MODERN WIRELESS

September.

RADIO PRESS

1/-

Vol. 1. No. 8. Edited by JOHN SCOTT-TAGGART, F.Inst.P., Member I.R.E. September, 1923.

No. 8

How to Change from Crystal to Valve. *By John Scott-Taggart, F.Inst.P.*

How to Make a Simple and Efficient Three-Valve Set. *By Percy W. Harris.*

How to Make Two Crystal Sets.

How to Make a Two-Valve Super-Set.

Letters to a Beginner.

How to Make a Two-Valve Note-Magnifier.

FREE WITH THIS ISSUE—A 16-PAGE WIRELESS MAGAZINE FOR BOYS.

Wireless Faults.—Circuits for Crystal and Valve Reception.—Crystal Notes.

Western Electric

Assembly No. 4.

This Western Electric Loud-speaking Assembly consisting of :—

Western Electric High-frequency Detector and Tuner
Western Electric Two-stage Amplifier
Western Electric Small Pattern (No. 44003) Loud-speaking Receiver

is recommended for use where the Broadcasting Station is some considerable distance away. If the incoming signals are not of sufficient strength to give satisfactory results in an ordinary Valve detector it is therefore necessary to use one or two stages of High-frequency Amplification.

This Western Electric Set is arranged for two stages of High-frequency Amplification, and with the detector it forms a Three-valve Set.

An inductance with a tuning condenser is provided to cover the broadcast wave-length.

The Western Electric Low-frequency Amplifier contained in a polished mahogany box is designed and constructed on the most simple lines, and is fitted with a switching key which enables either one or two valves to be used as required without change of connection. The key in its central position disconnects both valves.

The Western Electric Small Pattern (No. 44003) Loud-speaking Receiver will enable several listeners to enjoy the Broadcast Programme without the inconvenience of wearing head-receivers.

The whole assembly is neat and compact and gives the most satisfactory results.

Western Electric

MAKERS OF OVER HALF THE WORLD'S TELEPHONES.

WHOLESALE ONLY

CONNAUGHT HOUSE, ALDWYCH, LONDON, W.C.

Telephone : Central 7345 (9 lines).

BRANCHES : BIRMINGHAM, LEEDS, CARDIFF, MANCHESTER, NEWCASTLE, GLASGOW, SOUTHAMPTON.

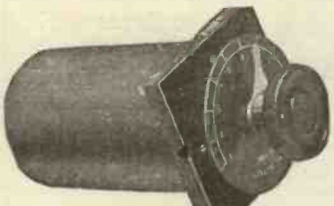
BUILD!
—with LISSEN master parts

Your New Station—Build it with LISSEN master parts throughout.
Your Radio Frequency Amplification—Certainly LISSEN master parts.
Your Tuning—LISSEN master parts.
Your Audio Frequency Amplification—LISSEN master parts here.
Your Filament Control—A LISSEN master part, too.
Your Variable Grid Leak—Also a LISSEN master part.
Your Fixed Condensers—All LISSEN master parts.

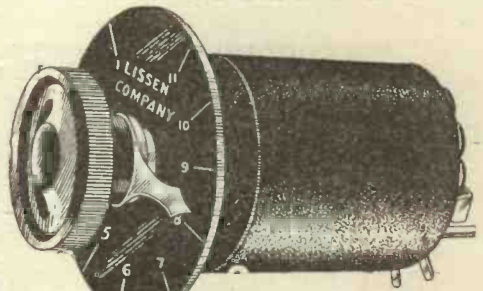
LISSEN MASTER PARTS—ALL BEHIND YOUR PANEL!
For any circuit you choose.

Whether you are building your new station, re-making your old one, or adding to your existing receiver, there is a

LISSEN MASTER PART for your every need.



1.



2.

1. The unequalled first stage of Radio Frequency—**LISSEN REGENERATIVE REACTANCE**—strikingly sensitive, selects with accuracy .. **52/6**

2. For 2nd (and/or 1st stage) Radio Frequency—**LISSEN REACTANCE**—for still greater range and power **32/6**

3.

4.

3. **LISSEN TUNER**—tunes high, tunes low, tunes sharply **22/6**

4. **LISSEN MICA VARIABLE CONDENSER**—low resistance-signal strength is always great —.001, .00025 and .0005 .. .. .. **17/6**

5. **LISSEN VERNIER**—for fine tuning in H.F. circuits **12/6**

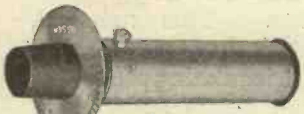
6. **LISSEN T1 TRANSFORMER**—for immediately behind the detector valve—an incomparable transformer .. **30/-**

7. **LISSEN T2** — for 2nd and 3rd stages L.F. .. **25/-**

8. **LISSEN T3**—the popular transformer—actually compares in performance with many expensive transformers—described as the best light transformer made **16/6**

9. **LISSENSTAT**—for perfect filament control .. **7/6**

6.

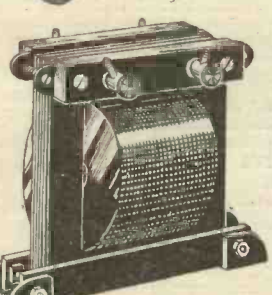


5.

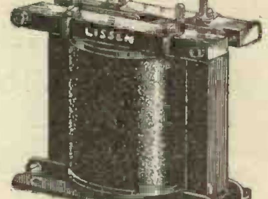
11. **LISSEN VARIABLE GRID LEAK**—for clear signals (neat and nicely finished, no thicker than a pencil, usual **LISSEN ONE-HOLE FIXING,** of course!) **2/6**

10. **LISSEN FIXED CONDENSERS**—they deliver all their stored-up energy.

.0001 to .0009	..	2/-
.001 to .003	..	2/6
.004 and .005	..	3/-



7.



8.

LISSEN MASTER PARTS INCLUDE EVERYTHING YOU NEED TO GO UNDERNEATH YOUR PANEL

LISSEN PARTS are the largest selling parts—they are supreme in their efficiency, supreme in their unique design, supreme in their ease of fitting—their rigid inspection during the making and their triple testing after ensure permanent satisfaction for everyone who buys.

LISSEN PARTS are master parts—all good dealers sell them. Send direct if any difficulty. Post Free.

DEALERS—Claim your maximum discount for stocking—ask your **FACTOR** or direct—Please order ahead.

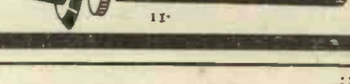
The trade should apply now for new LISSEN list—ready shortly—interesting details of LISSEN parts.

9.

LISSEN COMPANY

20-24, Woodger Rd., Goldhawk Rd., Shepherd's Bush
London, W.12
'*Phone*: 1072 Hammersmith.

N.B. — Close to Goldhawk Road (Met.) Station, Shepherd's Bush (Central London) or Hammersmith Tube. 'Buses 11 and 32.



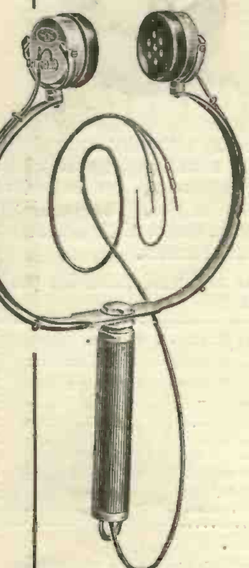
11.

BUILD——with the right parts!

STERLING

BRITISH MADE
RADIO HEAD TELEPHONES

Note reduced prices.



No. R. 1281.

Super Quality	R. 1238. Double Head Telephones.	120 ohms.	£1	17	6
	,, ,, ,, ,,	2,000 ,,	2	0	0
	,, ,, ,, ,,	4,000 ,,	2	2	0
	R. 1239. Single Head Telephones.	1,000 ,,	1	1	9
	,, ,, ,, ,,	2,000 ,,	1	2	9
	,, ,, ,, ,,	4,000 ,,	1	5	6
High Grade	R. 1260. Double Head Telephones.	120 ,,	1	2	6
	,, ,, ,, ,,	2,000 ,,	1	4	0
	,, ,, ,, ,,	4,000 ,,	1	5	0
Super Quality	R. 1281. Ladies' Hand Telephones.	120 ,,	2	16	0
	,, ,, ,, ,,	2,000 ,,	2	19	0
	,, ,, ,, ,,	4,000 ,,	3	0	0

No. R. 1238.

No. R. 1260.

Obtainable from all Electrical Dealers and Stores.

STERLING TELEPHONE & ELECTRIC Co., Ltd.,

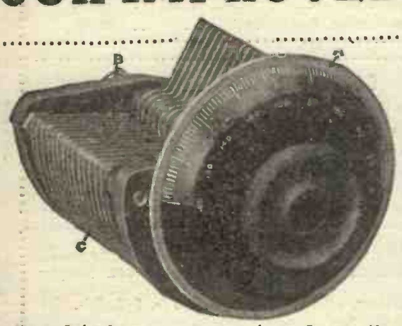
Manufacturers of Telephones and Radio Apparatus, etc.
(WHOLESALE ONLY)

Telephone House, 210-212, TOTTENHAM COURT ROAD, LONDON, W.1.

Telephone: Museum 4144 (7 lines). Telegrams: "Cucumis, Wesdo, London."

BIRMINGHAM: 150, Edmund Street. CARDIFF: 10, Park Place. MANCHESTER: 14, St. Peter's Square. NEWCASTLE-ON-TYNE: 9, Clavering Place. WORKS: Dagenham, Essex.

OUR IMPROVED



Complete in every respect, and exactly as illustrated, to the following specification.

Rotary, Air Dielectric, 22 Gauge Aluminium Vanes, Metal to Metal Adjustable Bearings. Spacing between plates sufficient for pressure up to 1,000 volts. Engraved Ebonite Dial. Is suitable for mounting on any panel up to ⅜in. thick by drilling 3 holes. Supplied with screws for fixing.

Plates	PRICES:	
57	.001	10/-
29	.0005	8/6
19	.0003	6/9
13	.0002	5/6

Postage and Packing:
1, 1/-; 2, 1/3; 3, 1/6.

If more than 3, kindly include ample for packing and carriage.

Most Dealers stock these. If unable to obtain locally, buy direct from us.

Don't allow our low prices to prejudice you. They are no criterion whatever of the value we offer. Our motto is QUALITY FIRST, and every Condenser carries our money-back guarantee.

REPUTATION

Your Condenser is not a "FALLON" unless the name "FALLON" appears on same.

type A II CONDENSER

—for Panel Mounting—

SPECIAL FEATURES:

A. Aluminium Screening Disc, which besides enhancing the appearance of the Dial as it lies flush with the Panel prevents the hand of the operator producing capacity.
B. Metal to metal adjustable bearings of which we were the originators, as applied to Condensers.
C. 22 Gauge hard Aluminium Vanes.

is unsurpassed for Workmanship, Quality of Materials employed, Efficiency and PRICE, which, by the way, has NOT been INCREASED.

TESTIMONIAL—ONE OF HUNDREDS:—

Sotterley, Wangford, Suffolk, May 20th, 1923.

Dear Sir,—The three .0005 Condensers you supplied me with recently are excellent, and equal to some I paid 35/- for. I have never seen better value for money, and I have been an experimenter for years.

The points of excellence are—

(1) Connection to moving plates, although frictional, gives no trouble whatever as in many Condensers.

(2) Both connections made by nuts and NO loose wire hanging from the moving plate connection as in the case of some, this wire frequently breaking. (3) Absolute rigidity. (4) Completeness (supplied with dial, etc.). (5) LAST—but not least—PRICE.

This letter is entirely unsolicited, and you can make any use you like of it and my name.

Yours truly, A. E. D. KENNARD,

Wireless Officer in France and Instructor at R.A.F. School of Wireless during the War.

ALL ORIGINALS CAN BE INSPECTED.

WARNING! *Don't buy shoddy sets of Condenser parts which are well-nigh impossible of assembly, or half assembled Condensers which are merely thrown together. BUY OURS—we specialise in Condensers Complete in every respect and exactly as illustrated.*

In response to numerous enquiries we beg to state we manufacture Variable Condensers only.

Prompt Delivery.

FALLONS

THE CONDENSER PEOPLE

230a, HERMITAGE ROAD, LONDON, N.4.

Finsbury Park, near the Manor House.

Sole Trade Distributors: Messrs. G. W. I., Ltd., Shanklin Road, Crouch End, London, N.8. To whom all Trade Enquiries should be sent.

Cash with Order.

London Agents: Vanstones, Ltd., 61, Chandos St., W.C.2

FALLON CONDENSER MFG. CO., LTD., Makers of half the World's Variable Condensers

HULLO

Raymond Variable Condensers

CHEAPEST! BEST!!

Note New Features!

Fully Assembled as Sketch

ALUMINIUM TOP & BOTTOM PLATES

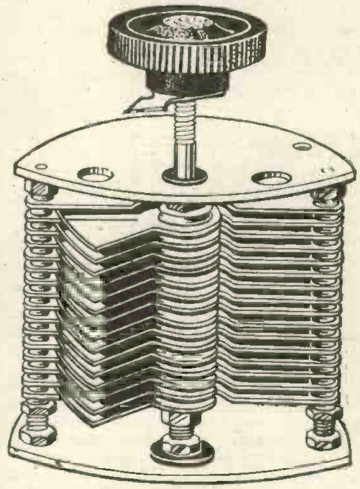
Prices Include—

EBONITE DIAL .0-180 (not shown) KNOB POINTER & BUSH

EBONITE BUSHES.
ADJUSTABLE BEARING.

ACCURATE .088 SPACERS USED

(Making condenser more compact for a given capacity.)



POST FREE.

Price fully assembled with ALUMINIUM END PLATES and Ebonite Dial, .0-180.		Assembled but without end plates or dial.	
.001	8/-	.001	6/-
.00075	7/-	.00075	5/6
.0005	5/11	.0005	4/6
.0003	5/2	.0003	3/3
.0002	4/3	.0002	2/6
.0001	3/9	.0001	2/3
Vernier	3/6	Vernier	1/9
POST FREE.		POST FREE.	

HEADPHONES.

Fine N. & K. Double Headphones, Splendid Tone, 4,000 ohms, very comfortable headbands, **15/11** pair nett.

Brunet (beware of cheap imitations offered at less than the firm of Brunet, Paris, sell in thousand lots), 4,000 ohms, horn headband, well-known as a first-class reliable and guaranteed phone, one price only, **17/11** pair nett.

B.B.C. Phones, very loud, sweet tone, 4,000 ohms, every pair guaranteed for perfect reception, complete with long cords, **16/11** pair nett.

Double Phone Cords, suit all makes of phones, **10d.** per pair.

Extra Good Lead-in Wire, 10 yds., **1/3**; **1½d.** per yard.

Buy the Good Goods at Low Prices. Not Nasty Goods at Cheap Prices.

Post orders must be accompanied by an extra sum of 2d. in every shilling or any part of a shilling, up to 20/-. Over 20/- post free with the exception of Accumulators and a few special articles marked in list. To facilitate delivery please see correct amount is enclosed as otherwise delay occurs. All orders in strict rotation.

Foreign orders 3d. in each 1/- or any part extra for post. Over £3 post free.

Accumulators, Rotax, 4 v. 40 amp., **17/6,** post **2/-** extra.

Accumulators, 6 v. 50 amp., in splendid carrying case, leather strap handle, **27/6,** post **2/6** extra.

High-Tension Batteries, guaranteed quality—

15 v. wax centre	2/6,	post 1/- extra.
36 v. ,, ...	4/9 ,,	1/- ,,
60 v. tapped every 3 volts	8/6 ,,	1/3 ,,

Complete with 2 Wander Plugs. Above are not included in free post offer, being fragile.

VALVES.

All valves offered are new and manufacturers' guaranteed quality. **No Rejects, Done-up, Renewed or "Dud" Goods are offered. Beware of Rubbish.**

French "R" Best type	10/6
Cossor, Pink Top	15/-
Cossor, P.2	15/-
Marconi "R" a.v. 45/60	15/-
Mullard Ora	15/-
Ediswan	15/-
Dull Emitter (delivery shortly)	27/6

INTERVALVE TRANSFORMERS.

Low Frequency Ratio 5—1.

Radio Instruments Ltd., Special Transformer ..	25/-
Tested on Aerial, high quality, perfect results ..	15/11
Very Good Transformer, Guaranteed	11/6

COIL HOLDERS.

3-way, very handsome design, first-class article, good appearance, worth much more, **10/-.**

3-way, second quality, a good serviceable holder, **7/-.**

3-way, cheaper quality, but worth more, **5/9.**

2-way, first quality, **6/6**; second do., **5/-**; third do., **4/6.**

CRYSTAL DETECTORS.

High-class Enclosed Whisker Detector, well made, generous size, on ebonite base **3/-.**

Enclosed Whisker Detectors, all good value, **1/8, 2/-, 2/6, 3/-.**

Perikon Detector, glass enclosed, with 2 crystals, adjustable pressure, on ebonite base, **2/-.**

Perikon Detector, built on generous lines, complete with 2 crystals, glass enclosed, dustproof, **3/-** and **3/6.**

FILAMENT RESISTANCES.

Very Good Resistances, wound on core, giving perfect results, 2 designs, **2/3** and **2/8.**

Various designs in stock, 1/8, 1/10, 2/-.

7 ohms, 3/6 and **4/-.**

TO CALLERS.—1d. in the shilling discount on most of the above. This will pay your fare, besides giving you utmost value for your money.

RIGHT OPPOSITE DALY'S GALLERY DOOR

M. RAYMOND

27, LISLE STREET, W.C.2

RIGHT OPPOSITE DALY'S GALLERY DOOR

OPEN EVERY DAY 9 a.m. to 8 p.m. SUNDAYS 11 a.m. to 2 p.m.

Contents

Editor:
JOHN SCOTT-TAGGART, F.Inst.P.

Joint Assistant Editors:
PERCY W. HARRIS.
E. REDPATH.

Staff Editors:
E. H. CHAPMAN, M.A., D.Sc.
A. D. COWPER, M.Sc.
G. P. KENDALL, B.Sc.
A. L. M. DOUGLAS.
R. W. HALLOWS, M.A.
S. G. RATTEE.

Scientific Adviser:
Prof. G. W. O. HOWE, D.Sc., M.I.E.E.

Advisory Editors:
Prof. R. WHIDDINGTON, M.A., D.Sc.
Prof. C. L. FORTESCUE, M.A., M.I.E.E.
Tel.—Central 3763.

Advertisement Managers:
SCHEFF PUBLICITY ORGANISATION, LTD.
125, Pall Mall, London, S.W. 1.
Tel.—Regent 2440.

MODERN WIRELESS

Radio Press Ltd
PUBLISHERS OF *WIRELESS WEEKLY*
DEVEREUX COURT.
• STRAND. W.C.2 •

All correspondence relating to contributions is to be addressed to the Editor of "Modern Wireless."

Editorial

WITH the coming of September the "how to make" wireless season can be said to have commenced in real earnest. During the summer months very few people care to work indoors with a hot soldering iron, but now that the shorter evenings drive us indoors, the experimenter begins to collect his component parts about him and sketches out the set he has longed desired to make.

* * *

There is no question that for the handyman, the making of wireless apparatus possesses a great fascination. It is not merely that the home construction of such sets effect a considerable saving, although this must have a powerful influence with many of us. Far more instruction is gained in making one's own set than can ever be acquired by manipulating the best of the ready-made sets. Many important improvements and simplifications of apparatus have come from those who have discovered the means of the improvement in their own workroom. Even the most experienced designer finds when he starts to make the set that some of the portions which on paper have seemed the simplest to make, offer several unforeseen difficulties. In this special "How to make" number of MODERN WIRELESS, we have carefully kept in mind the needs of the beginner, as well as of the more advanced experimenter, and the articles and sets have been chosen to make the widest possible appeal.

* * *

Very shortly two more British broadcasting stations will be opened. This means that many thousands more people will be placed within what we may term "crystal range" of these stations. In our pages this month will be found two entirely different designs for crystal sets, both of which will give admirable results within say ten or fifteen miles of a broadcasting station. Those readers more distant or who wish to be able to hear all the British broadcasting stations, will find the three-valve "all-concert" set to their liking. In the coming numbers of MODERN WIRELESS we shall give details of further highly ingenious and useful sets, both crystal and valve, which we are sure will prove very popular with our readers.

We are happy to present for the first time with this issue of MODERN WIRELESS our new Magazine *Junior Wireless* designed to have a strong appeal to every healthy boy. The editorship has been entrusted to Mr. Percy W. Harris, whose many books and articles have done much to popularise broadcast reception. It is our intention in this new magazine to present the name sound technical, and "How to make" articles that have distinguished MODERN WIRELESS in the past, but in all cases the sets described will be of the simplest possible nature commensurate with efficiency.

THE TRANSMISSION OF PICTURES BY WIRELESS

By J. H. T. ROBERTS, D.Sc., F.Inst.P. (Staff Editor).

The following article, which is based upon an interview with M. E. Belin and a visit to his laboratory, gives an account of the work of this famous French inventor in connection with the wireless transmission of pictures.

In the earliest days of radio-communication it was only possible to transmit messages by the aid of code signals (telegraphy) and the transmission of the spoken word by telephony was no more than a hope for the future. By the ingenious use of high-frequency continuous waves, and the modulation of the same by means of microphonic currents of speech frequency, the transmission of speech and music has now been made a matter of everyday experience.

The next step in the development of wireless is the transmission of pictures, drawings, and writing. It is, of course, tacitly assumed that the transmission, to be most effectual, must be instantaneous, or nearly so. As a matter of fact, it is already possible to transmit a picture by wireless by the method which is described in the present article, but this is not an instantaneous process, nor does it transmit the picture as a complete whole. The broadcasting of pictures has also been recently attempted by a method which, whilst it may contain the germ of future possibilities, cannot be said, in its present form, to be of much practical utility. The problem of the radio transmission of a picture as a whole and instantaneously would appear to be one of very considerable scientific difficulty, but so many problems which have appeared equally complicated have now been successfully solved that there seems no reason to conclude that the general problem of television will prove an exception.

If the condition of *instantaneous* transmission is not insisted upon, and allowance is made for the breaking-up of the picture into a number of small parts, these parts being transmitted separately, the problem becomes very much simpler. This is, in fact, the underlying principle of M. Belin's method ; it

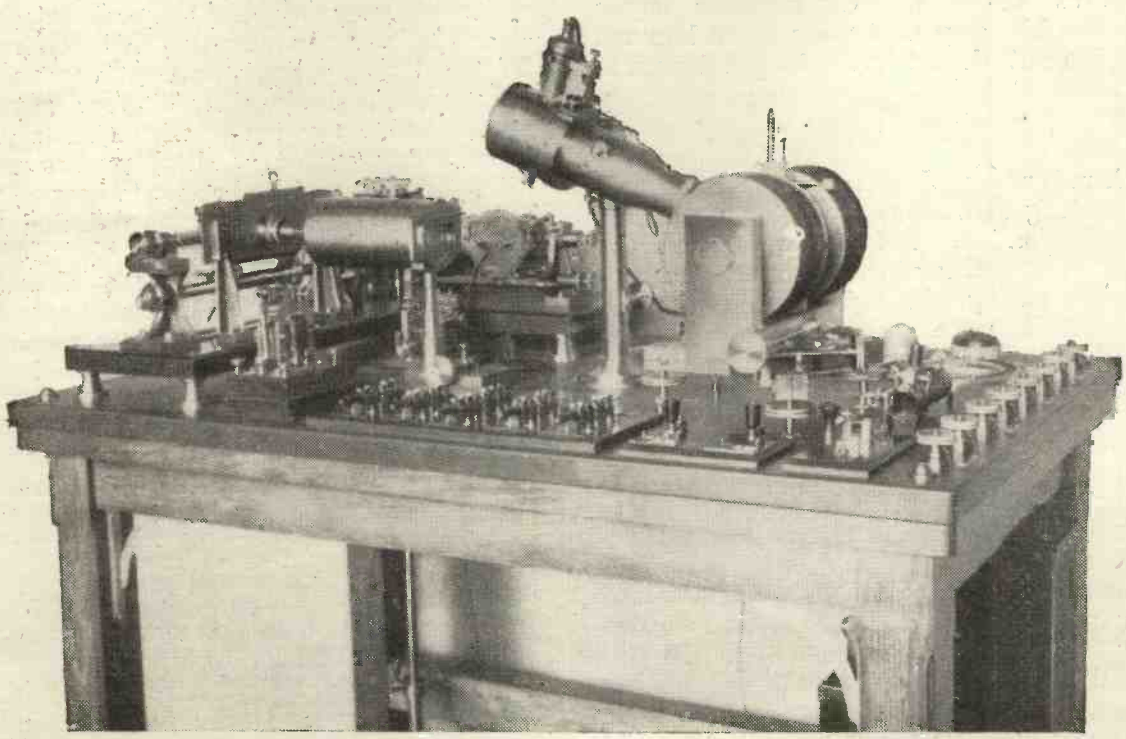


Fig. 1.—The elaborate apparatus used in the experiments described in this article. The receiving cylinder is on the left. The cylindrical objects on the right are the field-magnets of the Einthoven galvanometer.

must be admitted that, so far as it goes, the method has been very successful and is, even in its present form, of considerable commercial utility and importance. By the use of Belin's apparatus, not only pictures, but also line-drawings, and handwriting may be transmitted.

The Principle of Belin's Method.

The rough outline of the method may be given as follows. Imagine two of the old-style phonograph cylinders rotating at exactly the same speed, one placed at the transmitting station and the other at the receiving station. Suppose a picture is engraved upon the transmitting cylinder in such a way that the features of the picture stand out in relief. If a microphone be suitably mounted so as to make contact with the surface of the cylinder, the pressure against the microphone will be greater when a raised portion of the cylinder is passing it than when a hollow portion is passing. If the correspondingly-varying microphone current is made to have a modulating influence upon the high-frequency wireless waves from the transmitting station, these modulated waves may be made, at the receiving station, to influence a light-

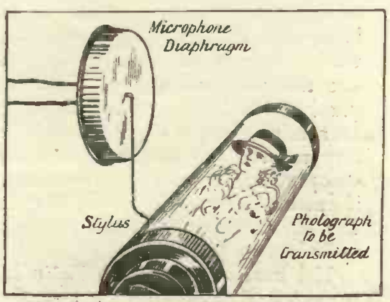


Fig. 2.—Principle of transmission with a microphone.

beam in such a way that, when this beam falls upon the second rotating cylinder, which is covered with photographically sensitised paper, light and dark impressions are produced corresponding to the raised and hollow portions of the original cylinder.

It will be seen that the fundamental principle of the method is comparatively simple, but in the practical development of the apparatus M. Belin has had many important technical difficulties to surmount.

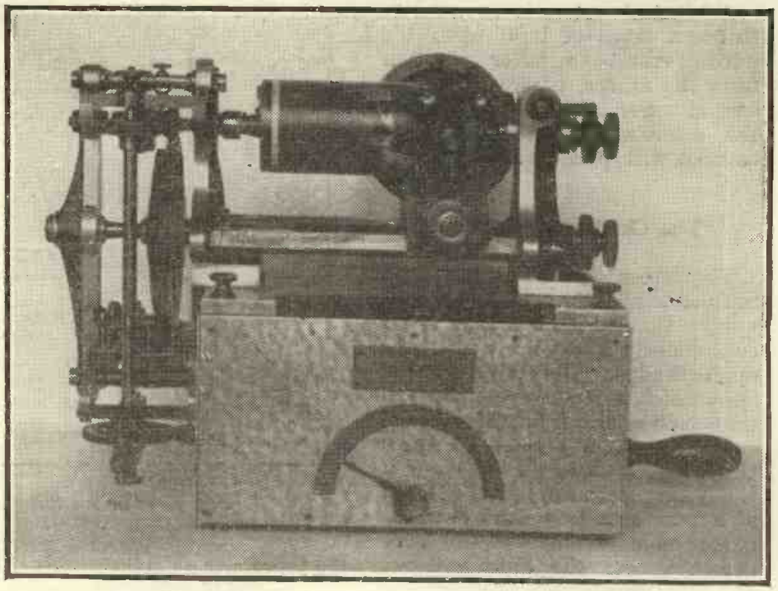


Fig. 3.—The actual transmitter with photograph in position.

The Preparation of the Transmitting Cylinder.

Without entering into the details of the photographic process by which the picture is transferred initially to the transmitting cylinder, we may say that the process involves the use of bichromated gelatine paper, and is in many ways similar to the process by which ordinary blocks are made, such as are used for printing illustrations in magazines. The net result is that the picture stands in relief from its surroundings. In Fig. 2 is shown the arrangement of the microphone in relation to the rotating cylinder. It will be seen that as the cylinder rotates, the sapphire stylus is actuated by the "hills" and "dales" (as it were) of the cylinder, and corresponding variations are produced in the microphone current. The actual machine by which this is carried out is shown in Fig. 3.

Method of Transmission.

Having obtained the requisite variations in the microphone current, the mode of superimposing these variations upon the wireless carrier waves is identical with that which is employed in wireless telephony, and therefore it is unnecessary, in this Journal, to give any further description under that particular heading.

The Receiving Apparatus.

This depends primarily upon the use of the principle of the "oscillograph," and will be understood by reference to Fig. 4. Two stretched wires A B, C D, support a tiny mirror which may be ⅛in. square. The telephone current from the receiving apparatus passes through these wires and the arrangement is placed in a strong local electromagnetic field. Owing to the interaction of the electromagnetic effects of the suspended mirror system and the local field, the mirror system suffers a deflection, the amount of which depends upon the strength of the telephone current traversing

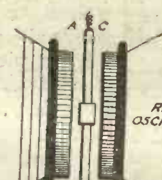


Fig. 4.—The principle of the receiving oscillograph.

the wires A B, C D. In other words, the angular deflection of the mirror is an indication of the strength of the telephone current, or the variations in position of the mirror correspond to the variations in intensity in the received telephone current.

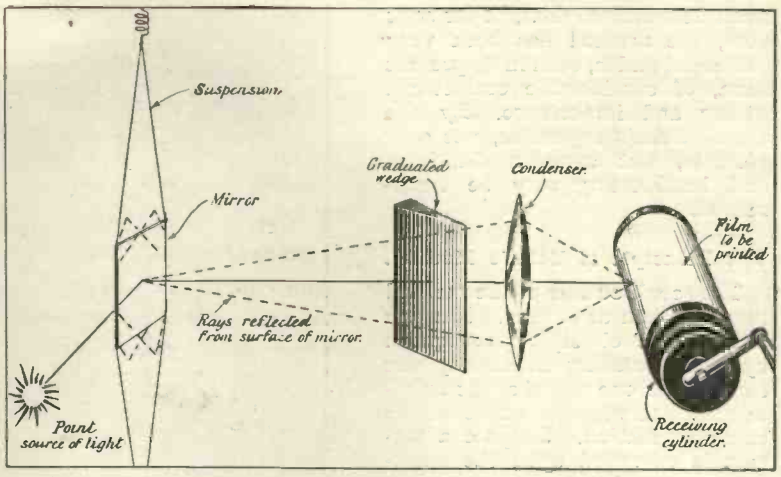


Fig. 7.—The receiving apparatus explained diagrammatically.

An optical system is arranged to throw a beam of light upon the mirror; the beam, after reflection from the mirror, passes through a special screen and then falls upon the receiving cylinder, which is covered with photographic paper.

The Graduated Screen.

The screen which has just been referred to above is made in a special way, so that its transparency varies continuously from one edge to the opposite edge. Thus the amount of light which is able to pass through the screen when a beam falls upon it depends upon the point at which the beam strikes the screen; if the beam passes through the screen at a part near to the most transparent edge, a comparatively large percentage of the light will get through, whilst if the beam is deflected so that it strikes the screen at a part near to the most opaque edge, a comparatively small percentage of the light will get through. Thus the amount of light which gets through the screen will vary as the beam is deflected along the line in Fig. 7.

Now this deflection of the beam along the line is exactly what results from the angular vibration of the mirror due to the telephone current passing through the wires A B, C D in Fig. 4. It will be seen, then, that this arrangement enables the variation in the received telephone *current* to be translated into variations in the *intensity* of the light which falls upon the photographic paper on the receiving cylinder. Since the variations of the telephone current correspond to the raised and depressed portions of the picture on the transmitting cylinder, we have now a completed method whereby the passing of a *raised* portion of the *transmitting* cylinder under the microphone stylus results in the production of a *strong* light on the photographic paper on the *receiving* cylinder, and the passing of a *depressed* portion on the transmitting cylinder produces a *feeble* light on the receiving cylinder. The raised and depressed parts of the transmitting cylinder are therefore recorded by dark and light parts (or *vice versa*) on the receiving cylinder.

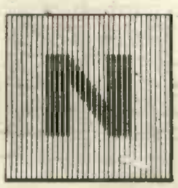


Fig. 6.—How the lines trace out the picture.

As the transmitting cylinder rotates, it also moves gradually along its own axis, so that eventually the microphone stylus has traversed a series of lines covering the whole area of the picture. Similarly, the receiving cylinder moves gradually along its own axis as it rotates, with the result that the spot of light draws a series of lines across the paper, these lines making up the received picture. This effect is illustrated in Fig. 6.

Synchronising the Two Cylinders.

One of the most important mechanical adjustments in this apparatus is the synchronising of the cylinders at the transmitting and receiving stations. It will be obvious that if one cylinder were to rotate a little faster than the other, the received picture would become inextricably confused. Great precautions have been taken by M. Belin to secure equality and uniformity in the speeds of rotation of the two cylinders. The cylinders are driven by clockwork mechanism and it is previously ascertained, by trial, that the difference in the total number of revolutions of the two cylinders during the time required for the transmission of a picture is an exceedingly small fraction of one revolution, so that, for all practical purposes, the speeds of rotation of the two cylinders are equal.

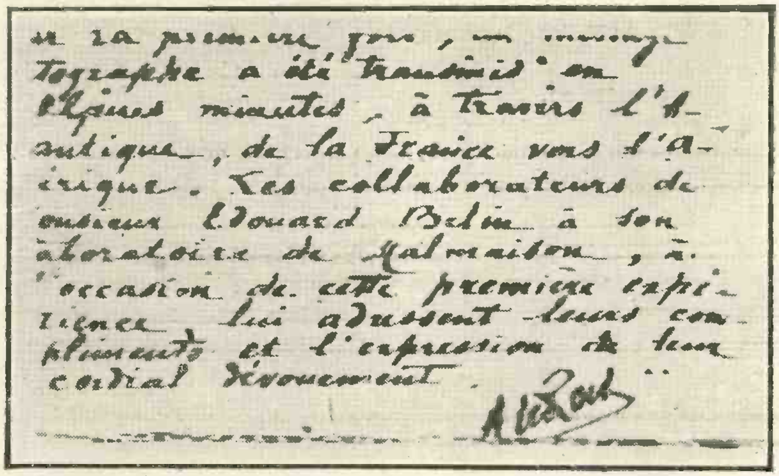
Keeping Cylinders in Step.

Not only is it necessary that the two cylinders shall rotate at the same speed, but it is also important that they shall be in step. The necessity for this may not at first be apparent. If the surface of the receiving cylinder were coated with photographic emulsion, so that there could be said to be no "starting point," it would be immaterial at what point of the cylinder a start was made. It is convenient, however, to attach a strip of sensitised paper to the receiving cylinder and evidently the picture is required to start at the moment when the "join" is passing the light spot. Also if the transmission of a picture should for any reason be interrupted before completion, it could only be resumed if means were available for keeping the transmitting and receiving cylinders in phase.

The method by which Belin has provided for keeping the cylinders in step is to arrange for the transmission of special periodic signals at the moment when the cylinders are set in motion. The frequency of the signals is such as to enable them to be easily distinguished in the telephone, and by the aid of a mechanical device, an advancing or retarding movement can be given to one of the cylinders at will, in such a way as to make the signals emitted by them coincide.

Effect of Atmospherics.

In some respects the receiving apparatus resembles the tape re-



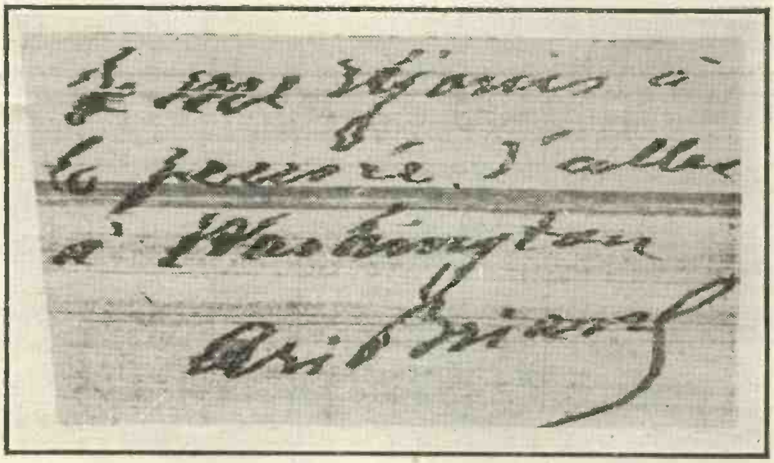
The first Belinogram.

ing tape recorded wireless Morse signals entirely unintelligible.

In the transmission of a picture, by the method described therein, however, it is only necessary to secure a system of shading, and provided the received picture shows sufficient contrast between the dark and light portions, it does not matter whether these portions are actually black and white. If atmospherics have the effect of breaking up a line which forms part of a black portion of the picture, the result will be merely to reduce the contrast, and the same remark applies if atmospherics cause a sprinkling of dots upon the parts of the picture which were intended to be white. It is, therefore, ex-

ceiving machine employed for automatic wireless reception of Morse signals, and, like the latter, it is liable to be affected by the reception of atmospherics.

There is, however, a fundamental difference between the effect of atmospheric interference in the case of Morse reception and in that of picture reception by the Belin system. A Morse character consists of a "long" or a "short," and if atmospherics have the effect of causing interruption during the transmission of a "long" they may break it up into a number of "shorts"; similarly, a series of "shorts" may be joined together by atmospheric interference into a "long." In this way atmospherics frequently have the effect of render-



The signature of M. Briand transmitted by Belinogram.

Even Chinese can be successfully transmitted.

tremely unlikely that atmospherics can interfere seriously with the fidelity of the received picture or with the legibility of transmitted handwriting. The point is that atmospherics are numerous and more or less "uniformly erratic," whilst the genuine transmission produces a picture which stands out sufficiently clearly from a grey or speckled background.

Trials of the Method.

The first practical trial of this system was made in June, 1921, from the Lafayette Station (Bordeaux). A portable transmitter at Radio Central (Paris) was connected by wire with the Lafayette Station and the wireless transmission from the latter station was received in the Belin laboratory at Malmaison.

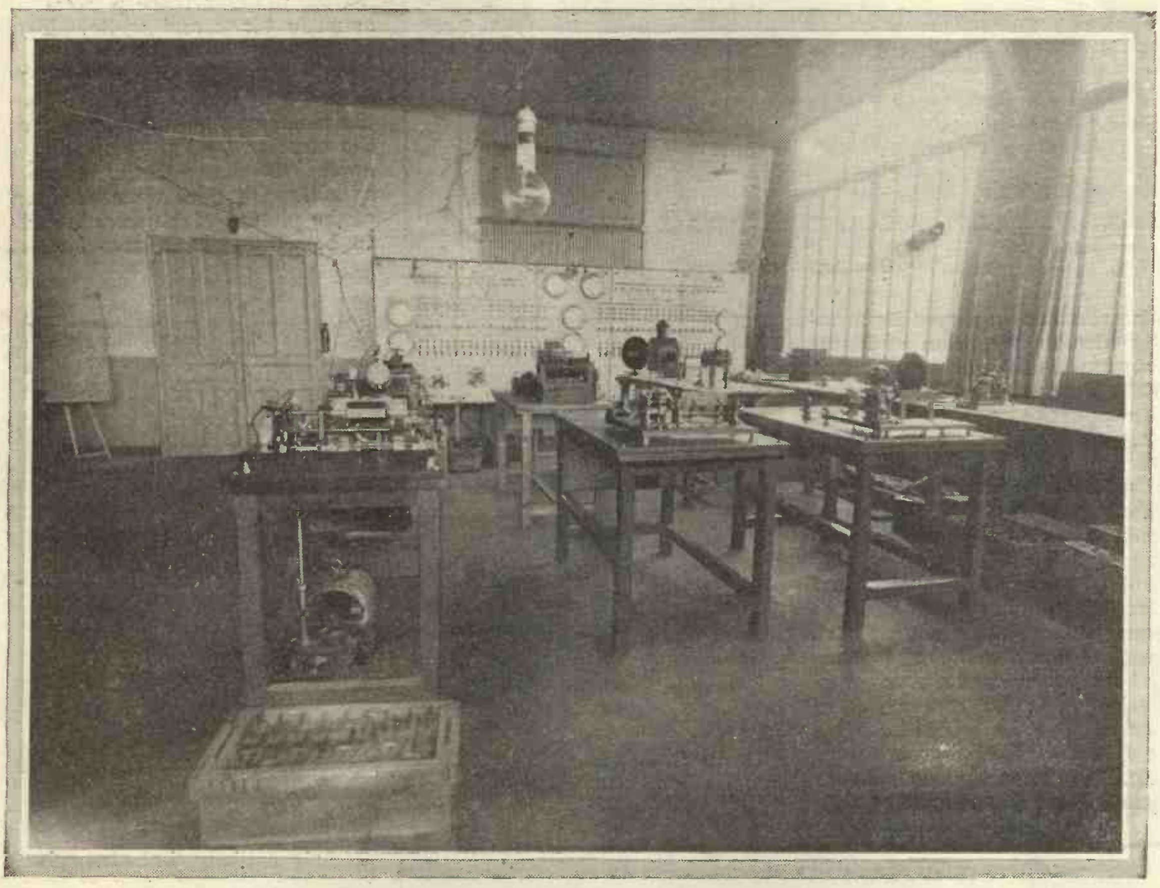
The second set of trials were made in July, 1921, between America and France. The transmission was sent from the U.S. Marine Station of Annapolis to Malmaison where reception was effected on a line aerial, using valve-amplifiers. The first satisfactory telephotographic message which had ever been sent across the Atlantic was received in this way during the night of the 4th-5th August, 1921.

A third series of experiments were made in October, 1921, when autographic messages were sent from France to the Marine Station of Annapolis. As in the original trials, the transmission was made from Paris by wire to the Lafayette Station at Croix d'Hins (Bordeaux).

Conclusion.

The foregoing description will show the essential simplicity and ingenuity of M. Belin's invention, and the illustrations herewith indicate the practical success of the transmission of pictures and writing by this method.

The transmission of a picture takes a few minutes, so that the method cannot, at any rate in its present form, be compared in any way to *television*, nor is it adaptable to the transmission of moving pictures. Television is one of the dreams of science, which there is little, if any, reason to doubt may some day come true. Many important inventions in wireless have been made by the amateur experimenter, and the fact that the problem of television appears so formidable is no reason why the amateur should not give it careful thought with a view to contributing even a small quota towards its solution. It is, in fact, very unlikely that the problem will be solved in a single night; it will almost certainly be the gradual result of a multitude of contributory efforts.



In M. Belin's laboratories, showing the apparatus illustrated in Fig. 1 on the left.

MY NEW CIRCUIT.

By E. T. FLEWELLING.

Every experimenter has heard of the Flewelling circuit, and many readers of this magazine have obtained wonderful results with it. In this article, specially written for MODERN WIRELESS, *the inventor himself describes his latest circuit and its modifications.*

Mr. E. T. Flewelling.

IN the original Flewelling circuit, super-regeneration was secured by a method that utilised the blocking and freeing of the grid of a vacuum tube in conjunction with a bank of three condensers. The theory of the circuit showed that this bank of three condensers was unnecessary and that the same results were obtainable by the proper placing of a single condenser, of the right value, in the circuit. The blocking and freeing of the grid of the valve is responsible for a characteristic sound in the phones dependent upon the rate at which this blocking and freeing action takes place. This blocking, etc., may produce condenser ripples running from once a second or less to as great a speed as 10 to 15 thousand or more times a second. The correct operating point seems to be in the neighbourhood of 10 to 15 thousand times a second, and the characteristic note of a successfully operating receiver is that of a high, shrill-pitched whistle, approaching the super-sonic range during reception, and therefore almost inaudible. The pitch of the whistle or rate of starting and stopping is controllable within suitable limits by the variable-resistance grid leak and should never be allowed to go so low in pitch as to be decidedly objectionable to the operator.

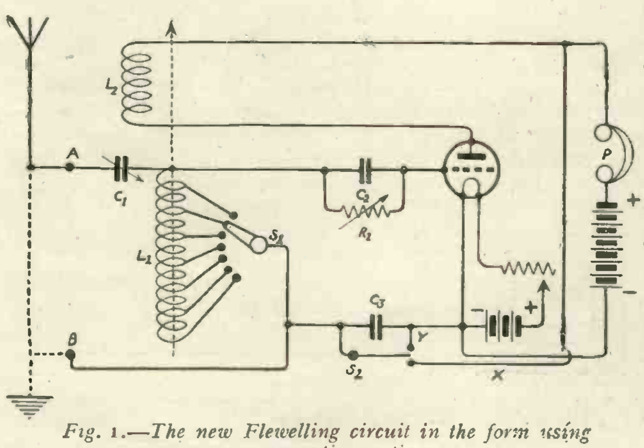


Fig. 1.—The new Flewelling circuit in the form using magnetic reaction.

The circuit is shown in Fig. 1 in the familiar "tickler-coil" form. Fig. 2 shows the circuit as used with a variometer or tuned anode circuit. Fig. 3 shows the use of a loop or frame antenna, which is shown directly tuned with the grid circuit without the use of the usual tuning inductance, although, of course, a loop may be used in any of the conventional ways.

From experience the writer would advise those who contemplate building the Flewelling receiver to build a plain regenerative circuit of the type that they prefer, except that they use about 25 per cent. more inductance than usual in the anode circuit. If such a circuit is built and put into successful operation most of the worries and troubles encountered in constructing a Flewelling super will be eliminated. After such a circuit is in successful operation it is an easy matter to open the

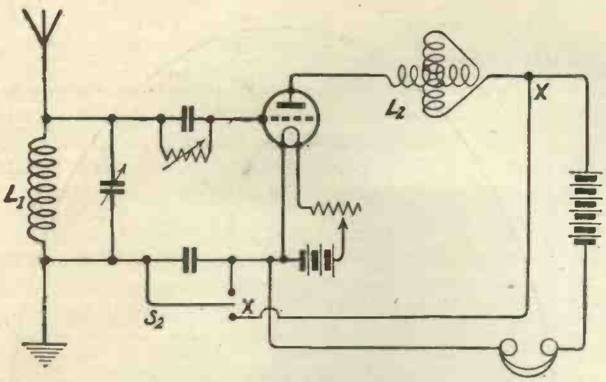


Fig. 2. A new Flewelling circuit using the well-known American method of obtaining reaction by tuning the plate circuit with a variometer.

filament side of the grid circuit and insert the .006 μF. condenser, which should be of a high-grade type, preferably one using a mica dielectric, and make the additional connection "X" between the anode and grid circuit, as shown in diagrams. It should be noticed that this connection is made from the side of the anode coil away from the anode, to the bottom or filament side of the tuning inductance, thus letting the .006 condenser act as a barrier between the high anode voltage and the filament of the tube. The switch "S_2" will enable one to rapidly change the circuit from a plain regenerative to a super-regenerative circuit. Its use is optional, but if used, care should be taken that the two contacts be so spaced that the switch arm cannot rest upon both points at once, as in such a case the voltage of the anode battery would be placed across the phones.

Most of the trouble encountered with this circuit seems to centre itself in the securing of a suitable variable high resistance for the grid leak. A tapped resistance, as a rule, is an impossibility in this circuit. The adjustment is so critical that the best operating point will most invariably be between contacts, therefore one should use a continuously variable resistance of the highest type. No value can be given for the resistance, except that it is in the neighbourhood of 1 megohm, because of the fact that its value depends entirely upon the various constants in the particular receiver in use.

High-grade inductances of low internal capacity should be used. It will be found that as the grade of inductance is lowered the frequency of the blocking action is also lowered and it may be brought to such a point by this means that control of the action is beyond the ability of the resistance. This applies particularly to the internal capacity of the coils. There is at this point a combination of constants in the circuit that will give results far beyond those obtainable with poorly designed apparatus. It is very strongly recommended that after the circuit is in successful operation that various types of inductances be tried. The difference in action will be immediately apparent and the experimenter may choose the combination that gives the best results.

