellow colour similar in general characteristics to copper pyrites only more sensitive. They provide an excellent detector for both plain crystal and valve-crystal work, are sensitive and yet sufficiently stable for even "double duals." Contact adjustment requires to be fairly firm, and once "set," sensitivity is retained over quite a considerable period.

Messrs. Beard & Fitch, Ltd., of 34, Aylesbury Street, Clerkenwell, E.C.1, realising a considerable demand, have produced the "Success" Neutrodyne variable condenser. It is a neat little instrument designed for "one hole" panel mounting, and provided with a most ingenious system of



A neat valve set, the Revophone II.

adjustment, which allows both coarse and "vernier" control. It can be reduced to an almost negligible capacity, and the component is so constructed that adjustments can be carried out without "hand capacity" causing trouble. In view of the popularity and undoubted merits of the Neutrodyne stabilising system, this latest "Success" component should meet a ready market at the retail price of 3s. 6d.

The Ashley Wireless Telephone Co., of Liverpool, has sent us samples of new plugs and jacks. Of the latter, the two standard types are being produced at 2s. 3d. and 2s. 6d. each, while the plug is retailed at 3s. They are well made and efficient in operation, both in point of smoothness and positiveness of contacts. They should not be confused with the "ex-service" telephone plugs and jacks, as they were designed and produced particularly for wireless purposes. Plugs and jacks are more used in the States than in this country, but nevertheless the general usefulness of such items is realised by a great number of amateurs for quick telephone and loud speaker and circuit change-overs.

An item that will appeal very strongly to the amateur constructor has been brought to our notice by Mr. F. L. Hart, of 28, Mount Park Avenue, South Croydon. It is a small soldering stove and iron designed for connecting by means of a flexible rubber tube to the gas supply. It is a well-made article, neat and solid in appearance, and is to be supplied at the low price of 4s. carriage paid, together with a most suitably-sized soldering iron for wireless con-

(Continued on page 1212.)

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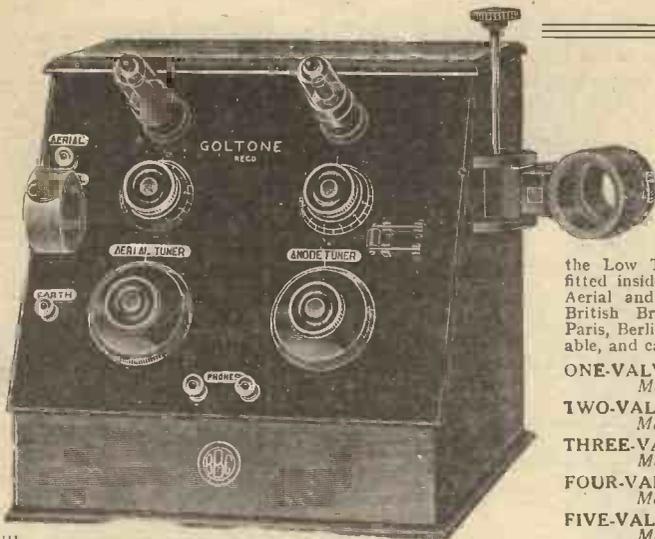
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Rusonite Permanent Detector , ideal for Reflex Circuits. No Cat's-whisker worry . . . 4/6	Carpax Valve Protector . Connect to one terminal of your H.T. battery and absolutely prevent valve blow-outs . . . 2/6	Electrad Certified Grid Leaks . Every one guaranteed, 2 megohms, 2/6
Carpax "Varimeg," the ideal Variable Grid Leak at last. Not compression type. Smooth variation, stable resistance . . . 3/- Range, ½ to 5 megohms	Carpax "Varinode," A variable anode resistance on same principle as Varimeg. Range 20,000 to 250,000 ohms. 3/-	Grip Tite Connector Clips , 1/- each, small size, 4d. each. Indorarial, 7/6. Send for list of complete receiving sets, 30/- to £11 10s.



Radio experimenters should send for our list of Tested Radio Specialities. This list is Free and Post Free. It will save you money and add to your enjoyment.

The above specialities are on sale at most dealers or direct from:

CARPAX COMPANY, Ltd.,
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You are not getting the best out of your Set—Your Panel is acting as a Slow Leak.

"INSULEX"

The Latest Discovery in Wireless

A scientific preparation for applying to the surface of wireless panels. NOT A LIQUID VENEER or VARNISH.

The efficiency of a wireless set depends to a great extent on the dielectric value of the ebonite used in the panel. When this becomes dirty, or coated with moisture in damp weather, the dielectric value falls, the high-frequency currents from the aerial taking the shortest path to earth—across the surface of the panel—causing a pronounced loss in signal strength. This applies to both crystal and valve sets.

On panels treated with "INSULEX" this can never happen. Your set will work better and look like new after one application.

"INSULEX" The result of two years' serious research. Is the only preparation made specially for the treatment of ebonite.

"INSULEX" Removes finger-marks, stains, etc. (No more green and discoloured panels.) Treated occasionally with "INSULEX" your panel will keep its colour for all time.

Start your wireless season by giving your panel a clean up with "INSULEX" and enjoy improved reception.

"INSULEX" in bottles, 1/6; Large Size, 2/6. Post 4d extra

Direct from the
DANUM TRADING CO., Scientific Chemists, 2, French Gate, DONCASTER.
TRADE ENQUIRIES INVITED

APPARATUS TESTED.

(Continued from page 1210.)

structional purposes. Its gas consumption is very low, not being more than about $1\frac{1}{4}$ c. ft. per hour. In our opinion it is one of the best value-for-money propositions brought forward within the last year, and should prove an indispensable item in the home for numerous purposes besides wireless. On test we found it to be perfectly satisfactory in operation, a clean, hot iron being available a few moments after lighting.

Quite unique is "Junit," a self soldering wire, samples of which have recently been sent us. In appearance it is similar to No. 18 gauge tinned copper wire, but it really consists of metal that acts similarly to ordinary solder. It retails at 4 yards for 6d., sufficient length to wire up at least a two-valve set of ordinary design. Naturally it is rather soft, and in making "bridge" connections one has to be careful lest the main leads melt away. Nevertheless it is an interesting little side line.

From Messrs. Radions, Ltd., of Bollington, we have received samples of their Radion G. P. valve, which takes approximately .48 amps. at about 4 volts. It is, as its designation implies, a general purpose valve, although in our opinion it operates more efficiently as a detector than amplifier. It is, however, quite a good all round valve, and, comparatively speaking, well made and

finished. It is necessary to run the filament rather brightly to get the most out of it, and we should have thought that this would tend to reduce its life. While we are on the subject of valves, might we respectfully draw the attention of valve manufacturers in general to the fact that to our knowledge there is no valve, at least on the English market, designed especially for dual amplification. If there is, then it has not been very well brought forward. The number of "reflex" receivers in use must be enormous, there must be a few tens of thousands of possessors of "P.W." Combination sets alone, and yet no valve manufacturer has come forward and said: "Here we have type so-and-so, designed particularly to perform the functions of dual amplification."

Whatever are the arguments against this, and we know some, the fact remains that there are only one or two bright emitters really suitable for reflex circuits, while there are many both specified amplifiers and general purpose valves which are not.



A special loading coil for Paris, manufactured by Messrs. B.T.-H. Ltd.

From the Radio Manufacturing Co., of 100, Dale End, Birmingham, we have received samples of R.M.C.

"S" and "C" type variometers. Both of these are designed for one-hole panel mounting and to cover the normal band of broadcasting wave-lengths. The "C" type, which retails complete with knob and pointer at 4s., is of conventional tube and ball style, but more especially in respect of connections embodies exceptional features. It is a well-made little instrument, and sound value for money at the price mentioned above.

The "S" type is of special spherical design, having a ball rotor and a "skeletion" spherical stator. The latter consists of a stiffly self-supported winding to reduce self-capacity losses, and to enable a closer separation of winding to be obtained, a graduated scale is provided with this model. It retails at 6s. 9d. complete.

We have tested both types and very satisfactory results were obtained both in crystal and valve circuits. Adjustments in both cases were mechanically smooth but not loose, and positive electrical connections and contacts maintained throughout.

We recently received a cabinet from Messrs. Pickett's Cabinet Works, Bexley Heath, S.E., which is to be used for a special receiver we are constructing. It is one of their "Concert" types, finished in light mahogany and shows excellent workmanship throughout.

This type, known more generally as "American," is rapidly increasing in popularity in this country; it offers many advantages besides being handsome in appearance.

The Radiovox

Valueless Square Law
Variable Condenser

is a Revolution in condenser design

8/6

Postage
3d. extra



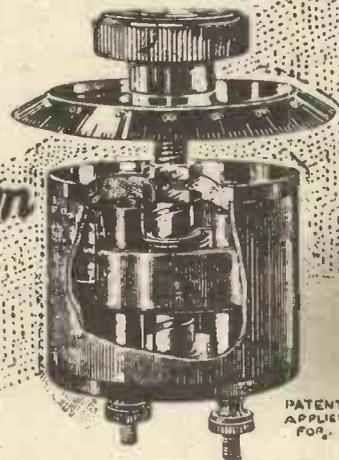
The "Radiovox" is a revolution in condenser design. It has an even scale of capacity variation throughout the whole of its range and, owing to the small size of the electrodes the losses are reduced to a minimum.

The "Radiovox" Variable Condenser is a sound, engineer built component—is entirely enclosed in a strong fibre case and an ornament to any set.

There are no delicate vanes to get damaged or dusty. The movement is firm and smooth and the position of the electrodes eliminates hand capacity effects.

Tuning is exceedingly fine and, although there is only one knob to turn, vernier adjustment is obtainable over the whole scale. The tuning in of distant Stations is simplified.

The "Radiovox" is British made and is guaranteed by the makers.



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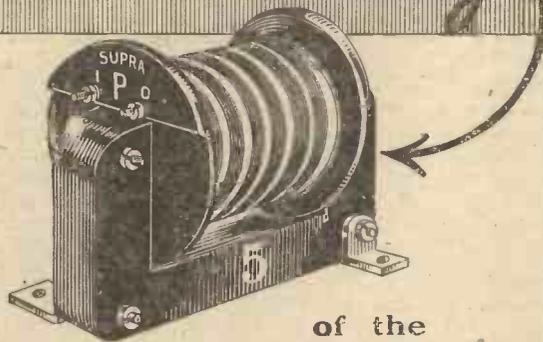
.001 .0005
and .0003 mfd.

It serves further to demonstrate the superiority of British components.

The price includes first-class knob and dial. All orders will be taken in strict rotation and will be dispatched immediately on receipt of remittance.

RADIOVOX CO.
(B. Dept) 57 CHANCERY LANE,
LONDON, W.C.

It's the windings



This illustration shows covering removed and one layer of the sectional winding.

of the **SUPRA**

THAT MAKE THE DIFFERENCE!

The efficiency of your valve set depends upon getting the maximum from each valve.

This is governed by the transformers you use. The "Supra" low frequency transformer has a ratio of 5 to 1, and is specially designed to give the utmost amplification without distortion.

The windings are in insulated layers, each having six sections, reducing self-capacity to a minimum.

Thirty-eight laminations of finest soft iron compose the core.

Those who have marvelled at the rich, full tone of our "Supratone" Amplifier, which incorporates two "Supra" transformers, will agree that our claims are not exaggerated.

Acknowledged the best

all over the country; everywhere that sets are being constructed you will find the "Microstat" being installed. Why? Because it is unquestionably the finest form of filament control, giving noiseless micrometer adjustment from zero to 100 ohms with any type of valve. Fitted as standard on our "Supratone" Amplifier. One-hole fixing.

The **MICROSTAT - 2/9**

12/6



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BROS., LTD.,

12, 13, 14, Great Queen St., Kingsway, W.C.2.

Works: LONDON, BIRMINGHAM, and WESTCLIFF.

'Phone: Gerrard 575 and 576. Grams: Zywateseng, Westcent.

This means your discovery of a perfect Crystal



When you see the distinctive "Hand-and-Crystal" on the carton (as shown below) your search for full sensitiveness ends. Eye-straining, temper-ruffling "prodding" in the vain hope of getting a "better spot"; breaking into an interesting musical item because the Crystal has "gone dead"; all this is ended if you accept the invitation of the "Hand-and-Crystal" and fit Sylvorex Crystal to your Detector. Sylvorex Crystal gives silver-toned, perfect rectification, and is exceptionally efficient in long-distance reception. It is sensitive all over and right through and carries a definite money-back guarantee—each Sylvorex being exhaustively tested on actual broadcast transmission before despatch.

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RADIO CRYSTAL

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Produced by SYLVEX, Ltd., 25, Victoria Street, London, S.W.1.

'Phone: Franklin 6003. Trade enquiries invited.

2/-

In airtight container, with Special Cats-whisker and full directions.



If you cannot obtain Sylvorex from your Radio Dealer, send P.O. 2/- direct, with your Dealer's name and address, and we send the Crystal by return post free. Remember, whether you buy Sylvorex from your Dealer or direct you test it at OUR expense; if you are not satisfied in every way your money is returned.

RADIOFORIAL

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be kept, as the original query cannot be produced in the answer. Cash should be sent in the form of a postal order.

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

NOVICE (Nottingham).—What is meant by oscillation interference?

This is due to the effect of excessive reaction in a valve set in such a way as to cause the valve to oscillate and energise the aerial. If reaction on the aerial is used, or if H.F. valves oscillate, a small oscil-

lating current flows up and down the aerial and sends off other waves of a wave-length approximating to the wave-length to which the oscillating set is tuned. This wave "gets mixed up with" other transmissions (e.g. broadcasting transmissions) and upsets them, producing a beat note as the two waves get in and out of step, for they will not be of exactly the same wave-length. This beat note is heard in other listeners' sets in the form of a high-pitched whistle, which will drop or interrupt anything else being received.

S. J. E. (Redhill, Surrey).—My neighbour's aerial is parallel to my own, and we share the same mast. When my three-valve set is tuned to the local station his signals are greatly increased, apparently by interaction, and he is unable to tune-out and listen to other stations. How can this effect be lessened?

To reduce interaction, the aerials should run at right angles instead of parallel, and reaction should not be used on either aerial or secondary circuit. Where aerials are separated only by a few feet it is impossible to avoid a certain interaction between them.

INDOOR (Camden Town, London, N.W.).—I am unable to erect an outdoor aerial, and have been told that I can use the electric light mains instead. Would this be an effective substitute, and is there any danger from shock in such circumstances?

The results obtainable with an "aerial" of this kind can only be ascertained by test, as they are sometimes remarkably good and sometimes very disappointing. There is no danger, providing that one of the specially constructed connectors of reliable make is used, and that the instructions are carefully followed.

R. A. E. T. (Witney, Oxon).—What type of amplifier, L.F. or H.F., should be added to a crystal set to increase very indistinct signals?

Generally speaking an L.F. amplifier is added to increase the volume of signals being received, but to add an L.F., signals must be clear and distinct in the first instance. Thus it would be advisable to add an H.F. in this case, to amplify the very weak impulses before they are passed on to the crystal for rectification.

(Continued on page 1218.)

HULLO! C.Q., WILL DAY CALLING

FOR WHERE THERE'S A WILL THERE'S A DAY.

TANDCO BASKET COILS (100 to 4,500 metres.)			
Duplex wound, 25 gauge D.C.C. wire, sewn supports unwaxed, very firm and strong, recognised as the finest type Coils yet made.		Enamelled.	
Size	1. 2 in., approximately 150 to 300 metres	5d. each.	No. 1. 4d. each
2. 2½ in.,	250 to 400	6d. "	2. 5d. "
3. 2½ in.,	350 to 550	7d. "	3. 6d. "
4. 3 in.,	450 to 650	8½d. "	4. 7d. "
5. 3½ in.,	600 to 750	10d. "	5. 8d. "
6. 4 in.,	700 to 1,000	1/2 "	6. 9d. "
7. 4½ in.,	950 to 1,350	1/4½ "	7. 10d. "
8. 5 in.,	1,300 to 1,750	1/8 "	8. 1/1- "
9. 5½ in.,	1,700 to 2,600	2/- "	9. 1/2- "
COIL HOLDERS. 1/6 each			
10. 1/4 "			
11. 1/6 "			
12. 1/8 "			

The new "Dayzite" Variable Condensers fitted with Aluminium End Plates, and both sets of Vanes adjustable. '001, 7/9 each; '0005, 5/8 each; '0003, 5/1 each; '0002, 4/7 each; Vernier 3/11 each. Postage 6d. each extra.

IF YOU WOULD SECURE IMMUNITY FROM LEAKAGE IN YOUR SET HAVE YOUR PANELS CUT TO YOUR SIZE FROM OUR FAMOUS EBONITE, ORDINARY FINISH, 4/6 PER LB. MATT FINISH, 5/- PER LB. AMERICA EASY ON ONE VALVE.

MAKE NO MISTAKE IN YOUR SELECTION. Do not keep wasting money on crystals of unknown repute. GET A CRYSTAL THAT HAS STOOD THE TEST OF TIME.

DAYZITE REGD.

Sold only boxed with Silver Cat's-whisker, 2s. 6d. each, postage 3d. extra. Makes excellent contact with Zincite for a Perikon Detector.

We had a call from a delighted customer recently who stated he received 2 L.O. at Brussels quite distinctly on a DAYZITE crystal.

Write at once for our new catalogue, post free by mentioning "Popular Wireless."

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Retail Prices	
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Obtainable from all Wireless Dealers or direct from the Patentees and Manufacturers:

Perfect contact—instantaneously—everywhere.

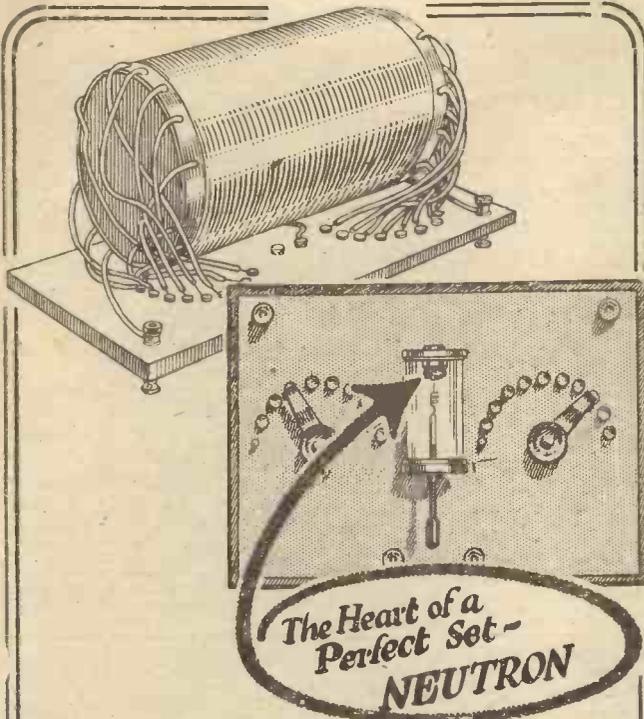
The tapered design of CLIX plugsocket ensures full surface contact in every one of its countless applications.

That's why CLIX, the Electro-Link with 159 Uses, supersedes all forms of Plugs, Terminals and Switches and has standardised the wiring of all radio circuits.

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Radio Engineers and Contractors

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The one great essential to perfect Crystal or Crystal-valve reception is a really efficient Crystal. A good aerial, heavy-gauge inductances, low capacity, good phones—all these help, but *the one vital point is your Crystal*. And the finest Crystal in the world—Neutron—costs you but 1s. 6d.

An indoor Aerial with Neutron equals an outdoor one with ordinary crystals. Neutron will even compensate for poor phones or inefficient coils; but be sure you get Neutron, in the black and yellow tin—the guaranteed and concert-tested wonder crystal.



The World's Greatest Radio Crystal
—Concert Tested and Guaranteed

FIVE PAIRS OF PHONES.

"I have tried this Crystal and now I should like to say I am quite satisfied with it. It might interest you to know it is at present in use on an ordinary crystal set and works with good strength five pairs of phones." G.H.S., S.W. 1.

Sole Distributors: V. Zeitlin & Sons, 144, Theobalds Road, London, W.C.1. Phones—Museum 3795 and 6841.

Long-distance Circuit Diagram FREE.

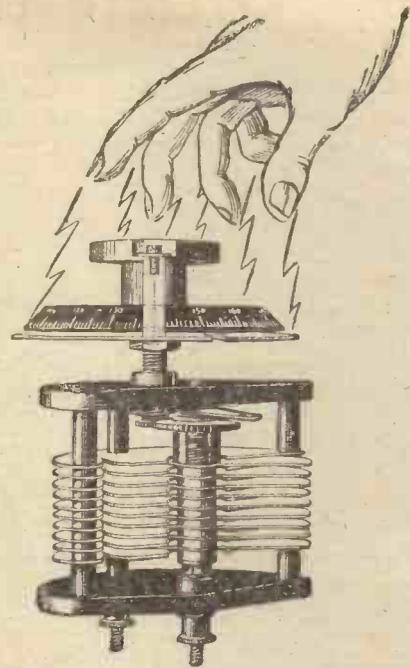
Ask your Dealer for Free Diagram (given on request to every purchaser of a Neutron) of the circuit used by 5 B T in receiving Brussels from Chiswick on a Neutron. We send one direct with sample Neutron if you enclose stamped envelope and 1/6 with Dealer's name.



Stocked by the Best Radio Dealers. Packed in tin with silver cats-whisker. Insist on Neutron, in the Black and Yellow Tin



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Protected throughout the World.

PRICES { .001..13/6 .0003..10/3
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J. H. NAYLOR, LTD., WIGAN.



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All these Goods sent by Post. Foreign Packing and Post extra. Orders in Rotation.

POST FREE COLUMN RAYMOND VARIABLE CONDENSERS HIGH QUALITY. NEW PRICES.

SORBO RUBBER EARCAPS .. pair	1/8
2-WAY EBONITE COIL STANDS ..	3/6
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"KENITE" RADIO PANEL 8 x 6 ..	1/6
" " " " 9 x 6 ..	1/9
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" " " " 12 x 9 ..	2/8
(Above fine value, easily worked.)	
D.C.C. COIL, 1,600 metres Chelmsford ..	2/3
72 in. PHONE CORDS, best qua. ..	2/3
DIAMOND WEAVE (5) COILS, AIR SPACED ..	3/6
(equal 25, 35, 50, 75, 100 honeycomb.)	
GOSWELL INSULATED VALVE LEGS, Set ..	1/3
BRUNET SHROUDED L.F. TRANSFORMER ..	13/6
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DITTO, 2 mfd. 4/3 25 mfd. ..	3/6
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RAYMOND FIXED CONDENSERS, .01 .02 ..	1/9
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EBONITE PANELS, 6 x 6 and 7 x 5, each ..	1/8
8 x 6 and 9 x 6 .. 2/6 10 x 8 ..	3/6
12 x 9 .. 5/- 12 x 12 ..	6/-
(Stock Sizes.)	
NEUTRON CRYSTAL SETS ..	10/6 15/-
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SET OF 7 TWIST DRILLS ..	2/-
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McMICHAEL'S BARREL H.F. TRANSFORMERS -	
300/600 ..	10/-
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Other sizes stocked.	
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AS SHOWN, WITH DIAL, KNOB AND BUSH.

.001 ..	6/11
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.0003 ..	5/-
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POST 6d. SET. UNSURPASSED FOR FINE TUNING.

NEW MODEL

With Knob and dial.

WITH VERNIER.	
.001 ..	8/9
.0005 ..	6/11
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With EBONITE DIAL and Two Knobs. Post 6d. Set.



No. 3 CONDENSER

WITH KNOB. POST 6d. SET.

.001 ..	6/11
.0005 ..	4/11
.0003 ..	4/6

18, Gosford Road, Beccles, Suffolk 17th October, 1924.

I received the "Square Law" Condensers, and I tried them in my "reflex" (single valve), and the results were so remarkable that I have given up all thoughts of building a 3 valve which I had ordered them for. Thanking you for your prompt attention, I shall be pleased to recommend you to my friends. (Signed) P. BULTON.

NEW MODEL SQUARE LAW

With Vernier. With Knob and Dial.

Aluminium Ends. Ebonite Ends.	
.0003 8/6 - - 10/-	
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Post 6d. Set.

TWIN CONDENSER SQUARE LAW

EBONITE ENDS

.00025 ..	12/6
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TWIN (Ordinary) Equal units of .00025 or .0003 9/- Complete with Knob and Dial. Post 6d. Set.

LONDON'S LARGEST Stockist of JACKSON BROS. "J.B." Variable Condensers, Complete with Knob and Dial.

SQUARE LAW STANDARD

.01 ..	9/6	.001 ..	8/6
.0005 ..	8/-	.0005 ..	7/-
.0003 ..	6/9	.0003 ..	5/9
.0002 ..	5/6	.0002 ..	5/-

Other sizes as advertised by "J.B." Post 4d.



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Patent Valve Holder	1/6
Goswell 2-way Vernier Coil Holder	9/-
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Goswell 3-way Cam Vernier	12/6

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Variable Grid Leak	2/6
Anode Resistance	2/6
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Series Parallel	3/8
T1 Transformers	30/-
T2, 25/-; T3, 16/6	
Coils - 25, 4/10, 30, 35, 40 4/10, 50 5/-, 60 5/4, 75 5/4, 100 6/9.	
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.001, .002, .003, .004, .005, .006, Fixed	3/-	
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Type 577, .01	7/6	
Grid Leaks, each	2/6	
Anode Resistance	50,000, 70,000, 80,000, 100,000, on stand complete	5/6

ALL VALVES ON POST SENT AT PURCHASER'S RISK.

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THORPE K4 (5-pin) 17/6	
PHILLIPS 4 ELEC-TRODE	12/6
(Both for UNIDYNE.)	

BRIGHT EMITTER 12/6 each

B.T.H.	R. Type
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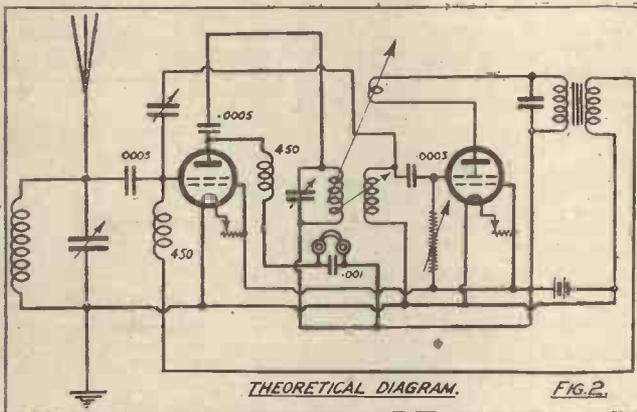
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RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 1214.)

D. C. (Glasgow), O. L. A. (London, W.), and several others ask us to reproduce the theoretical diagram which should have accompanied Mr. Marcus's article on a Unidyne Neurodyne Reflex circuit in "P.W." No. 135.

The diagram is appended. It will be noted that no values are given for the aerial, anode, or Neurodyne condensers. These should be of .0005, .0003,



and .00001 mfd. respectively. Special condensers for Neurodyne purposes are now being manufactured. The ordinary "vernier" is not suitable unless its plates are very considerably reduced in size.

J. H. R. (Sheerness).—In "Radiatorial" of "P. W." 134 (December 20th), the description of the wiring of the three-valve reflex set—in reply to "Three-Valve-Reflex" (Twickenham)—does not appear to agree with the original description. When Captain Twelve-trees described the connections in "P.W." 94 (March 15th), he stated: "The O.P. terminals of both transformers are now joined direct; from H.T. terminal a lead is taken direct to I.P. of No. 2 transformer," etc. Was the first description right? In my own case the results obtained by altering the transformer connections as per "P.W." 134 are well worth the trouble involved.

The apparent discrepancy is due to the fact that it is not possible to describe the correct connections for I.P. and O.P. (or for I.S. and O.S.) to cover all conditions of working. Every constructor must decide for himself which is the best way round to connect the primary of his L.F. transformer. This applies to every set employing this component, but is especially noticeable in reflex sets.

If the I.P. and O.P. connections have never been reversed it is always advisable to try them in both ways. It often makes little or no difference to the results, but occasionally signals are greatly strengthened, and there is often less distortion after reversal.

"SHORT WAVE" (Hertfordshire).—I am building a Super Heterodyne receiver with six valves, but wish to use this for both ordinary wave-lengths—200-500 metres—and for short waves of 50 upwards. Will this mean that I have to alter all the components, the interval transformers as well as the aerial tuner?

No, as long as the aerial tuner is arranged so that the first detector picks up the required signals, and the oscillator is tuned to heterodyne this incoming energy so that the "beat" produced is of the required frequency—usually corresponding to wave-lengths between 3,000 and 10,000 metres—nothing else need be changed. The interval H.F. transformers remain the same, all you have to alter are the aerial tuning, reaction coil, and oscillator coils, so that the correct heat frequency is produced. Once the Interval H.F. transformers have been set they need not be touched unless something goes wrong with the set or the adjustments are altered by mistake. These transformers have to be tuned fairly accurately, of course, or the signal strength suffers considerably. Needless to mention, perhaps, is the fact that the super heterodyne is usually a very powerful oscillator, and as such should not be used coupled to an outdoor aerial on broadcast wave-lengths during broadcasting. As a matter of fact, the receiver can be a

source of considerable interference to neighbour's sets when it is used on a frame aerial, so you must use the utmost care in handling it.

"NOVICE" (Chadwell Heath).—How can I tell when my set (one-valve) is oscillating? I can get 2 L O very well but cannot tune in other stations, or cut out whistling noises when I turn the condenser knob.

You should first of all move your reaction coil as far apart from the aerial coil as it will go, and tune the condenser until signals are at a maximum. You are now tuned in without reaction, and speech should be perfectly clear but not very strong. To strengthen,

move reaction coil a little towards aerial coil and re-tune slightly if necessary. All controls must be moved slowly and carefully, and the adjustments noted when the signals begin to strengthen.

If you move reaction too near to aerial coil you will oscillate, and interfere with all listeners in your area, so great care is necessary.

To tell when the set is on the edge of oscillation, and to keep it so on the different wave-lengths without actually slipping over into oscillation, is the whole art of tuning, and requires some practice and great care. At first, therefore, you should not attempt this during broadcasting hours. Tune into the higher wave-lengths, and listen to shipping, or to G.N.E., or about 600 metres, and notice the effect of reaction upon signals from spark stations. Some of these have high musical notes (like a flute), and you will find this can be greatly strengthened up to a point without altering its tone. As soon as reaction is pushed too far the note becomes hoarse and raucous, sounding, in fact, like a totally different station, until reaction is loosened again. Notice carefully how this change is accompanied by a soft, rushing sound as the valve commences to oscillate, or by a kind of click or pop in the 'phones.

Try the effect of tapping a moistened finger on the aerial terminal of the set when it is nearing oscillation point, and notice how loud and sharp the clicks grow suddenly when too much reaction is used.

The whole operation must be carried out very carefully, as every time the set oscillates it becomes a small transmitter, sending out a carrier wave which can cause interference.

You would do well to write to the B.B.C., 2, Savoy Hill, W.C.2, asking for their leaflet, "Anti-Oscillation," which will be forwarded free of charge. Copies may also be obtained from the nearest Radio Society, by joining which you could probably get practical lessons in handling sets, which are naturally of greater value than a mere description.

You will find in general that too much reaction invariably spoils your own reception (by distorting speech, etc.), as well as causing interference to all neighbours, so there is absolutely no advantage in keeping the coils too closely coupled or the filament and H.T. voltage too high.

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Telefunken Adjustable 'Phones	1	1	0
Radio Micro Valve '06		12	6
F.T.H. Valve '06		18	6
Phillips' Valve (No more to be had after this delivery.)		8	6
Dr. Nesper Loud Speaker	1	5	0
Ultra Loud Speaker	1	7	6
Cuckoo Loud Speaker	1	17	6
Electric Soldering Iron All Voltages (guaranteed one year.)	1	0	0
F.A.R. Transformer (French)		15	0
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Raestat Filament Resistance (for D. E. or Bright Valve)		2	6
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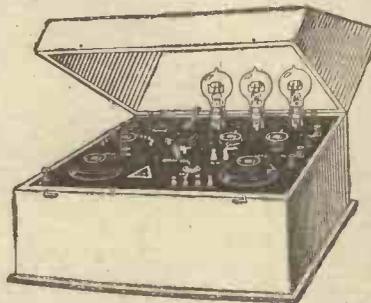
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" 28	"	7	5	0	10	17	6
" 28	"	9	15	0	15	0	0
" 30	"	9	7	6	15	0	0

*No. 28 has double circuit aerial tuning with 3 coil holder. All above sets subject 12/6 per Valve Marconi Royalty.

RADIAX LIMITED

10, RADIO HOUSE, PERCY STREET, TOTTENHAM COURT RD., LONDON, W.1.

3 minutes Tottenham Court Road and Goodge Street Tube Stations.



Barclays 596



THERE IS MORE IN IT THAN MEETS THE EYE

If you could see the filament of the average dull-emitter under a powerful microscope you would perhaps be surprised to find that the all-important thorium "coating" takes the form of a deposit of globules. The filament is not covered.

An examination of a "Six Sixty" filament would, however, reveal to you a very different state of affairs. The filament is manufactured from Molybdenum, a metal which takes a complete thorium coat. That is one of the secrets of the "Six Sixty."

It ensures a much greater electron emission which gives volume approximately 50% greater than a standard bright-emitter and, bear in mind, that with the "Six Sixty" an accumulator charge lasts over 10 times as long.

If you cannot get the "Six Sixty" at your dealers write direct to us.



Elecron Co. TRIUMPH HOUSE, 189 REGENT ST. LONDON W.1. Telephone Regent 5336

MICROMETER FILAMENT DIMMER

0.5 ohms 3/6
0.10 ohms 3/9

PATENTS APPLIED FOR

SPARE 0.5 ohms 1/- 0.10 ohms 7/6

CARTRIDGES
0.20 ohms 7/6 0.30 ohms 7/6

It's the Cartridge that counts

LOOK!

YOU MUST HAVE THESE IF YOU WANT THE BEST FROM YOUR SET.

BARRIES' LOW CAPACITY VALVE HOLDER, 1/3 each

"P.W." says, 15/11/24: "It is entirely original, highly successful, and in all cases constant. Enterprise people have introduced a really good Grid Leak. We have tested these ingenious Enterprise products and can certainly recommend their use for Untidy and ordinary circuits."

If your Dealer cannot supply, mention his name and address, when we will send POST FREE

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MH CRYSTAL

A high-grade crystal of Special Selectivity contained in dust tight metal box with glass top. A well-made non-corrosive spear-point cat's-whisker is included in each box.

It is so sensitive that a blind man can use it.

L.M. MICHAEL LTD
IN CONJUNCTION WITH B. HESKETH LTD
RADIO CORNER, 179 STRAND, LONDON W.C.2.

PRICE in Box 1/6

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CABINETS for Wireless CONSTRUCTORS

PICKETT'S
HIGH POLISHED
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from 1/6 each
They're good Value

Send for constructors list free
PICKETT'S CABINET WORKS
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HEADPHONE REPAIRS

Rewound, re-magnetised and readjusted. Lowest prices quoted on receipt of telephones. Delivery three days.—**THE VARLEY MAGNET CO., London, S.E.18.** Phone 888-9 Woodwich. Est. 26 years.

GUARANTEED 'PHONES.

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Genuine Telefunken (the World's best)	17/-
Dr. Nesper's (adjustable)	12/6
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Post Free.
Price List of other brands on application.
We save you money on all 'Phones.

RUST & CO., Reavill's Yard, Foreman Street, NOTTINGHAM.

Paris and other Stations

Clearly heard on Loud Speaker near London using the "MIRACLE" MASTER 2-Valve Set. £3-12-6, plus Royalties. 1, 2, 3, and 4 Valves. Trade supplied. Send Stamp for particulars.
World's Wireless Stores, Wallington.

AMERICA ON 12/6 '07's

TESTIMONY Nom de plume, Salisbury.
"Using bright emitter valves I had been able to receive America (WGY, KDKA, WBZ, and two or three others) nightly, and was quite willing to pass your Photron S.8, as satisfactory if it would only pick up the carrier waves of these stations. I was extremely pleased to find that if anything there was an increase in signal strength from these stations. I shall most certainly recommend this valve to my friends as the best obtainable, no matter what the price." Unsolicited testimonial, original may be inspected.

Fill volts 2.3, max. con. .07, anode 40-80. Concert tested and sent with instructions for use, post free on 24 HOURS' APPROVAL.

P.W. UNIDYNE D.E.'s, Phillips 4 Electrode Dull Emitter so creditably mentioned in the Nov. 22nd issue of "Popular Wireless," page 714.
Phillips 4 Electrode D.E. 1.8 volt, .16 amp. 25/-
Phillips 4 Electrode Bright Emitter ... 12/6
(See Correspondence Column P.W., Dec. 13th, p. 954)
Thorpe K4 Bright Emitter (5 pin) ... 17/6
Concert tested, post free, 24 hours' approval.
N.B.—We now insure valves against all postal damage at customers' request on extra remittance of 9d. per 12/6 valve, 1/- per 17/6 or 25/- valve, the only condition being notification of damage within 24 hours.

ANELOY PRODUCTS (Dept. P.25), Eton Works, Upland Road, London, E.F.27.

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A LION'S STRENGTH.

The "Lion" Crystal-Valve Combination.
Have you heard of the Wonderful **YELLOW Precious Stone Power Crystal GLLINGHAM** used in conjunction with **TELLURIUM**? The results it gives are truly marvellous. No cat's-whisker, consequently no annoying adjustments. Set in a second; keeps set for months. Supreme for Crystal Sets. Increase volume on reflex circuits. Sent post free. Obtainable only at 2/3 per pair from **S. LYONS, 119, Clerkenwell Road, London, E.C.1.**

Powerful, Pure, Perfect Reception.

THE SKINDERVIKEN MICROPHONE BUTTON

Pat. No. 120,734.

5/- **5/-**

Will enable you to Work a loud speaker off a crystal set. Magnify the sound of your gramophone up to 200 times. Fit up an efficient house telephone. Transmit piano, violin or gramophone music anywhere. Magnify sounds otherwise inaudible, etc. etc.

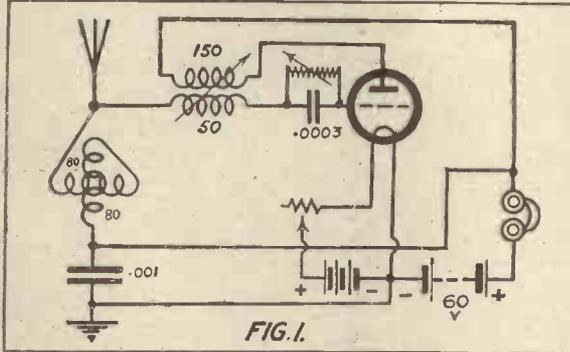
Everyone interested in sound transmission should write to-day for the "Marvels of the Microphone." Price 6d. Post free from Mikro Ltd.

MIKRO Ltd., 32c, Craven St., Charing Cross, W.C.2

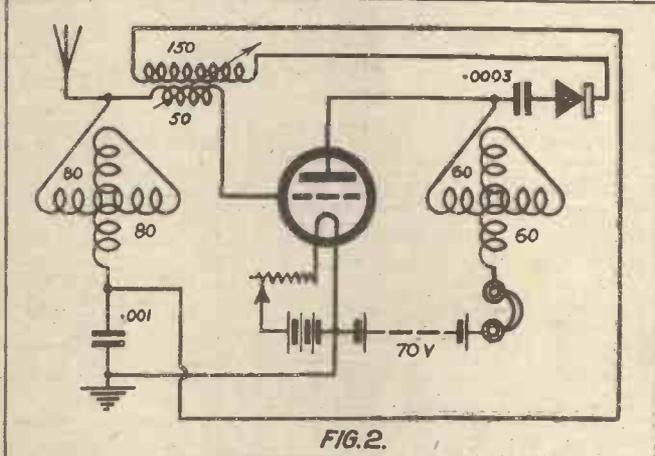
Correspondence

LONG RANGE ONE VALVE RECEPTION.

The Editor, POPULAR WIRELESS.
Dear Sir,—I think the results obtained on receivers built according to the enclosed diagrams will be of interest to you. On an indoor aerial four yards long I receive Aberdeen, Birmingham, and London. Other



English stations have been received but not identified. Aberdeen, about 850 kilometres, is, strange to say, as strong as 2 L.O.
Music is audible three feet from 'phones. I may state that the valve is of German manufacture,



designed somewhat like Myers valve (price 2s. 6d.). Tuning is sharp, tone very pure. I intend to try the sets in short with the aerial of the ribbon type described in POPULAR WIRELESS.
I remain, yours sincerely,
G. THYNELT.

ANOTHER GENEROUS READER.

The Editor, POPULAR WIRELESS.
Dear Sir,—I have in my possession a good number of "P.W.'s," ranging from Volume IV. to Volume VI, the numbers being, 75, 81, 86, 87, 88, 89, 90, 92 to 112, 114, 115, 118 to 132. Having no use for them, and

having seen letters in "P.W." from readers offering other "P.W." readers numbers of this popular paper, anyone desiring these numbers can have same by applying to the address below, when all books will be sent on free of charge.
Yours faithfully,
JOHN CARMICHAEL.

RE SOME INTERESTING ONE-VALVE CIRCUITS.

(Issue of December 16th, 1924.)
The Editor, POPULAR WIRELESS.
Dear Sir,—A few facts concerning the Hopwood Circuit mentioned in above article might be of interest to you.

I made up this circuit from a diagram in an issue of your paper of last February, and I was astonished at the results given by it. Have received every British broadcasting station in England and Scotland (not relays), as well as Belfast. Aerial is about 28 feet high (not screened at all), and 80 feet long, including lead in. Earth wire is 4 feet long, on to waste pipe.
In operating the set I find the results I get depend entirely on the amount of L.T. and H.T. which I put through the valve. After practice, the correct relative value of these two can be found, and on this everything depends for the quiet working of the set, which carelessly handled will howl badly.

Being seventeen miles from 2 L.O. I am fortunate in being able to tune in the other stations while 2 L.O. is "on," but without interference. Recently on a Sunday I got the church services from Glasgow and from Newcastle, both quite distinct and separate, though only a matter of a twist of the condenser of 5°.

Also a French station came through well with instrumental music, and a few minutes afterwards I got a German station with "speech." Am able to get Madri'd without any trouble at all, and the other night I enjoyed the "Messiah" from Belfast direct. It was so easily followed that I was able to detect in one instance where the soloist's rendering was different from that in the score I was using.

My observations on this circuit are that for a one-valve set it wants a lot of beating. I cannot get loud-speaker strength on it with dull-emitter valve, but with 'phones I can get 2 L.O. without aerial or earth, as clear as the ordinary crystal reception at that distance. The set is made up into a mahogany cabinet, and is self-contained, the accumulator (a 5/- Exide) and H.T. battery (60 volts) being accommodated at the side of the panel, the valve being behind but in sight, yet out of harm's way.

Wishing your paper every success.
I am, sir,
Yours faithfully,
"SATIS EST"
Walton-on-Thames.

CURING "MICROPEONIC" TROUBLE.

The Editor, POPULAR WIRELESS.
Dear Sir,—Perhaps the following hint may prove of interest to those of your readers who are troubled with vibration effects in their wireless sets, such as those caused by heavy traffic outside, or even by someone walking over the floor of the room in which the set is installed. I was much troubled in this way myself, until I adopted the following expedient.
One evening, when the trouble seemed worse than usual, and I was wondering what I could do to remedy the nuisance, in a fit of desperation—and inspiration—I rushed to the bathroom, got the rubber sponge, cut it into four pieces, and placed them one under each corner of the base of the cabinet. I was immediately rewarded with perfect peace from annoyance for the rest of the evening. Of course, I got into trouble from "Blossom" for my act of vandalism, but it was nothing compared with the other trouble!

I have since glued the four pieces of sponge on to a piece of stiff cardboard, the same size as the base of the cabinet. The device forms a perfect shock-absorber or anti-vibration cushion, and is well worth the small sacrifice entailed.
To those of your readers who are troubled as I was, my advice is—**TRY IT!**
Yours truly,
A. J. WOOD.

41, Nicolas Road, Chorlton-cum-Hardy, Manchester.

A "P.W." ONE-VALVE REFLEX.

The Editor, POPULAR WIRELESS.
Dear Sir,—You will be interested to know that I made up your one-valve reflex receiver, as shown in (Continued on page 1221.)

CORRESPONDENCE.

(Continued from page 1220.)

No. 131, Vol. VI, which proves most satisfactory. I receive Chelmsford, 18 miles distant, loud-speaker strength. I also receive London and Paris, the latter somewhat faint. The set gives much better results on higher wave-lengths.

Wishing you and your paper every success.

I remain,

Yours faithfully,

EDGAR PERFECT.

Sunny Bank, Sawbridgeworth.

INTERESTING "D X" RESULTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—It may interest you to know that on my home-built two-valve set (straight D. and L.F.), I have received the following stations: 6 B.M., 2 L.O., 5 I.T., 5 N.O., 2 Z.Y., 5 W.A., 5 S.C., 2 B.O., 2 B.E., 5 X.X., 2 D.E., 6 L.V., 5 P.Y., 5 N.G., 6 F.L., 6 S.T., 6 K.H., Radio Paris (S.F.B.), Ecole Sup. (P.T.T.), "Le Petit Parisien," Leipzig, Frankfurt-on-Maine, Hamburg, Munich, Munster, Brussels (S.B.R.), Amsterdam, Madrid (R.D.), Zurich (Höngg). All the above were "roped" in on a standard P.M.G. aerial, only 16 feet high.

Wishing "P.W." all the best.

Yours faithfully,

ERNEST W. SONES.

Westergate Street, Aldingbourne, Sussex.

"ALL B.B.C. 'SMALL FRY' TO UNIDYNE."

The Editor, POPULAR WIRELESS.

Dear Sir,—Of late I have, and am still, having some remarkable successes with the famous one-valve Unidyne. The Thorpe K4 seems to have become ultra sensitive with age and use. All B.B.C. stations can be considered as "small fry." So can most European stations. American transmissions, I get nightly. W.S.M., when 550 miles away, came in at good 'phone strength recently. The remarkable part of it is I can tune in Madrid, 800 miles away, on the earth wire alone (3 feet long). Music is quite good, but speech a trifle blurred (due to earth currents, I believe). But to get Madrid on one valve, with 3 feet of earth wire, calls for what Mr. Dowding calls "Operation."

Wishing your valuable paper all success.

Yours faithfully,

D. J. JENKINS.

School House, Gellinudd, Pontardawe.

P.S.—The set is as per specification in "P.W.," No. 112.

BROADCASTING FROM A LINER.

The Editor, POPULAR WIRELESS.

Dear Sir,—I wish to report one-valve reception between 01'00 G.M.T. and 02'44 G.M.T. this morning (December 16th), of pianola music transmitted from the grand ballroom of a liner 2,400 miles S.W. of Land's End, on a wave-length close to that of shipping. Jamming was experienced from untuned spark and a harmonic of G.F.A., but at quiet periods the following items were heard clearly: "Hungarian Rhapsody" (Liszt), 01'00 G.M.T.; "American Medley" (One Step), 01'45 G.M.T.; "Rigoletto" Selection, 02'30 G.M.T.

Before closing the announcer, speaking to American listeners, wished them a Happy New Year, and hoped they had been received. He also added that they were due in Southampton on December 21st.

It would be interesting to know the name of the liner in the above transmission.

Yours faithfully,

H. G. NEVILLE.

11, Carden Road, Peckham, S.E.18.
[This was W.S.M., the s.s. Leviathan. Ed.]

THE UNIDYNE NEUTRODYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—Just a line to tell you that I have made up the two-valve Unidyne neutrodyne given in your paper of November 22nd, and am very pleased with results.

I had previously made a D. and L.F. Unidyne set, but the first mentioned is a great improvement, and the best I have heard. I am sending a card to Mr. Marcus, and I must thank you all for such a fine set. I was pleased to see Marconi's apology. I thought of writing to him myself.

Yours faithfully,

A. W. BUTLER.

3, Old Church Yard, Liverpool.

B.B.C. AND THE THEATRES.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have read, with much consternation, the views of Sir Oswald Stoll, in an article by "Ariel" in your splendid paper.

Has Sir Oswald realised that the other is the B.B.C.'s theatre?

I wonder what Sir Oswald would say if it were possible for another company to erect a stage in the Coliseum, and start a rival production at the other end of the theatre?

The B.B.C. must have the monopoly of the ether, as a company has of a theatre, so as to ensure a good organisation.

Yours faithfully,

W. I. LONG.

Longlands, Carlton, Newmarket.



No. 3 of a Series.

The Living Artistes

THERE is no greater test for a Transformer than a Loud Speaker reproduction of a Symphony Concert. Delicate arias and impressive crescendos mean a wide range in amplification values that will readily discover any integral weakness of design.

For a Transformer to be capable of amplifying all frequencies equally—from the shrill notes of the piccolo to the boom of the double bass—necessitates the application of scientific laws. The Eureka Concert Grand, owing to its exclusive design, does amplify all audible frequencies equally; that is why in reproduction of a Symphony Concert you will not hear the

violins stressed to the exclusion of the flute or the oboe.

In fact, when the Concert Grand is used in conjunction with a good Loud Speaker each instrument can be readily picked out and identified. How very few L.F. Transformers will permit this being done.

Music lovers throughout the country have been quick to recognise that the Eureka has set an entirely new standard of tone perfection.

Concert Grand 30/-

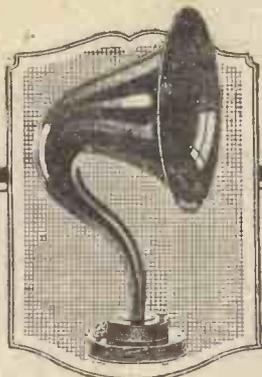
Portable Utilities Co., Ltd.,
Fisher Street, London, W.C.1.

Eureka 22/6
No. 2.
(For Second Stage.)

Supreme **EUREKA** for Tone

TECHNICAL NOTES.

(Continued from page 1193.)



Experientia docet!

THE very first Loud **L** Speaker ever built for wireless use in this country was a creation of S. G. Brown Ltd. Indeed the very term "Loud Speaker" was actually originated by them to describe this entirely new Instrument. Its name on any Loud Speaker is visible evidence that it has been built by master craftsmen—that it definitely conforms to the highest scientific standards of sound reproduction—and that irrespective of purchase price its tone is perfectly lifelike and natural.

See it at your dealer's to-day—examine its superior workmanship—but, above all, hear it on actual demonstration.

Prices

H1. 21 inches high.

120 ohms £5 : 5 : 0

2000 ohms £5 : 8 : 0

4000 ohms £5 : 10 : 0

H2. 12 inches high.

120 ohms £2 : 5 : 0

2000 ohms £2 : 8 : 0

4000 ohms £2 : 10 : 0

Q. The de-luxe model

£15 : 15 : 0 in all resistance

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19 MORTIMER STREET, W.1
15 MOORFIELDS, LIVERPOOL
87 HIGH ST., SOUTHAMPTON



Gilbert Ad. 2071.

connected in parallel across the secondary coil of the tuner. This will considerably increase the selectivity of the circuit and will thereby help to cut out local ship stations.

Another Method.

"Another good method of eliminating spark interference is to arrange an H.F. amplifying valve in the circuit, and the coupling between this valve and the detector valve should preferably be of the tuned-anode type.

"Spark interference can also be cured, to a certain extent, by re-arranging the earthing system of the receiving apparatus and by trying other means of earthing the set.

"Residents in coast towns will often find that it is only after a considerable amount of experimenting with various circuits, on the lines suggested above, that the trouble may eventually be overcome."

The Heaviside Layer.

A good deal of speculation surrounds the "Heaviside layer," the conducting region, which is supposed to exist in the atmosphere

NEXT WEEK.

Another Free Supplement "NINETEEN PICTORIAL CIRCUITS."

This useful inset will be given away with every copy of "Popular Wireless," on sale next Thursday. These nineteen circuits will prove of value to every amateur, and have been specially drawn in pictorial form.

Order Your Copy Now.

at a height of a few miles above the surface of the earth, and which is thought by some to account for the bending of wireless waves round the curvature of the earth. Experiments have been conducted in France by General Ferrie, using short waves—45 metres—and the results seem to support the belief in the Layer.

According to "Popular Radio" (N.Y.), "it is found that observations of the signal strength of the fundamental and the first harmonic at different distances from the transmitting station are most easily interpreted on the hypothesis that the waves have been reflected downwards from the supposed conducting layer." In reporting the results, Commander Mesny, of Gen. Ferrie's staff, says: "The results are well explained by the hypothesis of a reflecting action in the high atmosphere. This action, very intense at night, is not negligible by day. But the existence of a conducting layer is not yet absolutely proved." Further tests are in progress. Further information on this subject may be found in "The Very Short Waves," Pt. 2, by René Mesny.

(Continued on page 1123.)



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CARRINGTON MANUFACTURING CO., LTD.
18-20, Norman's Buildings, St. Luke's, E.C.1.
Telephone: Clerkenwell 6903.

CABINETS POLISHED. Sloping.

12 x 12, 12/- each. 12 x 9, 10/- each. Postage, 1/-
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W. JOHNSON, Elsdale Works, Elsdale Street, Hackney, London, E.9.

TELEPHONES RE-WOUND

to 4,000 ohms. Guaranteed. All makes 5/-
except Brown "A" 6/-, and Sullivan, Wax
filled, 10/- per pair. Ex-army converted to
high resistance, 2/6 each ear-piece. Re-mag-
netising 9d per ear-piece. Postage extra
6d. per pair.
W. JOHN MILLER, 68, Farringdon St. E.C.4
2nd and 3rd floor. Phone: Central 1950.

PANELITE.

Will stand 5,000 volts, will not fracture. 9" x 6" x 3/8",
1/6; 10" x 9", 2/2; 12 x 10, 2/9; 14 x 12, 4/6 Post paid.
RADIO PANEL CO. (Dept. P), 143, Fetter Lane, E.C.4.

3-VALVE SET in handsome polished sloping cabinet, work loud speaker, receive all B.B.C. Stations, Continent, America, etc. All accessories included, Valves, Accumulator, H.T. Battery, Lead-in Wire, Aerial Wire, Insulators, Headphones. This set is in perfectly new condition and guaranteed to give absolute satisfaction. A genuine bargain, **£8 15s.** Seen and demonstrated any time.—**BURROUGHS, McDermott Road, Peckham, London, S.E.15.**

A REAL ECONOMY. Radio-Micro '06 Dull Emitter VALVES. Perfect for H.F. Det., & L.F. Can be run off dry cells. Uses only 1/10th current of Bright Valves. **OUR PRICE, 12/6 EACH.** Packing & Postage, 6d. Trade Supplied. **Yeo Bros., Paul & Co., Ltd., 43, Caroline St., Cardiff.** Also 134, Victoria Street, Bristol; 200, Dock Street, Newport, Mon.

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**Peto-Scott's
Catalogue** 2087

TECHNICAL NOTES.

(Continued from page 1222.)

Strength of Signals.

Some very interesting experiments on the intensity of sounds, as interpreted by the ear, are reported in the "Physical Review" (Sept., 1924) by Dr. Harvey Fletcher. One point of importance in wireless, is that the ear itself, contrary to popular impression, is not a perfect acoustical instrument, and if the amplitude of the sound waves exceeds a certain limit, the ear actually begins to introduce distortion. This should be remembered in connection with loud speaker reproduction.

Another interesting point, although this has been known for some time, is that the apparent intensity of a sound depends, other things being equal, upon its pitch. Thus, if two sounds are of equal amplitude and different pitch, the one higher in pitch will seem the louder. This is to be expected from ordinary energy considerations.

Loud Speakers.

In this connection it should be remembered that, although at times we are inclined to think that no loud speaker was ever near perfection, the present-day developments in loud speaker design and construction are (at any rate, to my mind) very wonderful, considering the enormous difficulties that have had to be overcome. I myself have been very closely associated with acoustical research work for some years, both during and since the War, and I venture to say that no-one who has not had similar experience can fully appreciate the difficulties that are encountered in making a really faithful reproduction of the human voice. I mention this, not in any way with a view to apologising for present-day loud speakers—which, as I have said, I think are very good—but in order that we may perhaps appreciate them a little more when we hear in mind the immense amount of work which has been necessary to bring them to their present state.

Listening-in to Electrons.

To the many wonderful experiments carried out by the physicists of the General Electric Co. of America has now been added an investigation of the value of the electronic charge by a novel method which has been popularly described as "listening-in to the electron." An arrangement of valve amplifiers is used, by means of which it is estimated that a sound-magnification of close upon a million is obtained.

According to "Radio Digest," "the roar of iron atoms as they are attracted by a magnet is plainly heard by the use of a special device used in connection with a vacuum-tube amplifier and a wireless loud speaker. The special device carries out the idea of a German scientist, Dr. Barkhausen, of Dresden.

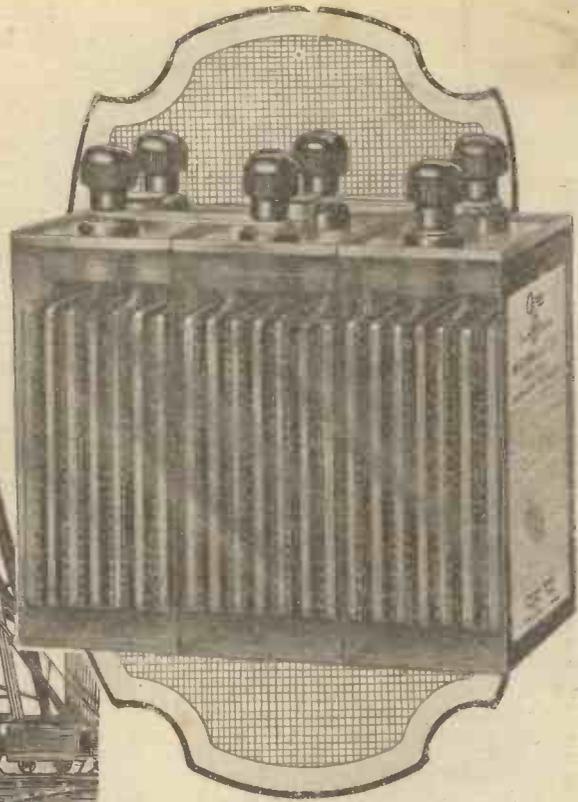
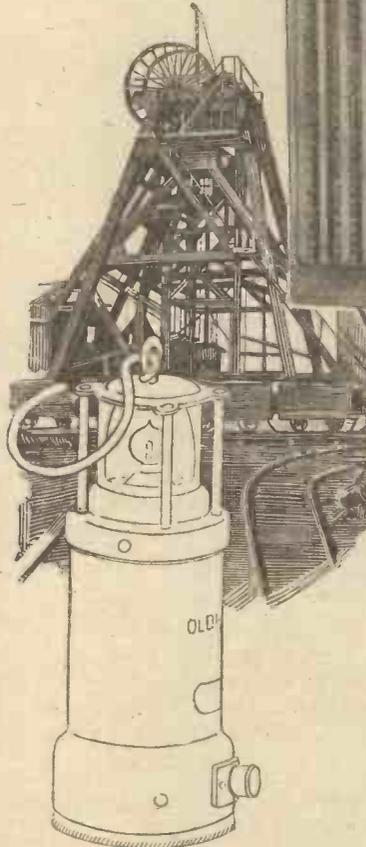
"A piece of soft-iron is inserted in a coil of 17,000 turns of wire, which is connected to the amplifying system. As the soft-iron atoms turn about in accordance with the polarity of a magnet close by, the roaring sound is produced in the loud speaker or headphones attached to the amplifying system."

The preceding description, although expressed in rather more than "popular"

(Continued on page 1224.)

Dull Emitter Valve Users!

A dry battery gives a fluctuating output and is a constant expense. Use an Oldham Portable and non-spillable Accumulator. 2 volts, 10 amp. hours (actual). From all Dealers **12/6**



Reliability
—the biggest factor in any accumulator

IT is perfectly true that you cannot tell how much your Accumulator has cost you until it is worn out. And how long it lasts depends on how well it has been made and how well it is treated.

If it is an Oldham you may know that it has been made under the same conditions and from the identical materials as the accumulator used in the famous Oldham Miner's Lamp. Obviously, reliability in an Oldham is more than a catch phrase. An Oldham Accumulator will outlast two ordinary accumulators—and its initial cost will be little, if any, more.

It is a real economy, therefore, to choose an Oldham and get an accumulator fitted with plates made under the special activation process. Such a purchase is a positive insurance against failure of filament current.

Your own Wireless Dealer stocks them, and will supply one ready charged.

Type C.L. Accumulators
(illustrated above).

	£	s.	d.
2 v., 10 amp. hrs. continuous	3	8	9
4 " 10 " " " "	17	6	
6 " 10 " " " "	1	6	3
2 " 20 " " " "	11	1	
4 " 20 " " " "	1	2	2
6 " 20 " " " "	1	13	3
2 " 40 " " " "	16	1	
4 " 40 " " " "	1	12	2
6 " 40 " " " "	2	8	3

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H.T.—L.T. BATTERIES.



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219/220 SHAFESBURY AVENUE W.C.2
FOR EVERY PURPOSE.

STEEL MASTS.

Catalogue "B" on request.
HAMILTON MAY, Weybridge, Surrey.

INCREASE YOUR SIGNAL STRENGTH ON YOUR CRYSTAL SET

It doesn't matter how many phones you are using, they will ALL be as strong as if they were in use alone if they are fitted

WITH "EXTRAPHONES."

"Extraphones" are wonder-attachments which fit any phone without alteration. Phones of any resistance may be used with the same effect

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TECHNICAL NOTES.

(Continued from page 1223.)

language, will give the reader an idea of the general nature of the investigations, and the principles upon which they are based.

Electronic Charge.

It will be remembered that probably the most accurate determination ever made of the value of the electronic charge was that of Prof. Millikan, and it is interesting to note that the determination which has now been carried out by Dr. Hull and Dr. Williams, who are the scientists responsible for the experimental work referred to at the General Electric Co.'s research laboratory at Schenectady, gives a value for "e" which agrees to within one-half of 1 per cent. with that obtained by Millikan.

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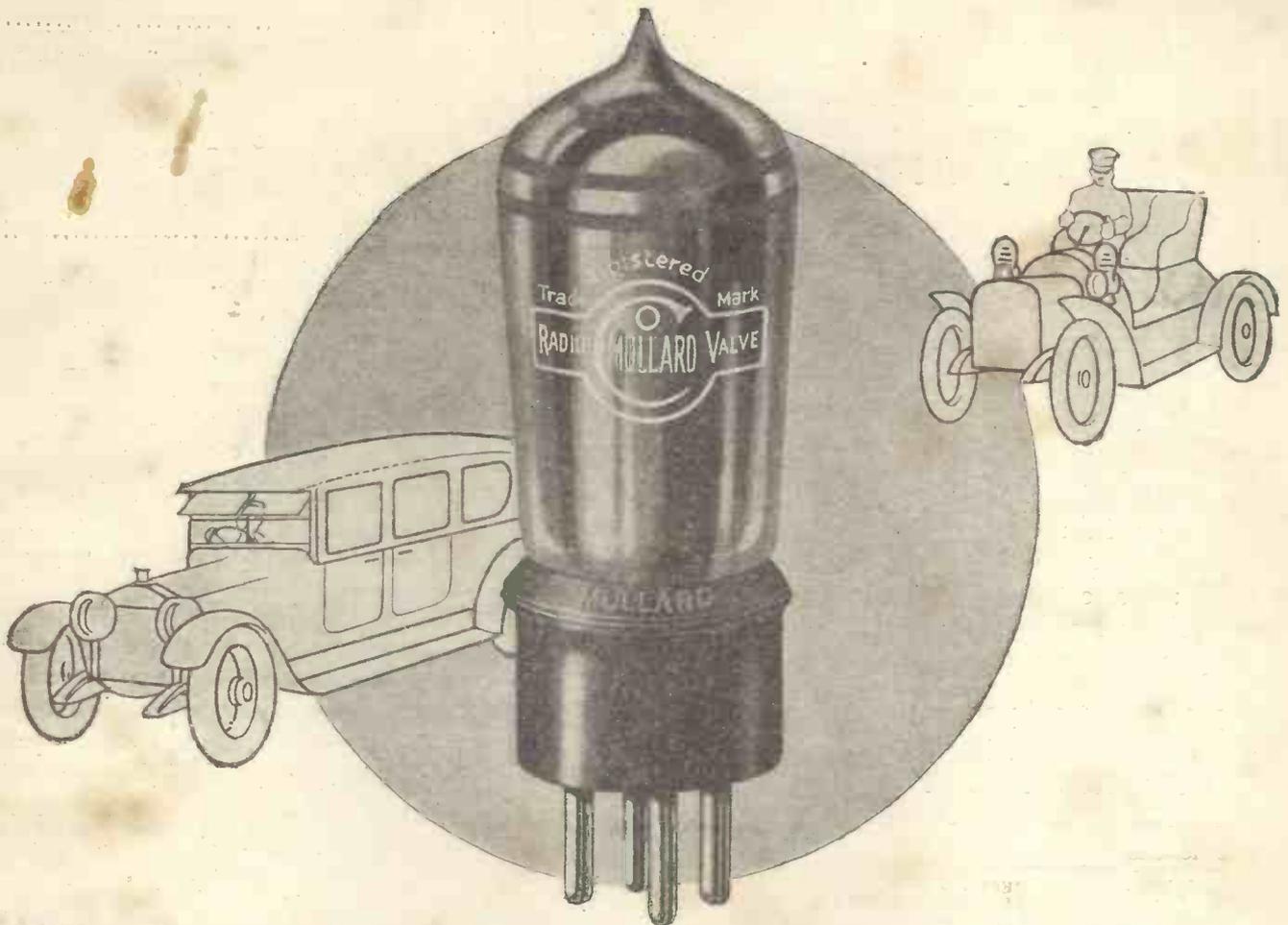
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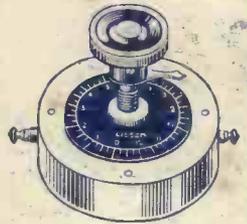
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"How to Make" Articles:

HOW TO CONSTRUCT A THREE-VALVE RECEIVER.

THE FOUR-VALVE "EXPANDING" SET. (PART 2)

America Calling.

All About the "Ultra" Coil.

"Doctor Radio."

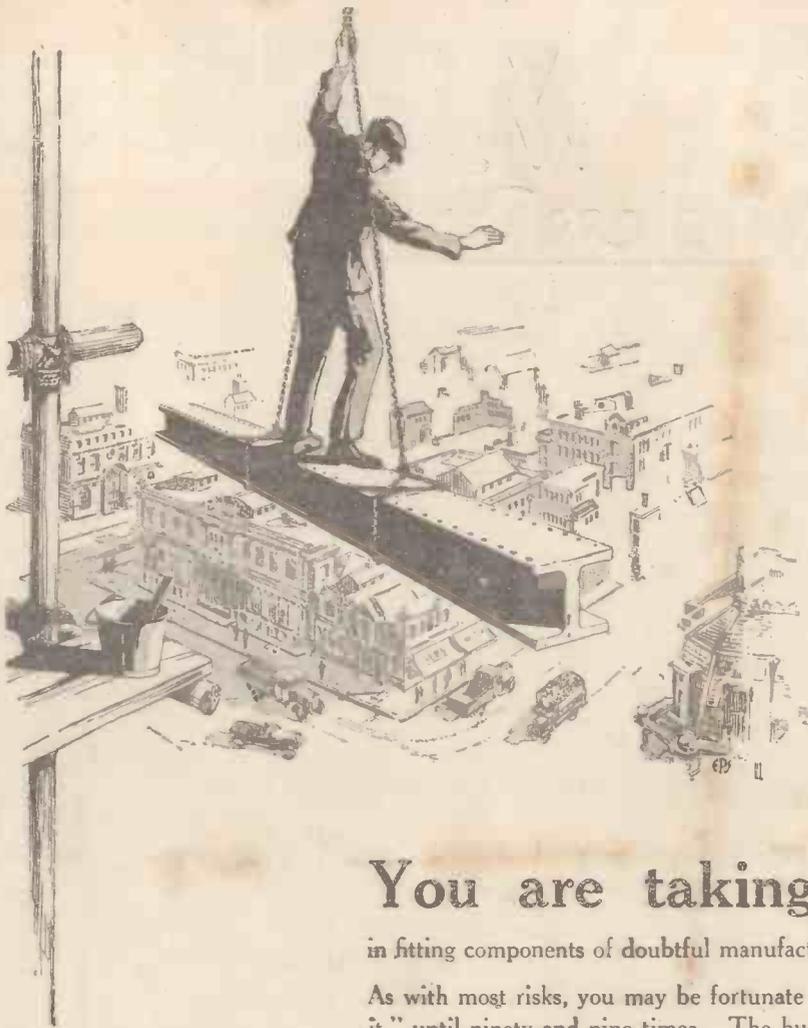
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The New 110-Volt Valve.

