

SITTING-UP TO HEAR AMERICA!

Amateur Wireless And Electrics

Vol. III. No. 79.

SATURDAY, DECEMBER 8, 1923

Price 3d

PRINCIPAL CONTENTS

REFLEX AMPLIFICATION

FORTY-ONE CRYSTAL
DON'TS

LOOKING AFTER YOUR
ACCUMULATOR

PLASTIC METALS FOR
SETTING CRYSTALS

ALL-PURPOSE RE-
CEIVER

A WELL-DESIGNED
INTERVALVE TRANS-
FORMER

BRITISH VARIOMETERS

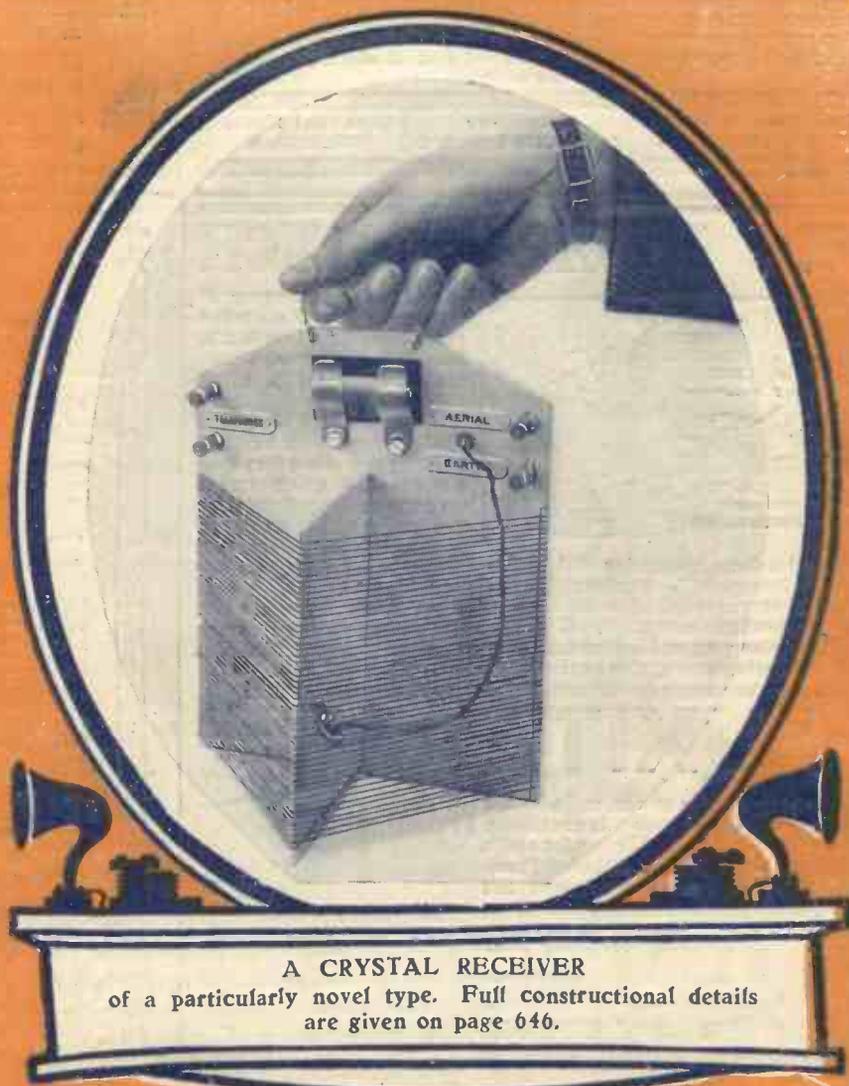
WAVELENGTHS AND
WINDINGS AT A
GLANCE

PRACTICAL ODDS AND
ENDS

EXPERT REPLIES TO
READERS' QUESTIONS

WELL ILLUSTRATED

Registered at G.P.O. as a Newspaper



A CRYSTAL RECEIVER
of a particularly novel type. Full constructional details
are given on page 646.

ECONOMIC ELECTRIC LTD.