The valve to be used in the circuit must be of the hard, high vacuum type in order that we may properly control its grid and use the higher anode voltages. As a rule it will be found that superior results are secured from the tubes of the larger sizes of the bright filament type, although very satisfactory operation may be obtained with hard tubes of the dull emitter type. Under rather critical conditions a soft valve might be used in this circuit depending upon the particular valve used and its degree of gas content, results being generally very mediocre.

Although the Flewelling circuit may be operated on a loop, ground, or antenna, or with no outside connection as may be desired, the control of the frequency of blocking is to an extent dependable upon the capacities and inductances associated with the circuit. The action might even be stopped entirely by association with the circuit of an antenna or ground of improper value. Note also that if we term antenna or ground energy collectors, then the energy collector used should be connected to the side of the inductance next the grid of the tube. One may readily ascertain if the energy collector used is suitable, by placing the circuit in operation not con-

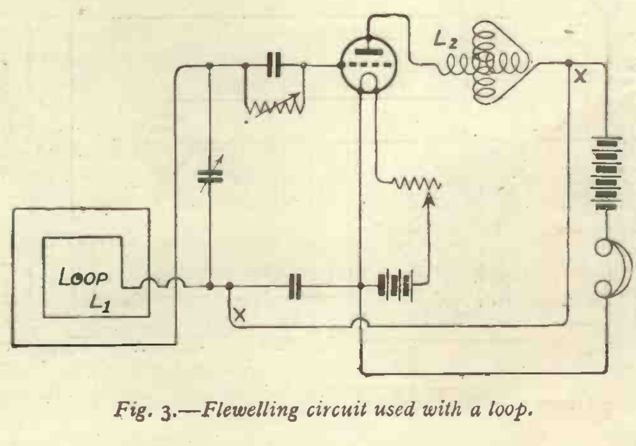


Fig. 3.—Flewelling circuit used with a loop.

nected to any outside conductors, the blocking frequency adjusted to what is deemed the proper point, and such an antenna or ground system used as will enable one to bring the receiver into its original adjustment. As a rule this will not be troublesome because the receiver has sufficient range of adjustment to be adaptable to average conditions.

The experimenter should bear in mind that he is not operating a super-regenerative circuit that is dependent for its action upon the use of a separate tuned oscillatory circuit as generally used to obtain super-regenerative effects. The action in the Flewelling super-circuit, given the correct constants, as shown, is dependent entirely upon one's ability to block the tube action by refusing to allow the negative charge to leak off of the grid and to be able to start the tube action at will. This means that the experimenter must devote his attention to the starting and stopping action of the tube itself, rather than to the other parts of the circuit.

The writer's attention has been devoted entirely to reception in the United States of radiophone broadcasting. Hence the constants given for the circuit are suitable for the broadcasting range of wave-lengths, which in the United States runs from 225 to 550 meters. The value of the tuning coil given will not cover this entire range, but it is a simple matter to either tap a large coil or exchange the coil, as the particular needs may call for.

Amplification through the use of this circuit is not such as to be of any value much above 600 meters, but as the amplification increases inversely as the square of the wave-length the possibility for the receiver on the wave-lengths down to, say, 10 to 25 meters, are very promising. The increase in amplification from 400 meters to 200 meters is quite noticeable. I cannot speak from actual experience, as I have not as yet visited England, but from past results with this receiver it seems to me that reception should be possible from such a station as 2LO, if conditions are at all favourable, almost anywhere in the British Isles, using the ground alone and without antenna of any kind. Spark stations are received with the mushy note, but the receiver is very suitable for C.W. reception.

Because of the simplicity of the circuit and the results that it gives, the experimenter should find a wealth of interest and experience in its operation.

CORRESPONDENCE

A Modified ST. 100

To the Editor of MODERN WIRELESS.

DEAR SIR,—I have no doubt you will be interested to hear that I hooked up this week the modified ST 100 circuit illustrated in the August number of MODERN WIRELESS in the 2 HF and crystal and 1 LF circuit, but used Igranic coils and condensers instead of the variometers (owing to lack of the latter). I used a 35 coil with .001 condenser and vernier in parallel for the ATI and 2 No. 50's for the anodes, and a No. 200 coil for the choke, 2 Cossor valves and Galena crystal, and, to my pleasant surprise, tuned in all the B.B.C. stations without difficulty. I used, however, a very loose coupling between the first anode coil and the ATI.

I also found that practically no grid bias was required (less than 1 volt) and the set functioned quite well without it. I also used a 3 plate vernier condenser across the choke and only needed about 100° out of the 180°. 100,000 ohm resistance in the circuit. I am now going to try different valves for this resistance.

There was complete absence of AC hum, although with the old ST 100 this troubled me considerably. I was also able to work my loud speaker (Brown High Res.) on Newcastle, Manchester, and faintly on London. Aerial twin, 40 ft. long (on 40 ft. mast), which passes only 3 ft. clear of top of house.

Many thanks for this splendid circuit.

F. B.

Eskdale, Carlin How
(About 5 miles S.E. of
Saltburn-by-Sea, Yorkshire).

Dual Amplification

DEAR SIR,—I feel it my duty to write you on your little portable receiver in this month's MODERN WIRELESS. But what you give *re* the results obtained is by far too mild. I took a fancy to the circuit, and put it up in a few hours, and was delighted with the results from Cardiff, a distance of 14 miles, and was more than surprised to hear all stations in the British Isles quite clearly. It is the "last word" in single valve circuits. Glasgow came in equal to a three-valve circuit.

I am, dear sir,

Yours, etc.,

(Signed) J. GARNET SILVERTHORN.

Crosskeys,
Mon.

A THREE-VALVE "ALL-CONCERT" RECEIVER

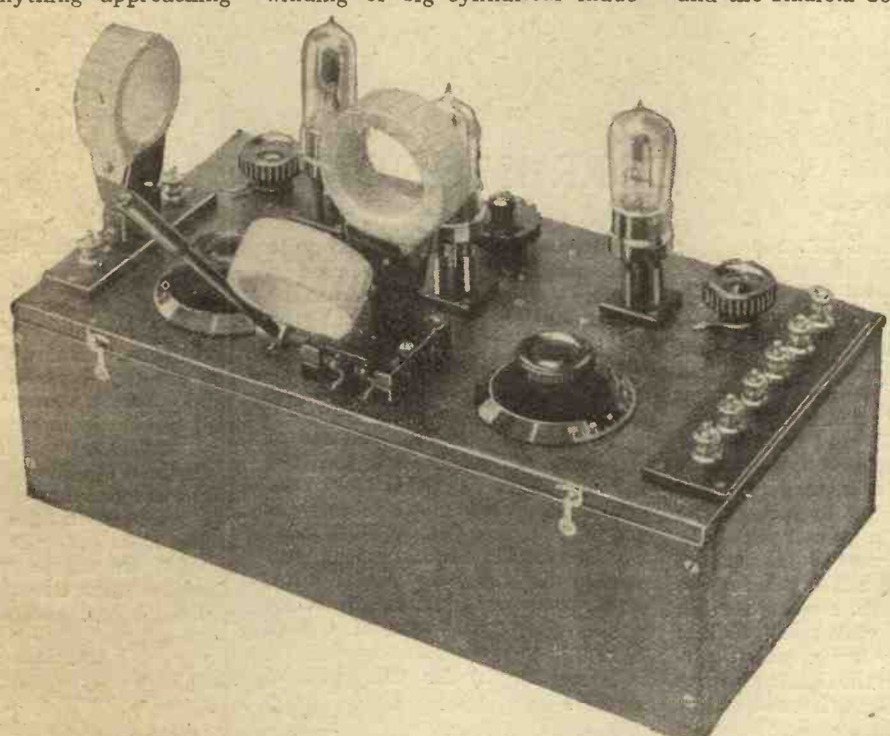
By PERCY W. HARRIS, Staff Editor.

In this article detailed instructions are given for the construction of a highly efficient three-valve receiver on which all-British broadcasting stations, as well as most Continental broadcasting, can easily be heard when conditions are normal.

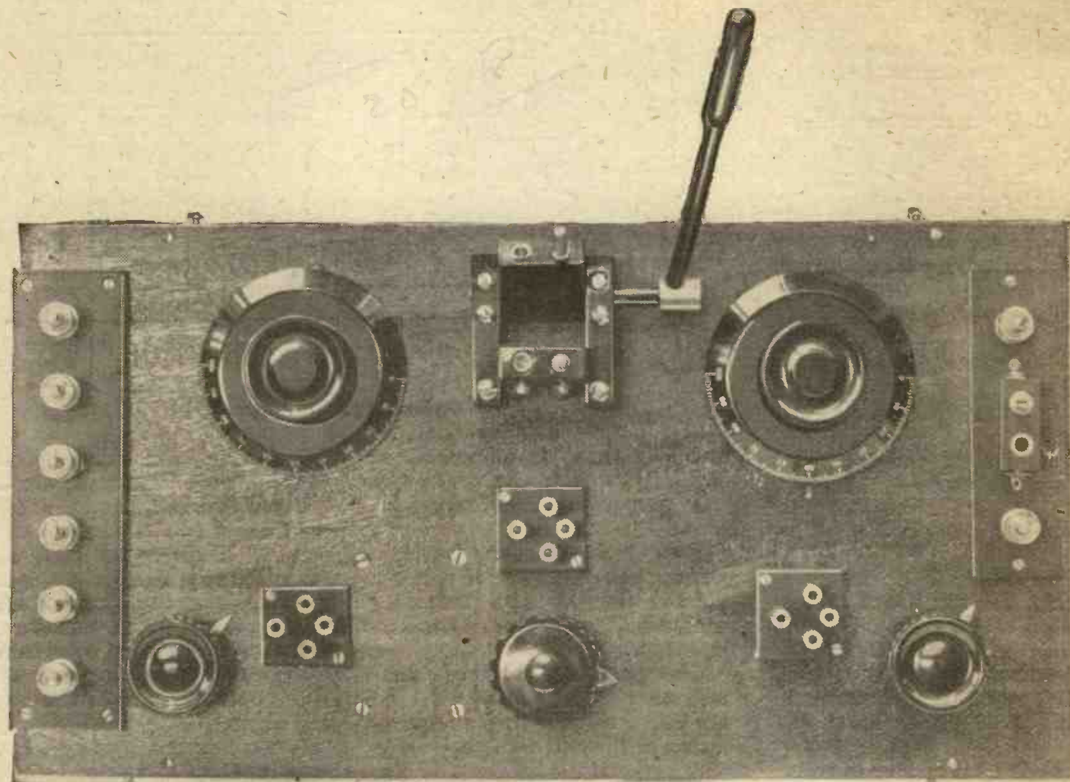
THE man who wishes to build his own wireless receiving set is frequently puzzled by the multiplicity of designs offered to him. The three adjectives, "simple," "efficient," and "selective," have been rather overworked and the reader usually looks for something more definite than mere generalities.

A good all-round broadcast receiver can consist of one high-frequency amplifying valve, and a detecting valve using reaction. If this is properly arranged oscillations will not get back to the aerial and cause disturbance. With two such valves when conditions are anything approaching normal we can hear all the broadcasting stations on a reasonably good aerial. The distant stations, however, will be weak and the nearest will not be sufficiently strong to operate a loud speaker. We can remedy this weakness by adding a third valve to act as a low-frequency magnifier, the complete set then consisting of three valves, one high-frequency, one detector and one magnifier. The present set contains these three valves used in the way described and all three operating at as near as possible their maximum efficiency.

To the inexperienced builder, the winding of big cylindrical inductances and making suitable tappings, together with the rather intricate soldering of wires to a stud switch or switches, rather puts such a form of inductance out of court. Our receiver is therefore designed to take standard plug-in inductances. The advantage of building a receiver to use such plug-in inductances is that if we only desire to receive, say, the British broadcasting, which is confined to a relatively small wave-length range, very few coils will meet our needs. We can start with these coils and later, if we desire to get long wave-length concerts, such as those from the Hague, the Eiffel Tower, and the Radiola Concerts in Paris,



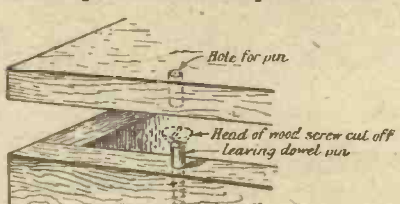
The complete receiver ready for use. The conventional ebonite top panel is dispensed with, and wood substituted without loss of efficiency.



Looking down on the instrument to show disposition of parts.

we can buy the additional coils as needed.

Another point of importance in designing a set is the question of complication of wiring. Many people like to build a set in which switches are provided to make various combinations of valves, such as a detector valve alone, a detector with one note magnifier, a detector preceded by a high-frequency valve, or all three together. I have already designed such a set, and it has proved very popular, but in practice it will be found that such flexibility is very little utilised, and if we do away with it we can obtain a very great simplification of wiring and some slight increase in efficiency. In the present set there is no switching and no means of making unnecessary changes from one arrangement to another. In practice it is a simple matter to use only two valves instead of three for receiving the local broadcasting, for all we need do is to turn off the filament of the first valve. The set will then function quite satisfactorily on strong signals without this valve, and accumulator current is thereby economised. If the signals are still too strong, we can detune the set slightly by turning one or other of the dials until the strength is brought down to that which we prefer to hear. All of the component parts are standard, and any good make will do. With the particular circuit used, for example, almost any make of transformer will give some kind of result, and there will be no howling or other troubles. In dual amplification circuits the choice of the transformer is a very important matter, and I have found that makes of transformer which work quite well in an ordinary circuit such as this are not always satisfactory in a dual amplification receiver such as the S.T. 100. This dual amplification receiver, whilst ideal for reception on a loud speaker from the local broadcasting station, is not always satisfactory for the reception of long-distance signals.



How the lid is attached to the box.

List of Component Parts

The following, then, are the components needed :—

One wooden box with detachable lid of the size to be given.

Eight terminals.

Three sets of valve sockets. (If the ebonite form of socket is bought, this should have a flange for screwing down to the wood. If the separate pins are bought, then they should be mounted on pieces of ebonite, described below.)

Two variable condensers, one of .0005 microfarads, and the other of either this valu e or an size down to half of this value (.00025 microfarads).

One fixed condenser .0003 microfarads.

One fixed condenser .001 microfarads.

One fixed condenser .002 microfarads.

One fixed condenser not smaller than .01 microfarads and, with advantage, as large as 1 microfarad.

One grid-leak (2 megohms).
One pair of clips for same.
Three filament resistances for panel mounting.
One L.F. inter-valve transformer.
One separate coil socket.
One two-coil holder.
Quantity of No. 22 tinned copper wire for wiring up.
Insulating tubing for covering above.
One ebonite strip 1½ in. by 6½ in. by ¼ in.
One ebonite strip 1½ in. by 4¼ in. by ¼ in.
One ebonite strip 2¾ in. by 1 in. by ¼ in.,
And, finally, if the separate valve legs are used,
Three ebonite pieces 1¼ in. square by ¼ in. thick.

Suitable coils for set.

If only British broadcasting is required a No. 25, 35, 50 and 75 Igranic or a set of Burndept concert coils or any similar set of coils to cover the broadcast band will do. If all broadcasting, British and Continental, is required, then a set of plug-in coils up to and including a No. 400 coil will be needed. One or two makers use a different denomination for their coils; Messrs. Gambrell Bros., for example, use A, B, C, etc., for theirs, but any firm will supply suitable coils if this set is mentioned.

If the reader has nothing whatever in the way of accessories, he will also need for the set :—

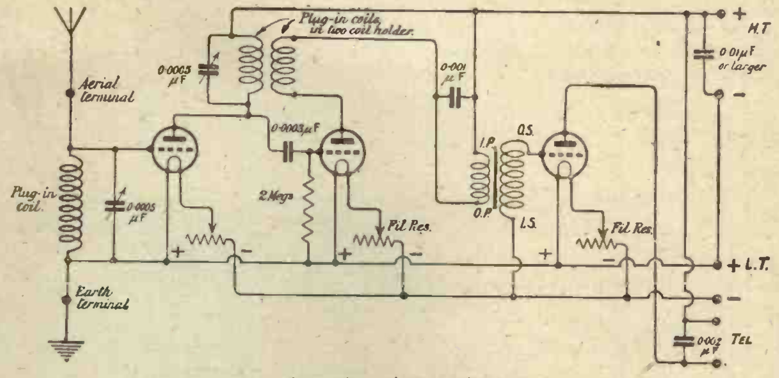
One accumulator of 6 volts and not less than 30 ampere hour capacity (actual) and preferably a 40 ampere hour (actual) capacity.

One high-tension battery, which should not be of a lower voltage than 60 and preferably should be tapped from 60 to 100 in steps.

One or more pairs of high-resistance telephones will be needed, according to the requirements of the listener (4,000 ohms will suit). If the reader is within, say, 10 or 20 miles of a Broadcasting station, then it may be desired to use the set to work a loud speaker. Any good high-resistance loud speaker will work with this set satisfactorily.

Unfortunately, there is no standard size for the various wireless components, save for such matters as the spacing of valve pins and the sockets for plug-in coils. Variable condensers, for example, are widely different in size for the same capacity. The best made are comparatively small, and indeed I could name two makes of condenser of identical capacity in which one is exactly twice the depth of the other. Filament resistances also vary slightly in size, and for this reason it is advisable to obtain all of the components first before you decide upon the size of the box to take them.

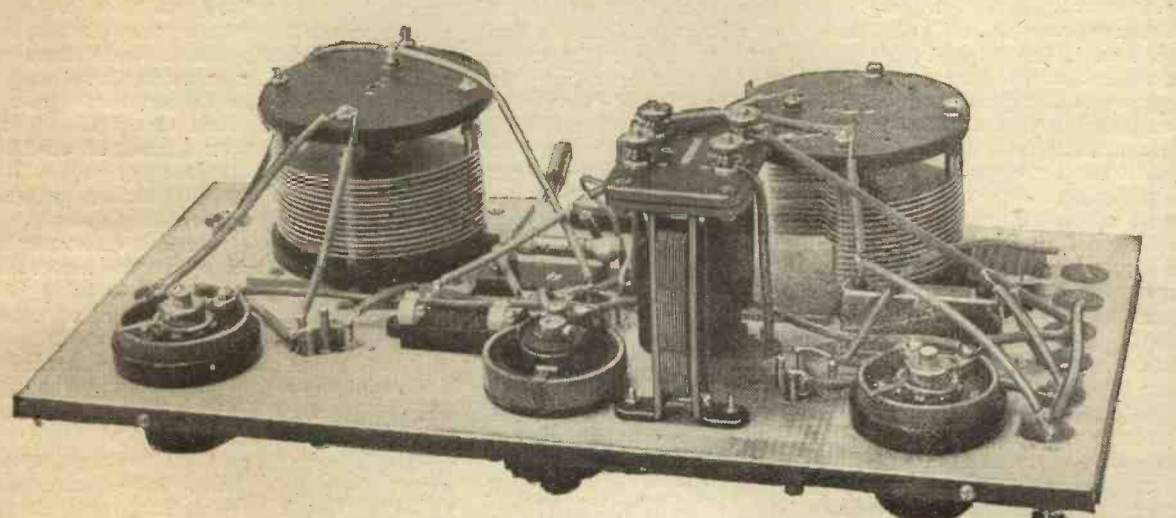
My own box measures 15in. by 8in. by 4½ in. deep, the wood being ⅜ in. thick. This is about the minimum size for the components available, and it would be advisable to make the box somewhat larger than this in most cases.



The theoretical circuit diagram.

Cabinet Work

For some reason or other, builders of wireless sets seem to fight shy of doing their own cabinet work seeming to imagine that such work is beyond their ability. Actually, however, the building of boxes for



The underside of the top panel, showing general arrangement and wiring.

wireless sets is quite a simple matter. Planed wood ⅜ in. thick can be obtained from any timber yard, and if the sizes are marked out carefully and the wood is sawn with a large hand saw it will not be found difficult to make good straight cuts. The sides of the box and the bottom can then be screwed together with or without glue. As the wood is bought already planed, the only finishing necessary before staining is to give the box a good rub down with emery or glass paper, after which a coat of water stain, followed by a coat of spirit varnish or, simpler still, a couple of coats of the combined varnish-stain, which can be bought from any oil-shop, will give the box a quite presentable appearance.

The only special point to be mentioned in regard to the box is the lid and the method of attaching. First of all, I intended to hinge the lid along one edge, so that it would lift and reveal the underside of the panel. However, on trial I found that there would not be sufficient clearance of parts to allow this, so I have made the set with a loose lid which fits on to four pins on the upper edges in the manner shown in the first illustration. These pins prevent lateral movement and four hooks hold it down securely in place. Of course, it is a simple matter to screw the lid down, but from what I know of wireless experimenters, they much prefer to be able to remove the top of the set to show the inside of the wiring, etc., without need of undoing any screws, which may spoil the appearance of the top by constant removal.

The first thing to do is thoroughly to examine the photographs and diagrams accompanying this article, and see the exact disposition of the parts. Do not try to improve the arrangement, but follow the actual design as closely as possible. For example, it may occur to you that it would be more convenient to place these filament resistances on the front of the instrument, and particularly you may not like the idea of placing the detector filament resistance behind the detector valve. All of these points, however, have been incorporated in the design for some specific purpose. Far more than the beginner realises, the actual disposition of the parts, the positions of the wires and lengths of these wires have a vital bearing upon the efficiency of the set. It is one of the most important features of the present design that the leads connected to the grids of the valve are exceedingly short. This shortness of lead is only obtainable by careful arrangements of the parts, and I would again emphasise the necessity of following the design carefully if you are to obtain the same excellent results that have been given by the original set.

By laying out these parts on paper in the manner shown, you will be able to see what space they will take, and this, of course, will determine the size of the top of the box. As to the depth of the box, it will need to be just deep enough to allow the condensers and transformer to clear the bottom. If, for example, Polar condensers are used and some makes of intervalve transformer which can be placed horizontally, then the box can be made shallower than that shown. If, on the other hand, variable condensers with widely - spaced plates are used, the box will need to be deeper.

Make the box completely first of all, for although you will find it necessary only to use the top of the box for the mounting of the apparatus, the rest of it will be very convenient as a support for the set when you are wiring it. The top should be treated with stain and varnish before any parts are mounted, as it will not be easy to stain and varnish it after the various components are in place.

Now, first of all, cut the ebonite strip of the sizes mentioned and when they are cut carefully remove the surface skin with emery paper. Although I emphasise the necessity of removing this skin in every "how to make" article I write, I still find readers who ignore the injunction, and trouble frequently arises from this cause. The outer skin of sheet ebonite is very often a poor insulator, and unless we remove this poor insulating skin we shall have all kind of noises and loss of signal strength.

Now, take the largest panel (that on the right of the instrument) and down the middle of the back scratch a line and on it mark off at inch intervals the points for the six holes which will take the terminals. Now drill clearance holes sufficiently large to take the shanks of the terminals and secure these latter in place with lock nuts.

Next take the left-hand panel which carries the plug socket, drill this to take the two terminals and also mount on it the plug socket.

Several manufacturers now make a plug socket mounted on a strip of ebonite which can be screwed to the wooden top of the case.

Two terminals should also be fitted in the manner shown in the photograph, and when holes have been cut at each end of the strip of ebonite, wood screws can be passed through it to secure it to the wooden top. Before mounting this and the other strips on top of the box, the top board should be cut out either with a key-hole saw or a large bit in a brace, so that there is plenty of clearance round the shanks of the terminals and other connections. A ¾in. auger bit will be found very useful in all this work, and the writer uses nothing else, occasionally joining up two holes with a key-hole saw.

The mounting of the three filament resistances will present no difficulty. Any standard filament resistance will do. The mounting of the two variable condensers, the fixed condensers, and the small ebonite strip (2¾in. by ¾in.) carrying the clips for the grid leak should now be proceeded with. The fixed condenser across the high-tension terminals in the author's set is a Dubilier type 577 which has a capacity of .01 μF. This is the smallest value that can be recommended in the circumstances, and the Mansbridge type of condenser with any capacity above this and up to, say, 1 μF will suit even better. However, the Dubilier type 577 has the advantage in ease of mounting and takes little space.

The intervalve transformer in the illustration is the Ferranti transformer sold as the "H.D." Any of the good makes of transformer work excellently in this circuit, and unlike those which are used in dual amplification circuits, it is not essential that they should have a low self capacity.

The three valve sockets can be of the type with a flange obtainable from practically any dealer, as these can be mounted on a wooden panel with ample clearance round the pins. However, at the time of making this set the writer had not such flanged sockets by him, and, therefore, cut three pieces of ebonite about 1 in. square, on which were mounted four separate sockets. This method can be followed in those cases where the flanged sockets cannot be obtained. The ordinary type of ebonite socket cannot conveniently be used on a wooden top, unless it is separately mounted on a small ebonite base.

A small ebonite strip will be noticed between the two variable condensers. This is merely a securing piece for the flexible leads which pass through the top board to the movable coil socket above. It is not wise to have loose leads on the inside of a set, and by this means they are held securely in place. This strip need not be of ebonite, as the wires themselves are insulated —a small strip of wood will suit excellently. It can be held by a central wood screw.

As soon as the two-coil-holder is in position and the other components have been mounted, it will be necessary to drill four holes for the leads to this holder. The flexible leads which go to the moving socket can be made of ordinary electric light flex, untwisted, the two ends being secured to the movable socket and pushed through the top board before the under wiring is commenced.

Wiring Up

The wiring up will present no difficulties if the diagram is carefully examined. As usual a full-size blue print is available at the standard price of 1s. 6d. from the offices of this magazine.

The top panel is secured to the rest of the box by four brass pins. These are fitted as follows :—First of all four wood screws of a suitable size are selected and four holes drilled through the top when it is exactly in position on the box. The drill should be allowed to pass through the panel and just into the box beneath, to form a marking point for inserting the screw. When the four top holes have been drilled and marked as seen on the edge of the box beneath, the top should be lifted off and four wood screws screwed into the wood of the edge of the box, the shanks being allowed to project for a distance equal to the thickness of the top panel. With a file or hack-saw the heads of these screws are now cut off and the tops filed smooth. The top panel can then be replaced and the four cut-off screws will hold it in position and prevent a lateral movement. To hold the top down four hooks of the conventional type are fitted, together with four round-headed screws. We thus have a very convenient method of holding the lid in place and of removing it rapidly without undoing a number of wood screws.

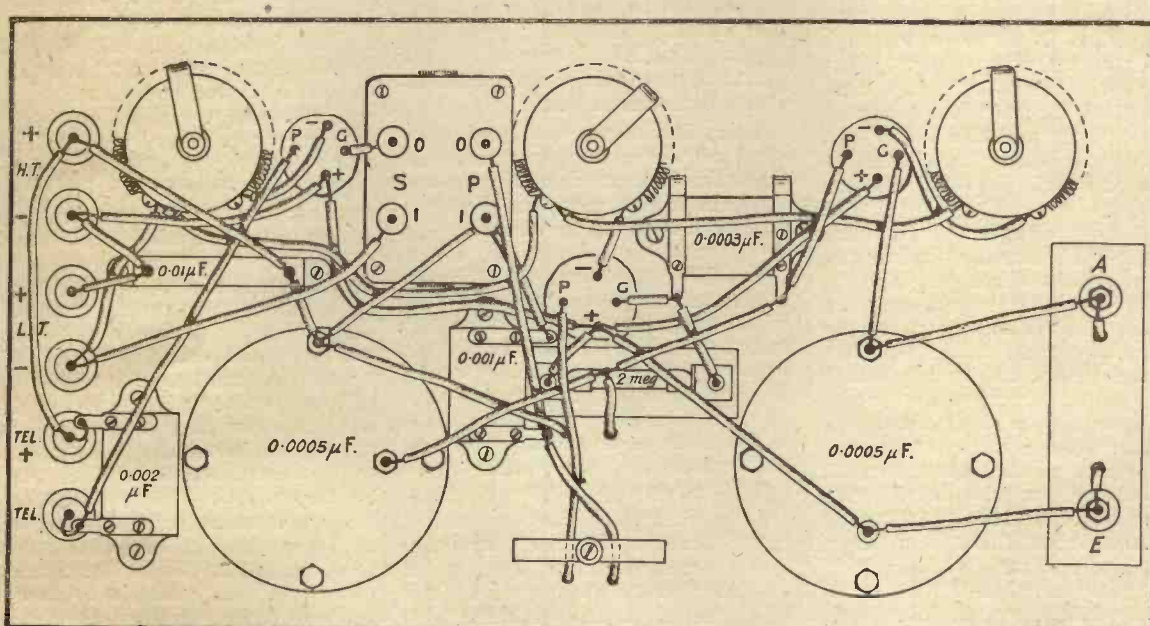
How to Use the Set

When the wiring has been finished and everything is in place, we will have to connect the aerial and earth leads, the batteries and the telephones. The panel on the right-hand side carrying six terminals is used as follows, reckoning from the top :—

High-tension positive.
High-tension negative.
Low-tension positive.
Low-tension negative.
Telephones.

The upper telephone terminal should be connected to the telephone lead marked with a cross ; this is necessary if the magnetism of the telephones is to be preserved. The same remark applies to loud speakers.

For broadcast reception from British stations, we shall require a set of four coils. The smallest coil should be plugged in the aerial socket ; the next size in a fixed socket and the largest of the three in the moving socket.



Practical wiring diagram.

First trials should be made with the nearest broadcasting station, which if situated within 50 miles or so will be very easy to pick up. The aerial condenser should be placed at about 30 and the anode condenser at about the same figure, and the moving coil should be gradually brought up against the fixed coil until at a certain point a "plop" will be heard, and a slight hissing in the telephones. This indicates that the set is oscillating. This oscillation does not reach the aerial, so there need be no fear of causing interference to neighbours' reception. When this hissing noise is heard, both condensers should be varied until a high pitch note is heard which sinks lower and lower as the condensers are moved. Now vary both condensers until you reach the point when the note, having passed from a high to a low tone, reaches to inaudibility. You will find that this point is on the tune of a station you wish to hear, but any telephony you may notice will be badly distorted. Now bring away the moving coil from the fixed until this distortion ceases and a slight readjustment of both condensers will give you good results. When you have practised tuning a few times in this way, you will find no difficulty in picking up the other stations by varying the two condensers. If both condensers are .0005 μF it will be found that a very slight alteration of the anode (right) condenser will change from one station to another. If you find it is difficult to stop at the correct point it is a simple matter to fix an extension handle to this anode condenser, when tuning will be much easier. Extension handles to fit the standard variable condenser knobs are now sold by most wireless dealers, or can be made up by the handy man from odd scraps of ebonite.

A range of about 40° will cover the wavelength band for British stations on a .0005 μF anode condenser, while with many aerials it will be possible to hear all of the stations on a No. 35 Igranic, No. 2 Burndept or "A" Gambrell patterns respectively, to mention three well-known makes. Where possible, however, the aerial tuning condenser should be used with the largest coil which will give the station being listened to. If the set is to be used for only British broadcasting, it is recommended that the anode condenser be of a value not larger than .0003 μF, as this will make tuning much easier, but if it is desired to use it for the longer wave Continental broadcasting as well, the value of .0005 μF should be chosen. The following are coils necessary for the Continental stations most popular among listeners-in.

EIFFEL TOWER.		
Aerial	......	200.
Anode	......	300.
Reaction	......	400.
RADIOLA CONCERTS.		
Aerial	......	150.
Anode	......	200.
Reaction	......	300.
DUTCH CONCERTS.		
Aerial	......	100.
Anode	......	150.
Reaction	......	200.
KONIGSWUSTERHAUSEN.		
Aerial	......	300.
Anode	......	400.
Reaction	......	500.
LYONS.		
(Same as Konigswusterhausen.)		
SCHOOL OF POSTS AND TELEGRAPHS, PARIS.		
(Same coils as used for British broadcasting.)		

The wavelengths and times of these stations will be found by referring to the broadcasting table on another page.

CRYSTAL NOVELTIES

On page 503 of the August issue we commented on the fact that the pre-war crystals, silicon and iron pyrites, seemed little used to-day. We have received from Mr. A. Hinderlich, of Willesden Green, some exceedingly good specimens of these two crystals, together with his new crystal Ghane. This crystal is now undergoing test, and reports regarding it will appear in our next issue. Meanwhile, we may say it has an appearance quite different from that of other crystals, being of a greenish colour and of semi-transparent appearance. The crystals supplied by this firm are sent out carefully packed in glass tubes, and if necessary can be supplied ready mounted in brass cups with screws for attachment to the stand. This is a feature which should recommend itself to many users, as several crystals are injured by heat and some skill is required in mounting the crystal to avoid overheating of the wood metal which surrounds it.

TRADE NOTES

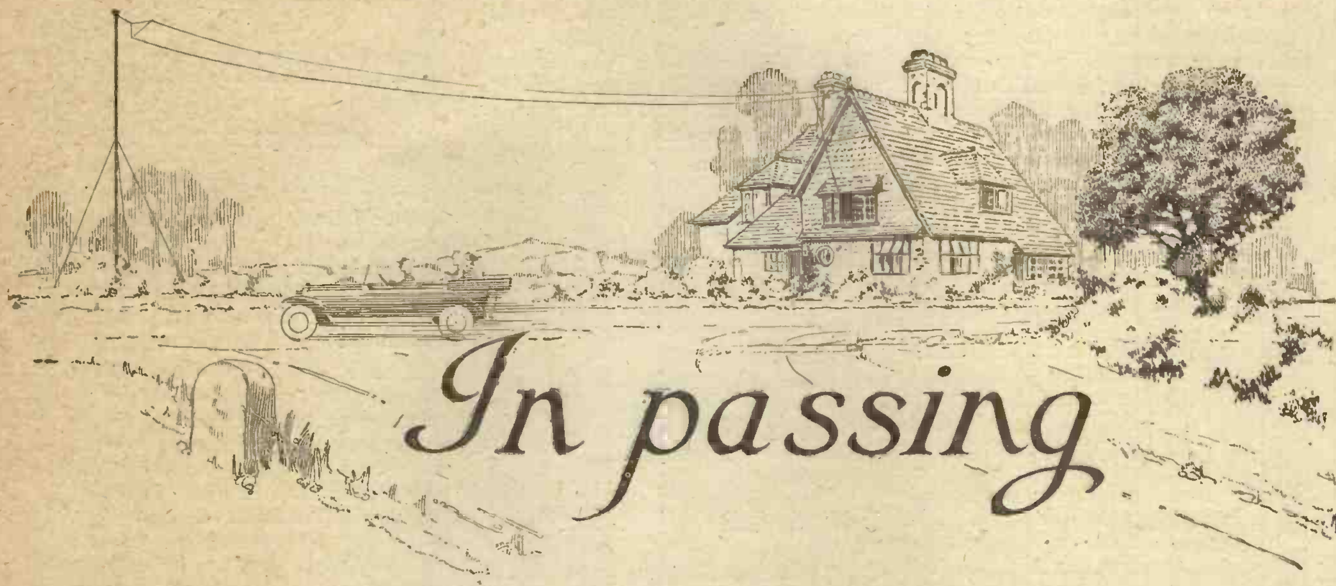
Messrs. Burne-Jones and Co., Ltd, of Kennington Road, S.E.11., ask us to draw attention to an inaccuracy in their advertisement in No. 7 of MODERN WIRELESS—"1,000-ohm resistances with clips" should read 100,000 ohms.

The Ever-Ready Co. (Great Britain), Ltd., send us their excellently produced catalogue of dry batteries, accumulators, etc., suitable for wireless work. This gives full particulars of the Company's well-known high-tension batteries and special low-tension dry batteries for use with dull emitter valves. A typical battery of the latter class is their W562 three volts, having a burning capacity of 500 ampere-hours. This is designed to work with the D.E.R., $L.T_1$ and $L.T_3$ valves. The length of life of this battery is easily calculated by dividing the ampere consumption of the dull emitter valves used into the capacity. Thus we see that such a battery is ideal for the country user.

Messrs. Economic Electric, Ltd., of Fitzroy Square, London, W.1, advise us that they have received a postcard from a Mr. C. M. Wilson referring to an article in the June issue of MODERN WIRELESS. This gentleman omitted to put his address on the postcard, and therefore the firm are unable to reply to him until receiving further notice.

Messrs. Ward and Goldstone, Ltd., send us their radio list No. 102, containing particulars of many kinds of crystal and valve set and numerous accessories. Among other novelties we notice the "easifix" flexible conductor wires for connecting up wireless panels, accumulators, etc. These are finished with tags for easy connection, and should prove very useful to the amateur.

The announcement by the M.O. Valve Co., Ltd., The Mullard Radio Valve Co., Ltd., and The Ediswan Electric Co., Ltd., that the prices of their dull emitter valves have been reduced to £1 7s. 6d. each is welcome news to all experimenters.



In passing

The Return of the Basker

AND so the end of the holidays arrives. As you read these lines you are probably sitting in the train, which is whirling you away from the rural delights of the remote spot which you chose for your change of air towards your town house and your wireless set. Possibly you are wondering, whether during your absence the aerial trim and taut has fallen into your neighbour's garden; you may be a little uneasy about the accumulator, which in the frenzied rush of your departure you forgot to take to the charging station for safe keeping; or it may be that you are asking yourself whether in the absence of Tiddles, the feline guardian of your home, the mice have been dining off the insulation of your wires and making comfortable nests within the coils of your inductances.

But whatever your train of thought may be, I'll wager that you are looking forward to a return to your wireless set. Your fingers itch to feel the touch of knobs and handles again; your ears long for the clinging caress of the telephones. It is most unfortunate that you cannot return to wireless without also returning to work. That is the one little cloud on the horizon. You are a little sorry for yourself on this head, and I am sorry for you, too, though my sorrow is lightened by a smile, for whilst you have ended your holiday I am just beginning mine. Whilst you lounged and basked on the beach in care-free sloth I was toiling and envying you. Now as you journey homewards I am travelling towards the fastnesses of Wales armed with a salmon rod and praying mightily for rain.

The Welsh Problem

They tell me that the valley for which I am bound is a wireless blind spot. I shall be able to test the accuracy of this statement, for I am taking with me a tiny set. It has three of the silliest-looking little valves that ever you saw—wee, dumpy things half the size of a sturdy respectable Ora. But the trio need no accumulator to feed their filaments; they are perfectly satisfied with what dry cells give them, and five flashlamp batteries appease the hunger of their plates. Thus my holiday set is contained in an attaché case. I can take it out fishing, if I feel so minded, rigging up an aerial, should the salmon prove sulky, as salmon will, with my rod and a length of flex. One little doubt assails me: if Cardiff is to be my broadcasting station for the time will my American "toobs" be able to amplify and detect Welsh? Will they impart a nasal drawl to the tones of Cymry, or, appalled by strings of ll's and dd's and syllables that sound like the remarks of Fido when he has inadvertently licked a blob of mustard off the plate, will they burst asunder in sheer despair? If someone could only invent a valve that would anglify as well as rectify I should feel happier about my receptions of 5 W.A. Three stages of anglification should enable one to get on terms even with the most forbidding of Welsh sentences.

The Tale of Horace Pottinger

Speaking of foreign tongues reminds me of the way in which the downfall of Horace Pottinger was recently brought about, to the no small satisfaction of all who knew him. Pottinger, I should explain, is the kind of fellow for whom geese lay golden eggs. He started a wondrous system whereby for a trifling payment of fifty guineas scraggy ladies could become as plump as partridges or those inclined to undue adiposity could be pared down to sylph-like proportions—I forget which. In any case the desired transformation was guaranteed to come about with a rapidity that was little short of miraculous. There was no doubt that his system produced effects, or at any rate he was able to persuade his victims that it did. As no woman is ever quite content with herself as she is, business was brisk, and Horace amassed a large fortune. So far there is no stain on his character. All is fair in love and war, and he waged a successful war on fat (or was it leanness?).

But once he had reached fame and fortune Horace became a terror to all. Though he had retired from business he retained his pushfulness. He was ever striving towards the top of any tree that he encountered, and he cared not a whit whom he pushed off in his upward struggles. And so when wireless came to our peaceful little community it roused Horace to resolve that he should occupy the foremost position amongst those who wangled condensers and lied glibly about their wondrous receptions.

How He Waxed Lippish

His wealth enabled him to keep always one step ahead of us. When we installed small sets with naked crystals Horace had a detector, which nestled within a glass sheath. As soon as we provided ourselves with glazed shelters for our crystals he went one better by boasting loudly of his single valve set. We followed, but Horace forestalled us by sprouting a second, and thereafter he always kept one valve ahead of the rest of us. His aerial was a little higher, his signals a little stronger than any of ours.

In short, he elbowed his way into the leadership that he coveted. He became the recognised authority. "Ask Pottinger" became the watchword of those in difficulties—not that he was able to help them much, but those who consulted him and failed to obtain plain answers to their queries were so impressed by his ready flow of long words that they felt that if they did not understand it was their fault for being so dense. Need I say that he pushed his way into the chair of our Wireless Club? Once there he became insufferable. He would buttonhole you in the street and tell you in a patronising, rather pitying way that, of course, you couldn't expect to get much in the way of signals with an aerial like that. Did he come to your house to hear what your set could do, he would place a stubby forefinger on the aerial terminal and say, "H'm, yes, I thought so. Of course, you know you're oscillating. Now, you should just see my new set . . . ."

The Conspiracy

We were under his thumb. We were Pottinger-ridden. The man was a pest, an incubus, a thing no longer to be borne. But how to get rid of him, how bring him toppling from his perch? That was the problem. The place seethed with rebellion. A few of us had determined that we would no longer stand his horrid domination. We were pledged to bring him crashing to earth or perish in the attempt. Many schemes were brought forward by members of our little band of liberators, but all were rejected for one reason or another as unsuitable. Snaggsworth proposed that we should import a genuine expert who should be introduced at the next meeting of the club as a visitor; he would ask the chairman questions and proceed to tie him into complicated knots. But no one knew of a tame expert who was available.

Inspiration Comes

And then the great inspiration came to Gupsfield. We had long looked upon Gupsfield as the rightful occupant of the throne usurped by Horace Pottinger, for he is an enthusiast of the first water, though a modest and a charming man withal. Such was his passion for wireless that he had christened his twin she-babes, despite the vicar's protests, Capacity and Radia. He wanted, it is said, to name the latter Inductance ("You can call 'em Constance or Prudence, so why not Inductance?") but Mrs. Gupsfield managed to squash this idea.

Gupsfield's scheme was fiendish in its ingenuity, and as it promised excellent results and presented no great difficulties for its carrying out it was adopted by acclamation. We had but to await a suitable opportunity, which was bound to arrive sooner or later, and the thing was done. Pottinger's descent into the soup was merely a matter of time.

The Blow Falls

The opportunity for bringing off our grand coup presented itself during the following week. The Doctor had just installed a new set and he and his wife invited all of us to go round to hear what it could do. We held a meeting of conspirators on the previous day, when every detail of our plan was worked out.

We turned up at the Doctor's not in a body, but separately. Everyone was there, the supporters of Pottinger, certain lukewarm backboneless creatures who had refused to take any side, and the enemy in the persons of our little band of brothers. When we had heard speech and music Gupsfield asked guilelessly whether the set could be tuned to the longer waves. Soon the ping, ping, ping of morse filled the room. "Oh," said Mrs. Grinslott, who had been let into the secret and had received her instructions, "oh, I do wish I knew what it was saying. It may be something fearfully interesting. How thrilling it must be to be able to read morse! I'm sure you can understand it, Mr. Pottinger, you are so clever."

The Woolly Socks

With an indulgent smile Pottinger produced pencil and paper and wrote quickly. When the signals ended he read out "H'm, not very interesting, I'm afraid; it says 'Plenty of cotton on offer, but few buyers. Prices tended to sag, but recovered slightly towards the close.'" "Are you quite sure that's right?" said Hawksby sweetly. A pencil was in his hand and a scrap of paper lay on his knee. "Of course I'm sure," said the Great Man. "I can read morse, if you can't. What did you make it?" With the accents of Cockayne Hawksby read out "N'oublie pas de porter tes chaussettes de laine chéri, ou tu t'enrhumeras. T'aime infiniment, Marie." Pottinger blanched but held his ground. "Absolutely nothing like it," he cried. "It was a market report in English." Then he noticed that Snaggsworth was also displaying a pencil and a piece of paper. "You'll bear me out, Snaggsworth," he said. "I don't think it's a market report," replied the second conspirator, "it's something about wearing woollen socks to avoid catching cold. A little message in French from someone called Marie." Then he handed his paper to the Doctor, who also took Hawksby's. Word for word, letter for letter, the two were the same. We had been careful of that when we wrote them out the night before.

The Fallen Pottinger

A chilly silence settled upon the room. Pottinger gave one wild glance around, then fled from the door. As no one else had attempted to read the message all were convinced that he had been bluffing and that he had covered up his inability to decipher morse by concocting the report. And so Horace Pottinger was crushed for ever. The finger of scorn is now pointed at him by all and sundry, and if he shows any signs of his old uppishness you have but to ask him what is the state of the cotton market or to make reference to the advisability of wearing woollen socks in changeable weather. So perish all such nuisances as he!

THE LISTENER-IN.

FROM CRYSTAL TO VALVE

Some advice to those of our readers who are anxious to change from crystal to valve reception.

By JOHN SCOTT-TAGGART, F.Inst.P., Editor.

VERY few stop at the crystal stage. The term "crystal scratchers" is a product of the broadcasting era, combined with the snobbishness of those who use valves and imagine that they are on a different plane to the humbler user of the crystal detector. I do not know what the pre-war enthusiast would have said if he had been called a "crystal scratcher" by, say, the user of a magnetic detector. For myself, I regard a crystal user as a person to be accorded full respect as an initiate of the mysteries of wireless —provided, of course, crystal scratching is merely a phase.

In pre-war days we used to think that there was a great deal to learn about crystal receiving circuits. Numerous experiments could be carried out and the person who discovered that a piece of graphite pressing on a special mineral ore gave good signals, was looked upon as an inventor of the highest order. Nowadays, of course, our attitude is very different, and even the production of a new valve without any filament or high-tension battery would be treated with studied calm. At least 500 people will have done it before, or wished they had done it before, which really amounts to the same thing. Nevertheless, the further one delves into the subject, the more fascinating does it become, and there is practically no limit to the experiments which may be carried out by the aid of valves, and there are still many problems to be solved.

Pursuit of research in the direction of crystal receivers is an almost hopeless task, while valves present a much more interesting field for work. I therefore counsel everyone who has had some little experience with the humble crystal to get on as soon as possible to the use of valves.

In this article I am not going to go into technicalities, but merely wish to chat informally to you about the line to follow when joining the ranks of valve users.

I advise everyone starting wireless to make up, first of all, a crystal receiver. I have heard of dozens of would-be experimenters who, instead of starting at the beginning, have attempted to make a four-valve set straight away, and when they get into trouble, have worried their wireless friends. The whole of my time is spent in trying to help 100,000 readers of my papers, but if I had the time and I were asked by a friend to tell him what was wrong with his four-valve set, his first venture in wireless, I would decline to do so. There must be thousands of ill-advised beginners who, instead of trying to learn to walk first, make a strenuous, but often futile, effort to run, and then waste the time and tempers of their wireless friends. If you *will* do this sort of thing you must expect to be treated as a nuisance. Your friend may begin by explaining to you what is wrong, and you will not have the slightest idea what he is talking about. He may tell you, for example, that there is not sufficient damping in the anode circuit of the second valve, and you will probably ask him how it should be done. No one wants to explain a subject to a beginner who has not even an elementary knowledge of the subject. If, then, you have been foolish enough to begin where most people nearly end, take your set when you are in trouble to a wireless dealer who knows his business. Don't take it to a neighbour whose friendship you value.