A Wireless Torpedo.

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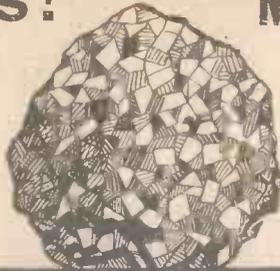
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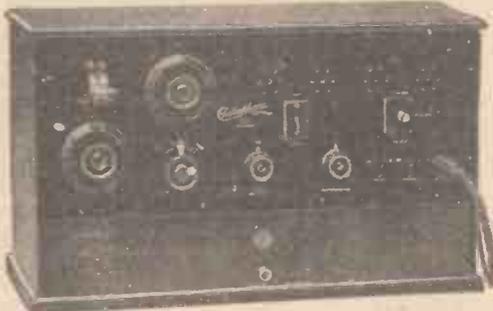
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M.Inst.R.E., F.R.S.A., F.R.G.S.

Technical Editor:
G. V. DOWDING, Grad.I.E.E.

RADIO NOTES AND NEWS OF THE WEEK.

Progress in Germany.

THE new German station at Cassel commenced operations on January 10th, and will work upon a wave-length of 292 metres, relaying the Frankfurt programmes. Since Hanover, Bremen, and Nuremberg made their appearance (on 296, 330, and 340 metres respectively), the main German stations have had to rearrange their wave-lengths, but in most instances the change has been only 3 or 4 metres.

Wave-length Revision.

THE new wave-lengths of the main German stations have been allotted as follows: Hamburg, 395 metres; Munster, 410; Breslau, 418; Stuttgart, 443; Leipzig, 454; Königsberg, 463; Frankfort-on-the-Main, 470; Munich, 485; and Berlin, 505 metres. In addition Königswusterhausen generally works on 2,800 metres on Sunday mornings at 1 p.m.

The Pope's Radio Receiver.

CARDINAL GASPARRI, on behalf of His Holiness the Pope, has expressed great appreciation of the gift of a special broadcast receiver, presented by the Marconi Co. The apparatus, which will tune-in to the principal capitals of Europe, has been placed in one of the drawing-rooms of the Vatican, where it will be used during diplomatic receptions.

Radio Directory Additions.

SINCE the publication of our Free Book, "The Amateurs' Radio Directory" one or two extra call signs have been brought to our notice, as follows:

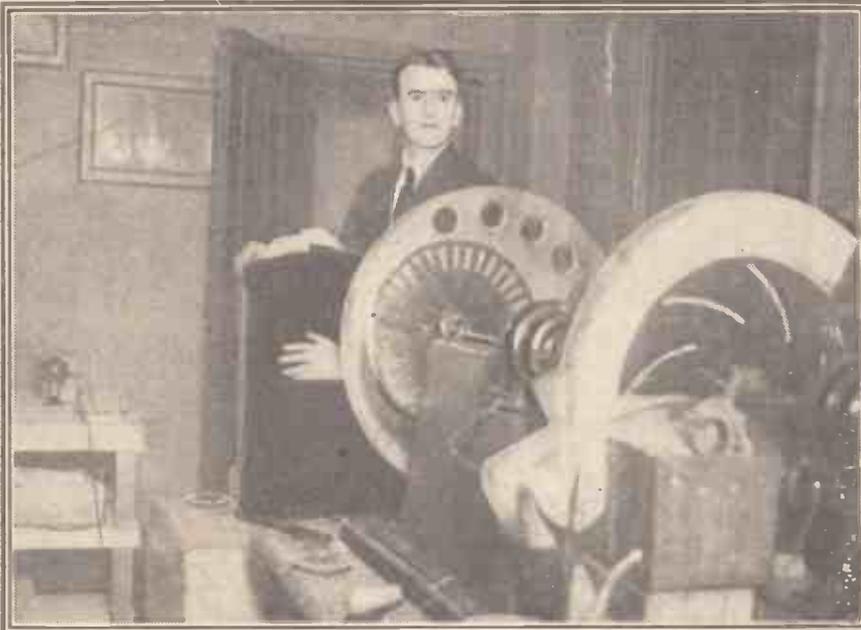
2 R I.—R. Pecorini.
2 A B R.—A Smith, 48, High Street, Yiewsley, Middlesex.
2 J B.—J. C. Bird, 72, Dyne Road, Brondesbury.

- 2 A O X.**—H. Hardy, 68, Langton Road, Wavertree, Liverpool.
- 2 A N G.**—R. W. Anderson, "Fairhaven," West St., Scarborough.
- 2 A M V.**—A. G. Priestman, 27, Pearson St., Carter's Green, W. Bromwich, Staffs.
- 2 A S V.**—A. H. Mallinson, 59, Talbot Road, Highgate, N.6.

opening of the station there in October, 1923, it has been the practice at 6 B M to keep the microphone in circuit during the whole of the evening programme.

The Inevitable Aerial.

A CORRESPONDENT who was at Ailsa Craig last year, tells me that he was surprised to see there a long single-wire aerial fastened to the rocky face of the cliff, the other end being fixed to the chimney of a small cottage. So if the B. B. C. decide to broadcast the cries of wild birds from there, they will find that even on that isolated rock the inevitable aerial is to be found.



Mr. Baird, a young inventor, whose experiments in connection with radio television are worth watching. Mr. Baird is seen above with some of his apparatus.

Correction—Hull Relay should read 6 K H instead of 2 H U. Wanted particulars of 6 H C, 6 G H, 5 L N, and 2 T K.

5 W R.

THE secretary of the Belvedere, Erith, and District Radio Society has asked me to make the following announcement: "If all transmitters that have worked with 5 W R would please refrain from calling up that station, or corresponding with the late Mr. C. E. Morriss, his parents would be grateful."

The "Open" Microphone.

THE experiment of leaving the microphone switch "open" during halts in the programmes, which has recently been tried at several stations, is nothing new to Bournemouth listeners. Ever since the

Record Breaking Audience.

A STORM of criticism has broken out among actor-managers, actors, and theatrical producers as a result of the free concerts recently given by two famous New York singers to an audience of 8,000,000 listeners. Madame Lucrezia Bori, prima donna at the Metropolitan Opera House, and Mr. John McCormack, were the singers, and for the first time in history the leading newspapers featured notices by their critics of a radio concert, and gave as much prominence to it as though the microphone had been the foot-lights. The performance may well herald the beginning of a new era, when operatic singers will sing to vast and invisible audiences, but the question of how the singers will be paid has yet to be solved, unless America follows the British precedent of a tax on listeners.

Was it a "Short Circuit" ?

STEPNEY was a radio desert recently, owing to the fact that four hundred accumulators, belonging to listeners there, were destroyed by a fire which broke out in Carr Street. The outbreak was soon

(Continued on page 1230.)

NOTES AND NEWS.

(Continued from page 1229.)

"contained" by the Fire Brigade, but there were some very "acid" remarks by the local valve set owners.

Jo'burg Received in England.

AN Isleworth amateur—Mr. Jack H. Ross—claims to be the first British amateur in England to receive readable telephony from the Johannesburg broadcasting station. Listening in on a two-valve set (O.-V.-I.) he first heard a band and then the announcement that the Johannesburg Municipal Orchestra had been playing Elgar's "Land of Hope and Glory." After expressing the hope that listeners had enjoyed it, the announcer repeated his statements in Dutch for the benefit of South Africans who spoke that language. Mr. Ross tells me that signals were of quite good strength on 'phones—about R 7.

Correspondent Wanted.

CAPTAIN WEST has forwarded me a letter which was addressed to him at the B.B.C. offices by a young American enthusiast who wants to correspond with a British radio fan. He says he is 15 years of age, in his freshman year in high school, and would be glad to hear from someone of his own "weight." The address is Ralph Crosley, 521, N. McKinley St., Sand Springs, Oklahoma, U.S.A.

5 X X's New Site.

THE site of the new super-station which the B.B.C. is erecting at Daventry stands about 600 ft. above sea level, and the actual ground where the station buildings and masts will stand is three or four hundred feet above the surrounding land, in open country. A T-shaped aerial will be employed, supported on two masts 800 ft. apart, and 500 ft. high. The natural wave length of the aerial will be as near as possible to that of the station, i.e. 1,600 metres, which is the same wave-length that 5 X X now employs.

Wonderful Earthing System.

A WONDERFULLY comprehensive earthing system is being planned at Daventry, consisting of a continuous underground metal plate, having a radius of 100 ft. and shaped like a flat ring. From this ring wires will be taken (at regular intervals) up to posts 10 ft. high, and all the wires will converge at the station, which will stand in the centre of the metal ring. The earthing wires will all terminate on a circular earthing ring at the top of the station, through the centre of which the lead-in will pass to the transmitting apparatus.

The Irish Exhibition.

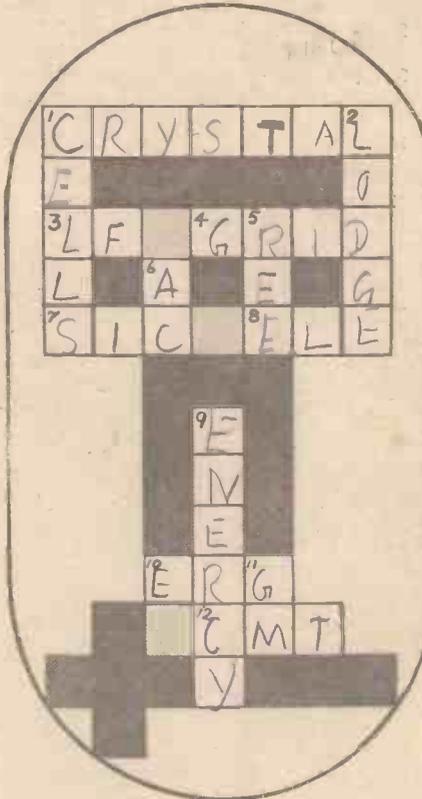
THE first Irish wireless exhibition is to be held in Dublin in February. The fact that a broadcasting service in the Irish Free State is expected to commence shortly has aroused a great and growing interest in the subject. The exhibition will be held in the Antient Concert Rooms, Dublin, and will remain open from February 23rd to February 28th, inclusive.

A "VALVE" CROSS-WORD PUZZLE.
By E. BLAKE, A.M.I.E.E.
For the first correct solution of this puzzle, received by the Editor, a prize of two guineas will be awarded. Closing date for entries Jan. 29th.

CLUES.

ACROSS.

- 1 If you will me correctly fix, I'll shut the door to number Six.
- 3 (Abbr.) Say elephant, and straightway think of me. Where the loud speaker is there I must be.
- 4 One of three elements I be; Look at the puzzle and you look at me. Or turn me backwards, add an E. And then I am sad melody.



- 7 (Abbr.) A ratio. Polyphemus, of the Cyclopes king, Lacked what I have—the self-same thing.
- 8 I am the first three-eighths of the whole, yet there Can be no fractions of that whole.
- 10 Behold me, half of number Nine Who will exist as long as time. In spite of this—now guess me if you can— I exist only by the will of man.
- 12 (Abbr.) The B.B.C. shouts me, The laggard flouts me, The mariner needs me, The horologer heeds me.

Down.

- 1 Most people use us for their valve receivers, We sound like a slang word for "deceivers."

- 2 Alike our pa's in naming us were willed, The man who wrote "The Vicar of Wakefield," The man who forced the kingly Charles to yield, The boy who wished to have his bowl refilled. To Masens has my surname a familiar sound, In a "garden of cucumbers" it may be found.
- 5 Call-letters of a station near the ice, If D displace E they think that colour's nice.
- 6 (Abbr.) Number one (down) cannot use me, And (across) doth sore abuse me. Look at bottom of design, Think what that means—and I am thine.
- 9 In two forms only I exist for ever, Mutable I am, but destroyed never.
- 11 By no means a "wireless" nonentity, I do some great things now and then, I'm a ruler at home, I am world-wide known, These initials reveal my identity.

Beam Stations.

PREPARATIONS are being made for the new British "beam" stations which will act as terminals for the beam services with Australia, India, South Africa, and Canada. I hear that a site for the first one has been provisionally fixed on in the neighbourhood of Dorchester.

6 P Q.

FOLLOWING on the successful Marconi transmission of pictures by wireless, I learn that Mr. Edwards, of Fair Haven, Castle Gresley, Burton-on-Trent (6 P Q), has been granted a licence for experimental work in radio transmission of photographs.

Directly Connected to 2 L O.

PROVIDING all goes well, Daventry should be working in the early summer, and interest in the great new station will to a large extent counteract the comparative slackness of the summer radio trade. I hear that overhead telephone lines will connect the station with 2 L O, and that as a stand-by underground lines will also be installed, for use in the event of a breakdown.

Talks from Belfast.

TALKS upon Ulster affairs are now being given upon Wednesday evenings at the Belfast station. Some distinguished speakers have promised to appear before the microphone, and they will treat of historical, social, and economic subjects, in a non-political and thoroughly popular manner.

Progressive Glasgow.

GLASGOW has a fine record for 1924, and I am told that the staff there have even more ambitious schemes afoot for the coming twelve months. First to give a whole Greek play, first to give a play by children, and first to give a complete act of an opera, 5 S C can certainly claim to have helped to make radio history in Britain. Glasgow was the first station to broadcast educational talks for school children.

THE GRID AS A TRAFFIC REGULATOR

How Amateurs May Get Best Results.

By SIR OLIVER LODGE, D.Sc., LL.D., F.R.S.

This practical article for the amateur by our scientific adviser has been specially written for "Popular Wireless." Those who desire maximum efficiency from their receivers will do well to study the advice given by Sir Oliver Lodge.

SUPPOSE you have acquired a new three-valve set, consisting of No. 1 valve, a high-frequency magnifier; No. 2 valve, a rectifier; No. 3 valve, a low-frequency or power magnifier; and suppose, as sometimes happens, you find a difficulty in obtaining any but a very feeble result, or even perhaps no result at all, notwithstanding that the connections have all been properly made, all joints and contacts good and firm, the plus and minus properly attended to, the whole high-tension battery fully connected up, and all the filaments glowing with adequate but not excessive brightness.

You may then perhaps try whether you cannot get a result by turning the rheostat or regulator of the No. 1 valve to zero, so that its filament is dark and it is no longer in action; you will then be working with only two valves and without a high-frequency magnifier, and yet from neighbouring stations you may now get a result. This will not always happen, but with some sets it does. Not that this is a right way of working, but it shows what was the matter. For now, having got the other two valves to give a result, if you switch on the No. 1 valve again, you will probably find that the loud speaker again becomes faint, or is silent.

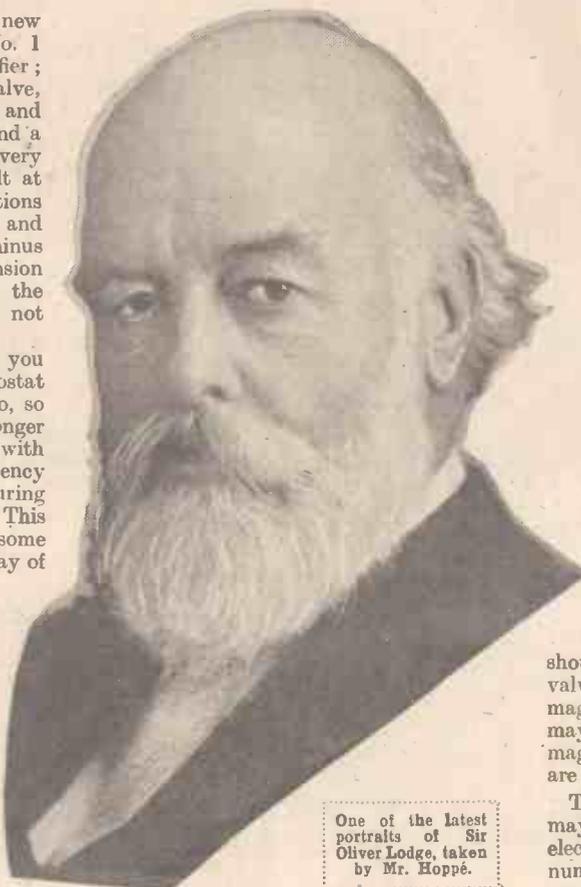
A Cause of Distortion.

You ask yourself the reason of this, and conclude that the high-tension battery is too strong for that valve. Two travelling plugs are probably provided, and by moving the wander plug which feeds the No. 1 valve down a long way, to lower studs on the high-tension battery, so as to apply a much lower potential to the No. 1 anode, you may be able to get it into helpful action; and after that you can proceed as usual.

Some valves seem able to work in spite of harsh treatment, but it cannot be well to depend on that, or to overstrain their capabilities. Everybody knows that the filament current must be adjusted neither too strong nor too weak, but regulation of anode potential seems less attended to, and too little facility for this is generally provided. And the result is distortion, if nothing worse. Too much reaction is no remedy, but is an additional defect. Good and pure and clearly articulated reception cannot thus be obtainable; though mere loudness can.

The fact is that the anode potential may be too high or too low for the grid potential. There is a best relation between anode and grid potential: if the anode is too high, it overpowers the grid; if the anode is too low, it is overpowered by the grid.

Consider more closely what is happening: Electrons are given off by the filament as



One of the latest portraits of Sir Oliver Lodge, taken by Mr. Hoppe.

negatively charged particles, and are attracted up by the positive anode. The grid stands in their way as a controller of current or regulator of traffic. The grid connected to the aerial is subject to fluctuations of potential: it may have a steady bias, but its potential is bound to fluctuate according to the received impulses; the whole reception depends on that.

Two Alternative Dangers.

When a grid is negative, it drives the electrons down or prevents their rising; when a grid is positive, it helps them upwards, and encourages them to shoot through to the anode beyond. It is the anode current which you ultimately utilise, and on which you are dependent.

But it is no use getting a strong anode current unless it is properly controlled and modified by the grid; and the grid potential must be strong enough to perform the

regulation effectively. The electrons, which are the current conveyers, must be disciplined and controlled by the grid in accordance with the received fluctuations of potential, that is, in accordance with all the voice peculiarities impressed on the ether waves by the sending microphone and the emitting valve apparatus.

The anode may be so strong as to haul up all the electrons in spite of the efforts of the grid to keep them down. That is a common danger, especially with No. 1 valve. On the other hand the grid may be so strong as not only to repel electrons when it is of negative sign, but to attract them so strongly when it is of positive sign that none or hardly any are able to escape its clutches. There are thus two opposite or alternative dangers, and the potentials must be adjusted so as to avoid them both.

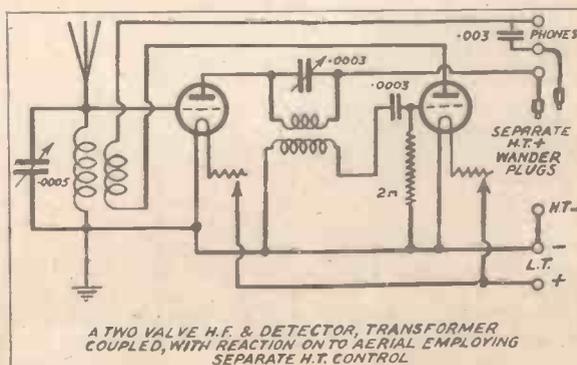
Varying Grid Potentials.

It is manifest that the grids of the series of valves are inevitably of different strength; accordingly the anodes should be of different strength too. No. 1 valve receives the aerial fluctuations unmagnified, and from a distant station they may be very weak. Grid No. 2 receives magnified fluctuations, and in No. 3 they are still more magnified.

The grid potential in No. 3 or No. 4 valve may be so strong as to monopolise all the electrons to itself, not allowing a sufficient number to go through to the anode; in that case magnification will cease; the valve will actually diminish the current which otherwise might have been obtained. Such a state of things is extremely unlikely in the No. 1 valve; the unmagnified oscillations in the aerial are bound to be rather feeble; they are probably insufficient to excite the grid too strongly anyhow.

A very moderate potential in the anode is sufficient to do the work; indeed a moderate potential is wisest, for it will then not

(Continued on page 1232.)



A TWO VALVE H.F. & DETECTOR, TRANSFORMER COUPLED, WITH REACTION ON TO AERIAL EMPLOYING SEPARATE H.T. CONTROL

THE GRID AS TRAFFIC REGULATOR

(Continued from page 1231.)

overpower the grid. And this is the basis of the plan known as Unidyne, which refrains from applying a high potential to the anode, even to the anode of the second valve.

Nevertheless, the second valve can stand a greater amount of anode potential, since the grid is already receiving a magnified impulse; and if we are to use the third valve, a high potential to the anode becomes necessary. Without high potential you cannot expect the third valve to magnify.

So far we have mainly considered the case of a grid too strong for the anode; it not so much regulates the traffic as stops it, absorbing too much of it into itself. But now take the converse case—the more usual case when a high-tension battery is employed—that is when the anode potential is too strong for the grid.

Unidyne Efficient "D X" Receiver.

The electrons given off from the filament are now rushed up violently to the anode, and the grid placed between them, in order to regulate the traffic, now stands helpless like a policeman standing in the middle of the North-Western Railway trying to regulate the Scotch and Irish mails. The speeds to be dealt with are beyond the grid's control. There is plenty of current; but the current is steady, paying no adequate attention to the fluctuations of the grid, and therefore paying no adequate attention to the received messages.

Everything is in working order; but the valve-property is out of action, the grid is no longer a regulator or controller of traffic. The remedy obviously is to weaken the anode potential. And if you want to receive from a feeble or a distant station, which is only able to make the grid voltage oscillate slightly, it will be well to reduce the anode potential a good deal. Hence, doubtless, it is that the Unidyne is efficient in picking up distant stations.

The anode potential of the other valves, to which grid alternations are supplied, may be higher, but still not too high. It is always important that the anode shall not overpower the grid. When listening to a strong near station that is unlikely to happen; but when listening to a far-off station it is likely enough. One might imagine that the feebler the impulses received, the more anode potential ought to be supplied; whereas the fact is just the reverse, and perhaps many amateurs overdo their high-tension, especially with the early valves of the series.

H.T. Control Necessary.

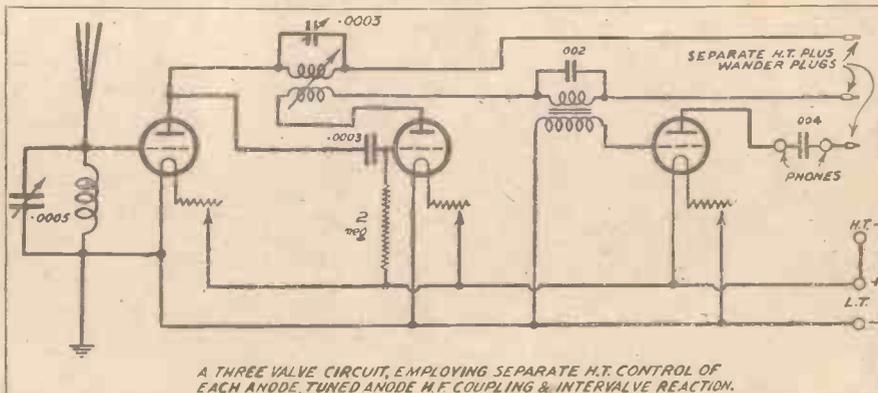
To sum up: The more distant or feeble the station listened to, the lower ought to be the high-tension potential applied to the anode of the first valve. It is possible that constructors do not allow sufficient reduction of the numbers of cells of the high-tension battery put into action on the anode, especially the anode of the first valve.

Too high a potential is detrimental. The high-tension battery ought to have studs all along, so as to be capable of ready

adjustment down to quite a low potential, and thus be made to suit different circumstances. The function of the No. 1 valve is clear reception. If it does not receive all the fluctuations clearly, subsequent magnification, so far from remedying the defect, only increases it. Given clear reception,

it can be magnified by subsequent valves as much as desired.

We must not depend for magnification on the receiving valve, and must not try to force it, either by reaction or by high potential or too bright a filament, or in any other way.



TWO HINTS

Simple Panel Supports.

THE system of using four legs to support a receiver panel is becoming very popular amongst experimenters, and for the benefit of those readers who may desire to adopt the method it is here shown how a simple set of supports may be made up from a few odd pieces of material.

Each support consists of a small strip of sheet brass, A, which has two holes drilled in one end to take ordinary wood-screws. To the other end is soldered a small brass nut. The screw to be used is provided with a small metal tongue, B, this being soldered to the head to form a thumb-screw. A square section wooden pillar, C, is recessed to take the lower end of the brass strip, which is then screwed firmly in position. A suitable base is then attached to the lower end of the pillar, this consisting of a small wooden block or an old ebonite knob.

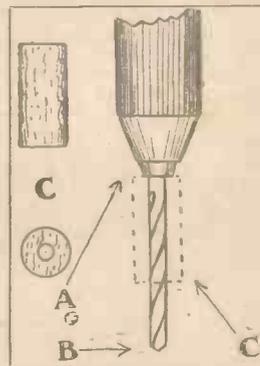
Care should be taken to see that all the pillars are of equal length, since no adjusting device is provided. During operations the panel is held firmly in position by the small clamping screws.

A Simple Drill Stop.

THE usual method of preventing a drill from cutting beyond any required depth is to use a small metal collar which it clamped to the drill by means of a small set-screw. In the writer's opinion this is most unsatisfactory, since it is

impossible for the small set-screw to grip the hardened steel drill tightly enough to prevent the collar from slipping if a little undue pressure is applied to same. The method outlined below will be found far more reliable.

Obtain a length of round, soft wood (curtain rod) and, with the drill which is to be used for the job, drill a hole down through the centre. Then place the drill in the chuck and carefully measure the distance between A and B. For example, if this should be 1 1/2 in., and the holes are to be 1/2 in. deep, then cut off a 1 in. length of the drilled wooden rod, C, and force it over the drill until the top portion touches the jaws of the chuck. It is thus impossible for the drill to cut deeper than the measured distance.



THE "BEST WAY" WIRELESS BOOKS

Have you secured your copies of those latest and most up-to-date radio publications—the "Best Way" Wireless Books? Two numbers are now on sale, dealing clearly and comprehensively with the construction of radio receivers. Crystal Sets and Valve Sets are dealt with in great detail, and every stage of construction is clearly described. Copious photographs and illustrations make the building of the various sets a pleasure, even to the veriest tyro.

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"BEST WAY" CRYSTAL SETS
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 (Including a pictorial blue-print of a Two-valve Reflex Set.)

Price 6d. each.

Obtainable from any Bookstall or Newsagent:

ABOUT THE "ULTRA" COIL

How to Obtain High Efficiency.

By K. D. ROGERS (Assistant Technical Editor).

The popularity of the famous "P.W." Ultra Crystal Set has resulted in many inquiries about the design of the coil used. Here is a practical article which every amateur will find valuable.

READERS who saw the articles on the POPULAR WIRELESS Ultra crystal set and made up the receiver will no doubt have been struck by the design of the coil no less than by the wonderful degree of efficiency that was obtained with the set. This efficiency, as was explained before, is

While in the case of crystal sets the greater the potential across the detector circuit the greater the current through the crystal and 'phones, and the louder the signals up to a certain point.

Realising that the greater the potential across the detector circuit (let us deal with crystal sets first) the greater the signals strength obtained, within the limits of the crystal to pass the current, the problem arises as to how we shall arrange the receiving set so that the incoming energy shall cause large currents to pass through the crystal and 'phones.

Operating the Detector.

As it is only practical to tap the detector circuit across part of the aerial circuit, it cannot be in series with the aerial, as this latter must oscillate freely according to the frequency of the incoming impulses; the only thing to do is to include in the aerial some form of "resistance" that will cause a drop of voltage, or difference of potential across it, and to tap the detector circuit across that.

As the impulses we are dealing with are of high frequency, this resistance must take the form of one that will allow the currents to oscillate without damping them out too much. So an inductance is used, which can be employed both as a "resistance" and as a tuning unit to govern the natural frequency (i.e. wave-length) of the aerial.

Thus we come to Fig. 1, where a coil of a well-known type is shown, the inductance being tuned by a variable condenser. The potential available for operating the crystal is obviously that across the coil, which for broadcast reception has about 35 turns or so.

Now it is obvious that if we can increase the size of the coil we shall increase the potential difference across the detector within the limits set up by the impedance of the coil itself, for this must not become too large compared with that of the aerial and earth.

Increasing Signal Strength.

So we come to Fig. 2, where a large coil is employed, and a series condenser to make up for the increased wave-length. And this is as far as we can go in the case of ordinary coils, though by means of a secondary circuit of suitable value the potential in the aerial coil can be stepped-up, and stronger signals be obtained. This type of receiver is shown in Fig. 3.

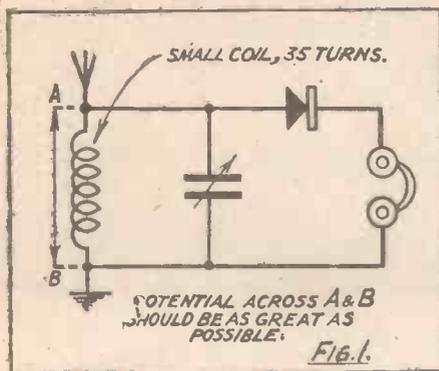
Unfortunately, if best results are to be

obtained, both the primary and secondary coils have to be tuned, and also there must be a method of coupling variation provided, so that the maximum voltage step-up may be obtained, and also a certain degree of selectivity introduced. This necessitates three controls, and therefore complicates the receiver so that it becomes quite a feat for the average listener to get the best out of his set.

The Ultra coil, used as a plain tuner (shown in Fig. 5), however, combines the advantages of the loose coupler, its selectivity and potential step-up, with that of ease of control, besides giving greater signal strength. This is due to the peculiarities of auto-coupling, where the secondary circuit is balanced on either side of the primary.

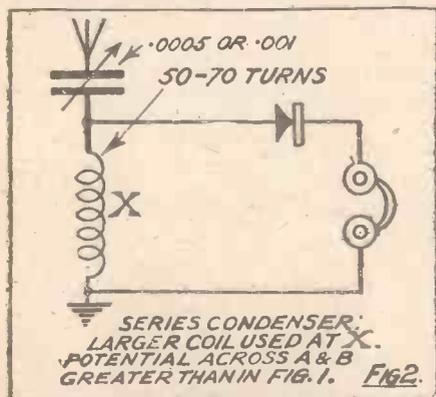
The New Coil.

As can be seen in Fig. 4, the detecting circuit, consisting of the crystal rectifier and the telephone receivers, is tapped off at the extreme ends of the inductance, while the tuned aerial circuit is tapped off from the centre. In this case the secondary circuit is not in tune with the oscillations to be received, as is the aerial, but is provided



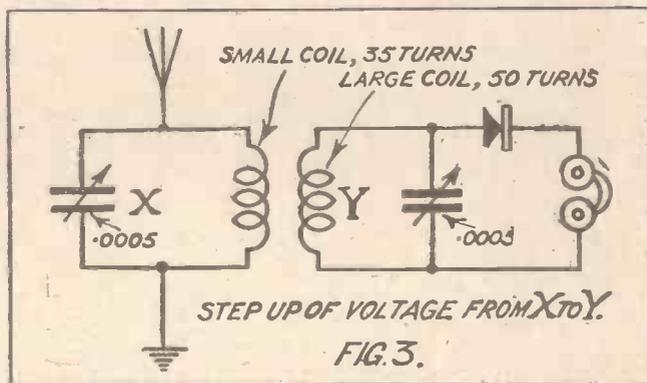
due to the fact than an auto-transformer is used so that the voltage across the detector circuit is made as high as practicable without cutting down the current flowing through the crystal, for it must not be forgotten that the crystal is a current operated device. This type of coil, which we have named the "Ultra" coil, is not only applicable to crystal sets, but also to valve receivers, and in various types and forms of circuits.

In order that all readers shall understand the operation of the Ultra coils, I propose to run through the theory of the coil



briefly before discussing its application to various circuits.

As is well known to most amateurs, valve "detectors," or rather rectifiers, are potential-operated devices. By this is meant that it is the difference of potential or voltage across the grid and filament of the valve that determines the efficiency of the receiver and governs the signal strength available. This is without discussing reaction or other forms of amplification, as these do not concern us at the moment.



with the maximum potential across its ends that is possible with efficiency, so that the circuit can be said to be provided with "forced" impulses.

In Fig. 5 the secondary is tuned to the frequency of the incoming impulses, and so the secondary is free to oscillate while the aerial, approximately in tune with the received oscillations, is tapped off as usual from the centre of the coil. In this case, less turns are used for the total coil, though those used for the aerial section remain the same.

The actual construction of the coil is very simple, and it may be of any type, though preferably either solenoid or basket. The total number of turns is wound on continuously, tappings for the aerial being taken off at the required positions, namely

(Continued on page 1234.)

BOOK REVIEWS.

Some New Publications for your Radio Library.

"Pitman's Radio Year Book, 1925," Price 1s. 6d. net. Published by Sir Isaac Pitman & Sons, Ltd., Kingsway, London, W.C. 2.

This very welcome Year Book hardly needs a review. Every amateur who is interested in his hobby must surely possess a copy, for it contains some of the most useful information in connection with wireless ever compiled, and, at the exceedingly moderate price of 1s. 6d., it is a book which most certainly should be in the possession of every reader of this journal.

History of Wireless.

The 1925 issue is an improvement on the 1924 issue, inasmuch as it contains a very excellent Photographic Supplement entitled "Radio History for 1924 in Pictures." The contributors to the issue include Lord Gainford, Mr. Reith, Captain Eckersley, and many other notable figures in wireless.

Altogether this is a book which can be heartily recommended to the attention of every wireless amateur.

"Wireless." By P. J. Risdon, F.R.S.A., with an introduction by Dr. J. A. Fleming, F.R.S. Price 6s. net. Published by Ward, Lock & Co., London.

Mr. Risdon is probably remembered by many readers of POPULAR WIRELESS as a contributor of distinction. His book contains 384 pages, and is illustrated with many excellent photographs and diagrams.

Dr. J. A. Fleming contributes a very interesting Introduction, while the author leads his readers from an outline for beginners to the ether theory, ether waves and vibrations, electricity and magnetism, electric current, primary cells and accumulators, electro-magnetic waves, and methods of generating them, and so on, right through the history of wireless technique.

Altogether this book covers an exceedingly wide scope, and shows evidence of very careful authorship. At the price of 6s. it is well worth an investment on the part of the amateur.

The Broadcast Library.

We note that Mr. Risdon publishes a chapter which originally appeared in the "Wireless Review and Science Weekly" (a journal which is affiliated with POPULAR WIRELESS) on how Sir Joseph Thomson discovered the electron. But it is to be regretted that Mr. Risdon has not seen fit to acknowledge, in the usual manner, the original journal in which his article was first published.

Three more books of the Broadcast Library edited by J. C. W. Reith have been received for review. They are all published by Messrs. Hodder & Stoughton at 3s. 6d. net, under the following titles:

- "From My Window," by Philemon.
- "At Home with Nature," by Kaye Robinson; and
- "All About Motoring," by Captain Twelvetrees.

The contents of these three books do not come under the legitimate scope of the review columns in POPULAR WIRELESS, but there can be no doubt that if the Broadcast Library continues to publish such attractive volumes by such excellent and well-informed authors, the public will have an opportunity of collecting a very useful and entertaining series of books.

Mr. Kay Robinson needs no introduction to readers of POPULAR WIRELESS. His nature talks from 2 L O are keenly appreciated by thousands of listeners-in, and in his book he again shows evidence of that charm of style and a wide knowledge of the mysteries of nature.

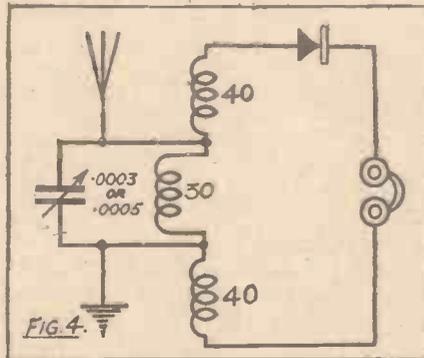
"From My Window," by Philemon, is a

ABOUT THE "ULTRA" COIL.

(Continued from page 1233.)

the centre of the coil, so that the portions on either side balance one another.

Before dealing with further adaptations of this type of coil (which, by the way, is covered by letters patent) the following list of coils may be of interest to those who wish to go right ahead with their experiments on this coil. In the case of valve detectors, the secondary is, of course, connected to grid and filament, the aerial remaining the same. As the coil is most efficient on short waves I do not intend to give details for wave-lengths above 600 metres.



The following is a list of approximate values for various wave-length ranges, both the windings being tuned, the aerial with either series or parallel condensers of .0005, and the secondary with a .0003 or .0005 parallel condensers:

Wave-length.	Aerial.	Sec.—i.e. total number of turns.
60—120	4 (series)	22
100—150	8 (series)	24—30
150—300	20 (series)	30—40
300—400	25 (parallel)	40—60
350—600 (approx.)	40 (parallel)	60—80

collection of essays, many of which are perfect little gems in their own way. These essays are very short, thoughtful and delightfully written, and it is with great pleasure that we welcome Mr. Reith's decision to include them in a separate volume.

Interesting New Volume.

"All About Motoring," by Captain Twelvetrees, should have a very wide appeal to those in possession of motor-cars of any description. Captain Twelvetrees is a practical motorist, as every listener who has heard his wireless talks must have realised by now. He does not fog his readers with long technical discourses on differential gears, etc., which is lucky, because the technical vocabulary of the motorist is even worse than that of the wireless amateur, or even the amateur golfer.

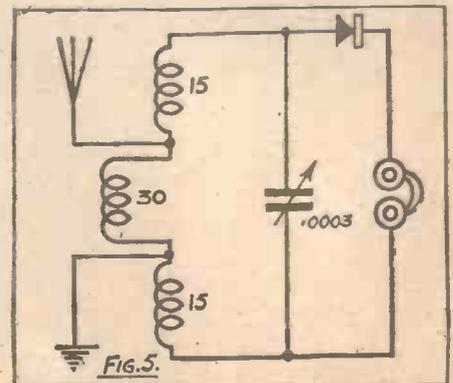
The next volume to be published under the general editorship of Mr. J. C. W. Reith is entitled "The Hidden Zoo," by L. G. Mainland, the well-known L. G. M. of the "Daily Mail."

The values given in the preceding column must not be taken as accurate for all sets or aerials, and I advise those who take up this type of coil to experiment with various values, both of primary and secondary portions of the coils. It will be remembered that the original Ultra crystal set utilised the coil wound in a solenoid fashion, with the tuning carried out by tappings on both primary and secondary. This is quite an efficient method for crystal sets where the crystal always introduces flatness into the tuning, but for valve sets it is advisable to have a variable condenser across the secondary in order to obtain finer tuning.

Plug-in Coils.

It has also been found by Mr. Dowding and myself while experimenting with this type of tuner that the basket coil or spider winding is admirably suited for the Ultra coil, so that it can be made very easily into a plug-in coil for fitting to the average set. In this event the aerial and earth tappings must be taken out to separate terminals on the coil plug, the secondary being connected to the plug and socket in the usual way.

Should readers not wish to make their own coils they will be pleased to know that the Igranic Electric Co. are carrying out experiments on the Ultra coil with a view to placing it on the market. They will, of course, utilise their famous duolateral method of winding.



THE WIRELESS TORPEDO.

A Radio Mystery of the War.

By AN EX-NAVAL OFFICER.

This interesting article deals with a part of naval warfare of which very few people are aware of. The radio torpedo has, indeed, sinister possibilities.

TOWARDS the latter part of the Great War the Allies were greatly disturbed by a mystery vessel which repeatedly attacked our monitors operating off the Belgian coast. The mystery ship, as it was called, appeared to come from the German naval base at Ostend, and as it was equipped with elaborate wireless aerials and accompanied by seaplanes, which carried on regular wireless transmission, by which the movements of the mystery ship appeared to be governed, it was naturally thought that the ship was controlled by wireless from the seaplanes, as no crew were visible.

Accordingly, special wireless transmitting stations were set up for sending out signals which would jam this ship and cause it to run amok. For, as far as was known, no wireless control apparatus existed which could not be upset by jamming.

After this the mystery ship was never seen again, and the Allies concluded that their jamming remedy had had the desired effect.

The point which it is desired to emphasise is—that it has always been possible to upset any wireless-controlled mechanism by consistent jamming, and although some devices have been perfected since the war for rendering it more or less difficult to jam a wireless-controlled vessel, a new device makes it positively dangerous to even attempt to jam any wireless-controlled mechanism.

A Valuable Invention.

This new invention works on the principle that if a wireless-controlled torpedo is fired into the midst of an enemy fleet, and any ship attempts to jam the torpedo by sending out wireless signals, as hitherto, the torpedo, instead of being put off by this procedure, will automatically turn round and face the interfering transmitter, follow the wireless waves to their source, and finally destroy the vessel from which they are radiated. In fact, a vessel which tries to jam one of these wireless-controlled torpedoes is literally asking for it.

It is well known that if a wireless receiving set, employing a frame aerial, is tuned to, say, the London broadcasting station, maximum signals will only be obtained when one of the sides of the frame aerial is pointing towards 2 L O. When the frame is rotated so that the sides of the frame are at right-angles to 2 L O—no signals will be heard—and it is due to this directional property of the frame aerial that this new radio torpedo is able to follow up any radiated wireless waves to their source.

In Fig. 1, two frame aerials, 1 and 2, are erected on the same axis, but at right angles to each other. We will now presume that the sides of No. 1 frame aerial, L 1 and L 2, are pointing respectively north and

south, while the sides of No. 2 frame aerial are pointing east and west. Both aerials are fixed, and cannot be rotated. At the moment the torpedo is travelling in a due easterly direction.

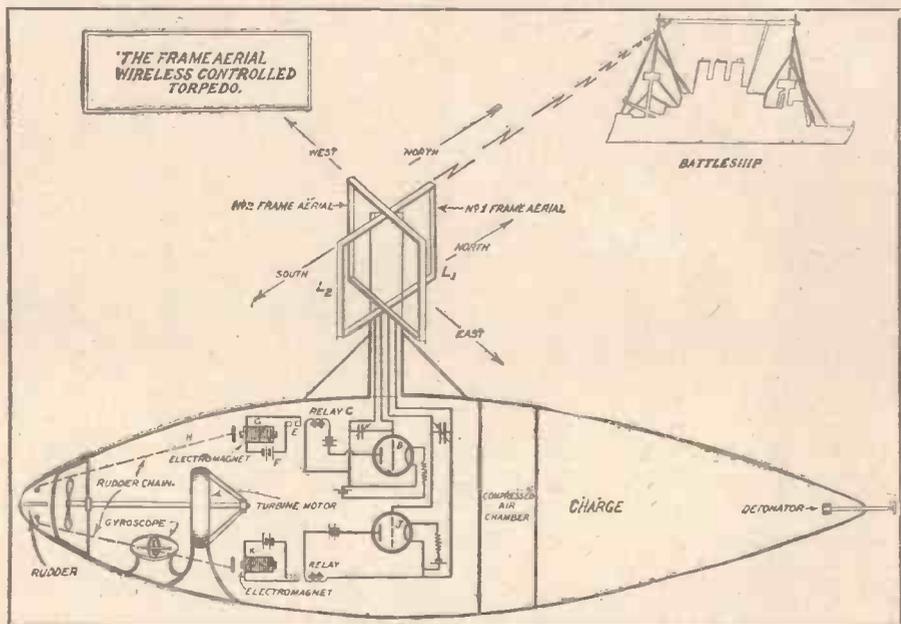
About a mile or so away to the north of this torpedo, an enemy battleship, A, is attempting to jam the wireless-controlled torpedo by radiating wireless waves. (It will be understood that the torpedo is not heading in the direction of the battleship, but is travelling, as mentioned above, in an easterly direction; while the battleship is to the northward).

As the sides of No. 2 frame aerial are pointing east and west, they are at right angles to the waves from the battleship,

of the chain H over to port. This causes the torpedo to swing round from its easterly course on to a northerly course, when it will be proceeding in the direction of the battleship radiating the wireless waves which are affecting it.

Silencing the "Jammer."

As the torpedo swings round, however, the energy picked by No. 1 frame aerial now begins to get weaker, for the latter is being turned away from the waves radiated by the battleship; while at the same time No. 2 frame aerial is beginning to pick up energy from the enemy battleship, as one of the sides of this frame is now turning towards the ship.



and therefore do not pick up any of these waves. On the other hand, No. 1 frame aerial is pointing north and south, and as the battleship is to the northward, one of the sides of No. 1 frame aerial is pointing directly at the battleship. Therefore this frame aerial will pick up a maximum amount of current from the battleship's transmitter.

Altering Course.

From No. 1 frame aerial this current passes into the receiver B, and on being amplified (for clearness only a detecting valve is shown in the diagram), energises the relay C, which closes the switch E, thus causing the battery F to excite the electro-magnet G, which pulls the rudder by means

At a certain point, when the nose of the torpedo is pointing directly at the wireless transmitting cabin on the battleship, that is, due north, an equal amount of wireless energy will be picked up by each frame aerial. Thus the energy now picked up in No. 2 frame aerial will pass through the receiver J and cause the pull of the electro-magnet K to balance the pull of the electro-magnet G. Consequently the rudder will be placed and maintained amidships and the torpedo will proceed in the direction of the battleship.

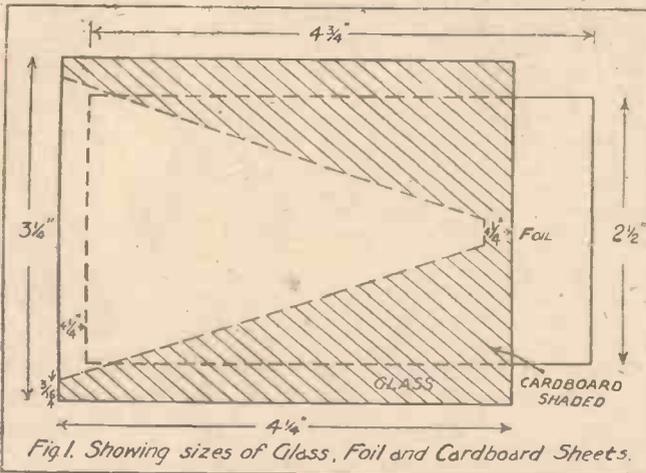
Any deviation from this course by the torpedo, owing to tide or current, will be counterbalanced by the variations in received energy from the battleship—so whatever happens, the battleships radiating the wireless waves will be struck by the torpedo.

HOW TO MAKE A SIMPLE SQUARE LAW CONDENSER.

By W. SHERRIFF, B.Sc.

WASH and dry eight old quarter-plate negatives after removing the film. Cut out four sheets of copper (or

the condenser. Bind the exposed glass with a layer of insulating tape, but leave the end open.



Mount the three metal plates in a hardwood end-piece, fitting them into three saw cuts, which are spaced to

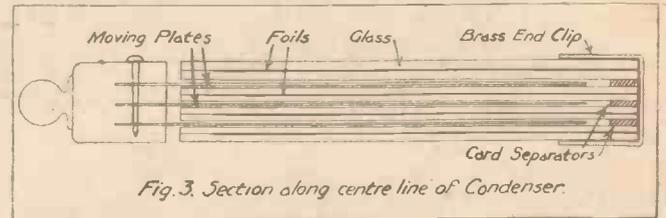
Proportional Overlap Increase.

Connect all three plates by soldering a wire vertically (Fig. 2), and solder to this a flex wire for connections to the moving plates. Add a knob to the end-piece.

The shape of the plates is such, that on sliding the metal plates in between the foil sheets the area of overlap increases in proportion to the square of the distance the plates are advanced. This gives "straight-line" tuning. A scale may be scribed on the top plate.

Advantages and Disadvantages.

Such a condenser costs very little, but is little inferior in efficiency to the ordinary air dielectric type, although it is harder to mount in a set.



allow the plates to slide smoothly into the spaces between the glass plates. Fix

The maximum capacity will be about .0003 mfd. This can be doubled by using rectangular plates, but in this case the "straight-line" tuning is lost.

tin) foil, 2 1/2 in. by 4 1/4 in. Fix one sheet between two glass plates, using a little shellac varnish, allowing 3/8 in. of foil to project at one end (Fig. 1) Make four sets like this.

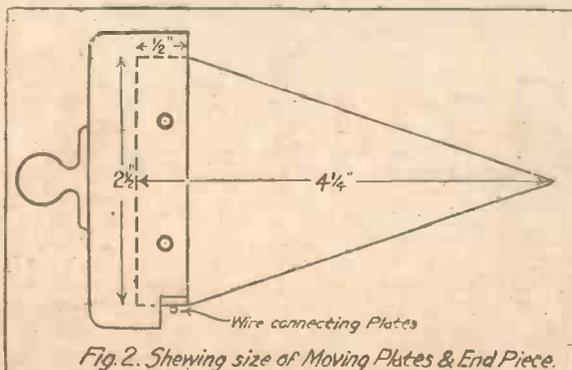
Cutting the Plates.

Cut out three metal plates to the dimensions shown in Fig. 2. Carefully flatten each sheet. Cut out three pieces of cardboard of the shape and size shown in Fig. 1, using cardboard slightly thicker than the metal plates.

Now assemble the four pairs of glass plates, with the cardboard separators between adjacent pairs, and the projecting foils all at one end.

Assembling the Condenser.

Bend the projecting foils over the ends of the glass plates, and clip on a bent strip of brass (Fig. 3). Solder a wire to this end piece for a connection to the fixed plates of



Technical Notes

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

Berlin "Eiffel Tower."

ACCORDING to reports from Berlin, work has already commenced there on the construction of an "Eiffel Tower" for wireless transmission. It will be provided with a restaurant 155 feet from the ground, the tower itself being 430 feet high. Fifteen feet from the top there will be an observation platform, reached by means of an elevator.

Condenser Template.

A simple method of ensuring accuracy in the marking of the drilling positions for a variable condenser, sent to me by a reader, is as follows. A piece of paper was cut to about the same size as the condenser end, and a hole made in it for the shaft of the rotor. The ends of the pillars were then inked by means of a stamp pad, and the paper was slipped into position on the end of the rotor shaft and pressed carefully against the inked parts. This gave an accurate template, the paper afterwards being pasted in position on the

panel until the drilling had been carried out.

Reviving Dull-Emitters.

It is well-known that many a valve which starts its career as a dull emitter soon graduates—or is it degenerates?—into a bright emitter, and soon comes to an untimely end. I have often been surprised at the large number of people who, whilst they are prepared to go to the extra expense of buying dull-emitter valves, being evidently fully conscious of the advantage in the way of low current-consumption, nevertheless seem unable to convince themselves that when the filament is at a very dull red heat it can possibly be functioning efficiently. There is apparently a great temptation to raise the temperature "just a little."

Care of the Valve.

It is no doubt this instinct that "seeing is believing" (which, in this case, is largely the result of previous experience with bright-emitter valves) that leads to the abuse of dull-emitter valves, and is responsible for transforming them into short-lived bright

(Continued on page 1231.)



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18 x 12 x 1/2 .. 13/-	12 x 11 x 1/2 .. 8/3	12 1/2 x 9 1/2 x 1/2 .. 7/6
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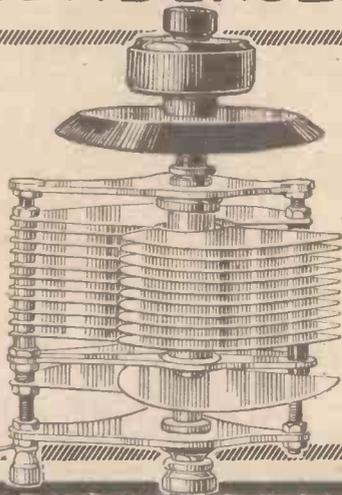
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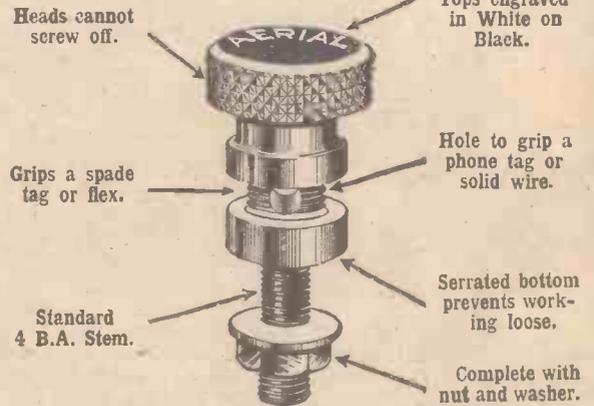
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HOW TO CONSTRUCT A THREE-VALVE RECEIVER. ONE H.F., DETECTOR, AND ONE L.F.

Built and Described by J. LAURENCE PRITCHARD.

On test this receiver was found to be very selective and one which can be well recommended to amateurs who want a reliable and efficient all-purpose receiver.

THE three-valve set illustrated in Fig. 1 has a stage of tuned anode high-frequency amplification, a valve detector, and a single stage of low-frequency amplification. Although the open circuit

are taken out to two stud switches situated to the right of the aerial and earth terminals.

The coarse tuning switch is above the fine tuning one. Between these switches

required. The potentiometer is of the rotary type, which is more easily mounted on a wireless panel than the sliding pattern. To the right of this component three filament resistances are placed, and immediately above them are peepholes for the inspection of the valves. Two pairs of telephone terminals are arranged in a vertical line at the right edge of the panel.

A dimensioned panel lay-out for securing these components in their exact position is

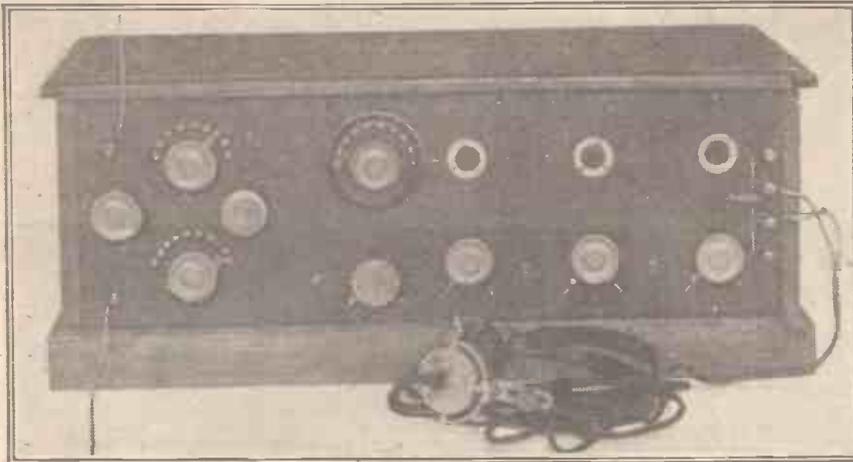


Fig. 1. The three-valve set complete.

is employed for aerial tuning with its advantages of ease in tuning, the set is fairly selective, and is to be recommended to those amateurs who desire a really good all-purpose set.

and to the right of them, and in line with the aerial tuning condenser, is the control knob of the vario-coupler rotor, which is employed to give a reaction coupling to the aerial tuning circuit. Continuing to the right of the panel is a variable condenser of .0005 mfd. capacity for tuning the anode of the H.F. valve. Below this is the potentiometer, which has a maximum resistance of 250 ohms. A lower resistance than this is not to be recommended, owing to the increased current re-

MATERIALS REQUIRED.

- 1/4 in. ebonite panel, 21 in. by 7 in.
- G.R.C. vario-coupler.
- Two stud switches.
- Variable condenser, .0005 mfd., 4/6 to 10/6.
- No. 50 or 75 duolateral coil, 5/6.
- Two single coil holders, 1/3 each.
- Potentiometer, 5/6.
- Three filament resistances, 1/9 each.
- Tubular condenser, 3/6.
- Grid leak and condenser, 3/6.
- Two fixed condensers, 2/- each.
- L.F. transformer, 20/-.
- Three valves, 12/6 to 30/- according to type.
- Batteries, cost according to make.
- Telephones, cost according to make.
- Valve shelf, terminals, wire, screws, etc.
- Wood for case.

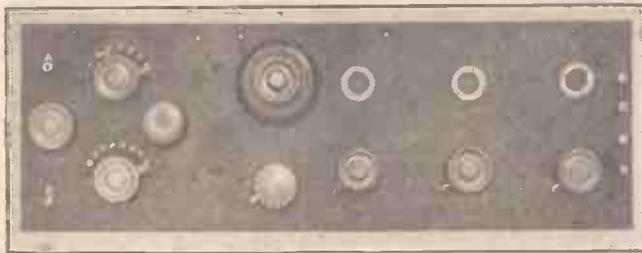


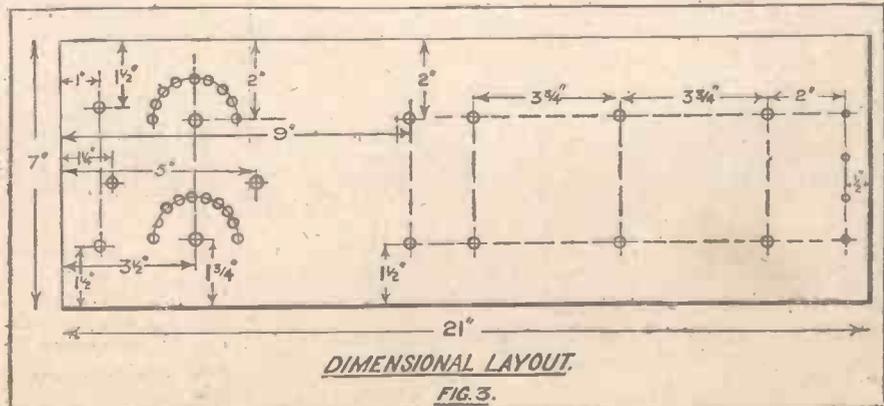
Fig. 2. Front view of the panel, showing position of the control knobs.

Under all conditions the set will be found extremely stable, this desirable feature being secured to a large extent by the use of a potentiometer. A duolateral coil is used with a variable condenser for tuning the anode of the H.F. valve. In the aerial circuit a G.R.C. tapped vario-coupler is employed, while extremely fine tuning is accomplished with a small variable condenser of the tubular type.

The lay-out of the panel is seen in Fig. 2. Aerial and earth terminals are placed respectively near the top and bottom left-hand corners of the panel. Between these the aerial tuning condenser is fixed. The G.R.C. vario-coupler has two sets of tappings, seven for coarse tuning and eight tappings for fine tuning. The tappings

illustrated in Fig. 3. The dimensions of spindle holes are intentionally omitted, so that they may be chosen to suit the particular components to hand. At the present time there is no standard size or method of fixing the many different radio components. The panel is of 1/4 in. good quality matted ebonite. Difficulty may be found in drilling holes in ebonite of 3/8 in. diameter and over, especially if the ebonite is brittle. Drilling should always be carried out from the outside of the panel, and the pressure

(Continued on page 1242.)



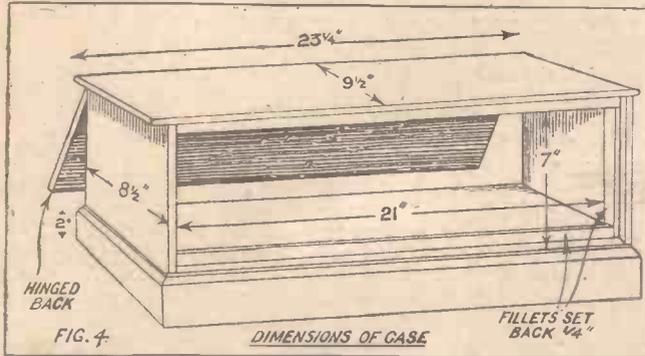
DIMENSIONAL LAYOUT.
FIG. 3.

THE THREE-VALVE RECEIVER.

(Continued from page 1241.)

of drilling reduced when the drill shows through the other side.

A good plan in drilling a large hole is to drill a small hole of about $\frac{1}{8}$ in. diameter



first of all. Before the drill goes right through the other side the panel should be turned over, and the hole drilled from the back to meet the hole already drilled, in the middle of the panel. This method obviates the likelihood of chipping. It should not be necessary to mention that pencil should not be used for marking out the position of the holes.

Making the Cabinet.

The valve peepholes are $\frac{1}{2}$ in. diameter, and if a drill of this size is not available, a good plan is to drill a number of small holes just inside the circumference of the circle, so that the holes nearly meet. The centre part may now be cut out and the holes trued up with a small half-round or rat-tail file. Three thin brass discs of 1 in. diameter are turned up to cover these holes, and are screwed to the panel by means of short countersunk screws spaced at equal distances round the discs. Each hole is filled in with a disc of red paper, which gives a pleasing appearance when lighted up by the valves.

Two extra holes are shown on either side of each switch for fitting stop-pegs for limiting the movement of the switch arms. Other details of the assembly of the com-

ponents will be given after the case has been constructed.

Dimensions for the case are given in Fig. 4. The appearance of the case is improved by tacking round the base four strips of 2 in. by $\frac{1}{2}$ in. wood to form a plinth. These strips are bevelled at their top edges and are secured with their top edges flush with the top of the base. Fillets of wood are tacked $\frac{1}{4}$ in. in from the four front edges of the case. The panel is screwed to these fillets. The back of the

case is hinged to a wooden strip 1 in. wide, attached immediately below the top of the case.

The top of the case overlaps the sides, and is moulded at its top edges. To prevent it from curling up it is securely nailed to the sides. Fig. 5 shows the case almost completed where the top is being nailed into position.

The valves are mounted in three sets of valve sockets

attached to a valve shelf, which is in turn screwed to the panel behind the filament resistances. The shelf measures 9 in. by $2\frac{1}{2}$ in., and is cut from $\frac{1}{4}$ in. ebonite. One set of valve sockets is attached in the centre of the shelf and the other two 1 in. from each of the sides. All three are 1 in. from the same side of the shelf. At this side and midway between the valve sockets two brackets made of $\frac{1}{2}$ in. by $\frac{1}{8}$ in. strip brass are screwed to the shelf so that this edge is 1 in. from the back of the panel. At the opposite edge three battery terminals of the telephone type are

ing to this illustration again, a telephone condenser of .001 mfd. capacity is attached to the panel close to the telephone terminals. The grid condenser of .0003 mfd. capacity is placed below the vario-coupler. It will be seen that the latter is arranged so that its tapping side is on the same side as the switches, in order to secure the shortest leads. (Fig. 6.)

Grid Bias Provided.

A close-up view of the tubular variable condenser is given in Fig. 6. This may easily be constructed at home, but, if desired, commercially made condensers of this type are procurable from the wireless retailer. Another component which is attached to the panel is a grid-biasing battery for giving the grid of the low-frequency valve a greater negative potential. The battery consists of two cells taken from a $4\frac{1}{2}$ -volt pocket flash-lamp battery. The pitch at the top of the battery is chipped away by gently tapping, taking care to avoid breaking the connecting wires which are concealed within it. The cardboard is then slit down with a sharp knife and removed. Either of the end cells is taken away by cutting its connecting wire. Care must be taken to see that the paraffin-

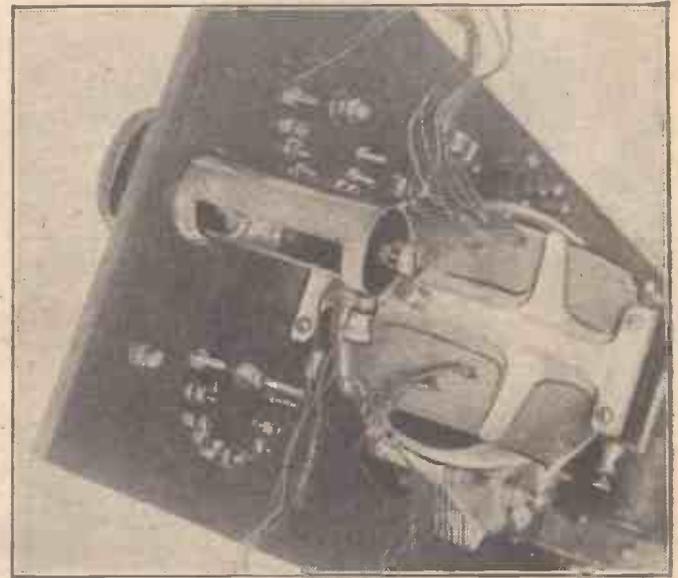


Fig. 6. Details of vernier condenser and position of vario-coupler with regard to the switches.



Fig. 5. The case of the three-valve set, showing lid being nailed into position.

placed. The shelf is screwed to the panel on a level with the spindles of the filament resistances. Its position is clearly shown in Fig. 7, which shows the back of the panel with the main components assembled.

The low-frequency transformer is placed between the first two valves, while a fixed condenser of .001 mfd. capacity, which is shunted across the primary of this transformer, is screwed to the panel to the left of the transformer, as seen in Fig. 7. Referr-

waxed strip of cardboard is kept in position.

A piece of very thin sheet ebonite is wrapped round the two cells to be used, and the unit is then secured to the panel by means of a strip of thin brass bent to the shape of the battery. In order to bend the ebonite without cracking, it should be gently warmed and bent over the battery while still limp. A close-up view of the grid-biasing battery is given in Fig. 7, where it is seen between the transformer and telephone condensers. The grid leak has a resistance of 2 megohms. It is fixed at one side to its proper clip on the grid condenser, but is held at its other end by a brass clip screwed to the panel. It is seen in Fig. 8, which gives a back view of the set completely wired. The circuit diagram is given in Fig. 10.

Wiring is carried out by the anti-capacity
(Continued on page 1243.)

THE THREE-VALVE RECEIVER.

(Continued from page 1242.)

method, which employs bare tinned wire of $\frac{1}{8}$ in. square section. This wire is often sold in hanks and requires straightening before use. To do this, one end of a length

holder screwed to the inside of the case. For general broadcast wave-lengths the loading-coil is not required and is, therefore, shorted by a plug and socket having a brass back-plate. This coil holder and shorting-plug and socket are illustrated in Fig. 9. The tuned anode inductance is of the plug-in variety, a coil holder for this coil being screwed to the base of the case at right angles to the loading-coil holder. Connection to both the coil holders is made with insulated flexible wire, these leads being

placed inside the set, connection to battery terminals being with flexible insulated wires. A back view of the receiver with the lid opened, showing the positions of the high and low tension batteries, is illustrated in Fig. 11.

For those who find it difficult to follow a theoretical circuit the practical wiring diagram of the panel is given.

In tuning the set the switches should be turned until a signal of some sort is heard. At the same time, the reaction coupling controlled by the rotor-knob should be varied, in order to suppress any tendency to self-oscillation, and at the same time bringing the signal to its maximum strength. It will probably be found that any alteration to the adjustment of the switches will require a further adjustment of the reaction coupling.