TELEPHONE : MUSEUM 1055

"XTRAUDION" VALVE

15/-



"A real mechanical job." — Amateur Wireless.
 "The 'Xtraudion' is a marvellous silent amplifier." — Bazaar, Exchange and Mart.
 "On the S.T. 100 circuit it gave a fine roar with 2 L.O.'s Dance Music, audible at the end of a large suburban garden." — Wireless Weekly, July 25.
 "Preference should be given to a valve using little current. The 'Xtraudion' using only .4 amps. fills the bill." — Motor Cycling, Aug. 8.

THE FAMOUS LOW-CONSUMPTION VALVE is recognised as a great advance in valve-construction. Two "XTRAUDIONS" use practically no more current than one of most other types. Amplification is enormous, the factor being 12. Silent working, due to the wonderful grid construction. Elements supported on two sides. Should filament sag, it cannot touch the grid. The anode is immensely strong and rigid. Send for our 40-page Radio Book and read all about it. Mailed post free for 4d.

Head Office : 10, FITZROY SQUARE, LONDON, W.1 Showrooms : 303, EUSTON ROAD, N.W.1 Branch and Works : TWICKENHAM

200,000 MAGNET LETTERS

Have been supplied by us to WONDERSIGNS of HOLBORN. Each letter is a perfect Magnet. Hence our knowledge of what a Magnet should be, and our ability to produce the BONTONE PHONE under mass production.

POINTS TO CONSIDER:—

Every Phone is sold under guarantee. Every Phone is tested before leaving Factory. We are old-established Manufacturers, whose object is to give complete satisfaction. Why saddle yourself with Continental Phones distributed by unscrupulous Importers, with small offices, elaborate notepaper and no guarantee or hope of redress if found faulty. Originals of upwards of 100 unsolicited Testimonials and letters of appreciation can be seen at our offices



BONTONE PHONES

4,000 ohms. Britain's Best.
PER 14/6 PAIR
 Carriage Paid United Kingdom.

GUARANTEE:

We agree to replace on return cash if Phones do not give complete satisfaction, subject to Phones being returned to us within 7-days of purchase, undamaged.

Sensitive, Durable, Comfortable and Beautifully Finished. Manufactured Entirely by BRITISH LABOUR.

LIBERAL TERMS TO THE TRADE.

B. D. & Co. (Edward A. Boynton)
 WORKS; GOSWELL ROAD AND CITY ROAD.
 OFFICES: 167-173 GOSWELL ROAD, LONDON, E.C.1.
 (ADMIRALTY, WAR OFFICE & INDIA OFFICE CONTRACTORS)

THE FLUXITE TOUCH



The touch that stamps your delicate little wireless set as perfect—without that touch, how can you say with conviction "My set is all it should be"?

We must admit ourselves that nothing is easier than twisting two wires into connection—it is quick—and it serves to a certain degree, but the snag is that it is liable to loosen, and electricians know Soldering renders your connections "looseproof"—it grips tight and doesn't let go.

Don't jib at the sound of soldering—just bear in mind the fact that Fluxite makes it an easy affair. Give the attention to your set that you wish it to give you, and solder each connection carefully with the aid of Fluxite; in other words, give your set the "Fluxite touch."

Ask your Ironmonger or Hardware Dealer to show you the neat little

FLUXITE SOLDERING SET.

It is perfectly simple to use, and will last for years in constant use. It contains a special "small-space" Soldering Iron with non-heating metal handle, a Pocket Blow-lamp, FLUXITE, Solder, etc., and full instructions. Price 7/6. Write to us should you be unable to obtain it.



FLUXITE SIMPLIFIES SOLDERING

All Hardware and Ironmongery Stores sell FLUXITE in tins, price 8d., 1/4, and 2/8.

Buy a Tin Today.

FLUXITE LTD., 326, Bevington Street, Bermondsey, England

For the tool-kit of your car or motor cycle or any soldering jobs about the home.