You will, of course, immediately ask "Do you expect me to make up a dozen different kinds of sets before I shall be graciously allowed to make a four-valve set?" I answer this by another question: "Are you intending to take up wireless as a hobby or do you want simply to make a single set which will enable you to get broadcasting cheaply?" If you are only interested to the extent of making a set which will get you broadcasting, and which you will not want to alter in any way later, I would probably tell you that the best thing you could do would be to follow very closely the instructions given in a book or wireless journal for making a given set. It is an actual fact that frequently 25 per

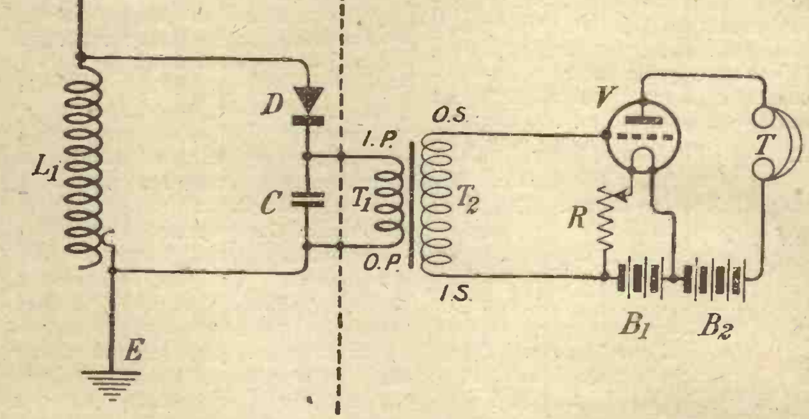


Fig. 1.—How to add a single-note magnifier to a crystal set.

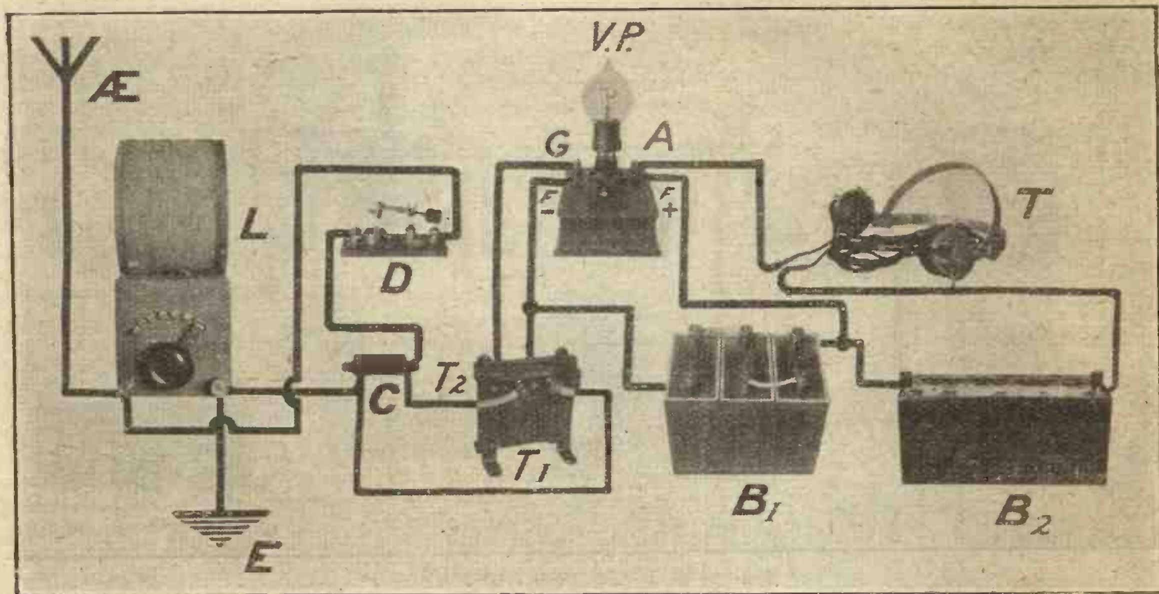


Fig. 2.—A pictorial representation of Fig. 1.

cent. of those who make up a set according to printed instructions do not get the fullest results. The design may be perfect, the instructions explicit, but the beginner without any technical knowledge or interest will probably fail. He has probably forgotten a connection, or the accumulator is reversed, or the high-tension battery is the wrong way round, or something stupid of that kind occurs.

If you are wise, you will want to know something about how the set works. There is nothing technically difficult about the way wireless sets work, whether they use crystal detectors or half-a-dozen valves. Books on the subject are published and written in a manner which even the beginner can understand, and in this respect the wireless enthusiast is probably far better catered for than any other hobby or art.

As to making up several sets, this again depends upon what you mean by "sets." If you mean beautifully made cabinets using first a crystal and a valve, then a crystal and two valves, and so on, I would say that such a procedure would be a waste of good money and time.

How I, personally, would recommend you to gain experience, is by making up skeleton sets. That is to say, sets which are little more than circuits with different components connected together by loose insulated wires.

Making up a complete set which is not to be altered is quite a different matter from trying out some new circuit or gaining experience of one of ordinary type. If you will take my advice, before trying to make up a boxed-in set, you will buy or make up individual components which may be joined up in a thousand and one different ways and which may be adapted to any new circuit that may come along.

If you propose trying out a one-valve circuit, the following components should be bought or made :

- 1 valve panel, consisting of a valve holder and filament rheostat with four terminals, one going to the grid, one to the anode and two to the filament.
- 1 crystal detector fitted with two terminals.
- 1 fixed condenser having a capacity of 0.002 μF (microfarad).
- 2 variable condensers, preferably having a capacity of 0.001 μF.
- 1 fixed condenser having a capacity of 0.003 μF.
- 2 fixed condensers having a capacity of 0.001 μF.
- 1 60-volt high-tension battery.
- 1 6-volt accumulator.
- 1 pair of high resistance telephone receivers, not less than 2,000 ohms resistance.
- 1 step-up intervalve transformer.

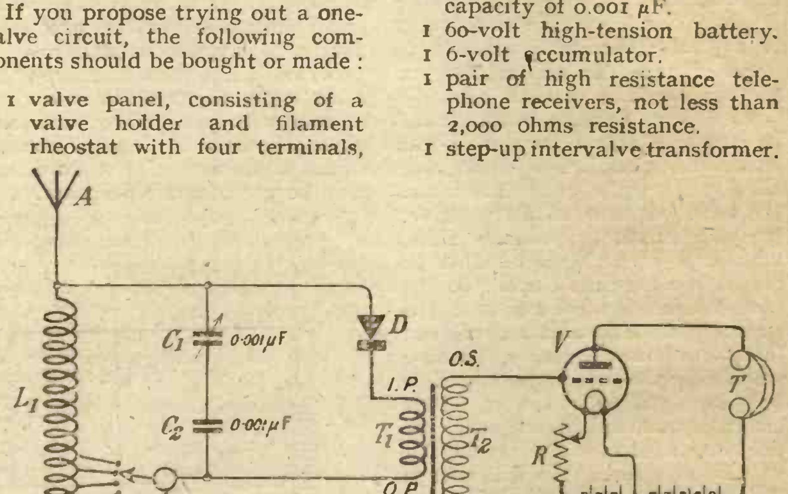


Fig. 3.—A crystal receiver using a tapped inductance and a variable condenser for tuning. Notice the fixed condenser in series with C_1. A single-valve magnifier has been added.

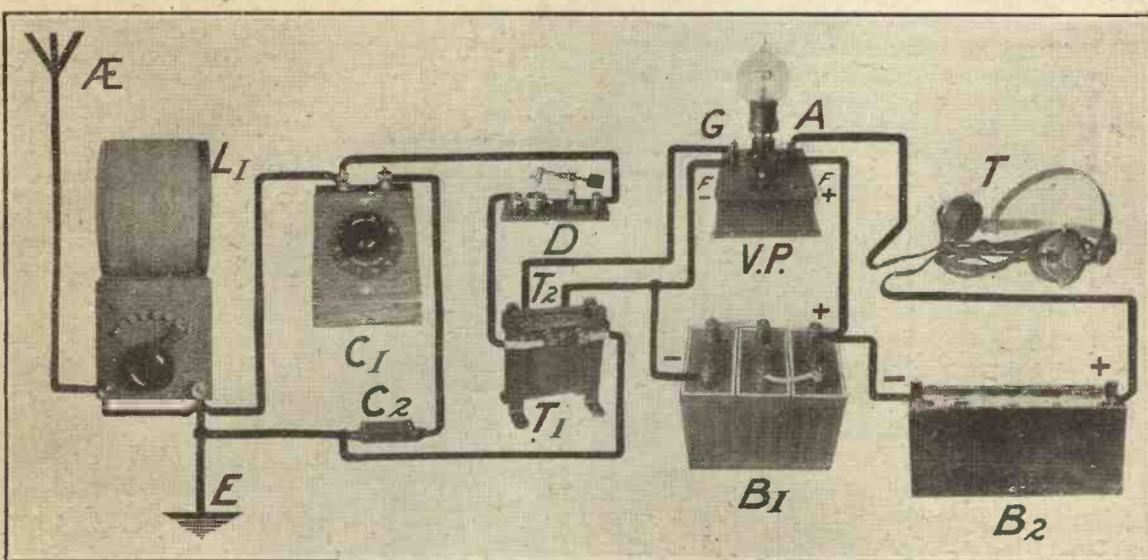


Fig. 4.—*Fig.* 3 *represented photographically.*

In addition to these requisites, it is desirable, but not absolutely essential, to have a set of fixed coils, such as the Burndept concert coils, and a three coil holder mounted on a stand with two terminals for each coil.

With reference to high-tension batteries, I would not advise having one of less voltage than 60. Generally speaking, the greater the high-tension voltage, the stronger the signals obtained. After the high-tension voltage has reached 45 volts the signal strength only increases slowly as the H.T. voltage is increased. A value of 60 volts is a good all-round figure.

As regards the accumulator, a 30 ampere-hour actual capacity accumulator giving 6 volts should be used. Don't buy a 4-volt accumulator for valve work, and what is more, always use a rheostat for each valve if at all possible. No two valves are exactly alike, and it is as well to be able to adjust the filament current to the best value. Make sure that the capacity of the accumulator is given in *actual* hours capacity, because frequently the capacity is stated to be the *ignition* capacity. This latter represents the capacity of the accumulator on an interrupted supply, and the figure will always be about twice that of the actual capacity.

As regards the valve panel, one with the terminals and valve holder fixed to an ebonite base is to be preferred, but if the expense of this is too great one mounted on a wooden base will give quite good results.

As regards the condensers, I here strongly advise buying a proprietary article. Some so-called condensers are barely worthy of the name, and their capacities vary greatly. It is hardly worth while for the beginner to make a fixed condenser, as they may be bought very cheaply.

As regards the valve to use, I have not found much difference between the different kinds now marketed. I would only warn the beginner against buying the cheap imported type of valve. Usually, these imported valves are soft, that is to say, the vacuum is very poor, and while the valves are good as detectors, they are little use when it comes to amplifying, and the experimenter with limited means wants to use a type of valve which may be used for all purposes.

If the reader will take my advics and make up the componente mentioned he can then proceed to gain some experience with valves. As he already has a crystal set, the first experiment I would suggest that he makes is to add a single valve as a low-frequency amplifier.

Adding an L.F. Amplifier

Fig. 1 shows the circuit which you should first try out. This represents an ordinary crystal receiver with a note magnifier following it. The connections are as follow :—

To the telephone terminals of the crystal receiver connect the terminals marked I.P and O.P of the primary of the intervalve step-up transformer T_1 T_2. The primary terminals are sometimes

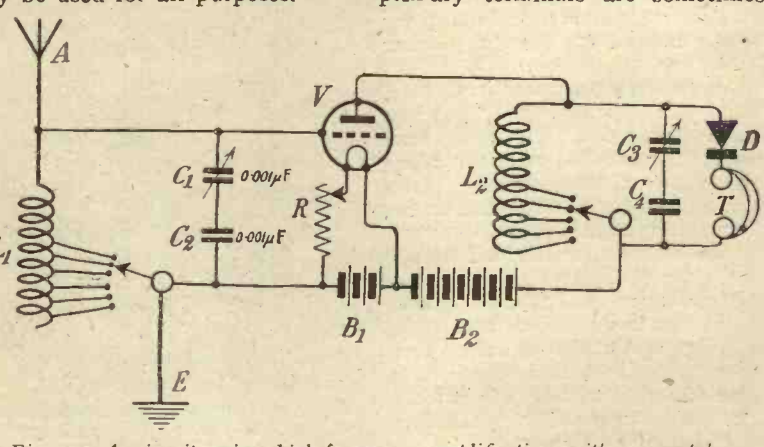


Fig. 5.—*A circuit using high-frequency amplification with a crystal.*

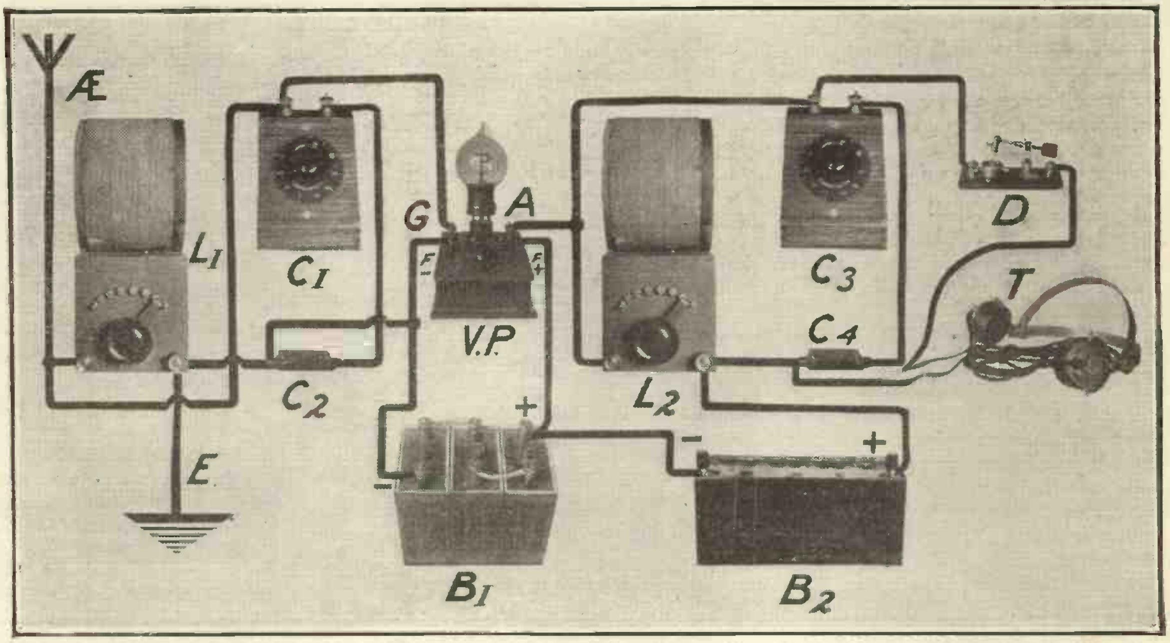


Fig. 6.—Fig. 5 represented pictorially.

marked P, but are usually marked I.P and O.P, which means "inside primary" and "outside primary." The secondary terminals, usually marked I.S and O.S, are connected across the grid of the valve and the negative terminal of the 6-volt accumulator. The terminals marked O.S should be connected to the grid and the terminal I.S connected to the accumulator. This will, in nearly all cases, give slightly better results than by reversing the connections, but whatever transformer is used, particularly one which has not the terminals marked in this manner, a reversal of connections to the secondary should always be tried.

It will be seen in Fig. 1 that the rheostat R is connected between one side of the filament and the *negative* terminal of the accumulator. The anode of the valve is connected to one side of the high resistance telephone receivers T, while the other side of these telephones is connected to the positive of the high-tension battery B_2, the negative of which is connected to the positive terminal of the filament accumulator. This completes the receiver circuit, and the only thing to do is to switch the filament current on to a medium brightness and listen-in in the ordinary way on the crystal detector receiver. The signals obtained should be several times as loud as if no valve amplifier were used.

Fig. 2 is a photographic representation of the circuit in Fig. 1. The reader who is beginning to take an interest in valves should master the methods of following out a circuit diagram. He should not rely on pictorial circuits. The average experimenter after a little practice can not only read a circuit perfectly, but he can also wire up a circuit he has in his mind without reference to paper. The beginner should not shirk understanding a circuit, and once he knows the symbols he should find little difficulty in being able to wire up a circuit, although it is no use denying that many a beginner is confused by a circuit diagram.

There are two points which should be noted when using a valve. Never have the filament brightness greater than is necessary; by having the filament as dim as possible without interfering with signal strength, several advantages will result, the chief one being an economy in the current from the filament accumulator, and still more important, the life of the valve is lengthened. The other point is in connection with the high-tension battery. Use as little high-tension voltage as you can without interfering with the required signal strength. Always treat your high-tension battery with the utmost consideration, and I would recommend using one of the types of wander plugs on the market, which is fitted with a small flash-lamp fuse. In case of a short-

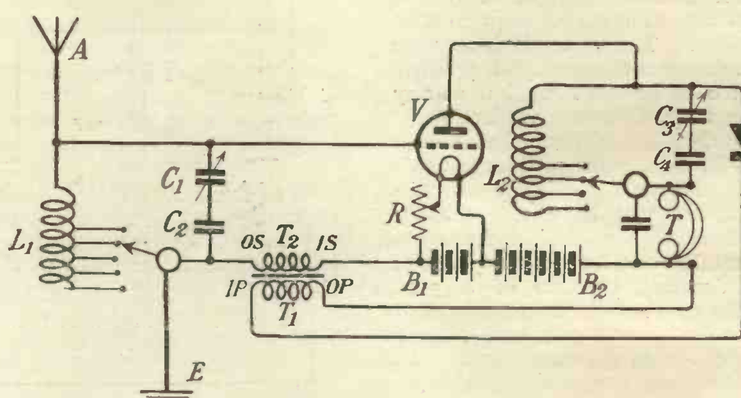


Fig. 7.—A dual circuit amplification of great interest.

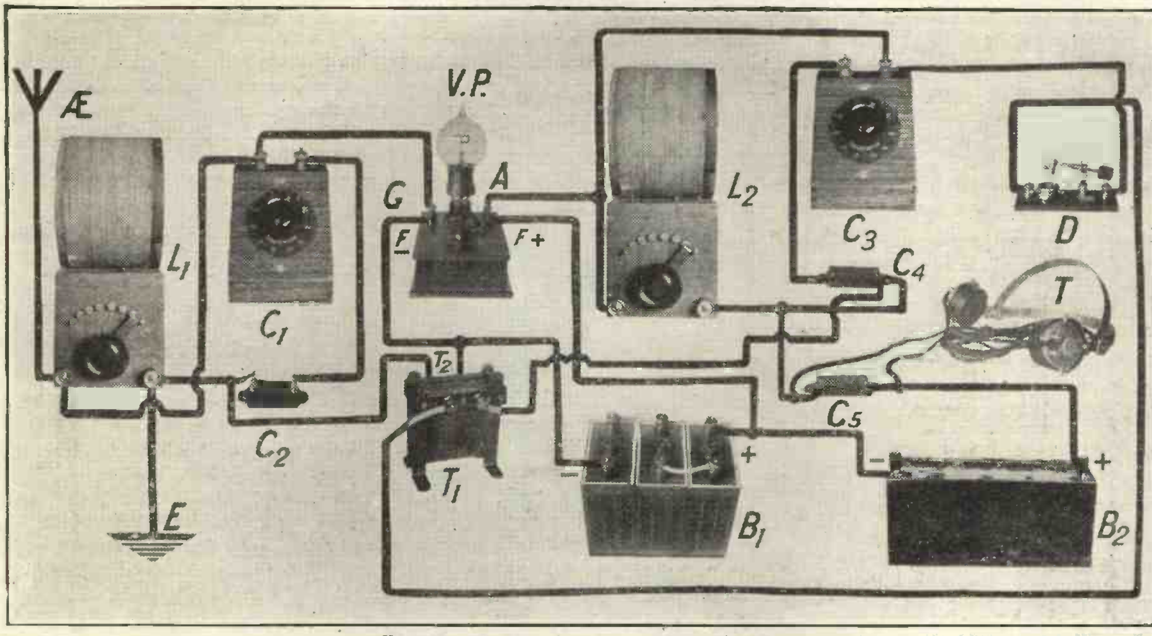


Fig. 8.—A pictorial presentation of Fig. 7.

circuit both the valve filaments and the high-tension battery will then suffer no damage. A steady short-circuit would, in some cases, burn out a valve, and in all cases injure the high-tension battery and perhaps render it useless.

A point to note, by the way, is always connect up your high-tension battery last of all, and when taking leads to the high-tension battery, or to the filament accumulator, join the wires on to the components first and then on to the battery, because if the order is reversed short-circuits are much more likely to occur.

If you buy your intervalve transformer, and you can afford to buy a good one, do so by all means. All sorts of shoddy intervalve transformers are on the market, and many of them are imported and are of very inferior quality. The price of intervalve transformers of good quality seems to me to be too high, but at any rate they do not give trouble.

In the Fig. 1 circuit an inductance coil L_1 fitted with a slider is used, and this you probably already have. If you have not already constructed a variable inductance, a suitable one for the reception of broadcasting consists of a 3-in. diameter cardboard tube, wound for a distance of 5 in. with No. 26 gauge double cotton covered wire. A ½ in. pathway is scraped along this wire and the slider moves along this.

You may, however, realise at once that although sliders are all very well for a beginner, they are apt to be very noisy and rather unmanageable. When the beginner starts to use valves he might just as well, once and for all, give up the idea that he is going to go on using sliders. Instead of variable inductances of this type he will henceforth probably use inductances tapped off at, say, every ten turns, shunted by a variable condenser. He may also use fixed coils (without tappings) of various sizes, and shunt them by a variable condenser. Each coil will give a certain range of wavelength, and by having a number of these fixed coils, any desired wavelength range may be obtained.

Variable Condensers

Personally, if I were starting all over again and my means were limited, I would prefer to buy a 0.001 μF (microfarad) variable condenser in preference to a 0.0005 μF condenser. The larger size of condenser is far more useful for general work, and with a fixed coil it is possible to get a very much wider range of wavelength. The only trouble, however, is that when tuning in to short wavelengths, such as those on which broadcasting is conducted, a movement of merely one or two degrees will often be

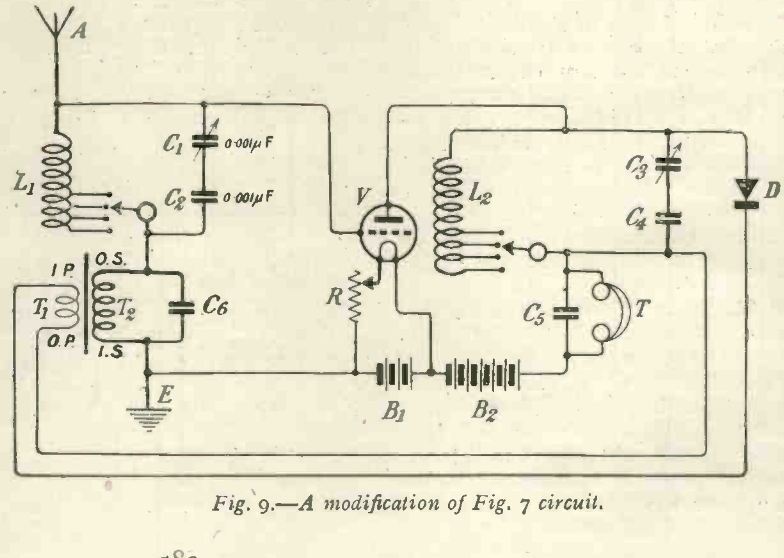


Fig. 9.—A modification of Fig. 7 circuit.

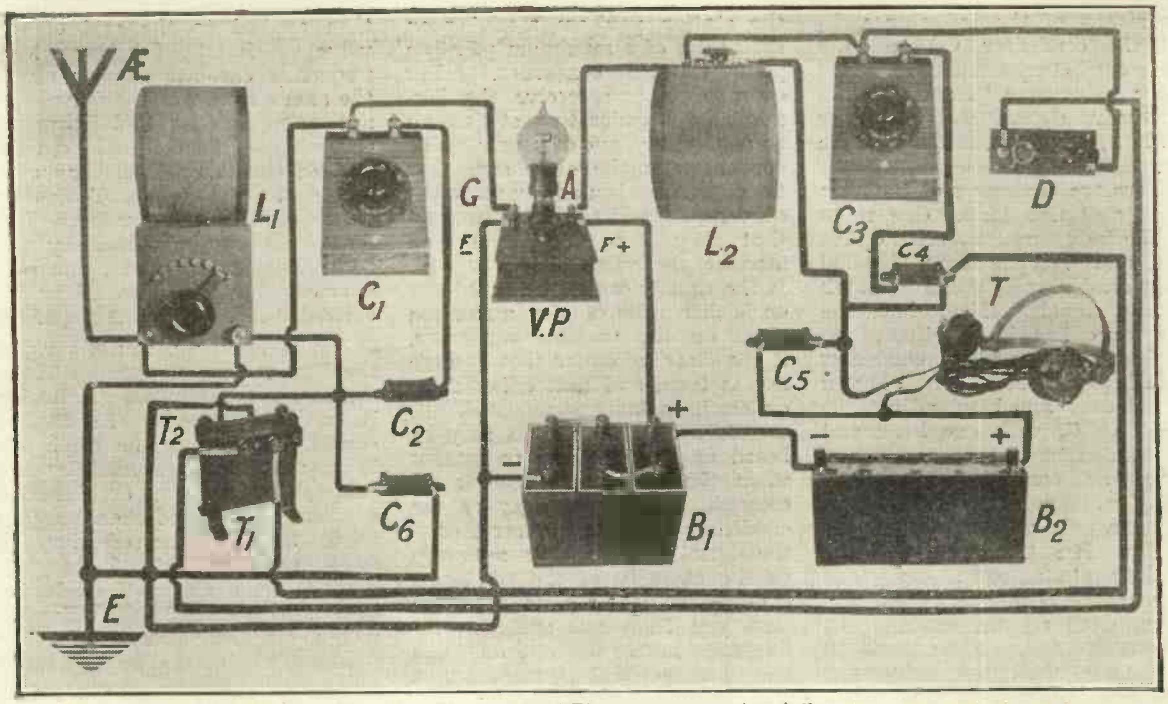


Fig. 10.—The circuit of Fig. 9 presented pictorially.

sufficient to cut out a station. The adjustment is, therefore, frequently very critical with such a condenser, and the beginner may have some difficulty in tuning in. To overcome this trouble, I would change the 0.001 μF variable condenser into a 0.0005 μF condenser. This would be done, not by taking plates off the large condenser, or anything drastic like that, but simply by connecting in series with the condenser a fixed condenser having a capacity of 0.001 μF capacity.

Fig. 3 shows the kind of circuit I would suggest that you use. The inductance L_1 is varied roughly by means of tappings, and is shunted by two condensers C_1 and C_2 in series. If it is desired to have a parallel condenser of 0.001 μF across the inductance L_1 the fixed condenser C_2 of 0.001 μF capacity is short-circuited. If, on the other hand, we wish to have a 0.0005 μF variable condenser across the inductance L_1, we leave the two condensers in series as shown in the diagram. For the reception of broadcasting, the inductance L_1 may conveniently be 60 turns of No. 26 gauge double cotton covered wire wound on a 3-in. diameter cardboard tube. Tappings are taken from the coil at the 12th, 18th, 24th, 30th, 36th, 42nd, 48th, 54th and 60th turns.

You will note that I have left out any condenser across the primary T_1 of the intervalve transformer T_1 T_2. This will usually not be necessary, but a 0.002 μF condenser may be tried.

Fig. 4 shows a pictorial representation of the Fig. 3 circuit.

High-Frequency Amplification

When you have mastered the simple low-frequency amplifier, you should next try high-frequency amplification. This time, instead of amplifying the low-frequency rectified signals which are always obtained from a crystal detector receiver, you are going to strengthen the actual high-frequency currents which are set up in the aerial circuit when wireless waves are arriving. The high-frequency oscillations are strengthened to several times their magnitude by means of the three-electrode valves, and the amplified oscillations appear in the anode oscillatory circuit, which consists of an inductance and a variable condenser. These high-frequency magnified oscillations are now detected by a crystal detector and a pair of high-resistance telephone receivers across the tuned anode circuit.

Fig. 5 shows the circuit we propose to try. The inductance L_1 is the same one used as before, and is shunted by the variable condenser C_1 of 0.001 μF capacity connected in series with the fixed condenser C_2 of 0.001 μF. Of course, if you only have a 0.0005 μF condenser, you would connect it across the used portion of the inductance L_1 in place of the condensers C_1 and C_2. The anode circuit of the valve now contains the inductance L_2, which is variable in steps, and is also shunted by two condensers, one a variable one (C_3), and the other a fixed one (C_4), both having a maximum capacity of 0.001 μF. The crystal detector D and telephones T are shunted across this circuit. The tuned anode circuit inductance L_2 may consist of 80 turns of No. 26 gauge double cotton covered wire wound on a 3 in. cardboard tube. Tappings are taken at the 30th, 40th, 50th, 60th and 80th turns. This inductance, of course, is larger than the inductance in the aerial circuit.

Fig. 6 is a pictorial representation of the circuit of Fig. 5, and the beginner should compare the two figures so as to familiarise himself with the method of drawing valve circuits.

High-frequency amplifier circuits are more tricky to work than low-frequency amplifier circuits. You should keep the inductance L_2 well away from the inductance L_1. You will find that two circuits have to be tuned, both the aerial circuit (by means of the inductance L_1 and the condenser C_1) and the anode oscillatory circuit, consisting of the inductance L_2 and the two condensers, C_3 and C_4, the former of which, of course, is the variable one.

There are two ways of tuning a receiver of this kind. One is to set the inductance L_1 on the first stud, and then to swing the dial of the condenser C_1 round to search for the signals. Meanwhile, the inductance has been adjusted to its first stud, and the condenser C_3 is kept almost at zero. If you do not hear anything, adjust the condenser C_3 with one hand and the condenser C_3 with the other. Move the condenser C_1 round slowly, while moving the condenser C_3 backwards and forwards fairly rapidly. If nothing is picked up, try the next stud of L_1. Carry out the same procedure as before and so on, until all the studs of L_1 have been tried. Then start all over again with the inductance switch of L_2 on the second stud, and the process is repeated for every stud of L_2. This looks a very laborious business, but in actual practice the experimenter learns to tune in a circuit of this kind without any really definite method. It is almost a question of instinct. In both this circuit and the other, of course, you may care to try short-circuiting the fixed condensers.

The other method of tuning which I was going to suggest was to leave the condenser C_3 and C_4 out of circuit for the time being, and adjust the switch on L_2 so that the whole of the inductance is included in the anode circuit. Under these conditions tune in the aerial circuit by trying the different studs in order whilst swinging the condenser C_1 backwards and forwards for each. Only one adjustment is now made, and signals should be quite clearly received. Once they have been heard, connect the condensers C_3 and C_4 in circuit, and tune the anode circuit by itself until the loudest signals are heard. A slight readjustment of the tuning of the aerial circuit may now be made.

A very important point which you should appreciate before you go further is that you should never be satisfied unless you can tune out the station you are receiving on both sides of a maximum point on your variable condenser. For example, if you receive the Birmingham broadcasting station on 10 deg. of, say, one of your variable condensers, make quite sure that the signals weaken as you move the condenser round towards zero, and that they also weaken as you increase the value above 10 deg. If the signals cannot be tuned out on either side of the maximum point on the variable condenser, it is a clear indication that you are not in tune, and that either more or less inductance is required. If, for example, your signals may be heard at 10 deg., and go weaker when the condenser value is increased, but get stronger as the condenser is moved to zero, or if the signal strength does not vary as the capacity of the condenser is decreased, it is a clear indication that you have not sufficient inductance in the circuit, and you should correct that by moving up a stud on the inductance.

Dual Amplification

The third important method of using a single valve involves what is known as dual amplification. It is, in fact, a combination of the Fig. 3 and Fig. 5 circuits. It is an interesting property of the valve that it will amplify, not only high-frequency currents, but also low-frequency currents at the same time. In other words, we can amplify the high-frequency oscillations in the aerial circuit, rectify them by means of the crystal detector, and then pass the low-frequency currents back into the grid circuit of the valve and amplify these low-frequency currents; the amplified low-frequency currents are then caused to affect telephone receivers connected in the anode circuit of the valve.

A step-up intervalve transformer is required, and Fig. 7 shows a suitable circuit. Fig. 7 is very similar to Fig. 5, except that in place of the telephones T we have connected the primary of a step-up intervalve transformer T_1 T_2, the secondary of which is now connected between the earth and the negative terminal of the filament accumulator B_1. The low-frequency currents passing through T_1 have their voltage stepped-up by the transformer T_1 T_2, and the currents are then applied to the grid of the valve which amplifies them, low-frequency currents flowing round the anode circuit of the valve, but not affecting the high-frequency currents also flowing in the circuit. A fixed condenser C_5 is connected across the telephones T in the anode circuit of the valve. The telephones are unaffected by the high-frequency currents, but *are* affected by the low-frequency currents which have been amplified.

Fig. 8 shows a pictorial view of the Fig. 7 type of circuit. There are various experiments which may be carried out with the Fig. 8 circuit. For example, the telephones T may be left unshunted by the 0.002 μF condenser, or different smaller sizes of condensers may be tried. Similarly, the secondary T_2 of the transformer T_1 T_2 may be shunted by a 0.002 μF condenser or a 0.0003 μF condenser. Experiments on these lines are often productive of good results, because different types of transformers give rather varying results, particularly in dual amplification circuits, which tend to oscillate of their own accord.

Fig. 9 shows a modification of the Fig. 7 circuit. The transformer secondary T_2 is now included in the aerial circuit in the position shown, and it is shunted by a condenser C_6, which may either be a variable condenser having a capacity of 0.001 μF, or a fixed condenser having a capacity of 0.0003 μF. Here again the value of this condenser will depend largely upon the type of transformer used, and in some cases it may be desirable to use a condenser having a capacity of 0.002 μF. As regards the condenser across the telephones, this may, as an experiment, be omitted. In dual amplification circuits, more than in any other, the fixed condensers in different parts of the circuit should be tried out experimentally.

In next month's issue of MODERN WIRELESS I propose to help you a little further along the road by explaining what you can do with two valves, both with and without a crystal detector. The notes in this issue should, however, give you useful information to initiate you into the use of valves.

HOW TO MAKE AN IMPROVED REINARTZ SET

By E. H. CHAPMAN, M.A., D.Sc., Staff Editor.

In this article Dr. CHAPMAN describes experiments made with the Reinartz circuit and how those experiments lead to an improved type of coil for use with this circuit.

SINCE the first published descriptions of the Reinartz tuner, the inventor, Mr. John L. Reinartz, of South Manchester, Connecticut, and many wireless experimenters on both sides of the Atlantic, have experimented in various ways with the original circuit and subsequent improvements. The Reinartz receiver is interesting in a good many ways. It was described in England by Mr. Percy W. Harris just at the time the announcement was made that the band of wavelengths allotted to broadcasting was from 350 metres to 425 metres. As the Reinartz tuner functions best below 450 metres, and as it employs what was to the English experimenter in early 1922 a distinctly novel method of obtaining reaction, it is not to be wondered at that the tuner attracted a good deal of attention in England last year.

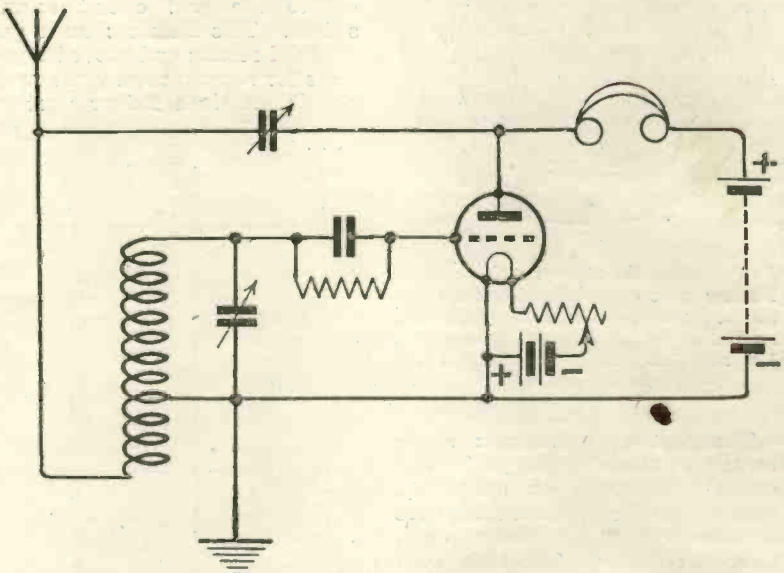


Fig. 2.—The circuit used by the writer is identical with that given by Reinartz for use with "exterior" coils. When note magnifiers are added the leads from the filament battery are reversed.

Possibly owing to the development of the Armstrong super-regenerative circuits, but more probably because the circuit cannot be used for broadcast reception, the Reinartz tuner has been pushed somewhat into the background in England, although in America it still remains very popular. There is no doubt, however, that this tuner forms an attractive basis for experimental work on short-wave reception outside broadcasting hours.

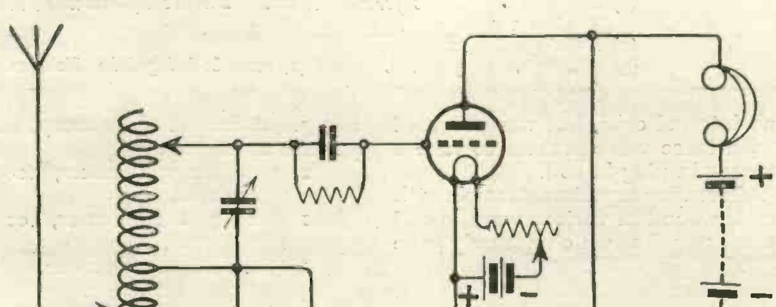


Fig. 1.—The Reinartz circuit as originally given by Mr. Percy W. Harris.

The present writer has made no less than seven Reinartz sets since the circuit was first described and has carried out a large number of experiments alone and in conjunction with Major C. E. Castellan, a wireless experimenter of many years' experience. The direct result has been the elimination of the reaction coil, as shown in the original Reinartz circuit, and the development of a new type of coil for the tightly coupled aerial-earth-grid circuits. Another direct result of these experiments was the independent discovery that the positive and negative leads from the filament battery, as shown in the original circuit, could be reversed without loss of efficiency.

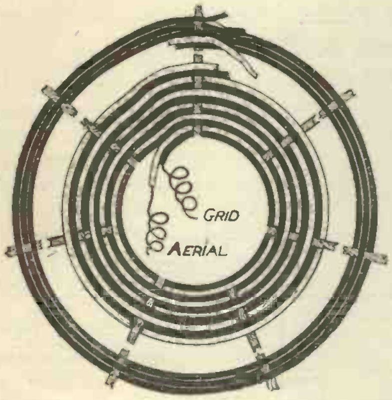


Fig. 3.—How the special coil is wound. Twenty turns of aerial and grid are first wound together, and then the grid coil is continued for another 50 or 60 turns. For clearness some of the turns are omitted in sketch.

The first two Reinartz single valve sets made by the writer had their coils wound on cylindrical formers. In the third set there were three basket coils mounted on a three-coil holder. The coils were aerial in the middle, reaction to left (variable), grid to right (also variable). In the fourth set there were two fixed basket coils, reaction, aerial and grid, the aerial portion being in the centre. This latter set proved the undoubted superiority of basket coils over cylindrical coils in the Reinartz tuner. The fifth set made by the writer was an extremely efficient one. The coils were "disposals" surplus. They were wound in basket form, the wire being stranded and covered with thick rubber tubing. The larger one, used for the aerial-grid coil, consisted of two basket coils in parallel, each section having about 20 turns. The reaction coil was of similar wire, there being 25 turns. As the two coils were fixed in thin boxes, it was an easy matter to screw the two boxes together. There were three tappings from the reaction and 18 tappings from the aerial-grid coil. Nine of these latter tappings were taken off to the aerial selector switch, the other nine being taken off to the grid circuit selector switch. This Reinartz tuner gave splendid results and proved a good basis for experimental work on the circuit. A sixth Reinartz set had no internal coils, but was provided with three valve sockets to take a three-pin plug-in coil.

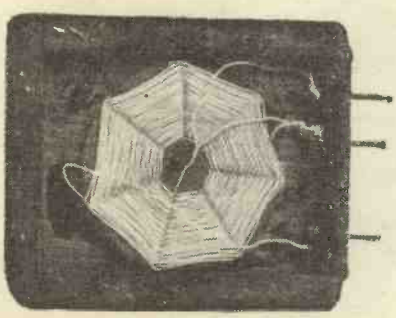


Fig. 4.—The finished coil in its case.

After many experiments made with coils wound in various ways, a coil was arrived at which not only gave good signals, but was remarkably free from all "wireless" noises. Telephony with this coil is exceptionally clear and free from any manner of distortion even when two note magnifiers are added.

The method of winding this coil (provisionally patented) was to wind two wires on a basket coil former simultaneously, one wire forming the aerial coil and the other forming the grid coil. After a certain length of aerial coil was wound on the former, together with the same length of grid coil, the aerial winding was stopped and the grid coil continued alone until the length used was about three or four times that of the aerial coil. How this coil appears when finished is shown in Fig. 3.

With this one-valve Reinartz set it has been easily possible to receive "2 LO testing" on a loud-speaker 12 miles from the transmitting station.

The last set on the Reinartz principle made by the writer and another Reinartz enthusiast is illustrated in Fig. 5. The set may be used as a 1-valve, 2-valve or 3-valve set. Various sizes of the three-pin plug-in coils were made for different ranges of wavelengths. The circuit diagram for this set is shown in Fig. 5. A full list of the component parts is as follows :—

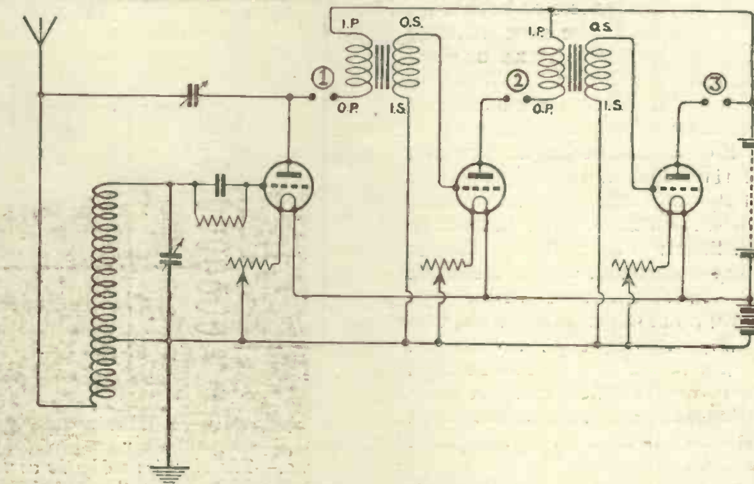


Fig. 5.—Circuit for 1, 2, or 3-valve Reinartz set.
(1) *Position of 'phones for 1-valve set. 'Phones left in when more than 1 valve used.*
(2) *Loud-speaker, 2 valves.*
(3) *" " 3 valves. Note (2) must be bridged in this case.*

- 2 variable condensers, .0005 microfarad
- 1 fixed grid condenser, .0003 microfarad.
- 1 grid leak, 2 megohms.
- 3 filament rheostats.
- 4 terminals.
- 9 valve sockets
- 3 valve holders.
- 2 low-frequency transformers.

The ebonite panel measured 14 in. by 9 in. A containing box was made to take this panel and to be deep enough (10 in. over all) to provide room for the high-tension batteries. How these batteries were fitted in the box is shown in Fig. 6. Two leads were left from the panel wiring to be connected to the high-tension batteries (60 volts).

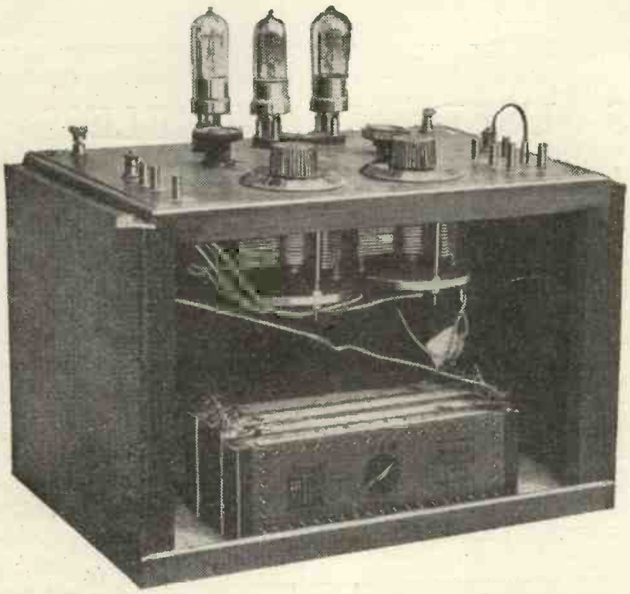


Fig. 6.—The finished set showing position of high-tension battery.

found to be a Cossor P1 valve as detector and two Mullard Ora valves as low-frequency amplifiers.

The results with this Reinartz set are exceptionally good from very low wavelengths up to 2,000 metres. An interesting point is that loud-speaker telephony from London amateur transmitters has often been obtained with very small filament current from a 4-volt accumulator. This is at a distance of 12 miles from London. Two valves gave all that was required in loud-signal strength from 2 MT in a small room, and the 3-valve set was ample to receive a special transmission from several London amateurs for the benefit of 150 schoolboys in a large hall.

The Reinartz circuit has perhaps been overshadowed by such giants amongst receiving circuits as the Armstrong circuits, the Flewelling circuits and " S.T. 100," but it still remains as a quiet, easily-worked circuit which will well repay the experimenter for time spent over it.

Fig. 7 is a photograph of the back of the panel and shows the wiring of the set. Fig. 4 shows one of the three-pin plug-in coils wound on a cardboard former of the basket or spider-web type. The front of the box containing the coil was removed for the photograph to show the coil itself. The only part of this box which is ebonite is the thin strip carrying the three valve pins.

When the set is used as a 1-valve set, the 'phones are placed in the first pair of valve sockets. The 'phones are left in these sockets when a loud-speaker is used with two or three valves. When three valves are used, the second pair of sockets are bridged as shown in the photograph reproduced in Fig. 6.

Although it is not desired to specify any particular type of valve, an excellent combination has been

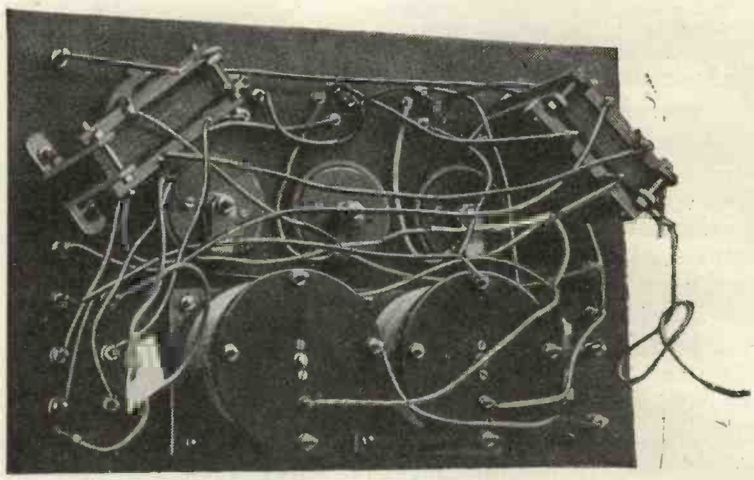


Fig. 7.—The back of the panel to show wiring.

INFORMATION DEPARTMENT.

This department deals with queries arising from articles in " Wireless Weekly," " Modern Wireless " or from any Radio Press Handbook.