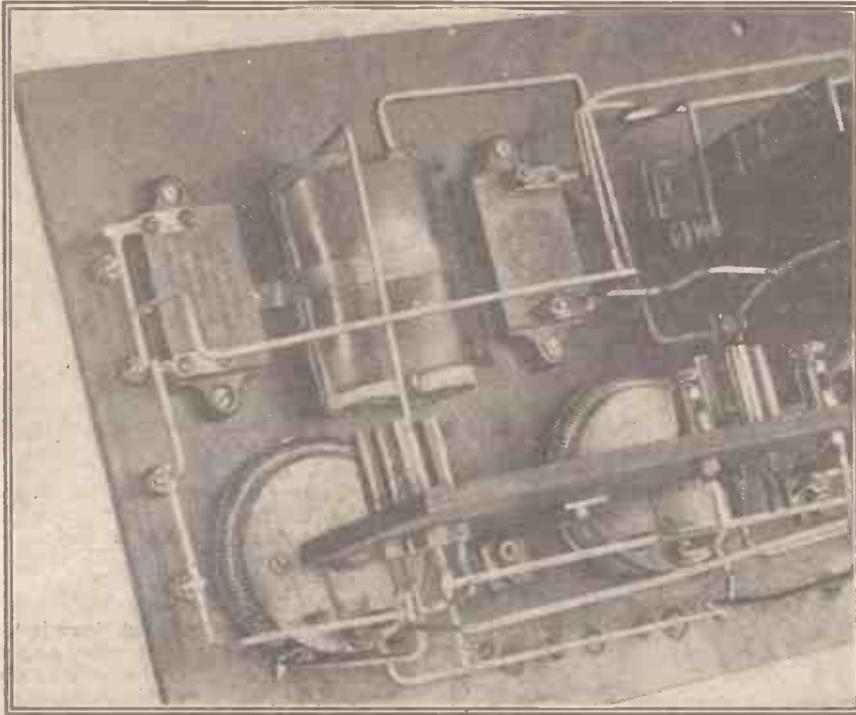


Fig. 7. Close-up of grid bias connections and right half of the panel.

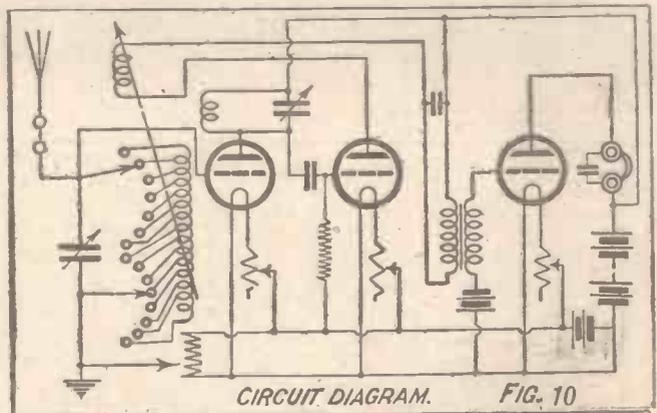
of wire is gripped tightly in a vice, and pulled out with pliers until it is felt to yield under the pull. Several lengths are prepared in this way and laid flat on the table, so that they may be cut up as required. The bends are made with a pair of square-nosed pliers. As far as possible the wiring should be carried out in the manner shown in illustrations of the completed set. Fig. 7 is useful in giving a close-up view of the wiring of the right-hand side of the set, while in Fig. 12 the completed wiring of the left part of the panel is seen.

Handling the Set.

In order that the set may receive on any wave-length, a loading-coil may be inserted in the aerial tuning circuit by means of a coil

connected to the coil holders after the panel has been screwed into position.

After the valves have been fitted into the valve holders the high and low tension batteries may be connected up. If dull-emitter valves are used the low-tension battery may be of the dry type, fitting inside the case. The high-tension battery is also



CIRCUIT DIAGRAM. FIG. 10

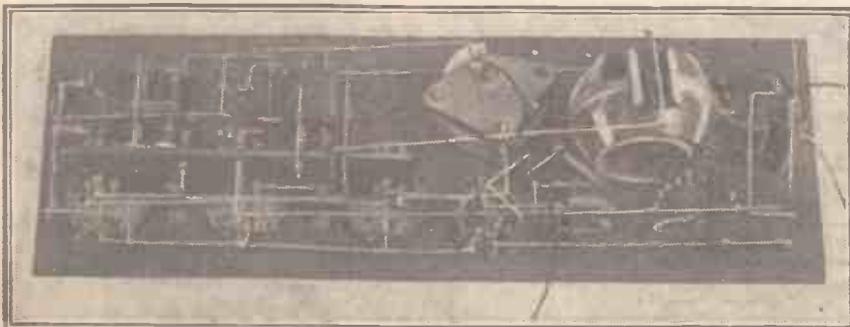


Fig. 8. Showing layout and wiring at the back of the panel

reception, and while tuning the set in it should be left with its knob about half-way round. When best results are obtained the potentiometer knob should be turned gradually to increase the signal strength.

If the potentiometer is moved too far, it will either cause the set to oscillate or else reduce the signal strength, maximum results being obtained at a point just before the set commences to get "woolly," previous to breaking into oscillation. Should the control be moved beyond this point, the signals will become distorted and probably not so strong. Care should always be taken, however, not to allow

(Continued on page 1244.)

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It will be found that the potentiometer will give a delightfully easy and precise control of the reaction for long range

THE THREE-VALVE RECEIVER.

(Continued from page 1243.)

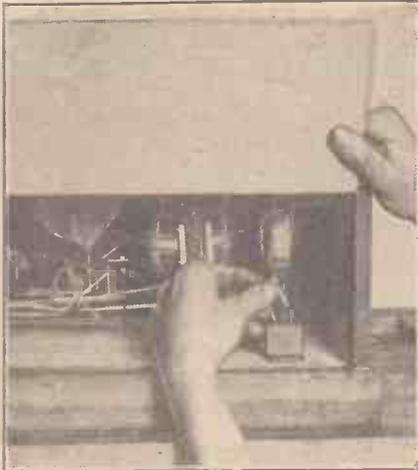


Fig. 9. The positions of the tuned anode and aerial loading coil can be clearly seen from the above.

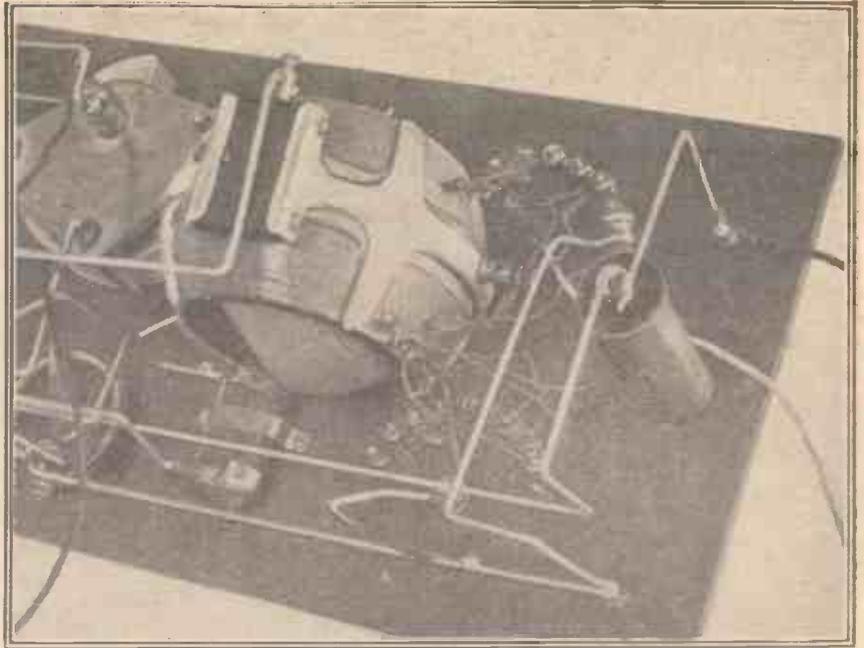


Fig. 12. A close-up view of the panel after wiring.

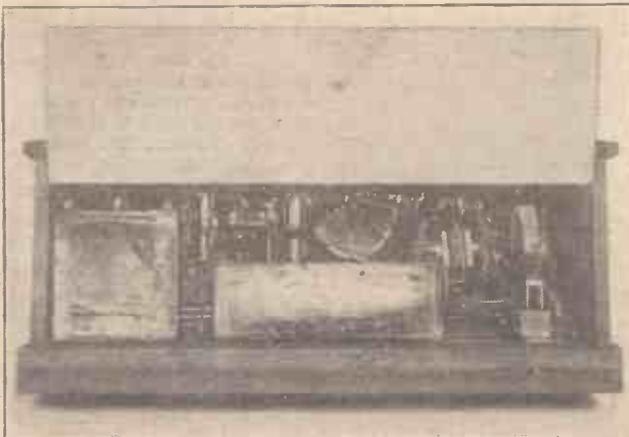


Fig. 11. Back view of the set, showing positions of L.T. and H.T. batteries.

The illustrations to this article have been specially taken by the author and indicate various aspects of the actual receiver described. One set has been specially constructed for the purpose of describing it in "P.W.," and it has been very carefully tested. Every set made by Mr. Pritchard bears the hall mark of reliability, and readers may build "P.W." sets without fear of failure.

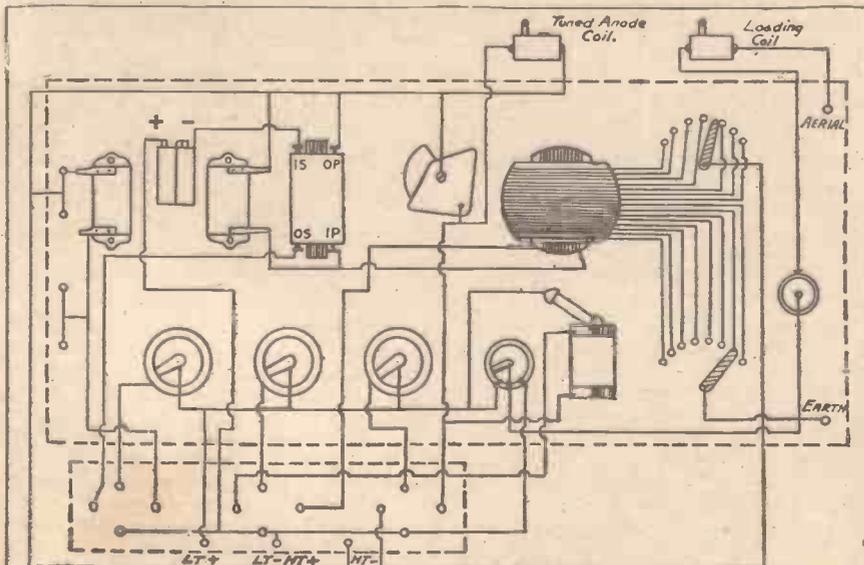
the set to oscillate on B.B.C. wave-lengths during broadcasting, as the set may cause a considerable amount of interference.

There is one more point that should be mentioned, and that concerns the grid bias. It may be found that, no matter how the H.T. and filament are controlled, the output from the set is choked or distorted and irregular.

Remove Grid Bias.

This denotes the fact that there is too much grid bias on the last valve, and so the leads to the grid cells should be disconnected and connected together instead. If this does not wholly cure matters, try using one of the cells only, instead of both.

Some of the dull-emitter valves will not take 3 volts grid bias on the first L.F. stage, but as some really require that amount it was considered desirable to include the two grid cells and to discuss this point in the article.



Practical Wiring Diagram of the back of the Receiver.

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Readers are also requested to note that, with this issue, new regulations with regard to the answering of technical queries, come into force. 6d. a query is now charged, and 1s. for supplying full wiring diagrams and receivers.

“ DOCTOR RADIO.”

THE ADVENT OF THE STETHOPHONE.

By **SEXTON O'CONNOR.**

Even doctors are feeling the effects of the rapid growth of the technique of wireless, as this article clearly shows.

MOST invalids, whether at home or in the hospital ward, look forward to the broadcasting hours as a welcome relief to the tedious monotony of convalescence, so that wireless, although not yet in the pharmacopoeia, is already regarded as a useful “ tonic ” by those who should know best.

The methods and technique of wireless science are, however, making themselves felt more directly in various interesting ways in medical practice. The ordinary stethoscope has been the doctor's best friend for more than a century. There are few of us who have not at one time or other been prodded about in various parts of our anatomy by the little horn-shaped “ business ” end of this instrument, whilst anxiously awaiting the verdict of the medico as he gravely “ listens-in ” to the wheezy “ broadcast ” coming from inside.

Electrical Poulitices.

The old-fashioned stethoscope has now been harnessed up to a thermionic amplifier, with astonishing results. The stethophone, as the new combination is called, is capable of magnifying the faintly-pitched murmurs and other mysterious sounds emanating from the human body into something approaching the intensity of the atmospherics received by a multi-valve set on a sultry night. The skilled medical ear is able to distinguish and classify these manifestations with more accuracy than when dealing with the relatively feeble and sometimes almost inaudible sounds heard through the ordinary stethoscope. Incidentally in many cases where the older instrument would prove inadequate, the stethophone is able to elicit audible symptoms capable of yielding valuable information to the physician.

Some of the possibilities of the stethophone, as an aid to diagnosis, were recently demonstrated by the Western Electric Co. at a Medical Congress in Chicago. By using several stages of valve amplification, the characteristic sounds associated with heart and lung disease from individual patients were heard simultaneously by no less than five hundred delegates at a time. The advantages of such a system for lecture and public demonstration purposes at hospitals and medical schools are obvious, although for ordinary practice a single stage of valve amplification is ample.

The application of heat for the alleviation of pain is even older than medical science. The soothing effects of a hot-water bottle or poultice are too well known to need any scientific proof. Unfortunately, it often happens that the seat of pain lies in some internal organ where it is not possible by ordinary means to apply sufficient heat to give relief.

By using high-frequency currents, generated by means of vacuum-tube oscillators,

it is now possible to apply what is, in effect, a hot poultice to the afflicted organ itself, no matter how deeply this is seated inside the body. This branch of therapeutics is called diathermy, and is at the present time rapidly growing in favour amongst medical practitioners.

It is not feasible to use ordinary direct currents of sufficient strength to produce the necessary amount of internal heat, because the resistance of the skin at the precise point of contact with the electrodes is so high that the patient would be severely burnt in the process.

The peculiar merit of radio-frequency currents, when passed through the human body, is that the heating effect is practically

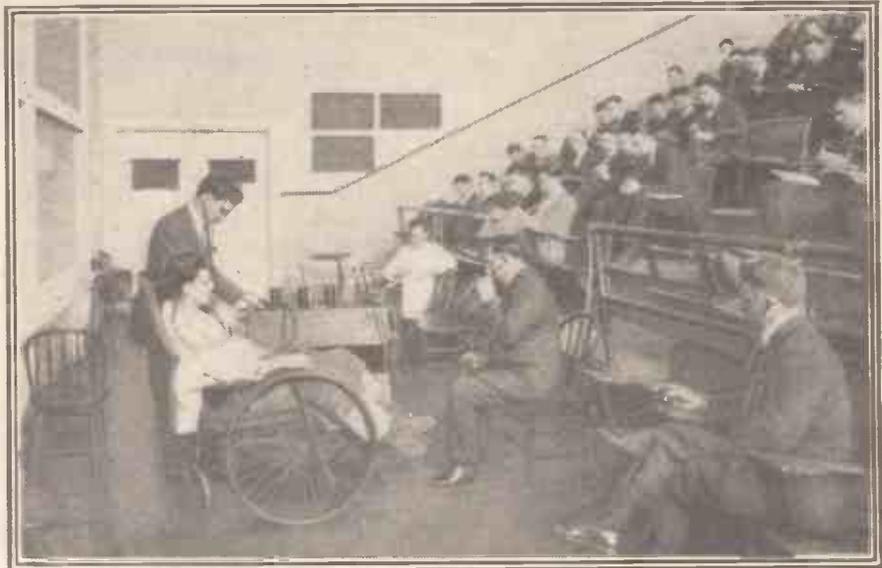
ordinary sewing-needle. One electrode is firmly strapped to the patient's skin, whilst the other electrode, or needle, mounted in a well-insulated handle, is manipulated by the operating surgeon. The currents are generated by a thermionic oscillator of the ordinary “ power ” type.

Relief for the Deaf.

The advantage of the radio-knife lies in the fact that the cut it makes is absolutely aseptic, so that the wound heals very rapidly and without leaving a scar. Moreover, by regulating the frequency of the current it is possible to coagulate the blood automatically as the cut is made. In this way the living tissue can be severed without loss of blood.

Apart from actual cutting operations, a surgical high-frequency needle or “ fulguration electrode ” can be used for desiccating or destroying warts, moles, and similar skin blemishes. Here it is not necessary to bring the needle into actual contact with the part of the skin under treatment. It is sufficient if an air space of from one-eighth to half an inch intervenes.

It is well known that many people who are—to put it mildly—very hard of hearing, can listen to broadcast with comparative ease.



(Photo by courtesy of the Western Electric Co.)
A demonstration of the Stethophone before medical students.

constant throughout the working circuit. In other words, the heat generated midway between the two electrodes (i.e. inside the actual flesh and tissue) is the same as that at the surface of the electrodes, so that the degree of internal heating is only limited by the temperature that the patient can bear without pain on the naked skin.

An “ R.F. ” Surgeon's-Knife.

Diathermy treatment has proved specially beneficial in alleviating and curing painful complaints such as lumbago, sciatica, and certain forms of neuritis. It is also valuable as a means of destroying those germ organisms that attack internal organs and give rise to pneumonia, peritonitis, etc.

By applying larger radio-frequency currents, of the order of from 300 to 2,000 milli-amps, it is possible to sever not only soft human tissue, but to cut through bone as well. The currents are applied by means of a thin steel electrode very similar to an

The usual explanation given is that the headphones necessarily press to some extent upon the bones of the skull, and that these transmit the vibrations to the “ inner ear,” which still remains sensitive, in spite of defects in the drum or outer passages.

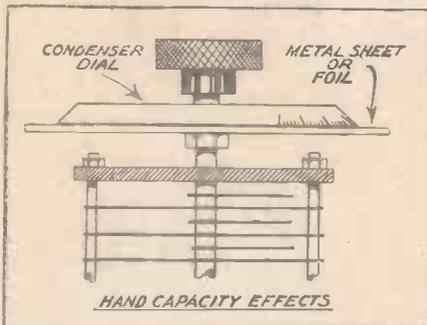
Ordinary deafness is due to the fact that direct access to the sensitive “ middle ear ” by air-carried sound-waves is blocked by some imperfection of the drum, or obstacle in the intermediate air-passages. The “ Otophone ” is an instrument which allows people in this category of deafness to hear ordinary speech or to listen in the lecture-hall or theatre with ease. In extreme cases of deafness, where the inner drum is destroyed or atrophied, the Brown “ Ossiphone ” enables sounds to be conveyed through the teeth or bones of the head to the sensitive auditory cells located in the innermost ear, which are still able to interpret the received vibrations as normal sounds.

Constructional Notes

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

Hand-Capacity Effects.

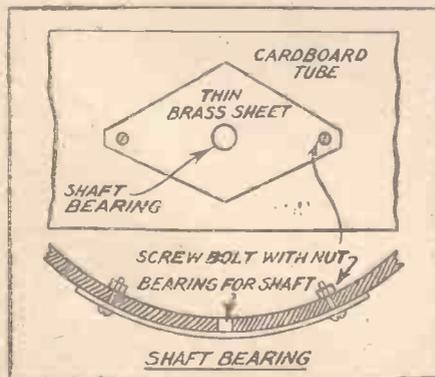
Nothing is more annoying, when tuning a receiving set, than to have the tuning go off immediately you remove your hand from the knob of the condenser. This means incessant trial and error to get it adjusted so that it will be about right by the time you have removed your hand. The simple device shown here, however, overcomes this trouble entirely. It consists



merely of a small circular disc or sheet of thin metal (or tinfoil) somewhat larger than the dial of the condenser, and either secured upon the underside of the dial (if a sheet of thin metal is used) or pasted upon the top of the panel below the dial (this method is applicable where a piece of tinfoil is employed). A suitable hole will, of course, need to be cut out for the shaft of the condenser. This metal disc is then connected to earth. With this arrangement no further trouble from hand-capacity will be experienced. If the shaft is electrically connected to one set of vanes, the clearance between the protecting disc and the shaft will need to be ample to ensure that the shaft does not make contact with the disc.

Variometer Shaft Bearing.

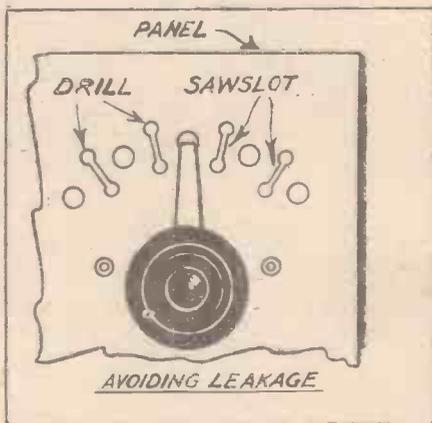
When making a variometer by means of coils wound upon cardboard-tubes, it is not easy to make neat and lasting bearings through the stator tube for the shaft of the rotor. The edges of the hole are very liable to be frayed, and, however carefully



the hole may be made, it is liable to become enlarged in use, with the result that the shaft eventually wobbles. The most satisfactory method for providing permanent bearings for the shaft is that indicated in the drawing herewith. A small piece of thin brass sheet is taken, which may be of any desired shape, and through the centre of this is drilled a hole of the appropriate size for the shaft. Two other holes are provided, by means of which the brass plate is secured to the cardboard tube by small bolts and nuts, as shown. The hole through the cardboard, is of course, made somewhat larger than the bearing hole through the brass plate. When drilling the hole through the brass, the latter should be held firmly against a backing of hard wood or metal, otherwise the thin brass sheet will be badly indented, and a burr will be thrown up around the holes.

Avoiding Leakage.

When it is necessary to use taps in a tuned circuit, losses can be reduced by cutting slots between switch points, as shown in the attached sketch. These slots



go right through the panel, and may be made quite large without seriously weakening the panel—they are cut when the panel is being drilled. In this way, accumulation of dirt or fine metallic particles, scraped off from the selector arm, which might cause leakage, is avoided. This little idea is taken from "QST," the journal of the American Radio Relay League.

Switch Stop.

If you wish to add a stop to a contact-stud, without soldering, the method illustrated herewith will be found useful. The stud in question is removed from the panel, and a soldering lug is slipped under the stud, the latter being then replaced in position and the lug bent upwards at right-angles to the panel. In the absence of a soldering lug, a spade-terminal may be used, the cylindrical part being opened out to conform to the curvature of the stud.

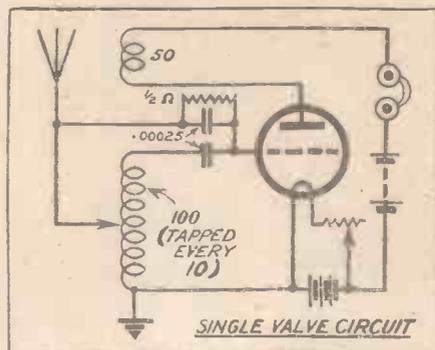
Owing to the insertion of this stop beneath the stud, it may be necessary to file the latter a little, to lower its top surface to the original level.

An Interesting Single-Valve Circuit.

The circuit illustrated in the accompanying circuit diagram is an interesting one to try and is very easily wired up. It is stated by a correspondent of "Radio Digest" to have given very good results. If the .00025 condenser is removed from the aerial circuit, the set does not work. The author states that he has had good success with DX on this set, and has in many cases obtained good loud-speaker volume. The circuit is also stated to be fairly selective.

Basket Coil Winding.

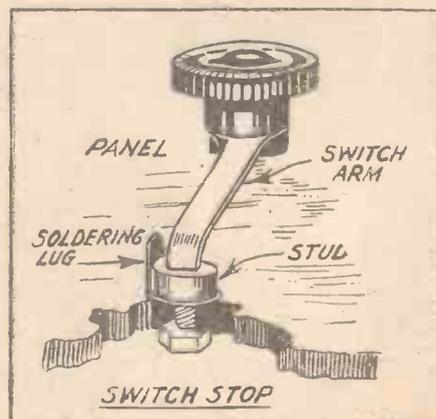
Enamelled wire should not be used in winding spider-web coils. The construction of these coils imposes a comparatively high mechanical stress upon the insulation,



which often causes the enamel on touching parts of adjacent turns to be scraped. Double-silk-covered, or double-cotton-covered is recommended for spider-web coils. If you have trouble with a set employing spider-web coils and cannot trace the trouble elsewhere, it is worth while trying out the coils and, if necessary, rewinding them.

Terminal Tabs.

Liability to mistakes in making connections, which often result in the burning out of valves, is a failing common to most beginners in wireless. A good idea, and one that will prove a reminder in making connections, is to have the leads from the low-tension and high-tension batteries provided with small tabs, marked with the voltage and polarity of each lead.



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PHYSICAL DEVELOPMENT AND FIGURE CULTURE.

Case No. 11,478. Mr. R. G. C., aged 18.

I am more than satisfied. I have increased 63 in. round the chest, and my height has gone up 34 in.

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INDIGESTION AND DYSPEPSIA.

Case No. A23,360. Mr. D. H., aged 21.

My liver is now in proper order. My appetite is quite good; so also is my digestion, and everything is satisfactory. The treatment has cured me.

Case No. A37,558. Mr. J. E. M., aged 38.

I have had no digestive trouble of any kind. I consider this nothing less than remarkable. There has been a marked improvement in my general health, and altogether I feel most grateful to you for what you have done for me.

NEURASTHENIA.

Case No. A32,647. Miss M. W. P., Aberdeen, aged 36.

I am very grateful to you for the careful way in which my lessons were compiled, for instead of the wreck I felt at the beginning of the course, I now feel in splendid condition.

Case No. G20,455. Rev. F., aged 81.

I am now in splendid health. Feel strong and vigorous, walk miles daily. My heartfelt gratitude to "Sandow" that it is so. The exercises seem a part of my daily life, and I delight in them. People keep telling me how smartly I walk. I say: "Yes, it is Sandow who gives me strength to do so."

LIVER TROUBLES.

Case No. A32,672. Mrs. M. C., Mickleover, aged 47.

The liver is also much more active, and I am able to get through my work without feeling real exhaustion, and now I am becoming ambitious.

HEART AFFECTIONS.

Case No. A33,042. Mr. D. E. Brynauyman, aged 49.

The doctor was here last Saturday with one of my little children, and I asked him to examine me, and he said that my heart is better than he ever knew it.

LUNG AND CHEST COMPLAINTS.

Case No. AD22,995.

Your exercises seem to be working wonders with my lungs and chest, and are no doubt fortifying me against the rigours of an English winter.

Case No. A38,063. Miss G. McC., aged 21.

Mrs. McCross writes: My daughter has kept free from Asthmatical seizures since she commenced your exercises, and at no time during the period has she taken any drugs. Our Family Doctor approves and admits there is an improvement in her.

RHEUMATISM AND GOUT.

Case No. A29,340.

It is with much gratitude that I can really say you have cured me of my complaint. I walk quite straight, no limping, and I have enjoyed myself this year more than I have done for the past 20 years.

INSOMNIA.

Case No. A32,946. Mrs. L. T., New Kent Road, aged 30.

I sleep well and enjoy my food, and have a good appetite, whereas before taking your advice I was told I did not eat enough to keep a canary alive. Sleep for 7 1/2 hours, and when you consider that for years and years I have not managed two hours' sleep (per night) you will see that the improvement is really excellent.

ANAEMIA.

Case No. A23,465. Miss V. F., aged 23.

General health much improved. Appetite much better. Have more energy and strength. Altogether I feel better in every way than I have done for years, and all my friends remark how much better I am looking.

CONSTIPATION.

Case No. 31,861. S. S., aged 31.

Before your treatment I was always taking aperients to keep my bowels in order. During the past six months my bowels have been regular and easy.

FILL IN AND FORWARD TO-DAY

THIS "POPULAR WIRELESS" ENTITLING COUPON for Free Copy of the Sandow Guide to Health and PERSONAL LETTER of ADVICE on your case by Mr. SANDOW.

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My occupation is..... My age is.....

Name..... (Please say Mr., Mrs., or Miss or Title)

Address.....

Jan. 24. To EUGEN SANDOW, 32, St. James' St., S.W.1.

PHYSICAL DEFORMITIES IN MEN. PHYSICAL DEFORMITIES IN WOMEN.

Case No. BB053. Lady, aged 26.

Improvement still maintained; the curvature at bottom of the back is gone, shoulders are now level, and general health splendid.

THE VOICE OF TRUTH. An Historic Certificate.

"We find that the Sandow Treatment has completely achieved the object for which it was undertaken in no fewer than 94 per cent. of cases, and satisfactory improvement was produced in over 99 per cent. of cases." Over 200,000 Successfully Treated Cases!

40,000 Cases of Neurasthenia. 40,000 Cases of Indigestion. 30,000 Cases of Constipation.

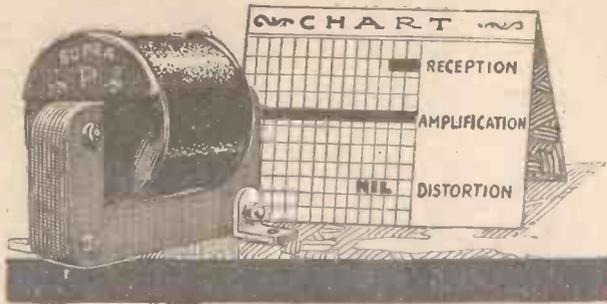
20,000 Cases of Liver Trouble. 12,000 Cases of Obesity. 7,000 Cases of Heart Trouble.

5,000 Cases of Lung and Chest Complaints. 5,000 Cases of Rheumatism and Gout. 4,000 Cases of Anaemia. 7,000 Cases of Lack of Vigour.

6,000 Cases of Insomnia. 4,000 Cases of Spinal Curvature and other Physical Defects.

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Good night Everybody!

"Good night, everybody," says my Volutone Loud Speaker, and I find myself saying "Good night, thank you, good night." And, after all, why shouldn't I? I know that my Volutone has been a very real friend to me. All through the summer he was with me, indoors and out of doors, and now that shorter days and long, dark evenings are here, I value his friendship more than ever. Ready to talk if I want to listen, to play to me or to sing to me. And if I join in his song (as indeed I do) is he annoyed? What a friend of friends!!

On a boisterous evening when we are all laughing and fooling, the Volutone plays with the loud pedal down and fills the room with music. On such a night as this, when I sit quietly by the fire, he sings softly and sweetly for me alone.

Yes, I will say good night to my Volutone. "Good night, old friend, until to-morrow. Good night, Everybody."

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E.P.S. 91

HOW TO CONSTRUCT A FOUR-VALVE "EXPANDING" SET.

Built and Designed by J. LAURENCE PRITCHARD.

PART II.

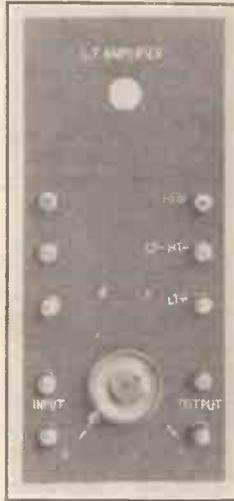
The conclusion of Mr. Pritchard's article, the first portion of which was published in last week's "Popular Wireless," is given below, together with the photographs and diagrams, some of which were referred to in the first article. A reference to last week's issue will enable amateurs building the set to compare the figure references with the photos and diagrams given below.

To accomplish this the top connecting strip is removed and the end of the flexible lead at present in the upper input terminal of the amplifier is securely clamped in the corresponding terminal of the detector panel. This is the only wire that requires to be moved. The reaction reverse switch will be called into play. The H.F. transformer used must be designed to suit the wave-length on which it is desired to receive. Tuned anode or resistance capacity units may be made up to fit the transformer sockets. If this is done, however, the present position of the grid leak will not be suitable for these methods of coupling. The grid leak instead of connecting across the grid condenser must connect the grid side of the condenser to the low-tension positive.

The construction of the two low frequency amplifiers follows very closely that of the previous units. A front view of one of the amplifiers is shown. It will be seen that the input and output terminals are arranged below the battery terminals

which occupy the same relative position as the previous units. The output terminals of the units under construction are placed in the same relative position as the output terminals of the detector unit.

The input terminals are correspondingly placed on the left side of the L.F. panels. The valve shelf peephole and filament resistance occupy the same positions as those given in Fig. 6 (Part 1 of



Panel for the L.F. units.

this article), which shows the lay-out of the detector panel. The method of mounting the L.F. transformer should be noted. It is placed in each unit behind the filament resistance. To ensure free movement of the contact arm the transformer is mounted away from the panel by means of short pieces of ebonite tube through which screws also passing through the panel and the feet of the transformer are bolted in position. A fixed condenser of .001 mfd. capacity is shunted across the primary of each transformer.



Fig. 11. Front view of H.F. amplifier, showing transformer sockets and top terminals.

The L.F. panels should be wired according to the wiring diagram given in Fig. 16. The diagram gives a back view of the panels as the wiring is actually carried out.

Connecting Up the Units.

The completed low-frequency amplifiers are attached to the right hand side of the detector panels and connected up to it by strips of stout wire. A back view of the completed set with the full number of units is shown in Fig. 14. A Marconi Osram valve is shown in the first L.F. unit, from which it is seen that as the niche inspection

(Continued on page 1250.)

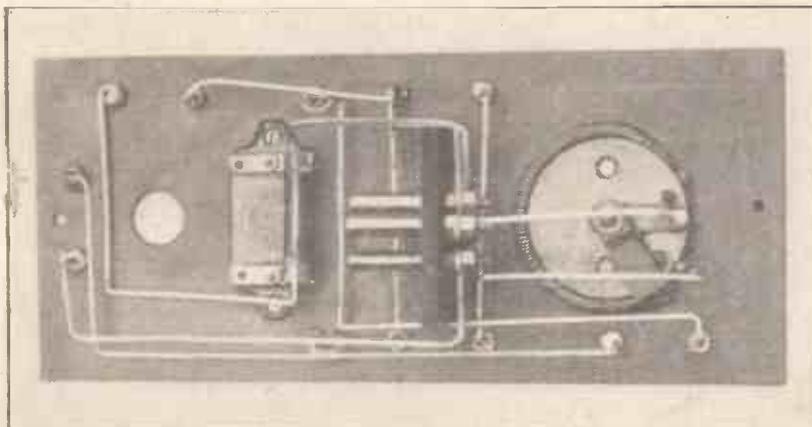


Fig. 9. Back view of detector unit. Reaction terminals are shorted if reaction not required.

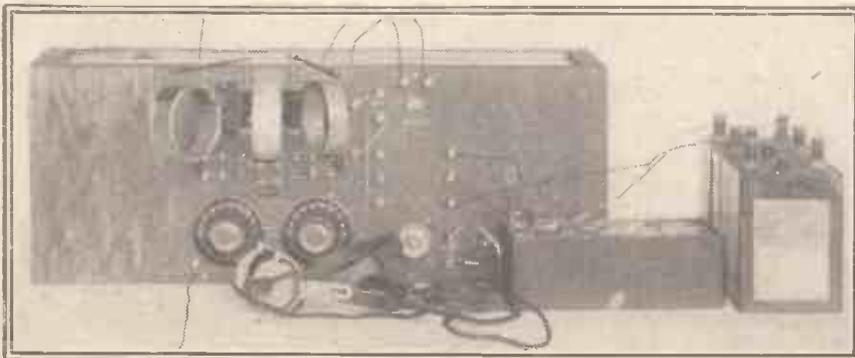


Fig. 10. The tuner and detector assembled as a single valve set.

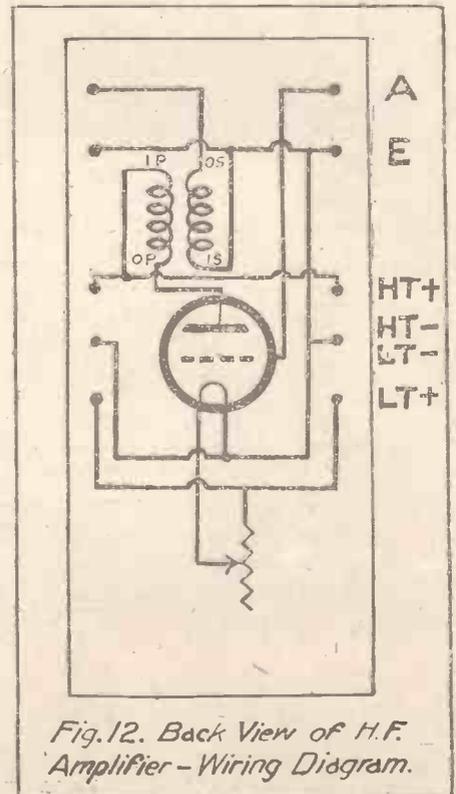


Fig. 12. Back View of H.F. Amplifier - Wiring Diagram.

A FOUR-VALVE "EXPANDING" SET.

(Continued from page 1249.)

hole is on the same level as the centre of the valve, the filament is readily visible. The front of the set is illustrated in Fig. 13, where it is connected up ready for operation.

In tuning to a station it will be found easier to start on the open circuit using a series arrangement of the .001 mfd. variable condenser where possible, and to change over to the closed circuit if greater selectivity

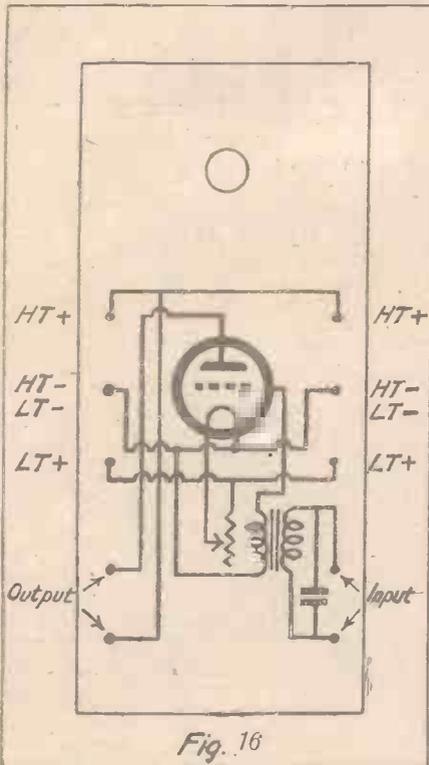


Fig. 16

is required. If the set has a natural tendency to self oscillate, it may be found an advantage to earth the battery side of the inductance coil. A theoretical circuit diagram of the complete receiver is given in Fig. 15.

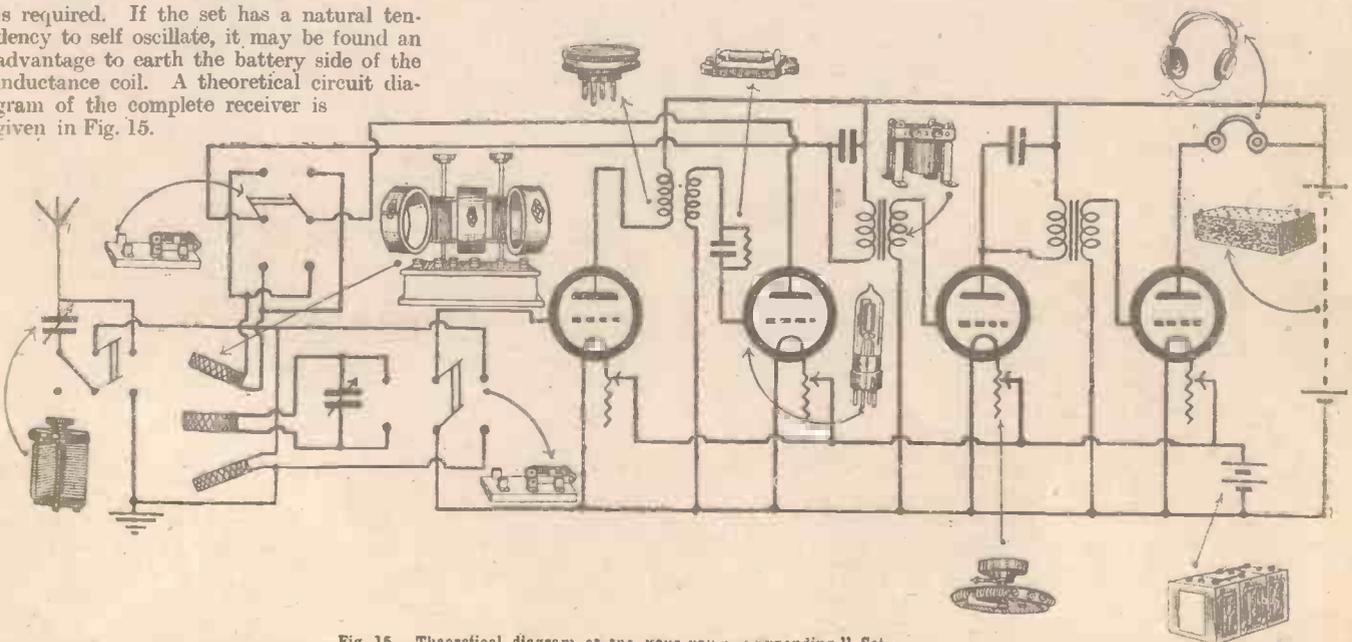


Fig. 15. Theoretical diagram of the four-valve "expanding" Set.

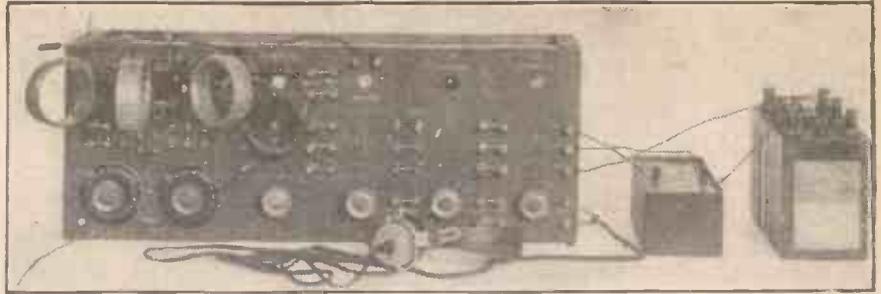


Fig. 13. The completed set ready for use.

With the assistance of the pictorial indications which are given, little difficulty will be encountered by even the less expert constructor in following the circuit.

Additional Refinements.

In order to increase the purity of reproduction when both L.F. units are in use, the addition of a 2 mfd. fixed condenser

connected to I.S. and their positives to the "E" lead. More especially if a power valve, such as a B.4, is used, this is to be advised.

It will be noticed that reference was made in the first part of this article, which appeared in last week's issue, to Fig. 13 as a back view of an H.F. unit. It has been found necessary, owing to lack of space, to withhold the photograph referred to,

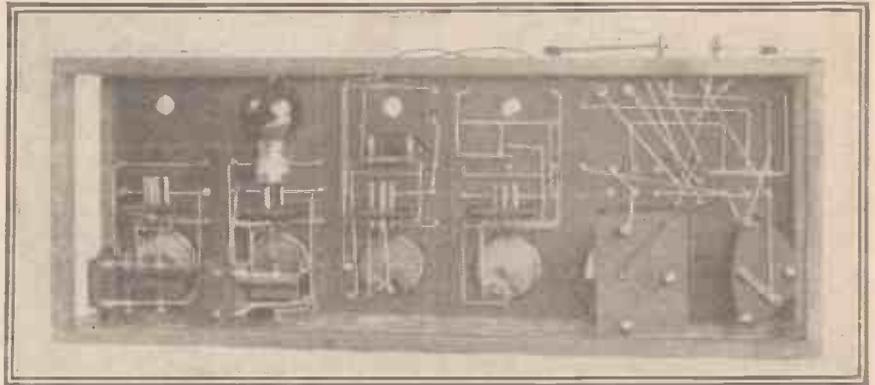
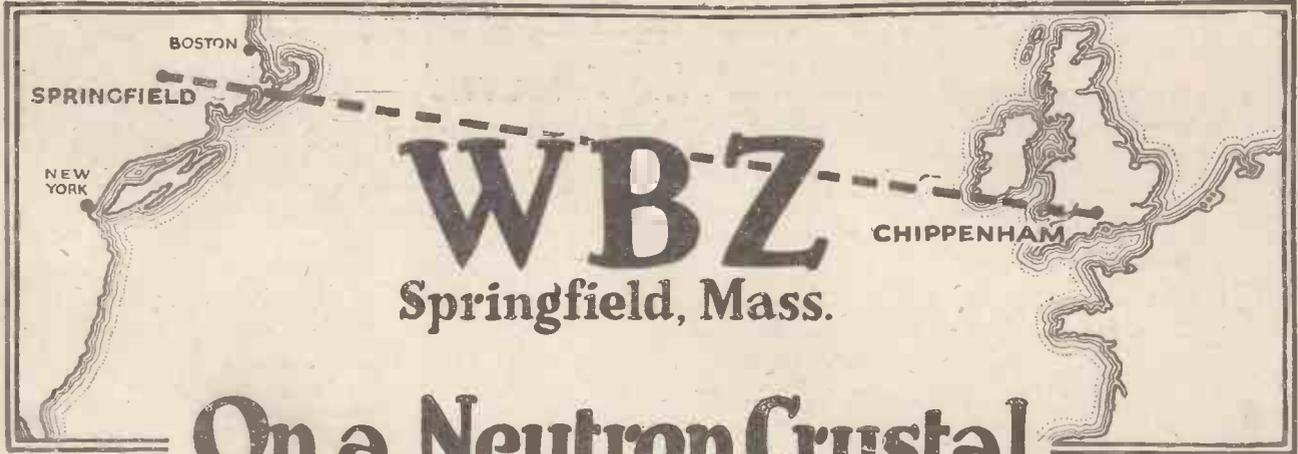


Fig. 14. A rear view of the set.

across the H.T. battery and one of .004 mfd. capacity across the telephone terminals is to be recommended.

Grid bias, too, can be added quite easily to the last unit by breaking the connection between I.S. of the L.F. transformer and the "E" lead, and inserting one or two small dry batteries with their minus poles

and this has occasioned a slight rearrangement of Fig. numbers. This does not, however, affect any other reference, and it will be found that Fig. 12, together with the fully explanatory text, clearly illustrates the advised method of making the connections to the H.F. transformer sockets.



WBZ

Springfield, Mass.

On a Neutron Crystal with 2 stages of Low Frequency

Chippenham, Wilts.,
December 14th, 1924.

Messrs. Neutron, Ltd.,
DEAR SIRS,

NEUTRON CRYSTALS.

As an enthusiastic owner of a 5-Valve set, I write to tell you of my surprising results with a small Crystal set. Owning the above-mentioned set and having been connected with Wireless Theory for the last 10 years and actual practice with a set for the past 5 years, I was, as I always have been, very sceptical about results when I bought one of your crystals a week ago. The results, however, have simply astounded me.

The first night, not having the ebonite ready, I just twisted some bare wire round the end of the detector and across the end of a plug-in (standard size) Coil block, the other end I connected with a pair of 'phone tags and condenser, a .0003 mfd. variable condenser for tuning completed my very crude "outfit."

Coupling up Aerial and Earth I was astounded by easily tuning 5 WA (40 miles), 6 EM (52 or 4 miles). I listened to the latter till close-down, and then picked up Madrid quite easily.

Of course, my mind was immediately filled with theories of re-radiation and such things as that. I will, however, admit that I made frantic haste to have everything properly mounted and soldered the next evening, when I again repeated the same performance. Subsequent tests have proved that 5 XX (100 miles, approx.) is absolutely comfortable strength, and 2 ZY (Manchester) is also audible.

Coupling a 2-valve **LOW FREQUENCY** amplifier to the above-mentioned set at 1.50 a.m. this morning, I picked up Music and Solos (Soprano and Baritone) from WBZ (Springfield, Mass.), and was in good touch for about 10-12 minutes, when the signals faded away.

A continued watch was kept for 11 hours, during which time I was in touch for about 60 per cent. of the time. Not so bad for the much-despised Crystal. Needless to say, I am now very much converted.

It is my hope now to be able to receive America direct with Crystal only, and with the strength that different stations have been coming in at this address I am feeling quite confident that it can be done. Needless to say, the Crystal will be Neutron.

My aerial is 100 ft. long, 34 ft. high leading-in end, 28 ft. high far end. Please particularly note that all current was switched off from the valve set during these tests, and every precaution taken to give the Crystal a "fair chance."

Very sincerely yours,
(Signed) R. A. H.

P.S.—During reception of Springfield, Mass., I distinctly heard the announcer give the call letters of the station *twice*, so that there is no doubt as to the accuracy of the reception.—R. A. H.

THIS is, we believe, the record for long-distance broadcasting reception on land.

Note that the only amplifier used was a low-frequency one; interpreted to the non-technical, this means that the signals were actually received and rectified by the **NEUTRON CRYSTAL**, the two valves serving merely as note-magnifiers, and not as "range-increasers."

The original letter, a copy of which is given here, may be inspected at the NEUTRON Offices.

Here is sufficient proof of the super-sensitiveness of **NEUTRON CRYSTAL** to justify you in selecting this as your Crystal. Sooner or later you will come to it, in any case, and in deciding **NOW** for **NEUTRON**, you will easily save the price of another pair of phones, by saving the expense of further tests.

and you can get the same results with a

Stocked by the best Radio Dealers: Packed in tin with silver cat's-whisker. Insist on Neutron. in the Black and Yellow Tin—or send 1/6 and Dealer's name, and this wonderful Crystal will be mailed by return.

Concert Tested and Guaranteed.

Sole Distributors:—V. Zeitlin and Sons, 144, Theobald's Rd., London, W.C.1. Phones: Museum 3795 and 6841. Produced by:—Neutron Ltd., Sicilian House, Southampton Row, London, W.C.1. Phone: Museum 2677.





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 Resistance 5 ohms, 6/- each.

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The VERNISTAT, the most delicate instrument yet produced for filament control. The EFESCA FIXED CONDENSER. The extra care and thought in the making of these enables us to guarantee their capacity accurate within very close limits.

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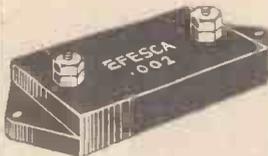
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Rigidly built to obviate leakage and ensure unvarying capacity. Every condenser is guaranteed accurate within close limits.

Price: '0001 to '0005 mfd., 1/4 each; '001 to '005, 1/4 to 2/- each.



EFESCA HEADPHONES

A popular priced headphone maintaining the usual Efesca standard of quality. 4,000 ohms, with 6 ft. flexible cord, 21/-.

A Retailer writes: "Capt. —, M.C., of this town, said that he had tried 9 different sorts of high-class Headphones; and that the Efesca were a complete revelation to him."

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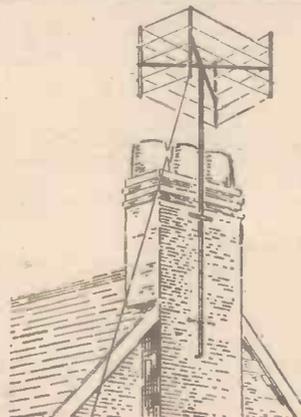
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THIS AERIAL HAS BEEN FULLY TESTED ON ALL KINDS OF SETS AND HAS NEVER FAILED TO GIVE THE BEST POSSIBLE RECEPTION

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HOW TO CHOOSE THE RIGHT COILS AND CONDENSERS.

USEFUL ADVICE FOR CONSTRUCTORS.

FROM A CORRESPONDENT.

The information given in this short article has been condensed so that the prospective constructor has essential advice on the suitability, etc., of coils and condensers complete in one article.

A DIFFICULTY often met by an amateur is that of choosing the size of coil or variable condenser to suit his set or his particular requirements as to wave-length, in order to tune in a near or some more distant station. The present article

not know whether to use the larger size coil and variable condenser of larger value, the smaller coil with variable condenser of lesser value, or any variation of these.

To begin with, he should draw a base line XOY (Fig. 1), and set up verticals at each point on which he will

presently mark the maximum, normal and minimum wave-length values obtained from the above formula. To a convenient scale he will draw a line parallel to the base to represent 365 m., the wave-length of 2 L O. At P and Q he will draw parallels to represent the normal wave-length of each of his coils, O P being the wave-length of the one-inch coil, and O Q of the two-inch coil. The maximum and minimum values of his two-inch coil, using the .001 variable condenser, are then plotted at E and E', and each point joined to Q. This is repeated for each condenser, and again for the one-inch

results obtained by using Fig. 1 may be plotted in another and more convenient form, as Fig. 2, where the maximum and minimum wave-lengths obtained by each condenser for coils of varying lengths are joined, forming curves by which at a glance it will be seen if the coil and condenser chosen will do the work required.

Effect of Reaction.

Thus AB shows that if a .001 variable condenser is used on a two-inch coil, it will tune from 260 to 580 metres, thus conveniently including 365, the wave-length of 2 L O, while if the same condenser were used with the one-inch coil, the wave-length obtained would vary between 130 and 310 metres as at CD, thus necessitating a larger condenser, say .0005, which would alter the range from a minimum of 210 to a maximum of 430 metres.

It must be remembered that the values found by using a cylindrical coil as above would not be correct for basket or duolateral coils, which, unlike cylindrical coils, have very small self-capacity, and which has not been taken into account in the above calculations. It must also be noted that values alter when reaction is used, the set having to be slightly retuned when reaction is brought into use. The principle, however, remains the same, and it is hoped that the illustrations given will serve to "clear

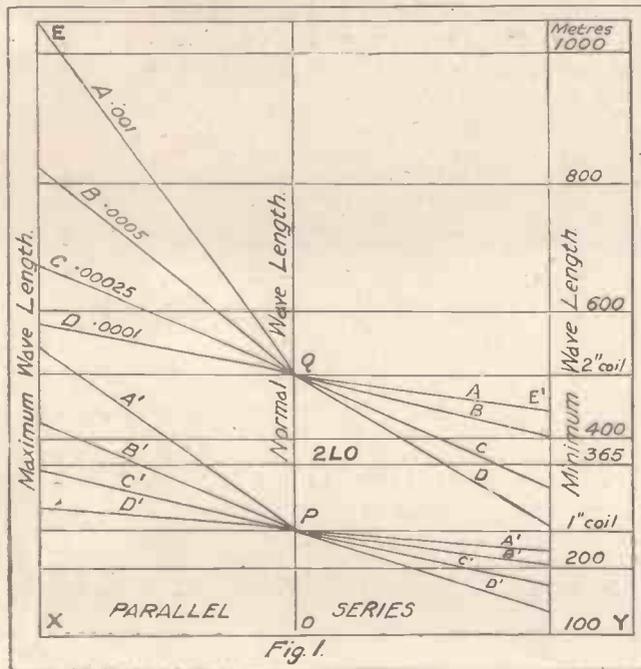


Fig. 1.

is intended to show in diagrammatic form, as simply as possible, the effect of his choice in selecting such coils or variable condensers as may be available, and the results obtained by placing the variable condensers either in parallel or series.

Choosing Condenser Valves.

It is generally known that the wave-length (λ) of a tuning circuit (including aerial and coil) is deduced from the formula $\lambda = 1885 \sqrt{L \times C}$, where L and C represent the inductance in microhenrys and capacity in microfarads respectively. It will also be accepted that the total capacity of several separate condensers in parallel is the sum of their individual capacities, while the reciprocal of their total capacity in series is the sum of the reciprocals of their individual capacities. By adapting these laws we are enabled to plot curves shown in Figs. 1 and 2, from which much useful information may be obtained.

Let us suppose the experimenter has four variable condensers of values .001, .0005, .00025, and .0001; also two cylindrical coils of 1 inch and 2 inches diameter, 3 inches long, and wound with 24 gauge D.C.C. wire. He desires to tune in, say, 2 L O, but does

coil, when it will be found that the lines C and D drawn for the two-inch coil and A' and B' for the one-inch coil each intersect the parallel representing 2 L O. From this it will be obvious that for economy, and as giving greater range of tuning, it will be better to use a .0001 variable condenser in series on the two-inch diameter coil, rather than a .001 or .0005 in parallel on the one-inch diameter coil.

This process may be continued for larger and longer coils covering the longer wave-lengths.

It will be clear from Fig. 1 that the practice often adopted of placing a .0001 fixed condenser in series on the aerial is often useful for short-wave reception, as it reduces the wave-length to a low value, which can easily be raised by adding another variable condenser, also in series or parallel, smaller coils being used if still lower wave-lengths are required. The

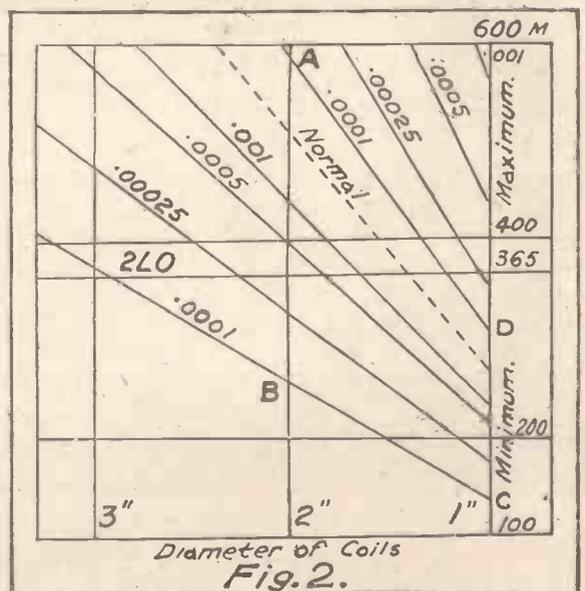


Fig. 2.

the air" a little for the non-technical experimenter, and give him some guidance in the selection of his units for successful reception.

THE NEW 110-VOLT VALVE.

"Direct from the Mains."

By L. W. CORBETT

(Formerly of "P.W." Staff and now our correspondent in New York.)

Amateurs will be interested in these details from America of a new type of valve which our correspondent recently investigated.

NOWADAYS we read of so many epoch-making (so described) inventions that it is unusual to give them more than cursory consideration, but the development of the valve described in this article is without question the most far-reaching in importance of any invention since the advent of the three-electrode valve.

This new invention is in the form of a valve that works direct from the mains. Just think what this means—no more heavy accumulators to be carried perhaps miles to have them charged, and then often at an exorbitant price, and that constant fear that the battery will run down when a much-favoured programme is to be broadcast will be at an end when these new valves make their appearance on the British market, as they no doubt will in the near future.

This valve, by the way, is of American origin, but that is no reason why it should not make its appearance over here, as some British manufacturer will no doubt obtain, or may already have obtained, as far as I can tell, the British rights for making them in this country, as is the case of some of the apparatus now being sold here.

"Extremely Long-Lived."

The internal construction of this valve is entirely new. It is fitted with the standard Edison lamp base, so that it will fit into any electric light socket.

The British socket is, of course, of different design. As I have stated before, this new valve has been brought out to work directly from the 110-volt house-lighting circuit, without the usual supplementary device—whether this supply is alternating or direct will make not the slightest difference.

The grid and anode leads are kept separate, which, of course, is of distinct advantage, especially in the case of short-wave work, which is now becoming so popular. One of the first questions that is likely to be asked is, "Is there any hum?"

The reply is, "Absolutely none." No "hum" or ripple from the high-voltage supply is apparent.

Preliminary tests of this new valve show that its filament is extremely long-lived, and will last for as much as ten times the life of the present valves, and when ultimately it does burn out it will probably cost less to renew than is the case with the ordinary six-volt type.

Now, referring to the construction, the elements are housed in the usual glass bulb, but this latter possesses different features. There are three indentations in the surface of the glass, which serve as passages for the connections to the various enclosed

elements. The exhaustion tip is at the lower side.

Fastened to the lower end of the glass tube, and extending right into the bulb, is a thin quartz tube, which is sealed at the upper end and left open at the lower end in order to receive the heating element.

This latter element is made of flat "nichrome" resistance wire wound over an "alundum" rod, and the complete element fits into a quartz tube. By simply removing the screw at the base of the tube, the heating element may be completely replaced.

Fitting closely over the quartz tube and inside the evacuated tube is an "alundum" sleeve. This is one of the essential elements of the new valve, and corresponds to the filament of the ordinary valve in action.

The Heating Element.

In action the "alundum" sleeve is brought to red heat, and it is for this reason that quartz is employed to house the heating element, as it will stand the high temperature.

The "alundum" sleeve, which is called the cathode, is encircled by a cylindrical grid of fine-mesh wire, which is suspended inside the valve by being sealed to a terminal at the top of the glass bulb.

Outside the grid is a metal cylinder forming the anode, which is also connected to the glass bulb. As in the case of an electric heater, the heating element in the

110-volt valve requires a short interval after switching on before it is red hot. When the "nichrome" resistance wire concealed within the close-fitting quartz tubes becomes red hot, the heat is conducted to the quartz tube, which also becomes red hot. Then the tight-fitting "alundum" sleeve will start to get hot also.

Result of Actual Tests.

Thus, it will be seen, the cathode receives its heat in this type of valve through conduction rather than directly, as is the case of a current being passed through a filament. When the cathode gets heated to a dull red, as in the case of the '06-amp. valve, it becomes a source of electron emission, and, on account of its large surface, is able to supply an abundance of electrons for any desired function.

The action of the valve, with the exception of the cathode heating, is the same as in any three-electrode valve, so it may be used in any circuit in which standard valves are employed.

Drastic rewiring of any existing circuit, so that these valves may be employed, will not be necessary, only a few changes to the filament circuit being required.

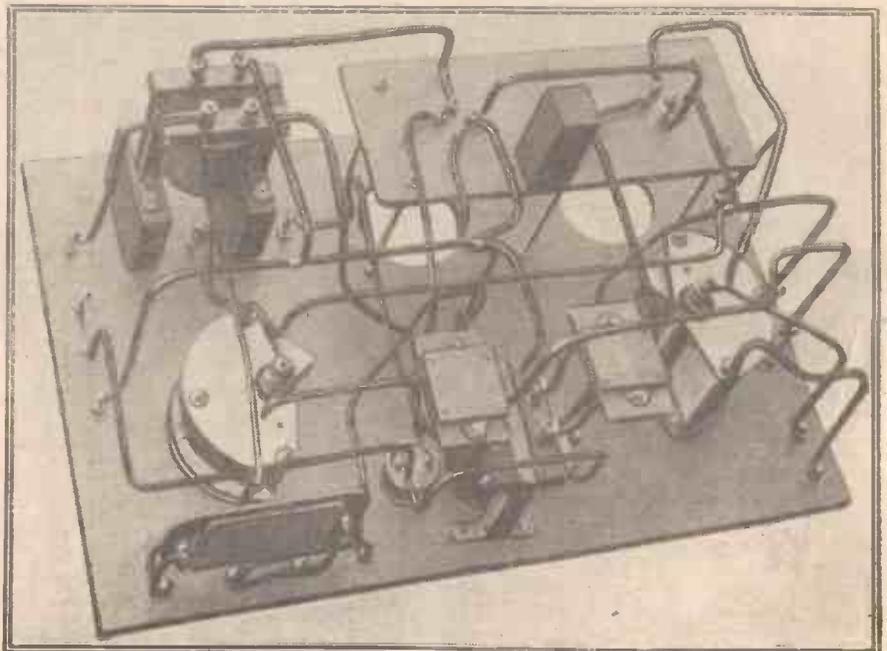
The leads, which in existing circuits connect from the grid circuit to the accumulator, will go to the cathode terminal of the new valve, while the ordinary grid and plate leads connect to the grid and plate terminals on the bulb as usual.

A high-tension supply is still, of course, necessary, but this may also be obtained from the house supply with a little extra apparatus.

There is no reason, however, why the "Unidyne" principle should not be adapted to a circuit employing this tube, in which case no batteries whatever would be necessary.

From the standpoint of economy and convenience there is nothing to complain of, while range and volume with the tube are excellent.

In actual tests, the current consumption of the new valve averages about 50 watts, which works out at about $\frac{1}{4}$ d. an hour.



An example of neat, well-spaced wiring. A "P.W." Reflex set made by Mr. Cyril Taylor, of 61, Diana Street, Roath Park, Cardiff.

Mainly About Broadcasting

by
The Editor

THANKS to the initiative and enterprise of Mr. Donald Calthrop, the well-known theatrical manager, responsible at the moment for the successful production "Yoicks," the senseless opposition of many theatrical managers to the broadcasting of excerpts from musical comedies, plays, revues, etc., is likely to be nipped in the bud.

A few days ago it looked as though the opposition party would have it all their own way. The threat of the provincial managers to refuse to book any play for the chief provincial centres that had been broadcast—even in part—was something in the nature of a coup, and several managers who had inhaled up their minds to give broadcasting a trial—especially after the astounding effects broadcasting had on the box-office receipts of His Majesty's Theatre, where "Patricia" is now being played—found their schemes nipped severely in the bud.

In fact, it looked as though the opposition was to have it all their own way, but at the eleventh hour along came Mr. Calthrop, courageously flying the flag of defiance, and declaring that he has the right to broadcast excerpts from "Yoicks" if he wants to.

Now it wants a lot of courage to risk a boycott such as Mr. Calthrop has laid himself open to, but the threat to ban "Yoicks" at some of the chief provincial theatres has not intimidated this go-ahead manager. If the ban is carried into effect, Mr. Calthrop does not intend to abandon the idea of a provincial tour; he will carry on, and give his show in tents and such halls, etc., that he can hire. He will tour "Yoicks" like a circus, and I'm sure he will do it successfully.

Public sympathy is with him, for there is nothing the public hates more than obstinate prejudice. The opposition party have absolutely no evidence that the broadcasting of excerpts from plays has a detrimental effect on box-office receipts. On the contrary, it has been proved time after time, that where the promoters of a good show have agreed to have parts of it broadcast, the effect on the box-office receipts have been all to the good. Witness the effect after parts of "Patricia" had been broadcast.

Mr. Calthrop does not believe that to broadcast "Yoicks" before it goes on tour will have an adverse effect on its reception in the provinces. No keen business man would believe such a fantastic theory. The fact that other theatrical managers do is to be regretted, no doubt, but that is their own funeral. Mr. Calthrop is right, and it is to be hoped he will win out and that the sooner the opposition realise it, and that broadcasting offers them enormous possibilities, instead of arguing illogically about its harmful effects, the sooner a stupid controversy will fizzle out, and the theatrical world enjoy the benefits broadcasting can offer to those who are progressive enough to accept them.

Just before going to press with this page I learn that Mr. Andre Charlot, the well-

known London manager, has decided to allow part of his revue, now playing at the Prince of Wales Theatre, to be broadcast, and it is likely that by the time this issue of "P.W." is on sale listeners will have heard extracts of Mr. Charlot's sparkling revue.

THE "P.W." TECHNICAL QUERIES DEPARTMENT.

Owing to the extraordinary growth of the Technical Queries Department, it has been found necessary to revise the regulations governing the conduct of this department.

Readers are requested to note the new rules, which are published in full in the Radiatorial columns of this issue.

Mr. Archibald de Beere—part founder of the famous "Co-Optimists," has also made arrangements for broadcasting part of a new revue he is interested in.

The progressive action of these two London managers will be a blow to the "die-hards"—and I think it sounds the death knell of the opposition which has tried so hard to restrain theatres from having anything to do with broadcasting.

On page two readers will find a short cross-word puzzle, composed by Mr. E. Blake, A.M.I.E.E. I have called it a "Valve" Cross-Word Puzzle, and Mr. Blake has put his riddle in "verse," just by way of novelty. The prize of two guineas

is offered on the understanding that my decision is final. It will be awarded to the reader who sends in the correct solution. If more than one correct solution is received the prize will go to the reader whose letter containing the correct solution is first opened. The closing date for entries is January 29th. And now get busy—and solve it if you can!

The B.B.C. have been at some pains to explain their policy in connection with the broadcasting of alternative programmes, supplied from "outside" sources.

A London newspaper recently "supplied a concert" en bloc, which was broadcast from 5 X X.

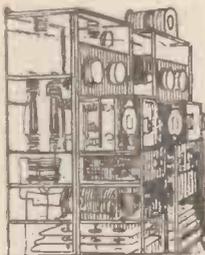
The merits of the concert, as a concert, need not be discussed here. That is a matter for the critics and the public taste; but the policy of the B.B.C.'s decision to allow "outsiders" to arrange an occasional concert is quite praiseworthy.

There is no logical reason why big concerns which can afford the outlay should not be allowed, at reasonable intervals, to "supply the talent." Harrods were the first, and no harm was done. Providing this "sub-letting" idea is kept within reasonable bounds, it should prove beneficial, not only to the B.B.C., but to listeners-in, who will doubtless appreciate the variety in the programmes, etc., made possible by this procedure.

I would suggest, however, that the B.B.C. would be doing a gracious thing if they invited the Wireless Publications to organise a concert.



This apparatus was used recently to "wireless" a portrait of Queen Alexandra to America.



Artistes of the Aether

By "Ariel"



Some of those who have given you pleasure when listening-in.

WITH Christmas well behind us, we now have time to look forward to what is, after all, the most important part of broadcasting—the programmes.