THE HOUSE FOR ALL Wireless Accessories

Adjustable Headphones, 4,000 ohms, per pair, 12/6 and 15/3	each	9/11
L.F. Transformers, tested and guaranteed	...	...
Aerial Inductance, T.M.C., 20 Tappings, mounted on ebonite, lacquer finish	...	9/-
Crystal Detectors in glass case	...	1/6
Perikon do. instrument finish, screw adjustment	...	3/-
Switch Arms, 4 laminations, complete	...	8d.
Fixed Condensers, .0001 to .003, each, 9d., .005, .006 each	...	1/3
W.O. Telephone and Pillar Terminals, 4 B.A. complete, each 1d.	...	1/5 doz.
Sleeving, assorted	...	8d. per yd. 3d.; per 3 yds.
Variometers, with knob and dial (not rubbish), each 2/10, 3/6 & upwards	...	...
Filament Resistances, really good	...	2/- each 1 8 and
Plated Terminals, W.O. or Telephone, 4 B.A. complete, 2 for	...	3d
Filament Resistance Dials	...	7d. each
H.F. Transformers, Pin in. type, 350/450 metres, each 4/9, 2 500/3,800 metres	...	7/3 each
Washers, all sizes	...	1d. doz. 2 doz. 1d.
Crystal Sets, Slider type, complete with highest resistance phones, etc.	...	30/- each
Genuine Phillips "R" Valves	...	9/- each
Screwed Rod, 12-inch lengths, 1 B.A., 2d., 4 B.A., ...	...	2d. each

Write for post free catalogue

We have always in stock Iseranic, R.L. Lissen, Sterling, Woodhall, T.M.C., B.T.H., Marconi-Osram, Gossor, Ediswan, Mullard, Dubilier, Siemens, G.R.C., etc., components in great variety.

TRADE SUPPLIED. Open 9.30 a.m. to 8 p.m.; Saturdays 1 p.m.

SHOVE, WIRELESS ENGINEERS PORTER & CO. 56 Mortimer St. LONDON W.1

Amateur Wireless

and Electrics

Vol. III, No. 79

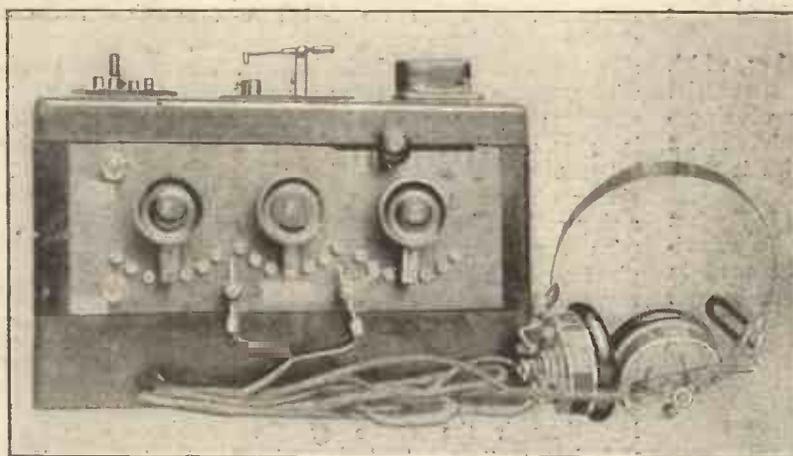
December 8, 1923

FORTY-ONE CRYSTAL DON'TS!

- D**ON'T omit to experiment with crystal detectors.
- Don't heat crystals unless it is absolutely necessary.
- Don't imagine that catwhisker points remain sharp for ever.
- Don't grind together the crystals in a perikon combination.
- Don't expect a crystal to retain its sensitiveness indefinitely.
- Don't forget that a small buzzer is useful for adjusting a crystal.
- Don't forget that those cups with three fixing screws are very useful.
- Don't forget that "quick-change" crystal cups save time and temper.
- Don't, when using the three-screw type of cup, grind the crystal to pieces.
- Don't keep on readjusting the crystal once you have found a sensitive spot.
- Don't leave crystals exposed to the atmosphere; it does not improve them.
- Don't forget that detectors with dust-proof covers are preferable to those without.
- Don't forget that all parts of a crystal detector should be well insulated from earth.
- Don't forget that when using a crystal set the first thing to do is to adjust the crystal.
- Don't clean crystals with petrol, which leaves a film of grease; use benzine or alcohol.
- Don't be satisfied with always using the same kind of crystal detector; try different types.
- Don't forget that platinum points for catwhiskers can be obtained from many electric lamps.
- Don't think that the addition of a battery and potentiometer will always give better results.
- Don't forget that most detectors with a catwhisker contact do not need an applied potential.
- Don't despise crystals because you use valves; they may stand you in good stead one day.
- Don't jam the catwhisker down on the crystal; a light contact usually gives the best results.