All queries will be replied to by post, as promptly as possible, providing the following conditions are complied with :—

1. *A Postal Order to the value of 1s. for each question must be enclosed, together with the Coupon from the current issue, and a stamped addressed envelope.*

2. *Not more than three questions will be answered at once.*

3. *Queries should be forwarded in an envelope marked " Query " in the top left-hand corner and addressed to Information Dept., Radio Press, Limited, Devereux Court, Strand, London, W.C.2.*

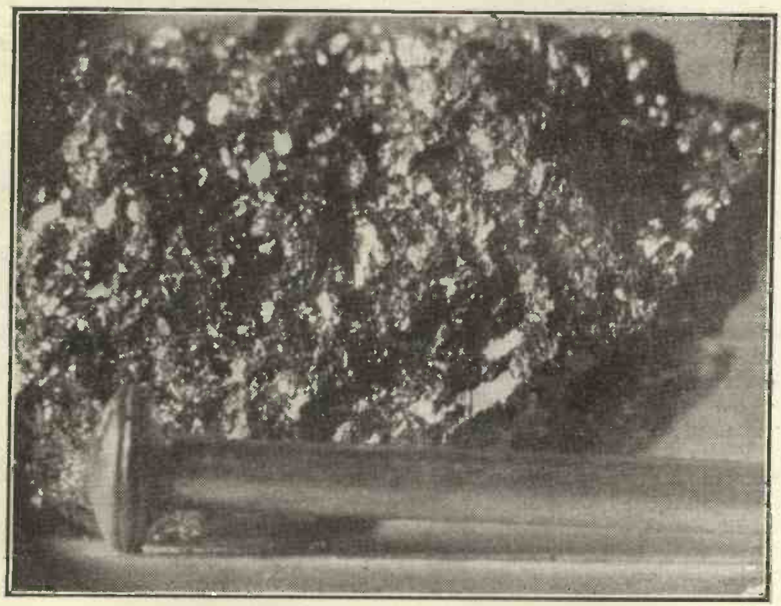
THE CRYSTALS USED IN WIRELESS

By E. H. Chapman, M.A., D.Sc., *Staff Editor.*

Photo-micrographs by Percy W. Harris. *Assistant Editor.*

The unique nature of the photographs accompanying this article make it of special value. The scale of magnification can be judged from the pin lying in front of the Hertzite crystal. The remaining photographs are to exactly the same scale.

THE majority of wireless experimenters commence their work with a crystal detector and sooner or later put aside their crystal in favour of the more versatile valve. With the advent of modern valve-crystal circuits, such as "S.T.100" for example, in which a crystal is used for rectification purposes, it appears as if the humble crystal is likely to come into its own once more with the serious experimenter. According, it is perhaps more than usually appropriate at the moment, to consider something of the nature of the better known wireless crystals.



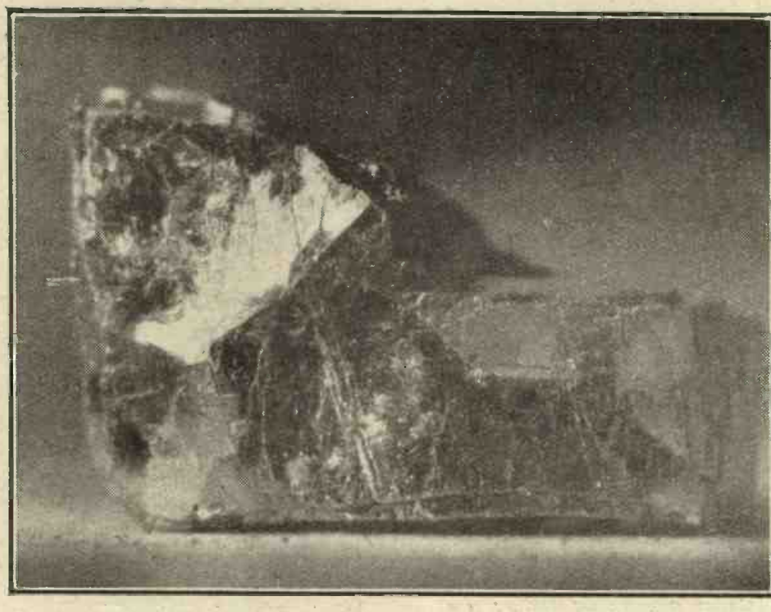
A fragment of hertzite, with the head of a pin to show degree of magnification. Compare this crystal with the natural galena on the next page.

There are many crystalline substances which possess the property of presenting a greater resistance to high-frequency currents one way than the other. The first substance to attract attention in this respect was carborundum which is, curiously enough, an artificial "crystal."

Owing to the fact that a battery is required to get the best results, carborundum is not used as much nowadays as it used to be. We may conveniently divide wireless crystals into two classes (i) those that work with a metallic contact and (ii) those that are used along with another crystal in a double crystal combination. In the former class we have the following "crystals": carborundum, silicon, and pyrites. In the latter class we have the graphite-galena combination and various combinations of the following mineral ores, bornite, copper pyrites, molybdenite, and zincite.

Carborundum

Carborundum is an artificially made compound of silicon and carbon. It is manufactured by fusing a mixture of coke and sand in an electric furnace at a temperature of about 3,500 degrees Fahrenheit. Granulated coke is first placed between the carbon electrodes of the furnace. A mixture of sand and coke, with enough salt added to the mixture to make it fusible and enough sawdust to make the whole mass porous, is then packed round the granu-



A crystal of natural galena. This substance is very sensitive in a few spots. Its place has largely been taken by special "ites" which are mostly specially treated galena, recrystallised to give a much greater number of sensitive points.

lated coke and the electrodes. The fusing takes about eight hours to complete.

When pure, carborundum crystallises out in hexagonal plates. In colour the crystals are very varied, sometimes being green, sometimes brown, sometimes grey and sometimes purple. The crystals may even be colourless and transparent. A certain relation seems to exist between the colour of the crystals and the rectifying properties.

The great characteristic of carborundum is its hardness, there being only one harder substance, the diamond. It is because of this extreme hardness that such a firm steel contact can be made with carborundum when used as a crystal detector.

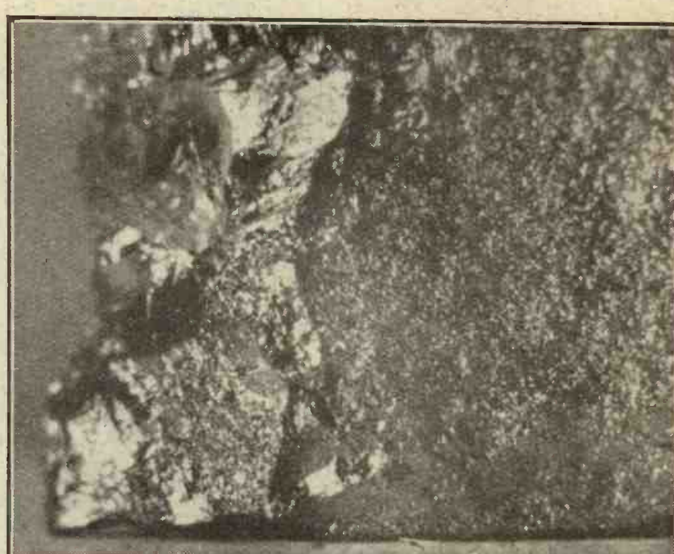
Silicon

In spite of its metallic appearance, silicon is one of the non-metallic elements. The silicon "crystal," so well known to the wireless experimenter, does not occur free in Nature, but, in combination with other elements, is found in great profusion in the solid matter of the earth.

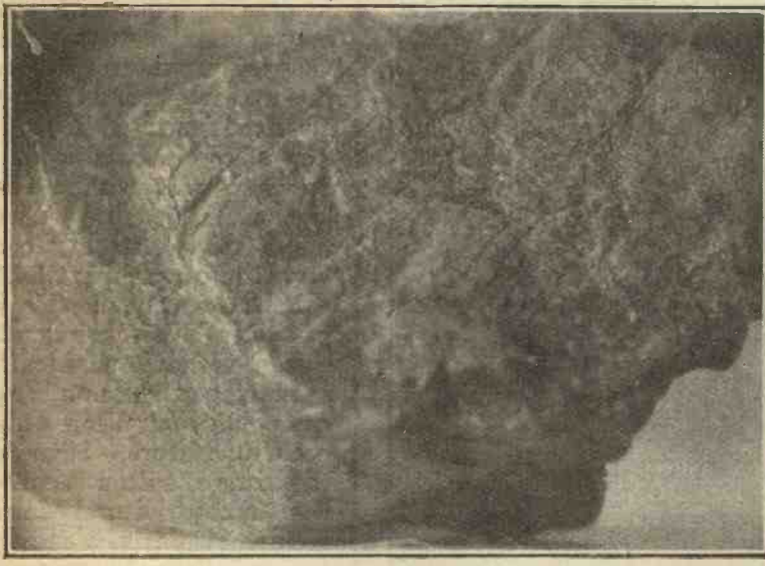
Silicon may be obtained by heating fine sand with magnesium powder. The magnesium oxide formed and the excess of sand may be dissolved out with acids. The silicon left is a dark brown powder with a very high melting-point. When fused, silicon becomes converted into graphitic silicon.

It is scarcely possible to pass over the wireless crystal silicon without mentioning something of the number of compounds of silicon which occur in Nature. Silica, as the oxide of silicon is called, has many natural forms including quartz, a mineral which the ancients supposed to be ice. Quartz, when fused, may be drawn into the finest of threads and used instead of silk fibre in electrical experiments of a delicate nature.

Amethyst (violet quartz), precious opal (which gives a more varied and more brilliant play of colours than any other mineral), jasper and agate are all naturally occurring varieties of quartz. In the form of tiny particles,



Copper pyrites, which has a texture quite different from galena. It is used with zincite.



Zincite. This is a reddish substance with a close texture quite different from that of most crystals. It is commonly used in conjunction with bornite (a crystal of which is shown below), or with copper pyrites (see previous page).

quartz constitutes practically the whole mass of the sands on the earth's surface.

Asbestos, felspar and clay are also compounds containing silicon, while the minerals figuring in the mica group, some of which are used for making the electrical insulating substance mica, so well known in wireless work all contain silicon in combination with oxygen and other elements.

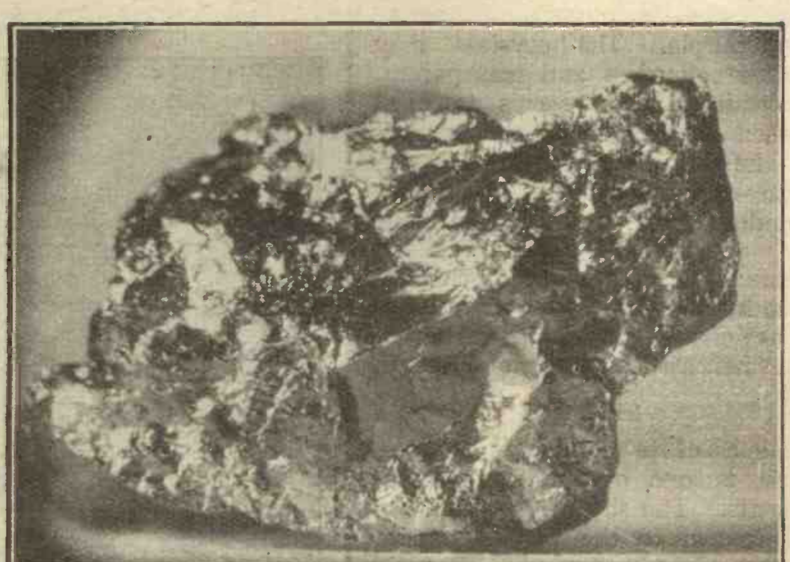
Pyrites

Pyrites is a very common mineral ore found in a variety of forms. The constituent elements are iron and sulphur. One of the chief commercial uses of pyrites is in the manufacture of sulphuric acid, the acid electrolyte of an accumulator. In the Rossland district of British Columbia, the pyrites found there is worked for the gold it contains in the free metallic state

Pyrites may be distinguished from chalcopyrite by its paler brass-yellow colour, by its greater degree of hardness and by the greenish-black streak running through it.

Graphite

A graphite-galena crystal detector usually consists of a piece of hard lead from a lead-pencil placed lightly on a lump of galena The two substances used in this crystal detector are of great interest. Graphite, a form of pure carbon, is most interesting because of its relationship to the diamond which is also a form of pure carbon. Graphite is a conductor of electricity, the diamond is a non-conductor. Graphite is one of the softest substances, whereas the diamond is the hardest known substance. We use graphite as a lead in the pencils with which we write on paper. In fact, the word graphite is derived from the Greek word grapho, to write. The last syllable of the



Bornite, as it will be seen, has quite a different texture from zincite. Compare this crystal with copper pyrites on the previous page. Bornite is allied to copper pyrites in its composition.

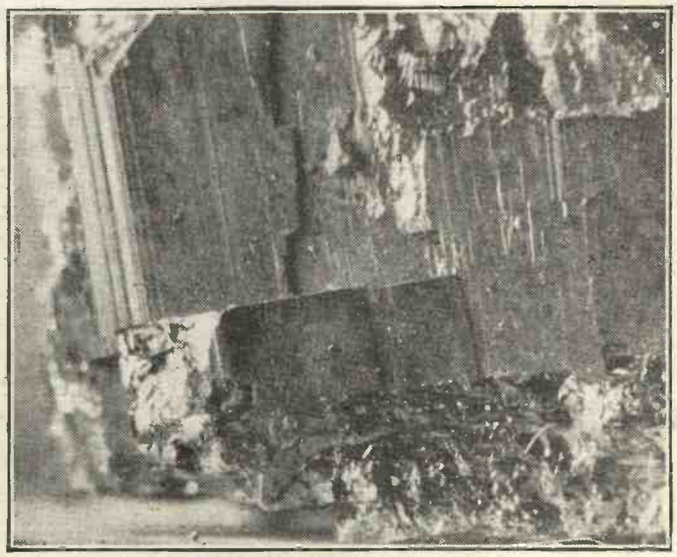
word telegraph is derived from the same Greek word.

It is possible to change a diamond into graphite by heating in an electric arc, but the reverse experiment has never been performed with a degree of success which would warrant its being used on a commercial scale.

The chief source of graphite in these islands is in the "black-lead" mines of Cumberland which have been worked now for four centuries.

Galena

The other mineral ore used in the graphite-galena combination is the common ore of the metal lead. It is mined in the lead-mines of Derbyshire, Cornwall, Wales and the Isle of Man. Galena may be recognised by its softness, its lead-grey colour and its weight. Almost all galena contains the metal silver and it is sometimes profitable to work galena for the silver it contains. Most of the crystals sold for wireless purposes under special trade names are galena specially treated to make them more sensitive.



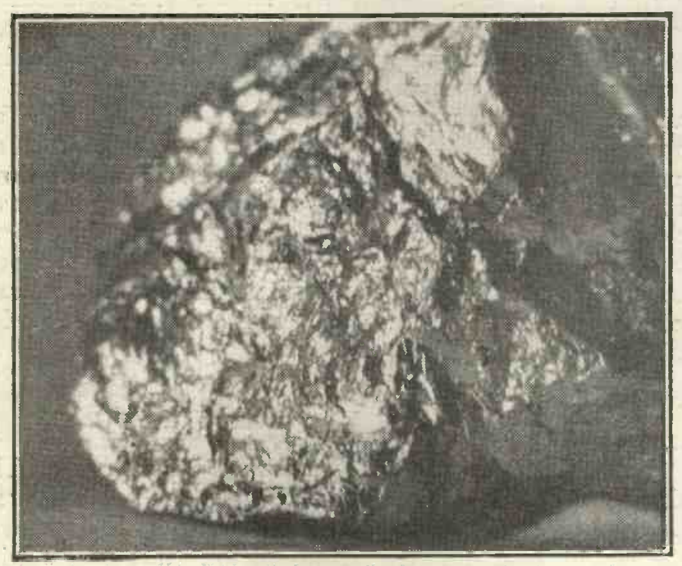
Iron pyrites, sometimes called "fools gold," has a characteristic structure. It was very popular in pre-war days as a catwhisker crystal.

Bornite, Copper Pyrites

Bornite, known also as erubescite and variegated copper ore, is a mineral ore containing the metals iron and copper in combination with sulphur. The most noticeable thing about bornite is that a freshly cut surface has a coppery or bronzy colour which very soon assumes the familiar blue tarnish on exposure to the air.

Chalcopyrite, or copper pyrites, is, like bornite, a compound of copper, iron and sulphur but in different proportions. The copper of commerce is mostly derived from chalcopyrite. Sometimes the crystals of chalcopyrite are of great beauty. Like bornite, chalcopyrite easily tarnishes on exposure. The tarnished masses of chalcopyrite found in Cornwall and other mining districts are called "peacock ore." Another Cornwall name for the same ore is towanite, the name coming from the name of the Towan mine in that county.

Chalcopyrite may be distinguished from iron pyrites by its softness, it being possible to scratch chalcopyrite with a knife.



Silicon, a cheap and efficient rectifier. It requires more skill in handling than hertzite.

Molybdenite

Molybdenite which, like bornite, may be used in combination with zincite, is a compound of the rare metal molybdenum and sulphur. Molybdenite, also called molybdenum glance, has a lead-grey colour and lustre.

Zincite

Zincite is a blood-red mineral ore streaked with orange. It is found in the zinc mines of New Jersey, U.S.A. Owing no doubt to the fact that zincite is only found in any quantity in this one mining area, the ore commands a higher price than other mineral ores used as wireless crystals.

How a Wireless Crystal Works

The wireless experimenter can easily demonstrate to his own satisfaction the way in which a wireless crystal functions. A small source of E.M.F. giving up to 5 volts and a delicate galvanometer would be required. The crystal to be experimented with would be fixed between two metal contacts and placed in series with the galvanometer. A few tests would show that when an E.M.F. is applied in one direction to the crystal the current which flows is 100 times or more stronger than the current which flows when the same E.M.F. is applied to the crystal in the opposite direction.

Some of the foremost of present-day wireless scientists have investigated the action of high-frequency currents on crystals, and although the results of their experiments are not in agreement on all points, it appears fairly certain that the effects are due to changes in resistance at the point of contact of the crystal or crystals. This change of resistance may be due wholly or in part to the heating effect of the high-frequency currents.

Although a great deal of experimental work has been done with wireless crystals there is still plenty of scope for the experimenter in this interesting field of work.

HINTS ON WORKING AND FINISHING EBONITE

EBONITE, vulcanite, or hard rubber, as it is variously called, is one and the same thing; the American name for it being hard rubber. The writer feels that perhaps a short description of the processes employed in the manufacture of ebonite will not be out of place, and will help the worker better to appreciate the nature of the material with which he has to deal. Ebonite is composed of pure plantation rubber, to which have been added various ingredients, the most important of which is the necessary sulphur for its vulcanisation. The best quality ebonite is made of pure Para rubber, while the cheaper grades are made from rubber gums of an inferior quality. The very cheap qualities of ebonite contain but little rubber in their composition, and the writer advises the purchaser to leave these severely alone, as quite apart from their brittle nature they have in most instances very poor insulating properties.

First Stages.

The first stage in the manufacture of ebonite is the "grinding" of the rubber between the rollers of the rubber mill. One roller travels at twice the speed of the other and thus pinches and rubs the rubber, generating a considerable amount of heat in the process. When the rubber has attained a smooth plastic state the ingredients are successively added and ground in. This having been completed the rubber dough is taken to another mill and calendered or rolled to an exact thickness (usually about an eighth of an inch for sheet ebonite), sheets, six feet by three feet, are taken, laid one on the other and well rolled together till the thickness of the desired finished sheet has been attained. These sheets are then placed in rectangular iron frames and their top and bottom surfaces covered with single sheets of tinfoil.

Rolling with Tinfoil.

This imparts the gloss to the sheets. The frames are placed in a steam-heated press and subjected to the required degree of heat for a certain period (this varies with the thickness of the sheet) until vulcanisation is complete. The frames are now removed, the tinfoil rolled off, and the sheets of ebonite are ready for use.

How to Trim a Panel.

We will now consider the working up of a valve panel or other piece of electrical apparatus: First carefully square up all sides and edges by means of a file, or files of two or three grades. If the edges are very rough an 8 inch bastard file is a convenient one to use. This may be followed by an 8 inch smooth file, and in succession, No. 2 and No. 1 emery or carborundum paper, grading down to F. or F.F. finally. Having squared up and finished our edges, proceed to remove the highly glazed surface by means of a rubber. This can conveniently be made of a piece of cork sheet measuring say 3 inches by 2 inches by 1 inch. Take a piece of No. 1 emery cloth, cover the rubber with it, and with a circular motion remove the polish from both sides of the panel or slab. A convenient way to hold the slab is by means of four thin strips of wood tacked to a table or bench by means of panel pins. These strips must of course be thinner than our panel.

Treating the Surface.

Having removed all the polish we will proceed to finish our panel. Take a piece of grade F paper, and use as before, but keep the panel and paper well wetted with paraffin oil. Having worked up a good smooth surface, free from scratches, again go over the panel, this time with F.F. grade paper. This will leave a nice smooth matt surface. The slab or panel may be washed over with paraffin oil and rubbed dry with a soft piece of rag. Care must be taken not to rub too hard or a semi-polished surface will be the result. If a polished surface is desired, finer grades of paper must be used in succession down to, say, No. 0, "blue back." Follow this by the application of pure whiting and a soft chamois pad or rubber.

A Final Polish.

A final finish may be given by rubbing with the ball of the thumb. These last stages are dry ones of course. The reason that we removed our first polished surface was because, strange as it may seem, this surface has not a high insulation resistance. Probably this is due to the sulphur in the rubber combining to a slight extent with the tinfoil during the process of vulcanisation. We now have our panel with one finished surface and edges. The underside need not of course be treated any further. It only now remains to mark out and drill our holes, and this last operation is one that is by no means easy to do very accurately and without chipping the panel, unless the correct method for doing so be applied.

Hints on Drilling.

First take a square, and with a sharp-pointed scriber scribe a line on the underside of the panel from top to bottom and side to side exactly at the respective centres of the sides and ends. From these two bisecting lines all our measurements are to be taken. Let us suppose we wish to fit a rotating switch arm and contact studs. First ascertain the exact position of the hole for the pin of the switch-arm and by means of a pair of sharp-pointed dividers make small marks or intersection lines, and make a small centre dot. Drill this about 1-16 inch deep with a small drill. From this centre, with the dividers set at the radius of the switch-arm contact, scribe a semi-circle, or circle as the case may be, and from the centre line carefully space out the positions of the studs by means of the dividers. When the exact position of these has been satisfactorily ascertained, the centres are marked by means of the drill as before. Proceed in this way till all the positions have been ascertained and marked. Having done this continue all these holes through from the back to the front face. The reason for continuing the holes through to the face is to guard against the tendency of breaking pieces out when a larger drill is used. The writer always uses a "pilot drill" for accurate work whatever the material to be worked.

Opening out the Holes.

All our holes having been drilled, it only remains to open them out to size. In the case of holes up to, say, ¼ inch diam., the drill can be fed through from the front face to the back without much fear of serious damage to the underside of the panel, if care is taken in the direction of not putting too much pressure on the drill, and of supporting the back of the panel on a piece of hard wood. For larger holes the writer advises that the holes should be first drilled half-way through the panel from the front, the remainder of the hole being drilled from the back. In this way no fear of damage need be anticipated. For drilling ebonite, fluted or spear point drills should be used as these have not so great a tendency to seize up or worm themselves in where a pilot hole has first been drilled.

NOTES ON THE VALUES OF INDUCTANCES, CONDENSERS AND RESISTANCES IN CIRCUITS

By *THE EDITOR.*

These notes should prove of value to all who find difficulty in knowing what values of components to use in a circuit.

EXPERIENCE goes to show that many readers would like to have every circuit diagram labelled with the different values of the parts. Other readers would feel insulted if this were done. The solution, of course, is to change the first class of reader into the second class by a few words of advice on what is really quite an important matter.

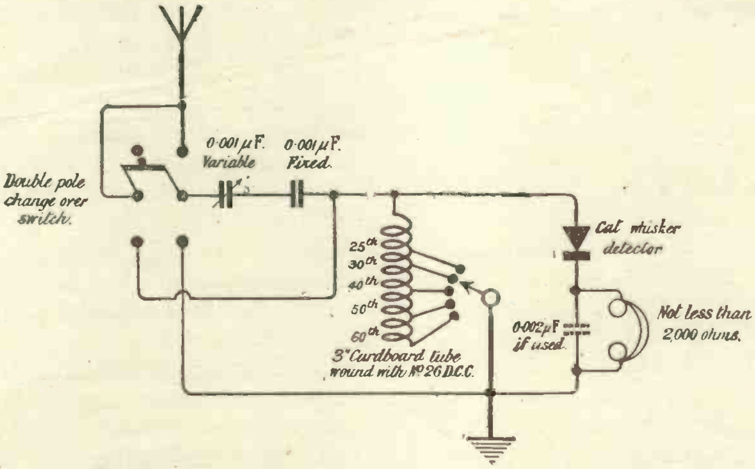
Fortunately, it is not quite so important in wireless to have everything exactly the right size. In engineering, it is essential to have all the different parts of exactly the correct size, otherwise they will not fit together. On the other hand, in the case of wireless apparatus, the value of components may, in many cases, be fifty per cent. out without very much alteration in signal strength. For example, the filament current can be varied over quite a wide range, without affecting the signal strength in any way. Likewise, a variation of high-tension voltage, in many cases, does not produce very much difference in the signal strength. In the case of a machine, it either works or it does not work; it is not often that there is any half-way house, whereas in wireless it is invariably the rule that deviations from the best adjustment merely result in weaker signals, and only when the deviation is very wide do the signals disappear altogether. This applies to tuning, and also to filament current, high-tension voltage, sizes of different condensers and resistances.

However, we all want to get the maximum results out of our apparatus, and even though each individual deviation from the best adjustment may not make much difference, yet if this happens two or three times in a set, there will be serious losses.

Let us examine the different components in a wireless receiver and note what values will usually give the best results. For tuning purposes, a variable condenser having a capacity of 0.001 μF (microfarad) is to be recommended for general use. When receiving broadcasting, it is desirable to connect the fixed condenser in series with it, the fixed condenser having a capacity of 0.001 μF. The inductance in the aerial circuit will, of course, depend upon the wavelength range to be covered. For the reception of broadcasting I would recommend an inductance coil consisting of 60 turns of No. 26 double cotton covered wire, wound on a cardboard tube 3 in. in diameter. Tappings from this coil should be taken at the 25th, 30th, 40th, 50th and 60th turns. The variable condenser for tuning this coil should be capable of being connected either in series with it, that is to say, in the aerial lead, or in parallel with the used portion of the inductance.

If a crystal detector and high resistance telephone receivers are connected across this aerial circuit, the telephones may be shunted by a fixed blocking condenser. This can, in most cases, be omitted without any effect on the signal strength. If such a condenser is used, a suitable capacity will be 0.002 μF, although the best value will depend, to a certain extent, on the type of 'phones used. The 'phones themselves should be of high resistance. It must not be imagined that it is the resistance of the telephone receivers which is of value, but the fact that more turns of wire are wound round the magnet. This unavoidably means that the telephones have a higher resistance, and so we speak of high resistance telephone receivers.

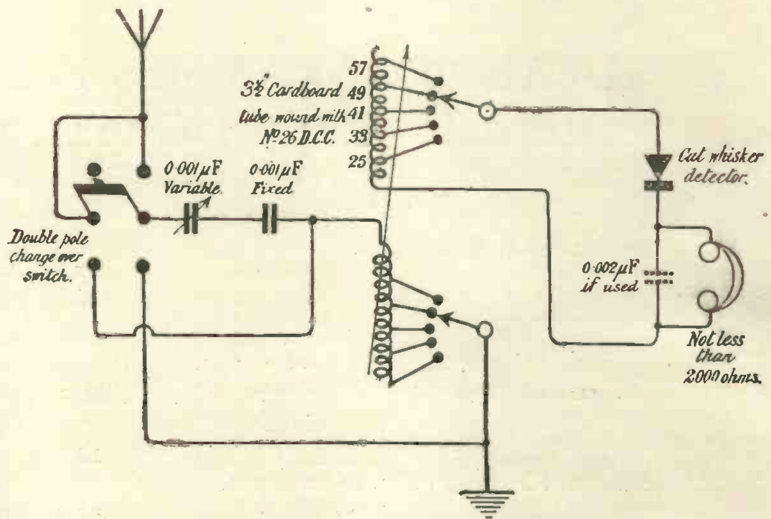
If, instead of having a direct coupled crystal receiver, we propose to use one of loose-coupled type, you will want to know what values of secondaries should be used. Well, the secondary may conveniently be an inductance wound on a cardboard tube 3½ ins. in diameter. Sixty turns of No. 26 gauge double cotton covered wire are employed, and tappings are taken at the 25th, 33rd, 41st, 49th and 57th turns. This inductance may



Values of condensers and inductances in a simple crystal set.

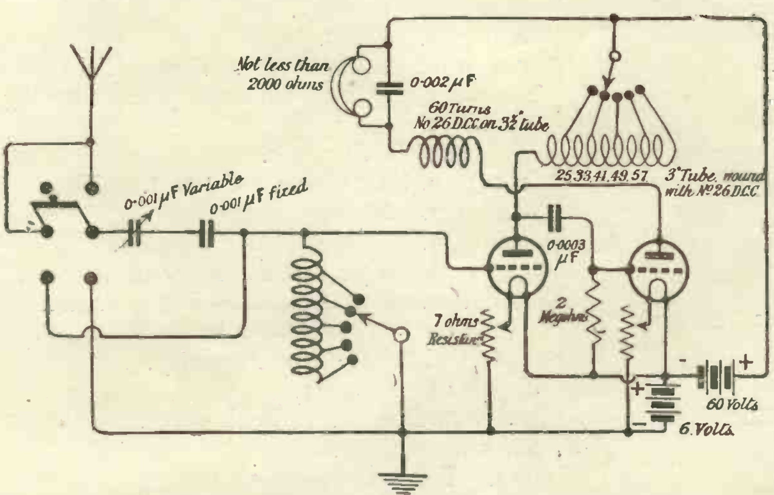
be shunted by a variable condenser. As before, I would prefer the use of a 0.001 μF in series with a 0.001 μF fixed condenser. Longer wavelengths may then be obtained by connecting the 0.001 μF variable condenser alone across the coil.

Now, as regards valve circuits, you will want to know the size of the filament accumulator, the high tension battery, the filament rheostat, and other details. The accumulator should be a 6-volt accumulator, and should have a capacity of not less than 30 ampere hours' actual capacity. The filament rheostats you will probably buy, or, at any rate, I would advise you to do so. If you make your own it should have a resistance of about 7 ohms. As regards the high-tension battery, 60 volts should be the minimum at which you should aim. You will, however, get results with a high-tension of as low a voltage as 40 volts. Personally, I use a high-tension voltage of 100 volts. In the case of dual amplification circuits, particularly, 100 volts is a great advantage, especially when a loud speaker is to be used. Different valve manufacturers specify different voltages for their valves, but I have not yet met a valve in common use to-day which is not better pleased the more the high-tension voltage is that you apply to it; of course, it is sometimes necessary to put a small negative potential on the grids of the valves when using the higher voltages. In all cases, a large condenser across the high-tension battery is desirable, and its value should be as high as possible. Not much advantage is to be gained by having a condenser larger than 1 or 2 microfarads.



A loose-coupled crystal set similarly explained. The aerial inductance should have the same number of turns as in the previous figure.

As regards the grid condenser, this should have a value of 0·0003 μF, or something in that neighbourhood, while the grid-leak should have a value of 2 megohms. Variable gridleaks are coming into fashion, but some of the kinds on the market need to be regarded



Values in a two-valve tuned-anode set. The anode coil should be shunted by a variable condenser.

with grave suspicion, as do some of the cheaper types of fixed gridleaks.

The pencil-line type of gridleak is obsolete and unreliable. Approved variable gridleaks have been mentioned in this journal, and in *Wireless Weekly.*

The advantages of a variable gridleak are not so much that the leak itself is variable, but the fact that the resistance alters the damping of the oscillatory circuit preceding it. This is particularly the case where reaction circuits are employed. It is in these circuits that a variable gridleak is the more valuable.

As regards what are known as "by-path condensers," that is to say condensers which are connected across telephone receivers, primaries of intervalve iron-core transformers, etc., a useful value for these is 0.002 μF.

As you will probably want to use tuned anode coupling, you will want to know the value of the inductance. A suitable size of inductance for this purpose is a cardboard tube 3 ins. in diameter wound with 57 turns of No. 26 gauge double cotton covered wire. Tappings may be taken at the 25th, 33rd, 41st, 49th and 57th turns. This should be shunted by a 0.001 μF variable condenser in series with a 0.001 μF fixed condenser.

If you are going to introduce reaction into this circuit, a reaction coil, consisting of 50 turns of No. 26 gauge double cotton covered wire, wound on a cardboard tube 3½ ins. diameter, will do admirably.

REGULAR PROGRAMMES FROM BRITISH AND FRENCH BROADCASTING STATIONS

(Times in British Summer Time.)

GREAT BRITAIN.

Station.	Call Sign.	Wave-length.
Cardiff ...	5 WA	353
London ...	2 LO	369
Manchester...	2 ZY	385
Newcastle ...	5 NO	400
Glasgow ...	5 SC	415
Birmingham	5 IT	42

Times.
3.30 to 4.30 p.m. (except London) and 5.30 p.m. to 11.0 p.m. London (day transmission) 11.30 a.m. to 12.30 p.m.

Sundays.
8.30 to 10.30 p.m. London also 3.0 p.m. to 5.0 p.m.

Silent Periods.

Cardiff	...	8.0 to 8.30 p.m.
London	...	7.30 to 8.0 p.m.
Manchester	...	7.45 to 8.15 p.m.
Newcastle	...	9.0 to 9.30 p.m.
Glasgow	...	6.0 to 8.15 p.m.
Birmingham		8.15 to 8.45 p.m.

FRANCE.

PARIS, EIFFEL TOWER. (FL, 2,600 metres.)

Weekdays (daily).

7.40 a.m.	Meteorological forecast.
12.15 p.m.	Meteor. forecast and time giving.
3.30 p.m.	Financial bulletin.
6.10 p.m.	Concert.
7.20 p.m.	Meteor. forecast.
11.15 p.m.	Meteor. forecast.

Sundays.

6.10 p.m.	Concert.
7.20 p.m.	Meteor. forecast.

Other concerts specially announced from time to time.

PARIS, RADIOLA. (1780 metres.)

Weekdays (daily).

12.30 p.m.	Information (Cotton Exchange, Havre, Liverpool, Alexandria).
12.40 p.m.	Concert.
5.0 p.m.	Commercial information.
5.10 p.m.	Financial information.
5.20 p.m.	Concert.
8.45 p.m.	News.
9.0 p.m.	till 10.0 p.m. Concert.

Thursday, 9.45 p.m. till 10.30 p.m. Dancing concert.

Sundays.

2.0 p.m.	till 3.0 p.m. Concert.
8.45 p.m.	News.
9.0 p.m.	till 9.45 p.m. Concert.
9.45 p.m.	till 10.30 p.m. Dancing concert.

PARIS. SCHOOL OF POST AND TELEGRAPHS. (450 metres.)

Tuesday and Thursday.

8.30 p.m. Concert.

And very frequent radiophone transmissions of plays (comic operas).

LYONS. YN, 3,100 metres.

10.45 a.m.	Concert (gramophone).
3.35 p.m.	Financial news.

A CRYSTAL RECEIVER WITH NOVEL POINTS

By ***STANLEY G. RATTEE,***
Staff Editor.

Although numerous designs for crystal sets have been published, the present instrument has several distinctly novel features which make for simplicity of construction and operation.

THE set described herein was made with the object of producing the best results from a crystal receiver with the minimum adjustment for tuning, yet at the same time permitting a variation in wave-length. Since the apparatus would ultimately be operated by a small boy, strength and robust construction were two of the essential features.

A photograph of the complete instrument is given in Fig. 1, whilst that of Fig. 3 shows the interior of the containing box.

The Containing Box

In the construction of a set of this type it is recommended that the containing box be the first component to receive attention, and for this purpose the reader should procure an ordinary wooden egg box, made from 3-ply board, or failing this a square foot of the unused material. The containing box forms for this set the foundation upon which to build, by reason of the fact that since there is no panel all the components are attached to the sides and base.

The top is fitted with a sliding lid to permit of access to the crystal detector and wiring. Cut from the lid of the egg box a piece of 3½ in. by 2¾ in. to form the base. Next cut two pieces having measurements of 3¾ in. by 2⅜ in., also one piece 2¾ in. by 2¼ in. and one piece 2¾ in. by 2⅜ in.

Place the base flat upon the table, and along its sides attach by means of small brads the two pieces measuring 3¾ in. by 2⅜ in., so placing them that ⅛ in. at each end extends beyond the base. Along the two remaining sides attach the end pieces measuring 2¾ in. by 2⅜ in. and 2¾ in. by 2¼ in. respectively and secure, in addition to the base, all the sides to each other by means of further brads.

Make by means of a sharp chisel, along the tops of the two sides and the higher of the two end pieces, a groove 1/16 in. wide, 1/16 in. down from the edges of the wood. This groove is intended for the lid to slide in, and for this reason care must be taken to keep the chisel straight.

The lid for the box should next be prepared, the dimensions for this being 2⅞ in. by 3⅝ in. Along the two longer edges of the lid and also along one of the shorter sides are cut grooves 11/16 in. wide to the depth of half the thickness of the wood. This produces a tongue 1/16 in. by 1/16 in. round three sides of the lid in order that the latter will run freely in the box.

The Inductance

The next item to receive consideration is the inductance. This is wound with No. 26 S.W.G. enamelled copper wire for 150 turns. The former is made of wood measuring 3 in. by 1½ in. by ½ in. into the ends of which are driven ¼ in. from the edges, and to a depth of ½ in. and opposite each other, two 1-in. nails with heads removed. At this point bore through the wooden former with the aid of a red-hot needle a hole ⅛ in. from one of the short edges through which is threaded one end of the wire for winding the inductance. If this end is bent so as to lie along the former parallel to the short edge near to it, it will be held sufficiently secure to enable one to commence the winding; care being taken to leave about 3 in. of free wire for subsequent connections. The winding is made by hand and 150 turns are placed side by side (since the wire is enamelled it is of no consequence if they touch) and drawn as tight as possible without breaking. The end, after the 150 turns have been wound, is secured by means of a few twists round a small screw driven into the end of former.

These operations complete our inductance, which is now ready for fitting in the box. The two 1-in. nails with heads removed are in-

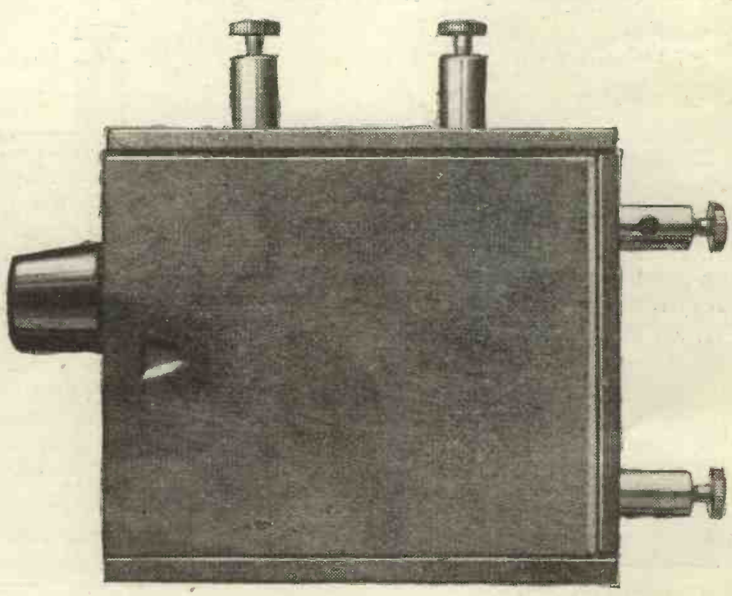


Fig. 1. The complete receiver with case closed. The aerial and earth terminals are on the right.

tended to serve as supports for the coil, and in order to eliminate the possibility of wear, these supports are secured in two brass bushes

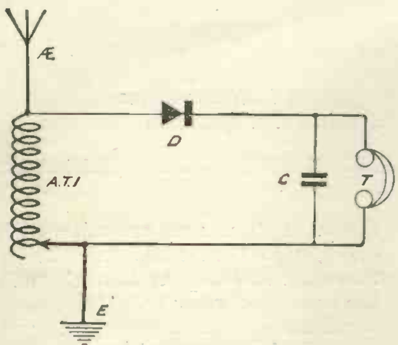


Fig. 2. The circuit used.

fitted in the two smaller and supporting sides of the box.

The brass tubing of a gas-burner by-pass forms an admirable material for making these bushes, and two pieces each of ⅛ in. in length should be cut by means of a hack-saw or file.

In the smaller sides of the box, and immediately opposite each other, are made holes (one hole in each side) by means of a small bradawl at distances of ½ in. from the edges of the base and sides. Into these are *forced* the two brass bushes.

With these in place the former may now be secured in the box by pushing the nail at one end into the bush far enough to allow the other nail to pass free of the top edge of the box and so slip into its own bushing. It can now be set so that the inductance should be "hinged" as it were, and free to move with an upward circular movement.

The Adjusting Arm

Whereas most solenoid or cylindrical inductances are varied by means of sliders or tappings with a switch, the arrangement embodied in the set under description is what is best explained as a "spiral" movement, and may be seen in Fig. 3.

The spiral or rod is made up of a brass rod, 3 in. long and ¼ in. in diameter, round which is bent (as seen in Fig. 3) 4 in. of No. 6 bare copper wire and soldered to the brass rod.

This feat is best performed by first bending the copper wire round a long pencil so as to get a twist in the metal and then hammering it into its final shape on the brass rod. By this means the wire can be made to grip the brass rod sufficiently hard to permit of soldering with a small iron.

In one end of the rod is drilled a hole ⅛ in. in diameter to ¼ in. depth, and at the other end is drilled to the same depth a hole big enough to take a 1-in. nail. Into the ⅛-in. drill-hole is fitted a short length of ⅛-in. brass rod, say, 1 in. in length, and then soldered. Now drill in the containing box a ⅛-in. hole 1 in. from the base and 1½ in. from the edge of the sides, immediately above the inductance, through which is fitted the ⅛-in. brass rod of the "spiral." On the other side of the containing box and immediately opposite the hole just

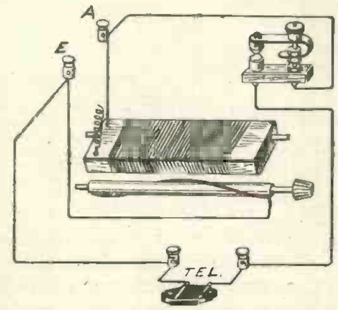


Fig. 4. Pictorial arrangement of circuit.

drilled make a hole with a small bradawl 1 in. from the base and 1½ in. from the side into which is forced a piece of the gas-burner "by-pass" tubing ⅛ in. long. Remove the head from a 1-in. nail and insert the spike through the bush into the brass "spiral" rod and then solder the nail to the rod.

In this position the spiral is free to turn, though not yet is it making contact with the inductance. The projection of the ⅛-in. brass rod through the containing box should now be fitted with an ebonite or fibre knob in order that it may be more easily turned, and further so that it may be insulated from the hand when the set is being operated.

In order that good contact may be made between the coil and the

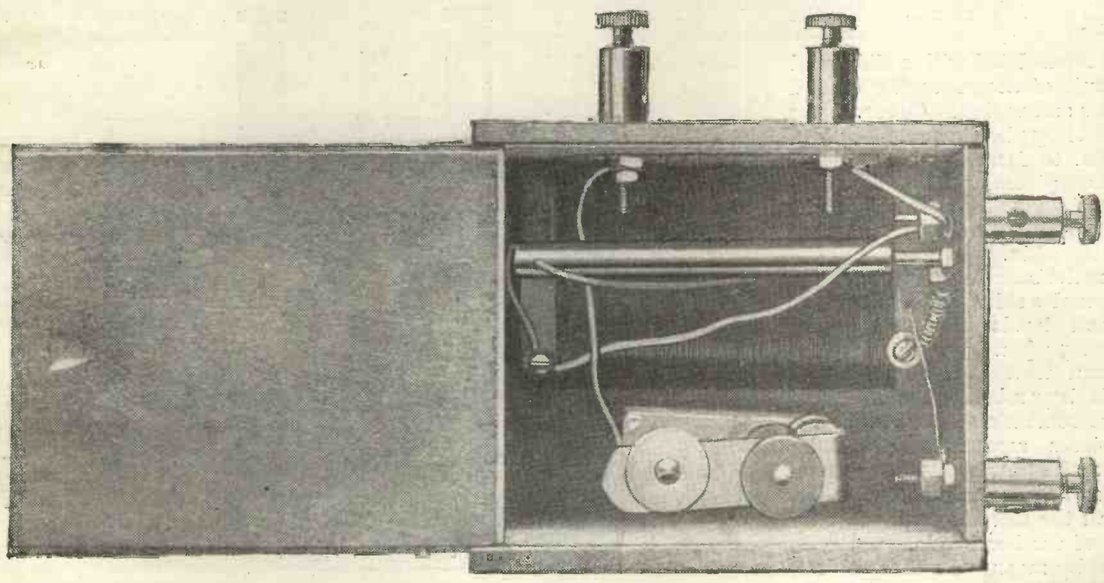
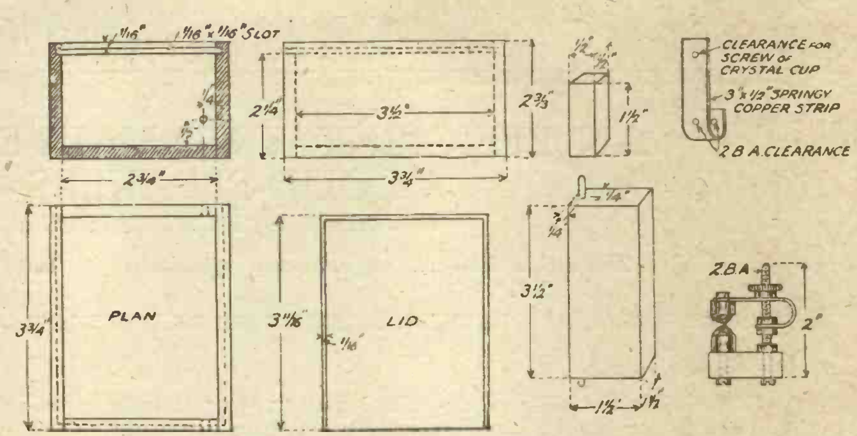


Fig. 3. View of the interior, showing spiral and crystal detector.

adjusting or "spiral" rod it is necessary (1) to scrape from the upper side of the inductance all traces of enamel; (2) to arrange a lifting device whereby contact is made at all times between the rod and bared windings. This latter is accomplished by means of a spring which served at one time as a part of a bicycle brake. One end is screwed to the wooden former and the other, after having been pulled to give a good hard tension, is screwed to the containing box as seen in Fig. 3. This spring lifts the coil on to the "spiral" and gives consistent pressure when the first-named is turned for adjusting.



Details of the box, inductance former and crystal detector.

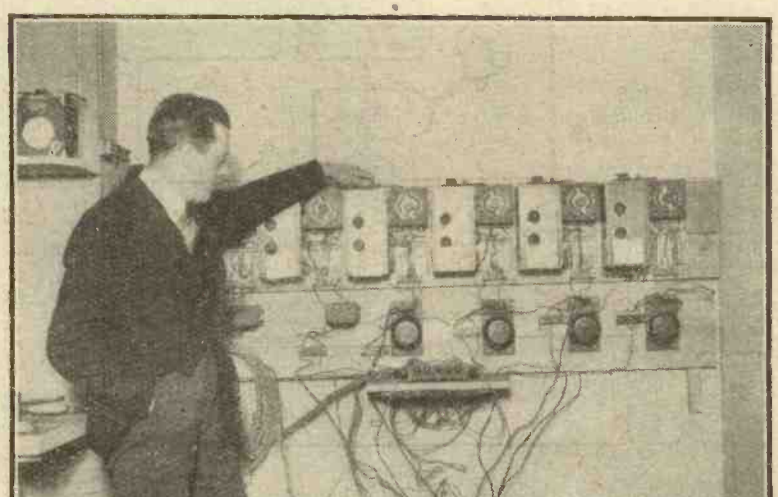
The Detector

The detector employed is a "perikon" combination and is made from a piece of wood 1½ in. long by ½ in. wide by ½ in. deep, screwed to the base of the containing box. At one end of the block is screwed into the wood a crystal cup (purchased) containing zincite, whilst at the other end is drilled a hole to take a conveniently small B.A. rod (2 B.A.) countersunk to take its corresponding nuts, on the underside of the wood; the length of the rod is 2 in. Next procure 3 in. of springy, copper strip ½ in. wide and bend at one end to form a **U**; through the two sides of the **U** drill holes, slightly bigger than the diameter of the rod, and at the other end of the strip drill a hole large enough to take the screw of a crystal cup. Place the two holes at the bent end, over the rod, securing the spring in position by means of a nut situated above the underside of the bend. Fit an ebonite knob with corresponding thread to the 2 B.A. rod which is projecting beyond the copper spring, so that the knob acts as an adjusting handle for the position and tension of the spring. To the other end of the spring is attached another crystal cup (with bornite as its crystal) held in its place by means of a nut on the upper side of the spring.