Judging from the preliminary announcements, still much precious time and current is to be wasted on many quite unwanted "talks," but there is a marked rise in the barometer as concerns first-class artistes, and amongst those who have been heard recently are Miss Carrie Tubb, the great Wagnerian singer, Miss Dorothy Silk, Miss Astra Desmond, Miss Winifred Small, Miss Adelina Leon, and the "stars" of the B.N.O.C., including Frederick Collier, May Blythe, Eda Bennie, and Miss Elsie Treweek.

A capital idea it was to broadcast Humperdinck's fairy opera "Hansel and Gretel" in the Children's Hour at 2 L O as well as previously in the ordinary programme, for it is essentially a work that children can listen to as well as see, and all the artistes were at their best. Miss Treweek, as the Witch, was indeed most realistic, and when one considers that her best-famed part is that of Venus in "Tannhäuser," to the Witch of Humperdinck is a wide step.

Apart from her operatic work, she is well known on the concert platform and she has been heard in all the principal halls of London and the provinces.

Humorous Items.

This, a most important section of all programmes, has been in good hands this last month. John Henry and Helena Millais are, of course, ever welcome, and it is good to note that they do not rely on stale material, even though they adopt the same characters. The same may be said of Louis Hertel and Vivian Foster, Vicar of Mirth ("Yes, I think so!"), also of R. Stephenson, Charles Wreford, teller of Devonshire stories, and Miss Stella Hackman, who was announced to broadcast again on the 6th. inst. Miss Hackman is one of the earliest of all our "artistes of the aether," for her resonant tones and clear articu-

lation were first utilised in the old days at Marconi House.

Popular Nights.

These actually are quite as difficult to frame as high-brow symphony, and in this respect 2 L O has scored well. Two artistes recently heard were Philip Middlemiss and George Pizzev.

Mr. Middlemiss is an entertainer who relies mainly on sheer literary merit for his success. Widely known on the concert platform, the War carried him into the trenches, where even then he was often told off for "relief" duty in the way of song and story. Subsequently he returned to his own profession and under the aegis of the B.B.C. is one of those who "stop at all stations."

In the way of vocalists, Mr. Pizzev is assured of success. Well known to listeners-in, broadcasting first in 1922, Mr. Pizzev is essentially an English singer. Of London birth, he commenced his musical career at the age of nine as choir boy of a west-end church, then under the direction of H. L. Balfour, the conductor of the Royal Choral Society, the carol recital of which was broadcast during the holidays.

During the War Mr. Pizzev fought in France and Belgium, subsequently taking up singing as a profession, studying at the R.A.M., and finally with Eugene Goossens, senior, of the Carl Rosa Opera Company. Apart from his choral and oratorio work, Mr. Pizzev does a great deal of concert singing, and in addition he is bass soloist of the church in which he started as choir-boy, thus, as he says, fulfilling his boyish ambition to occupy that post, also once held by Robert Radford, the famous bass of the B.N.O.C. Much of his success is due to his clarity of diction.

The "Super" Broadcast.

This particular "super" is not the ubiquitous individual of the Christmas pantomime, but a really most realistic production by the Cardiff station. Termed a Radio Pageant in three episodes, with the attractive title "The Pied Piper of Hamelin," the outstanding feature lies in the fact that the scenes are actually enacted out-of-doors, in order to obtain the last word in realism; real horses, galloping, real crowds with real clogs, and fountains with real water, broadcast from the open air

while the play proceeds in the studio. It is to be hoped that the B.B.C. do not go a step farther, and insist upon a real fire or a shipwreck in order to add, as Gilbert would have put it, "verisimilitude to an otherwise bald and unvarnished tale."

Newcastle.

The British public might be in danger of forgetting that we possess our own real "home-made" early operas, apart from "The Beggars' Opera," were it not occasionally for the great provincial centres. A word of praise is due to Newcastle for literally "unearthing" some of the most melodious of rarely heard works. Amongst them figured Wallace's "Lurline," as well as the more familiar "Maritana," and Purcell's "Don Quixote," the title and story of which was also used by Isidore de Lara quite recently.

Military Bands.

Of all types of music, the military band broadcasts less favourably than any other class of music. The brass tones on a "hurdy-gurdy" tone that detracts from the beauty of the actual music. No one who has heard, say, the Royal Artillery band or H.M. Royal Air Force band in the actual hall, such as the Palladium, will but admit that when broadcast, the difference is astounding, and to waste a whole evening of the high-power station on a military band, excellent though that of the Grenadier Guards is, generally speaking, was not to be commended.

Belfast.

The Irish programmes continue to maintain a very high standard, and in one or two cases we have had some Irish artistes here who have proved their mettle. Heard recently at 2 L O was a brilliant young violinist, Miss Edith Kelly-Lange. She is a true daughter of Erin, studying at the Royal Irish Academy of Music, Dublin, from the age of six years. At an early age she took part in the Feis Cecil, the Irish Annual Musical Festival, and which corresponds to the famous Welsh Eisteddfod.



Miss Elsie Treweek.



Miss Edith Kelly-Lange.



Mr. Philip Middlemiss.

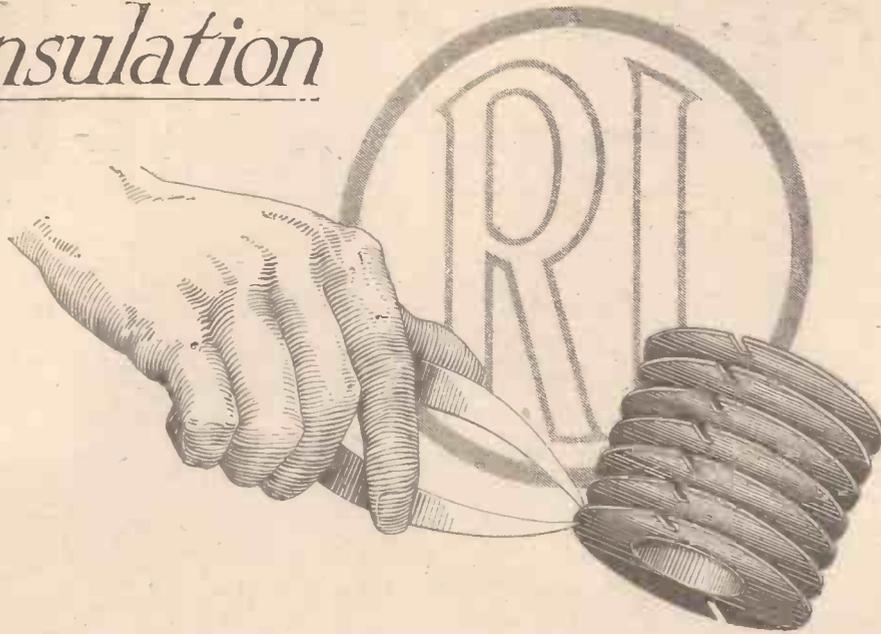


Miss Stella Hackman.



Mr. George Pizzev.

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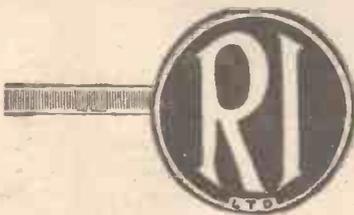
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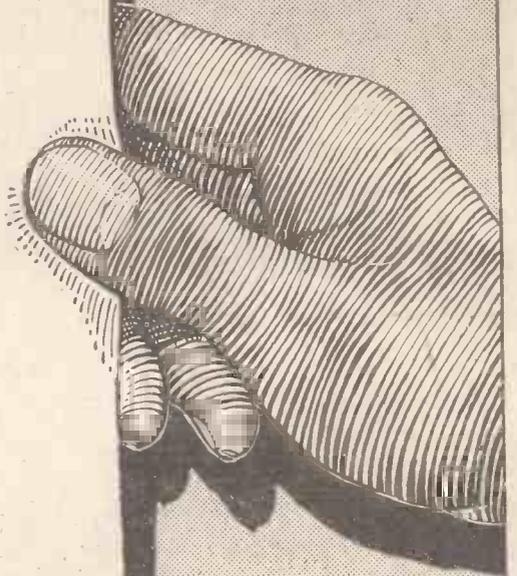
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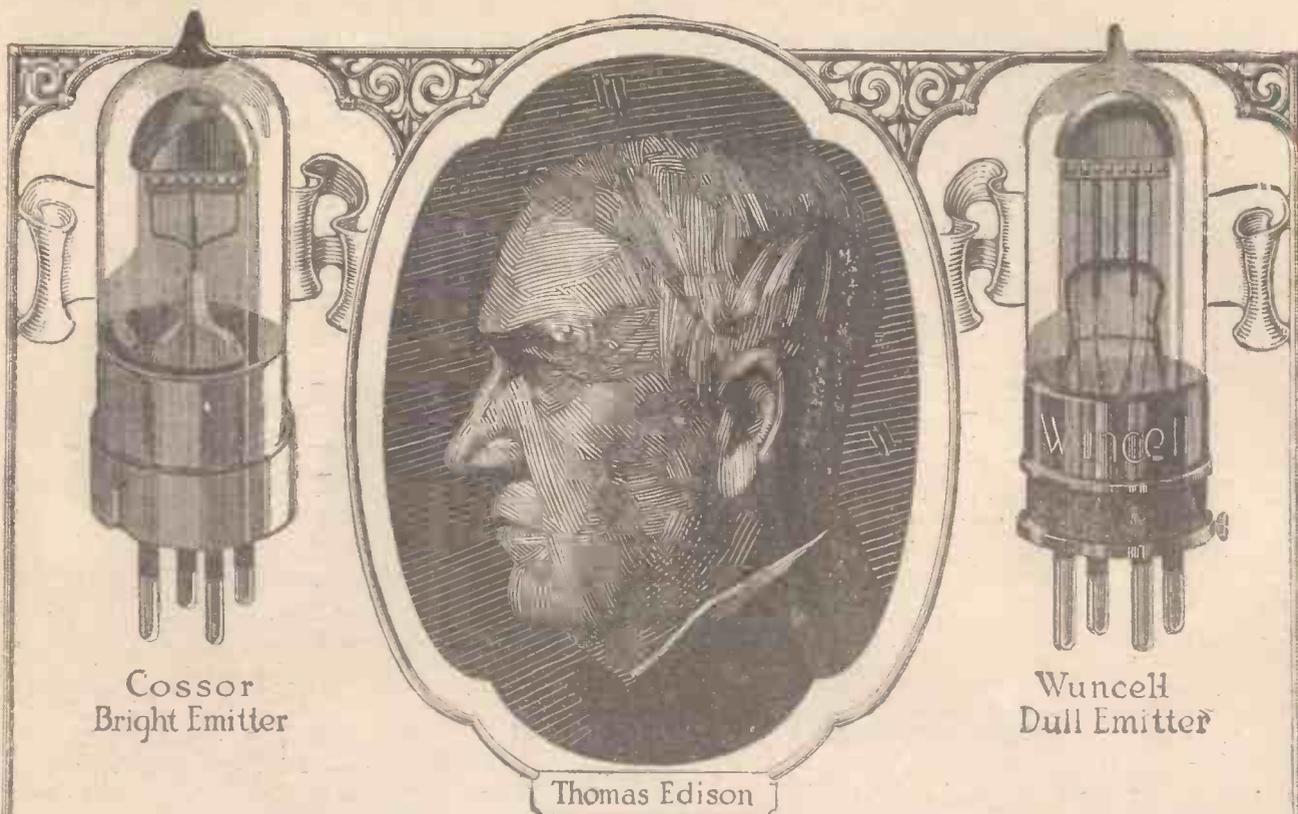


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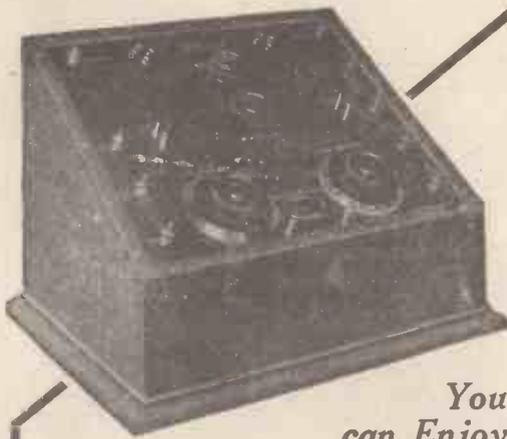
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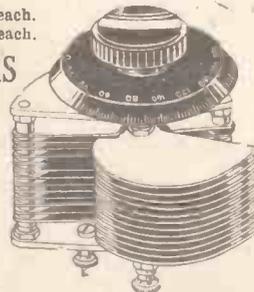
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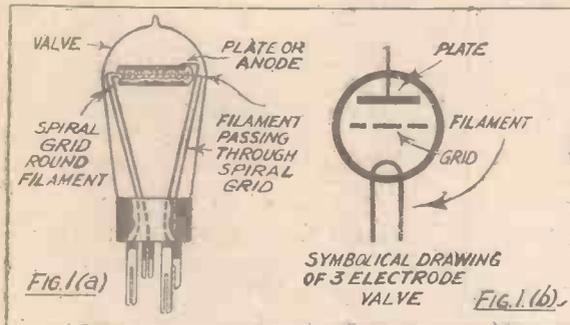
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PART 11. THE VALVE AS A RECTIFIER.

IN the last article we arrived at an understanding as to how the "plate current" is set up. The plate current, let me remind you, is that which flows from the glowing filament to the positive plate, through the high-tension battery, and from thence to the filament again. We must now consider the action of the "grid," which is a coil of wire, or mesh of wire, interposed between filament and plate. Fig. 1a is a drawing of a valve, and Fig. 1b



shows how a three-electrode valve is represented in electrician's diagrams.

Let us suppose that we have connected up the valve to the low-tension battery. You know that a stream of electrons are flowing from the filament en route to the positive plate. But there is this grid in between them and the plate. What happens is that whilst some of the electrons manage to find their way through the grid, others are less successful and are caught by it. Presently the grid accumulates so many electrons that its repelling influence, as a negatively charged body, is sufficient to prevent any more electrons reaching the plate and the plate current stops. So much for a *negative* grid.

Controlling the Grid.

Next, suppose we charge the grid *positively* by some outside means, and maintain it positive. The situation inside the valve changes, for the electrons escaping from the filament are not only attracted by the positive plate, but are encouraged to get to it by the positive grid. In fact (to parody the old song), "everything in the garden is positive," except the electrons. Under these circumstances the plate current increases. So much for a *positive* grid.

We have now to tackle the application of the valve to wireless reception. As has been explained in earlier articles, we have in our aerial an oscillating current, and therefore an alternating electro-motive force (E.M.F.) of very high frequency. In the case of the crystal detector the H.F. current is rectified and the pulses of current are caused to actuate the head telephones. In a valve receiver the valve also acts as a rectifier; this means that it is caused to act for all practical purposes as a one-way

conductor, thus converting the oscillations into pulses of direct current which can work the telephones. This is done as follows:

When you connect the aerial to the aerial terminal of your set you really connect it to the grid of the valve, because the aerial terminal is so connected *inside* the set. Fig. 2 shows how this is done. How the electrical energy jumps across the space between the coils L1 and L2 will be explained another time; let it suffice for the moment that it does, and that an alternating E.M.F. is applied to the condenser C1, which is to say that each side is positive at one moment and negative the next, and so on alternatively, as many times a second as the frequency of the waves striking the aerial.

(Ignore the presence of the condenser C2 and the squiggly line R round it for the moment, please.)

With an alternating E.M.F. applied to the condenser C1, it is plain that the same alternating E.M.F. will be applied to the grid and the filament. This means, of course, that the grid will be first made positive and then negative many times per second. Now look at the diagram and see what has been done to the path of the plate current. A pair of telephones has been joined up in it.

H.F. Impulses.

Now, if you have followed previous instructions you will know that what makes telephones respond and give forth sounds are *changes* of currents passing through them. It will also be understood that each complete wave influencing the aerial produces therein one complete oscillation, one surge being positive and the other negative. We will refer, therefore, to the positive and negative halves of a wave. Fig. 2a is a diagrammatic drawing of one oscillation. Considering the distance of the curve (at any point on it) from the horizontal line as a measure of the E.M.F., induced in the circuit by the passing wave, it is easy to see that at A the E.M.F. is zero, that it rises to a *positive* maximum at B, begins to decrease and reaches zero at C, changes direction for the second half of the oscillation, rises to a negative maximum at D, decreases in value again until it becomes once more zero at E. That is a complete "cycle" of events which occur with unimaginable rapidity; if you are receiving a 300-metre wave, for instance,

the complete cycle takes place a million times every second during the time that the transmitting aerial is radiating. The mind is liable to become confused if it dwells upon such frequencies, which are best accepted as facts while we are trying to analyse the action of the valve detector. Let us rather view the oscillations mentally through a slow-motion camera.

The Grid Condenser.

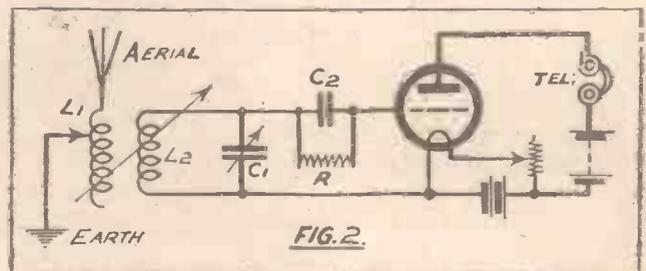
Looking once more at Fig. 2, it will readily be realised that if we were not to place the condenser C2 where it is, any electrons desiring to leave the grid could easily escape by passing through the coil L2 and thence to the positive terminal of the filament battery. They cannot, however, jump the gap made by condenser C2.

Suppose the first half-wave be positive. This applies a positive E.M.F. to the grid, to which a number of electrons are quickly attracted. Result: a slightly negative grid, and a negative grid means a drop in the current in the plate circuit.

The second half-wave applies a negative E.M.F. to the grid. This, already negative, becomes more so, and there is a big drop in the plate current. The positive half of the next wave arrives immediately, but cannot quite compensate for the now very negative grid, and when the next negative half-wave arrives it makes the grid more negative than ever; and if this process were to continue obviously the plate current would be completely stopped and the valve would not work.

Use of Leak.

To get rid of the surplus of electrons, which by the means just described pile up on the grid and the grid side of the condenser C2, we connect across the condenser C2 a very high resistance. (See R in Fig. 2.) This is a conductor, which, while it will not let the electrons pour helter-skelter through it to the coil L2, and so back to the filament



battery, will at least allow them to limp or "leak" painfully away. By this simple method the valve is enabled automatically, to bring itself into a condition whereby it can change the value of the plate current as much as possible each time it is required to do so, without becoming choked.

(Continued on page 1262.)

SOME USEFUL IDEAS.

A Useful Coil.

THE accompanying photograph depicts a very simple form of tapped coil which can be used in many different ways. It is easy to make and can be adopted to any desired purpose with the minimum of trouble. Instead of connecting the tappings to the orthodox multiple switch



which, of course, must be mounted on an ebonite panel and supported by a cabinet or other similar device, each tapping is arranged to terminate on the coil itself, under the shoulder of a small telephone terminal which is clamped to

the cardboard former. Making the tappings is simplicity itself.

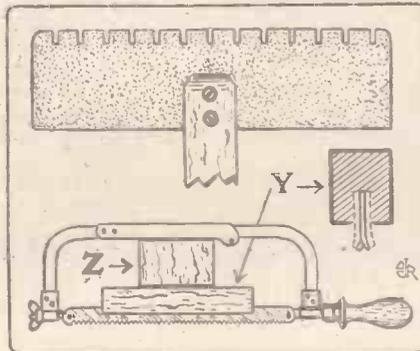
At the desired point a hole is pierced through the side of the former, and into this is fitted the shank of the terminal, which is provided with a brass washer. The wire is bared at this point, and then looped round the terminal shank, between the shoulder and the washer. Another washer is placed over the projecting end of the shank inside the former, the nut then being screwed up very tightly. The beginning and end of the winding is also connected to terminals in the same way.

If the tappings are arranged in the following order, as shown in the photograph, the coil will be found most useful. From top of coil (first terminal) to second terminal, 35 turns; between second and third terminals, 15 turns; between third and fourth terminals, 25 turns, and another 25 turns between the fourth and fifth terminals. Thus one is able to tap off 15, 25, 35, 40, 50, 65, 75, 85, or 100 turns by using two connecting wires and a little mental arithmetic. For example, if 35 turns are required, we connect up our leads to the first and second terminals; for 15 turns, second and third terminals; for 25 turns, third and fourth or fourth and fifth terminals; for 50 turns, third and fifth or first and third terminals; for 75 turns, first and fourth terminals, and so on. For loading existing coils to higher wave-lengths such an arrangement will be found almost indispensable.

Cutting Slots with Saws.

IT is often a very difficult matter to cut a number of slots of equal depth without the use of a guide or stop, and unless the slots in frame aerial spreaders are all of equal depth the appearance of the winding is anything but pleasing. The accompanying sketch depicts a simple and effective means of attaching a stop to the ordinary hacksaw. A piece of wood, Y, is

carefully slotted with the saw to be used for the job and then push over the saw blade in the manner shown. The distance between the point of the teeth and the under side of the wooden block, or in other words the depth of the slot in the block, will depend on the desired depth of the slots to be cut. The underside of Y should be accurately flat and perfectly smooth. Another wooden block, Z, is wedged firmly between the saw frame and the lower block in order to keep the latter in position during operations.



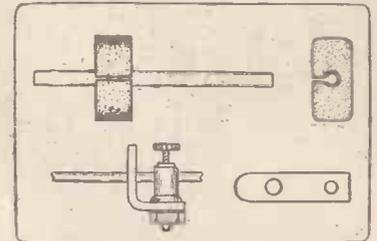
A slot cut with a single hacksaw blade is usually wide enough to accommodate the wire employed for winding frame aerials, but if, for other purposes, a wider slot is required then two or three blades should be fitted to the saw frame, which will usually accommodate three blades.

Simple Depth Gauge.

THE depth gauge is a very useful tool in the radio mechanic's workshop and this can easily be made from a small block of fibre or ebonite and an accurately

straight length of steel wire in the manner shown at the left in the sketch. The hole in the block is drilled slightly smaller than the diameter of the steel rod, one side of the block then being split by means of a fairly coarse hacksaw so that the rod is made a tight sliding fit into the hole. The rod may be about 2½ in. long by ⅜ in. or ½ in. in diameter, this size being most useful.

An alternative method of constructing the device is shown on the right where a strip of ½ in. sheet brass, about 1½ in. long



by ½ in. wide, is drilled to clear the steel rod and also to take the shank of an ordinary telephone terminal. This is then bent and attached to the terminal as shown, the rod being passed through the hole in the terminal and the clearance hole in the angle rest, and clamped in position by means of the small knurled screw.

Separate H.T. Leads.

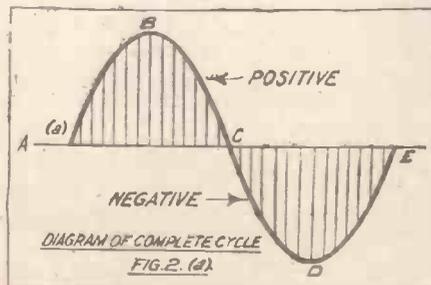
THE use of separate H.T. tappings for each valve in a multi-valve set is growing in popularity, and rightly so, for the best cannot be obtained from a set unless the valves are working under the most favourable conditions.

There is no difficulty in altering sets to take this refinement, for all that is necessary is to break the H.T. positive connection from the anode coil, reaction coil, transformer primary, or anode resistance of each valve where it joins the common H.T. + lead, and take the various broken connections to terminals. These terminals later have wander plugs attached for insertion in an H.T. battery. The H.T. negative is left alone, and the positive wander plugs are moved about on the battery until best results are obtained.

WIRELESS FOR THE BEGINNER.

(Continued from page 1261.)

The "grid leak" and grid condenser are generally marketed as one piece of apparatus. The condenser is not "variable," though you may choose what "capacity" of condenser you please, there being several

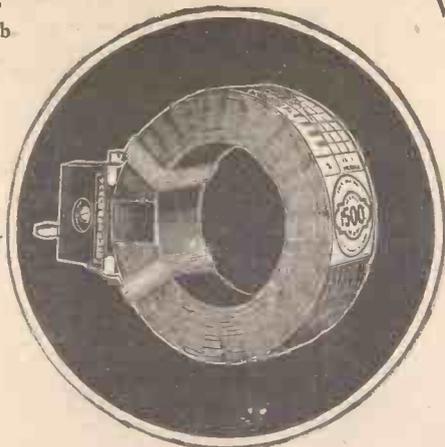


values suitable for the purpose. The grid leak is, more often than not, a pencil line; it is the graphite deposited by the pencil that forms the high-resistance conductor required. It is possible to buy variable "leaks," so that the user can find the precise resistance best suited to the valve and circuit in operation. Whether you would be better advised to use a variable leak or to invest in a small selection of leaks of different values I must leave to the teacher Experience to decide.

Rectification takes place by virtue of the fact that the current allowed to flow in the plate circuit is unidirectional. The telephones are inserted in the plate circuit and respond to the changes of current flowing through them, these changes occurring at "audio-frequency" in contra-distinction to the frequency of the received oscillations, which is far beyond the highest frequency detectable by telephone or ear.

What happens to the detected signals, so that they are increased in strength and become strong enough to work a loud speaker, will be explained in the next article.

IGRANIC
Honeycomb
Duolateral
COIL



Write for
List
Z 375



suit all circuits

Whatever circuit you intend to build you should investigate the claims of Igranic components to form part of its make-up. For instance, if you investigate the qualities of the famous Igranic Honeycomb Duolateral Coil you will find an inductance conforming as near as is possible to the ideal—a coil which is used by expert and amateur alike, and is built into the finest receivers sold.

As with the Igranic Inductance, so it is with all Igranic components, for they are designed by radio experts and built by electrical craftsmen whose knowledge dates long before the infancy of radio.

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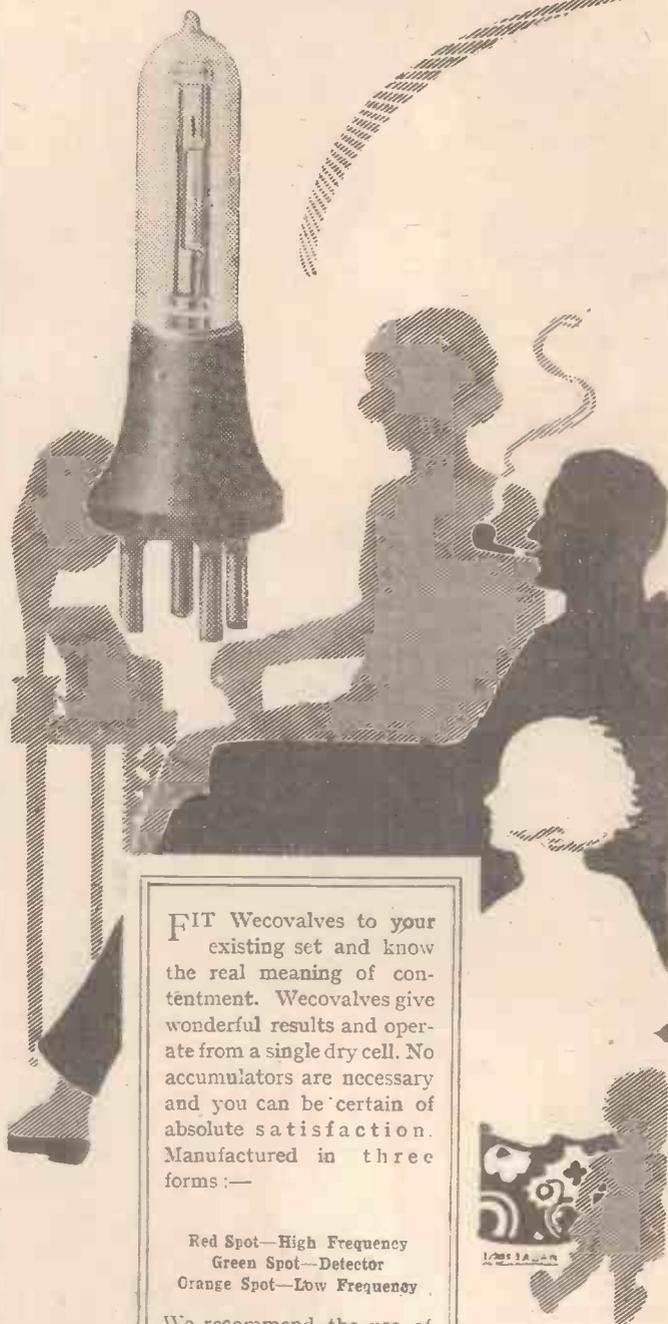
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IGRANIC Radio Devices include :

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All carry a six months' guarantee.

Contentment



FIT Wecovalves to your existing set and know the real meaning of contentment. Wecovalves give wonderful results and operate from a single dry cell. No accumulators are necessary and you can be certain of absolute satisfaction. Manufactured in three forms:—

- Red Spot—High Frequency
- Green Spot—Detector
- Orange Spot—Low Frequency

We recommend the use of Radio A Cells.

The World's Premier
dry battery valve
WECOVALVE

Excelling in 'finish' and 'design'

The popularity which Woodhall Components have achieved is due to their careful workmanship and scientific design; it is a popularity that arises from "satisfaction" rather than from "cheapness."

The **WOODHALL** No. 1 L.F. Transformer.



Of massive construction produced for high efficiency—it is one of the highest priced, because its production cost is heavy. It is wound with 42 gauge wire wound simultaneously with fine SILK. It shows most marked superiority on 2nd or 3rd stage of amplification, even on 200 or 300 volts pressure giving no trace of distortion and its amplification factor is decidedly above the average of other good-class transformers. Insulation is perfect between P. and S, and between windings and frame, and the transformer is one specially recommended for S.T.100 and other circuits of the "reflex" type **23/6**

The **WOODHALL** Vernier Rheostat



Combined plunger and rotary movement. The exceedingly fine adjustments it gives enable you to get the most out of your valves. Push-pull movement for coarse setting; rotary for vernier. Wonderfully smooth movement; best ebonite former: one-hole fixing. (Pat. No. 213,030.)

6 ohms	10 or 12 ohms	30 ohms
2/6	3/-	3/6

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"A rose by any other name . . ."

may "smell as sweet," but Hertzite sold under any other name but Russell's will not give you the best results. Don't try substitutes—get 100% reception with Russell's Hertzite.

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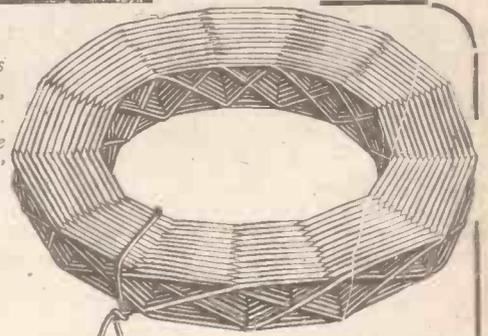


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Supplied in sets of 5 (Nos. 25, 35, 50, 75 and 100). Be sure to see the name "Reactone" on the box.

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Chelmsford Coil (No. 150) **2/6**



Highest Efficiency Coils are Tension-Wound

Each Reactone Coil, besides having a special formation to yield maximum air-space, is wound by special process under a constant tension.

A Coil is thus formed that is absolutely standard and true to calibration. Also extreme rigidity is attained without the use of shellac or wax. You therefore get an inductance

that is practically free from "self-capacity," and thus gives louder signals, sharper tuning, and readier reaction, besides being rigid and unvarying.

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Ask your wireless Dealer. In case of difficulty send P.O. for 4/9 (or 2/9 for Chelmsford Coil) and your Dealer's name and address to

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AMERICA CALLING.

By L. W. CORBETT.

A Radio News Letter from New York.

I HAVE just been having rather an interesting chat with the chief engineer of station W F B H, Hotel Majestic, New York. The theme, absorption of wireless waves by large structures, was made all the more interesting as we were standing at a point on the roof of the hotel, from which many of New York's mighty skyscrapers could be seen. This subject of absorption is of extreme importance in large American cities, and while in London and other B.B.C. centres it is somewhat unusual to find large "send" districts right within a radius of two or three miles of the broadcasting stations, it is not uncommon in such cities as New York.

"It is only quite recently that we have been heard down in Washington Square," said the engineer, pointing to a spot about two miles south of us. "We are only using 200 watts, but have had reports from amateurs telling of good reception nearly 2,000 miles away, so it shows what a very important factor this absorption of signals may be. Although Washington Square is only two miles or so from here geographically, I have calculated it to represent a distance of about a hundred miles electrically—taking into consideration the absorption factor."

The "Yank" Who Heard "L.O."

Quite recently a large skyscraper was started on, next door to a broadcasting station—note that American buildings are thrown up anyhow at an alarming speed, and are not necessarily built to last but to give immediate service—and it was found that as the skyscraper got taller it affected the tuning of the aerial, and every now and again it was necessary to retune.

You saw the photograph of station W N Y C in POPULAR WIRELESS a few weeks ago. Well, imagine several buildings twice as tall as that scattered about London. Say one or two around 2 L O, a few at various points along the Strand, etc. Then imagine Captain Eckersley trying to get as much out of 1½ kw. as he does now.

Talking about getting "as much out of 1½ kw. as"—let me give my own impressions of what the Americans get out of their rated power. I would imagine that they get as much out of 1 kw. as we do out of 1½ kw.—and I have been doing a lot of listening lately—but there is not that "finish" that modulation that is so characteristic of the B.B.C.'s efforts. If you tell that to the average American "fan," he will discredit you, but he has not heard 2 L O yet. In fact I have only met one American who has "heard" 2 L O from New York.

"Ever got any of the British stations?" I asked him.

"Gee, yep! On one toob, too."

"Who did you get?"

"M U U sendin' code."

"Broadcasting station I mean."

"Oh, yep. I guess I got—L O once."

"What sort of a receiver?"

"On'y a 14 toob Super Het, on the 'speaker,' too."

"I would like to have a look at it—may I?"

"'Fraid not; it belongs to a friend of mine."

Finally I got out of him that he had never heard any of the B.B.C. stations with a receiver of his own; but one point in his favour he did once hear—L O on a friend's 14-toob Super Het. It is not due to ineffective apparatus that the B.B.C. stations are not heard over here. There are two very excellent reasons. Firstly, all the B.B.C. wave-lengths are also covered by U.S. broadcasting stations, and as there are always several American stations on the

other hand they need not be considered as potential inviters of lightning strokes, being in a class where other metal objects normally found about buildings, such as metal gutters, down spouts, and wire clothes-lines. Aerials if earthed or provided with a lightning arrester may effect gradual drainage of electricity as well as a lightning rod, but a direct stroke is likely to fuse them or tear them from their fastenings on account of their small diameter."

I hope that nobody will misinterpret the above, and forthwith proceed to



A beautifully made Neutrodyne receiver entered for a recent American Wireless competition.

air on exactly the same wave-length as each British station, it seems a pretty hopeless case. Secondly, it is known that the signal strength increases as much as 50 per cent. during the dark hours, and just as it is beginning to get dark in New York, owing to the difference in the time the B.B.C. stations are now closing down. As regards 5 X X, I may state that hardly any American set is designed for high wave-length reception.

Plug-in coils are rarely employed, and indeed I quite recently experienced considerable difficulty in obtaining a two-way coil-holder, such as are in general use in British designed receivers. So nobody in America ever gets up to 1,600 metres. I will try to do so one day.

Investigating Lightning Effects.

The following statement is made on the authority of the United States Bureau of Standards, the U.S. Government's scientific research laboratory, and should set the minds at rest of those who are continually worrying about lightning striking their aerial.

This is perhaps a little late in the season, but remember it next summer, and put thy fears at rest. "Radio aerials cannot be regarded as an effective protection against lightning, but on the

erect an "antenna" of some few inches or even feet in calibre. The worst that can happen then is that your pet aerial may come to an untimely end.

Radio Stamp Collecting.

According to the "New York Herald Tribune," radio has made more liars than fishing, and no conversation is complete without the ravings of the DX fan who hears the coast on one valve every night. From now on the fan who lays claim to having received a distant station will be forced to support his claim by presenting a "verification stamp," which will be sufficient proof to remove all doubt from the sceptic's mind.

The principal broadcasting stations in U.S. have launched a plan that promises to furnish a new hobby to the radio public and the DX fan. Each station has a supply of beautiful steel engraved stamps, printed in various colours. To receive one of these stamps you must write to the station giving the time you heard it broadcast, and full particulars of the items you received.

If your report is correct, they will post you back one of these stamps with the station's call letters printed on it.

A small charge of about sixpence is made by all the stations, which covers cost of engraving the stamps and clerical expenses,



APPARATUS TESTED

The Technical Editor of "Popular Wireless" will be pleased to receive wireless sets and component parts from manufacturers and traders for test. Reports will be published under this heading.

IN a recent advertisement concerning H. and H. Tubular Galvanised Steel Telescopic Wireless Masts, which Messrs. Hildick & Hildick, Pleck Road, Walsall, offer complete and carriage paid for £4 17s. 6d., the height of these, viz., 35 ft., was omitted. This was unfortunate as, without this, the correct idea of the article could not be conveyed. We trust the above firm did not lose any orders owing to this regrettable omission.



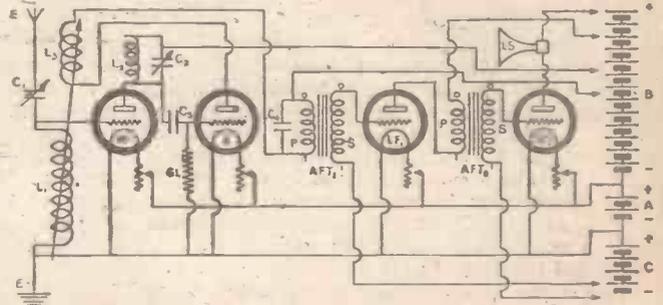
An interesting ceramic production. A variometer involving entirely new methods of design.

The Danum Trading Co., of 2, French Gate, Doncaster, have sent us a sample of "Insulex," a most interesting preparation scientifically produced for the purpose of

polishing and increasing the surface resistance of ebonite. It is a thickish fluid, dull amber in colour. We were unable to test its efficiency with ebonite suffering from surface leakage, but in itself it possesses a very high resistance value, so that there is no reason to doubt but that it does what is claimed for it. It certainly provides a very fine polish, and if the directions are carefully followed it is possible to impart a fine lasting lustre to the surface of an ebonite or composition panel.

Outstanding "D.X." feats of reception invariably depend upon a combination of favourable circumstances for their success, but nevertheless credit must be paid to all the components employed in the receiver used, as the old proverb, "The strength of a chain is that of its weakest link" is very applicable.

For this reason we were very pleased when the opportunity arose for us to test the "C. and S." dull emitter which was used by an amateur during successful reception of New Zealand, 4 A K, on a single-valve set. This valve, which retails at the low (Continued on page 1268.)



An ideal four-valve circuit, extracted from a Pamphlet published by Messrs. Ferranti's, of L.F. transformer fame.

- AE Aerial.
- E Earth.
- C1 Variable Condenser (.0005 mfd.).
- L1 Aerial Tuning Coil.
- L2 Tuned Anode Coll.
- L3 Reaction Coll. to couple with Tuning Coll.
- D .. Detector Valve or Crystal.
- LF1 } Low Frequency Valves.
- LF2 }
- A .. Low Tension Battery, 2 v. to 6 v.
- C3 .. Fixed Condenser (.0003 mfd.).
- GL .. Grid Leak (2 megohms).
- C4 .. Fixed Condenser (.002 mfd.).
- AFT1 .. Ferranti Intervalve Transformer Type A.F.2.
- AFT2 .. Transformer Type A.F.2.
- LS .. Loud Speaker or Telephone (2,000 ohms).
- B .. High Tension Battery, 100 v. to 150 v.
- C .. Negative Bias Battery, 3 v. to 9 v.



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Black Crystalline or Black Satin Enamel.

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4,000 ohms:
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120 ohms:
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TOMTIT.
Bright Stove or Black Crystalline Enamel.

2,000 ohms:
30/-



JUNIOR.
Black Crystalline or Black Satin Enamel.

2,000 ohms:
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These are the 3 C.A.V. LOUD SPEAKERS

No matter whether you choose Standard, Junior or Tomtit, each model will give satisfaction. The initials C.A.V. are a positive guarantee that the design, workmanship and finish are of the highest character, whilst the results obtained have to be heard to be believed.

L.F. TRANSFORMERS
For the first and second stages of amplification .. **27/6**

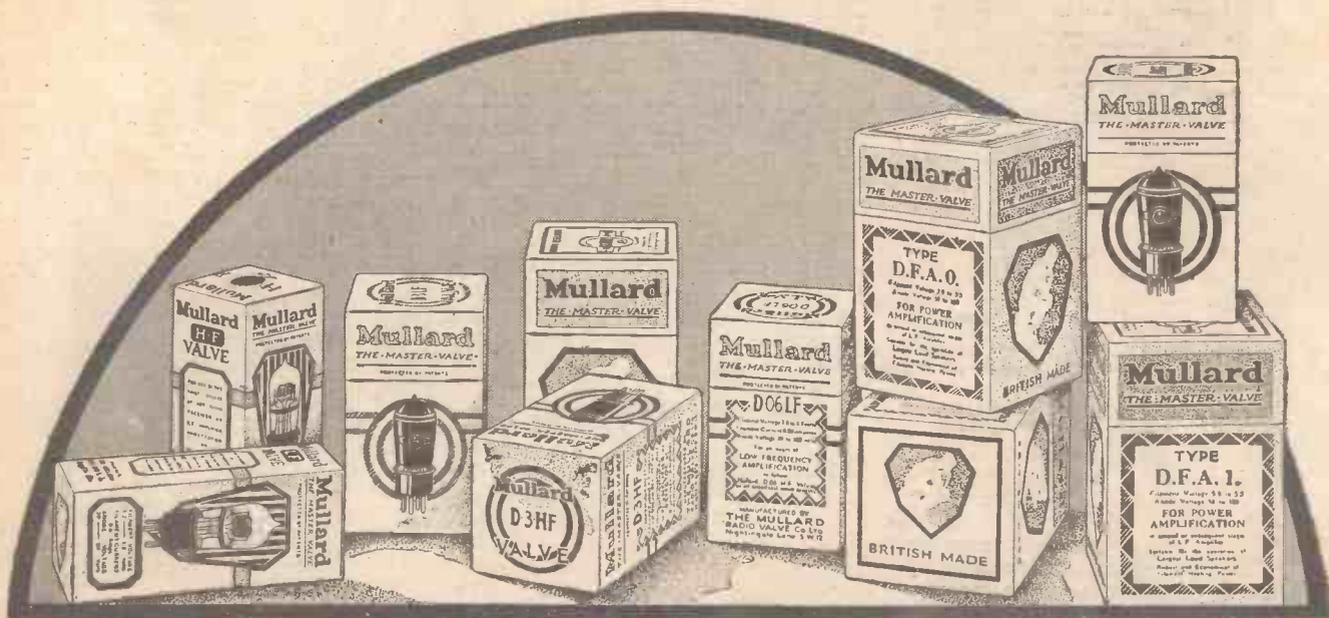
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Each of these strong and well-designed boxes contains a Mullard Master Valve.

You will find in the Mullard Comprehensive range the valves that will produce the finest wireless reception from your set.

BRIGHT FILAMENT VALVES (for 4-volt batteries.)

Mullard H.F. Red Ring Valves for H.F. AMPLIFICATION AND DETECTION, 12/6 each.

Mullard L.F. Green Ring Valves for L.F. AMPLIFICATION, 12/6 each.

(Recommended for reflex and dual circuits.) Leaflet M. 8 gives full information.

DULL FILAMENT VALVES.

Mullard H.F. Double Red Ring Valves for H.F. AMPLIFICATION.

Type D.3 for accumulators, 21/- each.

Type D.06 for dry cells, 25/- each.

Mullard L.F. Double Green Ring Valves for L.F. AMPLIFICATION.

Type D.3 for accumulators, 21/- each.

Type D.06 for dry cells, 25/- each. Leaflet V.R. 20 gives full information.

LOUD SPEAKER VALVES.

Mullard D.F.A.0. for 4-volt batteries, 30/- each.

Mullard D.F.A.1 for 6-volt batteries, 35/- each. Leaflet V.A. 4 gives full information.

MAKE YOUR CHOICE

Mullard

THE MASTER-VALVE

APPARATUS TESTED.

(Continued from page 1266.)

price of 12/-, takes 2 amps. at 2 volts. It is of rather unusual design, being short and rather "squat" in shape.

We tested it in all three positions—i.e. H.F., detecting, and L.F., and it proved a very good all-purpose valve indeed, although in our opinion it is more efficient when used as a detector. It is not microphonic and appears to be quite "hard," standing considerable H.T. voltages without ill effect. Taking everything into consideration, the "C" and "S" would appear to be a very good proposition at the comparatively low price mentioned above.



The C. & S. dull emitter valve.

In the ordinary course of events, the use of microphone amplifiers is not very satisfactory and, in general, we are very strongly prejudiced against them for broadcast reception purposes. There is, however, one exception to the rule, if we can call it such, and this is that very interesting instrument, the Brown "Crystavox." We recently had one sent us to test, and even although it is the product of such a well-known firm, we cannot but admit that when it arrived we viewed it with

just the slightest disfavour. We changed our opinion when we tested the instrument, for at five miles from 2 LO it operated very efficiently indeed when connected to a "P.W." Ultra crystal set.

The "Crystavox" is a combined microphone amplifier and loud speaker. It is compact and quite handsome in appearance. The loud speaker portion of the instrument is built on the same principles as the famous Brown "H," and employs the same tuned reed adjustable element as the almost more famous Brown "A" type headphones. This adjustment, by the way, and that of the microphone amplifier, are the only two "controls" involved. A 6-volt dry battery is necessary, but current consumption is almost negligible.

It is a curious and very commendable fact that the "Crystavox" is less "microphonic" than some valve amplifiers. This, we expect, is due to its unique design. It may be hard to believe, but the table on which the instrument was standing was knocked quite hard and no interference with its functioning occasioned. So far we have not mentioned anything about its reproduction efficiency in respect of volume or tone, and it must not be thought that we have purposely avoided this subject. The "Crystavox" is capable of filling a medium-sized room with music as faithfully and purely reproduced as the best of valve amplifiers and ordinary small loud-speakers; in fact it would take a very excellent combination of these indeed to beat it. The signals on the crystal set used must be loud, however; sufficiently loud for them to be heard twelve inches or so from the telephone receivers, but where this

condition obtains the "Crystavox" is to be fully recommended as probably the most trouble-free loud-speaking system that could be employed.

In styling it the "Crystavox" and always talking about it in connection with crystal sets, Messrs. Brown have, in our opinion, conveyed the impression that it is limited in its uses. It is our impression that the "Crystavox" has even greater scope among valve users. There must be thousands of owners of "stunt" one-valve sets which, although admirable for "D X" work, cannot have stages of L.F. added to render the use of a loud speaker possible unless separate L. and H.T. batteries are used. In such circumstances the "Crystavox" rises to the occasion admirably.

We have tested it in conjunction with various one-valve "supers," and it functions in this capacity as well or even better than with purely crystal circuits. On a future occasion we shall have something more to say about this very interesting instrument in connection with valve circuits.

The price of the "Crystavox" is £6 15s. Only one model is produced.



The "Crystavox" combined amplifier and loud speaker.

Keep up-to-date in Wireless Doings!

PITMAN'S

RADIO YEAR BOOK, 1925

(60th thousand)

GIVES FULL INFORMATION ON ALL THE LATEST DEVELOPMENTS practical instructions and advice for amateurs, special illustrated articles by experts, list of wireless societies, and a large number of most interesting photographs and historical and technical information

OVER 100 PHOTOGRAPHS of artistes, "uncles" and announcers
RADIO HISTORY of 1924
IN PICTURES

The Manchester City News says:—"There is a feast of good things in Pitman's well-produced and decidedly inexpensive annual to satisfy every class of wireless fan" whether he be professional, amateur or merely a listener-in who does not know a coil from a buttercup."

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Broadcasting the Nightingale.	The Inside of the B.B.C.
B.B.C. Stunts.	The "Death Ray."
Notable Radio Events in 1924.	Seeing by Wireless.
How to get the Best Results.	Wireless without Tears.
Radio and the Gramophone.	

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YOU CAN DO THIS!



When you pause for a moment before a wireless dealer's window to admire the array of wonders don't you often wish your own little home-made set at home had such neat and efficient wiring as those super-sets in the window.

If you examine the wiring of these super-sets, you will see each join neatly soldered. You can do this!

Just with some solder and a tin of Fluxite. And, apart from the resultant neatness, the receptive qualities of your set are considerably improved. Soldering is delightfully easy when Fluxite is at hand to help you.

Ask your Ironmonger or Hardware Dealer to show you the neat little

FLUXITE SOLDERING SET

It is perfectly simple to use, and will last for years in constant use. It contains a special "small space" Soldering Iron with non-heating metal handle, a Pocket Blow-lamp, FLUXITE, solder, etc., and full instructions. Price 7/6. Write to us should you be unable to obtain it.

Price 7/6



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All Hardware and Ironmongery Stores sell FLUXITE in tins, price 8d., 1/4. & 2/8

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ANOTHER USE FOR FLUXITE. Hardening Tools & Case Hardening. ASK FOR LEAFLET on improved methods

REACH OUT!



“LET **POWQUIP** GUARANTEED HELP YOU TO GET STATIONS HITHERTO BEYOND YOUR RANGE”

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Tested on Aerial and fully Guaranteed.

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COMPONENTS FOR BEST RESULTS

To endeavour to save money on components is fatal. You cannot expect to get good results from shoddy parts. Without being obviously damaged so-

called "clearance line" parts may often be perished and otherwise faulty. IT IS FAR CHEAPER IN THE LONG RUN to make sure of WHAT you buy, and WHERE you buy. Our Wireless Department sells nothing shoddy or unreliable, and all our prices are the lowest possible compatible with quality.

SPECIMEN LIST OF PARTS RECOMMENDED FOR TRANSATLANTIC V

Bowyer Lowe Variable Condensers '0005	..	17	0
'0003 Dual	..	1	9 0 0
Dubilier fixed condensers '0003	..	2	6
Mansbridge fixed condensers '25	..	3	9
1. U. F.	..	2	9
2. U. F.	..	4	9
Burndept Dual Rheostats	..	7	6
Igranic Potentiometers	..	7	0 0
Dubilier 2-grid leaks	..	2	6
Bowyer Lowe valve socket set	..	1	0 0
Burne Jones Magnum 2 coil holders	..	1	9 6
Utility switches 4 pole D.T.	..	6	0 0
Dubilier 80,000 Anode resistances	..	5	6
Connecticut on and off switch	..	2	9
McMichael H.F. transformers 300-600	..	7	0 0 0 0
" " " 80-150	..	3	0 0 0 0
Igranic coils from	..	1	2 6
VALVES, Marconi, Cossor, and Mullard	..	1	2 6
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RADIOFORIAL

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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.

Technical queries are answered by post at a charge of 6d. a query and 1/- per full wiring diagram. All queries must be addressed to the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, E.C. 4, and must be accompanied by a stamped and addressed envelope. Copies of the

queries sent should be kept, as the original questions cannot be reproduced in the answer. Cash should be sent in the form of postal orders.

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.



N. F. S. (Elstree).—I have recently built a five-valve set (2-V-2), and have been successful in tuning in WGY on 380 metres

several times. Generally, however, even at 3 a.m., he is badly mixed up with "mush" of a peculiar description. How can I eliminate this?

You will find it practically impossible to eliminate the "mush" which originates in your case probably from Northolt, only a few miles away. This station carries out a tremendous amount of traffic at all hours of the night, and has a most annoying amount of "backwash." Within a radius of 10 miles or more we have found it practically impossible to tune in American stations between 300 and 500 metres with any degree of purity and satisfaction, while Northolt is on, though as soon as the local station shuts down, even for only a minute, the distant telephony comes in with surprising clarity and strength. You may find that cutting out the two stages of L.F. will assist, though it will not cut out the interference. Reception of WGY on the loud speaker, an easy thing to do without such interference, will, of course, be practically impossible while Northolt is on. Other than using a really selective aerial system, and no L.F. stages, just 2 H.F. and detector, we can offer very little advice as to the solution of your problem. Wave-traps have been found to be useless in such cases as a rule, and, of course, a frame aerial needs more amplification to ensure results, while even then you will still have the background of ripple from Northolt. Leaflet may trouble you slightly on 400 metres or thereabouts, but as a rule the interference from that station is confined to a narrow band of wave-lengths, at any rate in your district, while the former mentioned station, which is very close, usually disturbs the ether over a band of wave-lengths of at least 200 metres.

S. C. A. (Caterham).—After Brussels had closed down the other day, I was searching round on a two-valve set when I heard a station, apparently foreign, on a wave-length only a few metres above Brussels. Somewhere about 290 I should say it was. Can you tell me what station this was?

In all probability the station was the new German station at Hanover, which has recently commenced broadcasting on approximately 295 metres. This station comes in very well on two valves in the London district, quite as well as Brussels, in fact.

(Continued on page 1272.)

New Cross Word Puzzle!

Find the Hidden Sentence and win £2 : 2 : 0

ACROSS.

1. To content.
4. To notice.
7. Pronoun.
10. Circle.
12. Royal Artillery.
13. Definite article.
15. Great.
18. Smallest particle.
21. Upon.
22. Christian name of famous man.
23. Exists.
24. Possessive case of a Great Country.
28. Nothing better.
30. Famous Eastern pilgrimage.
31. Possessive pronoun.
32. Towards.
33. Transparent stone.
34. Slang for money.
35. Arrived.
38. To oppose boldly.
39. To form.
40. Negative.
41. Error.
44. Sovereign.
45. To spoil.
46. Anger.
48. Conjunction.
49. To attempt.
50. Single.
52. Immediately.
54. That thing.
55. Distress signals.
56. Part of a face.
57. Personal pronoun.

DOWN.

1. To place.
2. Famous garden.
3. Boy's name.
4. Term used in algebra.
5. Plaything.
6. Hesitation.
8. A peace.
9. Thanks.
11. Expression of contempt.
14. Worn by almost everyone.
16. Part of fishing tackle.
17. Prefix meaning three.
19. Labels.
20. Mineral.
23. Little devil.
24. Before Christ.
25. Breed.
26. Too.
27. Part of windows.
29. Note.
34. Exacted.
35. A weight.
36. Related.
37. Repairs.
38. Distant.
39. Member of Parliament.
40. Used by fishermen.
41. Mother.
42. Mineral.
43. Binds.
45. Possessive pronoun.
47. Female sheep.
51. Negative.
53. Exclamation.



A Prize of Two Guineas will be awarded to the sender of the first letter opened which contains the correct Solution and the hidden sentence, by the first post on the 30th January, 1925. All solutions must be addressed to:—

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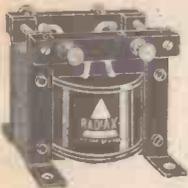
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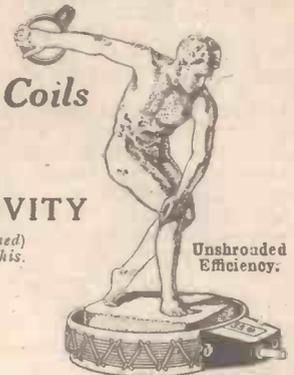
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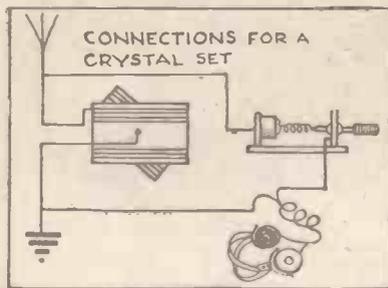
RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 1270.)

R. A. J. H. (Banbury, Oxon).—What is the simplest form of crystal circuit using a variometer for tuning? Do I need a variable condenser?

The diagram given herewith shows the connections for a very simple crystal set, employing a variometer for tuning. The latter consists of two short lengths of cardboard tubes, measuring 3 inches and 4 inches respectively (external diameter). Upon each tube there is a total winding of about 30 turns, but the best size depends upon the aerial in use, and frequently 25 turns upon each tube gives rather better results.

Across the variometer the crystal detector and 'phones are joined in series. The 'phones are generally of 2,000 or 4,000 ohms, but with some crystals 8,000 ohms are better, whilst low-resistance 'phones



(V.V.)

(several hundred ohms only) will be found to give good results with certain other crystals. In general, either 2,000 or 4,000 ohms are perfectly satisfactory for any crystal set.

If the variometer is a well-made one, there is no advantage in adding a variable condenser to the circuit, as all the tuning necessary is effectively introduced by the variometer. If a variable condenser is on hand (say, .0005 mfd.) it may be connected

across any small tuning coil, and the combined arrangement will then replace the variometer very effectively, the tuning being done upon the variable condenser.

The "P.W." Technical Queries Department.

REVISION OF RULES.

Owing to the extraordinary growth of the POPULAR WIRELESS Queries Department, the Editor is compelled to revise the regulations governing the answering of readers' queries, and the following new arrangement now comes into force:—

- (1) A charge of 6d. is made for every query sent to the POPULAR WIRELESS Queries Department. The "three for a shilling" regulation is cancelled.
- (2) A charge of 1/- is made for supplying full wiring diagrams.
- (3) All queries, together with postal orders and stamped and addressed envelope, to be addressed to—
**TECHNICAL QUERIES EDITOR,
POPULAR WIRELESS,
The Fleetway House, Farringdon Street,
London, E.C.4.**
- (4) Technical queries will not be answered by telephone.

If a small fixed condenser (.001 mfd. or so) is fixed across 'phones, it will sometimes improve the tone of results quite noticeably.

R. P. S. (North London).—I have a three-valve set employing a detector and two L.F. valves, the last L.F. being coupled by means of a choke made by using one winding of an L.F. transformer. My trouble is distortion

taking place on loud signals. The valves used are A.R. '06, B5 and DE3 — all '06 at 3 volts, and I have grid bias on the last valve. Variable H.T. on all.

Probably distortion is as much due to the last valve being unable to carry the energy as to anything else. The remedy in that case is of course obvious—use a power valve. Without doing this the next best thing is to turn your attention to the choke and see if this can be improved. Probably it does not really suit the circuit, but you should be able to reduce the distortion without purchasing another choke. A .001 mfd. condenser across the choke may help. If the other winding of the transformer is O.K. try the two windings in series and also alternately separately. Also vary the coupling condenser, which should have a value of about .02 mfd. Loading the unused winding by means of a .001 or .002 fixed condenser might help, though any loading will tend to reduce the signal strength slightly. This reduction will not, of course, be serious, as you are so close to 2 L.O., and it should always be the aim of the amateur to obtain clarity and pureness of reproduction rather than sheer noise and volume. A loud speaker not only delivers what is put into it, but also has an unhappy knack of magnifying any distortion that is present. A great deal of the distortion heard from loud speakers is due to a distorted input, and not to the loud speaker itself, provided this latter is not being "pushed" and forced to carry too much.

"UNIDYNE" (Liverpool) asks why his one-valve Unidyne receiver does not oscillate, and as several other readers appear to be in difficulties with regard to this set, we are again publishing the answer given in a recent number of "P.W."

There are several possible reasons why the set does not oscillate, even supposing that the circuit is connected up correctly. In the first place, it is advisable to have the aerial condenser in series with the A.T.I. Secondly, the grid leak must be a variable leak, and must really be a leak. This variable grid resistance is far more important than many people imagine, for it controls the potential of the main grid of the valve, and thus controls the oscillating properties of the valve. Make sure also that the valve is quite O.K. Some of the valves now on the market are too soft to be of any real value. With the condenser in series, either basket or Lissenagon coils

(Continued on page 1276.)

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 Ebonite Ball Rotor 5/11
 Strawboard, D.C.C. 2/6
 Ebonite, with dial 5/-
 Very special valve 1/11
 Valve Holders, Murray 1/3
 Solid rod ebonite 1/3
 Bretwood Anticap 1/9
 Goswell, A. cap 1/9
- Valves, purchasers' risk on post. 12/6**
 Valves, Myers universal 12/6
 Valves, Myers D.E. 21/-
 Valves, "Metal" .06 13/11
 Valves "Metal" "R" type BE. 7/6
 Valves "Radio Micro" .06 13/11
- Watmel Variable Grid Leak 2/6**
 Watmel Anode Res. 3/6
 Wates Microstat 2/9

N and K
GENUINE (OLD MODEL)
 (No. 2)
 Few dozen pairs, 12/11
 Post, etc. 6d. pair.
No. 3 NEW MODEL
3 POLE MAGNETS
 17/6 per pair.
N and K Model
 Lightweight 9 11. Post 6d. pair.
 All 4,000 Ohms.

FIXED CONDENSERS

- RAYMOND**
 are with Ebonite Base.
 Raymond .001 to .0005 1/2
 Raymond .002 to .006 1/3
 Raymond .02 and .01, each 1/9
 Mansbridge 2 mid. 4/3
 Mansbridge 1 mid. 3/9
 Mansbridge .25 mid. 3/6
 Edison Bell .001 to .0005 each 1/3
 Edison Bell .002 to .006 each 2/-
 Edison Bell 2 meg. 1/6
 Leak Clips 2/6
 McMichael's 2 meg. 2/6
 McMichael's 100000 Resistance Clips 2/6
 Dnbiller .0001 to .0005 2/6
 Dnbiller .001 to .006 2/6
 Dnbiller .01 (for loud speakers) 7/6
 Dnbiller 2 meg. Grid 2/6
 Dnbiller Anode Resistance 5/6
 (50,000, 70,000, 80,000, 100,000 ohms on Stand complete.)

BRUNET PHONES.
 New Model. Black Cords.
 4000 ohms 16/6
 Post 6d. pair.

FRENCH THOMSON-HUJSTON
 4000 ohm Phones, 15/11.

THORPE K.4.
 For Unidyne.
 5 pin with holder 17/6
 Phillips "R" 7/11
 French "R" 7/11

POST FREE PRICES.

PARTS FOR 2-VALVE UNIDYNE
 2 Thorpe K.4 Valves, terminals, 2 microstats, 1 var. grid leak, S P D T Switch, .0005 var. Condenser with vernier. Cam vernier 2-way stand 2 5-pin valve holders, 2 fixed Condensers, G R C Transformer, tinned copper wire nuts, screws, etc. The lot for . . . £3 15 0
 Carriage paid.
 All best quality.

TELEFUNKEN.
 (adjustable)
 4000 ohms 17/11
 (Lighter than a feather)

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 will oblige you with any lines in stock, less 20% on Proprietary articles.
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We can recommend these as being excellent Headphones, with a great reputation.
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ACCUMULATORS FOR CALLERS ONLY at present. (See Callers' List.)



Formo, open 12/6
 47 Bucks "Powquip" 12/6



Manchester "Powquip," 15/6
 Ormond 14/6



Shrouded "Powquip," 18/-
 Standard "Powquip," 14/6

PANELS DRILLED FREE WITH ORDERS OVER 20/-

PANELS DRILLED and ENGRAVED FREE WITH ORDERS OVER 25.
 West End Stockist of Edison Bell, Igranic, Goswell (quality), Polar, Jackson Bros. (J.B.), Marconi, Cossor, Mullard, Ediswan Valves, Sterling, B.T.H., McMichael's, Lissen, Dubilier goods.

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Adjustable diaphragm, detachable receivers, double leather-covered head-springs, long flexible cords, nickel plated parts. Very comfortable fitting to the head.
LOOK FOR THE TRADE MARK.
 4,000 ohms 13/3
 Post 6d. pair.

BRIGHT EMITTER 12/6 each

B.T.H. R Type
 Ediswan A.R. "
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 Cossor P.1 "
 Cossor P.2 "
 Mullard H.F. (Red Ring)
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21/- each Type
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 Ediswan A.R.D.E.
 Marconi-Osram D.E.R.

25/- each Type

B.T.H. B.5
 Ediswan A.R.O.6
 Marconi-Osram D.E.3
 Mullard D.F.Ora

DULL EMITTER POWER VALVES

For use with A.R.D.E. and D.E.R. Valves.
 Marconi-Osram Type D.E.G, 2-2.5 volt; .25 amps, 25/-

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 Mullard, Type D.F.A.2 30/-

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For use with Bright Emitters
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VARIABLE
CONDENSERS**
HIGH QUALITY
SENT BY POST 6d. SET EXTRA.

"DE LUXE" MODEL



AS SHOWN, WITH DIAL,
KNOB AND BUSH.

- 001 - 6/11
- 0005 - 5/6
- 0003 - 5/-
- 0002 - 4/9

POST 6d. SET.

UNSURPASSED FOR FINE TUNING.

NEW MODEL

With Knob and Dial.

WITH VERNIER.

- 001 - 8/9
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With EBONITE DIAL and
Two Knobs. Post 6d. Set.



**NEW MODEL
SQUARE LAW**

With Vernier.

With Knob and Dial.

Aluminium Ends. Ebonite Ends.

- 0003 - 8/6 - 10/-
- 0005 - 8/11 - 10/6

Post 6d. Set.



**TWIN CONDENSER
SQUARE LAW**

EBONITE ENDS.

- 00025 - 12/6
- 0003 - 12/6
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TWIN (Ordinary)

Equal units of •00025 or •0003. 9/-
Complete with Knob and Dial.
Post 6d.

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WITH KNOB. POST 6d. SET.

- 001 .. 6/11 •0005 .. 4/11
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LONDON'S LARGEST STOCKIST OF
JACKSON BROS.

"J.B." Variable Condensers. Complete
with Knob and Dial.

SQUARE LAW

STANDARD

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Other sizes as advertised by "J.B." Post 4d.

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- (one-hole fixing)
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- Gamages Permanite 1/-
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CONDENSERS.**

- 001, •0001 to •0005 10d.
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- 006, 1/3; •01, 1/9; •02 1/9

ACCUMULATORS

- 2 v. 40 amps. .. 9/6
 - 4 v. 40 amps. .. 16/6
 - 4 v. 60 amps. .. 19/6
 - 4 v. 80 amps. .. 23/6
 - 6 v. 60 amps. .. 27/6
 - 6 v. 80 amps. .. 33/-
 - 6 v. 105 amps. .. 38/6
- Hart's Stocked. All High Quality.

- Microstat .. 2/6
- Switch Arms 8d. to 1/-
- Leatherette Boxes with Lid .. 2/3 & 2/11
- Shellac .. 5d.
- Shorting Plug and Socket .. 4d.
- Contact Studs 4 for 1d.
- Nickel ditto 2 for 1d.
- Nickel Switch Arm 1/-
- Sorbo Ear Caps pair 1/4
- Tumbler Switches 1/4
- 'Phone Cords 6 ft. 1/-, 1/3
- Engraving .. 8d.
- Empire Tape 2yds. 1d.
- Allen Var. Grid Leak 1/3
- Best Sleeving 3yds. 10d.
- Rubber Lead-in 10 yds. 1/-
- Thick ditto, 1d., 2d., & 3d.
- Aerial, 7/22 100 ft. 1/11
- Ditto, Extra Heavy 100 ft 2/3
- Anti Cap. Handles 8d.
- Tumbler Switches 1/-

NOTE!

Our Wonderful Micro-
meter Adjustment Glass-
enclosed Detector. 1/9
Why pay more?

- 5 Waxless Coils 200/2000 .. 1/3
- 5 equal 25 to 100 .. 1/8
- 5 ditto, Extra Air Space .. 2/-
- 6 waxed 200/3600 .. 1/8
- 7 waxed 150/3600 .. 1/11
- Chelmsford D.C.C. 1/-, 1/3, 2/6
- Basket Holders 8d. 1/- 1/3
- Switch Arm 12 Studs, 12 Nuts, 12 Washers. Lot 10d.

VERY SPECIAL OFFERS

- Crystal Set fitted for Chelmsford .. 7/11
- RE ECHO set, worth 25/-, for .. 15/-

SPECIAL. To callers only. To customers purchasing 20/- worth of our own goods at full prices, we supply a first-class pair of 4,000 ohm 'phones for 5/- as an advertisement only.

SPECIAL BARGAIN.