- Don't be satisfied with poor results; a crystal set may have a range up to 150 miles for broadcasting.
- Don't forget that a crystal is a more efficient rectifier than is a valve and that it gives better tone.
- Don't buy or use detectors in which the catwhisker cannot easily be moved over any part of the crystal.
- Don't forget that some combinations need an applied potential; that is a potentiometer and a few dry cells.
- Don't judge a crystal by its name only; nearly all the "patent" crystals are a form of (artificial) fused galena.
- Don't forget that copper, brass and graphite can sometimes be used very successfully with carborundum.
- Don't throw away a crystal if you cannot find a sensitive spot on it; cut the top away diagonally with a pair of pliers.
- Don't think that only a flat steel spring can be used with carborundum; a rounded or sharp point is just as good.
- Don't scrap your crystal detector when

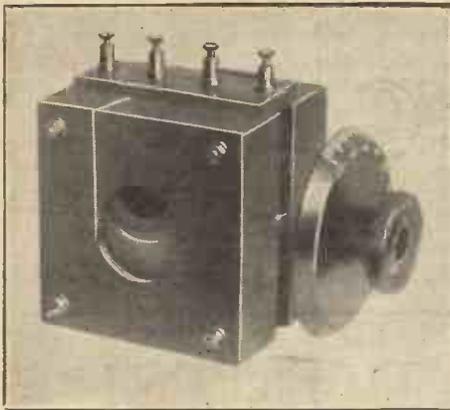
- because you happen to get poor results at first; you may get hold of a poor specimen.
- Don't forget that the best results are usually obtained with close-grained crystals; they have more sensitive points.
- Don't forget that there are other perikon combinations besides zincite and bor-nite; zincite and copper pyrites is another good one.
- Don't rely upon working a loud-speaker with a crystal. It has been done and you *may* be able to do it; but most probably you *won't*.
- Don't use two crystals in parallel at once in the same circuit; it will only cut down signal strength unless they are arranged in opposition for eliminating interference.
- Don't use an indoor aerial if you can possibly put one up outside; an indoor one will usually give good results, though, within ten miles of a broadcasting station.



The photograph shows a crystal set embodying a loose-coupled tuner, as described in the "Work" Handbook, "Wireless Telegraphy and Telephony," made entirely by Master E. G. H. Brown, of Stockwell, a schoolboy of fifteen.

- you begin with valves; crystal detectors are necessary in most reflex circuits.
- Don't try to adjust a crystal detector in the dark; you may succeed, but you will most likely only cause bad language.
- Don't condemn all crystal detectors

- Don't pick up crystals to examine them; you will not be much wiser afterwards. If you *must* look at them, however, use tweezers and not your fingers, which are greasy.
- Don't forget that different kinds of metal catwhisker can be used with the same crystal; try some unusual combinations and see what happens. You may discover something useful.
- Don't use ordinary solder for mounting crystals; the temperature at which it melts is likely to affect the crystal. Use Wood's metal or other fusible alloy which is specially made for the purpose.
- Don't think that high-resistance phones always give the loudest signals; some are of the opinion that low-resistance phones give better results with low-resistance crystals, even if a telephone transformer isn't used.



Peto-Scott "Variobloc."

Messrs. Peto-Scott

THE Peto-Scott variometer is called the "Variobloc." This variometer is quite different from all the rest so far as constructional details are concerned. Evidently the designers have thought out every point which can affect electrical efficiency through mechanical detail, and then, having decided upon the best, set to work to eliminate costly and unnecessary materials so that the result could be presented to the public at a competitive figure.

The formers are of hard wood covered with an insulating compound. The stator is in halves, adjusted by distance pieces and bolted together, leaving central holes but $1\frac{1}{2}$ in. in diameter through which the ball rotor is visible. This latter turns easily with a clearance of $\frac{1}{16}$ to $\frac{3}{32}$ in. The rotor contacts are positive; the inner ends of flat spiral springs have been soldered to both front and back spindles, the outer ends being fixed to brass strips which pass up to terminals. In operation, therefore, there is not the slightest chance of noisiness due to bad contacts.

The coupling value is decimal 95, which is extraordinarily good. On the aerial No. 1 variometer—the thicker winding—tuned from 200 to 710 metres, while No. 2 covered 250 to 800 metres, which is more than the firm claims.

Another very useful point lies in the fact that four terminals are fitted. In experimental work the units can be used in series, parallel, or the coils can become



Details of Sterling Contacts.