Wiring Up

Four terminals are fitted to the containing box, one for the "aerial," one for the "earth," and two for the "telephones"; the size and positions of these terminals are not of much consequence and may be left to the reader's judgment, though the smaller they are the neater will look the instrument. Across the terminals to be used as telephone terminals is connected a fixed condenser made up with 13 strips of tin foil, 7 one side and 6 the other, separated by mica strips.

The general wiring of the set is shown in Figs. 2 and 4, wherein are illustrated both pictorial and theoretical arrangements. With such a set as the one described it is possible to hear broadcasting over distances of about 20 miles when aerial conditions are good, and though the set was made for the purpose of tuning in broadcasting and nothing more, so long as good crystals are used, ships may also be heard.



The photograph shows Captain P. P. Eckersley standing beside the switch-board used for connecting 2 LO through to the various provincial stations by land-line

AN EFFICIENT TWO-VALVE SET FOR LOUD-SPEAKERS

By JOHN SCOTT-TAGGART, F.Inst.P.

This article deals with an extremely effective receiver using the ST. 75 circuit.

ALTHOUGH the ST.100 circuit is very hard to beat for loud and clear signals, yet chiefly owing to the fact that the crystal detector is used, there is always a certain amount of variation in the results obtained by different crystals and different crystal adjustments. The secrets of the effective working of the ST.100 lies in two things: the crystal and the intervalve transformer, the crystal of these two being by far the most important. There are many experimenters who have a strong prejudice against crystal detectors, and prefer a robust circuit which will stand any amount of abuse, and may be handled by the absolute novice.

Such a circuit is the ST.75, first described in *Wireless Weekly.* I believe when the merits of this circuit have been fully appreciated that it will become far more popular than the ST.34, or tuned-anode-with-reaction receiver. It is, in fact, derived from this latter circuit, and although only two valves are used, an additional stage of low-frequency amplification is introduced, giving about five times the signal strength obtained with ST.34.

The circuit which gives these very desirable results, and which enables the circuit to be used for loud-speaker work is illustrated in Fig. 1. It will be seen that the first valve acts first as a high-frequency amplifier, a tuned anode circuit being used; the second valve acts as a rectifier, and reaction is introduced from the anode circuit of this valve on to the tuned anode circuit. In the anode circuit of the second valve we also have the primary of an intervalve transformer which carries back the rectified low-frequency currents to the grid circuit of the first valve. In the anode circuit of this valve is included a loud-speaker, or telephone receivers, if these are used. These do not in any way interfere with the high-frequency amplification. Any existing ST.34 circuit may be readily converted into the new ST.75, and loud stable results are obtainable. Very loud signals are received regularly by the writer, on a small aerial situated about 12 miles from 2 LO. The aerial is 68 ft. long and about 12 ft. high and consists of one wire only.

The strength of signals is somewhat below the ST.100 for the local broadcasting stations, but the circuit is just as effective for long distance work, if not more so. Permissible reaction is used, and there are several further advantages of the ST.75 circuit, which will be discovered after a little experience with it.

The other figures illustrate different views of a set made up in accordance with the circuit diagram. The aerial inductance L1 consists of 60 turns of No. 26 double cotton covered wire wound on a cardboard tube 3 ins. in diameter. Tappings are taken at the 30th, 40th, 50th and 65th turns. The used portion of the coil is shunted by two condensers, C_1 and C_2. The condenser C_1 is a 0.001 μF Polar condenser, while C_2 is a 0.001 μF type 600 Dubilier fixed condenser. This latter condenser may be shorted by a brass strap. This brass strap is merely a strip of brass pivoted at the terminal and having an indentation at the other end which slips under the other terminal. By this means the condenser C_2 may be shorted, in which case the

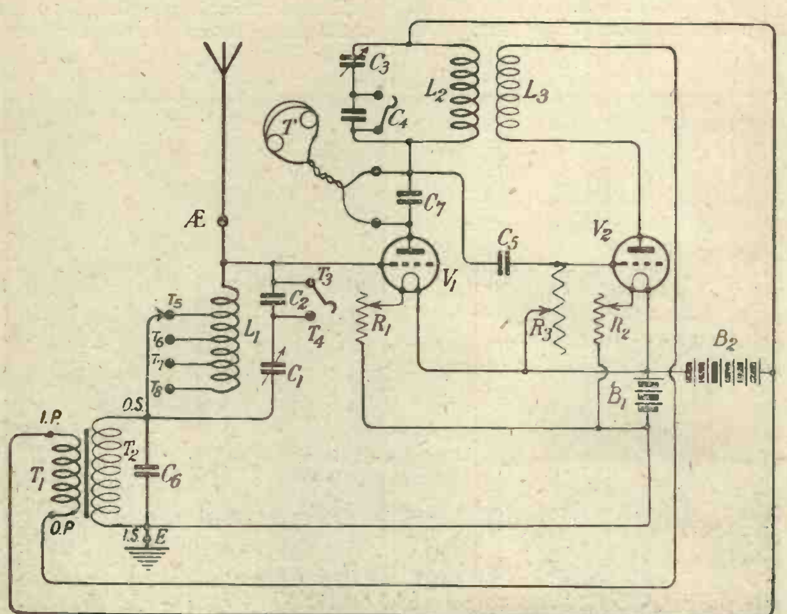


Fig. 1. The ST.75 circuit.

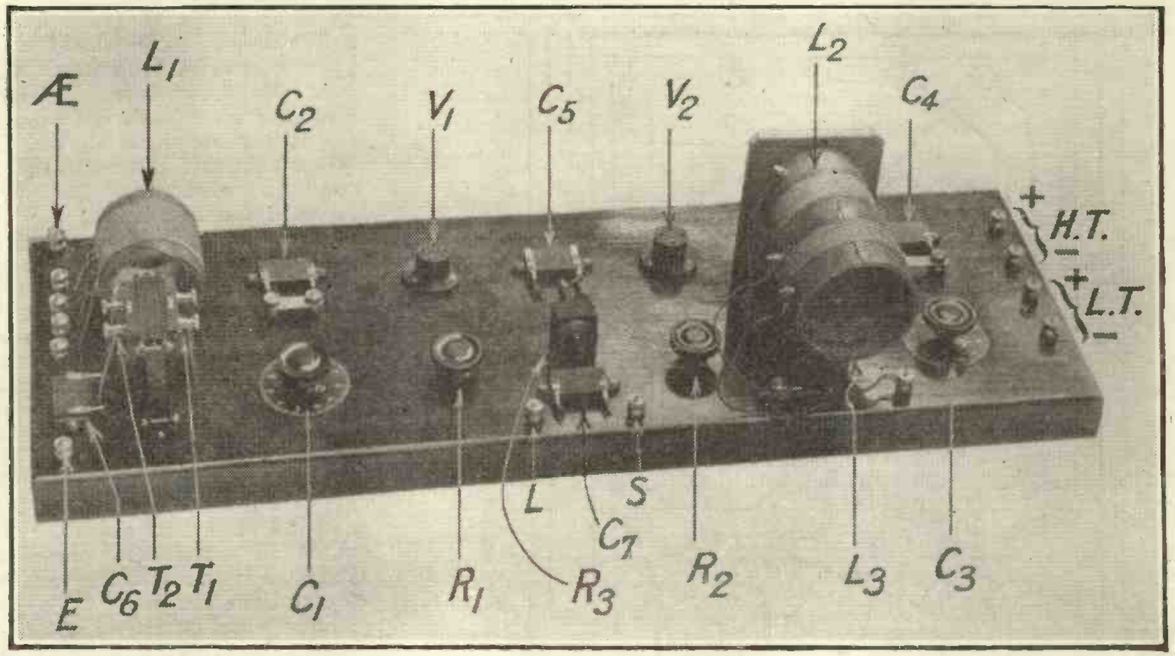


Fig. 2. The set made upon a board.

variable condenser across the inductance is a 0.001 μF. If, however, we leave the strap open so that C_2 is not short-circuited, we have what is, in effect, a variable condenser of 0.0005 μF. The value of this arrangement of condensers was pointed out in my weekly notes, "Mainly About Valves" appearing in *Wireless Weekly*. By this means, a much wider range of wavelength is obtainable.

Instead of having a switch to vary the aerial inductance, a wandering lead enables connection to be made to any of the terminals T_5, T_6, T_7 or T_8, thus varying the inductance in the aerial circuit, and therefore the wavelength to which the aerial circuit is tuned. The transformer T_1, T_2 is the 25s. type manufactured by the Lissen Company. The secondary winding is shunted by a 0.001 μF fixed condenser.

The gridleak is a Watmel variable gridleak which has been found to be a very satisfactory piece of apparatus. The grid condenser is of 0.0003 μF capacity. Across the loud-speaker or telephone terminals is connected a condenser C_7 of 0.002 μF capacity. All these fixed condensers should have mica dielectrics.

The tuned anode inductance is fixed, and consists of 40 turns of No. 26 gauge double cotton-covered wire wound on a 3-in. cardboard tube supported horizontally in the manner illustrated. It is shunted by two condensers in series, one being a 0.001 Polar condenser, and the other a 0.001 μF Dubilier fixed condenser. This latter condenser may be shorted when required.

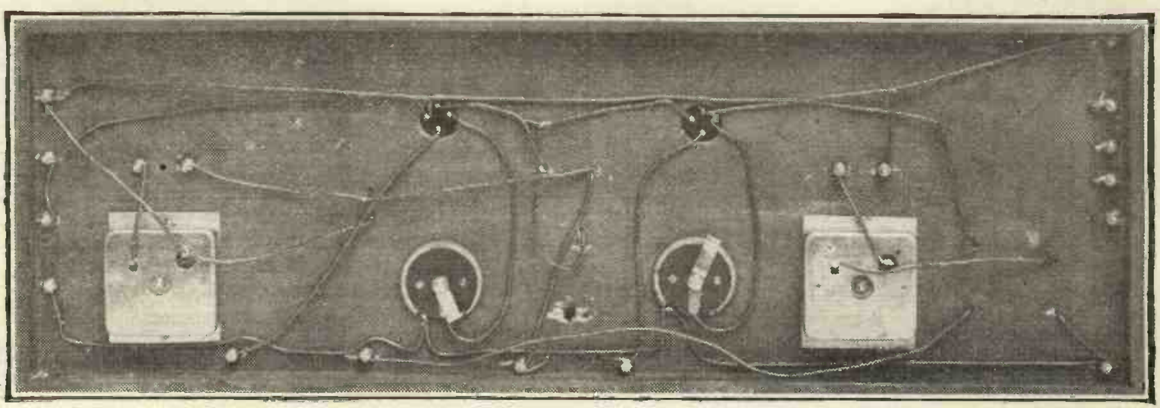


Fig. 3. The underside of the board.

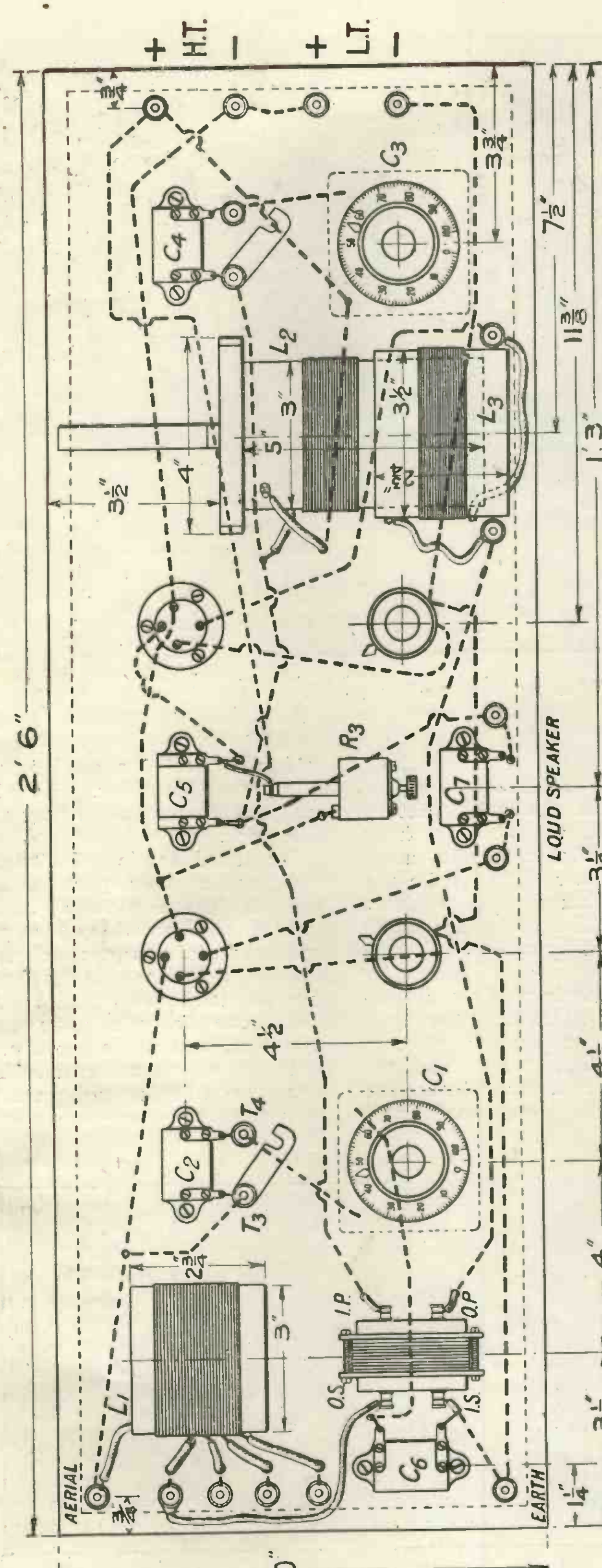


Fig. 4. The wiring of the set seen from above. Dotted lines indicate wires running beneath the board.

The reaction coil L_3 consists of 35 turns of No. 26 gauge double cotton-covered wire wound on a 3½-in. cardboard tube which slips over the other tube. Flexible leads are taken from the reaction coil to two terminals T_8 and T_9. When adjusting the reaction, the coil L_3 is moved up and down over L_2 until the best results are obtained. If no increase in signal strength results when the reaction coil is slipped over the tuned anode coil, and even after retuning of the two variable condensers, the reaction coil should be reversed and slipped on to the coil L_2 the other way round.

The method of operation of the set is really very simple. The first thing to do is to connect the aerial lead on to the terminal AE, and the earth lead on to the terminal E. The wire connection from OS is taken to the terminal T_5, and the condenser C_2 is preferably short-circuited; likewise, the condenser C_4 is short circuited. The reaction coil is taken off the tuned anode coil altogether and allowed to rest on the set. The two condensers C_1 and C_3 are now adjusted until the loudest signals are obtained. The condenser C_4 is now also unshorted and tuning accomplished on the condenser C_1, if possible. If the signals cannot be tuned out on both sides of an adjustment of C_1, try connecting the lead S on to the terminal T and retune. One or other of the terminals T_5, T_6, T_7, T_8 should be found to give the loudest signals after retuning on the condenser C_1. Now place the reaction coil L_3 over L_2 and increase the coupling between L_3 and L_2, at the same time retuning the two variable condensers in each case. If the reaction is made too tight the set will oscillate and howls will be heard. If there is no increase in signal strength as the reaction coil is slipped on, reverse the reaction coil and try again. During these operations, see that the gridleak is sufficiently low; in other words, see that the little knob is turned well round to the right, so that it is not quite as tight as it is possible to make it.

Above & below the Broadcast Wavelengths

An Extraordinary Aerial.

DURING the second short-wave transatlantic tests that were organised by the American Relay League and the Radio Society of Great Britain (or the Wireless Society of London, as it then was), the American representative, Mr. Paul Godley, who spent chilly nights under canvas at Ardrossan in the South of Scotland, made use of a type of aerial that is quite different both in its construction and in the theory of its action from anything in amateur use. This was the Beverage Antenna, a device covered by U.S. Patent No. 1,381,089. So far as the writer is aware, very little regarding this aerial has appeared in the wireless papers published in this country. Most experimenters, however, remember that Mr. Godley was using an aerial far longer than would be permitted to any ordinary amateur for his receptions. This was quite true, for the American representative's aerial stretched for no less than 850 feet, although the height of the suspended wire was only about 6 feet above ground level.

The Beverage Antenna.

Any short wave specialist who has sufficient space at his disposal, and can obtain the necessary permission from the Postmaster-General, will find that the Beverage Antenna opens up a wide field for experiments on quite novel lines. It consists of a single wire (Fig. 1) supported on light posts such as Army telephone poles, 6 feet or so in height, an insulator being needed at each post. It is not by any means expensive to erect since such small poles are used. The aerial is very markedly directional, and to obtain the full benefit of its action it must be so sited that its free end points towards the transmitting station whose messages it is desired to receive. It will be noticed that in this respect its behaviour is precisely the reverse of that of the ordinary inverted L aerial, whose free end should theoretically point *away* from the transmitting station.

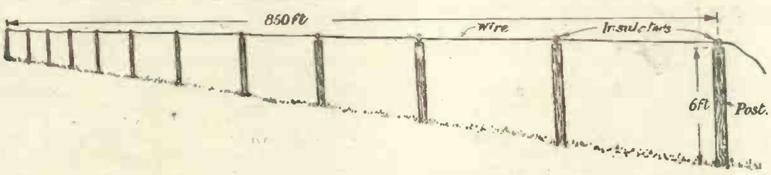


Fig. 1.—The Beverage Antenna.

The Theory.

The Beverage Antenna works on quite different lines. Owing to its great length in comparison with its height, it resembles in many ways an ordinary " land line " telephone wire. Hence a great deal of the theory of the propagation of electric impulses along telephone lines is applicable to the Beverage Antenna.

The Effects of Lag.

For radio frequencies, the velocity is very close to that of light, though it is always slightly less. When a radio impulse reaches the Beverage Aerial it will induce in the wire an impulse which is propagated along it at a velocity determined by the electrical properties of the wire. The wave moving along the wire will, therefore, move a little less rapidly than the free wave in space. The impulses in the wire will lag a little behind the electrical forces of the free wave (Fig. 2), and will absorb energy from them. It will thus be seen that the intensity of the disturbances in the wire will increase with the distance along the wire. That is, there is a building-up effect, which reaches its maximum at the end of the wire remote from the transmitting station.

As the two velocities are different, the lag between the two forces will continue to increase the further we go along the wire until the difference reaches 90° or even 180°. When this occurs any further energy passing into the wire will be in the wrong direction, and its effects will be to diminish the strength of the impulse in the wire. The length of the aerial must, therefore, be adjusted so that the lag will be sufficient to build impulses up to their greatest strength and stop short of the point at which the decreasing effect begins. On a 200 metres signal interference between the two sets of impulses will not occur until the wire has a length of about 3,000 feet.

The Balancing Resistance.

When an abrupt change is made in the electrical qualities of the line, such as that which occurs at the aerial terminal, the value of the wire's natural impedance will alter. There will be a reflection of the wave; surges will be set up and there will be a loss of energy. To prevent this it is necessary with the Beverage Antenna to ensure that the receiving apparatus connected to it offers the same impedance to the wave as does the aerial itself.

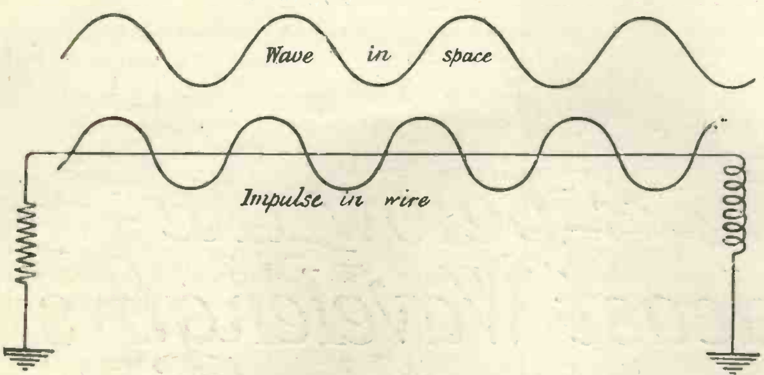


Fig. 2.—Effect of incoming wave on Beverage aerial.

This is done by earthing the free end, as shown in Fig. 2, through a resistance of from 200 to 500 ohms (see Fig. 3), according to the length of the waves that are being received.

Uses With Short Waves.

For dealing with waves of the order of 200 metres or less, the Beverage Antenna may be used conveniently with the supersonic method of reception, which was recently described in these notes. From the description given it will be seen that the Beverage Antenna is an excellent device for the long-distance reception of small powered short wave signals. Its building-up properties bring them in at the greatest strength obtainable, and its very marked directional qualities ensure the reduction of interference. The only point against it is its great length, but it is quite possible that good results may be obtained from low horizontal wires that are very much shorter than the 850 foot stretch used by Mr. Godley. In any case it is well worth the serious experimenter's attention.

Recently it has been improved so as to bring the balancing resistance to the same end as the tuning apparatus, thus avoiding a long walk when altering adjustments.

Some New Valves.

Valve manufacturers in the United States have been going ahead with various types of dull emitter valves. Two of these are particularly useful for short wave work owing to their very small internal capacity. These are the W.D. 11 and the U.V. 199, whose plates are little more than one-eighth of an inch in diameter. These types should effect something like a revolution in wireless, for since either will work off dry cells such as those used for working household electric bells, they bring the valve set within the reach of the man who lives far out in the country and has no facilities for getting accumulators charged. The writer has recently been able to test practically both of these types, and a third, the U.V. 201 A, which has a larger grid-plate capacity and is therefore not so suitable for dealing with very high frequencies.

Holders.

If any readers succeed in obtaining valves of these types they may

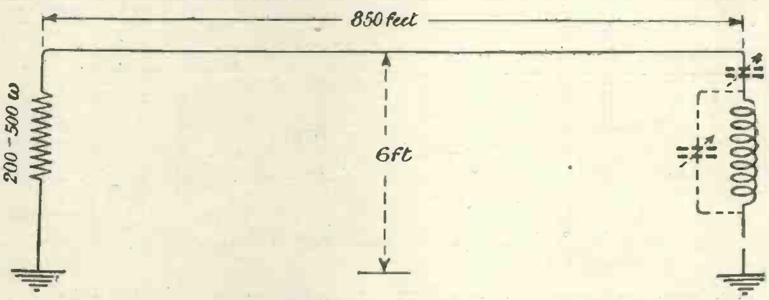


Fig. 3.—The aerial with balancing resistance and tuning inductance.

be rather perplexed over the question of a suitable holder. The ordinary American valve fits into a bayonet-holder, not unlike the usual lamp socket, save that it is of larger diameter and has four spring contacts. U.V. 201 A fits this holder, but each of the others requires a special adapter of its own. W.D. 11 has pins spaced like those of our own valves, but it will not go into their holders since the plate prong has a diameter about double that for the others. This difficulty may be got over by making up a holder consisting of three ordinary valve legs and a special fourth leg made from a short piece of ⅜ in. brass rod drilled to a suitable size. The simplest method, however, with any "freak" valves—American or German—is not to bother about holders at all! Leave the valve in its box, turn the box upside down and solder a flexible lead to each of the prongs. Connections can then be made with the greatest ease. One advantage of this rough-and-ready method is that all the valve contacts are positive.

As readers may have a little difficulty in telling which pin of the valve is which—they are not marked in any way—the connections are shown in Figs. 4 and 5. It will be noticed that in the ordinary valve the filament pins lie opposite the notch in the base of the cap, but in the U.V. 199 they are arranged diagonally.

W.D. 11.

W.D. 11 is a delightful little valve to use either as a high-frequency amplifier or as a rectifier for short wave reception. Though its current consumption is very small indeed, and the necessary filament voltage seems almost ridiculous at first sight, it performs quite as well as any "general purpose" valve that the writer has tried. It works with .25 ampere at 1.1 volts on the filament, and the plate voltage needed is only from 20 to 30. This is the anode potential generally employed with U.S. receiving valves; in fact, the 22½ volt "slab" high-tension

Fig. 4.—Pins of standard American valve.

Fig. 5.—Pins of U.V. 199.

battery is almost a standard component over there. The valve can be run from a single dry cell provided that the battery is given a few minutes' rest every now and then to allow it to become depolarised.

U.V. 199.

U.V. 199 makes a still more determined attack on filament current consumption, its requirements being only .06 ampere at 3 volts. So long as one takes care not to overload, it works very well, but it is a difficult matter to regulate its filament current unless an extra resistance of about 40 ohms is put in series with the ordinary 6-ohm rheostat for use with the 6-volt accumulator. The valve is designed to work off three bell cells wired in series, and even then a rheostat with a resistance of from about 25 to 30 ohms is desirable. If by any chance the filament is overheated, the valve promptly ceases to function, and though its former powers may be restored to some extent by disconnecting the plate battery and leaving the filament glowing for some time, it will probably be found to have suffered to a certain extent. When the valve is used as a rectifier, the secondary circuit should be connected to grid and filament *positive*.

In actual tests this valve was found to be rather unstable. The filament emission varied considerably and the life of the valve was short. The writer does not recommend readers to go to any trouble to obtain specimens of this valve. The next one, however, is a very different thing.

U.V. 201 A.

This is a dull emitter pattern of the famous U.V. 201. It works with .25 ampere at 5 volts, a wattage of 1.25, but in spite of these low figures its emission is equal to that of any good receiving valve of the high temperature variety. Both as an amplifier and as a rectifier, it leaves nothing to be desired. Its life is stated to be short, though nothing like so short as that of U.V. 199. The latter averages about 300-400 working hours, the former 600 or more. In making U.V. 201 A the makers seem to be on the right lines, for they have not endeavoured to do too much. If you cut down both current and E.M.F., a thin and therefore very fragile filament must be used. By leaving the voltage at 5 and paring away the current, the filament can be made fairly stout, and after all *voltage* is always easy to obtain, though *currents* of more than about .3 of an ampere demand a secondary battery if they are to be steady enough for filament heating purposes.

Fine Rheostats.

Those who do much work with distant short wave receptions will probably have had reason to quarrel with the stock type of rheostat if fitted to the rectifying valve. Their faults become particularly glaring if the rectifier is a soft valve. The average 5 or 6 ohm rheostat has not a smooth enough action and it does not allow sufficiently fine adjustments to be made. It pays to provide the rectifier with a really good rheostat, preferably with a "vernier" adjustment. The word vernier, by the way, is one of the most misused in wireless; it means really a double sliding scale by the aid of which very small fractions of a unit can be read off, but it is frequently applied to instruments capable of fine adjustment. If the rheostat is harsh in its action it is most unpleasant to work with, for it produces clicks that drown weak signals when its knob is moved.

L.F. Transformers.

It will be found that the low-frequency transformer which gives the best service for the reception of Morse signals is often by no means ideal for telephony. For receiving signals the most suitable transformer is one designed to respond to a frequency of about 1,000 a second, but for speech and music such an instrument will not do at all well, for it will have a marked peak effect and will produce distortion. For telephony the designer works to a mean frequency in the neighbourhood of 750 cycles a second. If, therefore, you are particular, as all wireless men should be, about the quality of your receptions rather than their mere strength, you may find it an advantage to provide two different low-frequency transformers, each designed for its special purpose, using one for signal reception and the other for telephony.

The Longest Waves.

Very few amateurs probably ever hear any of the really long wave stations such as Annapolis (NSS) whose wavelength is 17,000 metres, or Bordeaux (LY) whose 23,450 metre wave easily tops the list. The reason is that to do so means providing a set of inductances of the largest size, which are expensive to buy and tedious to wind unless one has a coil-making machine of some kind. Still, it is worth while to make up in one's spare moments a batch of coils suitable for receiving these giants, for when one gets on to the longest waves there is not the babel of signals that occurs rather lower down the scale and reception is extremely good. There is always, too, a certain thrill in bringing in a station that is working on some huge wavelength, and one feels several inches taller after receiving these signals from Annapolis. Tuning one of these waves is a very different business from what it is below 400 metres. On the short waves a tiny adjustment makes a vast difference in the frequency to which the set is tuned. But up above the difference made by a corresponding increase or decrease in the capacity of the circuits is very much smaller. The effects of body capacity do not manifest themselves to the same extent, and the high-frequency side of the set becomes much more stable. If one cares to go still further and to wind an inductance for a wavelength of 100,000 metres or so, a fresh surprise is waiting, for atmospherics come in not as toneless cracklings, but as musical notes.

LAMBDA.

LETTERS TO A BEGINNER

No. 1—Buying Your Broadcast Receiver

This is the first of a series of hints for the person who wants to begin wireless.

MY DEAR BEGINNER,

I was interested to get your letter telling me that you proposed going in for wireless and asking my advice how to go about it.

I suppose you have heard the broadcasting at Smith's or that friend of yours round the corner, and you want to have a set in your own home.

You start your letter by asking whether it is worth while taking up this new craze. My dear fellow don't imagine for a moment that wireless is a craze. Up to comparatively recently it was a very fascinating hobby, but since broadcasting started it has become three things: A still more interesting hobby; a source of entertainment as attractive to many as the kinema, the concert or the theatre; and, thirdly, it has become an institution and almost a necessity of everyday life. If you have not a wireless set you are missing one of the pleasures of life, and a pleasure which may be bought at a very low figure.

You would not take a walk in the country and keep your eyes shut, yet thousands of people are sitting at home to-day with the air all around them full of sweet music and entertainment, and yet they are deaf to it all. You yourself, while reading this letter, if it is in the evening, could, after a comparatively small expenditure, switch on this new source of enjoyment.

The beauty of it is, of course, that you can sit in your own home with your feet on the mantelpiece, and fifty per cent. of you buried in a cosy armchair. Your wife will enjoy the broadcasting just as much as you will yourself, although she will probably have very little interest in the technical side of the business. As for the children they will be delighted also, and it will be a job to pack them off to bed. As you probably know the children have a special hour to themselves, when their various uncles and aunts at the broadcasting stations entertain them with chatter, tales and music.

So much for the entertainment side of broadcasting. You will, however, probably get more and more interested in the technical side of the business. You will want to know how a valve works, the difference between an ohm and a mho, a grid and a plate and strange things like that. You will find that the introduction of a broadcasting set in your home will prove one of the best investments you ever made. If you find it worth your while to write to me again I will let you know some more about the technical side of the business. For the moment I am going to assume that you want to buy a broadcast set and desire some advice.

You want to know: "Is the apparatus messy?" "Do you have to have a lot of batteries?" "Where should you buy the set?" "What kind of a set should you buy?" "Do you need to know much about how it works?"

Perhaps I had better say at the beginning that I don't intend to say, "Go and buy Smith's two-valve set." It is impossible for anyone to single out any particular set as the best, and, in any case, I would have to know more about your requirements. If you were going to buy a gramophone you would buy a well-known make, and the particular type chosen would depend upon the price you were ready to pay. When you buy a wireless set, however, I would still advise you to buy a well-known make, but the results you would obtain would depend upon the price you pay. When you buy a gramophone the purity of the music would depend upon the price paid. In the case of a wireless set, however, the purity or excellence of the music or speech received is not in general affected by the price. The price, roughly speaking, governs the range of your wireless receiving station. It governs the number of broadcasting stations you can hear, or, if you intend listening chiefly to the broadcasting station nearest to you, the price will govern the loudness you can hear it, the ease with which you can tune in, and the general appearance of the set.

There are, as you probably know, six broadcasting stations situated at the following cities: London, Manchester, Glasgow, Cardiff, Birmingham and Newcastle. These stations are working every evening from about 5 till 11 o'clock, and they also work during the afternoon for a short period, except in the case of London, which works for an hour in the morning,

Now the kind of apparatus you want depends very largely upon the distance you happen to be away from one of these stations. The nearer you are the cheaper will be your apparatus, generally speaking.

You can listen-in to broadcasting either by means of telephone receivers or with a loud-speaker. Telephone receivers give very clear speech and music, but many people find that they are not as satisfied as with a loud-speaker because of the inconvenience. It is not possible to move about easily and a number of people cannot hear all at once unless they have telephone receivers on their heads. Some people compare the use of telephone receivers to the use of opera glasses at the theatre. Personally, I think that the loud-speaker will come into greater and greater vogue, because most people, sooner or later, get tired of telephones.

The trouble is, many people are disappointed with broadcasting after hearing a demonstration with a loud-speaker. They blame the loud-speaker, but in 99 cases out of a 100 it is the fault of the person operating the loud-speaker. A loud-speaker, properly used, will give excellent results. Improperly used, the results will be terrible.

There are, roughly, two kinds of wireless sets: crystal sets and valve sets. A crystal set is a very simple affair and may be bought quite cheaply. It is the cheapest form of wireless receiver and is simplicity itself to work. On the other hand, its range is, at the most, about 20 miles, and personally, if you live further away from a broadcasting station than 10 miles, I would not advise you to buy a crystal set. At about this distance, however, you can obtain quite good results with telephone receivers. You cannot work a loud-speaker, except with a valve set, although if you live near to a broadcasting station, say, within 10 miles, you will be able to add to your crystal set what is known as a two-valve low-frequency amplifier, a piece of apparatus which will greatly strengthen the signals and will enable you to use a loud-speaker. The results at 10 miles are not very brilliant, but when within a shorter distance, you certainly will find that a two-valve low-frequency amplifier and a crystal detector will give you good results. I am merely telling you this because you may imagine that you would like to start with a crystal set and then add to it later and use a loud-speaker. This is quite a good idea, but if you live further than 10 miles away from a broadcasting station, and you hope ultimately to use a loud-speaker, I would advise you to start straight away by buying a valve set.

Valve sets are quite simple to work, but they necessitate what are called "valves." These are similar to electric lamps, but are much smaller, and they work off batteries. Two kinds of batteries are required, one is called a high-tension battery, and the other is called an accumulator. The high-tension battery and accumulator do not take up much space, and they are not messy to use. The accumulator will require charging with electricity every week or every fortnight, according to how often you use it. If you use it every evening for the whole of the programme you will have to charge it every week, but if you use it less, you will need to charge it less often. Don't imagine that because batteries are used you are likely to get a shock. Some people imagine that electricity always gives you shocks.

The valves only need replacing very rarely, just as ordinary electric lamps bulbs do.

Now, as regards the type of valve set you are going to buy, if you have decided to buy one. I would advise you to buy a two-valve set, and then later on you can buy a two-valve amplifier, if you want it. If you can afford it, by all means buy a set which will give you loud-speaker results without any extra apparatus. This means a three or four-valve set. With the four-valve set you certainly ought to get loud-speaker results up to 40 or 50 miles from a broadcasting station, but the best thing to do is to choose your set and then ask the manufacturer to advise you if it will give the results you want. You can then blame them if it doesn't, and any reputable firm will help you out of your difficulty.

As regards firms who sell wireless apparatus, I cannot impress too strongly on you the importance of dealing with a reliable organisation. The boom in wireless has attracted all sorts of people who want to get rich quick at the expense of the purchaser. The result is that many sets have been designed by people who hardly know the elementary principles of wireless and certainly who do not understand the construction of the apparatus. Never buy nameless goods. The best thing you can do is to write to the advertisers in one of the wireless journals and ask for their catalogues or particulars of sets in which you are interested. Make sure, first of all before buying a set, that the manufacturers or dealers can recommend it for your particular purpose.

The advantage of buying advertised goods is well known, and this is particularly so in the case of wireless apparatus. Regular advertisers who sell their apparatus on their reputation cannot afford to risk that reputation by selling unsuitable or inefficient apparatus. Moreover, a good wireless periodical will not accept advertisements from firms in whom they cannot place confidence.

Having decided in your own mind what you can afford and what kind of a set you would like, I would suggest that you ask an experienced wireless friend whether he thinks that you will get the range that you expect. Manufacturers, as a class, are inclined to exaggerate the ranges of their sets, and therefore you should not simply buy the set from the manufacturers who claim the longest range. The advice of a wireless friend will prove invaluable. I would help you myself, but as I cannot, I suggest that you ask someone locally who knows something about the subject. Preferably, you should ask someone who has a good technical knowledge of the subject, and who is one of the class known as wireless experimenters.

I expect the next thing you will be writing to me about is, How to get the best results out of the set you have bought. If this is so, let me have your enquiries in good time.

Yours sincerely,

A Wireless Friend.

MIDGET SWITCHES

Small switches, whether double or single pole, are always most useful, for they will fit in anywhere on the panels of the set, and they can be made to serve a variety of purposes. The single pole, for instance, may be employed as a cut-out switch for high or low tension batteries, for short-circuiting gridleak, grid condenser or reaction coil, or for

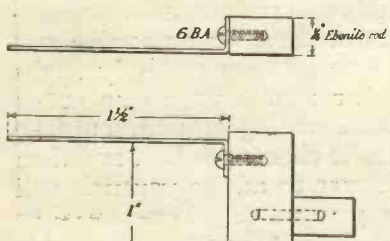


Fig. 1.—Useful forms of switch arms.

throwing into or out of action a connection between L.T. negative and earth. The double pole switch has an enormous variety of uses. To name only a few: it can be used as a series parallel device, as a means of throwing either loud-speaker or headphones into circuit, as a tune-standby switch, and as a cut-out for high or low frequency valves.

Switches of miniature size are now on the market, but they are rather too small to be satisfactory on the high frequency side of the set.

A type that is rather larger but still quite compact can be made without difficulty in the amateur's workshop. Fig. 1 shows the arms of S.P. and D.P. switches. Both are cut from sheet brass. They measure 1¾ in. in length, and are $\frac{3}{16}$ in. wide. Near one end a 6 B.A. clearance hole is drilled; the other end is drilled in the same way and then bent at right angles.

In the case of the S.P. switch, the handle is made of a piece of ¼ in. ebonite rod ⅜ in. in length, secured by a 4 or 6 B.A. screw. The twin arms of the D.P. switch are bridged by a piece of $\frac{3}{16}$ in. or ¼ in. ebonite, and a knob made as before is fixed, to its midpoint. This is done by drilling and tapping both knob and bridge. A piece of 6 B.A. screwed rod, or a screw with its head cut off, is then turned as tightly as possible into the knob. The knob is then screwed on to the bridge. Both clips and pivots are made from springy copper, brass or German silver. The latter are shaped as shown in Fig. 2, a 6 B.A. screw acting as the pivot bolt. When the arm has been inserted, the nut is tightened until a gentle pressure is exerted on the arm by the inside portions of the clip. The end of the screw is then slightly burred to keep the nut from moving.

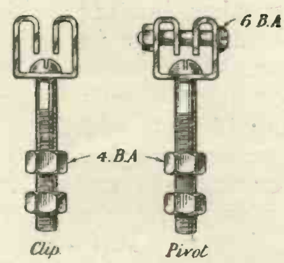


Fig. 2.—The clips and pivots used in assembling small switches.

Fig. 2 also shows the design of the clip contacts.

When laying out the panel for drilling, pivots and clips are 1 in. apart, and the same distance intervenes between the members of each pair in the case of the D.P. switch.

A single pole single throw switch type requires a total space of 2 in. by ¼ in. on the panel; a double pole double throw switch needs 4 in. by 1¼ in.

Practical Notes

COMBINED EARTHING SWITCH AND LIGHTNING ARRESTER

HERE is a description of a very easily constructed and efficient little switch and lightning gap. An inspection of the sketch will make it fairly clear.

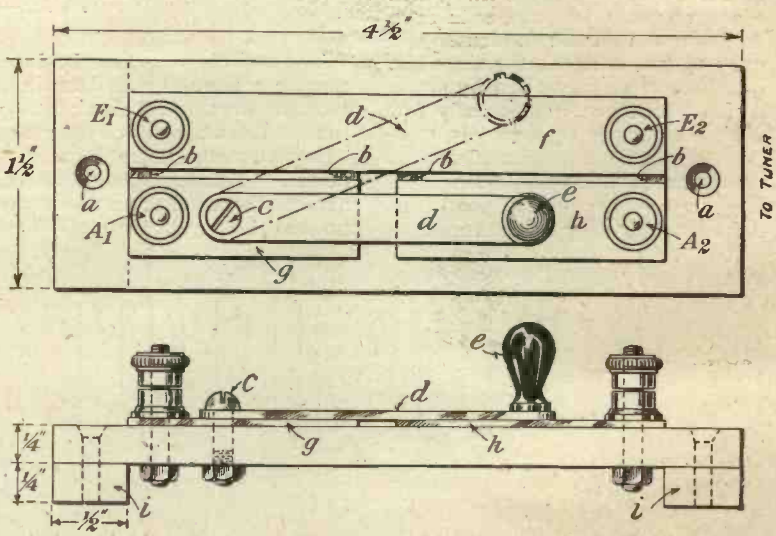
You will require an ebonite base 4½ in. by 1½ in. by ¼ in. thick, with two end blocks of the same measuring about 1½ in. by ½ in. by ¼ in. thick (marked *i* in sketch). Holes will have to be drilled at ends (*a*). Four terminals will be required (E_1, E_2 and A_1 and A_2). Next we require a strip of brass about 1-32 in. or slightly thicker, ½ in. wide by 3½ in. long, with ends at each end to take terminals E_1 and E_2; another piece of the same brass ½ in. wide and 1½ in. long (*g*), a third piece of brass ½ in. wide and 1¾ in. long (*h*) with hole drilled in to take terminal A_2, while the preceding one (*g*, 1½ in. long) will have a hole drilled in to take terminal A_1 and also a hole to take 4*B.A* screw (*c*) on which will be pivoted switch arm (*d*) which will be made of the same brass shaped as shown in sketch with handle (*e*) at one end and measuring about 2 in. long by 5-16 in. wide. The long piece of brass carrying terminals E_1 and E_2 will be fastened on baseboard by means of these terminals, then will follow the two smaller pieces of brass carrying terminals A_1 and A_2 fastened on the baseboard close to but not touching the longest piece, from which they will be separated by small pieces of mica, marked (*b*, *b*, *b*, *b* in sketch), the opposing edges of these pieces being in addition given a touch of shellac, and this will constitute the gap. In practice this little arrangement should be mounted outside (in a covered box, if desired), the aerial wire being connected to terminal A_1 and the earth lead to E_1, whilst the aerial connection of the tuner will be led into terminal A_2 and the earth to E_2.

The switch as drawn shows the tuner connected to aerial, and the dotted position of the switch-arm shows the aerial cut off from the tuner and thrown on to earth.

The distance of the lightning gap as shown in sketch is somewhat exaggerated, and will, of course, be much less, according to the thickness of the mica blocks inserted, which will be very small thin flakes.

When complete test with battery and phones to see that there is no leakage of current across the gap separating the three pieces of brass *f*, *g* and *h*.

W. P. A.



Details of the switch.

A SWITCH FOR TAPPED INDUCTANCES

By R. W. HALLOWS, M.A., Staff Editor.

ONE of the most useful switches that one can have for use with tapped inductances is that known as the tens and units type. Fitted to a coil with a 100 turns from which tappings are taken at every tenth turn up to the 90th, and then at every turn from the 91st to the 100th, it allows any number of turns from one to a hundred to be brought into play by the simple movement of a pair of selector switches. Fig. 1 shows its working. If the arm of the tens switch is placed on stud 6, and that of the unit switch on stud 7, the total number of turns is 50+7. With both switches on stud 1 only a single turn is in play, and when both are on stud 10 the whole coil of 100 turns is brought in. With a coil of this size fitted with such a switch, a variable condenser will not as a rule be necessary, since the inductance can be varied by single turns, which gives sufficiently fine tuning for most purposes. If, however, a small variable condenser is used, the switch can deal with a large inductance. One of 300 turns, for example, might be tapped at every 30th turn up to the 270th, and then at every third turn from the 273rd to the 300th. Adjustment would then be possible in 3-turn steps from 3 to 300.

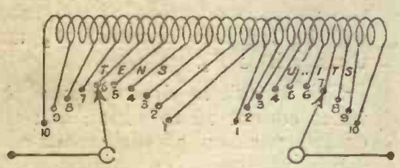


Fig. 1.—The Switch in Use.

The switch is quite an easy one to make, and though it is rather expensive to buy finished, its cost will not run to more than five shillings, if it is constructed at home. The materials required are:

- 2 laminated switch arms.
- 20 contact studs.
- 2 terminals.
- 1 piece of ebonite, 9 in. by 3 in. by ¼ in.

The switch arms can be bought complete from advertisers in this journal for a small sum; the contact studs run to 5d. or 6d. a dozen. The latter should be ¼ in. in diameter. There is one little thing about them that not everyone notices. Those that are sold cheaply are often not perfectly finished off, a tiny point of metal remaining in the centre of each which has not been reached by the lathe tool. Before they are used their heads should be made perfectly flat with a fine file, for if the points are left the action of the switch will be rough and contact at some studs will be very bad indeed.

To lay out the panel, as shown in Fig. 2, scratch two 1½-in. radius semicircles, with their centres 3½ in. apart on what will be the underside. Then set the points of a pair of dividers ⅜ in. apart and make ten scratches on the circumference of each semicircle with them. Where each of these crosses the circumference, drill a clearance hole of the right size for the shanks of the studs. Most makes are 4 B.A., but one occasionally comes across 5 B.A. shanks. At each of the centres drill a ⅜-in. hole for the bushes off the switch arms. Two 4 B.A. holes are made as shown for the terminals.

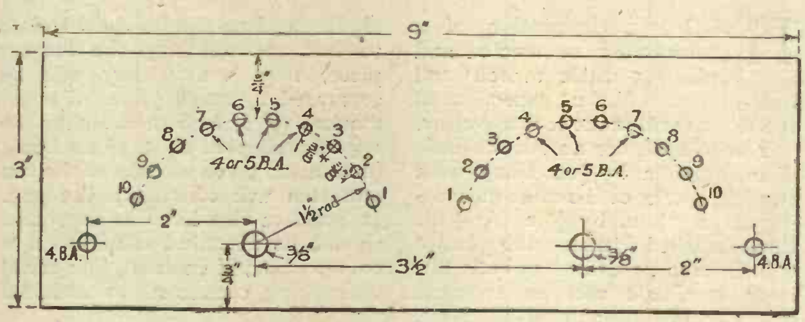


Fig. 2.—A Drilling Diagram.

The studs and switch arm may now be mounted, and the switch wired up, as shown in Fig. 3. When finished it is fixed to the base board of the coil. This can be done very neatly by cutting out an oblong in the wood, measuring 8 in. by 2¼ in., which will allow the shanks of studs and terminals and the spindles of the switch arms to clear it. The panel can then be fixed in place by means of four small screws at the corners.

The switch serves a large variety of useful purposes. It can be used for tuning a single circuit inductance or for the primary of a loose coupler. It is also most handy for tuned anode and reaction coils, where it enables one to use a much smaller variable condenser than would otherwise suffice.

R. W. H.

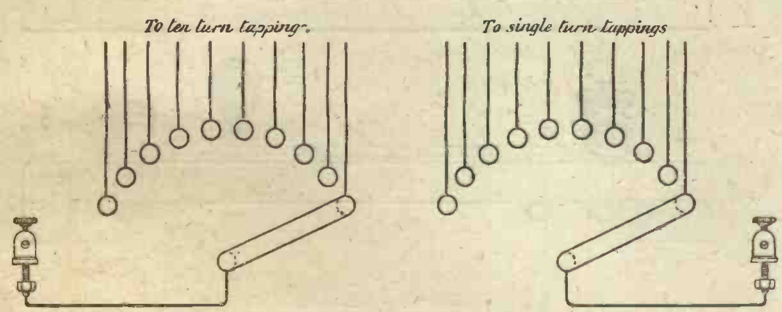


Fig 3.—How to Connect the Switches to the Terminals.

Reduction in Prices

on and from August 7th, 1923.

Consequent upon the increased demand and improved methods of production, resulting in decreased manufacturing costs, The General Electric Co., Ltd., have pleasure in announcing the following **substantial reductions in the prices of**

GECoPHONE

Headgear Receivers.