•0005

SQUARE LAW

with Knob

Callers only
6/6

- Legless valve holders 1/-
- ANTI CAP valve holder .. 1/-
- 2 mid. Mansbridge 3/9
- 1 mid. Mansbridge 3/3
- .25 Mansbridge .. 2/11
- Colvern Vernier .. 2/6
- Neutrodyne ditto .. 3/6

Radio panels "KENITE" (stand 5,000 volts), 6 x 6, 9d.; 7 x 5, 9d.; 8 x 6, 10d.; 9 x 6, 1/-; 10 x 8, 1/-; 12 x 9, 2/-; 12 x 12, 2/3. Above 3/16 in. thick. 1-in. also stocked.

- Legless valve holder 1/-
- Solid Rod Ditto .. 1/-
- Under Panel Ditto .. 1/6
- Ebonite Dials .. 8d., 1/-
- Valve Templates 2d. 4d.
- Adhesive Tape Roll 2d.
- Copper Foil per foot 2d.
- 1 in. Fibre Strip 3 ft. 2d.
- Insulated Hooks 4 for 3d.
- Ditto Staples .. 5 a 1d.
- Twin Flex 4 yds. 6d.
- Twin Silk Small 6 yds. 6d.
- D.C.C. Bell Wire 10 yds. 5d.
- Knobs, 2 B.A. 2d., 3d., 4d.
- Small Knobs 6 B.A. 3d.
- Small Knobs 4 B.A. 3d.
- Wander Plugs, pair 3d.
- Egg Insulators each 1d.
- Tape Aerial 100 ft. 2/-
- Valve Windows 4d. to 9d.
- Mica .. 2d.

**RAYMOND
CRYSTAL SETS**

- 7/11 9/11 12/11
- 2 B.A. Rod per ft. 2d.
- 4 B.A. Rod per ft. 2d.
- Basket Holders .. 8d.
- Also at 10d., 1/-, 1/3, 1/6
- 2-way Coil Stands 1/11
- 3-way ditto .. 3/6
- 2-way with ex-handles .. 2/11

- 2-WAY COIL STANDS 1/3, 1/9
- VARIOMETERS 1/-, 1/3
- DUTCH VALVES 4/3
- LARGE DETECTORS 11d.
- 5 WAXLESS COILS 1/3
- Do. EXTRA AIR SPACE 1/8
- 'PHONES 4,000 OHMS 6/11
- N. & K. PATT. 4,000 OHMS 8/11
- VARIABLE GRID LEAKS 1/2
- VALVES FOR UNIDYNE 12/-
- 5-PIN Ditto 13/11
- PORCELAIN D.P.D.T. 1/4
- Ditto, S.P.D.T. 11d.
- L.F. TRANSFORMERS 8/11
- SPECIAL BASKET HOLDERS 8d.
- Ditto, for Chelmsford Coils 9d.
- SINGLE COIL formers with spokes 8d.
- BRUNET 4,000 ohms, NEWEST MODEL. 18/6
- ACCUMULATOR CARRIER 2/3
- FLUSH PANEL sockets complete 4 for 5d.
- EBONITE BUSHES 1d. dozen 10d.

- C.W. BATTERY LINKS 2 for 1 1/2d.
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- GEARED 2-WAY COIL STAND 5/3
- CAM VERNIER ditto 4/6
- CLIMAX U.P. VALVE HOLDERS 1/3
- RHEOSTAT for D.E. or R. VALVES 2/2
- 2-WAY COIL STAND, ex handles 1/11
- Ditto nickel fittings 2/9
- Half opal and ebonite enclosed DETECTOR, worth 2/-, My price 1/-
- TAPPED COILS for CHELMSFORD 1/8
- Ditto for Broadcasting 1/-
- GRID LEAK CLIPS, pr. 1d.
- Valves: PHILLIPS "R" type 6/11
- Valves: FRENCH METAL "R" .. 6/6
- Valves: DUTCH (good) 11/-
- Valves: DUTCH DETECTORS 4/3 and 4/9
- Valves: DUTCH "R" TYPE 4/11
- Valves: FRENCH METAL "06" 12/11
- Valves: RADIO MICRO "06" 12/11
- VARIOMETERS, Finest Value in London. 1/4
- 1/8, 2/3. JUST TRY THEM.
- WEDGE-SHAPE COIL PLUGS Extra valve, 7d. and 8d.
- EDISON BELL ditto 11d.
- Fine little RHEOSTAT, 1 H.F.
- H.F. TRANSFORMERS, B.B.C. 2/6
- Red and Black TWIN FLEX 6 yds. 10d.

This is the shop for BARGAINS
See the name RAYMOND.

SUNDRIES

- Terminals complete—
- Brass Pillar .. 1d. 1 1/2d.
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- Fancy Patterns 1d. 1 1/2d.
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- Valve Sockets 2 for 1 1/2d.
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- Pulleys .. 4d.
- 4 Taps and Wrench 2/11
- Screwdrivers .. 6d.
- D.C.C. Wire, per lb.—
- 13 g. .. 9d. 20 g. .. 9d.
- 22 g. .. 10d. 24 g. .. 1/-
- 26 g. .. 1/1 24 g. .. 1/3
- 30 g. .. 1/6 Etc., etc.

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- 30 v. .. 4/6
- 60 B.B.C. .. 8/11
- 30 B.B.C. .. 5/6
- 9 v. B.B.C. .. 2/6
- 1.5 (D.E.) .. 1/9
- Ditto .. 2/- to 3/-

D.P.D.T. SWITCHES.

- Min Panel .. 1/-
- On China Base .. 1/4
- On Ebonite Base 1/1L 2/6
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- Miniature Panel .. 10d.
- On China Base .. 11d.
- On Ebonite 1/3 to 1/9
- Murray Valve Holder 1/3
- Spring Washers 4 a 1d.
- Coil Plug on Base 10d.

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- Ditto .. 9d.
- Shaped .. 8d., 1/-
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- With Dial .. 1/11
- Ormond .. 1/9
- 'Phone Connector 1d.
- Nuts 2, 4, 6 B.A. doz. 2d.
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BOXES

- 7 x 5 9 x 4 12 x 9
- 8 x 8 10 x 8 12 x 12

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RAYMOND GOODS

- EBONITE 6x6 .. 1/4
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- 8x6 .. 1/10

- STOCK 9x6 .. 2/-
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- 12x6 .. 3/-
- 12x9 .. 4/3
- 12x12 5/6
- 14x10 5/6

- 3/16 in. WE STOCK
- Cut to size 1-in.
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Our new Showrooms are now open, and have aptly been described by our clients as above. They are without doubt the finest in London.

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ALL THE VERY LATEST COMPONENTS FOR YOU TO INSPECT



SUPPLIERS OF CABINETS TO B.B.C.

AS RECOMMENDED BY TECHNICAL PRESS AND BY MR. HARRIS FOR all concert de luxe (16 in. by 8 in. SIZE). THESE CABINETS ARE OF THE highest finish, AND ARE accurately made. THE LID IS MADE TO LIFT AS SHOWN. EACH IS polished by hand.

To take Ebonite Panel.	Depth of Cabinet.	Mahogany.	Oak.	Best 1" Ebonite Panel.
12 x 8	8 in.	21/-	19/6	5/6
16 x 8	8 in.	25/-	23/6	7/6
20 x 8	8 in.	28/6	26/6	8/-

SPECIAL POST. 2/- EACH.

ROUNDED FACE 3 IN. I.D. x 1 1/4 IN. O.D.



OUR NOTED Valve Windows. SUPPLIED COMPLETE AS ILLUSTRATION. LOOK EXCEPTIONALLY NEAT. POLISHED BRASS, 3d.; nickel plate, 4d.; black nickel, 5d.



Tuned Anode Adapter. FOR CONVERTING H.F. TRANSFORMER TO TUNED ANODE. 2/- POST 2d.



Valve Template Stamp. HARDENED POINTS. ACCURATE. MOST USEFUL ACCESSORY. 1/- POST 2d.



Box Spanners. FITS ALL NUTS. 2-6 B.A. SHAPED IN CENTRE TO FACILITATE HANDLING. 8d. PER SET OF 2. POST 2d.

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Wireless Telegraphy (Elementary and Advanced)

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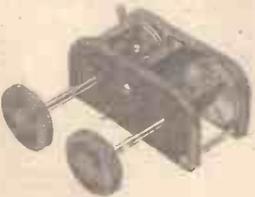
International Correspondence Schools, Ltd.,
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LOTUS CUT GEARED Vernier Coil Holders

—P. Pat.—



The Vernier movement comprises 3 sets of Precision Cut Gears and reduces the speed by 8 times. Essential to all Receiving Sets.



Two-Way Price 7/-
Three-Way „ 10/6

Manufactured by
GARNETT, WHITELEY & Co., Ltd.,
Lotus Works, Broadgreen Road, LIVERPOOL.

THE NEW INDOOR AERIAL

PORTABLE

NO INSULATORS



(Patent applied for.)

Can be used outside if desired.

INSIST ON "O.V."

ONE USER AT HASTINGS WRITES:

"I find with the 'O.V.' Aerial results are equal to outdoor aerial, and I have actually received the Montreal Station and signals, which were quite strong."

The Original can be seen.

PRICE 2/6 EACH.

No further expense.
SAVE MONEY.

Ask your Dealer for particulars.
TRADE ONLY.

CABLE AND ELECTRICAL SUPPLIES,
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GENUINE "BRUNET"

SUPERIOR COMPONENTS AT REASONABLE PRICES.



Stocked by
all leading
Wireless
dealers.

Fully
guaranteed.
Replaced with-
out question
if faulty.

PRICE	SHROUDED TYPE	PRICE								
13/6	<table border="0"> <tr> <td>Ratios 1/3 {</td> <td>5,000 Primary turns.</td> </tr> <tr> <td></td> <td>15,000 Secondary turns.</td> </tr> <tr> <td>Ratios 1/5 {</td> <td>5,000 Primary turns.</td> </tr> <tr> <td></td> <td>25,000 Secondary turns.</td> </tr> </table>	Ratios 1/3 {	5,000 Primary turns.		15,000 Secondary turns.	Ratios 1/5 {	5,000 Primary turns.		25,000 Secondary turns.	13/6
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	15,000 Secondary turns.									
Ratios 1/5 {	5,000 Primary turns.									
	25,000 Secondary turns.									
EACH		EACH								

"BRUNET" L.F. TRANSFORMERS

enjoy as high a reputation as the famous "BRUNET" Head-phones, and many leading manufacturers of wireless sets in Great Britain and Europe have always used this L.F. Transformer owing to its magnificent amplification without distortion, freedom from breakdown, and high insulation resistance.

OVER 1,000,000 in use.

"BRUNET" HEADPHONES

have been adopted by the majority of European Governments and Radio Companies as their standard type, and in Great Britain alone there are over 350,000 in use out of a total of 1,000,000 manufactured since 1914.

In the new model considerable improvements have been made in the head-band to ensure greater comfort; and the cord, of the same first-class quality, has been changed from green to black, striped with white. Ask your dealer.

PETTIGREW & MERRIMAN, Ltd.,

122-124, Tooley Street, London, S.E.1

(WHOLESALE ONLY)

Sole Distributors



Terminals

The Trade are requested to write direct for particulars regarding these highly appreciated lines.

CORRESPONDENCE.

(Continued from page 1276.)

W G Y ON A LOUD SPEAKER.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have the pleasure of informing you that I have carried out a protracted number of experiments on your circuit, "A One-valve Reflex Receiver," published April 20th, 1924.

Using this circuit I have been able to pick up all the B.B.C. stations—Birmingham and Bournemouth easily heard on the loud speaker; Hamburg, Berlin, Brussels, these also on the loud speaker; Petit Parisienne, Radio Paris, also on the loud speaker; and Madrid (Radio Iberica).

I have also added one H.F. valve and one L.F. valve to this circuit. Using the former, I was successful in picking up W G Y, New York, and the latter provides sufficient volume to fill the garden with music. Although I have tried many circuits and listened to many other sets, yet I have found none which combine, as this one does, greater flexibility, volume, clarity of tone—whether for near or distant stations—and cheapness with reliability in running.

May I congratulate the staff and the paper for the number of reliable circuits published together with the mine of information which goes with every issue of POPULAR WIRELESS. May the paper continue to flourish in 1925 as it has done in the years before.

Yours faithfully,

G. SAVILLE.

38, Hemstal Road, West End Lane, London, N.W. 6

THE "CHITOS" CIRCUIT.

The Editor, POPULAR WIRELESS.

Dear Sir,—I wish to agree with the large number of your correspondents who have praised the "Novel Circuit." Using this circuit I receive regularly all the main B.B.C. stations, several relays and a large number of foreign stations, some of the latter coming in with sufficient strength to be audible with 'phones off the head. Last week I tried to receive American broadcasting, and was successful every evening, and early on Dec. 20th I received four stations on the one valve alone. The stations were W B Z, W G Y, K D K A, and one whose call sign seemed to be W D B, but I have not got this one since, although the others can be got any evening. I got W G Y at 11.20 on the 29th, only to hear him say he was closing down until 6.30 (American Standard). American reception at such an early hour on one valve reflects great credit on Mr. Chitos, and whether it is a modification of "Colpitt's Oscillator" or not it is well worth trying, and I am eagerly waiting to see any improvements Mr. Chitos may have made on this circuit.

In operation the circuit is quiet and surprisingly easy to tune, although capacity effects are present, as other correspondents have stated. But a little practice soon shows the best way to overcome this trouble.

I must also mention that I have obtained much pleasure from the circuits published in your correspondence columns, and feel very grateful to your readers who have contributed them.

Yours faithfully,

C. L. BURTON.

17, Carlton Terrace, Cross Keys, Mon.

AN OFFER OF ASSISTANCE.

The Editor, POPULAR WIRELESS.

Dear Sir,—If I have ever entertained any doubts as to the popularity of your paper I have none now, for since my letter to you, published in the number dated November 20th, re the Twelvetroes Reflex Circuit, I have been simply swamped with requests for a diagram of the circuit, and information regarding the component parts and the building and working of same.

I have replied to as many as possible, and I trust that my experience and advice or help may be of use to my correspondents; but there are a number who have neglected to send stamps or envelopes for replies to their letters, and the majority of these I have been compelled to shelve, simply because I cannot see my way clear to spend the time and money in replying to them.

As so many of your readers have informed me that the back numbers of POPULAR WIRELESS containing the circuit is unobtainable, I have taken the liberty of having a large number of copies made, and have sent one to all who have asked for same.

I trust I have not been infringing any rights by so doing; my only wish being to help others, who, like myself, desire to possess a set which will give results that make listening-in a pleasure and not a nightmare.

I shall be very pleased to assist anyone who is anxious to try out this circuit, and hope that those who have not received replies to their requests will write again, not forgetting the stamped addressed envelopes, when they may rely on my assistance as far as lies in my power.

Again wishing your paper every success.

I remain,

Yours sincerely,

J. W. ROBERTS.

300, High Street, Sheerness.

(Continued on page 1279.)

CORRESPONDENCE.

(Continued from page 1278.)

A UNIDYNE DETECTOR—2 L.F.

The Editor, POPULAR WIRELESS.

Dear Sir,—I think it may interest some of your readers to know what splendid results I am getting with the Unidyne receiver. When the first test was made public in "P.W." I started right away and built a one-valve detector set. This gave me great satisfaction, but as soon as the diagrams were published I made a one-valve amplifier. This also worked beautifully, that I decided to turn the one-valve into a two-valve ditto. Now I have an original one-valve detector with two-valve amplifier, with switch one or two valves. I only use the third valve when I want the reception extra loud on the speaker, as I get excellent results on the two valves. This set has been working every evening from 5.30 to closing down time, Sundays included, for nearly seven months with the same K 4 valves all the time. I should say this is a jolly good test for the Unidyne, and I also consider it a real gem. I should like to thank Mr. Rogers and Mr. Dowding for what I think is a great invention.

Yours truly,
EDWARD GORDON.

Sunnyside, Princes Street,
Slough, Bucks.

RECEPTION OF AMERICA.

The Editor, POPULAR WIRELESS.

Dear Sir,—Although we hear of the success of many amateurs attempting to get Australia, this is not yet quite the general thing, and the reception of America is still looked upon by most of the average amateurs as a good test for one's set and abilities. Of the many U.S.A. stations the most popular one is, I think, K D K A. of E. Pittsburg. For the average amateur who has not much time to spend on the subject the dinner-hour programme transmitted from K D K A affords him the double pleasure of real DX. work and the enjoyment of a good programme between 11.15 to 12.15 p.m. every night except Sunday. For the reception of this station, working on about 65 metres, the writer has unfortunately to have a somewhat poor indoor aerial, and, in addition, the house is practically surrounded by a wood. The set is a two-valve one, with tuned anode coupling and reaction on the anode, Marconi D.E.R. valves, rheostat to each valve, West Electric phones. Tuning is effected by basket coils. Details of A.T.I. depend on aerial anode, 10 to 12 turns tuned by .0005 condenser in parallel with vernier, reaction anything from 20 to 30 turns. The writer, having a long earth, generally disconnects aerial without any appreciable difference to strength of signals which come in at R.3. A frame aerial can be used with 15 turns on it and .0005 condenser across it. Turns of wire should be added once station is received until zero of condensers are reached. A curious fact about writer's set is that grid leak is required to be connected across condenser to give maximum results, as they should be just below oscillation point. Low capacity in set is essential, especially in coil holders, with which the usual holder is dispensed with in writer's case. Diagram overleaf of movable fixed one just as ordinary terminal. Hopping information will be of some use to readers, and wishing your valuable and helpful paper every success in the New Year.

I remain,
Yours truly,

J. A. CHAMBERS.

Ombersley Court, Worcester.

ETHER AND REALITY.

A Summary of the First of Seven Fortnightly Broadcast talks by Sir Oliver Lodge.

ON Tuesday, January 6th, Sir Oliver gave the first of his series of talks on "The Ether of Space and Its Functions," under the auspices of the B.B.C. at 2 L O, which was relayed to many stations in the British Isles, and also to the longer-wave high-power station 5 X X at Chelmsford. The first talk was entitled "First Notions About the Ether. How Matter is Held Together, and How We See It."

He prefaced the series by the following prelude:

"We enter on seven explanatory talks about the Ether of Space, describing its various functions or uses, emphasising its importance in the understanding of the Universe, and showing how essential it is to all Reality.

(Continued on page 1280.)



A.J.S. PATENT VARIABLE LOW LOSS CONDENSERS

Fitted with vanes so shaped as to give a negligible minimum capacity and a greater maximum than can be obtained with other types. There is no rubbing contact. Fitted with Ebonite End Plates, adjustable brass bushes, knobbed dial, complete with 22-gauge aluminium vanes, .08 spacers.

.0002 mfd. capacity	s. d.
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In Polished Walnut Case and Electro-Plated Terminals.	12 6

.0002 mfd. capacity	£ s. d.
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THE UNITOP CABINET RECEIVER

forms top section of "Unit System" Cabinet, and contains A.J.S. 4-valve Receiver. Complete in itself, it may be converted into a beautiful pedestal cabinet by subsequent purchase of first a centre section to contain both batteries, and then base section containing special A.J.S. Loud Speaker. Used alone, the "Unitop" is a compact and attractive piece of furniture and a highly efficient Receiver, easily portable for outdoor functions. In Mahogany, or Light, Dark, or Wax-polished Oak. Complete with all accessories, ready for use, 30 Guineas (Without accessories, £24 10s. od.)



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But there is more in A.J.S. Wireless products than the name. Every A.J.S. Instrument possesses some point of definite superiority, some exclusive feature that makes it "just a little better."

Note the instruments illustrated and send for free Illustrated List describing the full range of A.J.S. Wireless Instruments, including the 2, 3 and 4-Valve "Desk Type" Receivers, the A.J.S. 4-Valve "Unit System" Cabinet and the A.J.S. 4-valve Pedestal Cabinet. Better still, ask the nearest A.J.S. dealer for a demonstration.

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THE A.J.S. LOUD SPEAKER

The A.J.S. Loud Speaker is the outcome of lengthy research and experiment, and justly claims to be the last word in Loud Speaker design. The accurate proportions and smoothly blending curves of its non-resonant horn give to the A.J.S. those correct acoustic properties which ensure the true reproduction of the sound waves, while its extreme sensitiveness enables the utmost volume of sound to be produced with complete absence of distortion.

PRICE:
With Metal Horn and Electro-Plated Fittings (as illustrated). £4 15 0
With Oak or Mahogany Horn and Electro-Plated Fittings. £5 10 0



ETHER & REALITY.

(Continued from page 1279.)

"We employ the ether every day and every minute of our lives; it is the very breath of our material existence; but it escapes what are called our five senses, and so we usually know little about it. Some few even deny its existence. This is ungrateful, and should be remedied. The remedy I attempt."

Sir Oliver then went on to explain that matter was discontinuous, consisting of isolated particles not in contact, and was only held together by cohesive forces existing in the ether. He supposed that if we could magnify a piece of matter to an impossible extent it would have an appearance something like the midnight sky, where the separated pieces of matter are similarly held together or united into systems by the force of gravitation—which also is a function of the ether. So that the ether is a great unifying entity, without which there would be no cosmos but chaos.

The ether seems to be an absolute continuum. The particles of matter are not separate from it, but so connected with it that they cannot vibrate without exciting waves or ripples—which ripples we primarily know as "light." In the same way a tuning-fork cannot vibrate in air without exciting waves in that which we primarily know as "sound."

The third function of the ether is therefore the conveyance of light and radiation of all kinds, which travel out from their source at a tremendous and fundamental speed, sufficient to carry them to the Antipodes (if like wireless waves, they are able to go there) in the $\frac{1}{14}$ part of a second.

And he concluded his first talk thus:

"If ripples are travelling from distant objects, there must be something which is rippling. You cannot imagine empty space being thrown into vibration; there must be something in space which vibrates, and that "something" extends to the furthest visible object, and constitutes a unifying and connecting mechanism, through which all our information is obtained.

"We have as yet very little acquaintance with the Universe; sometimes we seem to know a great deal, at other times we realise that we hardly know anything. The mystery of it all escapes us, and the possibilities of it are beyond our conception; many of them we could not apprehend if they were explained to us, we have not the terms or ideas to understand them. Meanwhile, we grope along as best we can, and do our daily work with a keen expectation of the future; and he is wisest who denies least of the mystery which surrounds us and the possibilities ahead.

"To assert, requires knowledge; to deny, requires much more knowledge. Let us be satisfied with positive knowledge so far as it has been vouchsafed to us, and leave negations to the self-sufficing and the omniscient. We can deny the self-contradictory and the absurd, but in the unknown and the mysterious, denials have no legitimate place; our business is carefully and cautiously to ascertain what is. We are surrounded by infinity, infinities of various kinds; and the wealth of existence is such as to justify a faith in our highest conceptions, a hope in the possibilities which lie before us, and a charity which enables us to do our daily work and to love our fellow men"

THE WAVES THAT ARE TIRELESS
"REVO" SAY "FOR WIRELESS"

WE STAND BY OUR GOODS

Confidence inspired by incomparable qualities, and a complete knowledge of the perfect workmanship of REVO RADIO GOODS enables us to do what no other radio manufacturer has done, that is to

GUARANTEE FOR 12 MONTHS
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REVO HEADPHONES
 21/- each.

REVO LOUD SPEAKERS
 JUNIOR 48/- SENIOR 80/-

WHY PAY MORE. MONEY CANNOT BUY BETTER.

Ask for particulars of Crystal Sets from 6/- each.
 Valve-Crystal Sets, Two Valve Sets, Amplifiers, etc., etc.

BRITISH MADE. BRITISH LABOUR. BRITISH CAPITAL.



IF UNOBTAINABLE LOCALLY PLEASE APPLY DIRECT TO —
THE CABLE ACCESSORIES CO. LTD. TIPTON, STAFFS.
 LONDON DEPOT! 28, SHOE LANE, E.C. 4.

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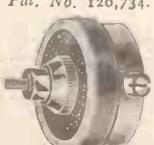
THE JEWEL CRYSTAL

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F. S., Yorkshire, writes:—
 "Listron is the finest crystal I have used. Its power of reception is marvellous."

LISTRON, 88, 89, 90, CHANCERY LANE, LONDON, W.C.2.
 Also obtainable wholesale from V. Zeitlin & Sons, 144, Theobalds Rd., London, W.C.1. W.A.S.

THE SKINDERVIKEN MICROPHONE BUTTON
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5/-  **5/-**

Will enable you to Work a loud speaker off a crystal set. Magnify the sound of your gramophone up to 200 times. Fit up an efficient house telephone. Transmit piano, violin or gramophone music anywhere. Magnify sounds otherwise inaudible, etc. etc.

Everyone interested in sound transmission should write to-day for the "Marvels of the Microphone." Price 6d. Post free from Mikro Ltd.

MIKRO Ltd., 32c, Craven St., Charing Cross, W.C.2

TECHNICAL NOTES.

(Continued from page 1236.)

emitters. It is a very good plan to have either a voltmeter or an ammeter at hand with which the voltage applied across the filament terminals or, alternatively, the current passing through the filament may be observed. When the conditions are in accordance with the rated conditions for the valve, the brightness (or dullness) of the filament should be very carefully observed; and on other occasions, when the voltmeter or ammeter is not used, care should be taken, having memorised the proper appearance of the filament when in operation, that the conditions are correctly reproduced.

Restoring Emission.

When a dull-emitter filament has, from any cause, lost its characteristic emission, it can be restored—at any rate, to some extent—by a number of artifices which have from time to time been reported in these Notes. Another dodge, recently communicated to me, is to switch on the filament and leave it so for about an hour, but with the high-tension battery entirely disconnected.

Adjusting Loudness.

If you are using two stages of L.F., and find that in some cases the first stage is not sufficient and the second stage is too much, the simplest way to adjust the loudness is to leave the jack in the second stage and slightly to de-tune. Another method is to place a high-resistance variable shunt across the terminals of the loud speaker.

Experimental Panel.

Experimenters who do a good deal of testing out of different circuit arrangements will find that ebonite becomes rather an expensive item, and the alternative of using the same panel repeatedly is inconvenient, partly owing to the fact that the new drilling positions often foul the old ones, and also because it is often desired to retain a particular lay-out undisturbed.

In this case, and in spite of much that is often said to the contrary, it will be found that a wood panel can be used quite satisfactorily, in which case, of course, the cost becomes practically negligible. For this purpose a good hard wood should be chosen, and it should be thoroughly seasoned and dry; in fact, no matter how well-seasoned it may have been beforehand, it will be as well to keep it for a few days in a very warm place before finally planing and smoothing it ready for use. As an additional safeguard, the wood may then be well-varnished with shellac varnish on both sides, and again left to dry for some days. If, after all this, the components are mounted up in ebonite or other insulating bushes, the panel will be found to be practically equal ebonite so far as insulation is concerned. It is always desirable to mount a wood panel or baseboard upon insulators.

Coil Tappings.

For making a series of tappings from an inductance coil, the most effective method is to provide two switches, one for the units

(Continued on page 1282.)



No. 4 of a Series

The Living Artiste

UNTIL you use a Eureka Concert Grand you will never realise how perfectly music can be broadcast.

The Eureka is an exceptional Transformer—unique in appearance and without parallel in performance. Its immense windings—more than 2½ miles of wire are used—its non-laminated core—its handsome coppered steel case and hermetically sealed interior—these are features which combine to make it the aristocrat of Transformers.

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Thanks to the Eureka we can now re-create the spirit of the artiste himself.

Concert Grand 30/- Portable Utilities Co., Ltd., Eureka No. 2. 22/6
Fisher Street, London, W.C.1. (For Second Stage)

Supreme EUREKA for Tone

Gilbert Ad. 2130

TECHNICAL NOTES.

(Continued from page 1281.)

Enclosed Type Cabinet



Fitted with fillets to take 12 x 12 in. panel 2 in. behind inside of doors. Valves can be fitted behind panel, the Cabinet having a sliding back for access to rear of same. Ample accommodation for H.T. batteries, etc.

Dimensions, inside size:
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WIRELESS MASTS

50 ft. With Iron Fittings. Sent anywhere. 13ft. Masts for fixing to house. List 2d. - Wireless set. 37/6	50/-
37 ft. vice 33x, Elms-rd., Aldershot	37/6

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We Repair Any Make of L.F. Transformer, making it equal to new

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5/- CASH WITH ORDER.

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When despatching enclose Name, Address, and Date.

TRANSFORMER REPAIR CO.,
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TELEPHONES RE-WOUND

to 4,000 ohms. Guaranteed. All makes by except Brown "A" 6", and Sullivan, Wax filled, 10/- per pair. Ex-army converted to high resistance, 2/6 each ear-piece. Re-max netising 9d per earpiece. Postage extra 6d. per pair.

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CABINETS for Wireless CONSTRUCTORS



PICKETT'S
HIGHLY POLISHED
CABINETS
from 1/6 each
They're good value

Send for constructors list free - PICKETT'S CABINET WORKS - BEXLEY HEATH - S.E.

Send for Constructor's List (P.W.) FREE.

and the other for the tens. For the first ten turns, tappings should be taken from every turn of wire. The first set of studs are connected to the turns of the first set of ten, whilst being between successive studs of the second set are ten turns of the coil. The two sets are connected together in series, and by means of the tens arm, two studs are found, one of which gives too high a value, and the other too low. The arm being on the stud of the lower value, the units arm is then used for final adjustment.

In this connection it should be remembered that the best results are usually obtained when the smallest possible capacity is introduced into the circuit, so that in tuning-in for a given wave-length it is desirable, as far as possible, to use the maximum amount of inductance and the minimum amount of capacity; these remarks, of course, apply more particularly to single-coil circuits.

The Helicoid Aerial.

Amongst my correspondence last week was a letter from Mr. A. E. Johnson, of Bristol, who sent me some pictures, together with an interesting account of tests, of his new "helicoid" aerial. This appears to be a spiral form of aerial, which is extensible and can readily be fixed either outdoors or indoors, and according to Mr. Johnson's letter, has great advantages and is very adaptable. According to one report, with the aerial fitted indoors inside a second-floor room at a distance of four miles from Bournemouth, the latter station was received on a crystal set with loud-speaker reproduction, clearly audible at a distance of 3 or 4 feet from the loud speaker.

Crystals.

In spite of frequent advice to the contrary, crystal users may often be observed to handle crystals carelessly with the fingers, after which they are no doubt surprised that the crystals do not function satisfactorily. It is important to remember that the fingers are naturally greasy, quite sufficiently so to cause a deposit of contamination on the delicate surface of a crystal and interfere with its efficiency.

If you place your fingers very close to a cold glass window, without actually touching, you will usually observe a cloudiness on the glass in the vicinity of the finger-tips, which indicates the evolution of water-vapour from the fingers in the same way that greasy matter is exuded from the pores.

In case anyone is apt to be sceptical on this point, and to think that the precautions referred to are exaggerated, it may be interesting to note that in certain factories where various delicate metal articles are assembled, it is a well-known practice to single out particular operators as being specially suitable for the work, owing to the dryness of their fingers.

The majority of the operators are found to be unsuitable for the handling of very delicate parts, whilst in the case of a minority of the workers it is found to be ruinous to certain kinds of pieces to allow these operators to handle them at all. Whilst all this has nothing directly to do with wireless crystals, it emphasises the

(Continued on page 1283.)

Charge Your ACCUMULATOR at Home with the TUNGAR BATTERY CHARGER.
Simple, Safe, and Economical.
No moving parts. Requires no attention. No Garage, Owner-Driver or Wireless Enthusiast should be without one. Will charge from 1 to 10, 6-12 volt batteries at a time. Deliveries from stock. Descriptive Booklet free on application. The Tungar Battery Charger is suitable for use on Alternating Current supply only.

Obtainable from your Garage or Electrician.
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H. Maddison, WOOD HORN Mfg., 2a, Ronalds Road, Holloway Road, near Highbury, N.5.
How to improve your Junior Amplion. Partic. free.
WOOD Bells, 14", 18", and 19", complete with gongs necks, Castings and Wood Bells for Gramophone Attachments. Any speaker fitted with Wood Bell. Improvement guaranteed. Trade supplied.

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TESTIMONY *Nom de plume, Salisbury.*
"Using bright emitter valves I had been able to receive America (WGY, KDKA, WBZ, and two or three others) nightly, and was quite willing to pass your Plotron S.S. as satisfactory if it would only pick up the carrier waves of these stations. I was extremely pleased to find that if anything there was an increase in signal strength from these stations. I shall most certainly recommend this valve to my friends as the best obtainable, no matter what the price." Unsolicited testimonial, original may be inspected.

File volts 2-3, max. con. 07 anode 40-80. Concert tested and sent with instructions for use, post free on 24 HOURS' APPROVAL.

English "R" Valves, 11, volts 4-5, anode 45-100, 7/9. Concert tested. Post free. 24 hours' approval. P.W. MIDWAY D.E.'s.

Phillips 4 Electrode D.E. 1/8 volt. 16 amp. 25/-
Phillips 4 Electrode Bright Emitter ... 12/6
Thorpe K4 Bright Emitter (5 pin) ... 17/6
Concert tested, post free, 24 hours' approval.

Insurance against all postal damage. Valve must be returned within 24 hours of receipt. 9d. per 7/6 or 12/6 valve; 1/- per 17/6 or 25/1 valve.

ANELOX PRODUCTS, (Dept. F. 25)
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GET AMERICA REGULARLY. "NO CAP" PLUG-IN EXTRA SHORT WAVE COILS.

5/- SET, POST FREE.

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PANELITE.

Will stand 5,000 volts, will not fracture. 9" x 6" x 3/4", 1/6; 10" x 9" x 2/2; 12 x 10, 2/9; 14 x 12, 4/6 Post paid.

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TRANSFORMER COILS.

CONSISTING OF PRIMARY AND SECONDARY WINDINGS. 21,000 TURNS. 5 TO 1 RATIO.

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BUNDLES OF SOFT IRON WIRE SUITABLE FOR ABOVE. 9d. PER BUNDLE.

DELIVERY FROM STOCK.

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"WIRELESS IN EVERY ROOM"

From one Crystal or Valve Set fit an Extensaphone and switch over to bedroom, sitting-room, etc., without removing set. Clear tone guaranteed. 5/- post free.

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Everything is so clearly explained that any beginner, without previous experience, can make the most efficient receiving sets obtainable.

Full instructions are given for **MAKING COMPLETE CRYSTAL SETS, ONE AND TWO VALVE AMPLIFIERS, DUAL AMPLIFICATION SETS, ALSO THE VERY LATEST TWO, THREE, AND FOUR VALVE TUNED ANODE RECEIVERS.**

160 pages (28 diagrams) 1/3 post free.
Satisfaction Guaranteed or Money Returned.

SAXON RADIO Co. (Dept 14) South Shore, Blackpool.

50% GREATER RANGE

Write now for Brochure telling you how you can make your set selective and increase its range 50% by fitting Bowyer-Lowe Square Law Condensers which have a capacity ratio of 150 to 1 and evenly distributed wavelength scale. Send a postcard at once.

TESTED SQUARE LAW CONDENSERS
BOWYER-LOWE CO. LTD. LETCHWORTH

TECHNICAL NOTES.

(Continued from page 1282.)

fact that crystals should never be handled with the fingers, but only with clean metal tweezers, and it shows that the precautions advised are not exaggerated.

Keeping Crystals.

It is a good plan whenever crystals are not in use to keep them immersed in pure benzene, or the very best petroleum spirit or ether, so as to keep the surfaces free from grease. Ordinary petrol should not be used for this purpose, as it almost invariably contains an appreciable percentage of heavier oils, which are left behind when the spirit evaporates.

Vitamins.

At first sight there would appear to be very little connection between wireless and vitamins. An interesting point, however, is raised by "Popular Radio" which, although it certainly seems rather "far fetched," may conceivably have bases of fact. It is known that for the development of most living creatures sunlight is essential, and in particular the ultra-violet rays. On the other hand, many foods are said to contain obscure substances called "vitamins," and feeding on vitamin-containing foods makes up to some extent for an insufficiency of sunlight. In other words, the sunlight and the vitamins seem to be complementary in their influence.

According to latest experiments it would seem that the vitamin is not a material ingredient in a so-called vitamin-containing food, but is rather a property of the food substance itself. The interesting speculation, according to "Popular Radio," is as to whether vitamin foods may not really have some subtle property of producing invisible rays which serve the same purpose as the sunlight. Although, as I have said, the underlying idea of the foregoing seems revolutionary, there is nothing inherently impossible in it, and if it should be substantiated it would certainly represent one of the most important discoveries of the century.

Interchanging Valves.

After completing the wiring of a valve set the usual thing is to insert the valves, and then proceed to a feverish manipulation of condensers, tuning-coils and reaction, without further regard to the valves, whose positions, initially accidental, become fixed and unaltering. It is well to bear in mind, however, that much better results can often be obtained by changing the valves around until you find the most advantageous positions for them. Although a number of valves may be rated for the same characteristics, they vary quite sufficiently to make a material difference when they are changed about in the manner indicated above.

Wireless Advertising.

The recently-expressed views of the U.S. Radio Controller, Herbert Hoover, on the subject of using the broadcast for advertising purposes, are interesting and important. Here they are:

"I believe the quickest way to kill broadcasting would be to use it for direct adver-

(Continued on page 1284.)

T M C

CHI VALENTE VA SANO.

"Who goes slowly goes safely," say the Italians; and even Casanova saw something in that.

The idea suggests the keynote of T.M.C. production—that "infinite capacity for taking pains" that is exemplified in the three T.M.C. products here illustrated.

The non-resonating horn of the TrueMusiC Concert Grand is of electrolytically-deposited copper. This loud speaker gives the purest tone combined with large volume, and you cannot get a better for drawing-room and dancing purposes.

The T.M.C. Clear as Crystal Headphones *actually* give signal reception that is "Clear as Crystal." The T.M.C. No. 3 Lightweight Headphones weigh only 6½ ounces. The earpiece attachments do not catch in feminine hair, nor the V-connections on the masculine pipe.

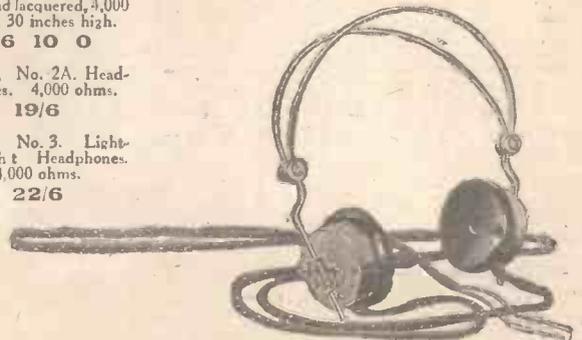
T.M.C. No. 2A Headphones are just as good, but slightly heavier—and 3/- cheaper. As headphones for listening-in, both are just as good as they can be!



TrueMusiC Concert-Grand, Nigger-brown finish, inside horn polished and lacquered, 4,000 ohms, 30 inches high.
£6 10 0

T.M.C. No. 2A Headphones, 4,000 ohms.
19/6

T.M.C. No. 3 Lightweight Headphones, 4,000 ohms.
22/6



The Telephone Manufacturing Co., Ltd., Hollingsworth Works, West Dulwich, S.E.21, E.P.S.203

TECHNICAL NOTES.

(Continued from page 1283.)

tising. The reader of a newspaper has an option whether he will read an advertisement or not, but if a speech by the President is to be the meat in a sandwich of two patent medicine advertisements, there will be no radio left. To what extent it may be employed for what we now call indirect advertising I do not know, and only experience with the reactions of listeners can tell."

The word "reaction" used by Hoover is interesting. I wondered, when I read it, whether he merely meant the "response," or whether this was a sly indication that he anticipated that reaction might be used as a new weapon of self-defence by listeners. But then I recollected that they call the latter kind of reaction "regeneration" in America. So he couldn't have meant that—but I give the idea for what it is worth.

Transmitting Microphones.

All transmitting experimenters know the difficulties of transmitting clearly speech and music by the aid of an ordinary microphone, such as the G.P.O. type, with flat diaphragm. A microphone of this kind is liable to produce all kinds of "blasts" and other undesirable results of irregular vibrations.

Many attempts have been made, from time to time, to produce an "aperiodic" microphone, that is, one which would not respond any more vigorously to one frequency than to another, and one of the most successful attempts appears to be that of H. J. Round, the well-known engineer of the Marconi Co. The microphone is supported in a somewhat elaborate way upon pads of felt or cotton-wool.

Loud-Speaker Diaphragms.

The same considerations apply to the diaphragms of a loud-speaker reproducer, and it is hoped that the experience gained in connection with the microphone will later be applied to the design of loud speakers. For further information, see patent 19117/23.

SALE

WEDNESDAY AND THURSDAY, JAN. 28 & 29, at 12 noon, each day.

Important 2 days' Sale.

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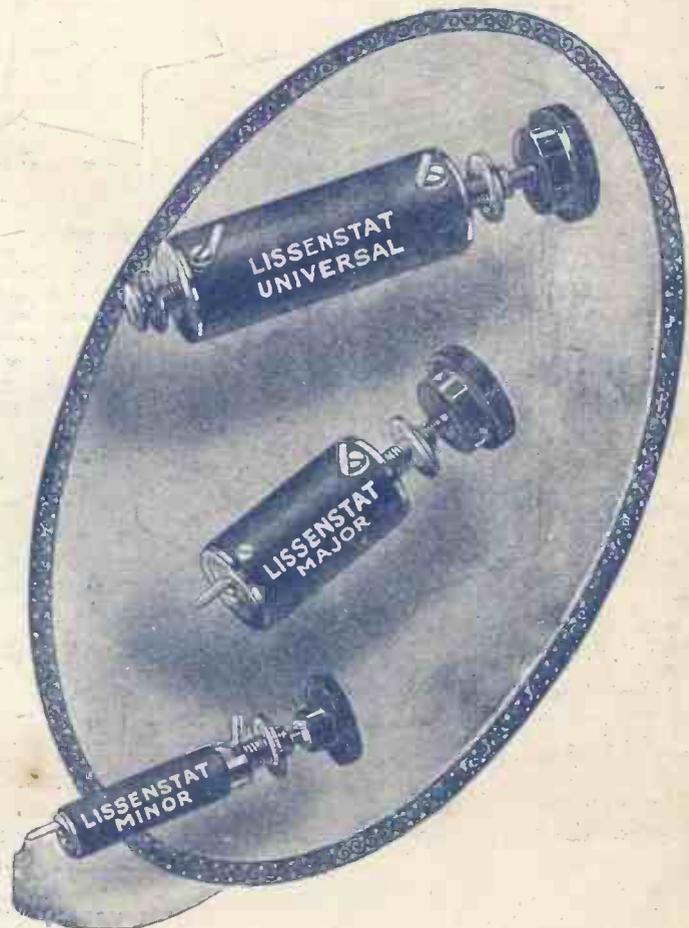
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LISSEN VARIABLE ANODE RESISTANCE, 20,000 to 250,000 ohms ... **2/6**



Smooth out your loud speaker distortion by putting a Lissen Variable Grid Leak across the secondary of the last transformer, or across the loud speaker itself—first position is better.

Don't Mix your Parts—there is a LISSEN Part for every vital place.

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Mr. E. J. Simmonds, of Gerrard's Cross, in his wireless room. Mr. Simmonds recently established two-way communication with an Australian amateur.

FEATURES IN THIS ISSUE.

A Fortune in Your Receiver.
 Two Ideas for Amateurs.
 Controlling the Ultra-Audion.
 Testing L.F. Transformers.

Notes on Short-Wave Reception.
 Making a Useful Switch.
 Past and Present Crystal Sets.
 Constructional Notes.

"DIE DEUTSCH FUNK": HOW THEY DO IT IN GERMANY.



A contrast—and a comparison.

HERE a "Type 600" is being shown in contrast with one of ten high power condensers recently built at our works. These are the biggest mica condensers in the world. The contrast is one of size and load capacity only. In quality of materials employed, skill in design and workmanship, rigorous testing before dispatch, and guarantee as to performance, the "Type 600" will stand the closest comparison point for point, not only with the big condenser shown, but with any other Dubilier Product, large or small. Be advised—

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The Valves which your set requires are those which will give you a first-class concert from your own Broadcasting Station rather than those whose chief claim is that they will receive concerts over stupendous distances.

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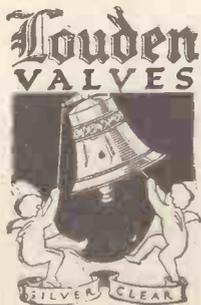
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Volume *plus* tone that is clear and mellow

THAT is just how the Little Sparta brings the Radio programmes to you. Its exquisite fidelity of reproduction *recreates* the singer's voice, the majestic power of the organ or the gay rhythm of the dance band exactly as it takes place before the microphone. The adjustable diaphragm permits of the most delicate contrc' resulting in a marked degree of tonal purity. Nothing has been omitted which can possibly add to its efficiency—it's all there.

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Supplied in Three Types:—

Type J. - - - 120 ohms
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55/-

All "Sparta" Loud Speakers are fully guaranteed, and despatched securely packed in cartons with full instructions for use.

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Immediately any wireless set is equipped with Bowyer-Lowe Square Law Condensers that set becomes more selective and yields purer, richer signals than would otherwise be possible. Why?

Because the Bowyer-Lowe design gives the square law effect with a lower minimum capacity than any other condenser has attained, and is built by experts in a scientific way whereby all other losses are reduced to the lowest limit.

You can install these condensers without in any way altering the design of your set. They are NO larger than ordinary condensers of the same maximum capacity.

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Your set will be easy to tune and calibrate, its wavelength range will be greater; it will be more selective, and you will obtain signals which in purity and volume will exceed your expectations.

Equip all your sets with Bowyer-Lowe Condensers, for maximum range, signal strength and purity of reception.

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For best results use Bowyer-Lowe Condensers in conjunction with Bowyer-Lowe MATCHED H.F. Transformers. Every one is guaranteed to match perfectly every other in the same range. All ranges and Neutrodyne model at uniform price of

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WRITE FOR OUR FREE CATALOGUE, containing 36 pages of information about all the Bowyer-Lowe Tested Components with blanks for your notes. Send 1½d. stamp to cover postage.

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POPULAR WIRELESS

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

RADIO NOTES AND NEWS OF THE WEEK.

The Recent Eclipse.

WHAT has been discovered about the effect of sunlight upon wireless, as a result of the recent eclipse of the sun? Reports upon the transmissions in this country are still coming in at the time of writing, and in America listeners co-operated in the tests upon a grand scale. The eclipse was a total one there, and automatic recorders provided a valuable check upon results. Whatever conclusions are arrived at, British listeners will be called upon to check them in two years' time, for in June, 1927, there will be a total eclipse in this country—the first for 200 years.

G F A To Move.

SOME months ago it was persistently rumoured that 2LO would have to move from Marconi House because of interference with G F A, the powerful station belonging to the Air Ministry. It seems now that G F A will be the one to move, for I hear that the Government contemplate transferring the Air Ministry headquarters from its present site in Kingsway to Whitehall. That district already boasts of the Admiralty station (B Y A), and there are also rumours of a very powerful police station to be erected at New Scotland Yard.

Wireless at the Yard.

SCOTLAND YARD is taking wireless very seriously nowadays. There are at least seven wireless-equipped motor vans now in use, and the Commissioner himself, as well as the "Big Four" area superintendents, employs the radio-van to keep in touch with headquarters whilst travelling. The four flying-squad vans have no visible aerial outside, in order to conceal their identity from wrongdoers, but the latest type now being tested has a collapsible aerial, which can be put up or taken down from the inside of the van whilst it is travelling at full speed.

Radio Vans.

EACH of the police vans has a 200-watt transmitter, capable of telephoning over a 30-mile radius, and of telegraphing in Morse-code up to 200 miles or so. The wave-length used is—well, I may as well tell you, because the messages are all

in code—265 metres, for ordinary reception. Messages are also sent upon 730 metres, and if by any chance the code fell into the wrong hands, the wave-length, code, and, in fact, the whole system, could be changed at a moment's notice.



The D. F. Frame Aerial on the liner "Leviathan."

3LO Calling!

HAVE you heard of 3LO? This is the call-sign of the new Melbourne station which has recently started broadcasting upon 1,720 metres. Neither this station, nor Perth, 6WF on 1,250 metres, has yet been received in this country.

Wireless to Australia.

IT is announced from Sydney that the charges for the transmission of messages over the "beam" wireless system have now been fixed. Full rate messages will be 2s. per word; deferred, 1s.; week-end, 6d.; Press full rate, 5d.; Press deferred, 3d. The service will be operating before the end of the year.

The Worst Ordeal!

I WAS talking to two of the "Co-Optimists" the other day—no names, no packdrill!—and asked them whether they would like to broadcast again, or was the last experience enough? Both shuddered, and confessed that "Mike" was the worst ordeal they had ever faced. But they both want to broadcast again—from a theatre, this time!

Vienna's Station.

A VIENNA correspondent has been good enough to send me a complete and up-to-date statement of the times of transmission of the Vienna station (Radio-Wien), which I pass on for the benefit of readers interested in that station. 8 a.m., Market Prices; 10-11.50, Concert; 12.05, Time Signal; 12.30, Weather Forecast; 2.30 p.m., Stock Exchange Prices; 3.0, First News Bulletin; 3.10-5 p.m., Concert; 6.50, Second News Bulletin; 7-9, Concert, followed by Time Signal; 9-10.30 (Wed. and Sat.), Dance Music. The wave-length is 530 metres, and all times are given in G.M.T.

A Novelty.

A "FIRST NIGHT" by radio is the latest development in the theatrical situation, and we are promised parts of "Love's Prisoner" on Feb. 3rd. Whatever the managers think of broadcasting there is no doubt of its popularity behind the scenes. Spot-limelight men and scene-shifters have 'phones on most of the time they are not moving about—in fact, one of them told me he listened-in to "Yoicks" whilst seeing it from the wings of the Kingsway.

Broadcasting in Sweden.

FOLLOWING the renewal of broadcasting activities in Norway there has been a spurt in Swedish interest in wireless, and I hear that several new stations will be in operation there soon. Next month Sundsvall is due to open, and the station at Boden will also be in commission before March. It is possible that a system of relays will supplement the main stations, now that Britain and Germany have both proved the success of a relay scheme.

(Continued on page 1290.)

assault
assault

NOTES AND NEWS.

(Continued from page 1289.)

Additional Call Signs.

THE following amateurs' call-signs should be added to the list which was given in the Booklet presented with "P.W." on Jan. 7th:

- 2 A Y Q—Mr. H. Stephens, 169 Murchison Road, Leyton;
- 2 A Y D—Mr. N. Swain, 60 Marten Road, Walthamstow. (Experimental aerial.)

The particulars against 2 W B should be read, "W. Bannister, 62, Knoll Dale," and those against 5 X C "John H. Gash, Oak House, 431, Meadow Roads, Leeds."

SHORT WAVES

"Heave a deep sigh
For all of the boobs
Who cross up their batteries
And burn out five tubes."
—Radio Digest."

"A man who had been deaf for thirty years recently heard a jazz band on the wireless. Perhaps this will be a warning to him not to touch it again."—Sunday Pictorial."

"In these days, when conductors seem afraid to refuse encores, the B.B.C. are giving a great benefit to music-lovers by allowing them the privilege of an uninterrupted presentation of oratorios, etc. It is a new sensation to be thus able to hear a work from end to end without interruption, and it is a privilege enjoyed by many."—The Rev. H. G. Peile in the "Times."

"The sooner theatrical managers realise the obvious value and enormous possibilities of wireless, instead of disputing on weak ground about its competitive disadvantages, the better."—Daily News."

"The developments in wireless are as wonderful as the dullness in Marconis, but all the scientific miracles of the year under liquidation are powerless to extinguish the cruel lie that it's never gonna rain no mo'."—Autolyceus, writing in the "Financial Times."

"On listening-in to the jazz music recently broadcast from Pittsburg, several eminent critics found themselves in full agreement with all that the atmospherics had to say about it."—Weekly Westminster."

"It is difficult to over-estimate the immense service which broadcasting has rendered in teaching many of us the correct way to pronounce the names of musical composers, and so freeing us from the necessity of trying to make the other man say it first."—Dudley Clark writing in the "Passing Show."

The Week's Query: "My set went fine until I reversed the crystal connections and put a .001 across the primary. Now signals are rotten—only about half strength. What shall I do?"

A Unique Feat!

AUSTRALIAN amateurs are still being received well in this country, but the feat reported by Mr. J. F. Cullen 68, Queen's Drive, W. Derby, Liverpool, must be unique, I think. At his station (5 O L) he received Australian 3 B Q on one valve. The Australian amateur was replying to British 2 O O and 2 N M, "F.B. O.M."

S. A. Broadcasting.

In a cheery letter from Roodepoort, Transvaal, a correspondent tells me that he has received a complete programme from K D K A, at a distance of just on 8,000 miles. He says that advertising spoils the South African broadcasting, and just as "you are sitting down and enjoying a nice selection they put over 'Where to get your pants pressed while you wait,'" etc.

The Reward of Merit.

THE good work of the American amateurs on short wave-lengths has been recognised by the U.S. Government, when revising the wave-length bands upon which amateurs are allowed to transmit. They have been assigned the following ranges: 200 to 150 metres, 85.6 to 75 metres, 37.5 to 32.8 metres, and 21.2 to 18.7 metres. In addition they will be allowed to experiment between 5.3 and 4.6 metres.

Come On, Someone!

WHICH is the best place in Britain for wireless reception? Hetton-le-Hole, Co. Durham, claims the most amazing results as regards distance, and a correspondent there tells me he can get Bournemouth or Aberdeen any night when 5 N O is silent. He gives some uncommonly good one-valve results also, and says "all my friends with efficient sets seem to get similar results." Can any other neighbourhood make a claim to better reception?



Some members of the Wireless Experimental Association with portable apparatus used recently to track down "howlers."

The New Craze.

LISTENING-IN to electrons (not elections) is the latest scientific marvel, described by Dr. A. W. Hull, of the Research Laboratory of the General Electric Company, in a paper read before the American Physical Society. Recent experiments made by Dr. Hull, in conjunction with Dr. Williams of the University of Michigan, shows it is possible to receive by radio the noise made by electrons in motion. Flying from a lighted filament in a vacuum tube, the electrons bombard a plate, in the way that is taken advantage of in an ordinary wireless receiving valve.

"A Mighty Reason."

BY means of enormous amplification the rain of electron-blows on the plate can be heard, and with further amplification they may become a mighty roar. According to Dr. Hull, noise is an inevitable property of electron emission—a puzzling statement in view of the fact that such emission generally takes place in a vacuum. One effect of the discovery is to provide an independent check upon the researches into the size of electrons.

Australia Again:

I HAVE received a very interesting letter from Cornerbrook, Newfoundland, written by an Australian who believes in having a radio set wherever he goes. He has tuned in nearly all the principal American stations as far down as Los Angeles

(California), and Porto Rico, Havana, Florida and Honolulu, as well as 2 L O and Aberdeen. His set is mostly made from British parts—of which he speaks very highly—and consists of 2 H.F., Det., and 3 L.F.

Interesting Radio Exhibits.

HAVE you seen the wireless exhibits in the Western Hall of the Science Museum, South Kensington (Imperial Institute Road)?

Some of the wireless pictures and apparatus used at Radio House and wireless to New York are on view there, including a photograph of the Prince of Wales, a copy of the portrait as it was received in New York, and one of the American papers in which it was reproduced.



Mr. Mason's Circuit.

MR. PHILIP MASON—of Simple Super-Circuit fame—calls my attention to an error in the wiring diagram given in "P.W.," No. 131 (page 798). The connections to the anode coil (the top coil in the photograph) should be reversed. This, of course, will only affect those who use plug-in coils of the non-reversible type.

Still Growing.

THE figures in connection with the Third Annual Chicago Radio Show have just been published, and they go to show that even yet America has not reached saturation point as regards its interest in radio. The average attendance was nearly thirty thousand people per day, and the value of the orders booked by the exhibitors during the six days the show was open totalled no less than £1,030,000.

8 E 1.

I AM indebted to a correspondent in Neuilly-sur-Seine—how POPULAR WIRELESS travels, doesn't it?—for particulars of the interesting French station 8 E 1, referred to by Mr. Atterton in our Correspondence columns of November 29th issue. He tells me that 8 E 1 usually transmits from Neuilly, but is occasionally moved to Paris, and sometimes to Deauville. The latter resort is on the Normandy coast, and it was probably from here that the loud reception on 500 metres referred to was obtained.

ARIEL

HOW TO CONSTRUCT A THREE-VALVE REFLEX SET. The Circuit with a Popular Appeal.

Built and Designed by Captain RICHARD TWELVETREES, A.M.I.M.E., etc.

PART I.

This receiver has been specially built by Captain Twelvetrees in order to place before "P.W." readers full and comprehensive constructional details about a type of receiver which for economy and efficiency has proved itself an ideal set for the experimenter.

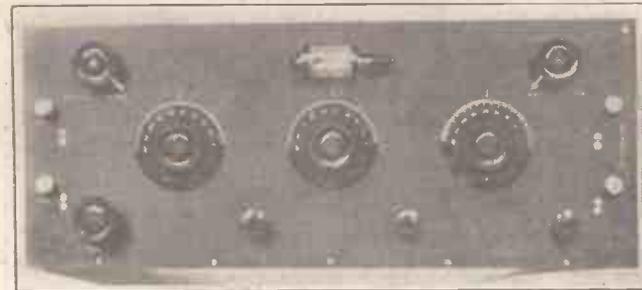
WHILST the ordinary form of straight circuit, used in receiving sets, finds many adherents among amateur constructors, the type of instrument employing dual amplification is of such interest as to merit the attention of all wireless experimenters, and the set described in the following notes may be regarded as a good example of this particular principle.

In the constructional features of the set

structuring any unusual form of receiving instrument, the amateur naturally desires to know something of the principles involved and details of any advantages claimed for it; so it may be well to preface the article with a few remarks on the principle of operation and advantages of reflex amplification which form the outstanding feature of this instrument.

It will be assumed that the reader has some theoretical knowledge of the principles embodied in the operation of the ordinary valve, as well as the usual form of intervalve coupling, and therefore he should experience little difficulty in following the explanation of the reflex principle.

In a few words, the reflex circuit owes its origin to the discovery that a single valve can fulfil two duties, instead of the single duty usually required of it. That is to say, it can act as an amplifier of high-frequency oscillations, and can, by the adoption of a special form of circuit, be made to amplify low-frequency impulses at the same time.



Front view of the panel of the three-valve reflex set.

no undue complication will be found. The cost of the instrument brings it well within the scope of the average home constructor, and the lay-out has been so simplified as to render the assembly and the subsequent operation extremely simple.

Before commencing the work of con-

Thus, with the use of a crystal detector and

MATERIALS REQUIRED.

No.	Description.	Type.	Price.
			£ s. d.
2	Two-pole anti-capacity switches	Utility ..	8 0
1	Two-coil holder	A & B Standard	5 6
3	Coils S2, S4, S4	Burndept	13 3
1	Condenser, variable, .0003 ..	Listolien	5 6
1	Ditto .0003 ..	Ditto ..	5 6
1	Ditto .00075 ..	Ditto ..	7 0
2	Transformers ..	Eureka No. 2 ..	2 5 0
	Ebonite as per drawings	British Ebonite Co., Ltd.	15 0
1	Fixed condenser .00025 ..	Dublier	2 6
1	Ditto .005 ..	Ditto	3 0
1	Ditto .001 ..	Ditto ..	3 0
1	Ditto .25 ..	T.C.C.	3 0
1	Crystal Detector	Burndept	5 0
3	Filament Resistances, 30 ohms	T.C.B.	12 0
12	Valve legs ..		1 0
12	Terminals ..		2 0
12 yds.	"Systoflex" ..		5 0
6 ft.	Brass rod, 2 B.A.		1 3
36	Brass nuts, 2 B.A.		9
1	Bush, a B.A. ..		2
1 lb.	Wire 18 S.W.G. tinned copper		2 4
3	Valves ..	B.T.H. B5	3 15 0
2	Brackets (Brass)		2 8
1	Wood panel as per drawing ..		1 6
2	Sets 'Neugraving'		1 3
1	Coil plug ..		1 6
1	Cabinet as per drawings ..		1 10 0
			£12 17 8

(Continued on page 1292.)

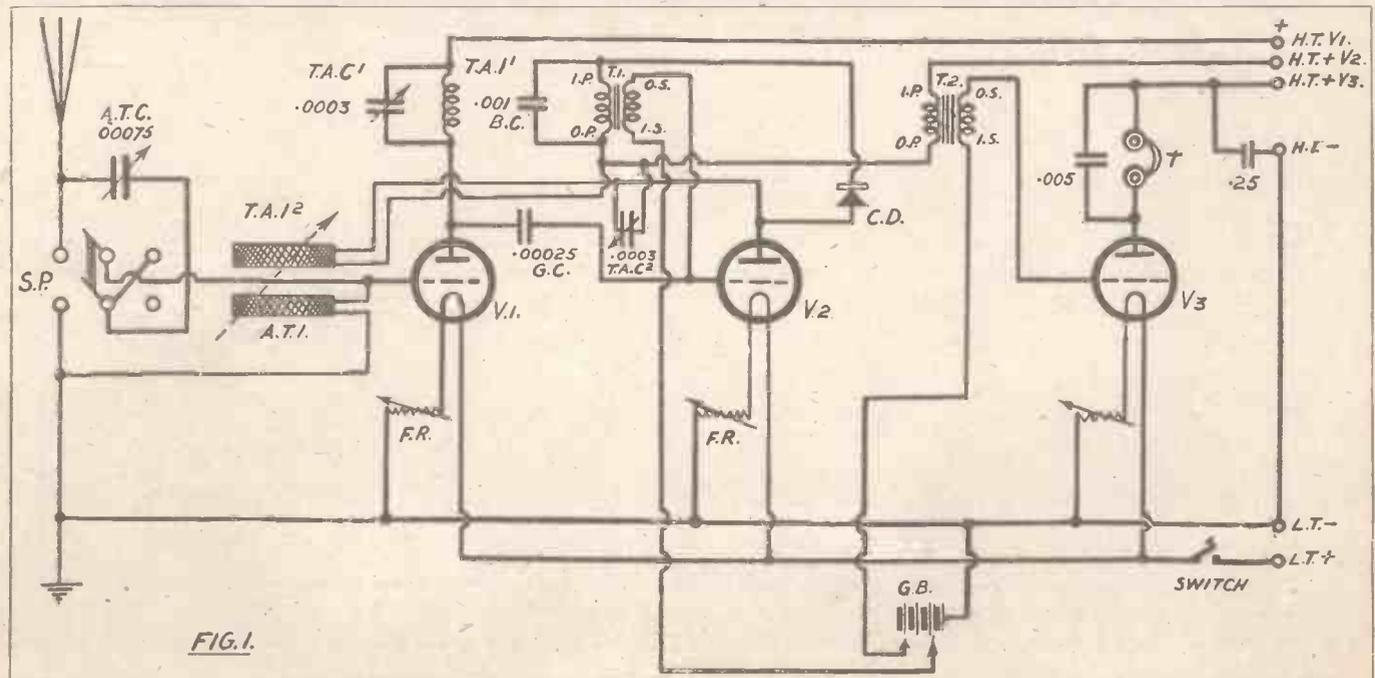
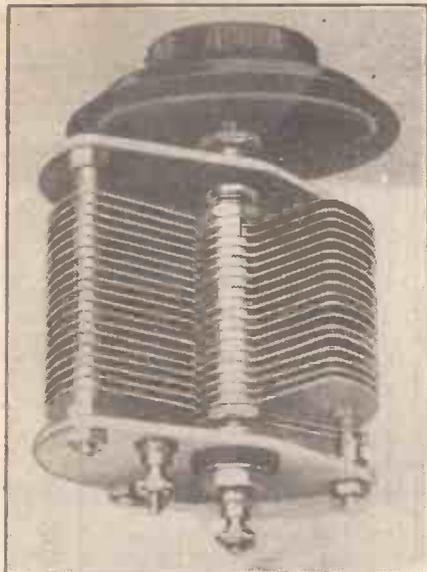


FIG. 1.

HOW TO CONSTRUCT A THREE-VALVE REFLEX SET.

(Continued from page 1291.)

three valves, the set possesses all the characteristics of one employing a similar detector and four valves. At the same time, the use of a dual circuit reduces working costs, gives a purer tone than when other designs are used, and permits of a volume



The '00075 mfd. variable condenser.

unattainable by the use of standard straight circuits.

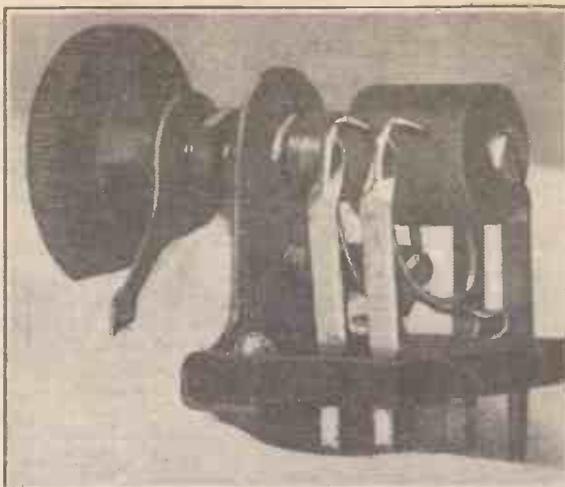
The circuit can be followed out by reference to the diagram reproduced as Fig. 1, from which it will be seen that the oscillations in the aerial, A, pass to a series-parallel switch, S.P., the latter fulfilling two duties: (a) Connects the aerial tuning condenser, A.T.C., in series with the aerial

tuning inductance, A.T.I., for receiving short wave-lengths; and alternatively (b) connects the aerial tuning condenser, A.T.C., in parallel with the aerial tuning inductance, A.T.I., for receiving long wave-lengths.

The coils for the two-way coil holder are selected in sizes to suit the varying wave-lengths used by different stations.

As the aerial tuning coil, A.T.C., is tuned to the required wave-length, the oscillations cannot pass the coil and thus continue direct to the grid of the valve V1. This has the effect of causing fluctuations in the circuit from the high-tension battery, which pass from the plate to the filament of the first valve V1, thus amplifying the high-frequency oscillations.

Between the high-tension battery and the plate or anode of the first valve V1, is a coil T.A.I.,



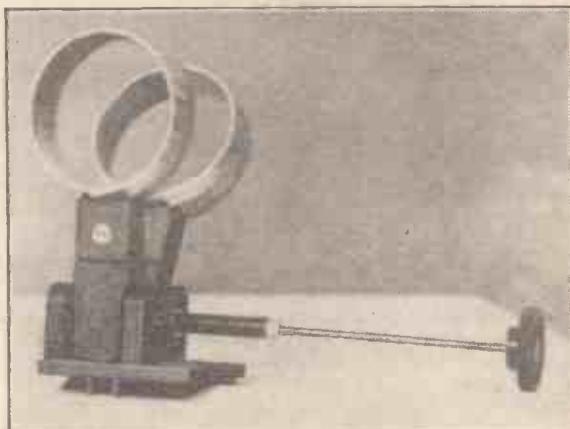
The anti-capacity main switch.

tuned by a variable condenser '0003 T.A.C.1, comprising what is known as a tuned anode. Its action causes a variation in the potential across the grid condenser G.C., shown between the valves V1 and V2, producing further amplification at high frequency.

(Continued on page 1293.)



Showing method of mounting the valves.



The two-coil holder with anti-capacity handle.