British Variometers.—II

The second article on variometer principles and types

primary and secondary in a loosely-coupled system, since it is only necessary to take out a stiff brass pin which couples one rotor terminal to one stator terminal. Here, again, the stator terminal next its fellow joined to the rotor has been fitted with the direction of the hole at right angles to the others so that it is impossible inadvertently to short-circuit the stator. On the whole the firm is to be congratulated on the method of turning out such efficient little instruments.

The Sterling

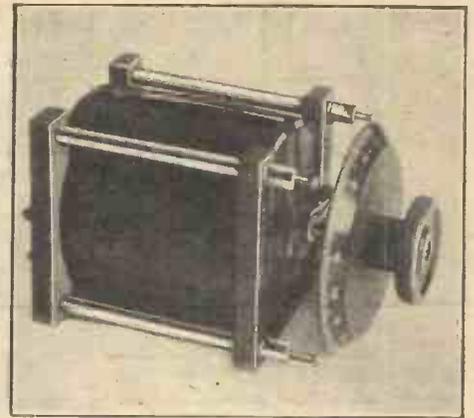
The wavelength range given up to the present has been taken when the respective rotors and stators have been joined up in series. The Sterling Telephone and Electric Company has, however, produced a unit which depends upon the use of both methods in obtaining a wide range. In a parallel position the Sterling variometer tunes, on the aerial, from 310 to 850 metres, when, on switching over to the series position, the rotor can be turned straight on, dropping back to 640 metres and passing to 1,720 at maximum. The coupling is actually decimal 8.

From every point of view it is a good job. It is obviously intended for panel mounting, otherwise we feel sure that ebonite cover plates would be fitted at each side to protect the stretched windings. The wiping contacts to the rotor are neat and effective; a photograph of the lower one is shown. A small pulley revolves between the two arms of a Y-shaped spring of german silver, while at the top a tiny coil spring of the same metal maintains the pressure, which, incidentally, gives a gentle braking effect to the rotary movement.

The rotor and all ebonite parts of the stator have been moulded. Both dial and knob are threaded; the two can be locked together on the spindle and a screw passing through the centre of the knob stabilises matters. The general appearance differs somewhat from other variometers, as will be seen by the photograph.

The Economic Electric Company

It would be difficult to imagine an instrument surpassing this in appearance. The photograph fails to give the effect of the high finish of the variometer. Both rotor and stator—which latter includes the feet—are moulded in an insulating composition which looks like highly-finished mahogany. The difficulty in making con-



The Sterling Variometer.

tact with the moving coils of the rotor has been banished by extending the spindle bearings and taking leads therefrom. Consequently the metal parts are the fewest possible. The rotor has been perfectly centred and the movement is easy and smooth. The controlling knob is a clean moulding, while the bevel has been formed in white ivory, the front face of which has been blocked-in in black, leaving the figures and divisions boldly standing out in white. All the metal parts are tinned.

It is interesting to note that the coils are joined in series, but the rotor comes between the two halves of the stator. That is to say, in tracing a current through the windings it would pass through half of the stator, through the rotor, and thence through the other half of the stator to the external terminal. The stator windings are inside the former, the rotor having a clearance of less than $\frac{1}{8}$ in. The wires are double-silk-covered and comparatively thick, giving a very high electrical efficiency. On test the percentage of coupling was found to be decimal 86.

On the aerial the useful range of wavelengths between approximately 250 metres and 1,080 are covered provided the aerial has the value usually associated with a single-wire P.M.G. aerial. Provision is made for panel mounting, but one feels disinclined to hide this instrument behind a board on account of its excellent finish and good appearance. F. A. B.

(To be concluded)



The Economic Electric Variometer.