The superlative quality of these instruments, to which they owe their widespread reputation, will be in every way maintained.

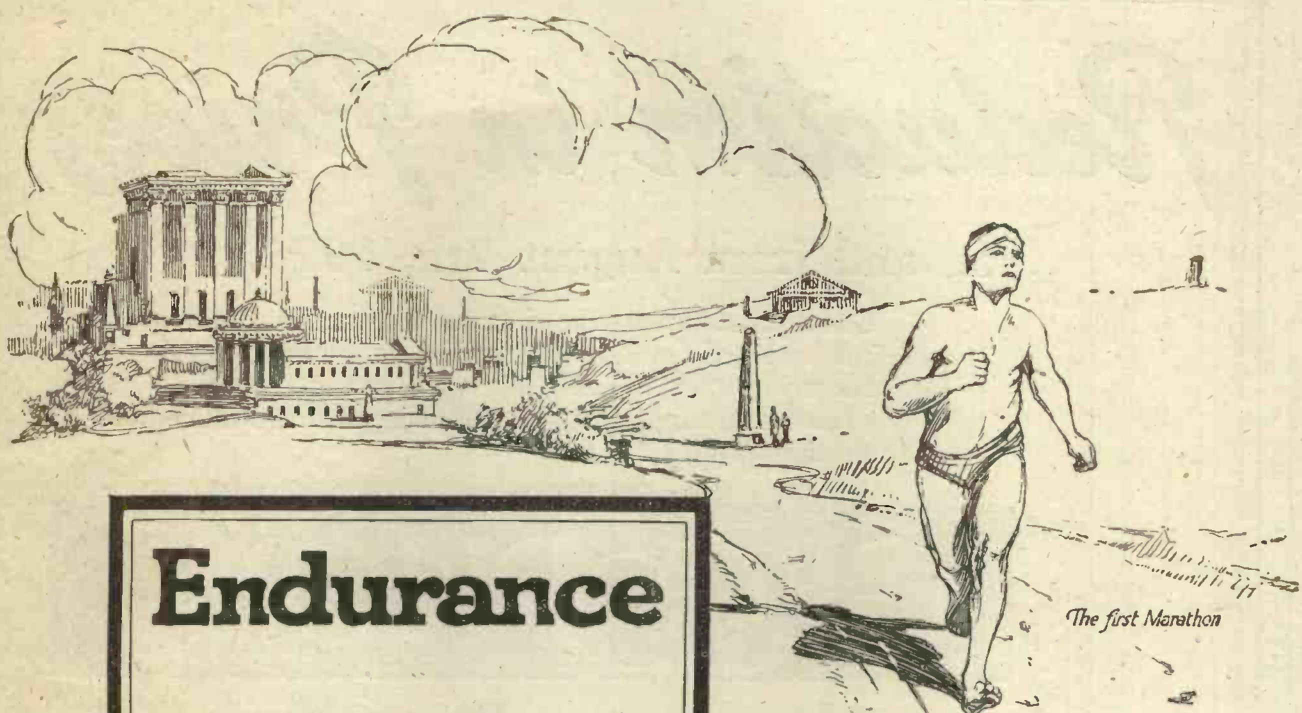
	Old Price.	Reduced Price.
Cat. No. B.C. 80, 120 ohms,	29/6	**22/6**
,, ,, B.C. 82, 2,000 ,,	31/-	**24/-**
,, ,, B.C. 83, 4,000 ,,	32/-	**25/-**
,, ,, B.C. 84, 6,000 ,,	40/-	**35/-**

Sold by Electrical Contractors, Stores, and Wireless Dealers.

(Wholesale only.)

THE GENERAL ELECTRIC CO., LTD.

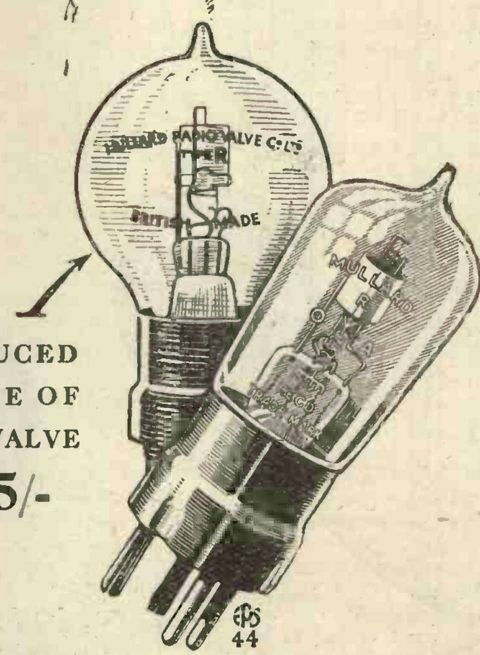
Head Office - Magnet House, Kingsway, London, W.C.



Endurance

IN ancient times the test of endurance lay in the running of races and in contests with wild beasts. To-day the demand for endurance is just as insistent, and anything which is to survive the stern competition must be of sound design and construction. For your wireless receiver you need Valves of endurance which will give unfailing satisfaction throughout a long life. If you wish to be assured of this specify

Mullard



REDUCED PRICE OF "R" VALVE 15/-

Obtainable from all leading electricians, wireless dealers, etc. *Advt. of THE MULLARD RADIO VALVE CO., LTD., Balham, S.W.12.*

EFFICIENT MOVING CONNECTIONS

ON wireless apparatus it is desirable to have moving contacts and connections as highly efficient as possible. It is essential that a moving contact should make a good positive connection, and at the same time work smoothly. Many amateurs connect flexible wires on to the spindles of switch arms and the like; this method is not to be recommended, as wires moving about inside a cabinet where they cannot be seen are liable to cause trouble. The small brass spring plungers in electric lamp-holders are usually well made, and will carry with ease the heaviest current required in any ordinary wireless receiving circuit,

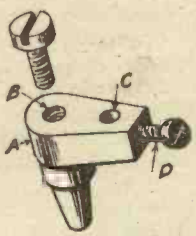


Fig. 1.—Plunger from lamp-holder.

and used as sliding contacts these spring plungers are very satisfactory. A typical lamp-holder plunger is shown at A, Fig. 1, the existing holes B and C can be used

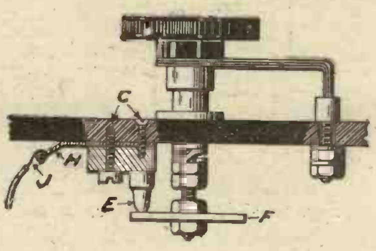


Fig. 2.—Application of the plunger to a switch.

for fixing purposes. The small hole B is generally tapped 6 BA and the larger hole C is just right for tapping 4 BA, but the width of the brass will usually allow this hole to be tapped up to 2 BA. The small screw D can be used as a set screw for locking the plunger in position when screwed on to a spindle. The method of adapting these plungers

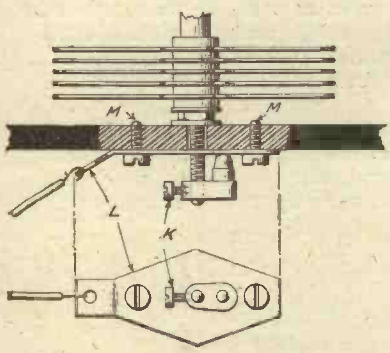


Fig. 3.—Making a good connection to moving vanes.

to various pieces of wireless apparatus is shown in the accompanying illustrations. Fig. 2 shows a spring plunger E making contact with a small brass disc F firmly fixed to a switch arm spindle by a nut on either side. The plunger is fixed to the underside of the panel by the two screws C firmly clamping the brass connecting strip H beneath it. The wire is connected to the strip of brass by passing it through the

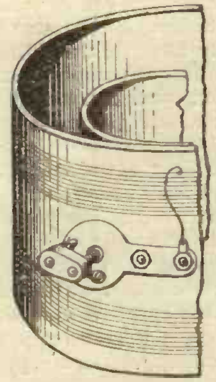


Fig. 4.—A variometer device.

small hole J and soldering. An alternative method of fixing a plunger is shown in Fig. 3 ; here the plunger is screwed on to the lower end of a condenser spindle, and securely locked in position by the

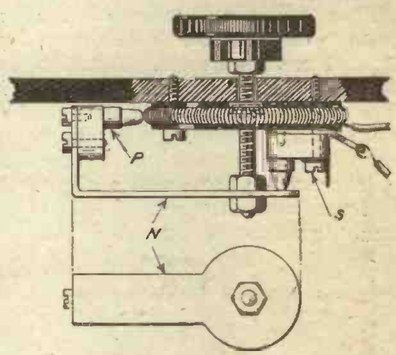


Fig. 5.—A smooth running attachment for filament resistances.

small screw K. The thin piece of sheet brass L with which the spring plunger makes contact is secured to the ebonite base of the condenser by the two screws M. It will no doubt be found that some condenser spindles do not protrude far enough through the ebonite to allow a plunger to be fixed to them ; this difficulty can be overcome by screwing a longer spindle end into the square brass rod. Fig. 4 shows how a lamp-holder plunger can be used for making the connection between rotor and stator of a variometer. This method ensures a positive connection. Many of the cheap variometers now on the market have a failing in this direction. Two spring plungers fitted to a filament rheostat are shown in Fig. 5. The arm N is of $\frac{1}{16}$in. sheet brass and is firmly held to the spindle by a nut on either side. Care should be taken in fitting this arm, as the plunger P will drag the wire if the pressure is too great. A piece of brass strip is bent to act as a stop, and is held in position by the screw S.

It will be found that these lamp-holder plungers have a steadying effect to the movement of the apparatus to which they are fitted, and that they also work very smoothly.

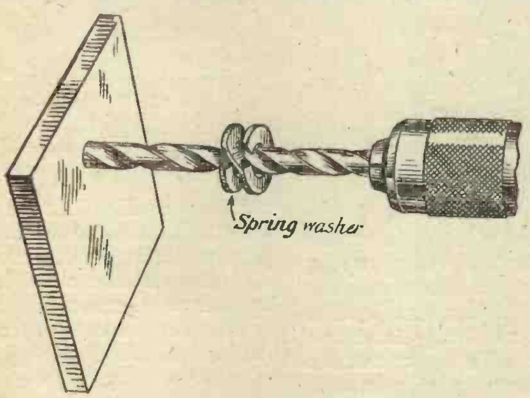
SOME DRILLING TIPS.

It is not by any means easy to make holes in ebonite that are perfectly straight, when using the ordinary hand or breast drill, and matters are still more difficult when a brace is employed for making large holes such as those required for the bushes of the spindles of variable condensers, rheostats or variometers. Here are one or two tips that will be found useful in the workshop.

In drilling vertically we nearly always find that unless we are very careful we make holes with a slight tilt from right to left. This is because in nine cases out of ten the right eye is the "master." Each eye sees a thing from a slightly different angle, but the image impressed upon the brain is that brought in by the right eye. Now if you place your left hand, as you probably do, on the handle of the drill and guide with your right eye it is obvious that the tendency will be for the drill to slope towards the eye. If, therefore, you do find difficulty in making holes straight, try the tip of closing the right eye and using the left only whilst you are drilling. If you are left-handed the left eye is probably the "master." In this case the order will be reversed. Guide the drill with the right hand and use the right eye only.

Another good way of obtaining straightness is to make use of the reflection of the drill, which appears on the polished surface of the ebonite. It is quite easy to see whether the drill and its reflection are at right angles to one another as they should be, or whether they form an acute or an obtuse angle. If ebonite with a matt surface is being drilled it can be made to reflect by wetting it with turpentine.

Many holes must be drilled horizontally, the work being held in the jaws of a vice. In this case it is easy to see that the drill does not incline to right or left, but it is difficult to keep it perfectly level. Most people drill holes with a slightly downward slope. The tip here is ridiculously simple. Place a round, flat, washer of fairly large diameter upon the shank of the drill, before introducing the point into the punch mark.



A Tip for Horizontal Drilling.

When the drill revolves rapidly the washer will spin on it, and if it is not held straight it will make its way, either down towards the work, or up towards the drill stock. By watching the movements of the washer, you can tell exactly whether you are going straight or not.

Twist drills are undoubtedly the best to use for boring ebonite, but as this material has the property of rapidly removing the cutting edges from steel tools, they should always be well lubricated with turpentine or oil. Don't let the drill turn too fast, or it may simply polish without cutting. Great pressure is not required.

Always place a piece of wood under the work, otherwise the edges of the hole may be torn or broken, when the point pushes its way through on the far side. R.W.H.

BASKET COIL MOUNTINGS

Very useful mountings for slab or basket inductances can be made with the help of the small ebonite blocks, each provided with one plug and one socket, which can be obtained quite cheaply from advertisers in this journal.

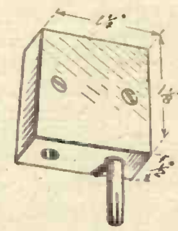


Fig. 1.—The Plug Socket.

These are of the shape and size shown in Fig. 1. The plug and socket are spaced to fit holders that take ordinary honeycomb coils.

Cut out two pieces of ⅛ in. ebonite half an inch wide and 4¼ inches long. Fasten these to the block by 4 B.A. screws, as shown in Fig. 2. Drill a 4 B.A. clearance hole through both uprights ½ in. below their tops.

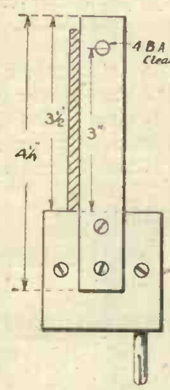


Fig. 2.—The Side Strips.

Now cut out a 1½ in. disc of ebonite ¼ in. thick and drill a 4 B.A. clearance hole through its centre. Place the disc over the basket and mount the coil between the uprights by means of a 4 B.A. screw and nut. The ebonite disc is needed to serve as a washer, since the coil is barely ¼ in. thick, and the distance

between the uprights is the thickness of the block, that is ½ in.

The wires from the coil are now

Fig. 3.—Profile of Mounted Coil.

secured to the two screws which run into plug and socket, and the mounting is complete.

THE PROPER WIRING OF PANELS

MANY amateurs, the writer finds, make the mistake of wiring the back of their panel with covered or insulated wire, often employing "sistoflex" of various colours for purposes of identification; then they make the further mistake of placing such wiring flat on the back of the ebonite panel itself and frequently, also, disregard the rule of avoiding wires running parallel one to another, and make their connecting wires unduly long and straggling.

Now we have only to open the back of any high-grade factory-made panel, and what do we find? All the connections are in *bare*, tinned copper wire of stout gauge, say about 18 s.w.g. or so, all joints are *soldered* and the wires are taken well away from the ebonite, that is they leave the panel at right angles, then another right angle occurs at one, two inches, or even at a greater distance, depending on the size and nature of components to be joined; from this second right angle the wire runs to its connecting point, and this being reached, it is again bent down at right angles to go straight down to its connection, which is, of course, effected by soldering. No parallel wires will be found, and wherever possible, the several wires cross at or near right angles, in various planes in respect of the back of the panel. This is the correct practice, and the results will justify the little extra labour and space demanded.

The soldering should, of course, be done with "soft" solder, and with any good flux or powdered resin; never use acid, and don't have your soldering bit too hot.

HIGH-TENSION UNITS FOR FLASH-LAMP CELLS

EXCELLENT high-tension units can be made up from pocket flash-lamp batteries so long as these are of good quality. Cheap ill-made cells will become noisy after a very small amount of use, but good ones will stand a great deal of work. The

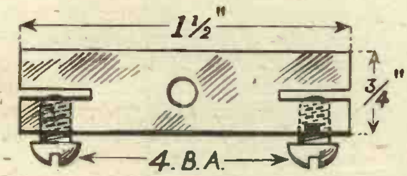


Fig. 1.—Connecting Strip.

writer had an 80-volt unit made up in this way on a five-valve set for six months, and despite constant use it remained perfectly steady in its output until the E.M.F. had sunk from 4½ volts to a little over 3 volts per battery.

One way of connecting the batteries in series is to solder the long (negative) strip of one to the short (positive) strip of the next until all are in place. This works quite well, but it has two disadvantages; unless sockets are soldered to the strips, intermediate voltages cannot be tapped by means of the wander plugs; and if one battery gives out, as batteries will, it cannot be removed and replaced without unsoldering and soldering up again.

It is better to make a set of connecting clips of the kind shown in Fig. 1. No great number is required, even if a high voltage is used on the anodes. As the E.M.F. of each battery is 4½ volts, eighteen joined in series will give a total of 81 volts. For such an H.T. unit seventeen clips are needed.

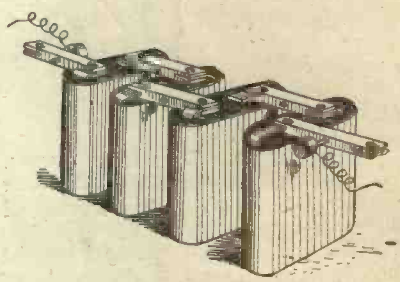


Fig. 2.—Cells connected up.

They are made of ¾ in. brass rod, either round or square, it does not matter which. A hacksaw cut is made at either end to take the battery strips, and a 4 B.A. hole is drilled and tapped in one side of the rod, running through to the slit. These are to take the set-screws which lock the clips in place. Fig. 2 shows a number of cells connected in series by means of the clips.

Wander plugs can be made very easily from ½ in. lengths of round ebonite rod ⅜ in. or ½ in. in diameter, into which are screwed valve prongs

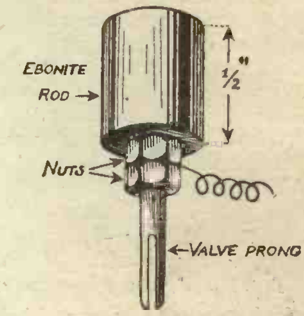


Fig. 3.—How to make the Wander Plug.

provided with two nuts (Fig. 3). The first of these locks the pin in position, and the lead is firmly gripped between it and the second.

R. W. H.

What others think

To the Editor of MODERN WIRELESS.

SIR,—As a keen reader of MODERN WIRELESS and *Wireless Weekly*, I take the liberty of writing you.

Here in Denmark we have to build our sets for the purpose of long-distance receiving, and consequently your recent article in *Wireless Weekly*, Vol. 2, No. 3, is of great interest to us.

I work with 2H—D—2L and tuned anode coupling, the first anode coil being fixed, the second anode coil and the aerial coil movable on each side of a fixed reaction coil in the centre.

In that way I have obtained the most efficient set for hearing Copenhagen, Berlin (Konigswusterhausen - Eberswalde), Paris (Eiffel Tower-Radiola) and—last but not least—the British stations.

It means that we here have to work with distances not under 100 miles (Copenhagen), and usually at 600-700 miles (Paris and London). We are able to obtain a regular reception, and of all the foreign stations we appreciate 2LO as the best one. Without paying any kind of tax or royalty or any other modern British kind of invention, we listen to Mr. Burrows' mellow voice and the busy drumsticks of the wireless band.

We get 2LO easily on three valves (H—D—L), more steadily on four (2H—D—L), and for loud-speaker we add the second L. The B.S.T. is a nuisance to us, as reception is out of the question before it is dark, which means that we cannot get good reception before 9.30 p.m. at present.

Working with a long distance receiver it is wonderful to experience how much more we get out of a high-frequency amplifier than of a low-frequency one. I read that the Americans use up to 5H, but until now I have not found any article in your magazines dealing with more than two stages. It should be interesting to read a little more about the matter, and no doubt many of the experimental licence-holders would be able to assist me.

We read over and over again about the transatlantic reception, and it is really astonishing to hear the results. Even a small power station, such as Nice, France, is heard somewhere in U.S.A. on one valve.

From Copenhagen we occasionally receive good concerts, either from Lyngby Radio or from "Teknologisk Institut" in Copenhagen. Moreover, there is a daily connection of wireless telephony between the island Bornholm and Copenhagen, and all these stations work at fairly high power, so that we can hear them on one valve here, which is over 100 miles away.

I cannot understand why the experimenters always turn their ears to the West for U.S.A., and why they always report the results from a distance of about 3,000 to 4,000 miles, and never has one mentioned that he has heard Denmark, which is only 600 miles away.

If we can hear London every night, then the British receivers should pick up our stations. Telephone conversation can be heard to Bornholm any day at about 2,400 metres wave-length. Even if the language cannot be understood, it must be possible to pick up the words: "Here is Lyngby, Hallo," or "Here is Ronne," (a town on the island of Bornholm), or "Here is Amager" (the telephone central in Copenhagen), etc.

It should be more interesting to listen to the concerts from Copenhagen and Lyngby, especially from "Teknologisk Institut," as we get very fine concerts; they use a splendid microphone.

They have no regular service, but usually transmit about twice a week from 8 to 9 p.m. (B.S.T.), until the Swedish station, Karlsborg (SAJ) jams it all out. Occasionally there has been a microphone put on the big orchestra in Tivoli in Copenhagen and first-class concerts transmitted. They work on 2,400 metres. At 10.30 a.m., 4.30 p.m. and 9.45 p.m. (when Karlsborg has ceased) you may hear weather forecast from Lyngby Radio (2,400 metres).

It occurs to me that here might be a field for work for British experimenters, who cannot yet go in for the transatlantic tests, to listen to the above-named stations. As these stations transmit with a rather strong power, they ought to be heard quite as well as we hear 2LO and the other British stations.

The German stations are now working more regularly. From 11 a.m. to 1 p.m. every Sunday Konigswusterhausen transmit good concerts, and a very fine clarionet plays good music accompanied by an organ (wave-length 3,200 and 4,000 metres and sometimes 300 metres). During the weekdays we hear (about 400 miles distance) concerts from Konigswusterhausen, 4 to 5 p.m., and in the evenings from 8 to 9 p.m., and from 10 to 10.30 p.m. Eberswalde gives good concerts (2,900 metres).

In conclusion I thank the British broadcasting stations for the pleasure they bring me every night.

I am, etc.,

HERMAN NIELSEN.

Aabyhoj, Denmark.

MARCONI VALVES
MADE AT THE OSRAM LAMP WORKS

FOR BROADCASTING
Important Announcement

REDUCED PRICES

Owing to greatly increased demand, and to improved methods of production—resulting in decreased manufacturing costs—the prices of

MARCONI VALVES
MADE AT THE OSRAM LAMP WORKS

("R" and "D.E.R." Types)

are REDUCED as and from August 1st, 1923, as follows:

	Old Price.	REDUCED PRICE.
"R" Type	17/6	**15/-**
"D.E.R." Type	40/-	**27/6**

Sold by:

Electrical Contractors, Wireless Dealers, etc.

(*Wholesale only*):

THE GENERAL ELECTRIC COMPANY, LTD.

Head Office: Magnet House, Kingsway, London, W.C.2

REG? TRADE MARK.

Branches throughout Great Britain and in all the principal markets of the world.

REG? TRADE MARK.

ARE YOU MISSING SOMETHING?

As a reader, and probably a regular reader of this magazine, you are in a position to appreciate at their proper value the articles which frequently appear giving the first and exclusive information regarding new apparatus and original circuit arrangements.

No doubt you, in common with other readers, many of whom have written to us, regret that a full month must elapse before the next issue is available, whilst, in the meantime, several new and interesting developments in connection with a new circuit or piece of apparatus, may have occurred.

This is undoubtedly where it will pay you to become a regular reader of *Wireless Weekly*, which not only contains full particulars of new circuits and constructional details of original sets *not published elsewhere*, but gives you week by week the latest and most up-to-date developments of circuits and sets described in MODERN WIRELESS, together with the actual experiences of members of our Editorial Staff, and experienced readers who have experimented with and, in some cases, devised improvements to the latest apparatus described in MODERN WIRELESS.

For this reason *alone*, a really keen wireless experimenter cannot afford to miss *Wireless Weekly*.

Do you know that in places as far distant as Buenos Aires, Johannesburg, Canada, Iceland and Western Australia, *Wireless Weekly* is eagerly awaited by readers who prefer it to any other wireless journal on account of its technical excellence, reliability, and varied contents, ranging from the humorous "Jottings by the Way," to the latest development in the Flewelling Circuit or technical article such as "Dull Emitter Valve Filaments."

The point is, if these readers consider it well worth their while to go to special trouble and expense *so as not to miss a copy*, it is certainly worth your while, when the only trouble involved is the placing of a standing order with your Newsagent, and the net expenditure per week only equals the price of a small packet of cigarettes. Less than a penny a day is a small price for a *really* sound journal produced by the identical staff that gives you MODERN WIRELESS.

Many of our readers tell us that *Wireless Weekly* is quite looked forward to in the home circle. Whilst the articles describing the latest apparatus or circuit arrangement, "Random Technicalities," or "Mainly about Valves," claim the attention of the authorised experimenter of the family, the humorous "Jottings" already mentioned, "Broadcasting News" and "News of the Week" make interesting reading for all the senior members. "Broadcasting News" in particular, with its commentary upon the past week's concert and musical programmes, and details of the principal forthcoming events, appeals to members of the family who, as a rule, are more interested in broadcasting than in experimental work.

Wireless juniors are not forgotten and scope for ingenuity and exercise of the instinctive constructional trait is provided for in the pages of "Constructional Notes," and in such articles as "Designing Simple Crystal Receivers."

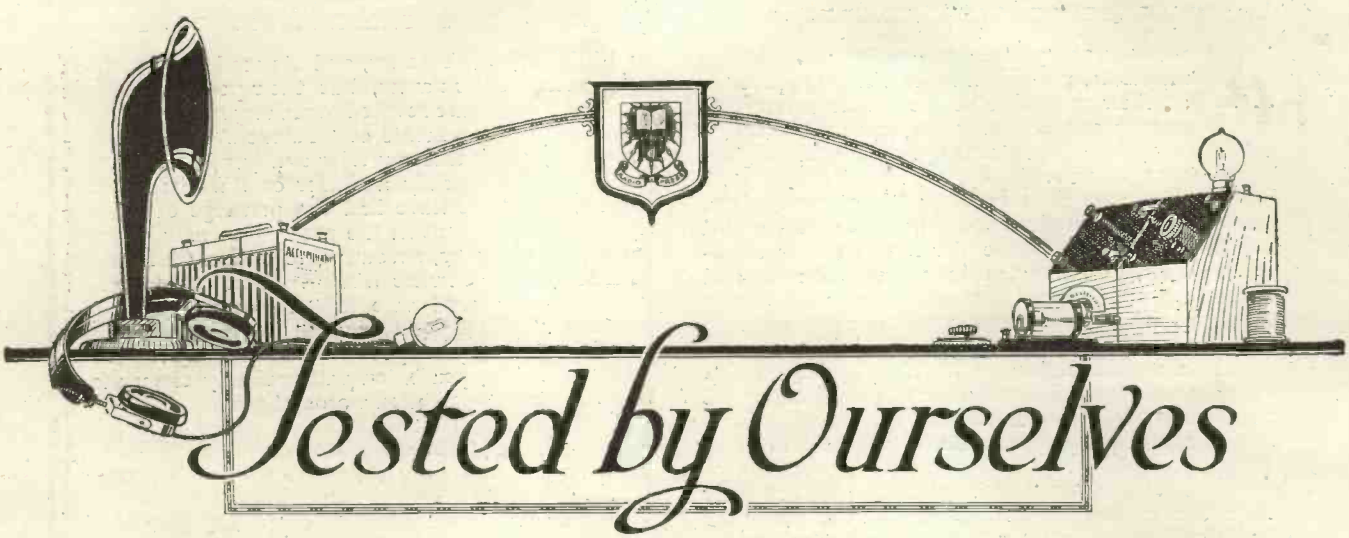
As to the personnel of *Wireless Weekly*, the principal members are already known to you as radio engineers of considerable experience. Their connection with *Wireless Weekly* is every bit as close as with MODERN WIRELESS, and its readers know that not merely their names, but their personal interest and best efforts are devoted to making *Wireless Weekly* meet the requirements of "listeners" and experimenters, better than *any other weekly wireless journal.*

If you are already a reader of *Wireless Weekly*, we feel that we have had the privilege of helping you to some extent in the past. We now ask you to assist us by endeavouring to obtain ONE NEW READER for *Wireless Weekly*. You will doubtless know some friend who is "beginning to be interested." Will you show him this page or, better still, lend him a copy of *Wireless Weekly?* Your personal recommendation will probably carry more weight than any printed words of ours.

The truth is that no one can *afford* to miss a *single* issue of *Wireless Weekly* if he is to be well informed. The new simplified Flewelling circuit, the ST75 circuit, the improved ST100 circuit, and other circuits were all first described in *Wireless Weekly*, and in some cases have not been described in MODERN WIRELESS. Every week the Editor (John Scott-Taggart, F.Inst.P.), chats about valves and how to use them. E. Redpath, well-known to tens of thousands of experimenters since 19 3, also contributes regularly, while Percy W. Harris, probably the best-known constructional writer in the country, gives technical and constructional hints.

The following are just a few of the articles which have appeared in *Wireless Weekly*:—

Experiments with an Armstrong Super-Regenerative Receiver—A 200-4,000 metre Crystal Receiving Set—An Experimental Five-Valve Amplifier—A New System for the Production of Continuous Oscillations—A Variometer Set for Broadcast Reception——How to Receive American Broadcasting—A Low-Frequency Amplifier—Wireless Terms Simply Explained—A Three- or Four-Valve Receiver Using Variometers—Loud-Speaking and Power-Amplification—A Two-Valve Broadcast Receiver—The Neutrodyne Receiver—The Possibilities of a New Receiving Principle—A New French Loud-Speaker—An Inductively Coupled Crystal Receiving Set—A Simple Method of Magnifying Signals—An Amateur's Four-Valve Receiver—The Choice and Operation of Valve Receiving Circuits—An Experimenter's Single-Valve Panel—A Fleming Valve Relay Device—Adding Amplifiers to Crystal Sets—A Super-sensitive Valve-Crystal Receiver—Pitfalls for Beginners—A Novel Reaction Relay Device—Broadcast Reception and Spark Interference—The New Flewelling "Super" Receiver—More About the ST.100 Circuit—Short Wave Reception—A Three-Valve Regenerative Receiver—High-Frequency Circuits in Receiving Work—My Experiences with ST.100—A Special Method of High-Frequency Amplification—An Improved ST.100 Circuit—A New Interference Eliminator—A Novel Low-Frequency Amplifier—Notes on Fading—An Interesting Three-Electrode Valve—The Construction of a Five-Valve Amplifier—The Reception of Continuous Waves—Interference Prevention—The Flame Microphone—A Progressive Unit Receiving System—A Three-Valve Broadcast Receiver—The Action of the Frame Aerial—A New and Highly-Sensitive Reflex Circuit—Ammeters and Voltmeters for Wireless Use—The ST.76 Circuit—Loud-Speaking Out-of-Doors—A New Simplified Flewelling Super-Circuit—Switching with Plugs and Jacks—Notes on the Physics of the Valve.

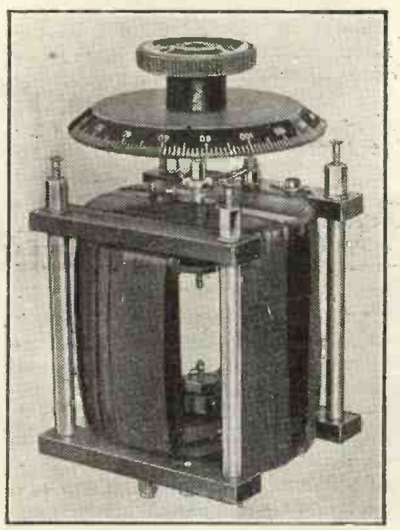


Tested by Ourselves

SPECIAL NOTE.—All apparatus described in this section has been tested by our expert, and readers can therefore rely fully on the opinions given.

A Wide-Range Variometer.

Messrs. Sterling Telephone and Electric Co., Ltd., have sent us for test an example of their variometer, for panel mounting, for which are claimed a high maximum to minimum inductance ratio, and an exceptionally wide wave-length



The Sterling Variometer.

range. This has an open framework with moulded composition ends, and a moulded rotor former, with fine wire coils, rectangular in shape and small clearance. Four columns with small screws are provided for mounting beneath the panel. The overall height is 4 in. below the panel. An ebonite knob and bevel scale are provided, but no stop. Contact is made to the moving coils by an ingenious spring frictional device; soldering tags are fitted for each coil. The instrument is characterised by fine finish and sound workmanship.

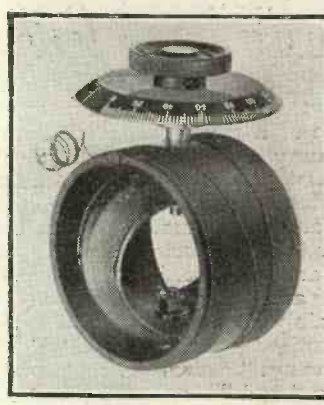
An important feature, which calls for distinct comment, is the series-parallel control of the two windings, stator and rotor, indicated by the makers, and which is partly responsible for the very large range of this variometer. We welcome this departure on the part of a reputable firm. The principle has been used for some time in certain wavemeters, but has not, as yet, achieved the popularity it deserves in variometers used for reception.

On test, on a P.M.G. aerial of .0003 μF capacity, the range, with .0005 auxiliary condenser in series for lowest range, and in parallel for the highest, was found to be from about 300 metres to over 3,000, the inductance ratio with windings either in series or in parallel being about 8:1

The minimum wave-length with parallel windings being just above that of the local broadcast station, the signal strength had necessarily to be measured with a .0005 μF series condenser.

It is undoubtedly a great convenience to have so large a range of inductance in one instrument, and resulting available wave-length (from about 370 to 2,000 metres on the aerial with variometer alone); an even more convenient instrument for general use would result if an alternative winding of fewer turns of larger gauge wire were available.

The instrument submitted represents an interesting type of variable inductance, finely made, and high-class in every particular.



The G.E.C. Variometer.

A Variometer.

From the General Electric Company we have received for test a variometer of the ebonite tube and ball rotor type, for panel mounting. This has a neat flange fastening, and requires but a ⅜ in. hole in the panel. The overall height is 4 in. below the panel. It is provided with a knob and good quality bevel scale. On close examination the

WIRELESS RECEIVING SETS FOR

HOME ASSEMBLY

The famous range of M.H. Wireless Receiving Sets are now available for the Home Constructor. Handsome Polished Mahogany Cabinet, Ebonite Panel Drilled, Polished and Engraved, all necessary components, screws, nuts and wire with full instructions for assembling and connecting. Write for particulars and prices.

The experimenter will welcome the new extra H.F. panel for the MH/LC, MH4R or MH4RT receiver combination giving greater range and search possibilities. Designed especially for and to work with these combinations, the H.F. panel conforms with their appearance and provides for simple connection to them. Particulars and Prices on application.

The Broadcast Listener will welcome the new extra H.F. Panel and the Control Panel for the MHBR and MHBR2a Broadcast Receiver and Amplifier. Greater range, definite control, increased selectivity and more powerful magnification are obtained by their addition. Their incorporation makes the B.R. Combination an Ultra De Luxe Set. Particulars and Prices on application.

VISIT OUR RETAIL SHOWROOMS:

(RADIO CORNER)

179 STRAND (*Corner of Norfolk St.*) LONDON, W.C.2

L. McMICHAEL Ltd.,

IN CONJUNCTION WITH B. HESKETH LTD.

Head Office, to which all correspondence should be addressed:—

HASTINGS HOUSE, NORFOLK STREET, STRAND, W.C.2

Bring in the Station you want

LO MANCHESTER BIRMINGHAM CARDIFF NEWCASTLE

Tingey Interference Eliminator

This instrument is specially designed to cut out the local Broadcasting Stations, and enables one to receive other Broadcasting Stations within range on nearly similar wavelengths.

It may be added to any type or make of receiving set.

Two connections only; one to the Aerial Terminal and one to Earth Terminal.

NOTE:—When ordering, state whether it is required to eliminate ships' spark signals on 600 metres or a British Broadcasting Station.

We manufacture Valve Sets—1, 2, 3, 4 and 5 Valves; also an excellent Crystal Set.

Send for our new Components LIST, free on request.

(*Patent applied for.*)

PRICE

£1 : 12 : 6

Postage 1/-

Offices and Showrooms:—

92, Queen St., Hammersmith, London, W.6.

'Phone: Hammersmith 1916. *'Grams:* "Tingoidar, London."

Chiswick Agents: The Askew Motor Works, Ltd., 72, High Road, W.4.

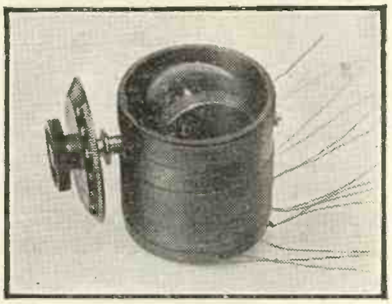
TINGEY WIRELESS LTD.

instrument was found to be substantially made, with good metal bearings and reliable electrical contact to the rotor, giving silent operation, the finish and workmanship being of a high order. Tinned soldering tags are provided for connections in the place of screw-terminals.

On practical trial with a P.M.G. aerial it was found to tune from 380 to 750 metres; by putting the rotor and stator in parallel it tuned from about 200 to 385 metres, and gave good signal strength with local broadcasting on the crystal.

A Tapped Inductance with Variometer Fine Tuning.

Also from the General Electric Company, and uniform in style with the variometer mentioned above, comes a tuning unit con-



G.E.C. Tapped Inductance.

sisting of a tapped inductance, with seven tapping points, on an ebonite tube 3½ in. diameter, with a composition ball-rotor wound with a few turns only, for fine tuning between the tappings—an exceedingly efficient and convenient combination. This has the same panel mounting (one hole) and dimensions and details similar to the former variometer, but with an overall length of 3½ in.

On trial, it was found to cover the range (on a P.M.G. aerial) from about 300 to 540 metres wavelength quite efficiently, with good overlap at each tapping stage and satisfactory signal strength. Altogether this instrument will make an excellent tuner for broadcast reception on aerials of widely different characteristics.

An 11-Plate Variable Condenser.

Messrs. Watson Jones and Co. have submitted for test a small variable condenser for panel mounting, known as the M. V. Pirie. This has an aluminium frame, and is arranged for fixing beneath the panel by three small screws; it is fitted with knob and pointer.

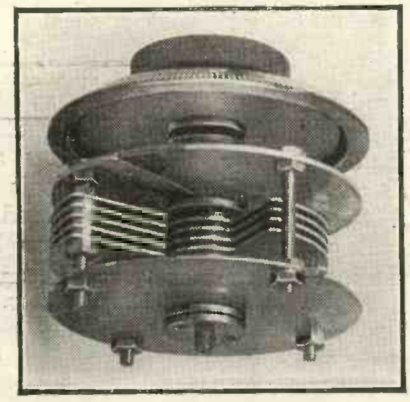
It was found to be mechanically rigid; the insulation good; the contact to the moving vanes satisfactory and silent in operation. The maximum measured capacity was about .00013 μF; the minimum being reasonably small.

A positive stop is provided; a soldering-tag replaces terminals for the connections. Altogether the instrument gives an impression of quite a sound, reliable small tuning unit.

A 9-Plate Variable Condenser.

The General Electric Company have also submitted for examination and test a small variable condenser, for panel mounting, with a maximum capacity of just under .0002 μfarads. The single hole flange panel mounting, knob and bevel scale and soldering tags in place of terminals, are uniform with the variometers referred to above; the overall depth is 2 in.

The instrument is substantially built, with brass end-plates; mechanically sound and smooth in action, the electrical contacts being reliable. On test (on the neon oscillator) the insulation resistance was found to be very high. The measured maximum capacity was just under .0002μF; but the minimum capacity was noticeably high, being over 10 per cent. of the maximum, no doubt on account of the particular arrangement of



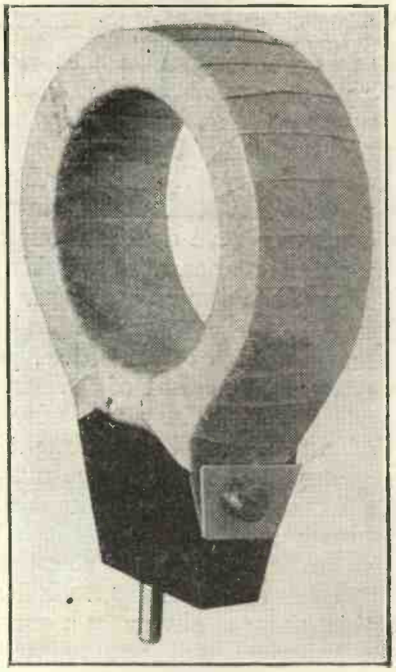
G.E.C. Condenser.

insulating sleeves and terminal connection adopted. The absence of a stop was also noticed.

The general finish and workmanship are of the same high order.

Atlas Tuning Coils.

We have received for test a set of "Atlas" tuning coils from Messrs. H. Clarke and Co. (Manchester), Ltd. These have an ingenious form of low-capacity winding, the lower numbers submitted being wound with a double twisted wire in a manner which certainly gives large spacing with minimum constructional material.



An "Atlas" Coil.

The conventional plug-and-socket mounting in ebonite is provided; the coils are neatly finished and of substantial build. While one of those submitted had a break in the winding connection at the plug, when this had been rectified—a moment's task—the signal strength measured on crystal reception compared quite favourably with that of a standard tuning device, on local broadcasting.

From the same firm we have received a sample set of parts, unassembled, for constructing a variable condenser similar to that noticed above. This set is complete with spacing washers, nuts, small screws, scale, etc.; a thoughtful item is a card template for drilling the fixing screw holes in the panel. The most troublesome part of the work of assembly, the fitting and bushing of the bearings, is already done. The amateur constructor should experience no great difficulty in making up a satisfactory and workmanlike condenser from these parts.

ARE YOU NEW TO WIRELESS?

A few words to the person who picks up "MODERN WIRELESS" for the first time.

MOST people, when they first become interested in a subject, want to know more about it. Fortunately for those interested in wireless, they can gain information both rapidly and cheaply. In the old days there were practically no writers on wireless matters, and certainly very few indeed who gave details about the home manufacture of apparatus suitable for listening-in. If you are anxious to know what wireless is, how it works, what to do to start, or any information of that kind, you are able to draw on the talent of the best wireless writers of the day. The reason why this happy state of affairs has been brought about is that, owing to the very large number of new enthusiasts entertaining the wireless field, it has become profitable to publish booklets dealing with the subject in an elementary manner.

When you pick up a wireless magazine like this, there is obviously a considerable portion which you will not follow, and which is, therefore, so much temporarily wasted paper. We believe that even if this amount is left out of consideration, the value of the information given is well worth the moderate shilling. Here again, the value given is possible simply because MODERN WIRELESS is printed in very large quantities.

Radio Press, Limited, the publishers of MODERN WIRELESS and its weekly companion, *Wireless Weekly* have a whole line of books on broadcasting, from both the theoretical and constructional standpoint, and these books are arranged so as not to overlap. It is obviously impossible in a periodical to explain the elementary parts about wireless every month or every week. The thing to do, if you want to catch up and to derive the full benefit of each month's issue, is to get some idea of the elementary principles of wireless.

There are two books which are indispensable to the novice, and these books have had a joint sale of nearly 200,000 copies. They are both written by the Editor of MODERN WIRELESS. The names of the two books are *Wireless For All*, sold at 6d., and *Simplified Wireless*, price 1s. Both these books are obtainable from any bookstall or bookseller's shop, or may be obtained from the Radio Press, Limited.

If you are interested in making a crystal set of your own, the next book to buy is *How To Make Your Own Broadcast Receiver*, price 1s. 6d., while the best elementary book on the valve is *How Wireless Valves Work*, price 2s. 6d.

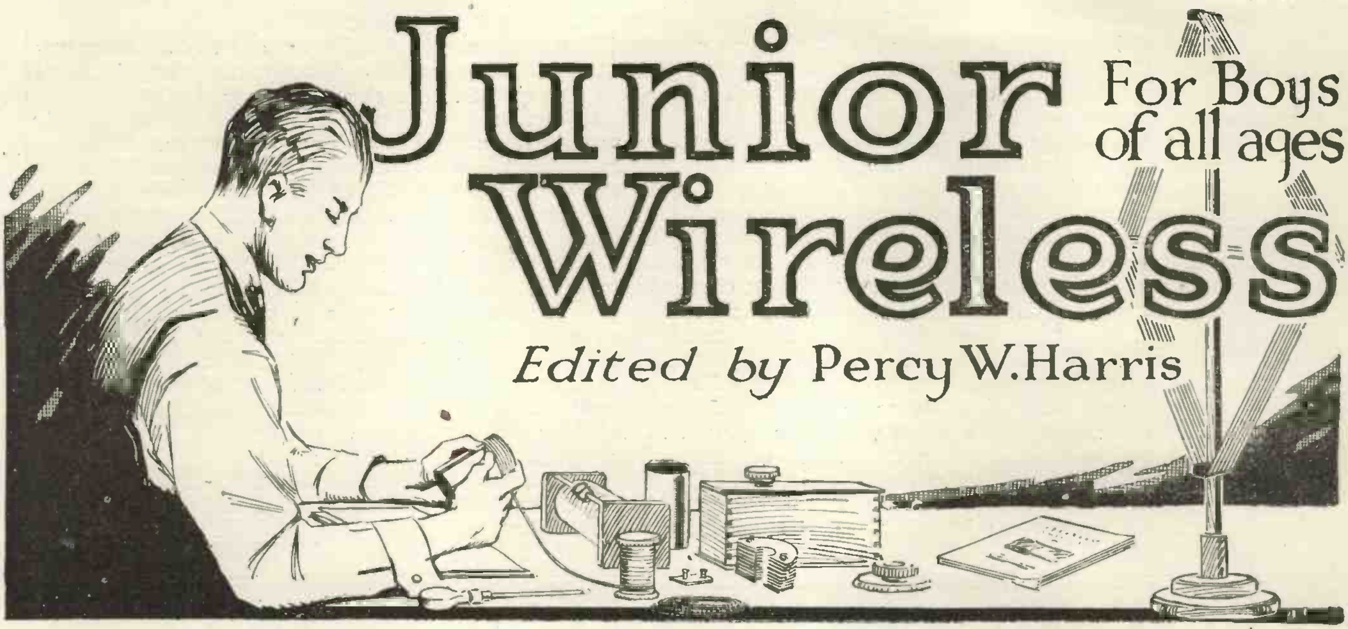
Each book deals with a separate phase of the subject. For example, *Wireless For All* introduces you to some of the simple facts about wireless and broadcasting, while *Simplified Wireless* is a sequel giving some technical instructions, and also details of how to make a broadcast set.

Don't imagine that buying a magazine is sufficient. Far more attention can be given to individual subjects, or individual aspects of subjects, in a book. A magazine presumes that the reader has reached a certain standard by reading elementary books on the subject.

The Radio Press library has proved phenomenally successful, and the publishers are disposing of the books at the rate of, approximately, half a million per annum.

The advantages of reliability and general soundness are obviously appreciated by the wireless public, and they realise that books issued by a responsible publishing house, which deals with wireless only, are greatly to be preferred. In view of the large quantity of wireless books now on the market, the advantages of making sure that you buy a Radio Press book are well worth the trouble. The authors who write the books, in nearly every case, help you every month and every week in the two periodicals MODERN WIRELESS and *Wireless Weekly*, and the bond of trust and friendship is more and more developed.

The beginner who desires a book on any phase of wireless is requested to look at the advertisement pages of MODERN WIRELESS, where he will find a selection which will suit every need.



Vol. 1. No. 1. SEPTEMBER. Published Monthly.

THE EDITOR'S CHAIR

HELLO! Hello! This is JUNIOR WIRELESS calling you for the first time. I think we have a very good programme this month and I can promise you that next month's issue will be even better. If you are just beginning wireless you will find in this number full particulars of how to erect your aerial at the lowest possible cost; how to make a novel, and certainly very efficient crystal set for half-a-crown; and how to make a neat two-valve note magnifier which can be attached to any crystal or valve set so that it will work a loud-speaker. You will also find a simple talk on valves by Mr. John Scott-Taggart, F.Inst.P., and some very useful practical notes and hints. You will not get any "dry-as-dust" articles in our little magazine, as I am determined that it shall be thoroughly practical, useful and readable. And don't forget that if there is an article you particularly want and you don't find it in "Junior Wireless," write to me and I will see what I can do to get it published early. It is my business to help you and if you will write to me and say what you want, we shall help one another.