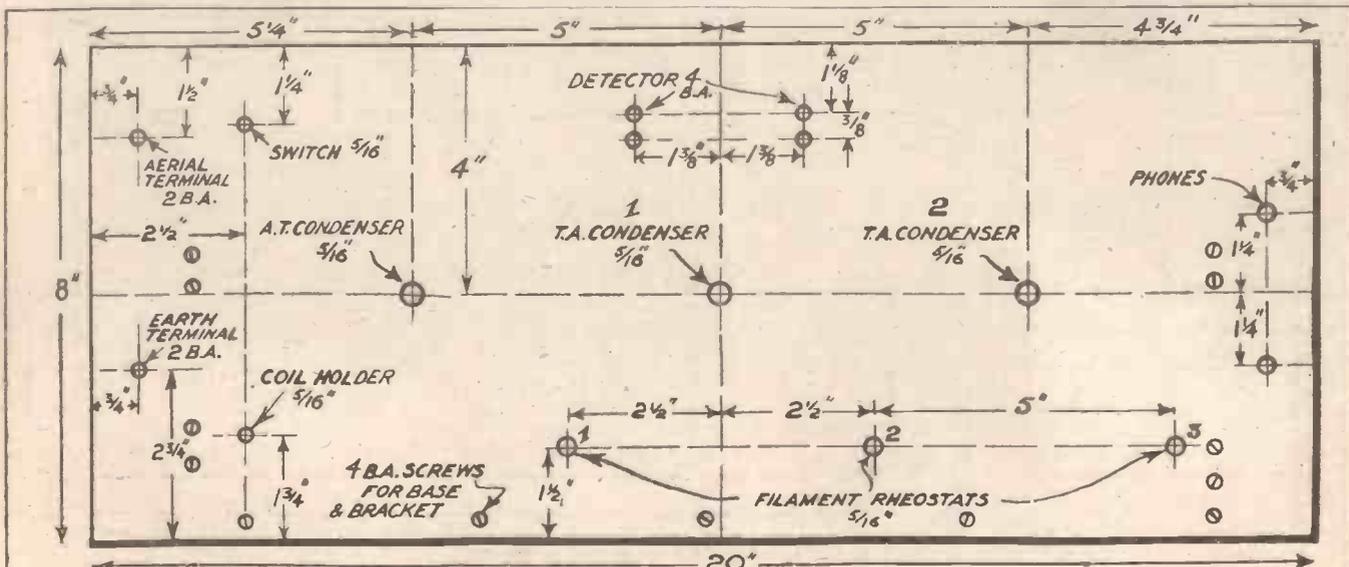


FIG. 2.

FRONT PANEL DIMENSIONS & DRILLING SIZES.

HOW TO CONSTRUCT A THREE-VALVE REFLEX SET.

(Continued from page 1292.)

The current in the plate circuit, passing through the tuned anode T.A.I.2 to the plate of the second, or dual, valve V2, as already described, creates a difference in potential across the tuned anode T.A.I.2, which forces a current through the crystal detector, C.D., where it is rectified and continues through the I.P. terminal of the transformer T1. The O.P. terminal of the

transformer T1 is connected to the high-tension battery via the transformer T2, thus completing the part of the circuit comprising the reflex feed.

The current passing through the primary winding of the transformer T1 induces a stepped-up potential in the secondary winding, the latter potential affecting the grid of the valve V2, which amplifies the signals at low frequency.

This completes the dual function of the valve V2.

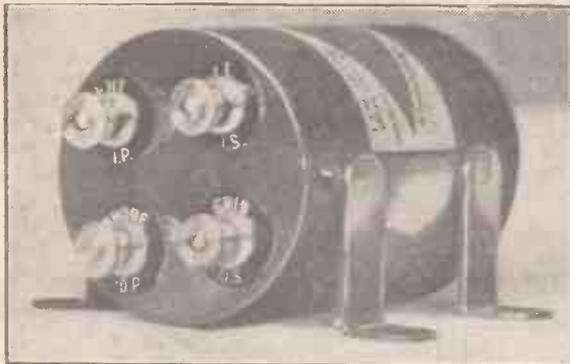
The necessary negative voltage on the grid of the valve V2 is derived from the grid bias battery, G.B. which

is connected, as shown, to the I.S. terminal of the transformer T1. From the above remarks it will be observed that the valve V2 amplifies both high and low frequency impulses simultaneously.

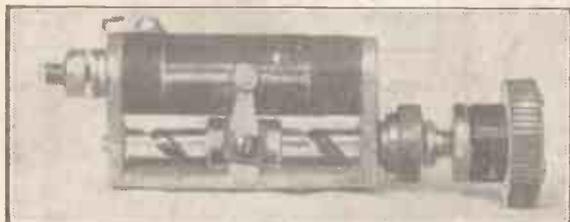
On tracing out the wiring of the transformer T2 from the high-tension battery, it will be seen that on passing from the battery to the plate of the second valve V2, the circuit includes the primary winding I.P.-O.P. of this transformer and the tuned



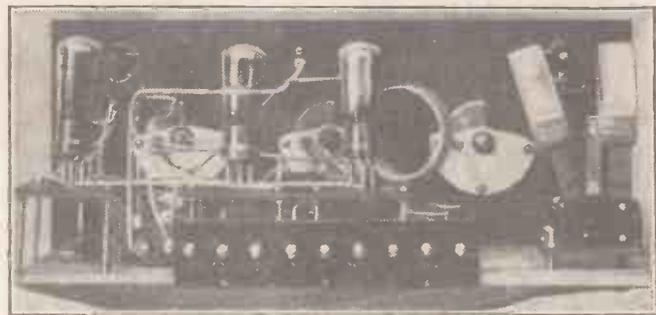
Applying transfers to the panel.



One of the screened L.F. transformers.



The type of filament resistance employed.



View of rear of panel, showing valves in position.

is connected, as shown, to the I.S. terminal of the transformer T1. From the above remarks it will be observed that the valve V2 amplifies both high and low frequency impulses simultaneously.

anode coil T.A.I.2, and this induces a step-up potential in the secondary winding I.S.-O.S. of the transformer T2, the potential thus created affecting the grid of the valve V3, or low-frequency amplifying valve, the necessary grid voltage being

(Continued on page 1337.)

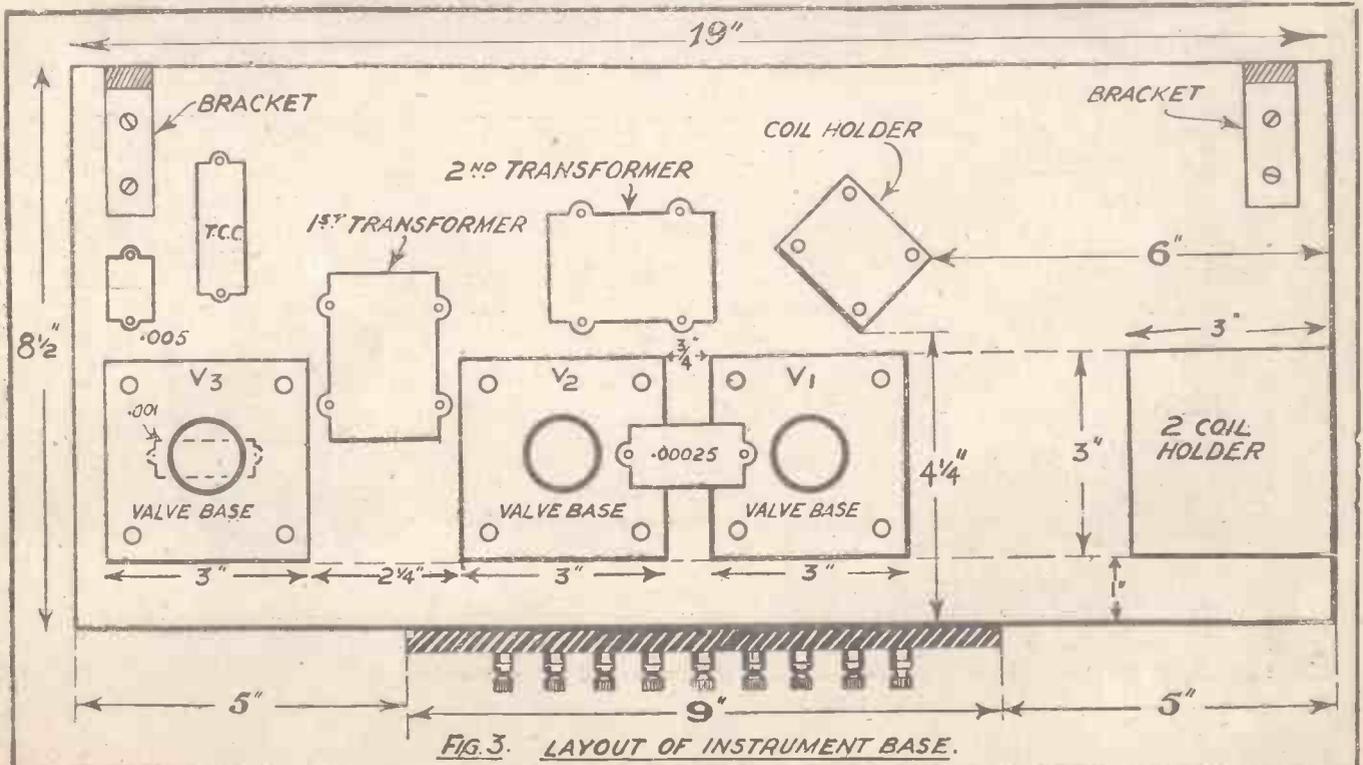


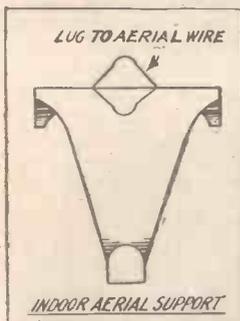
FIG. 3. LAYOUT OF INSTRUMENT BASE.

Constructional Notes

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

Indoor Aerial Support.

MANY people who use indoor aerials prefer to remove them when they are not in use, and if special hooks have been fitted, these are sometimes conspicuous when standing idle. The special type of hook shown in the illustration, however, appears when idle to be merely an ornamentation of the ordinary picture hook.

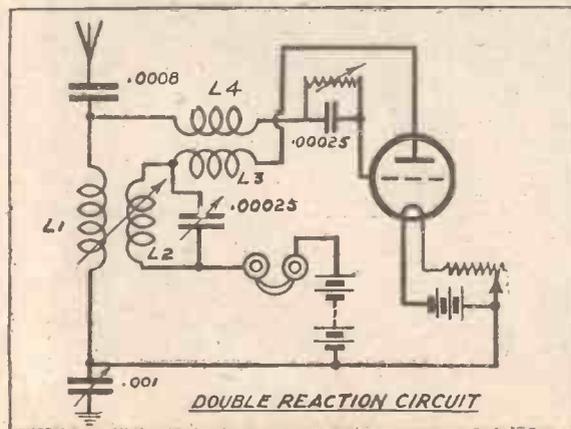


This ingenious support is the subject of British Patent 220459/23. The weight of the picture hanging from the lower point of the hook keeps the hook rigidly

upon the picture rail, the aerial being secured to the lug projecting from the upper part of the hook. The lug is formed during the manufacture of the hook, but presumably such a lug could be added afterwards to an existing hook by soldering.

Double-Reaction Circuit.

Here is a little circuit, from "Radio Digest," which is interesting to try, and for which it is claimed that it is of low cost, high selectivity, large volume, and a great distance-getter. The primary L1 is a 60-turn spider-web coil, whilst the reaction coil, L2, has 40 turns, with variable coupling between L1 and L2. L3 and L4 are spider-web coils with 40 and 10 turns respectively and fixed coupling. They are spaced about 2 in. apart. All these coils are wound with 22 D.C.C. wire. A vario-coupler may be used in place of coils L1 and L2. The rotor plates of the tuning condenser are to earth, and the plate circuit variable condenser should be provided with vernier. The fixed condenser in the aerial circuit is a mica condenser, the rheostat a vernier one, and all leads are kept as short as possible. It

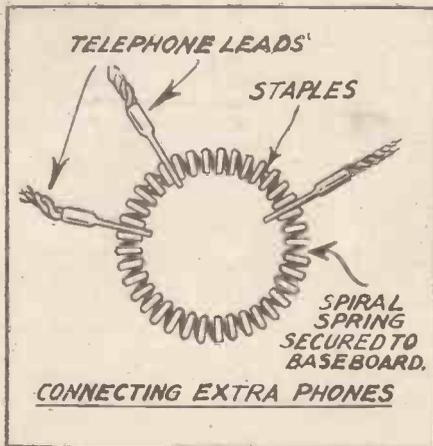


DOUBLE REACTION CIRCUIT

is stated that using dull-emitter valve and 22½-volt H.T., local stations were received as loud as with an ordinary circuit using detector and one L.F., with reaction.

Connecting Extra 'Phones.

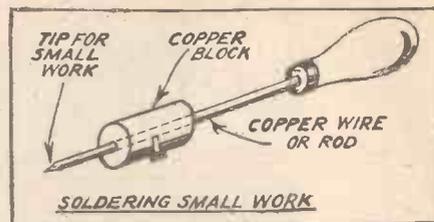
The drawing herewith shows a very simple arrangement for terminals for connecting extra pairs of headphones to a receiving set. To each of the 'phone terminals of the set is connected a spiral spring, which may be straight or arranged in circular formation as shown in the figure. The spring is secured to the baseboard by means of staples applied at the necessary points, and the extra 'phones are put in circuit by slipping one 'phone tip between turns of one of the spirals, and the other 'phone tip in the other spring in the same



way. The springs themselves may be made by winding fairly stout brass wire around any suitable cylindrical object, of a diameter of one-quarter to one-half of an inch.

Soldering Small Work.

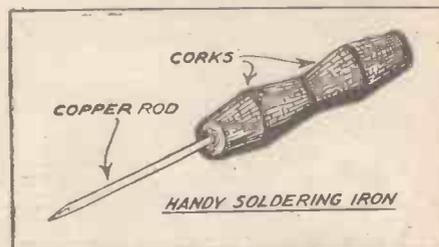
In order to solder small work, it is necessary to use a fine tip to the soldering iron, and this is most easily obtained by using for the "iron" a short piece of copper rod. This has the disadvantage, however, that the iron loses its heat very rapidly. This drawback may be overcome by making the soldering iron entirely of a length of copper rod, as shown in the figure, and slipping thereon a copper block, which may be either cylindrical or square-section, and which is preferably secured by means of a screw. This has the effect of giving the iron a much greater heat capacity, without interfering with its use for fine



work. In the absence of a suitable copper block, several layers of heavy-gauge bare copper wire (No. 18 or heavier) may be wound upon the copper rod near the tip, to and fro, for several layers. Owing to oxidation between the layers, however, this is not so satisfactory as the copper block.

Handy Soldering Iron.

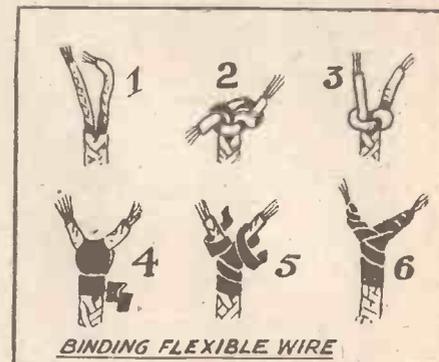
Here is a useful soldering iron for small work. Instead of securing a copper head to an iron shaft, in the usual way, a whole rod of copper is used, and for a handle, a number of ordinary corks are used, holes being bored through them, wide enough to



permit of their being slipped into position on the rod, as shown. The corks make a very good handle, and the tip of the rod should be filed to a suitable shape for the work for which it is intended.

Binding Flexible Wire.

When twin flex in a braided cover is to be bared with two tips for connectors, it is not always easy to make a permanent and neat job of the insulating covering, where the wires are separated out, and also there is in time a likelihood of the separate wires becoming broken at the end of the braid covering. A satisfactory method of overcoming the trouble is shown in the accompanying drawing. The two leads are first knotted in the manner indicated, and are then bound with insulating tape,



BINDING FLEXIBLE WIRE

as shown in Fig. 4, the end of the tape being then slit longitudinally and used to bind up the separate leads as shown in Fig. 5. This makes a satisfactory and permanent job.

“DIE DEUTSCH FUNK.”

How They Do It In Germany.

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

Mr. Sholl has just returned from an investigation of wireless conditions in Germany. This short article is, therefore, of especial interest to all British wireless enthusiasts.

BEFORE my recent trip to Berlin I was not at all sure whether we had won the war or not.

After a dose of German wireless I am positively certain that we have, and I am equally sure that we may whistle for our

are at the end—that is the end where the trouble starts, like balls of string, or an aerial coil that has come unstuck.

If we are lucky we shall get a wooden slide inductance, “ohne krystall,” for about 10 marks, and then we come to the ‘phones business.

We have to be careful here as all the best people use “Doppelkopfhörers,” and care should be taken to avoid any reference to “Dumkopf,” as this is Teutonic for blockhead, and might cause the gentleman behind the counter to burst into oscillation or tears—or both.

The Doppelkopf horrors—I mean hörers—may be had in all colours, and I am told that while for the present season both ear-pieces are to be of the same colour we are promised great things in this line in future if we are good.

After we have really found ourselves again, we set up the apparatus which we find is a “Funk Empfänger,” really.

The man in the shop might have told us all about it at the time if he had been “quite nice,” but there we are, we have had our “Funk Empfänger” all this time—about an hour—without knowing it!

Now, being really nice sociable people, we provide ourselves with a huge china ash tray set in a circular base, which bristles with insulated sockets.

This gadget stands in the middle of the table and we connect the output leads from our set to two of the sockets, send the children to bed, and plug in our Doppelkopfhörers.

We find there are not enough ‘phones for the ladies, so we keep them busy bringing up the beer while we light our pipes, or cigars.

Achtung!

If the ladies are very good we tell them odd bits of what is coming over, which amazes them to the point of ejaculating “Wunderschön” or “Kunstler.” But we are in too much of a hurry, we have not got our “Funk Konzert” yet. At zero hour our ears are split by two shrill notes from a gong and we adjust the Doppelkopfhörers, and tune in. Next we receive a raucous bellow which warns us “Achtung!” “Achtung!” and we send the ladies for the beer and baccy while we learn that the mark has beaten English sterling in a walk over.

Then we have a dreary lecture in which we are bullied, blustered, and talked down to by Die Herr Professor Doktor Von Achtundzwanzig, in the style of a Potsdammer sergeant who has got on to the wrong ‘phone number. And thus we enjoy our Deutsch Funk.



The Berlin Radio Hall—specially built for Germany's Wireless Exhibition

reparations while the gentle Teuton is suffering from “Funk.”

“Funk” is their mellifluous term for radio broadcasting, and the word sounds ever so much nicer than it really is. Such a blessed word—like the dear old lady's Mesopotamia—covers something really awful—a Teutonic frightfulness which is all the more so because it is unconsciously frightful.

As a nation possessing little or no sense of humour, as does the German, we do not find that unconscious humour which is the joy of we poor beings who shuffle on this mortal inductance—I mean this mortal coil.

Donner and Blitzen!

We are rather badly jammed here, aren't we? What I am getting at is that this uncommon frightfulness keeps getting up on its hind legs and prevents me getting on with my job.

Well, suppose we are in the Vaterland and we want some Drahtlose, Radiofunk, or just “Funk,” what do we do about it? We tremblingly remove our hat—if we have one—and approach a fierce-looking official for our licence and, having given a detailed description of our “horrible past,” get a form in which such nice kind words as “Verboten,” “Rückkopflung,” and “Hochfrequenzverstärken” struggle for supremacy and our hard-earned marks—real “gold marks,” of the paper variety.

We take this home and put it in the ice chest to prevent it suffering from spontaneous combustion, and then we find we



The inside of the hall in course of construction

A FORTUNE IN YOUR RECEIVER.

By A. J. BOYINGTON.

THERE is an aspect of radio research which is of remarkable and fascinating interest because of the almost illimitable possibilities which it involves. The practical application of wireless to commercial and industrial developments is already an accomplished fact, but as yet it is apparent that only the smallest fraction of its potential usefulness has been exploited.

The fuller employment of wireless is dependent upon a combination of circumstances and of difficulties which have already received the attention of some of the world's most brilliant scientists, and into which further research and investigation are being daily prosecuted. To this research, however, radio has attracted independent investigators by the thousand, rather than by the few, as has been the case with other sciences.

An Army of Experts.

In two decades it has passed from the rudimentary stage of a little indefinite knowledge complicated by vague conjectures and misunderstandings, to a phase of stupendous and world-wide interest such as has never before been accorded to any other science. It has brought into being an army of hundreds of thousands of experts, professionals and amateurs, nationally and internationally organised and equipped with the apparatus and inclinations to attack the most profound problems which it may present for solution.

That these problems are being solved we have every day new evidence, and since, coincidentally, the basic problems which stand in the way of further progress in wireless transmission and reception comprise the same fundamental mysteries underlying all the other uses of electricity and magnetism, the value of scientific research in this direction cannot be over-estimated.

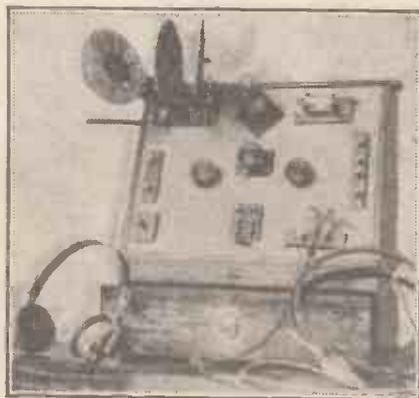
What the future of radio may be is a matter so immense as to pass our comprehension. Its application to every branch of human endeavour is being eagerly awaited by the whole world, and as soon as means can be devised for the proper control of wireless waves so that a million or more messages can be transmitted and received simultaneously from as many stations, without mutual interference; and as soon as natural electric, magnetic, and atmospheric disturbances can be controlled and eliminated; so soon will the world adapt radio more fully to its everyday needs, and the greatest possibilities of the science be realised.

Wireless in Commerce.

Some of the developments to be expected when that Radio millenium arrives may be visualised when one considers its possible applications to the hundred or so gigantic industries carried on by this and other countries. The shipping industry; the mining and engineering industries; railways

and all manner of transport; the telegraph telephone, and cable services; the transmission of news, photographs, and actual scenes; the medical, legal, and other professions; every branch of commerce; buying, selling, negotiations of contracts and concessions; in exploration and research; and down to the humblest domestic processes—all these are capable of extension, expedition, progression, or simplification by the helpful co-operation of radio.

Such institutions as the letter post and telegraph services may be entirely superseded or abolished when the better control of wireless makes it possible for millions of firms or individuals to inter-communicate by means of radio messages, received on typing machines as fast as they are typed out at the transmitting end. The transmission and reception of messages by this means is more than a practical possibility, for it has already been successfully demonstrated. But this development—like many others—is dependent upon better control of both transmission and reception, and



A "Popular Wireless" combination set constructed by one of our readers.

upon the neutralising of local magnetic and other natural or artificial phenomena created by atmospheric disturbances, electrical systems, steel buildings, and other local conditions.

When these pressing problems have received solution the task of supplying motive power by wireless waves from central generating stations will be much simplified, and the Utopian dream of numerous scientists will become reality. Cities of cleanliness will become the rule rather than the exception; light, heat, and power will be furnished by invisible waves of energy—generated at a central station or stations for the whole country and broadcast through the ether—and every factory, office, shop, and house will draw their supplies, as it were, out of nothingness.

Through the same medium, the progress of the Test Matches in Australia will be made visible, as well as audible, to the humblest householder in England, and an opera performed in New York will be pro-

jected on to the screen of a theatre or of a private house simultaneously with the incidental music. A doctor's patient taking a journey overseas will have this benefit: that the medical man can keep in constant touch with his charge, prescribing and advising even though a thousand miles divide. A large commercial undertaking may necessitate holding a hurried conference of the firm's directors—and only the chairman will be present in the boardroom; business is done via the microphone, and completed more expeditiously and satisfactorily.

Problems to Solve.

All these are more than possibilities: they are probabilities, dependent only upon the solution of certain problems of electrical and physical science now engaging the attention of scientists, and amateurs too, the world over. It may be that the answers to them will be found by direct experiment; it is possible that the solution will be discovered by accident. The amateur, experimenting with various factors of inductance, capacity, and resistance in his set in order to improve the quality of his reception, may discover some new principle or some new method of application of old principles, some utilisation of forces or elements now ignored, which may prove the key to yet another secret of the science.

Before the greater utilisation of radio can come about we must know, for instance, why wireless waves can pass through brick walls, through fathoms of water, or through the earth. We must know a great deal more about atmospheric and static disturbances—why they are directional, and come mainly from areas located at the magnetic equators, these areas being also the particular areas in which thunderstorms attain their maximum frequency.

We must investigate the nature and effects of the Aurora Borealis and satisfy ourselves how it is that, while causing disturbance to radio, telephone, and telegraph systems in some regions, these polar phenomena have the adverse effect in other regions. We must solve the mystery of the "dead spots" which occur at intervals on land and on sea. We must determine for ourselves what forces resulting from, or due to, the motion of the earth help or retard radio transmission. We must learn more about transmission of very short wave-lengths and the super-imposition of various wave-lengths upon one another.

Opportunities for All Amateurs.

In the not far distant future the greater part of wireless transmission will undoubtedly be of a directional nature. Marconi's "beam" system, or some other system partaking of its advantages and capable of directing radio signals in a given path at maximum intensity for a minimum power output, will be largely favoured. It will therefore be necessary to perfect such a system—a system which will work equally well in daylight or darkness—before the radio revolution can come about.

Progress towards this end must be rapid—far more rapid than progress in the other sciences has been—for, as mentioned before, radio has commanded the attention of hundreds of thousands of enthusiastic and independent investigators. The humblest of these, in his quest for knowledge, may surprise some great secret, and in the smallest and most trivial experiment may, consciously or unconsciously, make some remarkable discovery which will cause the world to acclaim him as the new Edison. To every radio experimenter is vouchsafed the opportunity, and the world of science will see to it that if successful he does not go unrewarded.



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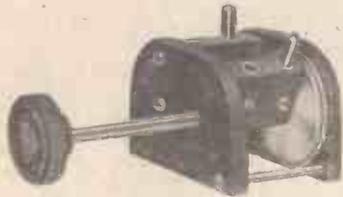
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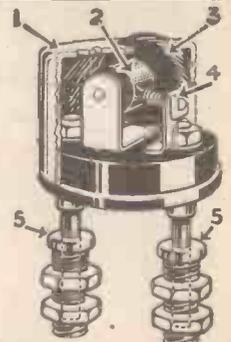
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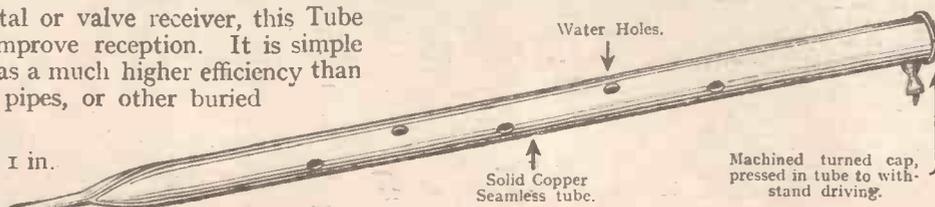
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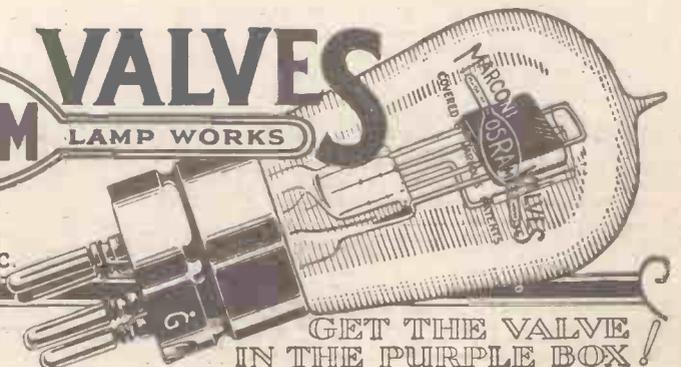
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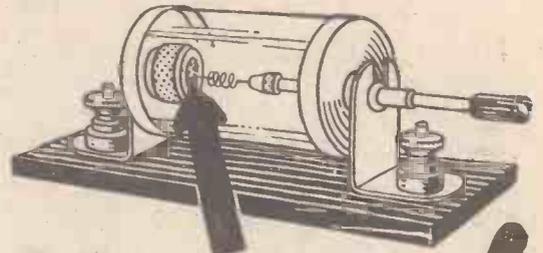
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HOW TO MAKE A USEFUL SWITCH.

By J. LAURENCE PRITCHARD.

In multi-valve sets and in experimental sets this ingenious switch can be used by the amateur with many practical advantages.

DURING the construction of a multi-valve set, it was found desirable to arrange a special switch to reduce the number of controls. The following switching operations were required.

Five Distinct Uses.

1. Aerial and earth short circuits to form a lightning conductor. All batteries disconnected.



Fig. 1. The completed switch.

- 2. Aerial and earth still shorted, but high tension battery connected to set.
- 3. Aerial and earth not shorted, high tension battery connected, low tension battery connected through a resistance so that valves glow dimly.
- 4. Low tension resistance shorted so that valves are at their correct brilliance, high tension battery connected, and set connected to permanently fixed aerial tuning inductance and condenser. This tuning arrangement being set to the wave-length of the nearby broadcasting station, reception from this station being automatic.
- 5. As No. 4, but fixed tuning arrangements acting as a wave-trap against the

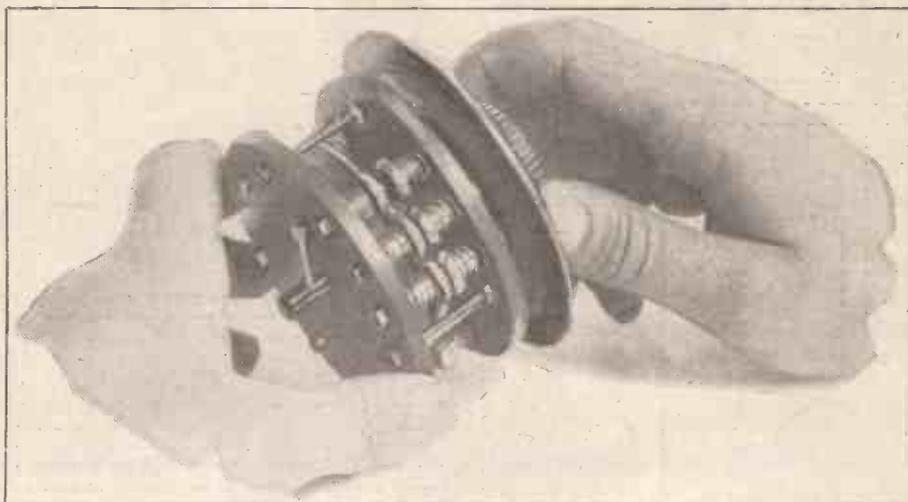


Fig. 3. One of the moving contacts forcing its way through the fixed rollers.

local station. A separate tuning system is introduced by which any desired station can be tuned in the ordinary way.

Constructional Details.

All these combinations of movements are obtainable by the simple operation of turning a dial and knob in an anti-clockwise direction in five distinct movements. The switch was designed to keep the capacity losses to a minimum. By the special design of contacts, uneven wear to the switch parts is eliminated, as a fresh point of contact is made every time the switch knob is rotated. A positive lock is provided at the back of the switch so that it springs from one position to the next when the control knob is operated.

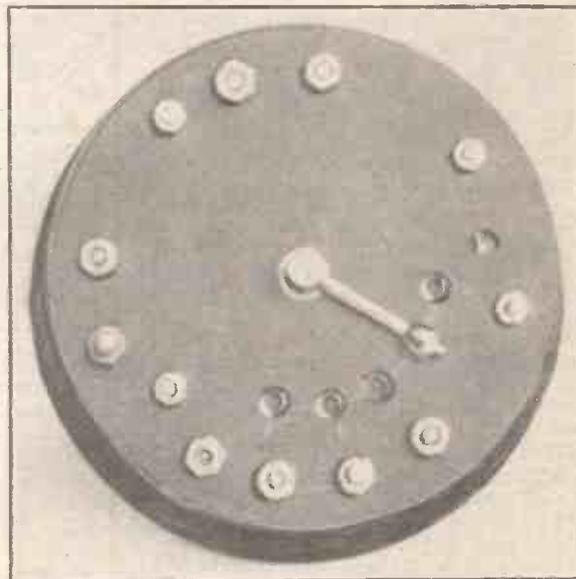


Fig. 4. Showing the method of locking the adjustments.

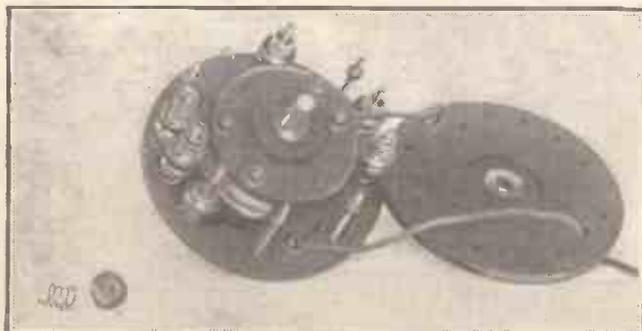


Fig. 2. Showing the fixed rollers positions.

The switch covered in a strip of thin transparent celluloid to keep out dust is illustrated in Fig. 1. There are two moving contacts consisting of flat pieces of $\frac{1}{8}$ -in. brass, cut on the outsides to a certain arc. These contacts, of which one is longer than the other, are bolted securely to the edges of two ebonite discs, in turn firmly secured to a brass

spindle. An insulated flexible wire joins each of the moving contacts on different sides of the ebonite discs. Fig. 2 shows the construction, where it will be seen that the contacts are on opposite sides of the disc and spindle.

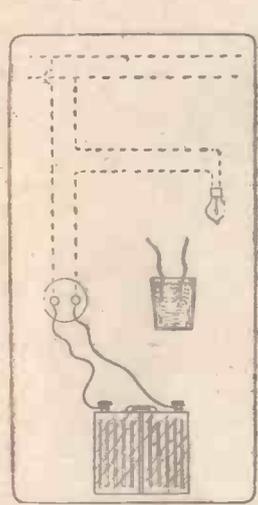
The moving parts are mounted on two larger ebonite discs having brass bearings for the spindles. The fixed contacts are arranged round the circumference, as shown in Fig. 2. Each fixed contact consists of two brass rollers having large flanges on their adjacent faces. On the straight portion of each roller is a wire spring which

(Continued on page 1302.)

TWO IDEAS FOR AMATEURS.

Charging Accumulators.

IF there is one enthusiast to be envied more than another, then it is the one who is fortunate enough to reside in a district where direct current is used for house lighting; for the problem of charging up the accumulator is then a pleasure, rather than a perpetual source of trouble.



Most articles on the subject of charging accumulators at home are of a purely theoretical nature, with the result that the reader, knowing little or nothing about electricity, is frightened off the subject.

Now, from a practical standpoint, the only "apparatus" required is two lengths of insulated wire

and a little commonsense; no elaborate measuring instruments being required, providing the accumulator is of robust design, that the voltage of the mains is 100 to 150, and that the lamp in the circuit to be used consumes an average amount of current.

Method of Connecting.

From the house-circuit shown dotted it will be seen that the switch is in series with the lamp in the usual way. All we have to do is to first find which lead to the switch is positive or negative, and then arrange our accumulator to act as the switch by connecting the accumulator leads to the two upper switch contacts (that is, to the contacts to which are joined the two down leads from the house-circuit) and setting the switch in the "off" position.

The best way to determine the polarity of the leads is to place a large teaspoonful of ordinary salt in a tumbler of water and then make this function as a temporary switch by plunging in the two attached leads from the switch contacts, keeping their ends well apart and at the same time carefully observing round which lead the small gas bubbles collect. This lead will be the negative, and this, of course, is connected to the negative terminal of the accumulator.

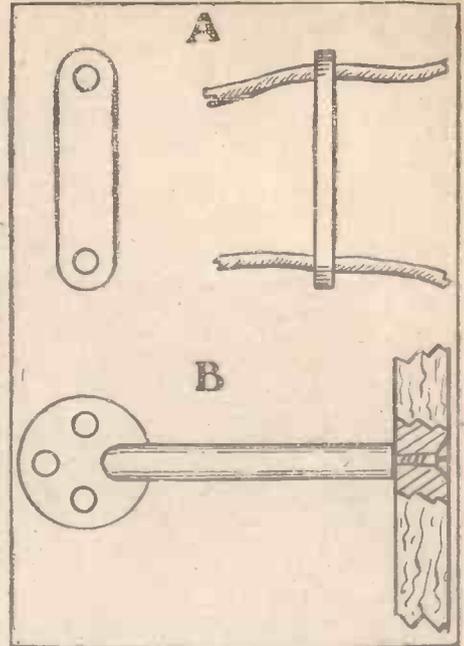
A small pocket voltmeter will be useful for reading the voltage before and after a charge. A new accumulator will require a continuous charge of 40 hours. It should then be discharged through an old 4-volt lamp, and then immediately charged up again before being actually used on the receiver. Eight to ten hours will be sufficient for every subsequent charge.

Wire Separators.

WHEN flexible wire is used for making internal connections considerable trouble is often encountered by the sagging leads being in very close proximity to each other.

This difficulty may easily be overcome, however, by providing simple separators or bridges which may consist of small links of $\frac{1}{8}$ in. sheet ebonite, arranged as shown at A, in the accompanying sketch. Alternatively, a perforated disc, or a piece of sheet ebonite of any other shape, may be secured in a slot at the end of a supporting pillar which is attached to the inside of the cabinet, as indicated at B.

By this means three separate leads can be carried, but even with good spacing, running leads parallel for any distance is not to be recommended.



A USEFUL SWITCH.

(Continued from page 1301.)

forces the rollers together. A length of brass rod passes through the centre of each fixed contact, the rod being threaded at the ends to which it is bolted

to the discs by means of a nut at either end. The moving contacts are arranged to force their way between the rollers of the fixed contact, as shown in Fig. 3, where the moving contact has opened one pair of rollers. Contact is thus made between the curved flat strip of brass mounted on the smaller discs, called the moving contact, and each pair of rollers which are electrically connected by the common spindle.

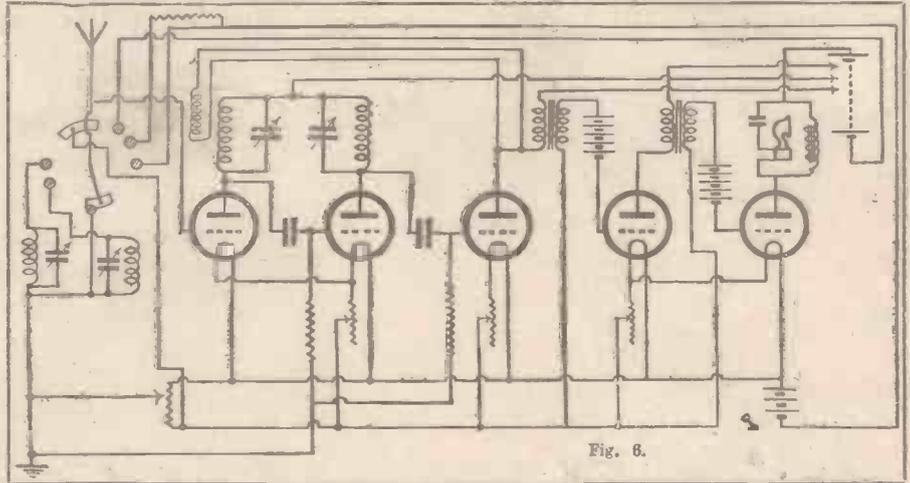


Fig. 6.

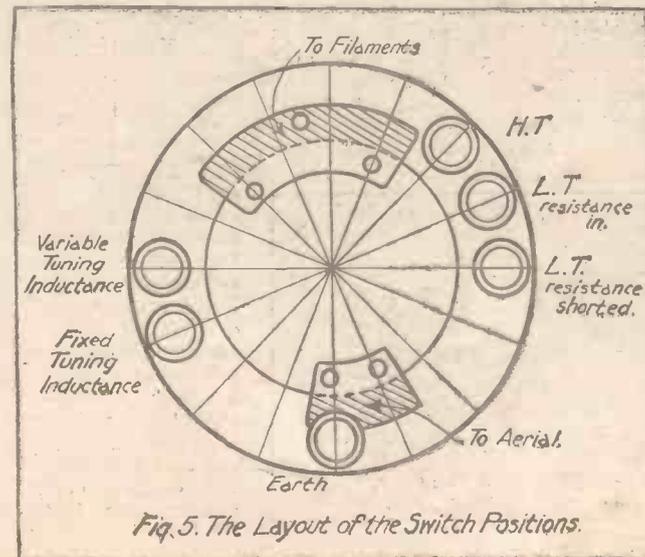


Fig. 5. The Layout of the Switch Positions.

The positions of the fixed rollers are shown in Fig. 2. In one set of fixed contacts, the latter are placed close together, and the moving contact on this side is $1\frac{1}{2}$ times longer than the distance between the outer studs. The other moving contact is just able to span two of the fixed contacts on the opposite side. The third contact is spaced some distance, apart in order to make contact when the other moving contact is not connected.

The back view showing the positive lock is given in Fig. 4. The lock consists of a piece of brass rod rigidly fixed to the spindle and having a ball—capable of being rotated at the other end. The ball runs into a series of depressions drilled in the arc of the movement of the ball. The depressions coincide with the switch positions. The positions of the switch contacts are given in Fig. 5. This should be studied in conjunction with the wiring diagram, Fig. 6, in which the switch is used.

NOTES ON SHORT-WAVE RECEPTION.

By K. D. ROGERS.
(Assistant Technical Editor.)

Readers who are experimenting with short-wave reception from distant stations will find sound practical advice in the following article.

SINCE writing the few notes upon the New Zealand receiver at Mill Hill School I have had a large number of letters from readers giving their experiences—most of them successful—with the set described, and asking for further details of apparatus capable of picking up long-range telephony and C.W. on wave-lengths of between 60 and 120 metres. Many have expressed their surprise upon the ease with which K D K A on 65 metres can be picked up night after night upon only one or two valves, and with more or less inefficient aerials. Indeed, one reader had received the famous Pittsburg station on one valve (built as Mr. Goyder had built his set) without an aerial at all—only an earth being used, but taken to the aerial terminal of the set in a similar way to that employed by the writer last winter.

Undesirability of Capacity.

Readers who have not yet tried their luck on short-wave reception and who possess one or more valves should certainly build a set or adapt their present receiver to enable them to tune down to 60 metres, for there is a peculiar fascination in listening on such wave-lengths that is not felt upon the lower frequencies, and there are innumerable amateur stations, both European and American, to pick up on the 70—120 metre band. It is indeed quite easy to log upwards of 20 American and Canadian C.W. stations in an hour or two, while there seems to be no end of French, Dutch, Italian, and Scandinavian stations available between 8 and 11 p.m. After that hour K D K A, P O Z (73 metres) and American amateurs claim the listener's attention.

In order to assist those who have not yet

ventured to the lower wave-lengths I intend to describe briefly a number of circuits and tuners capable of giving good results on ultra short waves, and all well worth trying, and also to describe one such receiver in detail.

Before discussing the various circuits and tuners available for this type of reception I must emphasise the fact that all unwanted capacity in the receiver must be eliminated.

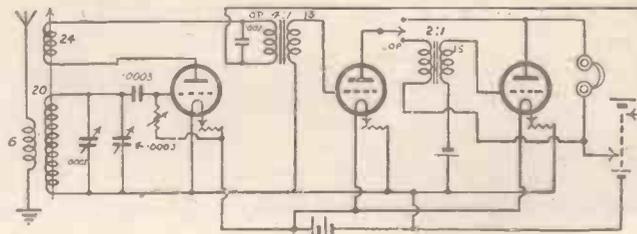


Fig. 1.

Not only is interwiring capacity likely to cause losses, but it will prevent the amateur from getting down low enough whatever type of coil he uses.

A very enthusiastic amateur known to the writer has been trying to get below 80 metres for a long time, but in vain, no matter what type of coils and condensers he uses, and no matter how he has to decrease his aerial capacity, and all because his set is such a jumble of wire that it never will have a chance of picking up such high frequencies. True, the set is perfectly efficient on broadcast wave-lengths, and has picked up

American stations and amateurs down to about 90 metres, but the owner cannot get K D K A, no matter how he tries, and solely because of the lay-out of the set.

Readers who intend to convert their present sets for short-wave reception will do well to look to the wiring and lay-out, and to see that no unwanted capacity exists. Grid and plate leads should be short and never parallel or close to one another.

Furthermore, any H.F. stage now in use must be cut out for short-wave work, as the capacity of the valve itself and its anode circuit will probably prohibit any chance of H.F. amplification on ordinary circuits below 100 metres, if as low as that even. So the first thing to do is to make arrangements to

allow the detector grid to go straight to the aerial or secondary coil.

Simple but Suitable.

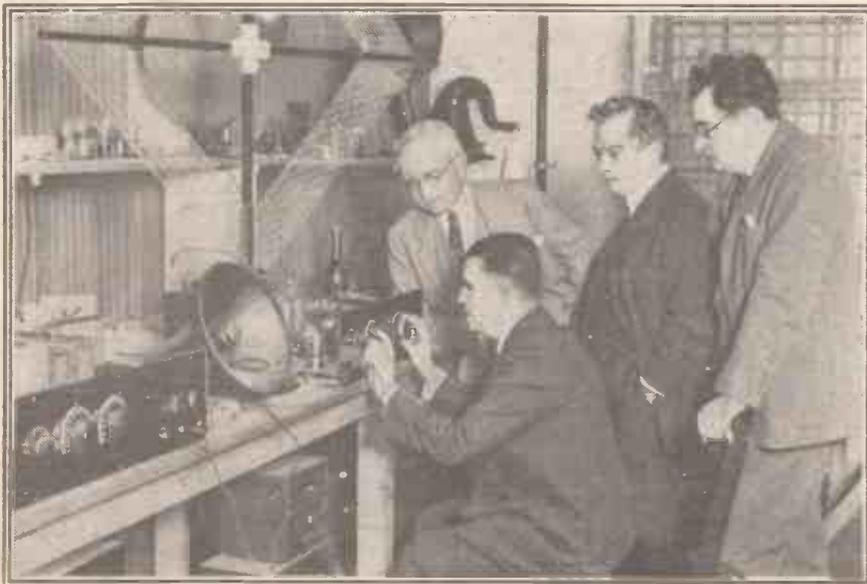
A word about the aerial and earth system will probably be useful at this point, though it is possible to pick up K D K A on practically any kind of aerial and with no earth. This, however, is not reception in the best sense of the word, and should be looked upon as just an interesting experiment, the real aim of wireless reception being purity and clarity of signals rather than ultra D X work on the minimum of apparatus.

Any good aerial will be capable of receiving short-wave signals, but it is usually worth while experimenting with various types and sizes in order to minimise the "fading" which so often characterises reception on the higher frequencies. A very great deal of this fading can be traced to the swaying of the aerial, or of a tree near the aerial, especially if this latter has a long horizontal portion, or if the down-lead is slack and passes fairly near the gutter of the roof or even the wall of the house.

The first step, then, is to make the aerial taut; it can be slackened off a little in case of storm afterwards if desired, but for short-wave work you cannot have it too taut. The next step is to try a shorter aerial. Fifty feet in length is ample, and the horizontal portion should be as small as possible. The writer has found that an aerial tending towards the vertical for the whole of its length is best.

In other words, the aerial consists of one long lead-in and no horizontal portion at all. This has been found to cut down fading due to aerial sway to a minimum, and even in a fierce storm and with a moderately slack aerial

(Continued on page 1304.)



American Radio engineers experimenting with a very short wave receiver in conjunction with a frame aerial.

NOTES ON SHORT-WAVE RECEPTION.

(Continued from page 1303.)

the fading is not troublesome—not sufficient to throw the set in and out of oscillation when near the oscillation point, as is so often done when a horizontal aerial commences to swing a little.

The earth requires attention also, and the stability and ease of control of the set will depend largely on the earth connection. Gas pipe and similar "earths" should be avoided, and the reader is advised to get right down to the buried earth 3 ft. or so deep if possible. One of those earth pins now on the market will be very useful. Failing the direct earth, a main water pipe should be used, but hot water pipes and those that go round the house before reaching earth will probably only lead to trouble.

Worth a Special Set.

Those readers who build a special set for short-wave reception—and it is well worth a special receiver—will find it best to build it on the American system, both from the point of view of accessibility and from that of appearance. Further details of a particular type of receiver will be given in a future issue, but those who wish to try the

set out before the full lay-out and wiring is given will be able to do so from Fig. 1, which gives the theoretical circuit and details of the coils, condensers, etc.

The Coils Used.

The coil in the aerial circuit (which, as will be seen, is untuned) consists of 6 turns of 22 gauge D.C.C. wound on a celluloid former of about $\frac{3}{4}$ in. centre with 11 slots. Coupled to this on one coil holder, and touching the aerial coil, is a similar one of 20 turns of 24 gauge D.C.C. on a former of 1 in. centre with 11 slots. To these two coils is coupled in a two-coil holder capable of fine variation a similar basket coil of 24 turns of 24. The secondary coil is tuned by a .0003 condenser (this capacity was used in order that a large range of wave-lengths should be covered), with a .0001 condenser in parallel for fine tuning. With the .0003 at zero and tuning carried out by the .0001 condenser only, a range of 50 metres to 100 metres or so can be obtained, while with the .0003 brought in, fine tuning, of course, being done with the .0001 mfd., the range is increased up to 200 metres approximately before the set ceases to oscillate, due to too small a reaction coil and too large a ratio of capacity. It must be remembered that the set under consideration is one actually in use and not a "theoretically" perfect one, and as such it probably can be improved. As the set is also used for wave-lengths above 100 metres a .0003 mfd. condenser was

found useful—hence its inclusion. Those who desire the set to cover wave-lengths up to 100 metres only should use the .0001 condenser by itself.

Wiring should be carried out with 18 or 16 gauge square wire, and the valves should be arranged so as to allow of very short grid and plate leads, and the components should be very well spaced.

For general reception (telephones) the first two valves only are used, and the last, a B4 power valve, is used only for loud-speaker work. The actual valves used are two B5 and one B4, and results on two valves on K D K A and American amateurs are quite as much as desired, the former usually coming in at R 5. The power valve with 3 volts grid bias increases this, and incidentally X's, to about R 8, and it is for this latter reason that it is left out for general work. It is essential that quiet L.F. amplification be obtained, so good L.F. transformers should be used. Those employed in the original set were one I.R.I. and one Marconi Ideal (2.7 to 1), though a Eureka No. 2 or a 2-1 or other second stage transformer give good results at this stage also.

In conclusion, I shall be glad to hear from readers who make this set, and to learn of their experiences; while further details will be given concerning the lay-out of the receiver in a future issue of POPULAR WIRELESS.



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

International Wireless.

IT is interesting to have the different views on the success and the value of the experiments conducted during International Radio Week. According to "Radio Digest," (U.S.A.), here are the lessons to be learnt from the tests:

1. More power, both in European and American stations, will mean more regular international reception.

2. Improperly operated regenerative sets are an abomination and must be ruled out if international reception is to be a regular programme.

3. Receiving sets used in Europe are not up to the standard in America, and they must be improved if listeners in Europe are to receive American stations as efficiently as Americans receive European stations.

4. An international division of certain broadcast wavebands is desirable to promote international exchange of programmes.

5. All broadcasting stations should be invited to participate. Owing to certain Canadian and other stations not having been so invited, these stations were transmitting during the silent hours set apart for European reception in America.

Reaction Coil Adjustment.

When using a regenerative set with fixed coils, it is sometimes difficult to get the circuit to oscillate properly, and although the adjustment of the effective value of the reaction coil by means of a condenser would seem to be a simple and well-known

artifice, I have several times noticed amateurs struggling to make a set oscillate, with coils which were not of the correct value. If the set tunes in very faintly, and there is no evidence of reaction when the reaction coil is adjusted, try the effect of a variable condenser across the reaction coil. Of course, if you have a large selection of coils on hand, this procedure may not be necessary, but it is simple and effective.

Reaction Control.

In this connection it may be worth mentioning that reaction is sometimes considerably influenced by the presence of a metal conducting plate in the vicinity of the detector valve. If an earthed metal plate be brought gradually up to the detector, it will be found that the reaction will usually be noticeably affected.

This effect may, in fact be made the basis of a simple device for controlling reaction. A small metal sheet, which may be of thin brass or of fairly stout lead- or tin-foil, is attached to a control shaft with insulating knob in the usual way, this shaft being mounted between bearings, or in a ball joint, after the manner of the cat's-whisker holder of a crystal detector. By means of the ebonite knob, the position of the metal sheet (which should be connected to earth) in relation to the detector valve is adjusted.

Broadcast Organ.

One of the world's largest pipe organs is to be erected shortly at Station W O C,

Davenport, Iowa (U.S.A.). The station itself will be one of the ten "super-power" stations of the country. The cost of the organ will be about £50,000, and many new features will be incorporated in its design. It will be housed in the Kindt Concertorium theatre, one of the largest buildings east of the Rockies. When in full blast the power of the organ is said to be so great as to set the entire building into sympathetic vibration. The organ is being built by the Æolian Co. of New York, and according to present specifications will be the most tremendous feat of organ construction ever attempted. When finished, it will require twelve large freight cars to convey it from the factory to its future home at Station W O C.

Easily-Made Grid Leak.

A variable grid-leak often adds considerably to the efficiency of the set, and such a leak may readily be made—quite suitable for test purposes—by means of a strip of wood soaked in Indian ink. It is sometimes stated that the stick of graphite taken from a lead pencil is suitable for the purpose of an experimental grid-leak, but, generally speaking, the resistance of such a graphite stick will be found to be much too low.

A pencil, however, may be soaked in Indian ink, provided the ink is not allowed to make contact with the graphite at the ends of the pencil. If this happens, the wood at each end may be cut away a little, so as to break the connection between the Indian ink on the outer surface and the graphite stick within.

The Indian ink on the outer surface of the strip of wood or pencil forms the resistance element for the grid-leak, and two wires are taken from the grid-leak connections of the circuit, to which two spring clips are attached. These spring clips are secured

(Continued on page 1338.)

PAST AND PRESENT CRYSTAL RECEIVERS.

An Historical Outline of Interest to All.

By B. S. T. WALLACE.

Crystal users will find much to interest them in this informative article, which outlines the great improvements made in all types of crystal detectors.

THE crystal receiver illustrated was constructed twelve years ago when broadcasting was a dream of the future, and the precautions adopted to obtain maximum efficiency make useful reading for present day constructors.

Signals in those days were, of course, practically limited to the spark variety and, compared with the modern broadcast signal, very faint at all times. In Government stations, such as the Post Office coast-to-ship installations, the receivers were always housed in silence cabinets.

An Early Receiver.

This particular receiver was designed to work from 300 metres, used by the amateurs, to the 7,500 metres of the first transatlantic spark station at Glace Bay, Canada. The latter station was successfully received in London on many occasions. It is also interesting now to recall that just before the outbreak of war the writer was engaged on an article, illustrated by a map, showing how amateurs "spoke" from London to Yorkshire by relayed transmissions, using, of course, spark transmission, crystal reception, and the Morse code. The war practically put a finish to amateur spark transmission.

The receiver is built throughout of ebonite. The box on the left contains the closed secondary circuit consisting of 1,400 turns of 36-gauge double silk covered copper wire tapped at points suitable to the various wave-lengths. An air spaced copper plate variable condenser, built on the side, is only used on wave-lengths above 1,600 metres, as the presence of added capacity across an inductance will always decrease the voltage available to operate the crystal, especially on short waves. Fine tuning of the secondary on short waves is obtained by adjustment of the coupling coil which slides inside.

Dead End Effects.

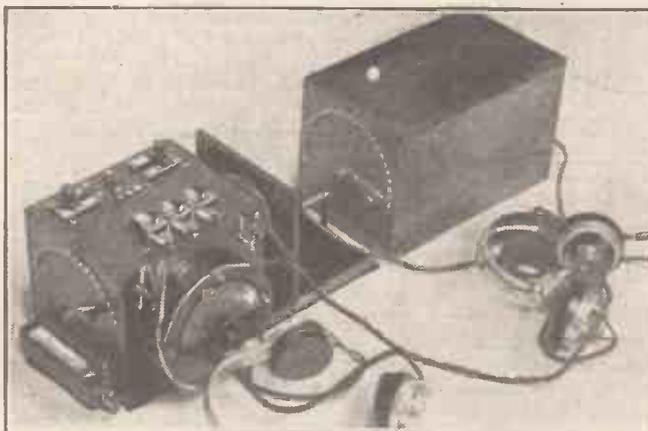
The coupling coil is wound with 22-gauge double silk covered wire also tapped in sections. The thicker wire is an advantage in this coil, there being little impedance across it. With the secondary coil, the damping of crystal detectors being very considerable, there is no advantage gained by using a thick wire.

It may be asked if there is any detrimental effect from the large dead end on the secondary—over 1,000 turns—when used for short waves. The answer is, none whatever, providing the inductance is correctly connected. The dead end must be at the low potential end of the coil, and the coupling coil, which is also the usual primary on short wave-lengths, must be correctly connected with respect to it. The dead end should be nearest to the primary coil and the aerial connection to

the primary should be made to that end nearest the secondary. The high potential end of the secondary is found by the following simple test.

Importance of Insulation.

When signals are being received touch with a finger first one end and then the other of the secondary. It will be found that at one end it has no effect, but at the other signals either weaken or disappear. This latter is the high potential end. The mere touching of an insulated wire at this end of the coil is usually sufficient to weaken signals and graphically illustrates that one cannot be too careful in the arrangement and insulation of even a crystal receiver.



The loose-coupled crystal receiver mentioned in the article.

Should signals weaken when either end of the coil is touched, it is an indication that the circuit is not properly tuned.

There are two double-pole two-way switches on the top of the case, one to bring the variable condenser in or out of circuit, the other to isolate and short-circuit the detectors: a very necessary precaution when spark transmission was in use, otherwise the detectors were certain to be put out of adjustment.

Crystal Combinations.

There are three detectors all of the double crystal type with a selector switch. A potentiometer, with the requisite small battery inside, is seen below the secondary switch. The crystal combinations are carborundum steel and tellurium zincite and a few other oxides. Nothing better has ever been devised. The ordinary cat's-whisker type is waste of time compared with them. Once the crystals are placed in contact the potentiometer does the rest. The main drawback to the general use of the double crystal detectors appears to be the difficulty in obtaining good zincite and

suitable carborundum and a rooted objection to a simple battery and potentiometer.

The box on the right contains the aerial inductance for the longer waves. It may sometimes be observed that a large aerial inductance is shown coupled direct to the secondary coil. This is bad practice both from the point of view of selectivity and signal strength. Only a portion of the aerial inductance should be coupled to the secondary coil. This practice is carried to its extreme at the present day in the Cookaday circuit that is all the rage in America. In this, one turn only of the aerial inductance is coupled to the secondary and ensures a selectivity that enables a powerful station to be tuned out at a distance of a quarter of a mile.

Inductive coupling was of greater importance in pre-war crystal working than with present requirements. The B.B.C. signals are so loud and their tuning very flat where crystal receivers are concerned; that there is little practical advantage with inductive coupling except when it is necessary to eliminate the local broadcasting transmission itself.

For instance, assume that 5 X X be transmitting a different programme to the usual London relay. At a position five miles from 2 L O it is practically impossible with a single circuit crystal receiver to tune in 5 X X without overhearing 2 L O. Inductive coupling will remedy this. It is a point not generally known at the moment because, transmitting identical programmes simultaneously, they do not often clash.

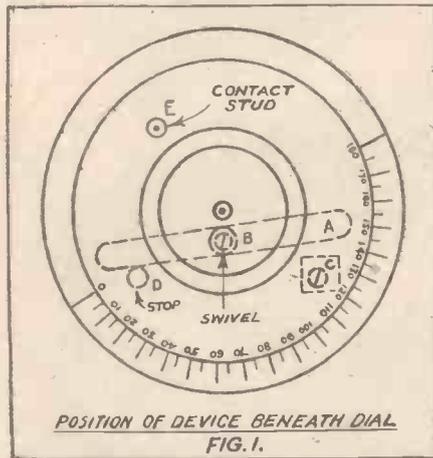
Telephone Condenser.

The one other component in the receiver is a telephone condenser, a frequent bone of contention! It is found in all the old standard circuits, but the amateur with local broadcast usually fails to detect any advantage from its use. There are two points to be considered. With a strong signal the increase given with a telephone condenser is so small that it cannot be detected by the ear. Actually on recording instruments it measures 2 to 3 per cent. On the other hand, the increase on very faint signals is unmistakable, and fully 100 per cent. There is a correct value for this condenser. The higher the resistance of

(Continued on page 1306.)

COMBINED VARIABLE AND FIXED CONDENSERS.

A GOOD many experimenters are familiar with the method of employing a fixed condenser in conjunction with a variable one, so as to be able to obtain a wide range of capacities. The advantages of using two, instead of one large variable one, are :



- (1) No more capacity than is really necessary need be used at any time, thus minimising losses.
- (2) Larger capacity is available when required.
- (3) Fine tuning is obtainable.
- (4) A low minimum capacity is obtained.

The main disadvantage of this method is that two controls are usually necessitated. The knob of the condenser, and the extra switch for switching the fixed condenser in and out. The writer has recently made use of the following simple device, however, which does away with the extra switch, the actual turning of the knob automatically switching the extra condenser in and out.

The action in tuning is one turn of the knob forwards from 0° to 180°, and another back to 0°, the whole range being covered by these two motions.

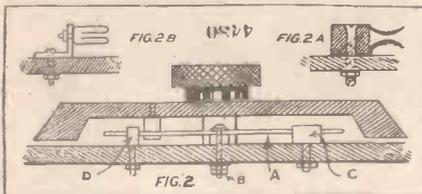


Fig. 1 represents the device, which is situated under the condenser dial itself, seen from above as if through the dial.

It will be seen that a brass strip A is pivoted at B so that it can swing either so as to make contact with the contact C, or in the opposite direction until it is checked by the stop D. A contact stud E screwed into the dial from below will press upon the brass strip when the knob is turned either

to 180° or 0°, so as to make or break contact between C and A.

Fig. 2 represents a sectional view of the device from which the general arrangement is clear. Fig. 2 (A) shows the method of making the contact piece. It will be seen that a small piece of brass strip is bent round a small piece of square brass or other material, and the ends shaped to receive the swivel strip. A hole is drilled clean through to accommodate the countersunk bolt, which secures the whole to the ebonite panel.

Novel Device.

One of the contacts used for knife switches could easily be adapted as in Fig. 2 (B).

Fig. 3 is the circuit diagram of connections. When the switch is closed the two condensers are connected in parallel, and the full value is attained, and when open, only the variable condenser is in circuit.

When the dial is at 0°, the contact stud E rests against the strip A, which we will suppose is in contact with C. A slight turn of the knob past 0° in a counter clockwise direction will cause E to press upon the strip, and the switch will be opened.

The variable condenser only is now in circuit. Suppose it has a maximum value of .0005 mfd. This value may gradually be obtained in the ordinary way, when the contact stud will now come up against the other end of the strip. A further turn

will close the strip, and will switch in the fixed condenser in parallel.

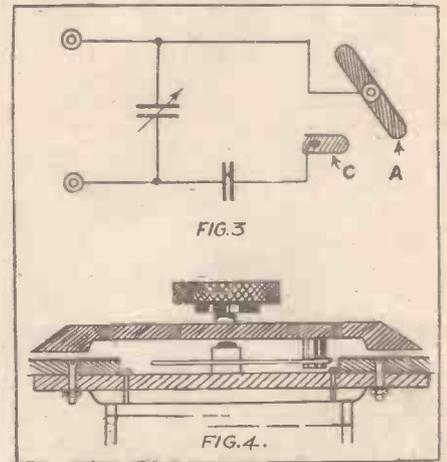
If the fixed condenser has a value of .0005 mfd. the total capacity will now be .001. A 180° turn back again of the knob will now cover all the ground backwards from .001 to .0005. Any values of condenser may be used, as suitable. Suggestions are :

Variable	Fixed	Maximum
.0003	.0002	.0005
.0004	.0003	.0007
.0005	.0005	.001

The dimensions of the actual parts may best be decided by the constructor himself, but a convenient size for the moving strip is 2 in. long by 3/16 in. wide.

The dial should be recessed at the back, but sufficient clearance for the switch of about 1/4 in. may be partially obtained by raising the dial if the latter is a little recessed.

An alternative method is shown in Fig. 4, where a large circular hole is cut of radius just larger than the radius from the contact stud to the condenser spindle, while another piece of ebonite is bolted on below.



PAST AND PRESENT CRYSTAL RECEIVERS.

(Continued from page 1305.)

the telephones the lower the value of the fixed condenser ranging from .002 for 8,000 ohm headgear to .005 for 1,000 ohms which is the value used in the famous war-time Mark III. crystal receivers.

Tests for efficiency used to be carried out by ear on faint signals and the use of multiple change switches for quick comparison. The following points were found advantageous: short compact leads, good insulation at all points of high potential, windings of silk-covered wire shellacked. Good insulation is of greater importance than the theoretical and sometimes imaginary advantages of cotton covering and no shellac. (Damp cotton makes an excellent grid leak, and I am sure it would be an extremely difficult task to give an experimental demonstration of the disadvantages of using shellac!) It is a noteworthy fact that the make of tuning coil showing greatest efficiency on N.P.L. tests is wound with silk-covered wire.

It must, however, be borne in mind that the advantage of these various points of ultra-efficiency is not so apparent with

strong as against weak signals. The explanation of this is interesting. There is a definite minimum voltage which an incoming signal must attain before it can be rectified by the crystal. Imagine a signal just too weak to be audible. We improve our apparatus five per cent and that signal can now be heard—i.e. the improvement is evident. Now take the hefty local station, almost as loud as the ear can bear. We increase this 5 per cent and the practical result is nil, it being difficult to detect such an improvement under the circumstances.

Despite the seemingly conflicting and apparently inconsistent behaviour of wireless under varying circumstances, it is all subject to strict law and order, and there is an explanation for everything.

The Brown A type receivers will be noted in the photo. In appearance they have not changed during the past twelve years, and are still foremost for efficiency. One wonders what the present day 10s. broadcaster will say when it is recalled that in 1912 these 'phones cost over five guineas a pair!

H.R. 'Phones.

Telephones of 8,000 ohms were always used for critical work. The effective operating resistance of most crystal detectors lies between 10,000 and 15,000 ohms by direct measurement on the received signal. So that theoretically a telephone approaching this value is best.



Learn the joys of exploring

IT may be that you are one of the people who are content with a "crystal." You get entertainment direct from your local station. It is "good enough." But is it? Only the man with the valve realises the fascination of exploring. Out in the ether are wandering music and voices—they are coming from every corner of the broadcasting world. Your aerial is picking them up, but you cannot hear them.

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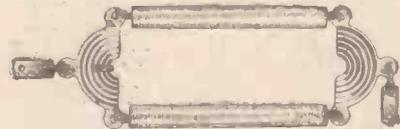
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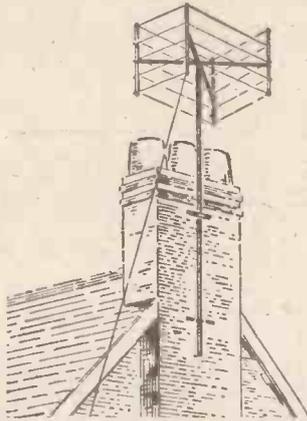
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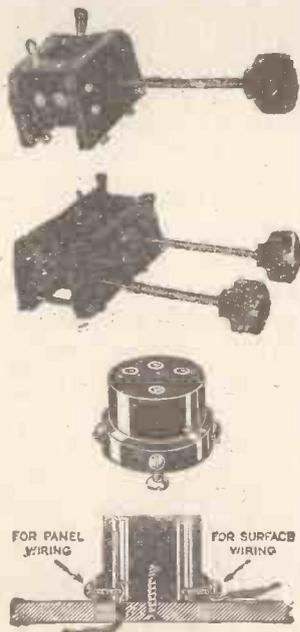
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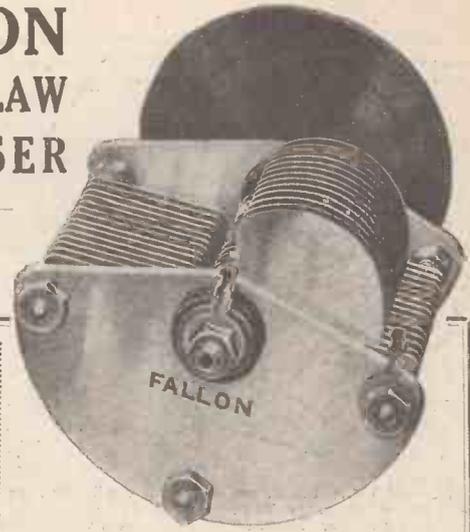
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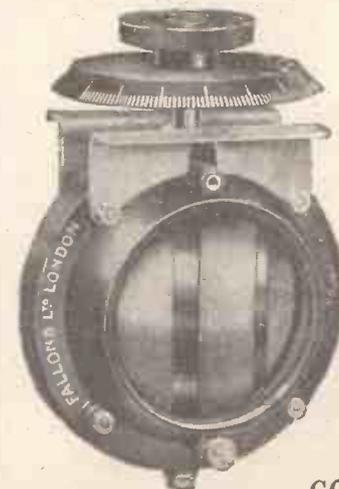
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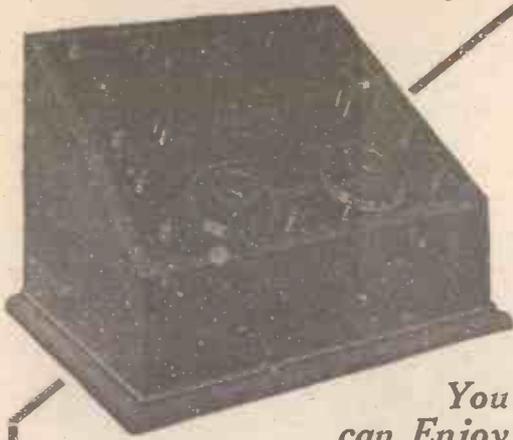
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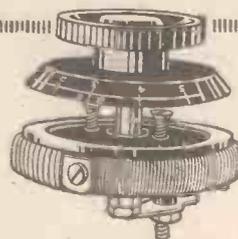
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HOW TO TEST LOW-FREQUENCY TRANSFORMERS.