* * *

Next month I hope to tell you of several interesting and amusing experiments that can be carried out with ordinary wireless apparatus, and of which you may not have heard. We are so used to using our wireless sets merely for the reception of broadcasting that we are liable to overlook what wonderful instruments they are in other directions. You will find a hint of what can be done at the end of the article in this issue, "How to make a Two-valve Note Magnifier."

Contents.

* * *

Recently we were all scared by a serious outbreak of smallpox. This month I want to warn you against the wireless disease known as "switchitis" which is having a devastating effect among young wireless enthusiasts. The symptoms are always the same. A quite healthy and normal young man suddenly takes interest in wireless. This, of course, is not in itself a dangerous disease. However, he has built for himself a crystal set, discarded it and made a valve receiver, he suddenly decides to build a 7-valve set with switches for every possible connection. He takes a large sheet of paper and draws out a fairly simple circuit for the seven valves (if a 7-valve circuit can ever be simple, which I doubt). Next he decides to include a switch to change the aerial tuning condenser from series to parallel. This is carefully drawn in. Then he decides he will have a switch to cut the high and low frequency valves, in or out, and to use one or all or any at will. The switches and studs are laboriously drawn in and then he begins to try and connect them up in the circuit. This usually takes him the best part of three evenings, at the end of which his hair is very much ruffled and his face very red. With the aid of sundry text-books, writing to the wireless papers and consulting all his friends until they are very tired of him, he succeeds in working out the wiring. By this time he is in such a terrible state that every moment of his spare time (and a great deal of his time which isn't really spare) is occupied in sketching out various switching arrangements on the backs of envelopes, inside the covers of books and wherever there is a blank space which will take a pencil diagram. He bombards his wireless friends with such questions as "I say, old man, will a Dewar switch do in a high-frequency circuit?" "Do you know where I can get those double-pole double-throw switches on china bases?" "What is the cheapest anti-capacity switch you can get?" and so on. The last and most terrible stage occurs when the said young man is fortunate enough to be able to buy all the parts he wants. Having spent pounds in buying all kinds of switches and a very large ebonite panel, he rushes at the job with eagerness, drills all the holes in the wrong places, fills them up with black sealing-wax, drills again, splits the panel and after much labour succeeds in getting the switches, sockets and the other paraphernalia in place. The kitchen table now becomes covered with a brown and horrible mess of soldering flux, tiny splashes of solder sprinkle the kitchen floor like a shower of silver stars, and terrible holes are burnt in the table-cloth by the accidental laying down of red-hot soldering-irons. Finally, and very proudly, he carries the set into the dining-room. The family gathers round, explanations are given, batteries, aerial and earth are connected up and the proud moment arrives. Standing gracefully at one side of the instrument, he turns to the family, smiles and depresses the switch which is to light all the filaments simultaneously. A moment of expectant silence, click goes the switch, seven blinding blue flashes burn out the valves and he realises he has connected the high-tension battery to the wrong terminals!

Such is wireless! Do not try to run before you can walk.

THE EDITOR.

A NOVEL INDOOR AERIAL

If you are near a broadcasting station, an indoor aerial may give you all you require. Here is a very useful arrangement.

WITH the invention of the modern super-sensitive circuits such as "S.T.100" for example, the indoor aerial is likely to become very much more popular than it has been in the past. Apart from the point of view of necessity, there is something rather fascinating in having one's aerial under one's own roof as it were.

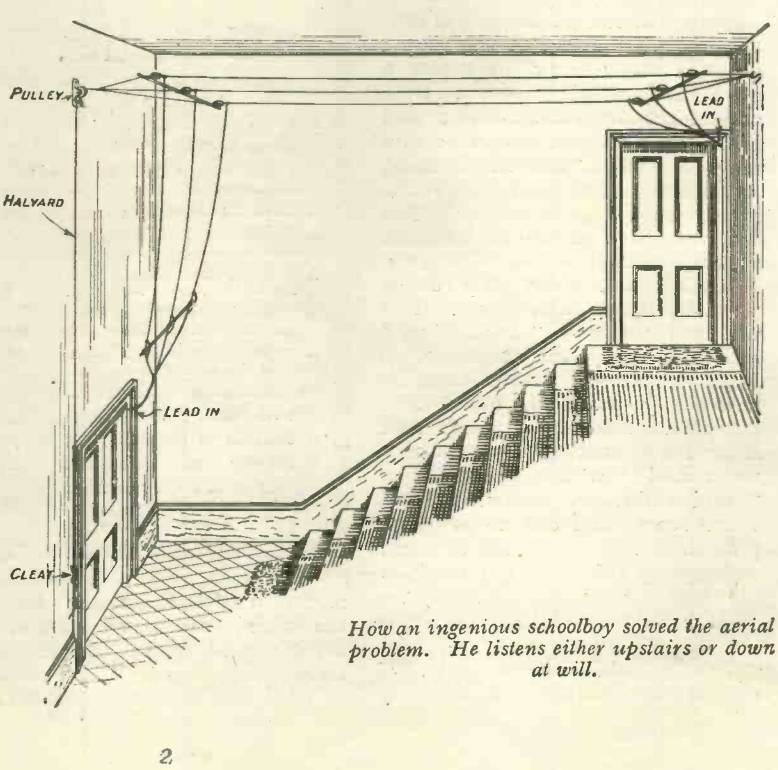
A schoolboy friend of the writer has recently erected an indoor aerial of decided ingenuity and efficiency. In erecting this indoor aerial, he has utilised to the best advantage the space above a straight staircase in his house.

The aerial consists of three parallel wires of inverted L shape. The horizontal portion of each wire is 15 feet long and the vertical portion 8 feet long, so that in all there is a length of 69 feet of wire in the aerial. Three light bamboo spreaders are employed and with each spreader there are three insulators. A pulley was only necessary for the bend of the L, the other two spreaders being within reach.

The ingenious feature of this aerial is that a lead-in is provided to a room upstairs as well as one to a room downstairs. These two lead-ins are of the usual type with screw ends. When the lead-in to the upstairs room is in use, the wire to the downstairs lead-in is unfastened and allowed to hang free. When the lead-in to the downstairs room is in use, the wire to the upstairs lead-in is allowed to hang free.

A crystal set with variable condenser tuning and a Hertzite crystal gives splendid signal strength on this aerial from 2LO, the distance from the broadcasting station being about 12 miles.

E.H.C.



How an ingenious schoolboy solved the aerial problem. He listens either upstairs or down at will.

THE NECESSARY AERIAL

By E. REDPATH.

In the following article, Mr. Redpath, whose experience of the difficulties of beginners is probably as extensive as that of any present-day writer, gives some useful practical advice regarding receiving aerials.

THE particular object of the present article is to show how simply and cheaply a perfectly satisfactory receiving aerial can be erected. By this I do not mean that all that you have to do is to throw a coil of wire out of the attic window to enable you to receive trans-Atlantic telephony, and I am sure that none of my readers will desire such unreasonable simplicity.

The Essentials.

I am not concerned at the moment with the case of the experimenter who lives in a nice open situation and has at the back of his house a garden some 100 feet long, at the foot of which he can erect a mast anything up to 40 or 50 feet high. On the contrary I wish to assist as far as possible those whose residential quarters are not so well situated; where space is strictly limited; the erection of high masts quite out of the question, and where the proposed aerial will doubtless have to be suspended between chimney stacks or other convenient points on adjacent buildings.

The first thing to be done is to carefully survey the prospective site or sites, keeping in mind the following conditions, which should be adhered to as far as possible.

1.—The aerial should be as long and as high as circumstances and the Post Office Regulations permit. The Regulations state that "the combined length and height of the aerial shall not exceed 100 feet." This is equivalent to stating that the length of the aerial proper, plus that of the down-lead, must not exceed 100 feet, and from enquiries which I have made in the proper quarter these dimensions are quite irrespective of the number of wires used in the aerial and down-lead. For all general receiving purposes, you will find a single wire perfectly satisfactory. If the total length available is short, however, say 30 to 40 feet only, two wires spaced some 6 feet apart upon light bamboo spreaders may be used with good effect, but *more* than two wires should not be used.

2.—The aerial and down-lead should be good conductors, that is to say, their resistance to the passage of electric currents should be as low as possible. This necessitates the use of either copper, phosphor-bronze or silicon-bronze wire, and the gauge or size of the wire should be such that it is capable of carrying its own weight and withstanding a certain amount of strain due to wind. On this account soft copper wire (as used for winding coils, etc.) is not of much use. It may be used, but will require adjustment from time to time as the wire stretches. Quite a thin wire will give satisfactory results, for instance No. 22 or even No. 24 S.W.G., but *hard drawn* copper of No. 18 or No. 16 S.W.G. will be found more satisfactory both electrically and mechanically. The first aerial I ever erected consisted of some second-hand telephone wire (silicon-bronze) No. 16 S.W.G., acquired for about a shilling. It proved a little troublesome to handle on account of its springy nature, and the verdigris with which it was practically covered got into my eyes and up my nose and temporarily interrupted the proceedings. But the aerial gave good results and doubtless pieces of it are still attached to the iron chimney fittings. There is no advantage in using enamelled wire, except that it helps to prevent corrosion, which occurs quickly in positions near to the sea.

3.—The aerial, down-lead and leading-in wire should be carefully insulated and (except the last named, of course) carefully isolated,

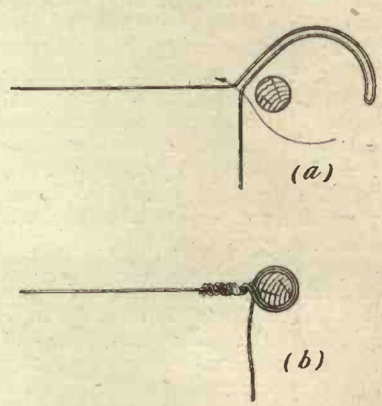


Fig. 2. How to secure aerial wire to spreader.

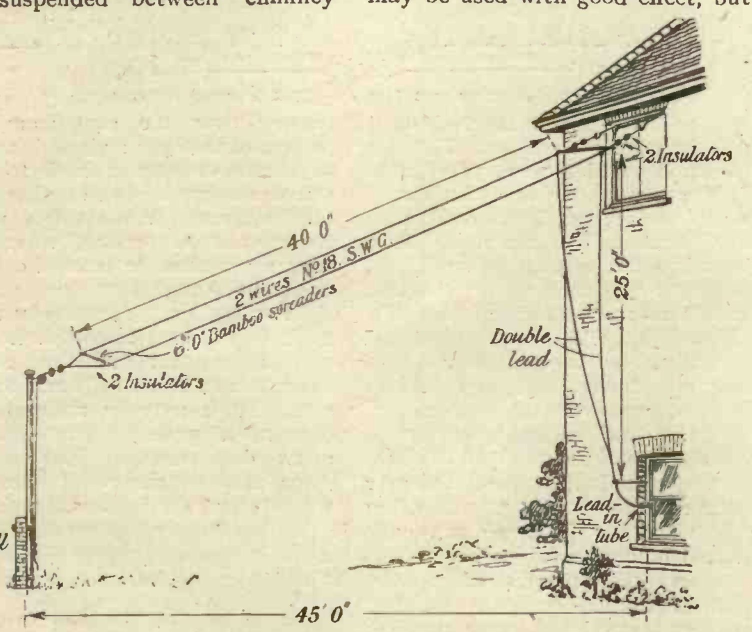


Fig. 1. This arrangement may not be ideal, but it is a useful solution of problem number 1 in this article.

by which I mean that they should be kept as far as possible from any earth connected body, such as adjacent roofs, walls, etc., which, especially in wet weather, may exercise a considerable screening effect. Despite this excellent theory, however—which I give here because it is obviously the proper thing to do—I have actually obtained good signals, and over considerable distances too, upon aerials which were by no means "far from any earth connected body." For instance, several parallel wires attached to insulators and supported upon small hooks screwed into the framing immediately below the slates of the roof, or a single wire carried along an upper landing, through a slightly opened window and allowed to hang down alongside the wall almost to the ground, but held about 2 or 3 feet away from the wall by means of a light wooden rod, enabled signals to be received from Paris (450 miles), Cleethorpes (about 200 miles) and Poldhu (about 250 miles) although I must admit that results were a little erratic at times. I mention these facts to show that if the new aerial must of necessity pass close to the ridge of a roof or to the corner of a building, you should not be discouraged on that account, but should go ahead and hope for the best. Actual trial later is the only reliable test. The insulation of the aerial does not present any difficulty and can be well done without incurring much expense. I advise the use of two or three quite small insulators, say of the reel or bobbin type about 1½ in. in diameter, at each end of the aerial, rather than a single larger insulator. Not only will the total insulation resistance probably be higher, but the weight to be supported will certainly be much less in the former case. Quite strong and serviceable insulators may be made from pieces of hard wood (oak or ash) ¾ in. diameter (or ¾ in. square if round wood is available), about 3 inches long having a small hole drilled right through about ½ in. from each end and being subsequently thoroughly dried and soaked in molten paraffin wax.

"Circumstantial" Aerials.

For all practical purposes nowadays there are two types of receiving aerials—the inverted L type aerial consisting of a horizontal wire or wires with the down-lead to the instrument taken from one end, and the T aerial, also consisting of a more or less horizontal wire or wires, but in this case with the down-leads taken from the centre. It is not my intention to discuss the theories of different types of aerials, but to show how they may be erected "according to circumstances" so as to yield the best possible results, and in considering one or two typical though imaginary cases the different types will readily be recognised.

PROBLEM No. 1.—*My upper window is 35 feet high and my back yard is 45 feet long. I can have my instrument on the upper, middle or ground floor, but have no access to the roof or chimney. Please advise re aerial.*

The simplest solution of this problem is shown in Fig. 1. Two strong hooks have been screwed into the upper part of the window frame (35 feet above the ground) and opposite ends of the upper spreader are attached to them, two small insulators being interposed between each hook and the spreader itself. The lower end of the aerial is attached to a light spar or bamboo pole attached to the wall by means of staples. The pole shown in the sketch is 15 feet high. If a 20-foot spar is available so much the better. Each aerial wire and down-lead is continuous. That is to say, the wire is not cut, but is attached to the upper spreader in the manner shown in Figure 2 (a) and (b). The lower end of the down-lead is kept at a distance from the house wall by means of a light wooden strut having an insulator (such as a very short piece of ebonite tube wedged tightly in a hole in the wood), at the outer end. At this point, or preferably just above it, the two down-leads should be soldered together and to the end of a length of rubber-covered flexible conductor, which, passing through the lead-in tube, ensures adequate insulation at this point. A 6 or 8 inch length of half-inch "water-gauge glass" makes an excellent lead-in tube, especially if it is packed with soft paraffin wax after the conductor is passed through it. Reliable ebonite leading-in tubes, complete with central brass spindle and terminals at each end, are now obtainable quite cheaply from wireless dealers.

With a decent crystal receiving set, carefully operated, the aerial illustrated in Fig. 1 should yield quite good results with one or two pairs of headgear telephones, at distances up to about 20 miles from a broadcasting station.

PROBLEM No. 2.—*My house is about 30 feet high to the ridge and is one of a row with similar houses backing it at a distance of about 55 feet. I am not permitted to attach ironwork to chimney. Please advise.*

Fig. 3 suggests an arrangement to meet the circumstances quoted. It will be seen that the aerial is a single-wire one with single-wire down-lead and is attached at each end to two small insulators, which in turn are attached to a length of flexible steel wire or aerial wire passing over the roof from the back of each house and made secure to cleats or staples fixed to any convenient woodwork on the front of the house. When all is made secure the supporting wires are scarcely noticeable from the front of either house.

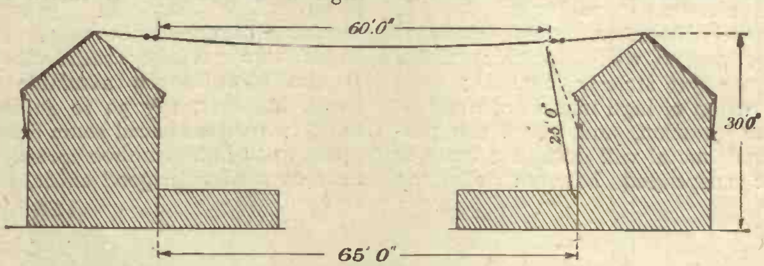


Fig. 3. How an aerial may be fixed between two houses.

In order to get the wire over the roof, a light rope or cord is first of all thrown over and the end of the wire made fast to it and drawn over. Rope may be used in lieu of wire if preferred, but has a great disadvantage in that it frays at the ridge tiles owing to the movement of the aerial and that it cannot be drawn up tight, or, if it is, it must be slackened off every time it rains (or every night in anticipation of rain), otherwise the contraction will cause the rope or aerial wire to break.

A VARIABLE CONDENSER YOU CAN MAKE FOR YOURSELF.

THE variable condenser about to be described has the merit of being simple to construct, and the parts required can be purchased for a moderate sum or taken from the stock of the wireless experimenter's junk heap.

The condenser has an overall dimension of 2½ in. diameter by 1⅞ in. depth and a maximum capacity of about .0005 μF., but any size may be constructed to suit the experimenter's requirements.

The principle is that of a fixed drum, the periphery of which acts as one plate. The other plate is a moving band, similar to a brake, which is tightened or loosened around the periphery of the drum, thereby altering the capacity.

The drum is made of hard wood 1½ in. diam. by 1 in. deep and a $\frac{3}{16}$ in. clearance hole is drilled through the centre of the drum to take the spindle. This drum may be purchased from any woodworker for a few pence. The drum is well shellaced and a piece of tin-foil 4½ n. long by ⅞ in. wide is stuck with shellac round the periphery of the drum, a tab being left for one connection.

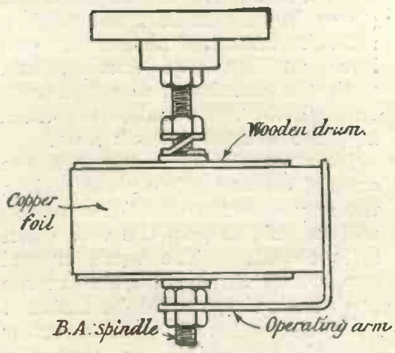


Fig. 1.—The finished condenser.

Over this tin-foil a strip of best ruby mica .002 in. in thickness measuring 4⅞ in. by 1 in. is stuck with shellac, taking care that the ends meet in the centre of the gap between the ends of the tin-foil. A few small nails at the end of the mica will keep it in place.

The spindle and arm to operate the moving plate consist of a 2 B.A. screwed brass rod 2¼ in. long and a strip of brass ⅜ in. wide by 2¼ in. long with a $\frac{3}{16}$ in. hole drilled ¼ in. from one end, the strip is then bent at right angles 1 in. from the centre of the hole.

The moving plate is a strip of .002 copper-foil 4 in. long by ⅞ in. wide. One end of this plate is fixed with small nails to the periphery of the wooden drum, care being taken that this is done between the ends of the tin-foil, the other end is soldered to the operating arm.

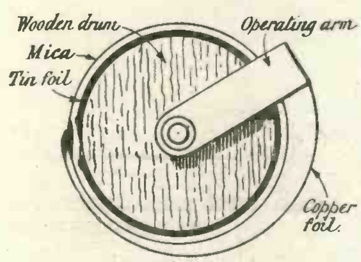


Fig. 2.—A view of the underpart.

The arm is then fixed to the spindle with two lock nuts, and a strip of copper or brass ⅜ in. wide by ½ in. long with a $\frac{3}{16}$ in. hole drilled at one end through which the spindle is passed acts as the connection to the movable plate, the spindle is passed through the hole in the drum and spring washer, lock nuts, and knob are fitted.

The finished condenser is then mounted on a wooden disc and fitted in a cardboard tube 2½ in. diameter by 1⅞ in. deep. The writer has had a couple of similar condensers in use for some time and has found them very reliable. It may be added that in place of mica, waxed paper or empire cloth can be used, but the capacity of the condenser will be considerably reduced.

A TELEPHONE SWITCHING DEVICE

IT will be found that discriminating visitors often prefer the telephones to the loud speaker, especially when really good music is being broadcast. In order, however, to use several pairs conveniently, a suitable method of switching is a *sine qua non.* The usual method is to use a rotary multi-stud switch as a telephone distributor.

The switching arrangement shown in the diagrams has many advantages over this. As will be seen, it consists essentially of four ordinary switches, across each of which are connected the leads to one pair of phones. The connections are so arranged that when any one switch is open the corresponding phone is placed in series with the others; when closed, the phone is short circuited.

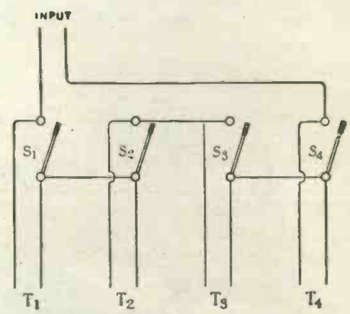


Fig. 3.—How to wire the telephone leads.

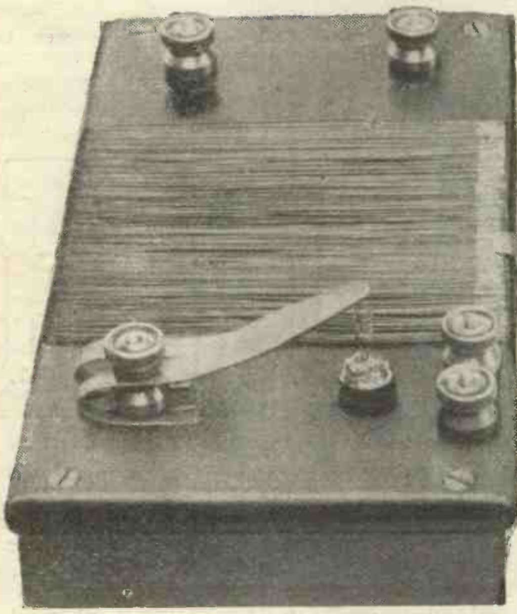
The advantages that may be claimed for this method are:—(1) Any one of the four phones or any combination of them can be instantly put in circuit. There are 15 possible different combinations in this case; (2) The apparatus can be enlarged indefinitely at any time to take any number of phones; (3) The cost of construction is small. Any type of switch will serve. Or in place of each switch two terminals might be arranged opposite each other, which could be shorted when required.

A CRYSTAL SET FOR HALF-A-CROWN.

By THE EDITOR.

This is one of the simplest and most efficient crystal sets for a boy to make.

HERE is a new type of crystal set which will give splendid results from your local broadcasting station and which can be made in an evening by any boy who likes to try. There are no cylinders to wind with even layers of wire, no fidgeting with sliders to make them run easily, no worries in mounting the cardboard roll evenly between two end pieces, no tiresome woodwork, and, in fact, nothing whatever to prevent you finishing the job quickly.



A new use for a tie-clip! In this set the clip is used for tuning.

Look at the photograph and you will see that the set is very unusual in its appearance. Even if you have to buy everything new (and you will probably find several of the parts round the house) it will not cost you more than half-a-crown, and I guarantee that no boy will be able to hear better and louder signals on the most expensive crystal set. Make it and see!

These are the parts you want before starting the set :—

A strip of thin wood, 8 ins. by 4½ ins. (the top of a cigar-box will suit excellently for this).

Two pieces of wood, about an inch square section and 4¼ ins. long.

Five ordinary brass terminals (almost any terminal will do provided one of them is not the kind in which a wire is pushed into a round hole).

Three ounces of No. 24 gauge enamelled copper wire.

One tie clip.

A piece of thin brass or tin measuring about 4 ins. long. If you cannot find anything better you can cut this out of an old tin.

One small metal cap, such as the top of a tabloid bottle or similar small tube.

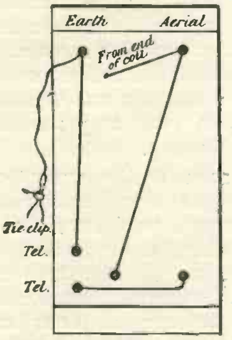
One piece of crystal, such as Hertzite or Galena.

Cut out the piece of thin wood to the size shown and with your pocket knife round the side edges very carefully. This rounding of the edges should be done for about 5 ins. down each side. Rub the wood over with sandpaper to make it nice and smooth, and if you like, give it a coat of stain and varnish. When this has been done glue the two end strips of wood in place (I should not try to nail them as the wood will split if you do this), and with a red-hot needle of fair thickness make a hole about 2 ins. from one end in the middle of the board. Now push one end of the enamelled wire through this and bend it so that it will not pull back again, and then wind on the wire as shown in the photograph. If you live near a broadcasting station which has a fairly short wavelength, such as Cardiff or London, you will not need to wind on more than about 120 turns to receive this local station quite satisfactorily with any ordinary aerial. If, however, you live near Birmingham, Glasgow or Newcastle I should make the coil 150 turns. Wind the turns very carefully so that the adjacent wires touch, but do not overlap one another, and be sure to draw the wire tight as you go. When you have wound on the number of turns selected secure the wire carefully in place and make another hole at the end of the board through which you can push the finishing end of the wire. Leave about a foot of wire for subsequent connecting up. Next drill the holes for the five terminals shown (these holes can be made with a red-hot knitting needle if you have nothing else handy), and push the shanks of the terminals through the holes and secure them in place with their lock nuts.

How to cut the metal strip.

Now carefully scrape off the enamel on one side of the coil in the way shown, so that the tie clip will be able to grip the wire when it is closed. The small crystal cup, which will be made from the top of a phial, should be fastened to the baseboard with a screw through its centre, so that the screw holding it will project on the other side for connection.

The strip of brass or tin must now be bent to the shape shown, and taking a small length of the spare wire scrape the enamel from it, wind it round a knitting needle or pencil, solder one end to the end of the brass strip and cut the other end off sharp, either by cutting the wire diagonally to give a kind of chisel point or else by rubbing it with a file to make a good sharp finish. If you care to buy a gold cat-whisker for 4d. or 6d. this will give even better results, but it is not necessary. When you have soldered the cat-whisker in place and have cut this strip in the manner shown, bend it round and push one end of the kind of fork so made under the terminal which is to hold it; screw this tightly in place and undo the top milled nut of the terminal. You will now be able to bend the strip

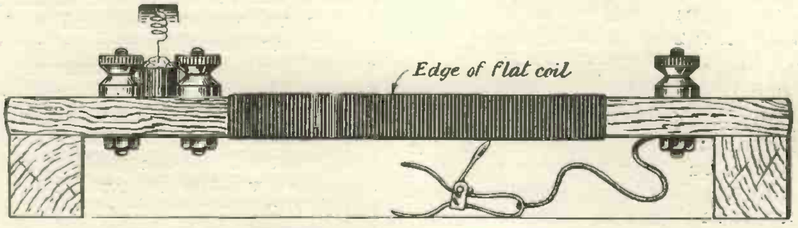


How to join up the terminals, etc.

round, so that the divided portion comes over the shank of the terminal. Now put the milled nut back and you will see that by screwing it up and down it will give you a very nice variation of movement of the cat-whisker.

and solder it to the earth terminal as shown. The other end of this wire will need to be soldered to the tie clip handle.

The next step is to take your crystal very carefully and, without fingering its surface, fix it into the little metal cup by means of silver paper or any other tinfoil you can find. To do this first of all take the crystal in a pair of tweezers and wrap the silver paper carefully round the under side; then, still holding with the tweezers, force silver paper all round it in the cup until it is quite tight. This will make you the necessary good contact. A final bending of the brass strip and the cat-whisker will be needed, when the set is ready for trial. When all is finished connect the aerial and earth to the two terminals shown and the telephones in place and carefully place the cat-whisker on the crystal. Now undo the clip and rub it on the bared wire backwards and forwards slowly until you hear the best results. When you have come to the place where the signals are loudest, close the clip and leave it in position; the set will now be tuned for the broadcast station and can be left in this position as long as you desire to hear it. A slight adjustment of the crystal may be needed, and you will soon have your set going in fine style. On an ordinary aerial quite loud results are obtainable up to 10 miles, and I shall not



An edgewise view of the receiver.

You are now ready to connect up the terminals and the ends of the coil as shown in the drawing. Then take a piece of flexible wire which you can cut from an odd length of electric lighting flex

be surprised if much greater distances are covered with it.

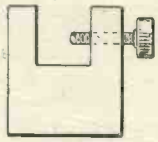
NOTE.—The manufacture of this instrument commercially has been protected.

TRICKS WITH WIRELESS

See next Month's "Junior Wireless."

A FINGER PROTECTOR

A VERY useful little gadget that protects the fingers from being pinched when using a round or square file, can be made, as shown in the drawing, from a small piece of scrap brass or other metal. A slot about ½ inch in depth is filed out and a 4 B.A. set screw is inserted into one of the arms.



The finished protector.

The protector is placed on the blade of the file ½ inch or so from the handle. So long as the fingers are kept behind it there is no fear of their being pinched between the handle and the work.

The device can be readily adapted to quite a number of useful purposes. For example, when drilling a hole to a certain depth in an ebonite panel for tapping, it can be clamped to the drill at the right height, and will indicate with accuracy the point at which to stop.

R.W.H.

"RUBBING DOWN" EBONITE PANELS

ALL makers of their own sets know the difficulty in rubbing down the ebonite bought for panels to the necessary matt surface, as for some reason it is only to be bought in the polished state. The usual recommendation is to rub down with emery or crocus powder, but the result is usually a scratched piece of ebonite that looks ugly. The private individual cannot get hold of the machinery that makers have for the purpose, but a really fine matt surface can be gained by getting a small piece of the cream grit that monumental masons use for rubbing down lead lettered inscriptions, and using that instead of the emery or crocus powder.

WIRELESS VALVES—WHAT THEY ARE AND WHAT THEY DO

By JOHN SCOTT-TAGGART, F.Inst.P.

A few words to those whose knowledge of valves is nil.

IT is impossible to mix in wireless circles for more than five minutes without hearing the word 'valves' used. The person without any knowledge of wireless, wonders, of course, what this mysterious instrument can be.

A valve is a small electric bulb, rather like a small electric light lamp. This little lamp is one of the most wonderful devices that science has given to us, and by its means the whole aspect of wireless has been changed. There are still extensively used receivers which are called "crystal receivers." These do not use valves and possess the merit of simplicity and cheapness. On the other hand, such receivers have a very limited range and are not capable of giving results on a loud-speaker.

The valve carries out two principal duties in a wireless receiver; it amplifies and it detects. By "amplify" we simply mean strengthen. If signals can just be heard in telephone receivers, the signals may be made approximately seven times as loud by the use of a valve. Two valves will strengthen the signals seven times seven, which equals forty-nine times the original strength. Each valve amplifies the signals by about seven times, so that it will be seen that by having a number of valves a very high degree of amplification is possible. This means that very feeble signals may be made very loud, or signals which were previously inaudible are made sufficiently strong to be clearly heard.

The other function of a valve is as a detector. A detector, you will understand, is a piece of apparatus which will convert the high-frequency oscillations in the aerial into low-frequency currents which will work the telephone receiver. An ordinary crystal detector is a very simple form of detector, but a valve is much more reliable and is also more sensitive.

The valve may be used either as a detector or as an amplifier.

The accompanying figure shows a typical valve. The valve which you will be dealing with will be of the three-electrode type. They are called "three-electrode valves," other names being "three-electrode vacuum tubes" or "thermionic valves" or "thermionic tubes." Quite a number of different names are given to the valve, but they all mean the same thing. There are slight differences in different kinds of valves; the parts are differently shaped, but the results obtainable are usually the same in all cases.

A typical modern receiving valve—the "Ora."

The three-electrode valve is so called because it has three distinct parts to it. These parts are known as the filament, grid and the anode. The filament is usually a straight wire supported at its two ends by metal supports. A current of electricity is passed through this filament, or wire, which is thereby heated to almost white heat, just as in the case of the filament of an electric lamp. Around this filament we have usually a spiral of wire, which is quite separate from the filament and does not touch it. This wire is known as the "grid." Around the grid we usually have a cylinder of metal. This cylinder is usually called the "anode," although it is sometimes termed the "plate." The reason for this latter name is that in the earlier types of valve, the anode was in the form of a flat plate.

If you have seen a valve, you will notice that there are four pins at the bottom. These pins are arranged in a certain manner. Two of them are connected through the respective ends of the filament; another pin is connected to the grid, and the fourth pin is connected to the anode. These four pins fit into four corresponding sockets of a valve holder. It is thus a very easy matter to replace a valve.

As regards the operation of a valve, this may be described in a very rough way in a few words. When the filament is heated by an electric current which is obtained from a six-volt accumulator, or other battery, millions of small particles of electricity are shot off from the wire. If we connect a battery of about 60 volts across the anode and filament in such a way that the anode is made positive with respect to the filament, these little particles of electricity, which are really negative electricity, are attracted to the cylindrical anode and flow around the outside anode circuit. If the voltage of the grid with respect to the filament is now varied, we will vary the amount of current flowing between the filament and the anode, and therefore the current flowing in the outside anode circuit. If the grid is given a positive voltage there will be an increase in the number of negative particles of electricity flowing between filament and anode, and there will therefore be an increase in the anode current. On the other hand, if the grid is given a negative voltage with respect to the filament, the grid will repel a large number of the small negative particles of electricity which would have gone to the anode. A negative voltage on the grid therefore decreases the anode current.

When the valve is being used as an amplifier, the signals which would ordinarily affect the telephones are made to vary the voltage of the grid of the three-electrode valve, and therefore cause changes in the anode current. This anode current is now passed through a pair of high-resistance telephone receivers, which would ordinarily be connected between the anode and the positive terminal of the high-tension battery, which is the name given to the battery of about 60 volts connected in the anode circuit.

The process of strengthening the signals which would ordinarily work the telephone receivers is known as low-frequency amplification, and the valve with its attendant apparatus is known as a low-frequency amplifier. Sometimes it is called a note amplifier, or note magnifier, and sometimes a speech magnifier.

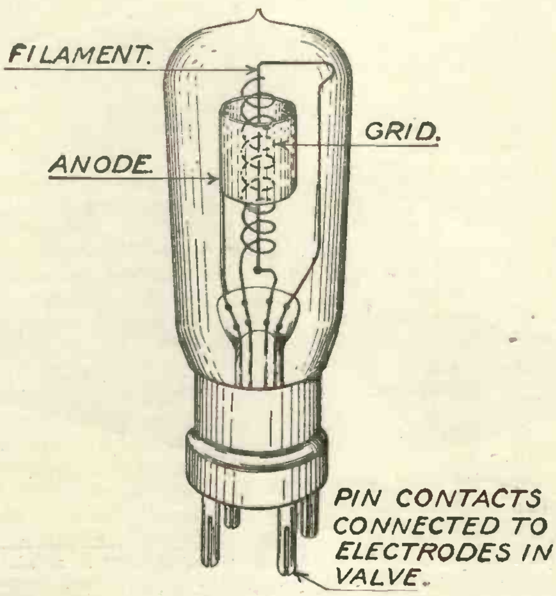
Why the valve amplifies or strengthens is a question which cannot be dealt with briefly, but the fact remains that very small changes of grid voltage will cause relatively large variations of the current flowing between filament and anode and round the anode circuit.

An entirely different kind of amplification is that known as "high-frequency amplification." In this case, instead of amplifying or strengthening the currents which would ordinarily work the telephone receivers, we strengthen the original high-frequency currents and then apply them to a detector, such as a crystal detector. High-frequency amplification, or radio-frequency amplification as it is sometimes called, is very effective when long ranges are to be covered, but low-frequency amplification is usually used when loud results are to be obtained and signals are fairly strong to commence with.

Frequently we use both low-frequency and high-frequency amplification, using either a crystal or a valve as a detector.

Those who desire to obtain the best results with their sets should obtain some technical information regarding the operation of valves and valve circuits. There is no particular difficulty in the study, but the reader will require to obtain some elementary book on the subject, such as "Wireless Valves Simply Explained," by the Editor of MODERN WIRELESS. Details of this book are given in the advertisement pages, and those who desire to know more about the fascinating subject of valves will probably find what they want in this book.

Meanwhile, the reader will have some general idea of what a valve is and what it does, which will provide him with a sound basis for the acquisition of a more exact knowledge by reading and experiment.

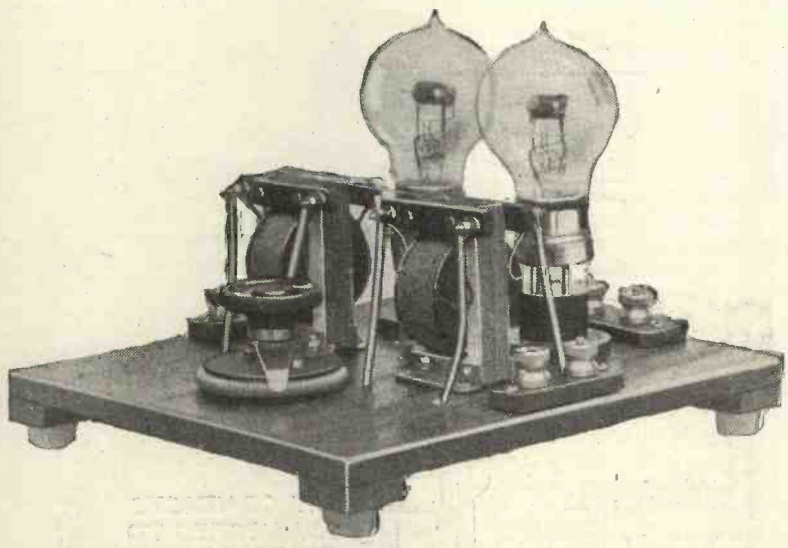


The valve explained.

HOW TO MAKE A TWO-VALVE NOTE-MAGNIFIER

Is your crystal set too quiet? Make this magnifier and you will be able to hear a tremendous strength or work a loud-speaker.

THIS fine little two-valve note-magnifier can be quite simply made in one or two evenings by any experimenter. It is a very useful instrument, for with it any crystal set can be made to operate a loud speaker, if the broadcasting station is not more than about 10 miles distant.



It is quite simple and inexpensive to make, as there is no elaborate cabinet or panel.

Here are the parts required. You can send this list to any wireless dealer and he will be able to supply you with everything you require. If you are writing to any of the advertisers in this magazine simply say that you want the parts for the Junior Wireless Two-Valve Note-Magnifier, and they will know what is wanted.

1 ebonite strip, 4½ in. by 1 in.
2 ebonite strips, 2¼ in. by ¾ in.
2 flange-type valve sockets.
1 filament resistance.
8 terminals.
2 intervalve transformers.
A fixed condenser of .001 microfarads.
A few yards of tinned copper wire No. 22 gauge.
2 yards of insulating tubing.
(You can make the baseboard yourself).

How to Make the Set.

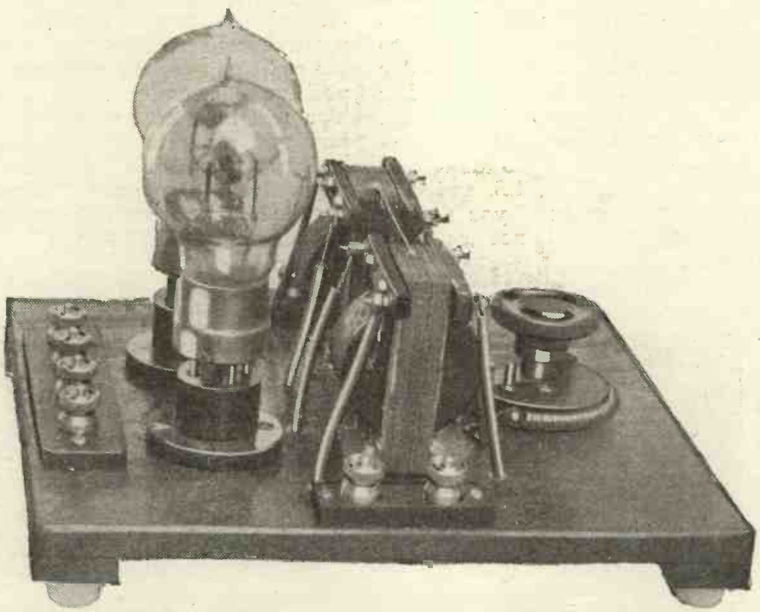
First of all you will require a wooden baseboard 8in. by 9in. by about ⅜ of an inch thick. This can be made of any good wood. You will also require four small pieces about an inch square and an inch thick to glue on to the four corners to keep the board well away from the table. The filament resistance can be of the type which will screw down to the top of the board, as if this kind is used it is not necessary to do much cutting to the baseboard to fit it. The one in the illustration is of this type. If you cannot get this kind of resistance, you can use the ordinary panel-mounting type.

Any good intervalve transformer will do. The best kinds cost anything from a guinea to twenty-five shillings, but some of the less expensive are quite effective. I cannot recommend you to buy any intervalve transformer which does not carry a maker's name. Those shown in the illustration are made by Messrs. Peto-Scott and give quite good amplification.

When you have all your parts ready, take the ebonite strips, and with a piece of emery paper remove the shiny surface. This will not be difficult if you rub the ebonite with a circular motion. When you have done this the ebonite will look a very dirty brown, but if you dust it well and wash it under the tap it will regain its black colour. A very slight touch of oil or vaseline on a piece of rag, well rubbed into the ebonite, will help to remove any final brown tinge.

This is easily done by placing four drops of ink on the socket pins and pressing them on to the wood in the positions shown ; this will make four black dots. Now with a drill and your pocket knife cut out the wood round about these black dots, so that you can screw the sockets in place and still allow room round the pins of the socket. The same procedure should be followed to find where you must cut the wood underneath the ebonite strips carrying the terminals. Be very careful to cut the wood out as shown in the drawing, as if you do not do this the current may leak through the woodwork.

The next step is to screw the two intervalve transformers in place, and when they are in position drill the holes in front and at the back of each of them to take the leads through the baseboard. Screw the ebonite strips in place by means of wood screws and fasten the flange valve sockets in place so that their pins do not touch the wood baseboard anywhere. The four square pieces of wood which form the coil pieces should be glued or screwed in place, being careful not to split the wood if you follow the latter method. The small fixed condenser must now be attached to the underside and you will be ready to wire up the set.



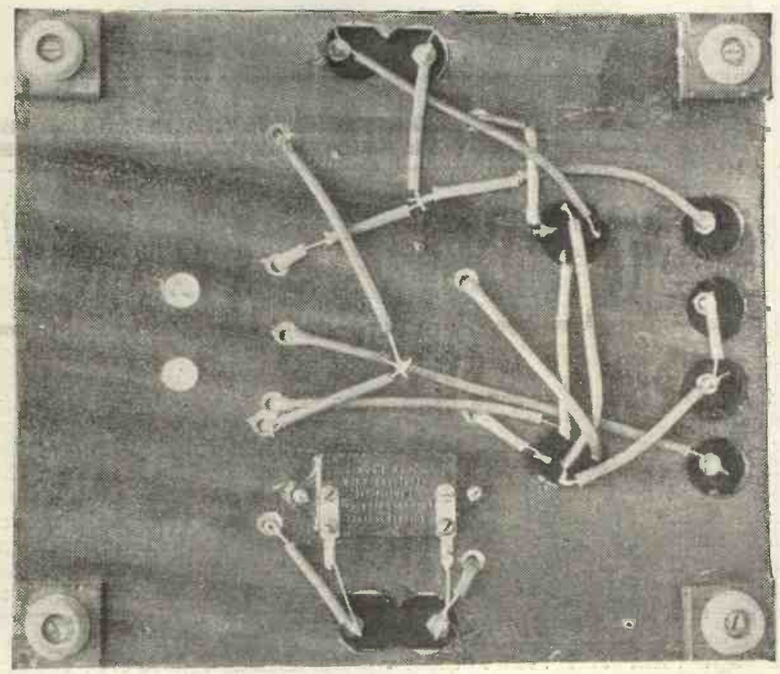
Another view of the instrument. Notice the two iron cores of the tranformers are joined with a wire.

You will need now to drill the holes in the ebonite strips to take the terminals. Fixing across the holes for these terminals should be carefully marked out to be an inch apart, and when these are made pass the shanks of the terminals through them and secure them with a lock nut. You can now lay these strips by. Next find the positions where the holes in the board will have to be cut to allow the terminals and the pins of the valve sockets to pass through.

I strongly advise you to solder all the connections where possible. If you are not used to soldering try to find a friend who has done it before and watch what he does. Be very careful to file the ends of the screws and terminals which have to be soldered quite bright. Do not use much soldering paste. Fluxite is quite good and a touch of this paste on the end of a match should be applied to each point to be soldered. With the hot soldering iron at hand cut off lengths of wire of about the right size for each particular connection; solder one end of the wire in position and then cut off a length of the insulating tubing just long enough to reach almost to the other end of the wire. Slip this in place and then solder the opposite end of the wire. You will probably not need to solder the wires to the intervalve transformers, as these are usually fitted with terminals or lock nuts. Be very careful to place the intervalve transformers so that the markings I.P., O.P., I.S. and O.S. are just as shown; if you do not do this you will not get the results.

If you look at the wiring of the underside of the panel, you will see that in two places in the middle of the panel wires are joined together. At other places the wires cross one another without joining. Be careful that you have the valve socket the right way round. You will notice that the pin which is spaced away from the others is at the back of the instrument. The two iron cores of the transformers should be connected by a wire in the manner shown in the photograph.

The set is now ready to try; connect your crystal set or whatever it is you wish to magnify to the left-hand terminals and your telephones or loud speaker to those on the right. The left-hand pair of back terminals is for the negative and positive low accumulator wires and the right pair for the negative and positive high-tension battery leads. You will have to be very careful how you connect the high-tension and the low-tension wires, otherwise your valve will be ruined. Remember the H.T. positive is the extreme right-hand terminal looking from the top.



A picture of the underside, showing the wiring and how the wood is cut away. You can fit four rubber feet instead of the thick wood blocks, as shown, if you desire. Some dealers keep them. They are not necessary, but they save the table.

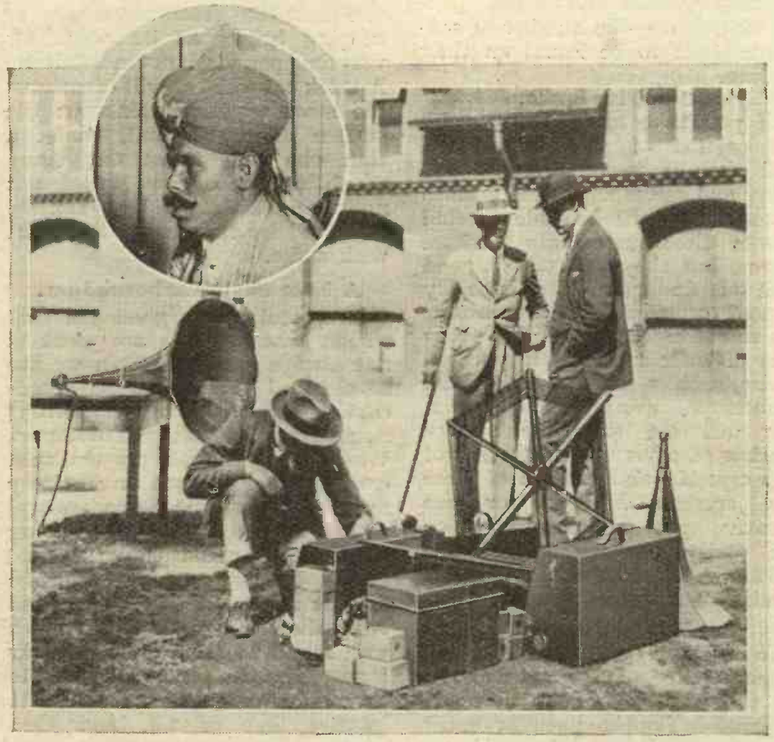
Before putting the valves in their sockets make quite sure that the filament resistance is turned right off. Any good valves will work well with this set, such as the Marconi R, Ediswan R or A.R, Ora, Mullard R, Cossor, or any of the well-known makes. The high-tension battery should be about 60 volts and the low-tension accumulator should be 6 volts. Do not use a four-volt accumulator with this set or you will not get the best results. The telephones used should be 2,000 or 4,000 ohms, and if you use a loud-speaker this should also be from 2,000 to 4,000 ohms.