By "RADIOGRAPH."

This is the first article of a useful series for the assistance and general help of the amateur constructor. Others will be published from time to time.

DURING the course of his experience the average amateur constructor will have probably found that there are a sufficient number of minor difficulties tending to hinder his eventual success, without these being added to by faults which may exist in the component parts used in construction.

At the present time there is so keen a competition amongst wireless dealers that

failures, failure to produce satisfactory results is often attributable to the inefficient operation of the transformer, or transformers used in the circuit. This particular instance offers a good example of the value of the "pre-assembly test," for one is apt to imagine failure to be caused by a mistake in the wiring, or an incorrect circuit, when the whole trouble may be due to a "dud" transformer.

In some of his early experiments, the writer experienced a great deal of difficulty owing to the employment of a pattern of transformer which would be immediately rejected on sight by the well-informed amateur of to-day. This particular type of transformer never could have worked, for the simple reason that it was wound with an insufficient number of turns to make an effective magnetic coupling. Readers should always be wary of transformers, and, indeed, all other wireless components, that are offered for sale at prices very much below those of instruments produced by reliable manufacturers.

Methods of Testing.

For the purpose of this article we may leave out particulars of the laboratory test for transformers, which includes the use of an apparatus invented by the Post Office engineers some years ago, which consists of a direct reading resistance bridge, which is used in conjunction with a mirror galvanometer. The whole of the apparatus is too costly for amateur use, but passing mention may be of interest.

A practical method of transformer testing includes the use of:

- (1) An accurate milli-ampere meter, giving readings from 0.1 milli-amperes to 10 milli-amperes. As small instruments cannot be relied upon to give accurate measurements, the size selected for these tests should have a scale over a 6-in. dial.
- (2) An extremely accurate voltmeter, of about the same dimensions, reading from zero to 7 volts.
- (3) A reliable accumulator of from 4 to 6 volts capacity.

The chief point to ascertain in connection with the transformer test is that the resistance of the winding is intact, and that it possesses the definite value for which it is designed.

Assuming a transformer to be purchased with a stipulated resistance of 12,000 ohms on the secondary circuit, we have something definite upon which to base our test.

Fig. 1 illustrates the method of connecting up the necessary instruments for testing the resistance of the secondary circuit of the transformer. The positive terminal of the accumulator is connected to one terminal of the milli-ampere meter, of which the opposite terminal is connected with the I. S. terminal of the transformer to be tested. The negative of the accumulator

is joined with the O. S. transformer terminal, and the voltmeter is shunted across the accumulator leads.

Ascertaining Resistances.

Now, by applying Ohm's law of resistance, the resistance of the secondary winding of the transformer can be accurately determined. As the resistance of the winding should equal the voltage of the accumulator divided by the current passing through the milli-ampere meter (the latter being divided by 1,000), we get the following formula:

$$R = \frac{V}{M} \div 1,000$$

When R = Resistance; M = Current in milli-amperes; V = Voltage of accumulator.

By the assumed readings in the case of our example we find: Voltmeter, 6; milli-ampere meter, 0.5. Thus, by transposing figures for symbols, we obtain the equation: $R = 0.5 \div 1,000$; or $R = 12,000$.

This example proves that the winding of the transformer secondary is in accordance with the initial requirement.

In working out this formula, the reader must not always expect to arrive at the exact equivalent of resistance, and in practice a margin of error up to about 8 per cent. is permissible.

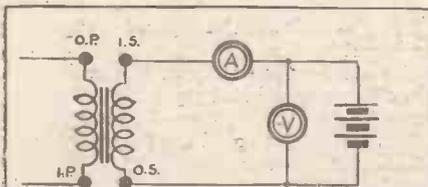


FIG. 1. TESTING RESISTANCE OF TRANSFORMER.

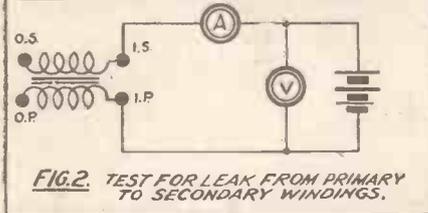


FIG. 2. TEST FOR LEAK FROM PRIMARY TO SECONDARY WINDINGS.

the amateur has to exercise due discretion in selecting components that may be relied upon to give effective results. Whilst every precaution against placing defective components in the hands of their customers is taken by dealers, there is always a chance, however remote, of the constructor being confused and harassed by incorporating faulty components in sets they are building.

Causes of Failure.

Perhaps it is not going too far to state that many a promising effort which might lead to an interesting development has been nipped in the bud simply because some component part has failed to fulfil its duties and, disappointed with the non-success of his attempts, the amateur has abandoned his efforts, without knowing that he was on the point of effecting what he desired.

The object of the present series is to aid the amateur in testing the most commonly used components, before they are incorporated in a set, so that, so far as their action is concerned, there may be no possible shadow of a doubt.

In dealing with the various tests, the writer has divided the methods adopted into two classes: (1) By making use of certain forms of testing apparatus, some of a more or less elaborate description; and (2) By the aid of such simple appliances as are included in the progressive amateur's outfit.

LOW-FREQUENCY TRANSFORMER.—In the case of building up low-frequency ampli-

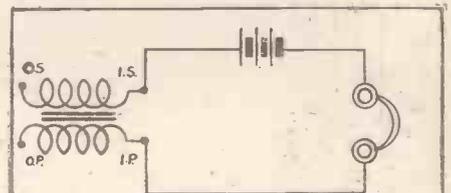


FIG. 3. PHONE TEST FOR TRANSFORMER

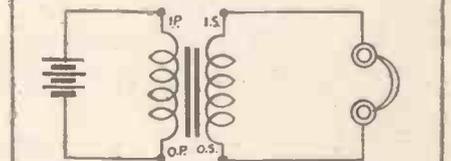


FIG. 4. PHONE TEST FOR MAGNETIC-COUPLING.

In the event of any wide differences being found, the transformer should be rejected or returned to the suppliers in exchange for another.

A similar course of procedure is adopted for testing the primary winding of the transformer, the resistance value being ascertained from the supplier at the time of purchase. This particular form of test will be mentioned later in its application to various other forms of component parts.

TRANSFORMER LEAKS FROM PRIMARY TO SECONDARY.—In addition to defects liable

(Continued on page 1312.)

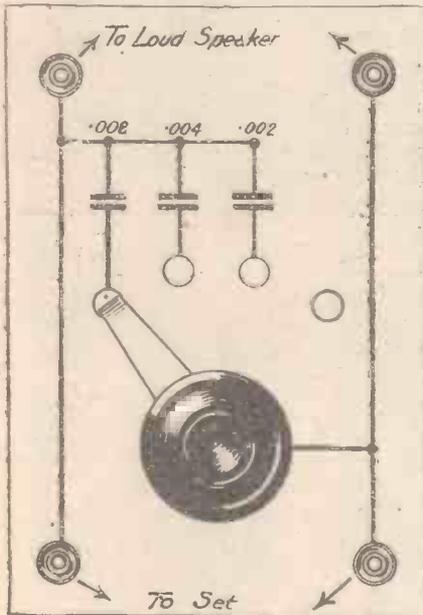
A HANDY LOUD-SPEAKER ATTACHMENT.

A CONDENSER across the output terminals of the set often improves the quality of the loud-speaker reproduction. It is desirable also to be able to vary the capacity in use to suit the type of transmission. This can be done conveniently by the attachment described below, the use of which enables changes to be made without altering the adjustments of the set.

The first task is to construct a series of three fixed condensers. These need not be of specially good quality, and can be quickly and cheaply made by the constructor. The materials required are sheets of waxed paper and tinfoil, both of which can be obtained from dealers in electrical supplies. The amount to purchase can be calculated easily from the particulars given below.

Making the Condensers.

The sizes the writer has found useful are quoted here, but the constructor is advised to experiment with his own set and loud speaker before deciding which three to incorporate in the instrument.

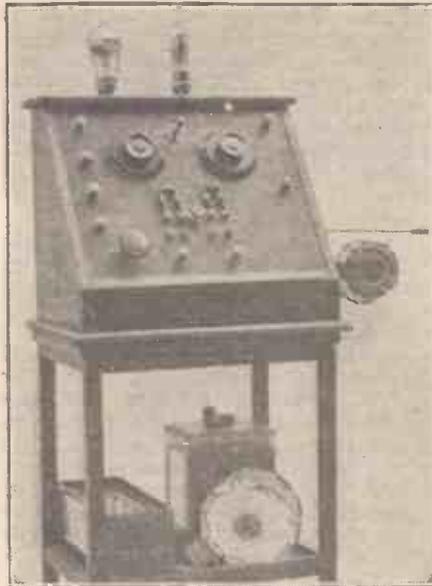


To suit the switching arrangement described later in the article it is necessary to choose capacities in the proportions of 1, 2, and 4; thus, .002, .004, and .008 mfd. would be suitable.

The condensers should be made up in the usual way. When the sheets of tinfoil and paper have been assembled, with the tinfoil overlapping 4 sq. in. between each pair of plates, fold the projecting $\frac{1}{2}$ -in. of foil over a bared copper wire for connections at each end of the condenser; wrap the whole in a piece of waxed paper and press with a warm iron. Allow to cool, taking care that there is no slipping while the wax is melted.

Suitable sizes and numbers of plates are—
.002 mfd.: 9 sheets waxed paper 3 by 2½ in.,

.004 in. thick; 8 tinfoil sheets 2 by 3 in. (2 by 2 in. overlap). .004 mfd: 17 sheets



The "P.W." Combination Set mounted on a stand. Who made it? The reader who sent the photo did not send us his name!

HOW TO TEST L.F. TRANSFORMERS.

(Continued from page 1311.)

to occur in the primary and secondary windings, there is a possibility of leakages existing between the two circuits, which will not be apparent as the result of the previous test. Fig. 2 shows the method of connecting up the transformer with the same instruments as were used previously. In this case, the need for calculations disappears, for should there be any leak between the two windings, the defect will be shown by the final deflection of the milli-ampere meter needle. If there is no leak, the needle of the instrument will remain at zero.

No Apparatus Required.

When using the instruments for accurate electrical measurements, care must be taken not to confuse induced currents created momentarily for those which it is desired to measure.

TESTING TRANSFORMERS WITHOUT APPARATUS.—There are two simple tests for transformers which can be applied without the use of apparatus, and, although useful the results obtained cannot be considered in any way as comparative. The first of these two is shown diagrammatically in Fig. 3, and has for its object the testing for leaks between the primary and secondary circuits.

waxed paper 3 by 2½ in., .004 in. thick; 16 tinfoil sheets 2 by 3 in. (2 by 2 in. overlap). .008 mfd: 33 sheets waxed paper 3 by 2½ in., .004 in. thick; 32 tinfoil sheets 2 by 3 in. (2 by 2 in. overlap).

When finished, try them on the set during a transmission by attaching them in turn across the loud-speaker terminals and noting the effects. Try them on various types of item, varying from ordinary speech to the Savoy bands in full blast.

The Contact Studs.

If the results are worth the trouble, mount the condensers in a small box; 3½ by 4 by 1½ in. should be large enough. The top of the box should be an ebonite panel with two input terminals from which flex leads connect to the output terminals of the set. In the centre construct a four-point switch so that the contact arm will make contact with either each stud separately, or with any adjacent pair.

The output may conveniently be a plug switch made of valve sockets and valve legs. This is then connected to the loud speaker.

The wiring is as shown in the diagram. It will be noticed that you have six different arrangements.

Contact arm on stud 1, no capacity across the speaker; contact arm on stud 2, .002 mfd.; stud 3, .004 mfd.; studs 2 and 3, .006 mfd.; stud 4, .008 mfd.; studs 3 and 4, .012 mfd.

The series may be extended by fitting another condenser with 64 tinfoil sheets and .016 mfd. capacity, and an extra contact stud; in which case you get: Contact arm on stud 5, .016 mfd.; studs 4 and 5, .024 mfd.

One of the secondary terminals of the transformer to be tested is connected with one terminal of a 4½-volt dry battery, the other terminal of which is connected through a pair of headphones to a terminal on the primary winding of the transformer. A convenient break is arranged in the circuit, so that when the operator puts on the headphones and makes and breaks the circuit, the sounds produced by the diaphragms will indicate the condition of the transformer.

Not Easily Confused.

On breaking the circuit as stated, a slight "click" will be heard in the 'phones, which is caused by the induced current created by the magnetic coupling of the two windings.

This is not easily confused with the increased volume of sound heard in the 'phones, when any leakage exists between the two windings.

TEST FOR INTER-MAGNETIC COUPLING.—This test, which may also be described as a test for inductance, is shown diagrammatically in Fig. 4, the same battery and headphones being used as in the previous case. The battery is connected with the terminals of the primary winding, with a convenient means of breaking the circuit. The secondary terminals are connected direct with the telephone leads.

When the current for the primary circuit is alternately made and broken, the effect of the induced current in the secondary winding will be to cause a series of very loud noises in the headphones, thus showing that the magnetic coupling of the transformer is operating efficiently.

Mainly About Broadcasting

by
The Editor

SCHOOLBOY readers of POPULAR WIRELESS may be interested to hear that a schoolmaster stated a few days ago that, in his opinion, wireless was having a harmful effect on scholars!

It appears that in the opinion of this schoolmaster, listening-in for distant stations after 2 L O and the other B.B.C. stations have closed down, is a vice too freely indulged in by young gentlemen who, having completed their home work, should get to bed early, in order to come to school nice and fresh and ready to absorb the words of wisdom which fall from the lips of their scholastic mentors!

This particular schoolmaster seems to think (at least, he does in regard to his own scholars) that there is too much listening-in among boys in this country in the early hours of the morning, with the consequence that they come to school with their heads full of excitement at having heard Vienna on one valve and W G Y on a similar outfit, and that they are sleepy-eyed and very inattentive to lessons.

I am rather inclined to think that the schoolmaster has some justification for his statement, and I think a friendly word of warning to young readers of this paper and to young wireless enthusiasts would not be out of place. Do not overdo it. There is nothing that palls so quickly as a hobby over-indulged in.

If you sit up night after night trying to tune-in distant stations—note that I say “trying”—the first flush of enthusiasm for D X work will soon pass. Over indulgence in wireless, like over indulgence in anything else, is bound to produce a reaction which will probably make you heartily fed up with the subject before very long.

There is no harm in sitting up late on a Friday or Saturday night trying to tune-in distant stations, because the majority of people can stop in bed the next morning, and a “radio debauch” once a week is not likely to produce very harmful results, or to lessen one’s interest in a fascinating subject.

Anyway, it looks as though schoolboys will have to be careful if their schoolmasters are going to start an anti-listening-in campaign!

Talking of wireless and schools I hear that Mr. J. C. Stobart, the B.B.C.’s Director of Education, has circularised a note to all educational authorities on the subject of broadcasting to schools. He claims that there is a definite place in the curriculum for the wireless lecture for pupils over 11 years of age.

He states that essays written by children on wireless lectures, and from evidence collected from teachers, indicate that wireless educational talks are absorbed by the children with more readiness than lectures delivered verbally to a class. Mr. Stobart hopes that before next summer it will be possible to transmit wireless lessons from the B.B.C.’s new high power station, shortly to be erected in North Hants.

On the other hand, certain educational authorities are not too pleased with the results of the B.B.C.’s wireless educational lectures, chiefly because the apparatus fitted up in many schools is not giving satisfactory results. It will be a pity if wireless lectures are to be discouraged because of the failure of the apparatus fitted up in various schools, and I should like to point out to any schoolmaster who happens to read these words that POPULAR WIRELESS will only be too pleased at all times to advise and assist any school which is fitted up with a wireless set not giving satisfactory results.

Since I wrote in last week’s POPULAR WIRELESS about Mr. Donald Calthrop’s

Follies to be broadcast. Mr. Duprez was in rather a quandary. He was told by Sir Francis Towle, of the Metropole Hotel, that his contract with the Midnight Follies must be adhered to, and Moss’s Empires, by virtue of another contract, told him that he was not to!

I understand that in the end Mr. Duprez did not take part in the performance when the show was broadcast the other evening.

But all this unpleasant controversy business about the theatres and the B.B.C. looks like being finally cleared up very shortly, for negotiations have now been opened up between the B.B.C. and a special theatrical and concert managers committee, and a B.B.C. official stated recently that a meeting would shortly be held in order to



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action in resigning from the Theatrical Managers’ Association because he had made up his mind to broadcast “Yoicks,” many surprising developments have occurred in connection with the broadcasting and the theatres controversy.

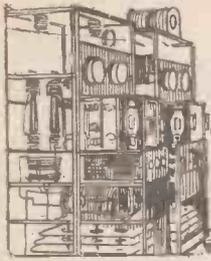
For instance, listeners-in are shortly to hear the first night performance of a West End play called “Love’s Prisoner,” to be produced at the Adelphi Theatre. Mr. Harry Welchman, who is presenting the play, stated to a pressman: “Whatever the managers and wireless authorities may decide between them, I have asked and arranged with the B.B.C. to broadcast the end of Act II and the end of Act III, for I am a firm believer in the power of wireless. Moreover, I have such a faith in the play that I am prepared to risk the whole world hearing its first reception by the Adelphi audience.”

A rather amusing situation arose out of the theatre broadcasting question the other day, when Mr. Fred Duprez, who has a contract with the Midnight Follies, was informed by Moss’s Empires, with whom he also has a contract, that he was not to allow his performance in the Midnight

effect a working compromise between the B.B.C. and the theatres.

The broadcasting of excerpts from Charlot’s Revue and the obvious intention of many other managers controlling West End theatres to give radio a chance has, I think, broken the back of the opposition party, and it will not be long before all this stupid prejudice against broadcasting excerpts from plays will be finally disposed of.

I have had many letters from readers regarding the Super-Selective Circuit, recently described in “P.W.” by our American correspondent, Mr. L. W. Corbett. Mr. Dowding and myself recently tested this circuit very thoroughly and there is no doubt that the claim that it is super-selective is more than justified. It is the most completely selective set I have ever handled. But our American correspondent must be corrected; the set is not particularly easy to handle, although I do not doubt that with patience and care the amateur who constructs the set will be exceedingly pleased with it as an experimental selective receiver of undoubted merits.



Artistes of the Aether

By "Ariel"



Some of those who have given you pleasure when listening-in.

ONE has only to look back through history to see that every new step in civilisation has been literally fought tooth and nail by the very people to whom it brings benefits. The whole country was to be spoiled by the railway; all the crime of the nation was due to the cinema, and wireless was to ruin the stage and the musical profession.



Miss Marie Novello.

That it has not had this effect on the latter is proved by the fact that so many of our greatest artistes have braved the terrors of the microphone, and though the theatrical and variety managers are still playing the part of the "coo" before Stephenson's "Rocket," they will not long "block the line." A fresh step towards this was made by the first lecture-recital organised by the British Drama League, the subject, though perhaps a little dry, being "Greek Drama," but in the capable hands of Miss Elsie Fogerty and Mr. Lewis Casson.

Orchestral Music.

Some well-contrasted events may be noted here. At the Royal Opera House, Covent Garden, we had the second of the International Symphony Concerts, conducted by M. Ernest Ansermet; the Scottish Orchestra, at Glasgow, conducted by Vaclav Talich, and relayed to the studio; and at 2 LO the Symphony Concert, conducted by Mr. Eugene Goossens, almost his first appearance in public since his successful tour in America.

Here again the marked feature of the programme was its diversity of style. The true classics were represented by works of



Mr. John Turner.

Mozart, Haydn, and Schubert, the moderns by Borodin, Manuel de Falla, and Frank Bridge, while perhaps to most music lovers the outstanding item was Mendelssohn's pianoforte concerto with Miss Marie Novello as soloist. One of our best-known pianists, Miss Novello hails

from the country which has given us some of our most distinguished musicians, and was born in Maesteg. A student first under Mme. Clara Novello-Davies, the singer and conductor of the Ladies' Welsh Choir,

and later under Letchetitsky, in Vienna, Miss Novello made her first appearance in Cardiff as a child prodigy, and from that time onward has appeared in every great London hall and festival in the kingdom.

Burns' Night.

There is one date in the whole year when perhaps the Scottish and English nation are more firmly united than by any legal Act of Union, and that is on "Burns' Night" at the concert given annually at the Royal Albert Hall, London, under the ægis of the Scottish Association. January 24th attracted not only every Scotsman within reach but a vast number of English music-lovers who appreciate the homely and melodic quality of the old songs. To broadcast this event, therefore, to the still larger audience who cannot possibly reach the hall was a happy thought on the part of the B.B.C. The artistes included Mme. Lily Payling and Miss Flora Woodman amongst others, and had the co-operation of the Scottish Clans Association Pipers, the band of H.M. Scots Guards, and the Pipers and Drummers of the London Scottish.



Miss Cecilia Farrar.

Handel's "Messiah" than was given at 2 LO, at Christmas, would be hard to find. The Frôme Choral Society, with Mr. Sydney Coltham as tenor, and the Wireless Orchestra, were at 6 B M.

Another popular singer both at London and Bournemouth is Mr. John Turner. He, too, has made himself distinguished for his oratorio work, and his repertoire includes rôles in the "Messiah," "St. Paul," "Elijah," "Creation," as well as in "Tale of Old Japan," and "In a Persian Garden." That he is equally at home in operatic and ballad singing has been made very apparent.

A Successful Pianist.

At the same concert at Bournemouth appeared the well-known Bournemouth pianist and composer, Miss Nora Bradbury, who has broadcast from this station on several occasions. A pupil of the famous pianist, Howard Jones, winner of the Associate Diploma and a Licentiate of the Royal College and Royal Academy of Music respectively, both distinctions being earned within a few months of each other in her

seventeenth year, it was safe to predict a musical future, and one which has been fully realised.

Popular Concerts.

For the most part, this type of entertainment is most successful, whether in the hands of individual singers, or with a concert party, such as "The Londoners," or "The Pack of Cards." For many listeners-in "The Roosters" have too military a flavour, the soldier concert party being really a relic of the late war, but on Military Band Night at 2 LO some very attractive soloists were to be found. One recently comprised the performances of three good entertainers in Jack Duncanson, Alba Rizzi, a speciality pianist, and Mabel Fitzgerald, while the vocal items found able representatives from the two well-known Yorkshire vocalists, Miss Cecilia Farrar and Mr. Robert Naylor.

Miss Farrar first studied as a violinist, but she admits that she always found it "so much more interesting to sing the solos rather than to play them," and she was early tempted to take up the study of singing seriously, which she did, subsequently making a special study of oratorio work.

Mr. Robert Naylor is a prize-winner of the Plymouth Musical Festival of 1918, and a pupil of the international baritone, M. Dingh Ghilly, who is greatly interested in the young tenor.

Mr. Naylor is a popular singer with wireless audiences, and with his usual concert work has just returned from a tour of the North, singing at some twenty concerts, his reception at the City Hall, Glasgow, being unequalled during the last twenty years.

Cardiff.

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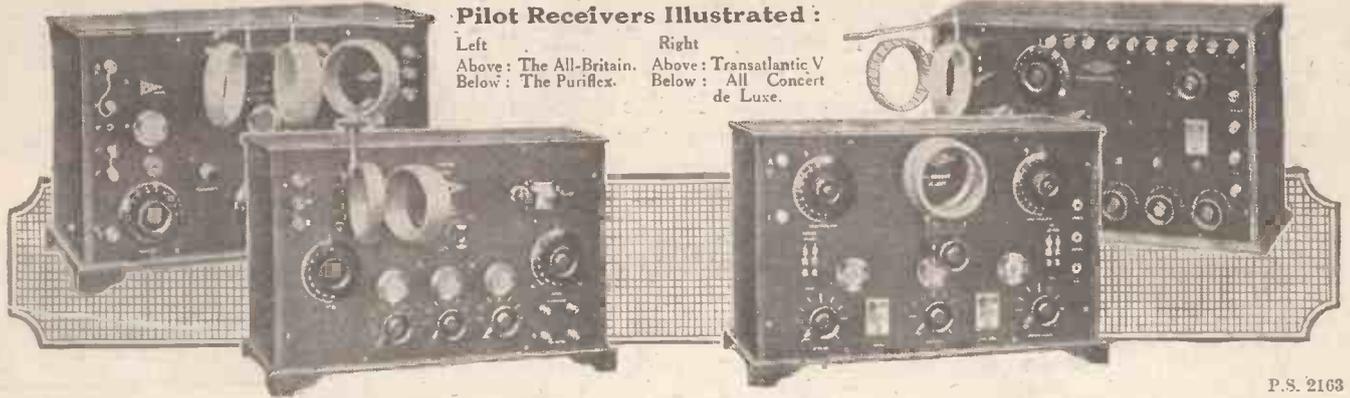
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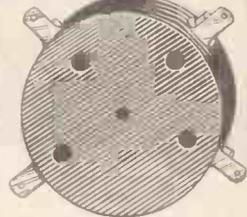
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SOME HINTS ON CONTROLLING THE "ULTRA-AUDION." The Importance of Reaction Adjustment.

By Lieut.-Commander H. W. SHOVE, D.S.O., R.N.

The De Forest "Ultra-audion" has many modifications, but the most popular circuit is that which employs an inductance in the aerial to which the anode is connected, and a series condenser on the earth side, the voltages across which are applied to the grid-filament circuit. It is the control of the reaction in this arrangement which our contributor deals with in the following interesting article.—The Editor.

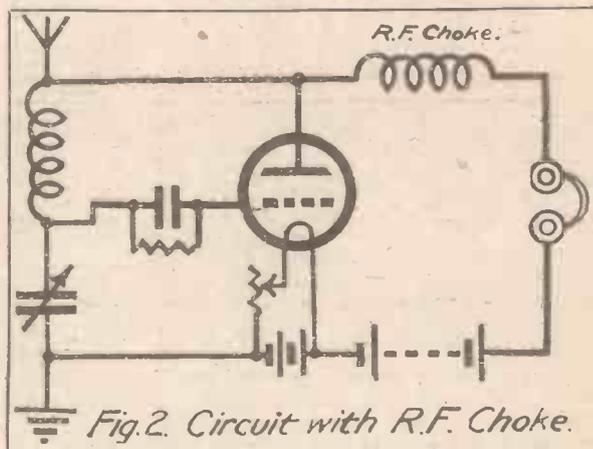
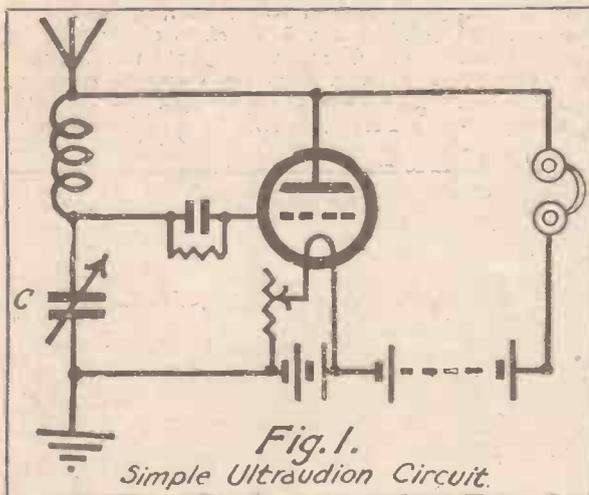
TAKING the circuit in its simplest form (Fig. 1), where the A.T.I. consists of a plug-in coil and no special stabilising device is fitted, it is evident that with a given coil and constant strength of the incoming impulses in the aerial, the voltages applied to the grid will depend simply on the impedance of the condenser C to the

these, that connected to the A.T.I., is designed to carry the H.F. feedback; the other, through 'phones and H.T. battery, the L.F. 'phone current. In order that they may perform these respective functions efficiently and without undue wastage through the impulses taking the wrong path, attention should be paid to their relative

impedances to H.F. and L.F. currents. such a coil to high-frequencies is large, but the low audio-frequencies pass through it comparatively easily.

The H.F. Choke.

The introduction of this choke, as shown in Fig. 2, at once provides us with another variable factor, which we can use to control



impedances to H.F. and L.F. currents.

If the 'phones happen to be of suitable impedance, and the capacity of their leads, etc., is sufficiently small to prevent serious leakage of H.F., the circuit may work well without any additional device for splitting the impulses. But very

particular frequency of the received wave. And, since the setting of this condenser is fixed by tuning considerations (it being the only tuning control), these voltages cannot be regulated by the operator. Similarly the "feedback" from anode through A.T.I. to grid and filament is an uncontrollable factor. The result is that nothing can be done, so far as the tuning circuit is concerned, to prevent instability if the reaction should happen to prove excessive.

Regulating Reaction.

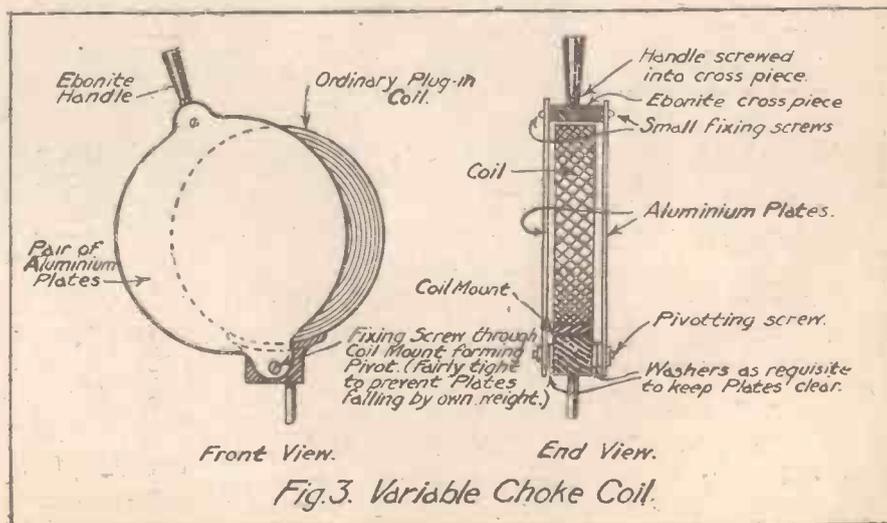
Nevertheless, the Fig. 1 circuit is capable of giving very fair results if a proper value of A.T.I. coil is chosen for the wave-band to be covered. The set can be adjusted to work just off the oscillating point over quite a wide range of frequencies by skilful handling of the two factors which are variable—viz. the filament temperature and the H.T. voltage. If this simple circuit is employed great attention should therefore be paid to the provision of a really good, finely adjustable, filament rheostat and an H.T. battery allowing of variation of anode voltage in small steps. These controls can always be used as auxiliaries, even with the special devices to be discussed later.

In Fig. 1 it will be noticed that there are two branches of the anode circuit. One of

often this is not the case. It will then be found that the feedback is insufficient to bring the circuit up to the oscillating point. The usual remedy for this is the provision of a "Radio-Frequency Choke" in the 'phone circuit. The inductive impedance of

the degree of reaction. The larger the choke the more effectively does it prevent the passage of H.F. through the 'phone branch of the anode circuit, and consequently the more effective the feedback to the A.T.I. But it is not generally very convenient to employ the large variable inductances covering

(Continued on page 1318.)



ON CONTROLLING THE ULTRA-AUDION.

(Continued from page 1317.)

a large band of frequencies if a smaller coil will do moderately well.

A single coil of 'moderate size (about 350 turns for the "Broadcast Band") may,

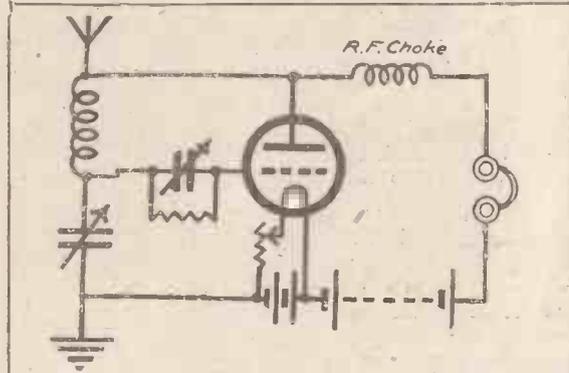


Fig. 4. Circuit with Variable Grid Condenser

however, be made to function as a variable choke without much complication by using "eddy current" plates of aluminium or brass arranged as in Fig. 3. The adjustment of these plates to cover more or less of the coil proportionately decreases its inductance and, therefore, its choking value. This method is well worth trying out.

Resistance Control.

Fig. 4 shows a method of control sometimes advocated and often giving quite good results, though the writer does not care for it. This consists in the use of a variable grid condenser. The grid leak may be either fixed as shown, or also variable. It may also, of course, be either in parallel with the condenser or taken directly to the filament (generally the positive side), according to the arrangement best suited to the valve in use. The writer disapproves of this system, because the grid condenser and leak ought, in his opinion, to be kept to their legitimate function of

rectification. Improper values of either of them very quickly give rise to more distortion than that which is inherently inseparable from the leaky condenser method (of which in itself the writer is not particularly fond for telephony reception).

Even when the grid condenser is fixed, a variable grid leak is often used. Provided it is of a reliable type, this fitting has its uses. But they should be concerned with obtaining proper rectification with the valve and filament rheostat adjustment in use. In passing, it may be remarked that it is not always realised that the values of the filament rheostat resistance and grid leak interact in a very im-

portant manner. This cannot be discussed here, but the fact should be borne in mind in trying to get the best out of any "leaky condenser" valve detector.

Direct variation of the aerial resistance may be introduced by means of a variable resistance, either in the earth lead, as shown in Fig. 5, or the aerial, Fig. 6. A carbon compression rheostat of fairly high maximum, such as are sold for use as filament resistances for '06 valves, can be employed for this purpose. There is the theoretical objection to this method that it is a frank reduction in the efficiency of the whole set. But the writer has used it with good results, and does not consider that the argument has much weight; for, in any case, we cannot make use of the "negative resistance" introduced by reaction to the full extent. It is for this very reason that we have to make use of these artificial damping devices.

Whether the resistance should be in the aerial or the earth lead is best settled

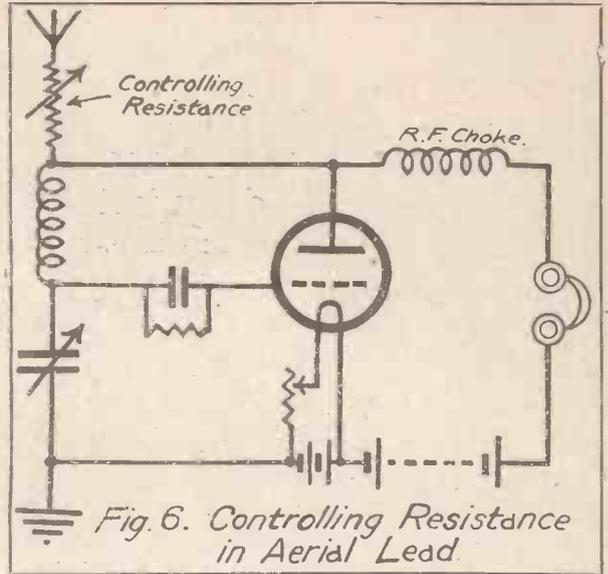


Fig. 6. Controlling Resistance in Aerial Lead.

by experiment. Theory and the writer's experience favour the arrangement of Fig. 6. In Fig. 5 the effect of the resistance is to place the whole set at an H.F. potential to earth. But the arrangement appears to work well in some cases.

Finally, we have to consider one of the

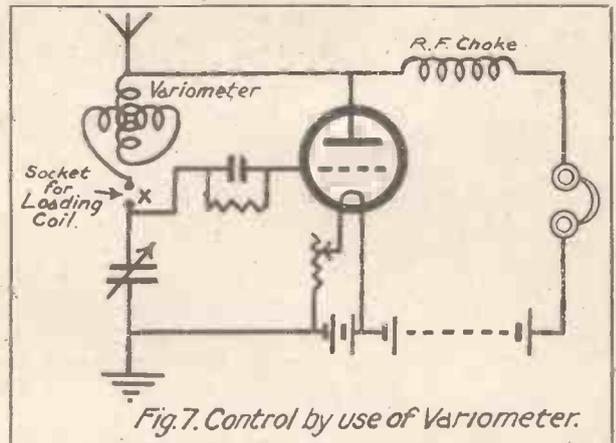


Fig. 7. Control by use of Variometer.

earliest methods of control, and one which, in the writer's opinion, remains perhaps the best. This consists in the use of a variable A.T.I., generally a variometer. The provision of a good variometer is, of course, (Continued on page 1321.)

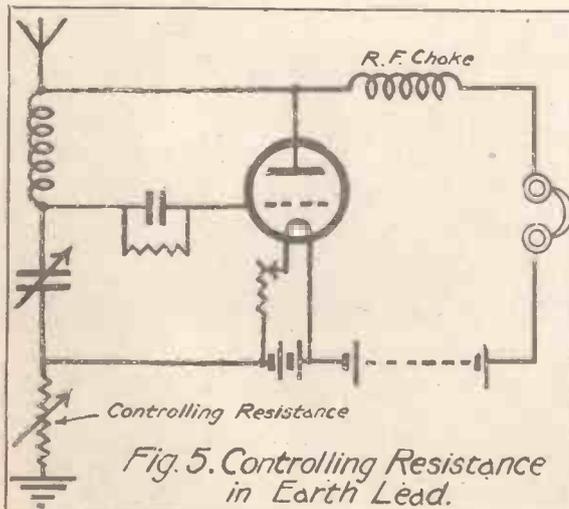


Fig. 5. Controlling Resistance in Earth Lead.

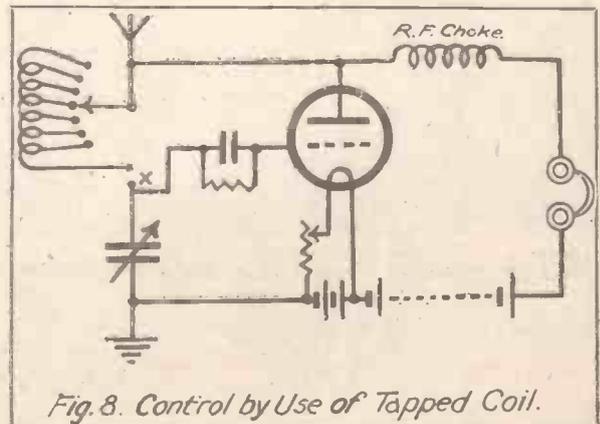
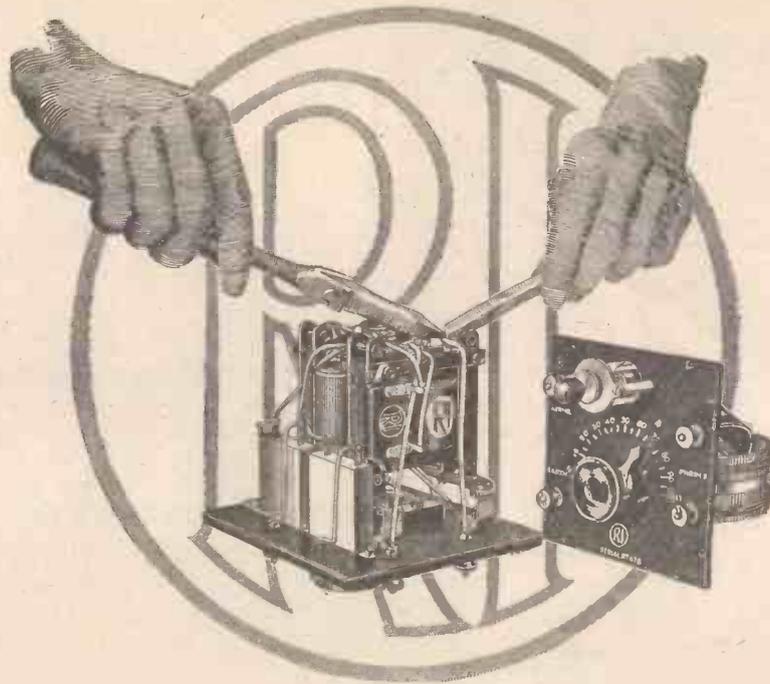


Fig. 8. Control by Use of Tapped Coil.



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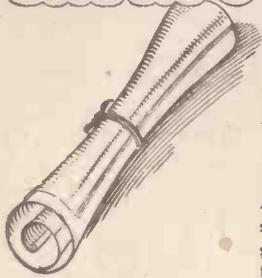
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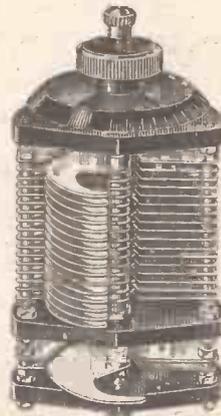
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**ON CONTROLLING THE
"ULTRA-AUDION."**

(Continued from page 1318.)

expensive, and there are objections to it on several grounds, notably the limitation of the tuning range and, in most cases, the introduction of additional rubbing contacts. The first may be got over by fitting a plug-in loading coil in series with the variometer (as at X, Fig. 7). The second is a matter

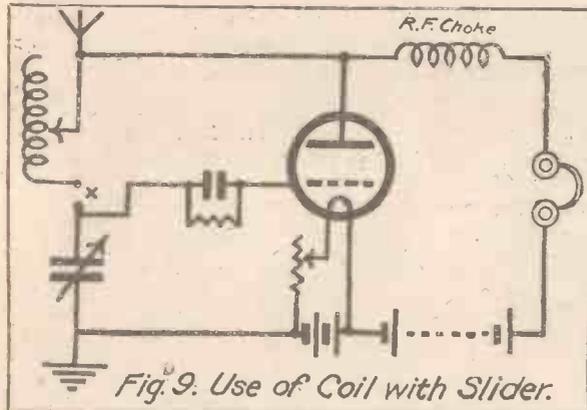


Fig. 9. Use of Coil with Slider.

of design. The writer agrees that the fewer rubbing contacts there are in a set the more likely is it to be efficient. But if a really good instrument is purchased there is comparatively little fear of trouble. Two swinging coils can, of course, be used to form a variometer. But this method never seems to give the same fine control as the

meter on the score of restriction of tuning range (which can be remedied in a similar manner), and also to the more serious one of the introduction of "dead-end" effects. But those possessing such inductances can usefully employ them in the "Ultra-audion" as in other circuits.

It must be remembered that the adjustment of the variometer, as well as that of the series A.T.C., alters not only the reaction but the tuning. "Tuning in" is thus a "two-handed job" with this arrangement. There are an indefinite number of settings of the A.T.I. and A.T.C. which will bring in the desired station, but the one which gives the best results can only be found by trial. The A.T.I. and A.T.C., of course, work "against one another"—i.e. if the A.T.I. is increased, the A.T.C. must be reduced to pick up the same station again. With a little practice a station can be "followed up" with ease up and down the scales until the best signals (just off the oscillating point) are obtained.

**NOTES ON
DRY CELLS.**

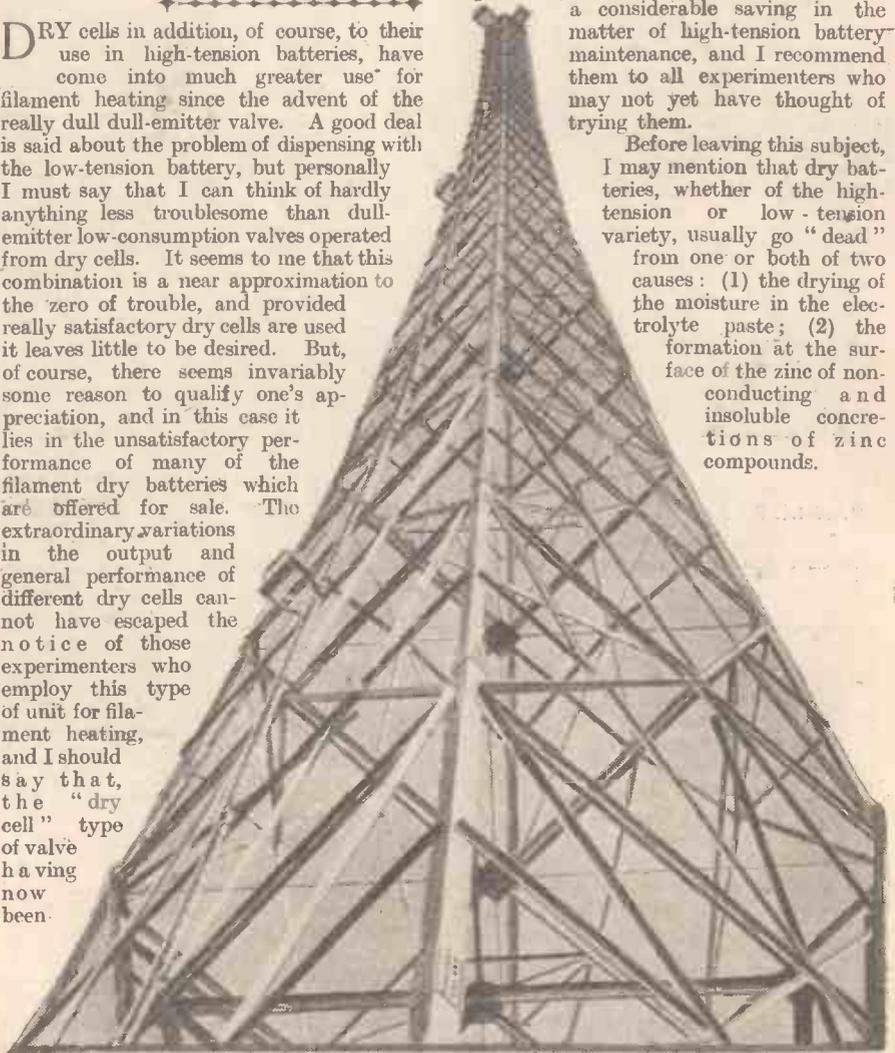
DRY cells in addition, of course, to their use in high-tension batteries, have come into much greater use for filament heating since the advent of the really dull dull-emitter valve. A good deal is said about the problem of dispensing with the low-tension battery, but personally I must say that I can think of hardly anything less troublesome than dull-emitter low-consumption valves operated from dry cells. It seems to me that this combination is a near approximation to the zero of trouble, and provided really satisfactory dry cells are used it leaves little to be desired. But, of course, there seems invariably some reason to qualify one's appreciation, and in this case it lies in the unsatisfactory performance of many of the filament dry batteries which are offered for sale. The extraordinary variations in the output and general performance of different dry cells cannot have escaped the notice of those experimenters who employ this type of unit for filament heating, and I should say that, the "dry cell" type of valve having now been

brought to a state of considerable perfection, the next step is to effect a corresponding improvement in the dry battery itself.

It seems that the dry cell has undergone little or no development since the days when it was first produced for pocket flashlight batteries, at a time when the demand was so insignificant as to give little incentive to manufacturers to devote any considerable amount of research to the subject. I may be wrong, but I fail to see (and I have frequently heard observations to the same effect) any notable difference between the flashlight battery of fifteen years ago and the flashlight battery of to-day which constitutes the unit of the wireless high-tension battery.

I suppose there is no experimenter of more than six months' standing who has not a museum of discarded high-tension batteries in some corner of his wireless room, representing, of course, considerable outlay. And, unfortunately, the real tragedy of it is that many, if not most, of the units in a discarded battery are capable of further service if they could be separated from the defunct units; in other words, the good are necessarily thrown away with the bad. This has to a large extent been got over lately by the introduction of the high-tension battery boxes, in which flashlight 4½-volt units are assembled. In these boxes the individual units are accessible, and defective ones can at any time be rejected and replaced by good ones. These boxes effect a considerable saving in the matter of high-tension battery maintenance, and I recommend them to all experimenters who may not yet have thought of trying them.

Before leaving this subject, I may mention that dry batteries, whether of the high-tension or low-tension variety, usually go "dead" from one or both of two causes: (1) the drying of the moisture in the electrolyte paste; (2) the formation at the surface of the zinc of non-conducting and insoluble concretions of zinc compounds.



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rotary type, and there is usually difficulty in noting the exact angle of the coils for future reference.

Variable A.T.I.

The "eddy current" plates referred to in discussing the R.F. choke can be applied to the A.T.I. This is a promising method which, however, the writer has not yet tried out and cannot, therefore, speak of with the authority of experience.

Other ways of varying the A.T.I. more or less continuously are the tapped coil, Fig. 8, and the slider, Fig. 9. These are open to the same objection as the vario-

WHAT THEY THINK.

GEORGE ROBEY & LESLIE HENSON ON BROADCASTING.

By "ARIEL."

THE other evening, while walking down the passage behind the stage of the London Hippodrome, I met Mr. George Robey, "made up" for his part in that successful show "Leap Year."

"Ah! if it isn't my old friend Rudolph Valentino!" he exclaimed, proffering his hand to me.



Mr. George Robey.

"I am not Rudolph——"

"Of course not; I am indeed sorry; you are—er—er—Douglas Fairbanks?"

"No, Mr. Robey, I am not. I am——"

"Yes, yes, of course; on looking closer I can see you are 'Mr. A.'—I mean Mr. 'Ariel.' Well, come along to my room. I have just three minutes to spare before the curtain goes up."

G. R. of 2 L O.

So we walked to his room and sat down, while his dresser added more grease to his face.

"Now tell me what you want," he inquired.

"Well, I should like to have your opinion of broadcasting," I replied rather inanely, for G. R. always takes my breath away.

"You will no doubt remember that it is now well over a year ago since you visited 2 L O at Marconi House."

"Yes, I remember quite well. I was unable to broadcast because my "silly-sisters" (solicitors) reminded me of my contract with the managers."

"I thought you were averse to broadcasting, even though your contract forbade you to broadcast," I said in surprise.

"No, not at all," he said. "In fact, I like it; I consider it the most wonderful discovery made since the introduction of marriage. And believe me, if wireless broadcasting had been invented thirty-five

years ago, I should be George Robey of 2 L O and should broadcast every night if I were allowed to, and tell the managers of the theatres to go to——"

"MISTERROBEYPLEASE," was the sudden interruption of a small boy with a big voice. Mr. Robey immediately jumped up, and with a parting remark to the effect that I was to wait, he made his way to the stage.

Stale Jokes.

I glanced round the room, looking at the photos of well-known artistes of the footlights, and after a passing remark to the dresser, I made myself comfortable in an armchair, and commenced to read an illustrated paper. But not for long, as I was frequently interrupted by the dresser, who seemed to be keen on talking.

"That there boy who called just now saved the boss."

"Saved the boss? Do you mean Mr. Robey?" I asked, always seeking news.

"Yes, sir."

"Tell me what happened," I said, feeling very interested to hear what this man had to say about Mr. Robey and his life being saved by a call-boy.

"Well, sir, he called Mr. Robey just as he was about to say something to you which, I guess, could not be published. I am a member of the Society of ——"

We were at this juncture interrupted by the entry of Mr. Robey looking extremely happy, and with perspiration rolling down his greasy face.

"Here we are again," he ejaculated somewhat jovially. "Now tell me what I said when that boy called me."

I reminded Mr. Robey what he had said, and added: "don't you think that, after a few weeks' broadcasting your jokes and funny sayings would become exhausted?"

"No, I don't think so. If you are a comedian you must think out fresh jokes and sayings as opportunities arise. Comedians are born, not made."

A Fine Advertisement.

"MISTERROBEYPLEASE!"

Here Mr. Robey was called away again; this time, unfortunately, until the end of the show.

"Cheerio, Ariel," he said as he left, to which I reciprocated "Good-night," and made my way to Mr. Leslie Henson's theatre, where I found him dressing for the "finale."

"Come right in if you are good-looking," was the cheerful answer to my knock.

Well, I went in.

Mr. Henson made a wry face, but I was permitted to stay. And I put the same old question to him.

"Fine, the finest advertisement the world has ever seen. I love it, and as my

wife says, 'I adore it.' But she has never said that to me."

Broadcasting Beneficial.

"Did you reap any benefit from the broadcasting of 'Patricia' at His Majesty's Theatre?"

"Oh, yes, I think we did remarkably well," Mr. Henson said emphatically, "considering the opposition of the Press, who, as you know, condemned the show; but thanks to broadcasting, this opposition has been overcome."

"Then you approve of broadcasting plays?" I said.

"Not complete shows; only sketches from a show."

"Do you think there is any harm in comedians broadcasting?" was my next question.

"Yes, unless they broadcast jokes or sayings years old, which are out of date for the footlights, but then I suppose the Broadcasting Company would not like that, and I don't blame them."

"Do you still take a keen interest in wireless?" I further asked Mr. Henson.

"Oh, yes, I have started to reconstruct my "P.W." set for the first time, and I guess before it's finished I shall have to get somebody to put it right!"

On my way home I thought over my interviews with these two famous comedians, and remembered the early days when I called on them to ascertain their views on broadcasting, when a war was raging between the B.B.C. and the theatre managers. Opinions have changed, views



Mr. Leslie Henson.

have altered, and little can we wonder, when experience has taught us that broadcasting is not an enemy of the theatre, providing, of course, discretion is shown. The broadcasting of "Polly," "The Beggar's Opera," "Patricia," and other productions has certainly made many people sit up and take notice in theatre-land.

BRITEZITE CRYSTAL

USED
NIGHTLY
IN A
MILLION
HOMES



"BRITEZITE BRINGS IN BROADCAST BEST"

Used by many
Leading Makers
in their
Wireless Sets

Extra Loud all over

Stocked by
the principal
Wireless Dealers.

1/- PER
BOX

Satisfaction
Guaranteed or
Money Returned.

Read what
"Popular Wireless" says:
" Britezite is
one of the most
efficient we have
yet had brought to
our notice."

Sep. 13th, 1924.

If any difficulty in obtaining from your local dealer, please write to
BRITISH CENTRAL ELECTRICAL CO., Ltd., 6 & 8, Rosebery Avenue, London, E.C.

WAVES AND STRAYS.

By HIGHAM BURLAC.
OLAF'S MAGNUM OPUS.

WHAT Olaf—that's my nephew—doesn't know about cat's-whiskers isn't worth worrying about. I do not really know why he is called Olaf, though I suspect it is some nonsense of his mother's about "Hardy Norsemen" and the Heroes of Asgard. As a matter of fact, Olaf is just a snub-nosed, freckled schoolboy, too short about the trousers, I always think, and too long about the back hair.

An Apology.

When wireless "came in," as he says (bless his innocence!), he threw up stamps and motor-bikes without so much as a backward glance, such is the callous ingratitude of the young. And now he is *profound* when speaking of wireless, though I fear he has never realised that the science of wireless—which he fondly imagines he has conquered—is a gem which has an insignificant facet called "transmission," to mention only one other. However!

It chanced that some time ago one of these Editors fastened on to me with a "rush" job. I was to produce a complete glossary of wireless terms in some disgustingly short time. I was suffering from writer's cramp and water on the valve, too. So whilst I turned my rapier-like intellect upon terms like "logarithmic decrement," I asked Olaf to knock up a few notes on milky ones like "plate," "valve," and so forth. Olaf toed the line like a Briton and dyed himself with ink almost up to his elbows, but the results of his agony never went into my Glossary. You've got to have them, because if Olaf does not see them in print somewhere, he'll never acknowledge me again.

The Great Effort Begins.

ABAC.—A back is a football player. He stands in the third row from the front, and gets more mud than the others.

ACCUMULATOR.—This costs anything from 12s. 6d. to £3, and has two terminals, one red and the other negative, though mine are both green. These things have to be charged, and they charge half-a-crown to charge them. The faster they run down, the bigger bill you run up. This is called the Law of Compensation.

ANODE.—An Ode is sometimes a piece of poetry and sometimes not. All the Odes I have met were not. They were done in Latin by a man called Horace. Horace is now dead. What rot!

BOOSTER.—This is a man who puts in advertisements for you. They smook cigars and have much money, but are not esthetic—so my father says.

BATTERY.—The thing you ring bells with, but useful for flash-lamps. Some are wet and some are dry.

BAR MAGNET.—See Barmaid.

BEAT RECEPTION.—We generally experience this on Mondays. Strange how week-ends spoil masters' tempers.

CHARGE.—How much for something. Also what the copper says you've done.

CONDENSER.—You tune with a condenser. It is made of alternate plates of metal and

nothing. The less nothing you have, the more you pay. The metal is thrown in.

CONDUCTOR.—A wire. Hence bus-bar, a live wire, and a 'bus conductor the same, if inspector aboard.

CONTINUOUS WAVES.—Used by most post-office stations to jam those ghastly educational talks and chess moves.

CRYSTAL DETECTOR.—You can get them cheap, but mostly kids have them. It has a slider and a cat's-whisker, and you put the cat's-whisker on the crystal and hear things.



A portable one-valve set built by Mr. R. T. Cox,
14, Ruthin Gardens, Cardiff.

Sometimes you have a varyommitter, which is two balls of wire inside each other.

(Ha! This is Olaf at the top of his form.—H. B.)

CURRENT.—Electricity. It is made of volts and sparks. You can get it out of the wall to light lamps, or from batteries and cetera. A man called Benjimen Franklin used to fly kites with it at a place called Leyden.

D.F.—We are not supposed to sware at our school.

DIELECTRIC.—The inside of a condenser. The microfarads depend upon this. It has one hole fixing, and costs more if you get it in a box.

DOWNLEAD.—That part of the aerial which comes through the wall and the housemaid trips over it.

DYNAMO.—These are found in all electrical things. They go round rapidly, and have swishboards.

EARTH.—This is when you bury something metal in the garden for a wireless. When we buried ours, father broke a big earthenware pipe and had a plumber for days.

EBONITE.—Black stuff, much better than cardboard for wireless. It seems very brittle. You have to be very careful to scrub it, or it will conduct.

ELECTRICITY.—See Current. They used to do it by rubbing amber with silk, and then it was called elektron, which is Greek for Edison.

FILAMENT.—What you burn out in a valve and have to buy another. They have a lot of resistance, though I think this is a mistake. They get too hot.

FREQUENCY.—The number of times a second. A wave-length has bags of it.

GALENA.—Hurtsight. Shilling each.

GRID.—Something in a valve. Does not burn out, but is otherwise useful if it leaks. Grid leaks are easy. You lick a pencil and draw a thick line.

Nearing the End.

HENRY.—Cristian name of the man who invented tuning coils.

H.T.—What you don't want in a Yuni-dyne. If you keep it a long time it swells up, goes white, and won't work.

INDUCTANCE.—Wire that goes round and round in a wireless set. If you want to hear Chelmsford it costs you more, because you have to buy another bit.

LOW TENSION.—About five volts. What burns filaments out. If you have a Dull Emetic the L.T. lasts longer.

MAGNETISM.—Comes out of a magnet and picks up nibs, but can be used in wireless to make the telephones gee.

MORSE.—Dots and dashes once made in America. Now used by the Post Office and other places of that kind, if any, and by Marconi operators at sea.

NEGATIVE.—Not. Meaning "not positive." If you join it to negative, it is negative, but more so and no good.

OHM'S LAW.—Algebra. It means that if you have more of something, you get less

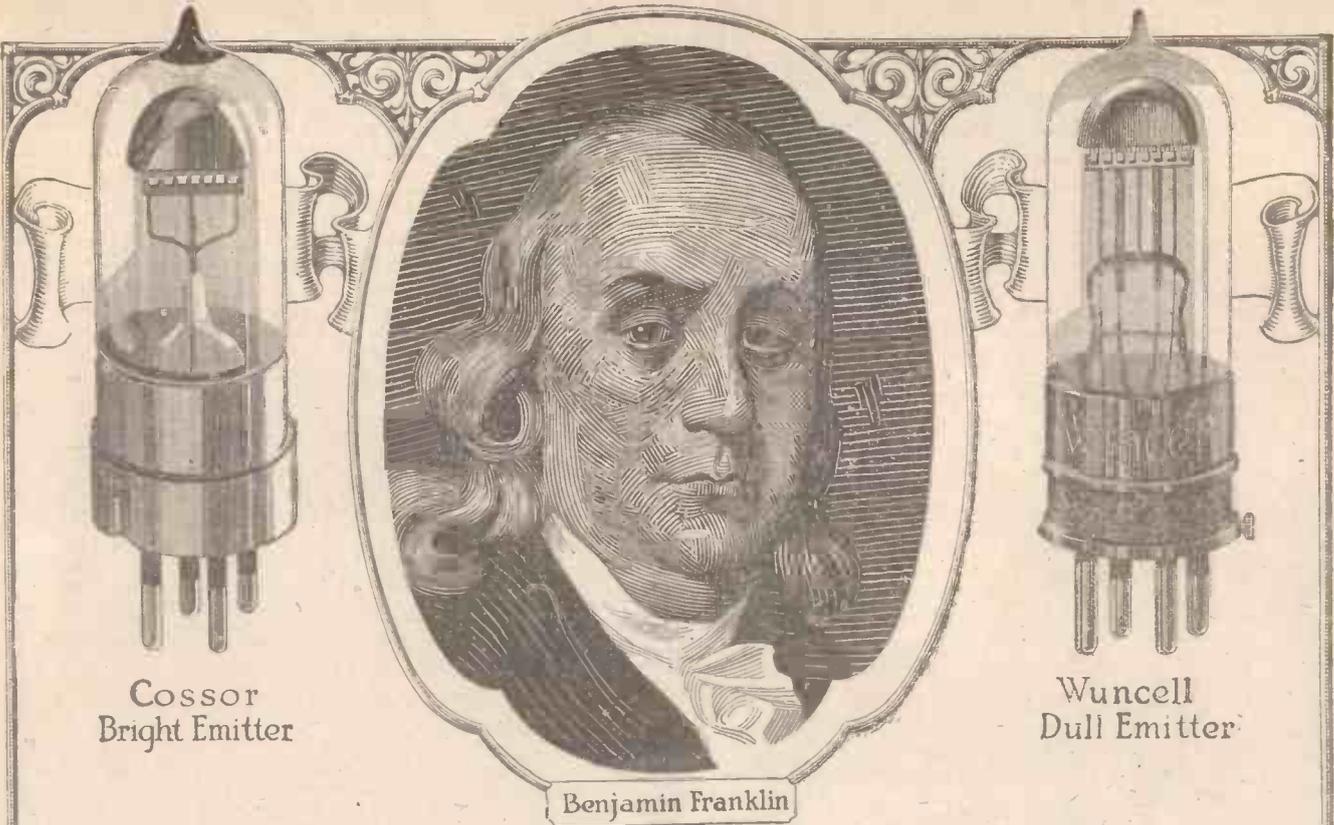
of something else. If you don't pay attention to this you burn out a valve. Men who sell valves want this law abolished.

PLATE.—A thing in a valve to join the high-tension battery to. Also used in baseball, churches, and false teeth.

REACTION.—What Captain Ekkersley goes on about. You turn a handle and the thing whistles at you, thus making the music much louder—specially drums and such.

VALVE.—What makes wireless so dear. A glass sort of thing full of eggzorst-ed-air with a filament. It lights up and uses up the battery. When—

(Look here, Higham! This is a technical magazine!—Ed.)



Cossor
Bright Emitter

Wuncell
Dull Emitter

Benjamin Franklin

Benjamin Franklin's gift to Radio

TO all wireless enthusiasts Benjamin Franklin should be remembered as the first man ever to attempt the extraction of electricity from the atmosphere. His early kite-flying experiments effectively demonstrated that in very damp weather when the atmosphere was heavily charged with electricity that a strong electrical current ran down the wet string.

To-day, in this country, there are more than a million Benjamin Franklins busily engaged night after night in extracting electrical energy from the ether and converting it into enjoyment. Some do it by means of simple Crystal Sets and others by means of more efficient Valve Sets. Of all the Valve enthusiasts, by far the greater proportion are Cossor users—

for there is no Valve more popular in Great Britain.

With their arched filaments and their electron-retaining hood-shaped Anodes the P1 and the red-topped P2 are a familiar sight in every Wireless shop. And now comes the Cossor Wuncell—an entirely new type of Dull Emitter—which bids fair to attain an even greater measure of popularity.

In this short space we cannot tell you its many advantages—how its filament, when glowing, is all but invisible; how volume for volume it is fully the equal of our own Bright Emitters; how in current consumption and long life it is unexcelled—all these points are fully covered in a large interesting Folder which your own dealer can give you free, or which we will send you on receipt of a postcard.

No. 3 of a Series.

Cossor Valves



The Technical Editor of "Popular Wireless" will be pleased to receive wireless sets and component parts from manufacturers and traders for test. Reports will be published under this heading.

FROM Messrs. the Melville Production Co., Ltd., of 59, New Oxford Street, London, W.C.1, we have received a very interesting model of a new type of loud speaker. In appearance it is similar to none of its numerous predecessors, being absolutely unorthodox in design. It consists of an elegantly shaped, polished upright wooden case, over the front of which ornamental silk material is stretched. A small adjusting screw at the back, and the connecting leads, are the only clues to the instrument's identity.

Its tone of reproduction is very pleasing, and strings come through with all their original "timbre." This loud speaker can handle very considerable volume, sufficient to make its frame mechanically vibrate, without serious distortion arising, but in our opinion it is not as sensitive as the majority of loud speakers, but where ample volume is obtainable it is sure to prove popular.

Experimenters desirous of obtaining really first-class yet moderately priced fixed con-

densers cannot do better than give Lissen fixed condensers their consideration. We have been testing a range of samples recently submitted to us and discover them to be efficient, both in respect of insulation and closeness to specified values whilst being stout in construction and neat in appearance.

By the way, we have had a "Lissenceptor" Mark 2 on test for some few weeks, and find it to be a most efficient "wave trap." Of course, there are cases when the Lissenceptor fails to completely cut out a jamming station, and this is hardly to be wondered at in view of the flatness of tuning



An R.M.C. "skeleton" type spherical variometer.

common to so many "spark" interruptors, but even the worst of these can be considerably subdued with the assistance of the above-mentioned instrument.

Messrs. the Fallon Condenser Manufacturing Co., Ltd., have sent us samples of their new Phoxe Tip Jacks. These little devices, which are retailed at 9d. per pair, are excellent substitutes for terminals and, in our opinion tend to enhance the appearance of a panel.

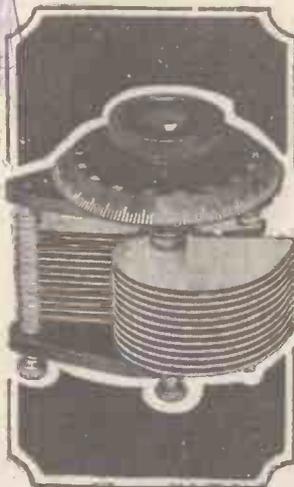
The features claimed for these jacks are positive contacts, quick operation, and no nuts to lose.

A neat and very convenient soldering outfit has been placed on the market, known as the "Rozinal" set. It consists of a soldering-iron with a blow-lamp attached, so that it can be kept hot the whole time it is in use. The blow-lamp is operated on benzol or petrol, and a small spirit-lamp is provided to start the blow-lamp. It is extremely convenient where any considerable amount of soldering is to be done and avoids the waste of time involved in reheating the iron as in the ordinary method.