When everything is ready turn the filament resistance on and listen. If this little magnifier is connected to an ordinary crystal set in place of the telephones, and if you put a loud-speaker on the output terminals in the right you will be astounded at the volume of sound. As soon as I had completed this amplifier, I connected it to the little crystal set also described in "Junior Wireless" and using an indoor aerial under the roof of my house in Hampstead, six miles away from 2 LO, I was able to work my Claritone loud-speaker excellently. The music could be heard all over the house and, of course, if I had used my outdoor aerial it would have been very much louder still.

An Interesting Trick.

If you have a loud-speaker and a pair of telephones you can have some very good fun with this amplifier. Instead of using the set in the ordinary way, connect the loud-speaker to the *input* terminals. Now connect your telephones to the output terminals and listen. You will hear all kinds of weird noises. The loud-speaker will pick up every little sound in the room or garden and the valve will magnify these sounds to a wonderful extent. Your watch ticking or the clock in the room will sound like hammering metal, and if anybody should speak you will be nearly deafened. It is very interesting to listen to all these magnified sounds. Try it and let us know what you think of it.

The Elephant Would Not!



Recently a loud-speaker was installed at the Zoo and the elephant's mahout went to 2LO and had to give the animal orders by wireless. The elephant simply ignored the voice.

Above: The apparatus at the Zoo. Inset: The mahout.

A CHAT ABOUT CRYSTALS

Facts you may not know.

What's in a Name?

IF you go into a wireless shop and ask bravely for a crystal for your receiver, the assistant will immediately ask you what kind you require. If you say, "What kind do you keep?" he will reel off a list of names as long as your arm. Some of these names you will recognise as those of mineral substances with which you are already acquainted, such as silicon, galena, copper pyrites, iron pyrites, etc. You will find, however, that many of them have such names as hertzite, lionite, permanite, electronite, markonite and what-not. If you are not experienced in using crystals you can do worse than choose one of the crystals with a fancy name, for they are practically all specially treated galena, itself a very good rectifying substance. The special crystals are greatly superior to ordinary galena in one very important point—the number of sensitive spots to be found on their surface.

Sensitive Spots.

If you take an ordinary cubical crystal of galena you will find that it is very bright and shiny and smooth. On the smooth surface you will be able to find two or three exceedingly sensitive places, but they will take a good deal of finding. The specially treated crystals on the contrary are sensitive on practically every part of their surface. If you examine such a crystal under the microscope, using a low power, you will see that the surface consists of a very large number of tiny crystals, and as each of these tiny crystals has one or two sensitive spots on its surface, you can easily see why the whole substance must have a very large number of sensitive places.

The Whisker.

There is a great deal in the proper choice of the cat-whisker. By the way, I wonder who was responsible for the peculiar term? I don't see why the fine wire we use for making contact with the surface of a crystal should be called a cat-whisker any more than a pig's bristle or a dog's hair. However, there it is. The name is stuck fast in wireless literature and cannot be removed even by force. This cat-whisker must be of metal, and it is advisable that the wire of which it is made should be as fine as possible. The end of the wire which touches the crystal surface must be kept quite bright, and as such metals as copper and brass oxidise or have some other film deposited upon their surface from atmospheric action, if we are to retain our crystal detector at its maximum sensitiveness, we must occasionally keep this surface bright by clipping off the ends of the wire.

Try Gold Wire.

If you take my advice, you will buy a gold wire cat-whisker. These are very cheap, as the gold is only 9-carat, and being fine very little of the material is used. This cat-whisker costs about 4d. to 6d. and has the great advantage of keeping bright at its point for very long periods, if not indefinitely. A thick cat-whisker will often miss the most sensitive points on the surface of the crystal, whilst a thin one will ferret out many which otherwise you would not notice. Thick whiskers can be improved by sharpening the point with a file.

A Note about Carborundum.

A crystal which gives the best results when signals are weak is not always the best when we are so situated that our local broadcasting station gives very strong signals, even with a crystal detector. When strong signals are the rule, carborundum without any battery applied to it (as is usually necessary) will often be found particularly good. The carborundum crystal should be made to press firmly against a steel or brass plate and trials should be made to see which way round in the circuit it works best. Try the plate connected to the aerial and the crystal to the 'phones first of all, and then compare the signal reception this way with that given by connecting the crystal to the aerial and the plate to the phones.

do not make the mistake of connecting the 'phones to the aerial side and the crystal to the earth side, for although the circuit may look the same the result will be very different. It is always necessary to place the crystal on the aerial side.

* * *

It is quite a mistake to think that only valve sets will work with indoor aerials. A few days ago a guy rope of my aerial broke and I had to have recourse to an indoor aerial which I keep for emergencies. I am six miles from 2 LO and with a single wire running from the dining-room up the stairs into the roof and round the rafters I was able to hear quite well on a crystal set, if not quite so well as usually is the case with an outdoor aerial. I recently heard the case of a man living five miles to the south of 2 LO who uses a crystal receiver quite successfully with an aerial consisting of two or three wires across the room and an earth consisting of two or three wires of similar dimensions laid on the floor. In wireless as in many other things, you never know what you can do until you try and this was a brilliant illustration of the truth of the adage. "WHISKERS."

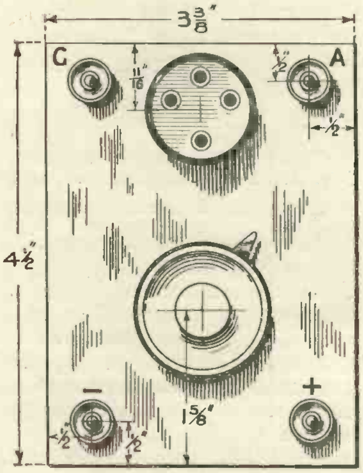
A CHEAPLY MADE VALVE PANEL

A VALVE panel is absolutely necessary for effective experimental work, and the following is a description of a very convenient type which may be made for less than 4s. 6d.

The necessary materials are :—

Three 2 BA nuts.
Two washers.
Some $\frac{1}{16}$th in. sheet brass.

The ebonite panel, on which is mounted the rheostat and valve holder, fit into a wooden box, dimensioned as shown in the figure.



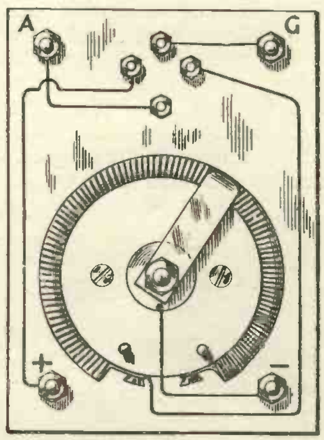


Fig. 1.—The top and underside of the completed panel.

One piece of ebonite measuring 5 in. by 3½in.
Four terminals.
10 feet of No. 24 gauge Eureka wire.
One piece of ebonite measuring 2½ in. by 2½ in.
One valve socket.
One ebonite knob.
2 in. of 2 BA threaded rod.
One spring washer.

Inside the box at each corner is a supporting block glued in. When the ebonite panel is pressed down into the box, it will rest on the four supporting blocks, the top surface of the panel lying flush with the top of the box.

The small piece of ebonite is shaped into a circle, and by means of a file the edge is made to slope, so that when the disc of ebonite is screwed to the main panel, the rheostat coil of wire will spring into place, and will be held in position by the sloping edge. The coil itself consists of No. 24 gauge Eureka bare resistance wire, and is

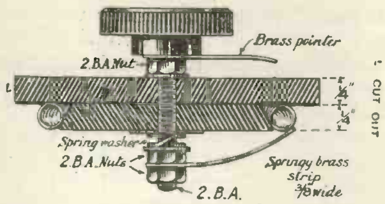


Fig. 2. Showing how to assemble the filament resistance.

wound round a pencil. The ends of the wire are fixed to two screws as shown in the figure. Two stops may also be provided. It should be noted, however, that the brass strip which slides over the resistance wire, should at the beginning be capable of slipping off the coil so as to break the circuit completely. This end of the coil is preferably wound with a rapidly decreasing radius, so that the sliding contact will move smoothly on to the coil when first switching on. The brass contact arm is made out of thin brass sheet, and is secured to the spindle by means of nuts. A large washer should be cut out of brass sheet, and placed next to the ebonite of the ebonite disc. A spring washer ensures good contact between this large washer and

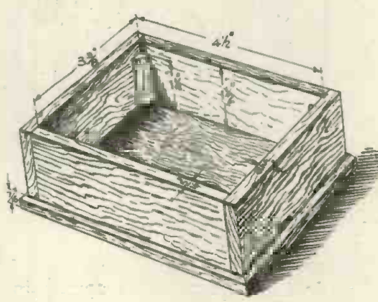


Fig. 3. The wooden box, with its dimensions.

the spindle carrying the moving contact. A lead is soldered to this large washer as shown in the diagram.

TUNING WITH CONDENSERS AND VARIO-COUPLERS

IN the majority of vario-couplers and all variable condensers the control shafts form parts of the circuits and the capacity effect caused by the hand operating the unit cannot be overcome, even by shielding the instruments with ebonite or other panels.

To overcome this, the condenser or vario-coupler should be placed as far as possible from the panel on which the controls are fixed and the shafting cut off about an inch

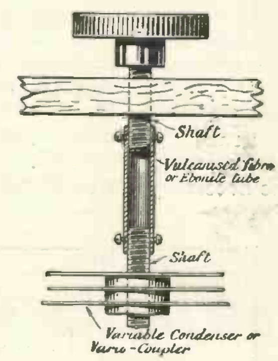


Fig. 1. The remote-control arrangement in position on a condenser spindle.

from the instrument. The spare piece of rod, if more than an inch in length, can be used to hold the knob or handle. A length of tubing, either ebonite or vulcanised fibre, should then be fixed by set screws to the two parts of the severed shaft, as in the diagram.

This method will obviate any noticeable capacity effect caused by the operator's hands, and therefore tuning will be greatly simplified. The advantage of such devices as this are especially noticeable on the really short waves around 200 metres, but even on the broadcasting wavelengths it is very beneficial, and should be fitted wherever space permits.

F. C. L.

"Jones was sensitive, But his 'phones weren't"—

and when the attendance of his little neighbourly concerts began to wane, Jones sought the reason by a close-up study of the remaining few. The visible frowns of the frank—the obvious flattery of the false—capped by granny's remark that it was "as good as a phonograph," told Jones that his set was not the hit of the season. Not until the man in the train told him of the Polar Dynaphone did Jones realise that the day of the ordinary, or purely magnetic headset is over.

No usual type of purely magnetic headphone can give the EXACT reproduction of music and speech as given by the most successful invention in latter-day wireless history, the Polar Dynaphone. Its introduction has been the signal for the scrapping of hundreds of headsets which were giving distorted and indistinct reception on otherwise perfect sets.

The Polar Dynaphone is not merely a departure from every other type of phone, but is an accepted advancement in scientific and structural principle, which has come to stay, and to be the future standard.

In addition to the magnetic effect as in the ordinary phone, there is coupled an electro-dynamic action which results in much more perfect reproduction than can possibly be secured by magnetic action alone.

The Dynaphone gives full-toned rendering in which every note and chord is plainly discernible in its exact, natural pitch. Those who have already experienced the faults and distortions of the ordinary headpiece are loudest in their praises of the Polar Dynaphone.

Small, light, impervious to variations in temperature, and most comfortable to wear, the Dynaphone is obtainable at Polar Stockists all over the country. If your local dealer is not a Stockist, send your order direct, mentioning his name, to—

24/-

POLAR DYNAPHONE.

RADIO COMMUNICATION Co., Ld.,

Telephone: *CENTRAL* 8180 (*3 lines*).

34/35, NORFOLK STREET, STRAND, W.C.2.

Telegrams: *RADIOCOMCO-ESTRAND, LONDON.*

BRANCHES—

NEWCASTLE: 17, Sandhill, and 23, Collingwood St. **CARDIFF:** Atlas Chbrs., James St. **WARRINGTON:** 106, Bridge St. **GLASGOW:** 125, Hope St. **ABERDEEN:** 9, Hadden St. **LIVERPOOL:** 67, Dale Street. **SOUTHAMPTON:** 19, Queen's Terrace.

ALWAYS IN STOCK

- Polar Accessories.
- Lissen Accessories.
- Radio Instruments.
- Mullard Accessories & Valves.
- Cosser Valves.
- Marconi R Type and Dull Emitter Valves.

GAMAGES FOR SERVICE

GAMAGE'S LIST OF WIRELESS APPARATUS

—packed with bargains in everything for the Wireless enthusiast will be SENT POST FREE ON REQUEST.

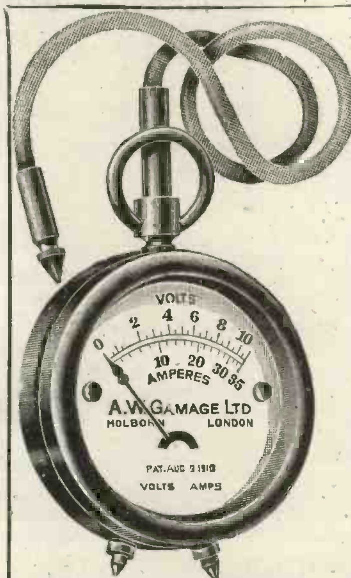
A glance at the bargains here depicted will convince you that Gamage's, with their many years of practical experience, give "the finest service in the world." This claim is substantiated by our gratifying huge daily sales. Every experimenter and amateur should take advantage of these unique buying opportunities. Orders by post will receive the same careful attention as that accorded to personal buyers. Write to "Gamage's Wireless Information Dept." and let us help you in your experiments.

SPECIAL OFFER OF VARIABLE CONDENSERS

The capacity of these Condensers is .00045, being but slightly smaller than .0005 and can be used with great success where a Condenser of this capacity is required giving finer tuning. These Condensers carry the usual Gamage guarantee and every one is tested before despatch. Price each **7/6** Post. 9d.

THE FAMOUS GAMAGE THREE-COIL HOLDER

This accessory is perfectly finished throughout and can be thoroughly recommended. Finished in polished mahogany and ebonite with burnished and lacquered brass fitments. Size, 8 ins. by 6 ins. by 5 ins. Price **25/6** post free. Coils extra.



WATCH TYPE COMBINED DEAD BEAT VOLT-AMMETERS

In nickelled brass case. Reading: 0—10 volts. 0—35 amps. Post 6d. Price **7/6**

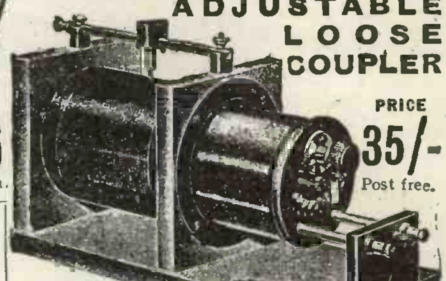
CRYSTAL DETECTOR

Well finished and fitted with famous Permanite Crystal.

Lacquered brass, mounted on ebonite, Ball joint and "cat's whisker." Fitted with our famous "Permanite" Crystal. Post 6d. Price **4/6**

ADJUSTABLE LOOSE COUPLER

PRICE **35/-** Post free.



Tapped on Secondary, covering band of wave-lengths 300 to 1,000 metres. The most efficient for shorter wave-lengths especially with crystal receivers. 10% better results than the ordinary "tight" type. Especially effective when used with a Variable Condenser, either in shunt or series.

"PERMANITE."

For utmost results use "PERMANITE" Crystal. Highly sensitive and remains in adjustment longest. Clear, powerful results. Per large specimen. Post free **1/6**

SINGLE VALVE PANEL.

The ideal accessory for amateur experimenters. This single valve panel consists of valve holder and filament resistance mounted on ebonite panel on polished box. Size, 4½ ins. by 5½ ins. Post 6d. Price **12/6**

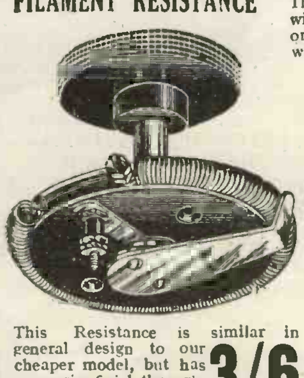
FULLER'S BLOCK WIRELESS ACCUMULATORS

SPECIAL OFFER of ex-Govt. stock, but absolutely unused. Exceptional value.

- 2-volts. 40 amps. **10/6** Postage 1s.
- 4 volts, 40 amps. **21/-** Postage 1s.
- 6-volts, 40 amps. **31/6** Post 1s. 6d.

Boxes to hold 5 of these, fitted with lid and carrying strap. Each, **1/6** Postage extra. Five accumulators and box sent carr. free

FILAMENT RESISTANCE



This Resistance is similar in general design to our cheaper model, but has a superior finish throughout. Post 6d. Price **3/6**

MORSE PRACTICE KEYS

Well finished and accurate working. Mounted on polished wooden base. Length of tapping key base, 3½ ins. by 2½ ins. Post 6d. Price **3/6**

Larger key, similar type to illustration. Mounted on polished walnut base, 4⅞ ins. by 2⅝ ins. by ⅞ in. with two terminals. Price **4/6** Post 6d.

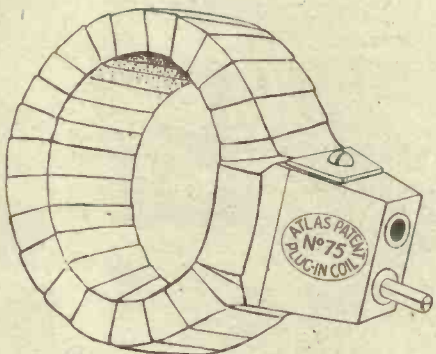
A. W. GAMAGE. LTD., HOLBORN, LONDON, E.C.1.

Hello! Hello! Hello! C.Q.—"ATLAS" COILS calling

"ATLAS" Patent Plug-in Coils

Tune in Telephony Triumphantly on Long or Short Waves.
Adjustment Simplicity itself.
Superiority unsurpassed.

Capacity reduced to a minimum.
Optimum Wavelength Range.
Induction—Maximum obtainable.
Leave nothing to be desired.
Signal Strength increased.



SPECIAL FEATURES:

Wound in true concentric circles, thus obviating sharp bends. Result: fine tuning. Air-spaced between layers and turns.

Coil No.	Wavelength in metres with .001 Variable Condenser in shunt. Min.	Max.	Price. s.	d.
25	120	375	5	0
35	175	515	5	0
50	230	730	5	2
75	325	1120	5	6
100	410	1520	7	0
150	660	2300	7	10
200	850	3100	8	8
250	1280	4150	9	0
300	1550	4940	9	5
400	2045	6380	10	3
500	2980	8900	10	6
600	4000	12100	11	0
700	4970	15000	11	10
1000	6100	20000	12	8
1250	7000	22000	14	0
1500	8200	26000	15	0

Total for Set of 16 Coils £7 7 10

Users say:
"Absolutely the best."

Discounts for Quantities.
Trade Terms on Application.

Enquiries solicited for all Radio Components.

CATALOGUE ON REQUEST.

Our Works are replete with Modern Machinery and our Staff is expert in all matters Radio.

ONLY HIGH-CLASS GOODS SUPPLIED, AND ALL INSTRUMENTS TESTED AND PASSED PRIOR TO LEAVING OUR WORKS.

H. CLARKE & CO. (Manchester) Ltd.,

Radio Engineers,

ATLAS WORKS, OLD TRAFFORD, MANCHESTER.

TELE*phone Nos: 683 and 793 Trafford Park:*
TELE*grams: "PIRTOID, Manchester."*

Head Telephones

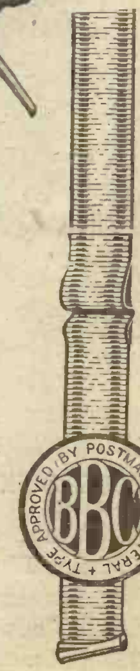
Satisfaction depends entirely on the quality of the head telephones you use.

If these are good, perfect reception is possible, but if poor in quality and design, satisfaction cannot be obtained from the best of receiving sets.

Specify B.T.H. Head Telephones and save the cost of poor quality apparatus which you would soon discard.

Price, per set (4,000 ohms) 25/-
Price, per set (120 ohms) 22/6

Obtainable from all Dealers in Radio Apparatus.



Supplied only to the Trade.

Sole Agents for the Music and Gramophone Trades:— The Murdoch Trading Co., 59 & 61, Clerkenwell Road, London.

The British Thomson-Houston Compy., Ltd.,

:: *Electrical Engineers and Manufacturers* ::
Head Office and Works :: Rugby, England
London Office :: :: "Crown House," Aldwych.

B T-H

1'6

Sold by all Booksellers and Newsagents or 1/7½ post free.

Build most of your own Wireless apparatus.

QUITE a number of the simpler components used in every Wireless Receiver can be constructed at home by anyone without the necessity of special tools or skill.

This little Book contains practical instruction in the making of these components and shows by diagrams exactly how each is made. In addition, full details, such as gauge of wire to be used, number of turns, etc., are invariably stated.

Every description is accurate and is the result of the author's own experiences.

If you are a beginner you will appreciate this Book because it shows you many short cuts in saving money, while if you are a seasoned Experimenter you'll value it because its information will show you how to add and improve your Set at little cost. Get a copy to-day—it will save its cost on the first piece of apparatus you make.

RADIO PRESS, LTD.
Devereux Court, STRAND, W.C.2

SHOWS YOU HOW TO BUILD YOUR OWN ——

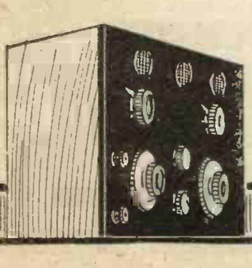
Anode and Grid Resistances.
Filament Rheostats.
Potentiometers.
Basket Coils.
Slab Coils.
Solenoid Coils.
Duolateral Coils.
H.T. Batteries.
Condensers.
Crystal Detectors.
L.F. Transformers.
H.F. Transformers.

"The Construction of Wireless Receiving Apparatus,"

By P. D. TYERS.

5th Edition. **96 Pages.**

RADIO PRESS, LTD.,
Devereux Court,
STRAND, W.C.2.



WIRELESS **STANOPHONE** APPARATUS

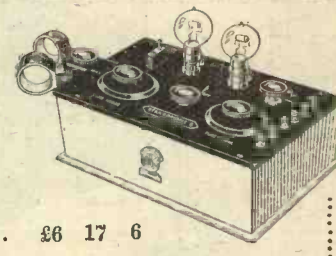
This Single Valve Set is fitted with REACTION approved by P.M.G.

Set only, as illustrated £4 15 6

Complete with all Accessories and B.B.C. royalty paid £9 11 6

This set tunes from 325-3,000 metres and has special internal coil for Paris time signals. It is easy to operate and is a well-finished and efficient receiver.

Single Valve Set, all as above, but receiving broadcasting only. Complete £8 16 0



2-Valve Set (1 H.F. and 1 Detector)

Price, Set, only .. £6 17 6

Complete with all Accessories (Royalties Paid) £14 5 6

WE STOCK AMPLION LOUD SPEAKERS.

We supply frame aerial for use with this set. Price 15/-.

Receives all Broadcasting on P.M.G. Aerial.

This set is extremely efficient and receives well on frame aerial. It employs REACTION and is fitted with extra plug holder for additional coils for Hague and Paris telephony and special stud for cutting in frame aerial.
And **Crystal Sets** from 18/6

AGENTS FOR "FALLON" CONDENSERS. WRITE FOR LIST. AGENTS WANTED.

Manufactured by **GERRARD 1814.**

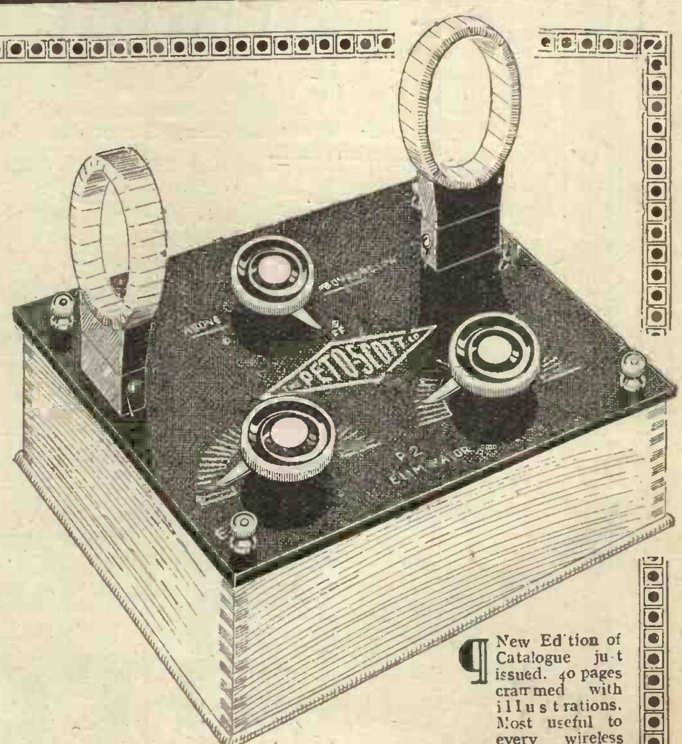
W. VANSTONE, LTD., 61, CHANDOS STREET, W.C.2

Introducing the wonderful new

P2 ELIMINATOR

(Patent applied for.)

At last we are able to announce a perfect means of tuning out all interference on any required wavelength. If you are troubled by any commercial station, such as Leafield, North Foreland, Seaforth, etc., you can now eliminate them entirely even within a mile or two from them. And if you want to tune out your local Broadcasting Station, you can do so with the greatest of ease.
Here in Holborn, within sight of 2LO, we can tune it out and get Birmingham on our usual out-door Aerial.
The **P2 Eliminator** *balances out interference.* By means of a 4-way switch you can :—
(1) Eliminate the interference immediately below the Station you want.
(2) Cut out the interference immediately above.
(3) Neutralise stations working above and below at the same time.
For use on wavelengths up to 600 metres the instrument is quite self-contained, but for higher wavelengths plug in coils are to be used.
Remember, the **P2 Eliminator** can be used with any type or any make of Valve Set—no alterations are required, merely connect up as explained.
To get the most enjoyment out of your Set you must have a **P2 Eliminator.**

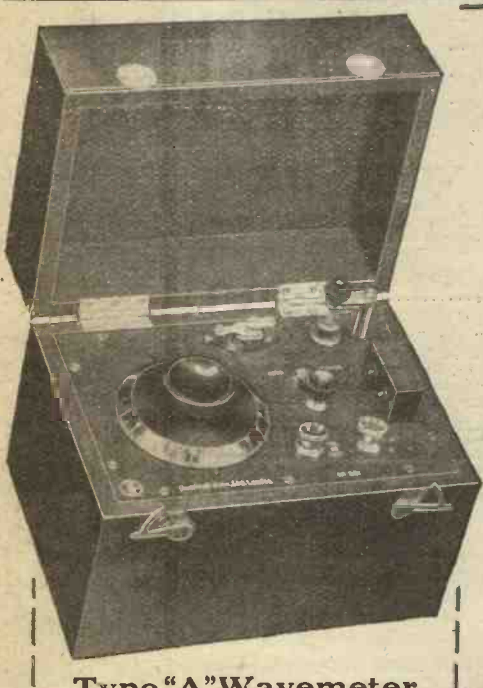


New Edition of Catalogue just issued. 40 pages crammed with illustrations. Most useful to every wireless enthusiast. 4d. Post Free.

Prevents interference by Spark Stations and cuts out your local Broadcasting Station when you will.

PETO-SCOTT Co., Ltd.,
Head Office : 64, High Holborn, W.C.1.
Branches : 99, High Holborn, W.C.1.
3, Wellington Street, Strand, W.C.2.
4, Manchester Street, Liverpool.

£3 3s. 0d.
Carriage paid.

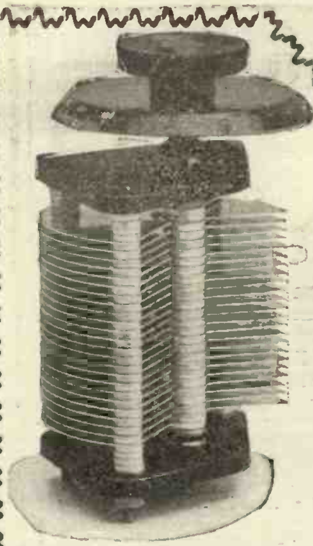


APOLOGY

Wireless Crystal "TALITE" Trade Mark.

My attention having been drawn to the sale at my premises, 143-44, Fleet Street, E.C., of an article in substitution of and represented as the above-named Trade Mark "Talite" Crystal, I HEREBY express my regret to HARDING, HOLLAND and FRY, LIMITED, of 27, Garlick Hill, E.C., the Sole Selling Agents for "Talite" for any inconvenience, loss or damage they may have sustained in consequence thereof, and UNDERTAKE that no further sales of any substituted article shall be made.

DATED this 3rd Day of August, 1923.
(Signed) R. GREEN,
143-144, Fleet Street, E.C.



JUST WHAT IS WANTED!

A Variable Condenser of right capacity.

Try a

J B

WHICH HAVE BEEN THOROUGHLY TESTED AND FOUND CORRECT.

THE ACME of PERFECTION

SCIENTIFICALLY DESIGNED BY EXPERTS.

ONE HOLE only for **FIXING** to **PANEL.** Large **METAL** to **METAL BEARINGS.**

Completely assembled as illustrated, including

KNOB and DIAL.

·001 ..	8 6	Packing and Postage extra.
·00075 ..	8/-	
·0005 ..	7/-	
·0003 ..	5 9	One only. 9d.
·0002 ..	5/-	Two .. 1/-
VERNIER	4/-	Three .. 1/3

Unsolicited Original can be seen at our office. LONDON, E. 17.

Messrs. Jackson Bros.

Dear Sirs, It will be of interest to you to know that I have tested the 12 Variable Condensers bought from you and of your make, Types ·001 to the Vernier. The Condensers came through the test with very satisfactory results, being of the capacity specified. It is with pleasure I write these few lines to congratulate you on the excellent results.

Yours faithfully,
A. W——, A.M.I.E.E.

Obtainable through your dealer or direct from:

JACKSON BROS., *Condenser Specialists,*

Enquiries to :—

Head Office—8, Poland St., Oxford St., London, W.1.

Trade Enquiries Invited. 'Phone : Gerrard 6187.

Works: PRECISION RADIO WORKS, MOLESWORTH ST., LEWISHAM JUNCTION, S.E.13. 'Phone: Lee Green 1225.

Genuine Hellesen

DRY BATTERIES -LOW TENSION- TYPES FOR DULL EMITTER VALVES

For Filament Lighting of the New D.E.R. type Thermionic Valves. Write for full details and Leaflet 142.

Dry Batteries, Reliable and Clean, Replace Dirty, Troublesome and Inconvenient Accumulators.

DRY BATTERIES ARE ALWAYS MORE CONVENIENT THAN ACCUMULATORS.

But in many instances they are not suitable for the work required and the messy acid Accumulator has to be used. D.E.R. Valves have a consumption varying from 0.2 amp to 0.4 amps, and for such a consumption Dry Cells are eminently suitable.

Two cells, each 1½ volts, are necessary to make a 3-volt battery, and to further increase capacity for additional valves one or more similar combinations must be connected in parallel.

PRICE LIST.

"GLOWE," 1½ volts, 7 by 3½ by 3½, 4 lb., 60 a.h. capacity, 9/6 ea.
"GLEAM," 1½ volts, 8¾ by 4½ by 4½, 9 lb., 130 a.h. capacity, 18/6 ea.

The above capacities are based on 0.4 amps. for 50 hours per month. Write us for fuller details.

A. H. HUNT LTD. (Department W.E.),
H.A.H. WORKS, TUNSTALL ROAD, CROYDON, SURREY.
Croydon 2225 *"Keyage Croydon."*

"MAGNUM" COMPONENTS

FOR THE

ALL-CONCERT RECEIVER

as described in this issue.

	s.	d.
1 Magnum Intervalve transformer ... ... (Specially recommended for this circuit.)	15	0
2 Variable Condensers .0005 with scales and knobs	16	0
1 Fixed ,, .002	1	6
1 ,, ,, .0003	1	6
1 ,, ,, .0002	1	6
3 Filament Rheostats	6	0
3 Valve Holders	2	6
6 Terminals mounted on ebonite panels	2	0
1 Coil Holder for 2 coils	6	6
1 Coil Plug on ebonite base with A. & E. terminals ...	2	0
1 Grid leak, 2 megohms	1	0
1 H.T. Condenser (ex-Government while stock lasts)	1	6
	£2 17	0

COMPLETE SET AS ABOVE—CASH WITH ORDER.

Carriage and packing free for set as above, also with extras.

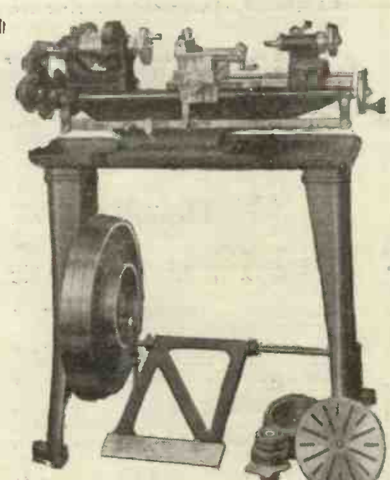
If required :—	s.	d.
100 volt H.T. with tappings and plugs	15	0
6 Volt 40 A.H. Accumulator	27	6
"MAGNUM" Tapped coil 180-1,000 metres, specially recommended for this circuit ...	12	6

S.T. 100. All parts stocked for this wonderful circuit.

Send for list of COMPONENTS specially recommended for all circuits described from time to time.

BURNE-JONES & CO., LTD.,
MANUFACTURING RADIO ENGINEERS,
Montford Place, Kennington Road, London, S.E. 11.
'Phone: HOP 6257.

Amateurs!



For 20 years the most beautiful work has been turned out by experimenters and model engineers possessing

DRUMMOND LATHES

The initial outlay is amply repaid—the pleasure obtained is endless.

Write for Lists.

They will show you the lathes in full detail; you will note the rigid construction, the modern design, the large capacity of these splendid tools. We illustrate above the 3½ in. lathe for treadle drive.

DRUMMOND BROS., LTD., Reid Hill, Guildford.

Post this Coupon.

Please send me lists of 4 in. and 3½ in. lathes, with details of deferred payment system.

(Send in unsealed envelope for ½d.)

NAME ....

ADDRESS ....

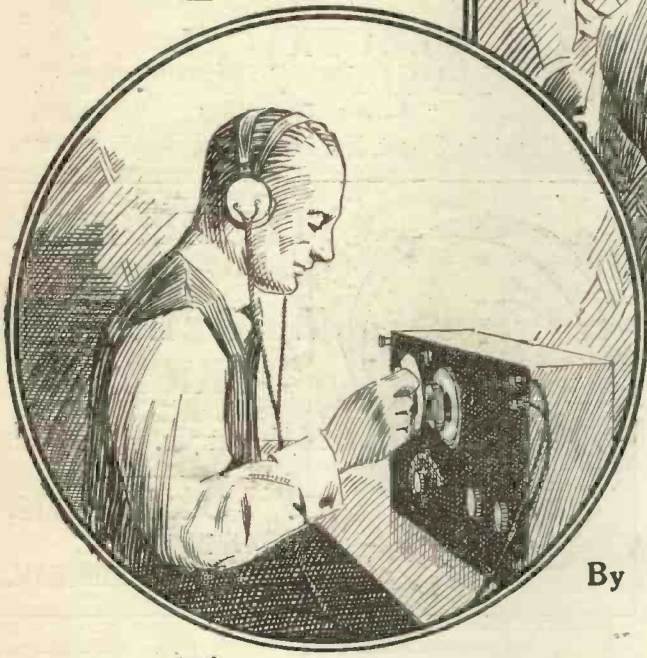
....

COUPON

Questions and Answers

In future this coupon must be accompanied with 1/- P.O.

"MODERN WIRELESS September 1923.



How would you choose your Magazine?

By its general appearance—

The clean, attractive-looking appearance of ***Wireless Weekly*** has made for it many friends. If you appreciate the "quality touch" in any magazine, pick up a copy at your next opportunity. Being printed on superior paper its illustrations are sparkling and full of detail—a very important feature in any technical journal. Its text pages are neatly arranged and printed in a good, clear type which is easy to read Further, ***Wireless Weekly*** is the largest Magazine of its kind on the market.

By its Contents—

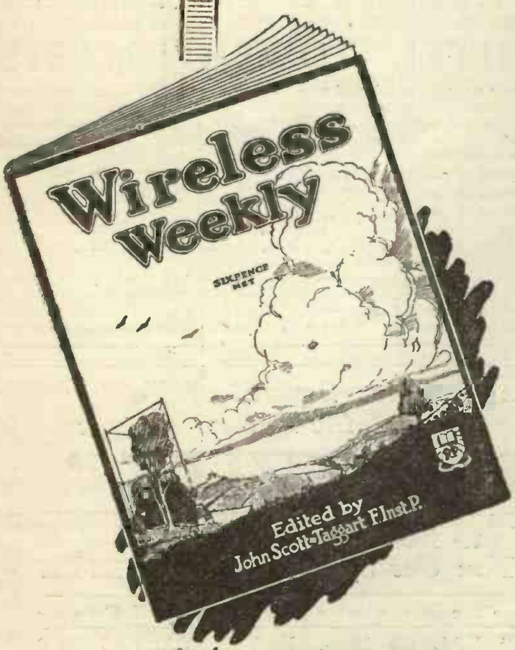
While such rapid progress in Wireless is being made it is more than ever imperative that you should keep up to date. A Circuit considered good to-day may be out of date to-morrow. ***Wireless Weekly*** is always in the fore-front with its news service of all the latest wireless inventions and discoveries. And its reputation for dependability is a guarantee that only accurate information shall be chronicled in its columns.

By its Policy—

Perhaps more important to you than any other feature is the policy of the Magazine. That the policy of Radio Press, Ltd.—proprietors of ***Modern Wireless*** and ***Wireless Weekly***—is vigorous, is obvious from the very large number of regular readers of these two Magazines. To help the beginner by putting him on the right paths from the first—to encourage the experimenter by showing him the results of the labours of others—to assist the manufacturer by establishing a feeling of confidence among readers—these are in brief the aims and ideals of ***Wireless Weekly.***

By its Editorial Staff—

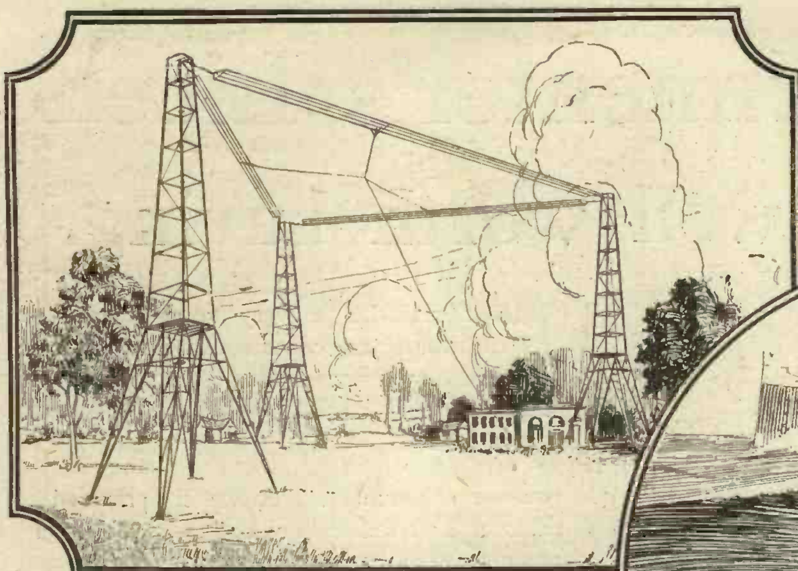
The Editorial Staff of ***Wireless Weekly*** is the largest group of technical Wireless experts exclusively devoted to any one Magazine in the country. Each one is a specialist on some phase of the Science, and his knowledge and experience is available only for Radio Press publications and for no other. By this means every Article—whether practical, theoretical or constructional—is thoroughly dependable. In addition, ***Wireless Weekly*** is in a position to exercise rigorous care in selecting contributions from only authors whose work is well known and reliable.



Published every Wednesday
6d.

RADIO PRESS LTD.,
Devereux Court, Strand,
W.C.2.

Sold by all Newsagents and Booksellers everywhere.



An Experimenter's Licence is well worth having.

This is what the P.M.G. said

"In order to ascertain my position I felt it my duty to place the whole facts before the Law Officers of the Crown, and I have just received the opinions of the Attorney-General and the Solicitor-General.
These are that I am not only entitled, but compelled by law to issue an Experimenter's Licence to those applicants in regard to whom I am honestly satisfied that they are genuine experimenters.
This being so, while it would be wrong to issue an Experimenter's Licence to the man who is obviously merely a broadcast listener-in, it would be equally wrong to decline to issue such licences on a wholesale scale."

To a Representative of the Press.

UNDOUBTEDLY a very large number of wireless enthusiasts are contravening the present regulations regarding licences. Some through ignorance, others wilfully because their applications for Experimental Licences have been turned down.

If you are a genuine Experimenter, prepared to take up Wireless as a serious hobby and not merely as a means of passing a pleasant hour in listening to broadcast Concerts, then you are **entitled** to an Experimenter's Licence.

Many applications for Licences have been turned down by the authorities because the applicants were not fully aware of the necessary requirements which had to be fulfilled.

This little book by E. Redpath (assistant Editor of Wireless Weekly) has been written to explain exactly what an Experimenter should know and how he should set about obtaining his Licence.

Remember this important point—even if a Constructor's Licence is issued, it is practically certain to contain special restrictions regarding the use of Receiving Sets and Circuits. With an Experimenter's Licence your work is practically unhampered. Why not get a copy of this book to-day and legalise your position at once and for always?

Radio Press, Ltd
PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
DEVEREUX COURT. STRAND. W.C.2.

1/-

From all Booksellers & Newsagents, or 1/1½ post free direct.

Gilbert Ad.

RADIO PRESS Series No. 11.

USE THIS COUPON

in writing to advertisers in "Modern Wireless."

CUT HERE

In connection with your announcement in MODERN WIRELESS, please supply me with:

Enclosed please find remittance of..........................

(Leave blank if not an order)

If an open envelope is used in applying for catalogues a half-penny stamp will cover postage.

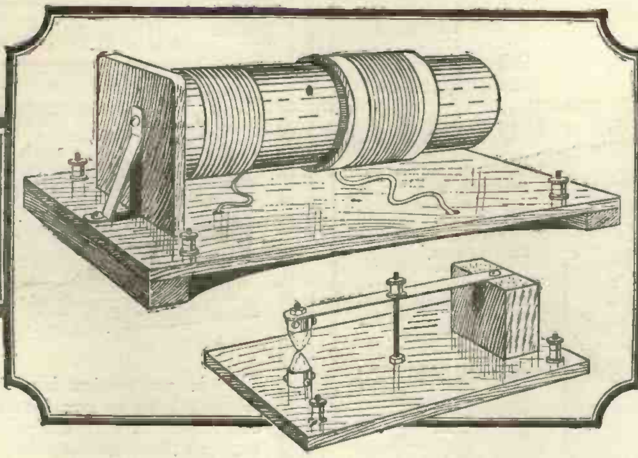
Name..

Address..

....

Date..

CUT HERE



A Crystal Set is always useful—

No. 3 of the RADIO PRESS Series

WHEN your Accumulator runs down, or your Valve burns out, or your H.T. Battery suddenly develops noises—these are the occasions when you would give almost anything for some means of "carrying on." Why not forestall these possibilities by making a Crystal Set now?

This new Book by John Scott-Taggart, Editor of "Wireless Weekly" describes three useful Sets which can be made by anyone without special skill in the use of tools. In fact, the simplest of them (illustrated above) can even be constructed of material you would find around the house.

All have been designed to give good results with a range of, say, 25 miles from your nearest Broadcasting Station.

Get a copy of this Book to-day—even if your present Set seems immune from breakdown, you will never regret the time spent on building a Crystal Receiver.

Contents

Radio Press, Ltd.
PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
DEVEREUX COURT. STRAND. W.C.2.

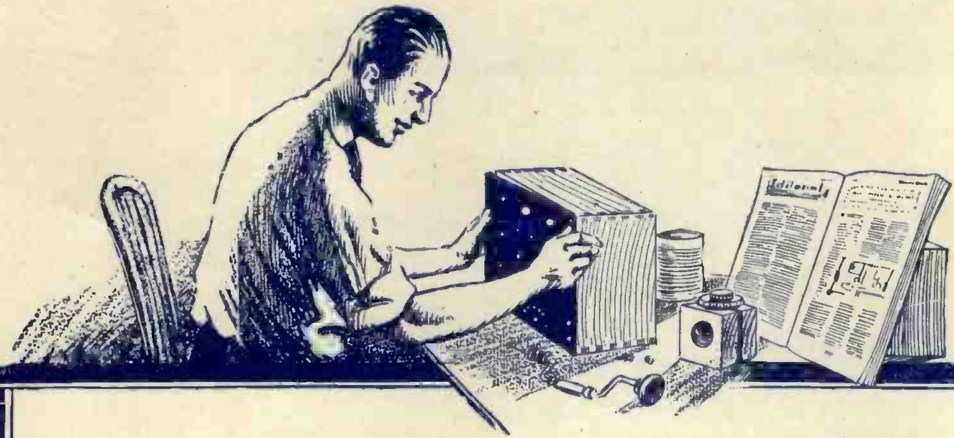
From all Booksellers and Newsagents, or 1/7½ post free direct

How to make your own Broadcast Receiver

1/6

By John Scott-Taggart, F.Inst.P.

Index to Advertisers



Radio Press Books give him all the information he needs

Complete List

	Price.	Post free.
1. Wireless for All.... John Scott-Taggart, F.Inst.P.	-/6	-/7½
2. Simplified Wireless. John Scott-Taggart, F.Inst.P.	1/-	1/1½
3. How to Make Your Broadcast Receiver. John Scott-Taggart, F.Inst.P.	1/6	1/7½
4. How to Erect Your Wireless Aerial .... B. Mittell, A.M.I.E.E.	1/-	1/1½
5. The Construction of Wireless Receiving Apparatus .... P. D. Tyers.	1/6	1/7½
7. How to Make a "Unit" Wireless Receiver .... E. Redpath.	2/6	2/8
9. Wireless Valves Simply Explained.. John Scott-Taggart, F.Inst.P.	2/6	2/8
10. Practical Wireless Valve Circuits ..... John Scott-Taggart, F.Inst.P.	2/6	2/8
11. Wireless Licences and How to Obtain Them .... E. Redpath.	1/-	1/1½
Elementary Text-book on Wireless Vacuum Tubes.............. John Scott-Taggart, F.Inst.P.		10/- (Post free)

¶ Those printed in heavy type have been published recently.

HOW many turns for a Coil to reach the Paris Wavelength—the type of circuit to operate a Loud speaker using only an indoor Aerial—Crystal or Valve rectification in a multi-valve Set? These are a few of the questions which confront the amateur constructor.

Some will find out the correct answers by expensive experiment—others, more wisely, will benefit by the experience of those who have trodden the thorny paths of Radio before them.

The concentrated experience of some of the best known Wireless engineers and experimenters is available for all readers of Radio Press Books. You cannot do better than purchase the complete Library—one Book at a time. Each Book covers a different phase of Wireless and none overlap. Get one or two to-day and keep them by you for ready reference—they are sure to save their cost many times over. From all Booksellers.

RADIO PRESS LTD.,
Devereux Court, STRAND, W.C.2.

Radio Press Books
— a - complete Wireless Library

Gilbert Advt.

Printed by ODHAMS PRESS LTD., Long Acre, London, W.C.2, and published on the 1st of every month at 3, Bolt Court, Fleet Street, London, E.C.4, by the Proprietors, RADIO PRESS, LIMITED, Devereux Court, Strand, W.C.2. Subscriptions and editorial communications to go to latter address. Advertisement Offices: Scheff Publicity Organisation, Ltd., 125, Pall Mall, London, S.W.1. Registered as a Magazine for transmission by Canadian Magazine Post. Sole Agents for Australasia Gordon & Gotch (Australasia), Ltd. Sole Agents for South Africa: Central News Agency, Ltd. September, 1923.