It would appear that there is more in "Junit," the "self-soldering wire" which we recently commented upon, than our first investigation led us to believe. It consists of copper wire which is grooved on both sides to hold the solder. We were hopelessly inaccurate when we stated that there was a possibility of "Junit" melting through by the careless handling of the

(Continued on page 1328.)

LOOK TO YOUR TUNERS for dielectric losses



Whether your present condensers are Metal or Ebonite End Plates and your receiver unaccountably lacking power — be sure your trouble lies in the bad insulating properties of the insulation between the two sets of plates. High dielectric losses cause leakages, absorptions, inability to oscillate on the lower degrees of the scale. These signal weakening losses follow the use of poor quality End Plates or insulating bushes. Your only safeguard against condensers in this category is simplicity itself. Always purchase Condensers bearing our monogram — it is the insignia of low dielectric loss — actually J.B. are recorded (N.P.L.) 0.05 ohms — a negligible quantity.

Incorporation of J.B. Condensers gives you the highest tuner efficiency. Fit them — preferably the J.B. Square law.

001	9/6	00025	6/9
00075	9/-	0002	5/6
0005	8/-	0001	5/3
0003	6/9	Vernier	4/6

As Condenser Manufacturers we have long realised the vital electrical duty of variable condensers. J.B. Condensers represent both high mechanical and electrical design.

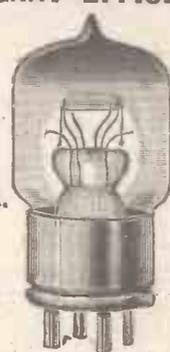
J.B. Instruments are obtainable from all dealers or direct from the manufacturers: Post, one, 6d.; two, 9d.; three, 1s.

JACKSON BROS.
8, POLAND ST.—OXFORD ST. Telephone:—
LONDON—W.1. GERRARD 7414
(First Floor)

Darclay's 604

"ELEGANT EFFICIENCY."

FIL. CUR.
2V, 0.2A.



PRICE
12/-

NEW ZEALAND on a Single Valve—

A C & S DULL EMITTER OF COURSE! THE ONLY VALVE THAT GETS THE UTMOST OUT OF THE ETHER. A SAMPLE WILL CONVINCE YOU OF THE IMMENSE SUPERIORITY OF THIS VALVE OVER ALL OTHER TYPES.

Complete Illustrated Catalogue Free.

CRAIK & SMITH,
Phone: Clerk. 7346. ALLEN ST., E.C.1.

Exide

THE LONG-LIFE BATTERY

To interest and amuse our friends we offer the following prizes for the correct solution of the cross-word puzzle below.

1st. One Exide L.T. Wireless Battery—6 volt. 60 amp. hrs. capacity Value £3/3/0

2nd. One Exide Hand Lamp Complete Value £1/12/0

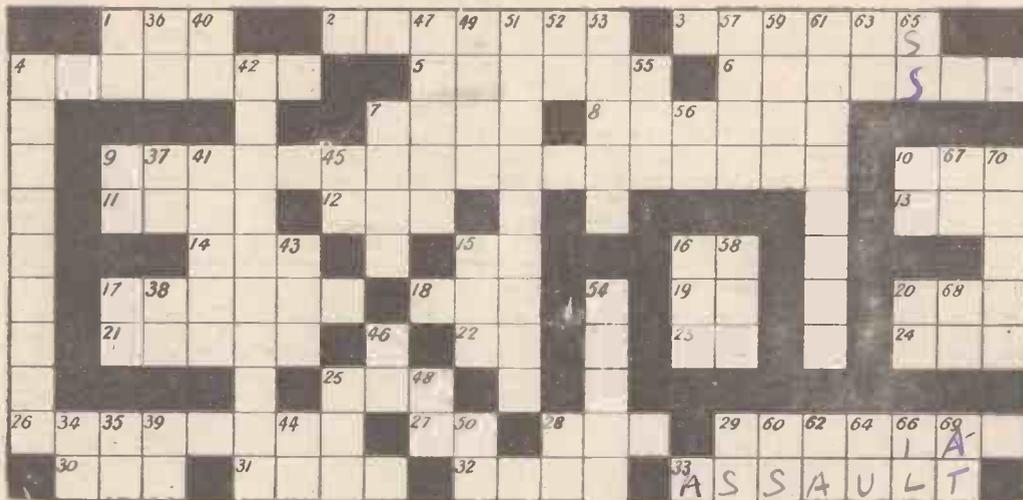
3rd. One Exide H.T. Wireless Battery—24 volts Value £1/4/0

Also 20 Consolation Prizes, each comprising one "Chloride" folding steel foot rule, in case.

No envelope will be opened before February 10th, when the prizes will be awarded to the first 23 correct solutions opened.

Our decision must be accepted as final.

Envelopes to be marked "Competition" in top left-hand corner, and addressed to:—The Chloride Electrical Storage Co. Ltd., Clifton Junction, near Manchester.



The "words" in this puzzle include several generally accepted abbreviations or initials similar to the following:—

"R.H.A."—Royal Horse Artillery.

The "Clues" are not put forward as exact definitions but as affording an indication to the required word.

HORIZONTALS

- 1 Seven Hundred
- 2 A rare fruit tree.
- 3 Hard workers
- 4 A mineral found in Norway
- 5 Hero of a Roman epic
- 6 Your interest is
- 7 Useful for slotmeters
- 8 Probably dumped
- 9 A quality lacking in celluloid
- 10 A scriptural beast of burden
- 11 A great poem
- 12 Useful at Bridge
- 13 Goes with a dash
- 14 Demonstrative adjective
- 15 A royal title
- 16 Thus
- 17 Dismal
- 18 A woman's secret
- 19 Another scriptural beast
- 20 Yours' or mine
- 21 Dig again

HORIZONTALS—continued

- 22 Indefinite article
- 23 Prefix signifying facility
- 24 A smaller scriptural beast
- 25 Upper crust
- 26 Comfortless
- 27 The song of the lost sheep
- 28 An emollient
- 29 Crippling
- 30 Demonstrative adjective
- 31 A monkey's tail
- 32 Found in cheese
- 33 A crime of violence

VERTICALS

- 4 Surpass
- 34 Electro-Technics
- 1 A note of a scale (musical)
- 9 That's it
- 17 The family friend
- 35 Abbreviated bobs
- 36 Keeper of the Rolls

VERTICALS—continued.

- 37 Not hall-marked silver
- 38 A British Regiment
- 39 Anglo-Saxon
- 40 101
- 41 Often quoted
- 42 Having feet made to specification
- 43 A physical unit
- 44 Often before day
- 45 Unmarried artist
- 25 Little Nigger Boys
- 7 A darling
- 46 End of the fight
- 47 A type of pie
- 48 Lead
- 49 To put in possession
- 15 The Heavies
- 50 A light metal
- 51 Beginning
- 52 A respected profession
- 28 Preposition
- 53 A gold coin

VERTICALS—continued

- 54 The nest of a bird of prey
- 55 A clerical area
- 56 England's glory
- 16 Worth listening for
- 57 Half a rubber
- 58 Bottled bullock
- 29 One better than a barbeior
- 59 Long ages
- 60 In or near
- 61 Has no meaning
- 62 Perfection
- 63 and 64 Thou and I
- 65 Steamer
- 10 Date indication
- 20 Quite right
- 66 A negative prefix
- 67 Postal-address sign
- 68 West Indies
- 69 Over there
- 70 Grand at horse shows

Showrooms and Depots:

LONDON:
219/229, Shaftesbury Avenue,
W.C.2

BIRMINGHAM:
58, Dale End

THE Chloride ELECTRICAL STORAGE COMPANY LIMITED.

CLIFTON JUNCTION, NEAR MANCHESTER

THE LARGEST BATTERY WORKS IN THE BRITISH EMPIRE.

Showrooms and Depots:

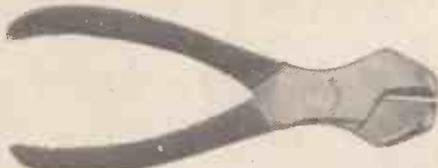
BRISTOL:
22, Victoria Street

MANCHESTER:
1, Bridge Street

APPARATUS TESTED.

(Continued from page 1326.)

iron; we had failed to detect that copper foundation, which naturally gives "Junit" all the tensile properties of ordinary copper wire. For easy working, "Junit" is to be thoroughly recommended; it simplifies soldering to a very considerable extent.



A useful accessory. Aeronomic bending pliers with which true right bends, even in No. 16 gauge square section wire, can be obtained.

Messrs. The Rexo Engineering Co., of 2, Ravenscourt Square, London, W.6, are the patentees and manufacturers of "Junit."

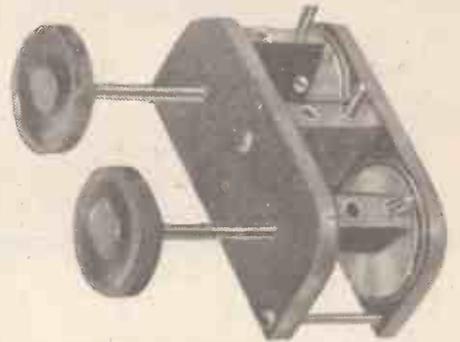
Messrs. The H.R.P. Co., of 46, St. Mary's Road, Leyton, E.10, wish us to point out that they undertake the rewinding, adjustment, and general overhauling of all makes and types of telephone receivers, and not only "ex-Army" phones, as their advertisements might tend to imply. We can also point out for the benefit of our readers that the H.R.P. people are perfectly trustworthy, and we have received quite a number of letters praising their low prices and general good service.

Messrs. The Dubilier Condenser Co. (1921), Ltd., inform us that their works, offices, and administration have been moved to larger and more commodious premises. Their new address, readers should note, is now the Ducon Works, Victoria Road, North Acton, London, W.3.

An interesting attempt to produce a "low loss" plug-in coil has been commendably carried out by Messrs. Faulkner & Co., of Manchester. It takes the form of the R.G. Strip Coil, several samples of which have been sent us for test. The R.G. Strip Coil, although outwardly very similar to any other plug-in coil, is not wound with wire, but with thin strip copper some $\frac{1}{8}$ in. wide. This copper strip is well spaced and insulated by means of a patent winding method which, in addition, makes the coil most rigid. Contrary to expectations, the R.G. coils do not prove to be possessed of disadvantageous values of self-capacity. On test they functioned admirably, and "coupled" in a most gratifyingly "lively" fashion. We would not like to say that they are better than any others we have tested, but they are well up to first-class standard. Mechanically, they are sound and well-finished, and are provided with a distinctive violet-coloured band upon which the name appears in gold letters; and this, together with the usual brass and ebonite fittings, combines to give them a rather pleasing and out-of-ordinary appearance. We wonder whether amateurs will appreciate the introduction of colour into their accessories? Personally, we like it. Mahogonite led the artistic way; perhaps some day it will be possible to

choose, say, violet-coloured valves to match grey-coloured condenser dials, heliotope terminals, and blue filament resistances!

Messrs. Wates Bros. have sent us a further supply of their Microstat filament resistances. The Microstat which is being sold to-day is a great improvement on the original Microstat as we remember it, good though it was. They are now provided with smaller milled adjustment knobs and screw-fixing terminals, while the resistance element has been considerably improved and a smooth control from zero to about 100 ohms is obtainable. We have used Microstats with 1.1 volt dull emitters working from a six-volt accumulator, and while this practice is by no means to be recommended, it offers proof of the efficiency of the little Microstat which we consider excellent value for money at 2/9.



A "Lotus" cut geared vernier coil holder as manufactured by Messrs. Garnett, Whiteley & Co., Ltd., of Liverpool.

Profit by the Experience of Others

PROOF

TAUNTON.
"With your Crystal and a One-Valve home-made Amplifier I got these American stations direct. They were quite loud on Phones."

WHAM WGY KDKA WOR WBZ



MORE PROOF

LYME REGIS.
"I must write to say your claims are quite justified. 'The Mighty Atom' is all-sensitive."

BEST PROOF

TRY IT ON YOUR SET.

The Crystal with the **SIGNED** Guarantee in every Box

The "Mighty Atom" is all it claims to be—**Britain's Best Crystal**

Special Cat's-whisker in Tube, Tweezers, Directions and signed tester's Slip. See that the Seal is unbroken. Obtainable of all Dealers, 1/6; if any difficulty write direct to

BRITAIN'S BEST CRYSTAL LIMITED,
234/5, SALISBURY HOUSE, LONDON WALL, E.C.2

Result of Cross Word Puzzle Competition will be published on February 7th.

HULLO EVERYBODY!!

ALL GOODS ON THIS PAGE SENT BY POST.

U.K. POST FREE, EXCEPT WHERE MARKED. FOREIGN PACKING AND POST EXTRA ORDERS DESPATCHED IN STRICT ROTATION AT EARLIEST POSSIBLE MOMENT.

CALLERS PRICES ELSEWHERE.

- Aerial 7/22, 100 feet 3/-
- Copper Strip, do. 2/9
- Allen Variable Grid Leak 1/9
- Burndept Detector 5/6
- asket Coil Holders 13, 1/6
- Battery Links . doz. 1/3
- Bretwood Var. Grid Leak 3/-
- Anode Resistance 3/-
- Bushes, Ebonite, doz. 1/4
- Crystals—Neutron or Gilray 1/6
- Hertzite or Permalite 1/-
- Coil Stands—2-way Baby 3/6
- 2-way De Luxe 3/11
- 2-way Vernier 5/6
- 2-way Geared 5/11
- 2-way Polar 6/3
- 2-way with ex. handles 3/11
- 2-way Shipton Vernier 4/6
- 3-way Baby 4/6
- 3-way De Luxe 4/9
- 3-way ex. handles 5/6
- 3-way Shipton Vernier 8/-
- Crystal Sets—For B.B.C. and 5 X X 9/11
- Neutron Long Distance 32/6
- Re-Echo, Sloping 17/6
- Brownie 8/6
- Coils D.C.C. 1,600 metres 2/-
- With Adapter 2/9
- No. 50, 75, 100 set 2/3
- Coil Plugs 2 for 1/6
- Wedge 2 for 2/0
- Edison Bell do. 2 for 2/6
- Detectors Enclosed—Micrometer 2/9
- Nickel Large 2/3
- Micmet 6/3
- Burndept 5/6
- Fixed Condensers—Raymond .001 to .0005 1/2
- Raymond .002 to .006 1/3
- Raymond .02 or .01 (Above Ebonite Base) 1/9
- Mansbridge 2 mfd. 4/3
- Mansbridge 1 mfd. 3/6
- Mansbridge .25 mfd. 3/6
- Edison Bell .001 to .0005 each 1/3
- Edison Bell .002 to .006 each 2/-
- Edison Bell 2 meg. Grid Leak 1/6
- McMichael's 2 meg. Grid Leak 2/6
- McMichael's .100000 Ohm Resistance 2/6
- Dubilier .0001 to .0005 2/6
- Dubilier .001 to .006 3/-
- Dubilier .01 (for loud speakers) 7/6
- Dubilier 2 meg. Grid Leak 2/6

- Fixed Condensers (contd.)
- Dubilier Anode Resistance 5/6
- (50,000, 70,000, 80,000, 100,000 ohms on Stand complete.)
- Flex—2-Colour Twin 12 yds. 2/6
- Lighting 12 yds. 2/-
- Min. Silk Twin 12 yds. 2/-
- Goswell—Valve Legs, Set 4 1/3
- Valve Holder 1/9
- 2-way Cam Vernier 9/-
- 3-way Cam Vernier 12/6
- 3-way Ordinary 7/6
- 2-way Panel 3/-
- 3-way Panel 5/-
- Basket Holders 1/4
- H.F. Transformers—McMichael's 300/600 10/-
- 1100/3000 10/-
- Energic, 250/700 3/11
- 450/1200 4/3
- 900/2000 4/8
- Raymond B.C.C 2/9
- 5 X X 2/9
- Igranic Rheostat 4/6
- 30 ohms 7/-
- Potentiometer 7/-
- Variometer 10/6
- Coils (all numbers) 25 5/- 35 5/-
- 50 5/2 75 5/6
- 100 7/- 150 7/10
- 200 8/8 250 9/-
- 300 9/5 400 10/3
- 500 10/6
- Lissen—Minor, 3/6 ; Stat 7/6
- Universal 10/6
- Switch 2-way 2/9
- Series Parallel 3/9
- Anode Res. 2/6
- Var. Grid Leak 2/6
- Choke 10/6
- L.F. T.1 30/-
- T.2 25/-
- L.F. T.3 16/6
- Coils—25 .4/10 35 .40 40 1/0
- 50 .5/- 60 .5/4
- 75 .5/4 100 .6/9
- 150 .7/- 200 .8/5
- Polar Condensers .001, .0005 or .0003 10/6
- Micrometer 5/6
- 2-way Junior 6/-
- Rheostats One hole fixing 1/6
- C. & S. fixing 1/5
- De Luxe and Dial 2/6
- Burndept 4/6
- McMichael Dual 7/6
- Shipton Strip 7 ohm (with fuse) 3/6
- 30 or 60 ohm 3/6
- Potentiometer 600 ohms 4/6
- Crowa for DE or R 2/6
- L.E.S. Micro Control 3/6

- Switches Panel DPDT 1/6
- Panel SPDT 1/4
- Ebonite DPDT 2/6
- Ebonite SPDT 1/9
- Simplex Lead in 1/9
- Sq. 1/4 Bus Bar 1/6
- Switch Arms 1/-
- (Inc. studs and nuts.)
- Terminals Phone or W.O. doz. 1/9
- Pillar large . doz. 1/9
- Pillar medium doz. 1/3
- Nickel 6d. doz. extra. (All with nuts)
- Transformers, L.F. Ferranti 17/6
- Igranic 21/-
- R.I. 25/-
- Ormond 14/-
- G.K.C. 83 15/-
- Super Success 21/-
- Standard Success 16/-
- Brunet Shrouded 13/6
- Formo Shrouded 13/-
- Formo open 12/6
- French 9/3
- Valve Windows 2 for 1/-
- Valve Holders Murray Anticap 1/3
- Legless Anticap 1/3
- Bretwood 1/9
- Climax UN panel 1/6
- (Similar to H.T.C.)
- Solid Rod Standard 1/3
- Goswell 1/6
- Valves Myers Universal 12/6
- French "R" 7/6
- Dutch Detector 5/6
- Dutch "R" 5/11
- Metal '06 13/11
- Radio Micro '06 13/11
- Bright Emitter B.T.H. "R," Edison A.R., Marconi Osram "R" or "R5," Mullard O.R.A., Cossor L.F. P1, Cossor H.F. P2, Mullard H.F. Mullard L.F. 12/6
- Dull Emitter B.T.H. B3, Edison A.R.D.E., Marconi D.E.R., Myers, each 21/-
- Dull Emitters B.T.H. B5, Edison A.R. "06," Mullard D.F. O.R.A 25/-
- D.E. Power Valves Marconi D.E. 6 25/-
- Power Valves (for '06) B.T.H., B6 35/-
- Marconi D.E. 4 30/-
- Mullard D.F.A. 30/-
- Power Valves, for B.E., B.T.H. B4, Marconi, Mullard 35/-
- (Valves posted buyer's risk.)
- Watmel Var. gd. Leak 2/6
- Anode Res. 3/6
- Wates Microstat 2/9

HEADPHONES

We can recommend these as being excellent Headphones, with a great reputation.

- B.T.H., 4,000 ohms 25/-
- G.R.C. 4,000 ohms 20/-
- BRANDES 4,000 ohms (matched tone) 25/-
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- STERLING 4,000 ohms 25/-

(Above post free).

DR. NESPER HEADPHONES

Adjustable diaphragm, detachable receivers, double leather-covered head-springs, long flexible cords, nickel plated parts. Very comfortable fitting to the head.

LOOK FOR THE TRADE MARK.

4,000 ohms 13/3

Post 6d. pair.

BRUNET PHONES.

New Model. Black Cords.

4000 ohms 16/6

Post 6d. pair.

FRENCH THOMSON-HOUSTON 4000 ohm Phones, 15/11.

TELEFUNKEN. (adjustable) 4000 ohms 17/11 (Lighter than a feather)

N and K GENUINE (OLD MODEL) (No. 2)

Few dozen pairs, 12/11

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3 POLE MAGNETS 17/6 per pair.

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West End Stockist of Edison Bell, Igranic, Goswell (quality), Polar, Jackson Bros. (J.B.), Marconi, Cossor, Mullard, Edison Valves, Sterling, B.T.H., McMichael's, Lissen, Dubilier goods.

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EBONITE PANELS 3-16th in.

6 x 6 .1/8 10 x 8 .3/6

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600 ohms 5/-

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NEUTRODYNE MICRO-CONDENSER.

A useful adjustable condenser of small capacity and dimensions, soundly constructed, essentially designed for providing feed back and oscillation neutralising potentials. ONE HOLE FIXING. Fitted with Terminals and Soldering Tags. Price 2/3 each, post free.



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Rheostat, with Dial, 2/6

Bretwood, Valve-holder, 1/9



Manchester, "Powquip," 15/6

Ormond 14/6



Shrouded "Powquip," 18/-

Standard "Powquip," 14/6



"R.I." NEW MODEL IN SEALED BOX

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FERRANTI L.F. BETTER THAN THE BEST 17/6



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HIGH QUALITY
SENT BY POST 6d. SET EXTRA.

"DE LUXE" MODEL



AS SHOWN, WITH DIAL, KNOB AND BUSH.

- 001 - 5/11
- 0005 - 5/6
- 0003 - 5/-
- 0002 - 4/9

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UNSURPASSED FOR FINE TUNING.

NEW MODEL

With Knob and Dial.

WITH VERNIER.

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- 0005 - 6/11
- 0003 - 6/9

With EBONITE DIAL and Two Knobs. Post 6d. Set.



NEW MODEL SQUARE LAW

With Vernier.

With Knob and Dial.

Aluminium Ends. Ebonite Ends.

- 0003 - 8/6 - 10/-
- 0005 - 8/11 - 10/6

Post 6d. Set.



TWIN CONDENSER SQUARE LAW

EBONITE ENDS.

- 00025 - 12/6
- 0003 - 12/6
- 0005 - 12/11

TWIN (Ordinary)

Equal units of •00025 or •0003. Complete with Knob and Dial. Post 6d. 9/-

To meet the wants of amateurs requiring a good Square Law •0005 at a low price, ask for

No. 7

•0005 SQUARE LAW

Complete with Knob and Dial.

Post free 5/11

LONDON'S LARGEST Stockist of JACKSON BROS.'

"J.B." Variable Condensers, Complete with Knob and Dial.

SQUARE LAW STANDARD

- | | | | |
|-------|-----|-------|-----|
| •001 | 9/8 | •001 | 8/6 |
| •0005 | 8/- | •0005 | 7/- |
| •0003 | 6/9 | •0003 | 5/9 |
| •0002 | 5/8 | •0002 | 5/- |

Other sizes as advertised by "J.B." Post 4d.

CALLERS! THESE 4 COLUMNS FOR YOU

Warning! Note name RAYMOND on shops. You will not be able to buy these goods otherwise. Nearest Tube Leicester Square. This address is at the back of Daly's Theatre. Open Weekdays 9 to 8, Saturdays 9 to 8.45, Sundays 10 to 1.

SUNDRIES

- Lead-in tubes, 6d., 7d., 8d.
- Valve Pins and Nuts, 2 a 1d
- Stop Pins and Nuts, 2 a 1d
- Nickel Terminals 2d.
- Nickel Contact Studs. 2 for 1 1/2d.
- Nickel Switch Arm 1/-
- (one-hole fixing)
- Voltmeter 4/6
- Gamages Permanite 1/-
- Condenser Brushes 6d.

RAYMOND FIXED CONDENSERS.

- 001, •0031 to •0005 10d.
- 002, •003, •004 1/-
- 006, 1/3 ; •01, 1/9 ; •02 1/9

ACCUMULATORS

- 2 v. 40 amps. 9/6
- 4 v. 40 amps. 16/6
- 4 v. 60 amps. 18/6
- 4 v. 80 amps. 23/6
- 6 v. 60 amps. 27/6
- 6 v. 80 amps. 33/-
- 6 v. 105 amps. 38/6
- Hart's Stocked. All High Quality.

- Microstat 2/8
- Switch Arms 8d. to 1/-
- Leatherette Boxes with Lid 2/3 & 2/11
- Shellac 5d.
- Shorting Plug and Socket 41d.
- Contact Studs 4 for 1 1/2d.
- Nickel ditto 2 for 1 1/2d.
- Nickel Switch Arm 1/-
- Sorbo Ear Caps pair 1/4
- Tumbler Switches 1/4

- 'Phone Cords 6 ft. 1/-, 1/3
- Nugraving 6d.
- Empire Tape 2yds. 1d.
- Allen Var. Grid Leak 1/3
- Best Sleeving 3yds. 10d.
- Rubber Lead-in 10 yds. 1/-
- Thick ditto, 1d., 2d., & 3d.
- Aerial, 7/22 100 ft. 1/11
- Ditto, Extra Heavy 100 ft. 2/3
- Anti Cap. Handles 8d.
- Tumbler Switches 1/-

NOTE!

Our Wonderful Micro-meter Adjustment Glass-enclosed Detector. 1/9 Why pay more?

- 5 Waxless Coils 200/2000 1/3
- 5 equal 25 to 100 1/8
- 5 ditto, Extra Air Space 2/-
- 6 waxed 200/3600 1/8
- 7 waxed 150/3600 1/11
- Chelmsford D.C.C. 1/-, 1/3, 2/6
- Basket Holders 9d. 1/- 1/3

RAYMOND CRYSTAL SETS

- 2 B.A. Rod per ft. 2 1/2d.
- 4 B.A. Rod per ft. 2d.
- Basket Holders 8d.
- Also at 10d., 1/-, 1/3, 1/6
- 2-way Coil Stands 1/11
- 3-way ditto 3/6
- 2-way with ex-handles 2/11

VERY SPECIAL OFFERS

- Crystal Set fitted for Chelmsford 7/11
- RE ECHO set, worth 25/- for 15/-

SPECIAL. To callers only. To customers purchasing 20/- worth of our own goods at full prices, we supply a first-class pair of 4,000 ohm 'phones for 5/- as an advertisement only.

SPECIAL BARGAIN.

- 0005 Variable Condensers SQUARE LAW with Knob Caller's Price 5/- Splendidly Finished.
- Legless valve holders 1/-
- ANTI CAP valve holder 1/-
- 2 mid. Mansbridge 3/9
- 1 mid. Mansbridge 3/3
- .25 Mansbridge 2/11
- Colvern Vernier 2/8
- Neatrodne ditto 3/8
- Radio panels "KENITE" (stand 5,000 volts), 6 x 6, 9d.; 7 x 5, 9d.; 8 x 6, 10d.; 9 x 6, 1/-; 10 x 8, 1/-; 12 x 9, 2/-; 12 x 12, 2/3. Above 3/16 in. thick. 1/2-in. also stocked.
- Legless valve holder 1/-
- Solid Rod Ditto 1/-
- Under Panel Ditto 1/6
- Ebonite Dials. 8d., 1/-
- Valve Templates 2d. 4d.
- Adhesive Tape Roll 2 1/2d.
- Copper Foil per foot 2 1/2d.
- 1 in. Fibre Strip 3 ft. 2d.
- Insulated Hooks 4 for 3d.
- Ditto Staples 5 a 1d.
- Twin Flex 4 yds. 6d.
- Twin Silk Small 6 yds. 6d.
- D.C.C. Bell Wire 10 yds. 5d.
- Knobs, 2 B.A. 2d., 3d., 4d.
- Small Knobs 6 B.A. 3d.
- Small Knobs 4 B.A. 3d.
- Wander Plugs, pair 3d.
- Egg Insulators each 1d.
- Tape Aerial 100 ft. 2/-
- Valve Windows 4d. to 9d.
- Mica 2d.

- 2-WAY COIL STANDS 1 1/3, 1/9
- VARIOMETERS 1/-, 1/3
- DUTCH VALVES 4/3
- LARGE DETECTORS 11d.
- 5 WAXLESS COILS 1/3
- Do. EXTRA AIR SPACE 1/8
- 'PHONES 4,000 OHMS 6/11
- N. & K. PATT. 4,000 OHMS 8/11
- VARIABLE GRID LEAKS 1/2
- VALVES FOR UNIDYNE 12/-
- 5-PIN Ditto 13/11
- PORCELAIN D.P.D.T. 1/4
- Ditto, S.P.D.T. 11d.
- L.F. TRANSFORMERS 8/11
- SPECIAL BASKET HOLDERS 8 1/2d.
- Ditto, for Chelmsford Coils 9d.
- SINGLE COIL formers 8 1/2d.
- BRUNET 4,000 ohms. NEWEST MODEL 16/6
- ACCUMULATOR CARRIER 2/3
- FLUSH PANEL sockets complete 4 for 5d.
- EBONITE BUSHES 1d.
- dozen 10d.
- C.W. BATTERY LINKS 2 for 1 1/2d.
- "LEDION" sets of 5 COILS 1/8 and 2/3
- GEARED 2-WAY COIL STAND 5/3
- CAM VERNIER ditto 4/6
- CLIMAX U.P. VALVE HOLDERS 1/3
- RHEOSTAT for D.E. or R. VALVES 2/2
- 2-WAY COIL STAND, ex handles 1/11
- Ditto mickel fittings 2/9
- Half opal and ebonite enclosed DETECTOR, worth 2/-. My price 1/-
- TAPPED COILS for CHELMSFORD 1/6
- Valve for Broadcasting 1/-
- GRID LEAK CLIPS, pr. 1d.
- Valves: PHILLIPS "R" type 6/11
- Valves: FRENCH METAL "R" type 6/6
- Valves: DUTCH (good) 11/-
- Valves: DUTCH DETECTORS 4/3 and 4/9
- Valves: DUTCH "R" TYPE 4/11
- Valves: FRENCH METAL '06 12/11
- Valves: RADIO MICRO '06 12/11
- VARIOMETERS. Finest Value in London. 1/6, 2/3. JUST TRY THEM.
- WEDGE-SHAPE COIL PLUGS Extra value. 7d. and 8d.
- EDISON BELL ditto 11d.
- Fine little RHEOSTAT, 1 H.F. 1/-
- H.F. TRANSFORMERS, B.B.C. 2/6
- Red and Black TWIN FLEX 6 yds. 10d.

This is the shop for BARGAINS See the name RAYMOND.

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- Terminals complete—
- Brass Pillar 1d. 1 1/2d.
- W.O. or 'Phone 1d. 1 1/2d.
- Fancy Patterns 1d. 1 1/2d.
- Extra Large 2d. 3d.
- Valve Sockets 2 for 1 1/2d.
- Machine Cut Screws Stocked (Best).
- Pulleys 4 1/2d.
- 4 Taps and Wrench 2/11
- Screwdrivers 6d.
- D.C.C. Wire, per lb.—
- 13 g. 9d. 20 g. 9d.
- 22 g. 10d. 24 g. 1/-
- 26 g. 1/1 28 g. 1/3
- 30 g. 1/6 Etc., etc.

H.T. BATTERIES

- 60 v. with spokes 7/6
- 30 v. 4/6
- 60 B.B.C. 8/11
- 30 B.B.C. 5/6
- 9 v. B.B.C. 2/6
- 1.5 (D.E.) 1/9
- Ditto 2/- to 3/-

D.P.D.T. SWITCHES.

- Min Panel 1/-
- On China Base 1/4
- On Ebonite Base 1/11, 2/6
- S.P.D.T. SWITCHES. Miniature Panel 10 1/2d.
- On China Base 11d.
- On Ebonite 1/3 to 1/9
- Murray Valve Holder 1/3
- Spring Washers 4 a 1d.
- Coil Plug on Base 10d.

- De Luxe Crystal Set 7/11
- 4 Whiskers, 1 Gold 2d.
- Coil Plugs (ebonite) 6d.
- Ditto 9d.
- Shaped 8 1/2d., 1/-
- 5 ohm Rheostat 1/-
- Various 1/3, 1/6, 1/9, 1/11
- With Dial 1/11
- Ormond 1/9
- 'Phone Connector 1d.
- Nuts 2, 4, 6 B.A. doz. 2d.
- Washers 12/- 1d.

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- 7 x 5 9 x 4 12 x 9
- 8 x 6 10 x 8 12 x 12

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- EBONITE 6 x 6 .. 1/4
- 7 x 5 .. 1/4
- 8 x 6 .. 1/10

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- 10 x 8 .. 3/-
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- 12 x 9 .. 4/3
- 12 x 12 5/6
- 14 x 10 5/6

3/16 in.

- WE STOCK Cut to size 1-in. 1d. sq. in. EBONITE.

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Technical queries are answered by the Editor at a charge of 6d. a query and 1/- per full wiring diagram. All queries must be addressed to the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, E.C. 4, and must be accompanied by a stamped and addressed envelope. Copies of the

queries sent should be kept, as the original questions cannot be reproduced in the answer. Cash should be sent in the form of postal orders.

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.



J. H. T. (Westminster).—In the description of "A Reflex Circuit with Switching," which appeared in Correspondence of "P.W." No. 137

(January 10th), the coil which is coupled to the aerial has a '0002 variable condenser beside it. The two are connected at the top, but not at the bottom, although apparently they should have been joined there also. Is it right to connect both top and bottom so that the coil is connected across the condenser, and then both connections are taken out to the switch?

Yes. The lower connection of the '0002 variable condenser should be "wires joining" instead of wires crossing, as shown by the diagram.

"NEXT-DOOR'S AERIAL" (Staffordshire).—During the recent bad weather, my neighbour's aerial blew down several times, and it has broken my aerial in three or four places. He refuses to pay for the damage done, although I only asked him to replace the broken aerial wire by a new length. Can I compel him to compensate me for the damage?

It is not possible to express an opinion on the merits of this dispute unless one is advised as to the fixing of the aerial. It may be said, however, that if your neighbour's aerial is so fixed that if it does come down it must necessarily damage your aerial, then the neighbour is responsible for the damage done. In any case, the amount involved is so small that you would be strongly advised not to consider legal proceedings. The trouble and expense incurred would be greater than the trouble and expense at present suffered.

"TWO-VALVE UNIDYNE" (Preston).—As I am quite a novice at wiring up, I find great difficulty in following the connections for the detector and L.F. Unidyne circuit. The diagrams and photographs in "P.W." Nos. 105 and 106 show the connections for 4-pin valves, with an extra terminal for the extra grid; but I have purchased the set of parts advertised in "P.W.", and I wish to use 5-pin valves. Can you publish a diagram showing the wiring from point to point?

(Continued on page 1334.)

AVOID DISTORTION—
insist on having
"TANGENT" FITMENTS—

Selectivity and sharp tuning depends on your tuning coils; efficiency and clearness on your components

"TANGENT" TUNING COILS
Covering wave-lengths from 250 to 9,500

"TANGENT" LOUD SPEAKERS
"Concert" Model, "Tangent" Tall Boy, and Baby "Tangent"

"TANGENT" L.F. TRANSFORMERS
Large and Small

"TANGENT" "DISCOL" H.F. TRANSFORMERS
All wave-lengths from 80 to 4,000

Obtainable from all good dealers,
but in case of difficulty—write us.

GENT & CO., Ltd.
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"FARADAY WORKS," LEICESTER.
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FOR
WHERE THERE'S A WILL THERE'S A DAY.

T'ANDCO BASKET COILS (100 to 4,500 metres.)
Duplex wound, 25 gauge D.C.C. wire, sewn supports unwaxed, very firm and strong, recognised as the finest type Coils yet made. Enamelled.

Size	Approximately	150 to	300 metres	5d. each.	No. 1.	4d. each
2. 2 1/2 in.	250 to	400	"	6d.	"	2. 5d.
3. 2 1/2 in.	350 to	550	"	7d.	"	3. 6d.
4. 3 in.	450 to	650	"	8 1/2 d.	"	4. 7d.
5. 3 1/2 in.	600 to	750	"	10d.	"	5. 8d.
6. 4 in.	700 to	1,000	"	1/2 "	"	6. 9d.
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COIL HOLDERS. 1/6 each

10. 1/4 "
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IF YOU WOULD SECURE IMMUNITY FROM LEAKS IN YOUR SET HAVE YOUR PANELS CUT TO YOUR SIZE FROM OUR FAMOUS EBONITE, ORDINARY FINISH, 4/6 PER LB. MATT FINISH, 5/- PER LB. AMERICA EASY ON ONE VALVE.

MAKE NO MISTAKE IN YOUR SELECTION. Do not keep wasting money on crystals of unknown repute.
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Sold only boxed with Silver Cat's-whisker, 2s. 6d. each, postage 3d. extra. Makes excellent contact with Zincite for a Perikon Detector.

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AGENTS WANTED IN ALL BROADCAST AREAS.

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 1332.)

The accompanying sketch, which is partly pictorial, shows how the different components should be connected. The upper portion of the diagram (with shaded edges) represents the back of the panel, and needs no explanation except that the grid leak

above a road, and I am now informed by the local authorities that I must either take the aerial down, or undertake to pay 10/- a year, and 10/- for a stamp for the agreement. Now the houses on both sides of the road belong to me, and when they were built I paid for the road to be made up.

Am I bound to take down my aerial in such circumstances, or failing this pay the money demanded?

The authorities can compel you to pay a nominal charge for the aerial. The roadway does not belong to you—if you have paid the local authorities for making up the road, that fact indicates that the road has been taken over.

J. W. (no address given).—Would you please publish in next week's "P.W." directions for making a low-frequency transformer, and list of the articles needed?

As a general rule we do not advise home constructors to attempt to make an L.F. transformer. The purchased article is no dearer, and is generally far more efficient when constructed under workshop conditions than it can ever be when home-made.

We have, however, occasionally published details of transformers made by contributors to "P.W." for use with a specific set.

These are not generally suitable for all-round use, and as you do not say what ratio, etc., is required we cannot recommend any such instrument for your purpose.

C. C. L. (Hartlepool).—On page 1183 of "P.W." of Jan. 17th, a wiring diagram of the "Four Circuit" two-valve set is given, but it is not very clear to me. I should be glad if you

will explain the use of the terminals, etc. Looking at the diagram referred to (Fig. 7), the terminals correspond with the layout in Fig. 5, page 1182. Commencing at the top left-hand corner and going downwards the terminals are as follows: 2 for primary coil, 2 for secondary, 2 for reaction, the lower of which goes to centre of S.P.D.T. switch. At the bottom we have the one end of switch, phones, H.T. + and -, and L.T. + and -. The two on the right-hand side are for the amplifier coil plug and the two on the top are aerial, and earth, the latter on the left. The grid condenser is wrongly placed, however, and should be across the two grid lead points shown connected to top terminal of secondary and to grid of valve. The condenser is shown being removed of course. There is also one point we should mention, and that is that the left-hand side of the S.P.D.T. switch on the extreme right of Fig. 6 should be connected to the top of phones, and not left unconnected as shown.

B. S. G. (Weymouth).—Being a new reader, I have not seen the early copies of "P.W." giving details of the "Unidyne" two-valve set and should be obliged if you will let me have a list of components.

The actual components used in the set described in "P.W." were as follows, but there is no reason why other makes than those stated should not be used if the apparatus is really efficient:

- Ebonite panel about 10" x 7" x 1/4"
- 2 Microstat rheostats (any good resistance giving fairly fine control will do).
- 2 Variable grid leaks.
- 2 valve holders to fit the type of valves used.
- 2 valves of the four-electrode type (Thorpe K4 are O.K.).
- 1 Vernier control to coil holder.
- 1 L.F. transformer (R.I.) or other good 5-1 ratio type.
- 1 cabinet to fit panel.
- 6 terminals.
- 1 S.P.D.T. switch.
- 1 .0005 Variable condenser, with vernier for preference.
- 1 fixed .001 mfd. condenser.
- 1 fixed .0002 mfd. condenser.
- About 16 ft. tinned copper wire (18-gauge square section is best).
- Sundry screws, etc.

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natural reproduction
which characterises so
many Loud Speakers is
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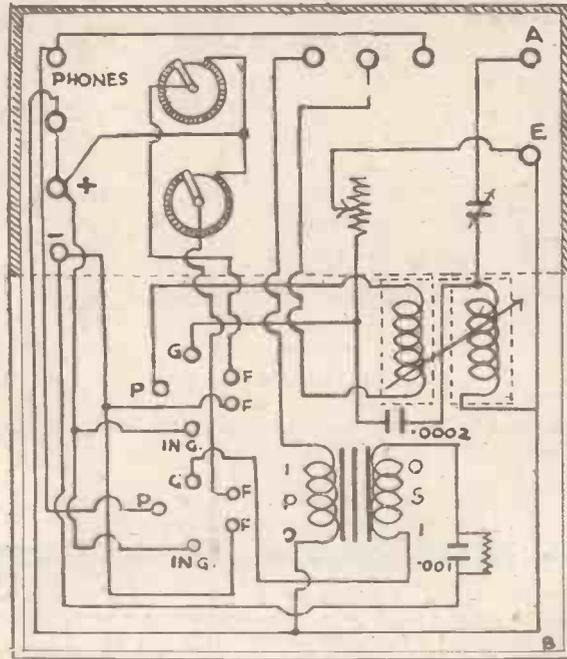
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2000 ohms £5 : 8 : 0
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is shown symbolically below the centre stud of the switch, with the variable condenser on its right.

Below the dotted line are the two valve positions, with the sockets marked as seen when looking down at the baseboard. The transformer connections are marked, but on both sides the leads should be tried in the reverse position until the best results are obtained. The leak across the .001 should be varied carefully, as explained in "P.W." No. 117, and for close coupling between the coils it is essential to use the types recommended, and not any plug-in coil that happens to be on hand.

NOTE.—This query has been reproduced from a previous issue at the request of a number of our readers.

"LICENSED LISTENER."—For the past twelve months my aerial has been erected

The "P.W." Technical Queries Department.

REVISION OF RULES.

Owing to the extraordinary growth of the POPULAR WIRELESS Queries Department, the Editor is compelled to revise the regulations governing the answering of readers' queries, and the following new arrangement now comes into force:—

- (1) A charge of 6d. is made for every query sent to the POPULAR WIRELESS Queries Department. The "three for a shilling" regulation is cancelled.
- (2) A charge of 1/- is made for supplying full wiring diagrams.
- (3) All queries, together with postal orders and stamped and addressed envelope, to be addressed to—
**TECHNICAL QUERIES EDITOR,
POPULAR WIRELESS,
The Fleetway House, Farringdon Street,
London, E.C.4.**
- (4) Technical queries will not be answered by telephone.

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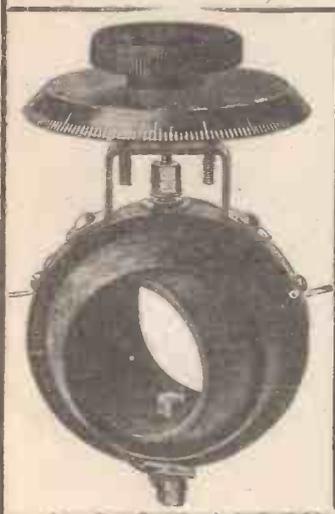
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This is an entirely new departure in valve design. The unique construction of the electrodes enables the distance between them to be greatly reduced, so that Electrons only traverse a very SHORT PATH. This gives:—

Greater Amplification. Exceptionally good rectification. Greater output without distortion.
EXCELLENT FOR 'LAST STAGE' AMPLIFICATION

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SKELETON
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160 pages (28 diagrams) 1/3 post free.
Satisfaction Guaranteed or Money Returned.
SAXON RADIO Co. (Dept. 14) South Shore, Blackpool.

Correspondence

RESULTS WITH THE ULTRA-AUDION.

The Editor, **POPULAR WIRELESS.**
Dear Sir,—Having been a reader of your valuable paper from its first number, I feel compelled to write you on the success that I have gained from advice given.

First, I constructed a crystal set, variometer tuned, with which I logged all B.B.C. stations, the nearest main station being Manchester, 20 miles, not a bad record, you'll agree. Now, I have an ultra-audion one-valve set, using a soft Dutch valve, with this I have logged in all 29 stations, B.B.C. and continental, below 600 metres; over this length 5 X X and a few more come in well.

Hoping this will be of some use to readers who have not constructed sets, and are doubtful of results got from simple supers described in your journal.

Wishing you all the success you deserve,
Yours faithfully,
CYRIL OWEN.

Tower Buildings, Bangor Road, Conway, N. Wales.

INVITATION TO AMATEUR TRANSMITTERS.

The Editor, **POPULAR WIRELESS.**
Dear Sir,—I have received a letter from a French amateur at Caen, who is anxious to exchange telephony with an amateur here.

If any reader is anxious to do this, I shall be only too pleased to give details of wave-length and proposed workings.

Yours faithfully,
H. W. SKOW.
135, Gleneldon Road, Streatham, S.W. 10.

ANOTHER OVERWHELMED CORRESPONDENT.

The Editor, **POPULAR WIRELESS.**

Dear Sir,—Allow me to thank you for inserting my letter re wireless periodicals for disposal in "P.W." I have been overwhelmed with replies from all parts, including applications from Belgium and France, and having received upwards of 170 replies the task of attending to same has been considerable. In fact, not having found it possible to acknowledge each one individually in cases where postcards or no postage was sent might I beg a little more of your valuable space to thank all who have written and to inform them that I have endeavoured to divide the papers as fairly as possible, taking applications in rotation.

I consider that the replies received from so many centres are a striking testimonial to the remarkable circulation of **POPULAR WIRELESS.**

Again thanking you.
Yours faithfully,
J. L. FULFORD.

91, Richmond Wood Road,
Bournemouth.

THE "PICKARD" REFLEX SET.

The Editor, **POPULAR WIRELESS.**
Dear Sir,—Please allow me, through the medium of your columns, to congratulate Mr. M. C. Pickard for devising the fine reflex circuit published in your issue of September 27th last. I have constructed a set from his specification, with the exception of the A.E. tun. condenser, which I wired series instead of parallel. I may say at once that it is all he claims it to be, and I consider is a big improvement on the orthodox reflex circuit.

Here, in Leicester, the nearest B.B.C. station 4s at Nottingham, and that is a relay—26 miles. Then comes Birmingham with 38 miles. These two stations I receive at medium strength on a loud speaker with my aerial under the roof.

Several other stations, including 2 L O, 2 Z Y, and 6 B M, come in with great strength in telephones. On one occasion I tuned in a German station which was quite audible in a moderate-sized room on the loud speaker, and as a tribute to its range I may say that at 4 a.m. on Sunday last I succeeded in picking up W G Y, which was transmitting dance music, very enjoyable on the 'phones.

This is the first transatlantic station I have ever heard direct, and consider it speaks very well indeed for a circuit which is economical, stable, and easy to handle.

In case any other enthusiast should find them useful I append the following details:

Valve—Ediswan A.R.D.E.
Crystal—Tungstaltite (old type red label, intend experimenting).

Transformer—Nameless, cost 13/0.
'Phones—Foth.
Coils—Basket (home made).
R.F. choke—Basket (home made).
Fil. volts—1.8—2.0.

Anode volts—100 (twice makers' specification).
Re latter detail. The American was received with only 50 volts H.T., but for loud speaker the increase works wonders.

Other stations which come in well on 'phones are Radio Paris, School of Posts, and Brussels.

My lowest wave-length received to date is 2 T N, of Polesworth, on a wave of 118 m.
Possibly with a bright emitter valve this circuit would be still more efficient.

In conclusion, may I thank you and Mr. Pickard for the many enjoyable hours I have spent since erecting this receiver, especially during Christmas-time.

I am, sir,
Yours faithfully,
LIONEL P. MORLEY.
19, Sherrard Road, Leicester.

THE "CHITOS" CIRCUIT.

The Editor, **POPULAR WIRELESS.**
Dear Sir,—I should like to add yet another tribute to Mr. Chitos for the novel circuit he devised, and which was published in **POPULAR WIRELESS**, August 16th.

London at 4 miles comes in at splendid strength, it sometimes being necessary to detune in order to hear comfortably. The tunes of the Savoy Band can be followed when someone else is wearing the 'phones.

The one great drawback is hand capacity, just removing the hand from the condenser after tuning is sufficient to send the set into oscillation. As yet I have been unable to tune in any other station (except Croydton), so if Mr. Chitos has received any other stations I would be greatly obliged if he would state the coils used through the columns of this paper.

I am sure other amateurs would welcome the knowledge. Wishing "P.W." every success.

Yours faithfully,
A. GIBBENS, Regular Reader.
10, Southolm Street, Battersea, S.W.11.

CRYSTAL "D X" RECEPTION.

The Editor, **POPULAR WIRELESS.**
Dear Sir,—Being interested in this subject, I have recently carried out tests with my crystal set, and have been astonished at the results obtained.

I can tune in (at about R 2 or R 3 sigs.) 6 B M and 5 I T at almost any time when 2 L O is not working, and have also on occasion logged 5 N O and 2 Z Y. Chelmsford I can receive quite clearly; even when 2 L O is transmitting, and sometimes am able to tune out 2 L O entirely in favour of 5 X X.

I am situated at three miles from 2 L O, and my set is condenser tuned, with A.T.I. and vario-coupling. I use a really good "Mars" aerial, Valpo crystal, and double earth system (one direct to ground and one to water-pipe).

Wishing your paper every success,
Yours faithfully,

CHARLES P. PARSONS.
P.S.—Incidentally, I may mention that I have tried many of the proprietary crystals on the market. A few were utterly hopeless, and several gave indifferent results. The three best (for my set, at any rate) are undoubtedly Valpo, Britezite, and Geocites. 23, Queen's Gardens, W.2.

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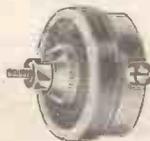
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5/-



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Will enable you to Work a loud speaker off a crystal set. Magnify the sound of your gramophone up to 200 times. Fit up an efficient house telephone. Transmit piano, violin or gramophone music anywhere. Magnify sounds otherwise inaudible, etc. etc.

Everyone interested in sound transmission should write to-day for the "Marvels of the Microphone." Price 6d. Post free. (Send postal order—not stamps.)

MIKRO Ltd., 32c, Craven St., Charing Cross, W.C.2

THREE-VALVE REFLEX RECEIVER.

(Continued from page 1293.)

obtained from the grid bias battery, of which the negative terminal is connected with the I.S. terminal of the transformer T2.

The variation of the grid potential of valve V3 causes a fluctuation in the high-tension current which passes through the 'phones, causing the production of the signals, on its way to the plate of the valve V3, where it flows via the electron stream to the filament, thus completing the circuit to the negative terminal of the high-tension battery.

Testing Components.

Reaction effects are obtained by coupling the tuned anode coil T.A.I.2 to the aerial tuning inductance A.T.I., by the use of the two-coil holder carrying the respective coils.

For the convenience of the operator, a main switch is provided, this being shown diagrammatically as breaking the low-tension positive lead, thus switching off all the valves.

Though every care is taken by the manufacturers of first-class components, the amateur constructor is well advised to apply a few simple tests to the parts he buys before building them into a set, otherwise great confusion may result.

For example, though the vanes of a variable condenser may appear to clear each other, it is possible that annoying short circuits may exist. A simple rough and ready test for determining the efficiency of the condenser consists in connecting a wire from one side of a 100-volt battery to one of the condenser terminals and flashing the wire from the opposite pole of the battery to the other terminal of the condenser, the vanes being rotated at the same time. Should any spark occur during the test, the condenser will be at fault and should be changed for another immediately.

Perfect contact between the moving contact and the winding of the filament resistances is most essential, as well as the mechanical perfection of these components.

Transformers must be taken on trust to a large extent, but provided high-class components are purchased there need be little anxiety on this score.

Faulty Coil Holders.

To test the fixed condensers, a current of 20 volts is used to charge up the plates, by connecting the battery momentarily with the terminals. Then the plates are allowed to discharge through a pair of 'phones, and if all is in order a click will be heard at the moment of discharge.

In selecting coil holders care is needed to see that the coils will fit without straining the legs and that perfect contact exists between the moving member and the terminals of the two-way coil holder.

Another useful hint is that of ensuring that the knobs and dials of all control components rotate truly when mounted on their respective spindles, for nothing so mars the appearance of a well-built set as "wobbly" knobs and dials.

Fig. 2 gives full dimensions of the front panel, which is preferably of matt finish, the ebonite manufactured by The British

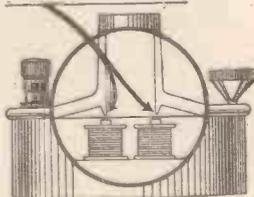
(Continued on page 1338.)



Voiced like
an Organ

The Secret of the
Tone of an Organ

The Secret of the Tone
of the RADIOSUN



The whole basis of music is one of vibrations and harmonics, but the feature that makes or mars perfect music is the way in which the harmonics are produced from the vibrations. Given a *solid magnet structure* and a *correctly proportioned diaphragm* you can take it that your vibrations will be really good, but the resulting harmonics depend entirely upon the way you use those vibrations.

The great art of the organ craftsmen lay in their master knowledge of harmonics, and the secret of their greatest achievement was the voicing of the pipes.

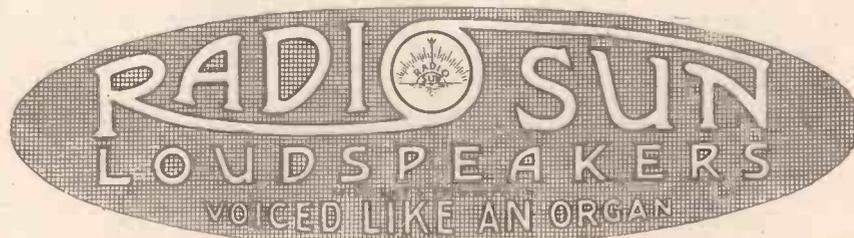
THE RADIOSUN LOUD SPEAKER

is the only loud speaker with the mouth of the sound chamber *voiced like an organ*. You can guess the immense difference this makes. Every intonation is reproduced from the vibrations of the diaphragm in perfect form, giving real music throughout the range of wireless broadcasting.

The Radiosun Loud Speaker was designed by an organist and engineer, that is why it can give *you* the purest music. Remember, it is voiced like an organ, and it is the only loud speaker with this supreme feature of design. The entire magnet system is unique. Look out for further particulars of this wonderful loud speaker in our advertising.

Write for booklet explaining the wonderful difference free on application.

PRICE :
£5 - 0 - 0



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INCREASE YOUR SIGNAL STRENGTH ON YOUR CRYSTAL SET

It doesn't matter how many 'phones you are using, they will ALL be as strong as if they were in use alone if they are fitted

WITH "EXTRAPHONES."

"Extraphones" are wonder-attachments which fit any 'phone without alteration. 'Phones of any resistance may be used with the same effect.

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Concert tested. Post free. 24 hours' approval.
Insurance against all postal damage. Valve must be returned within 24 hours of receipt. 9d. per 7/6 or 12/6 valve; 1/- per 17/6 or 25/- valve.

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We Stock Everything and All Goods Are Post FREE.

TECHNICAL NOTES.

(Continued from page 1304.)

upon the element at various distances apart until the proper value for the leak is obtained. Should this grid-leak be required frequently for general experimental purposes, it may be mounted up by securing the resistance element between two small wooden supports on a baseboard, and arranging a slider (after the fashion of a slider-coil) so as to make the necessary adjustment of resistance valve.

Filament Control.

Although the filament rheostat is a comparatively simple affair in its theory, it offers a good deal of scope for more efficient design. This was impressed upon me recently during some tests with a five-valve set, where the rheostats were designed (and made) by the owner of the set.

At first they struck me as being very clever, inasmuch as they permitted of a rapid adjustment to approximately the correct value, followed by a vernier adjustment for the final setting. I forgot to say that the valves were mixed, some of them being rated for about 1·8 volts, whilst a 6-volt accumulator was used throughout.

(Continued on page 1339.)

THREE-VALVE REFLEX RECEIVER.

(Continued from page 1337.)

account of its excellent finish and high insulating qualities. The use of inferior material, especially with circuits of this description, is liable to lead to disappointing results.

The most convenient method of locating the various holes for drilling the panel is that of making a full-sized drawing on a piece of stiff paper, marking the position of all the holes, then laying the paper on the panel and pricking off the centres of the holes with a sharp-pointed scriber. In Fig. 2 the actual sizes of the holes are determined by the dimensions of the component spindles and are shown on the diagram. In drilling all holes through the ebonite, clean results will be secured by moistening the drill with turpentine, using high speed and light pressure on the drill.

Baseboard Layout.

The ebonite panel carries the components used for controlling—i.e. the variable condensers, rheostats, switches, coil control knob, aerial, 'phone, and earth terminals.

Fig. 3 shows the general lay-out of the instrument base, which is made of a piece of hard wood about 1/8 in. in thickness, planed smooth on both surfaces. The first stage of assembling the components on this board consists in making the bases for the three valves, details of which can be seen in one of the photographs. The bases are attached to the board by four 2 B.A. studs, so that the platform is 2 3/4 in. above the board, thus rendering the valves extremely accessible as well as ensuring adequate insulation.

The terminal strip, measuring 9 in. by 2 in. by 1/4 in., is provided with nine equally spaced terminals, and before this is screwed to the base a length of 18 in. of 18 S.W.G. tinned copper wire is attached to each terminal.

(To be concluded next week.)

Charge Your ACCUMULATOR

at Home with the **TUNGAR BATTERY CHARGER.** Simple, Safe, and Economical. No moving parts. Requires no attention. No Garage, Owner-Driver or Wireless Enthusiast should be without one. Will charge from 1 to 10, 6-12 volt batteries at a time. Deliveries from stock. Descriptive Booklet free on application. The Tungar Battery Charger is suitable for use on Alternating Currents supply only.

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ALL MAKES OF 'PHONES REWOUND. 4,000 ohms, 5/- per pair; 8,000 ohms, 1/6 extra. Remagnetising and adjusting, 2/-; postage, 6d. Transformers rewound any ratio, from 5/- The H.R.P., 46, St. Mary's Road, Leyton, E.10.

EBONITE BUSHES

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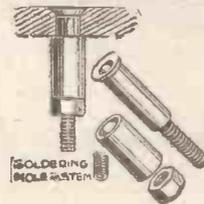
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'Phone 428

TECHNICAL NOTES.

(Continued from page 1338.)

I found that when these rheostats were adjusted for the proper brightness of the filaments, the slightest shake of the set was liable to cause a considerable change in the resistance, and in the circumstances described, it will be seen that the danger of burning out a filament was pretty serious.

With care, it was possible to avoid any damage, but in the hands of a beginner I feel sure that burn-outs would have resulted with these rheostats. It is therefore very desirable to give the same attention to the choice of good rheostats—particularly with low-voltage dull-emitter valves—as to the choice of other components of the set. A good rheostat only costs two or three shillings whereas a dull-emitter valve may cost anything from twenty to thirty shillings.

Valve Sockets.

I do not know whether everybody's experience is the same as mine, but I frequently find that the standardisation of valve pins and valve sockets is anything but satisfactory. In some cases very considerable force has to be applied to get a valve properly inserted into a valve-holder and afterwards the valve-pins will be found to be considerably mutilated.

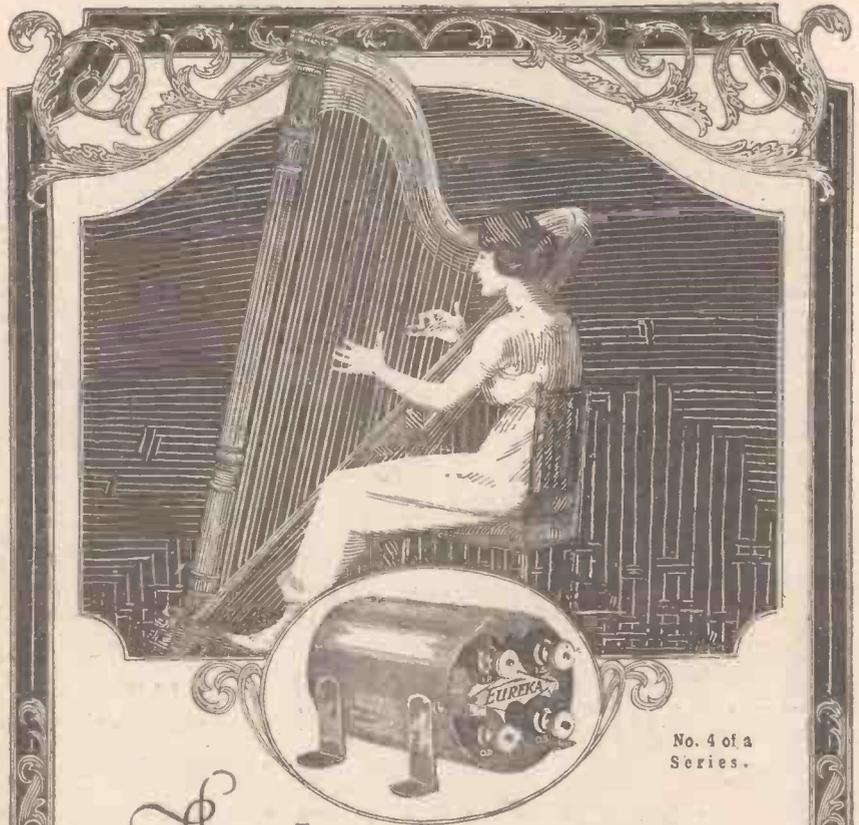
This state of affairs should not be so. It ought to be a comparatively simple matter to standardise the positions of pins and sockets particularly having regard to the fact that considerable tolerance is available in the springy prongs of the pins. In some valve-holders this difficulty is partly overcome by making the sockets either flexible or slightly loose, so that they are able to adjust themselves to the pins when a valve is inserted.

As regards the flexible socket-tubes, a friend of mine informed me the other day that he had made application for a patent for a valve-holder in which the metal socket-tubes were embedded in fairly soft rubber instead of in vulcanite or other unyielding composition.

Aerial Wire.

It is surprising what a difference there is in different types of aerial wire. I have at different times tried most of the usual types of aerial wire, including of course the conventional 7/22's, and all kinds of single wires. Under some circumstances, as, for example, when using a multivalve set, where the energy of the incoming oscillations is not of great importance, one is apt to think that more or less any aerial wire will serve the purpose. But in the absence of any H.F. amplification, where the efficiency of the aerial becomes more important, surprising differences will be noticed when using different wires. Although I make it a rule to avoid as far as possible naming particular proprietary components, I must say that I have found the "Mars" aerial wire really most efficient. During some preliminary tests with a valve set having no H.F. amplification, quite loud signals were obtained with an indoor aerial of this wire, about 6 ft. long. That the aerial was really serving a definite purpose in this experiment was proved by substituting a

(Continued on page 1340.)



No. 4 of a Series.

The Living Artiste

JUST as the balance wheel is to the watch so is the L.F. Transformer to the Receiving Set.

Without the proper functioning of the one, even the finest gold watch is utterly useless. And without a Transformer capable of an equal amplification over all the usual frequencies, even a super-Receiver and the most expensive Loud Speaker are little more than ornaments.

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The Eureka Concert Grand is a laboratory production. Its 2½ miles of wire are wound with scientific precision and its turn ratio is calculated to a nicety. Its design is not based on academic theory but on the results of many hundreds of pounds' worth of actual research work.

A non-laminated core—a coppered steel case—an extremely generous primary winding—these are some of the factors that have caused the Eureka to be considered Britain's Transformer-de-Luxe.

The Transformer which enables the Loud Speaker to re-create the living Artiste.

Concert Grand 30/- Portable Utilities Co., Ltd., Eureka No. 2. 22/6
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Supreme **EUREKA** for Tone

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2-CIRCUIT
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PRICE

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Variable Anode Resistances and Grid Leaks of new design—many other strikingly new lines. List quite free on request.

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The Renowned H.T. Battery for Wireless.

The "ELKA."

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CHAMBER DESK TOP CONDENSER LIDDED

Send for Constructor's List (P.W.) FREE.

TECHNICAL NOTES.

(Continued from page 1339.)

piece of 7/22 aerial wire of the same length in its place, when the signals became barely audible.

Molybdenite as a Detector.

Probably the most commonly used crystals, apart from the many proprietary varieties, are galena and the perikon combination. Galena is a natural sulphide of lead, whilst the perikon couple is generally understood to refer to zincite (zinc oxide) and bornite or copper pyrites (sulphides of copper and iron). Another crystal which, however, is very useful, but which is not employed to anything like the extent it deserves, is molybdenite, which is a sulphide of molybdenum. This is a very soft, cleavable mineral, the efficiency of which as a detector is not impaired by splitting. Most pieces of molybdenite will give very good results and it has the further advantage that it is sensitive practically all over its surface. As a cat-whisker for molybdenite, a strip of silver or aluminium may be used and it will be found that such a contact is not easily displaced. In other words, a molybdenite detector is one which has much to recommend it in the way of stability and reliability.

Lightning Arresters.

In spite of the fact that perhaps fifty per cent. of articles describing the making of different wireless sets emphasise the importance of the earth switch or lightning arrester, and that the same advice is given in the literature accompanying most bought sets, many owners of sets neglect to instal this important component. It is commonly considered that lightning is more likely to occur in summer than in winter, but in view of the extremely uncertain character of the weather in this country, and also of the fact that an outdoor aerial is an excellent collector of atmospheric electricity, it is desirable to have a switch by means of which the aerial may be connected to earth.

Quite Easily Made.

Moreover, lightning arresters are very cheap and easily fitted, and, in the absence of a bought component, one can very readily be made by the most inexperienced amateur. It is preferable to mount the arrester indoors, so as to protect it from moisture, otherwise it may develop a certain amount of electrical leakage, and detract from the efficiency of the aerial.

CUTTING'S (Hedges' Patent) WIRELESS TUBULAR EARTH

removes all lightning risks, inconveniences and disturbances, and improves your reception. No bolts or clamps to break continuity. Absolutely permanent conductivity.

Note the copper point (with 18' of earth wire attached); special carbon filling; sealed cap; self-watering device and ease of fitting—merely driven in ground. Certified by "Popular Wireless" as of solid construction, ingenious in design and technically sound. Obtainable direct from the Licensed Manufacturers:

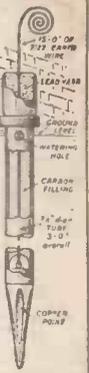
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ACCUMULATORS. Best quality. Guaranteed.

	3 M'thly		3 M'thly	
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4v-40	17/-	6/3	6v-40	25/-
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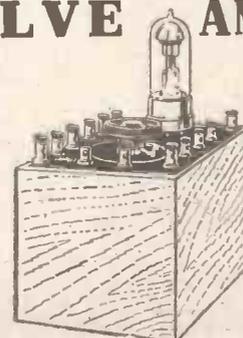
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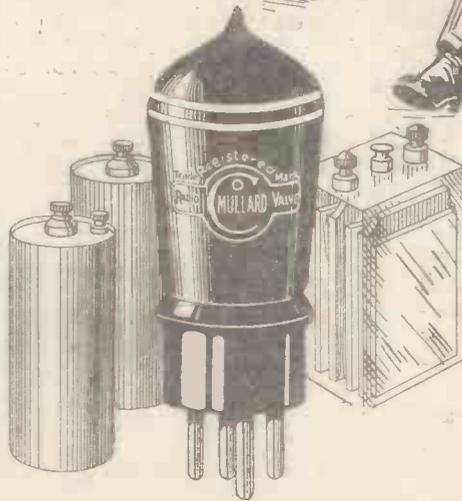
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LISSESTAT MINOR (patents pending)—is replacing thousands of discarded and inefficient rheostats. Provides LISSESTAT control at a popular price. LISSESTAT ONE-HOLE FIXING, OF COURSE

3/6



LISSESTAT MAJOR (patents pending)—gives the most acute tuning possible. LISSESTAT ONE-HOLE FIXING

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Receivers fitted with Lissenstat Control are equipped for the finest detection possible.

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Every different condition of reception may call for a different leak value—you can get it with the LISSEN Variable Grid Leak (patents pending). Distant stations—near-by transmissions—strong signals or weak—reaction or not—hard valves or soft—straight circuit or reflex—if you are using the LISSEN Variable Grid Leak you are certain of getting the utmost sensitivity out of your tuning. Every range of resistance value required of a leak is covered, with minute variation throughout. LISSEN ONE-HOLE FIXING, OF COURSE



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