REFLEX AMPLIFICATION

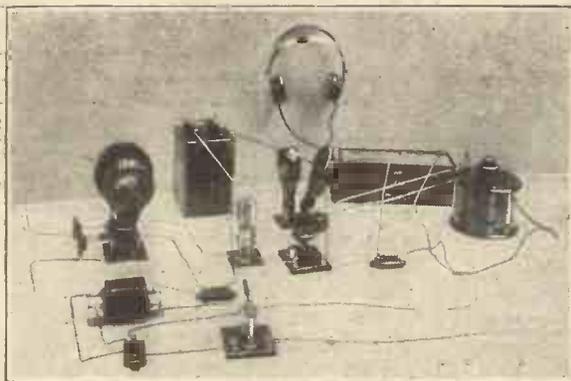
THE SUPER CIRCUITS.—III

IN dual or reflex amplification circuits a valve is so arranged that it performs the twofold task of amplifying high- and low-frequency currents simultaneously. High-frequency signal impulses are first passed through a valve in the usual way. The corresponding amplified currents are then rectified either by a second valve, or more usually by a crystal, and the resulting low-frequency components are finally led back to the grid of the first valve and again amplified before being passed through to the phones.

An Old Principle

Such receivers can hardly be called new at the present day. The underlying principle of making a valve do double duty in this fashion dates back to the year 1913, and is, in fact, an obvious development of the original discovery of reaction or ordinary back-coupling, which was made in the same year.

The method has, however, recently been revived, and is now being widely used by amateurs, principally in connection with combined valve and crystal circuits. A single valve, back fed with rectified signals from a crystal, can with careful handling be made to give superior results



Signal energy from the aerial is fed to the grid of the valve *V* through the coil *L*. The amplified high-frequency currents are transferred through the plate coil *L2* to a circuit *L3-C1* tuned to the signal wavelength. Here they are rectified by the crystal *K* and charge up the condenser *C2*, which then discharges through the primary *L4* of a transformer, the secondary of which is included in the grid circuit of the valve. Corresponding low-frequency potentials are accordingly superimposed on the grid and pass in amplified form through the telephones in the plate circuit. The secondary of the grid transformer is shunted by a condenser *C* to bypass the original high-frequency currents.

Omitting the crystal *K*, the same effect is secured as if the points marked *G F* were connected between the grid and filament of a second detector valve instead of being

MAKING A VALVE DO DOUBLE DUTY

High-frequency currents are built up in the circuit *CL* and are rectified by the crystal *K*, which, in series with the primary *T* of a transformer, is shunted across the condenser *C*. Low-frequency surges are therefore set up across the winding *T* and are transferred to the secondary winding *T1*, the two ends of which are connected across the grid and filament

of the valve, one end being connected to the filament at *M*, whilst the other end *N* leads to the grid *via* the aerial coil. The plate current variations corresponding to the doubly-amplified signals then pass through the phones.

Current Paths

In order to prevent possible confusion, the rectified current from the crystal should be regarded as flowing in the first place merely into the condenser *C1*, and not through the phones. The effect of its passage through the primary *T* is, however, transferred to the grid of the valve, and therefore directly controls the electron flow across the valve and through the whole of the external plate circuit, including the high-tension battery and phones.

By directly coupling the coil *L* to the aerial inductance the signals are further

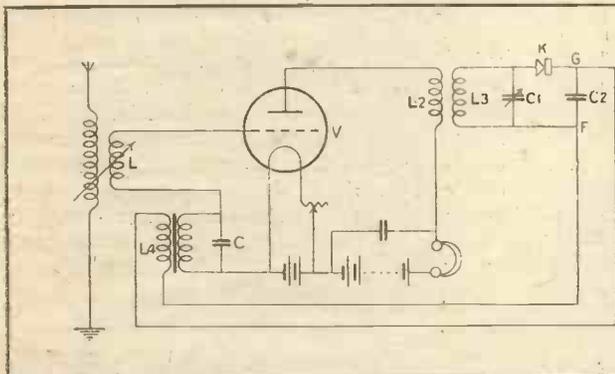
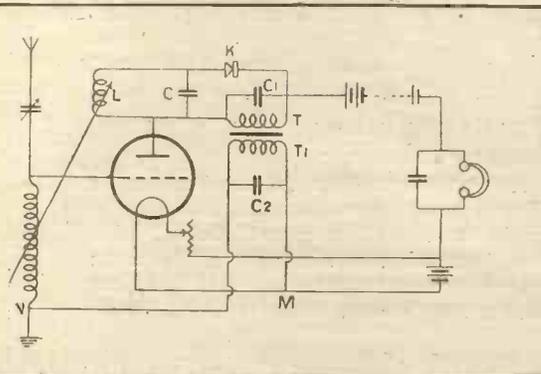


Fig. 6 (left).—Original Dual-amplification Circuit.

Fig. 7 (right).—The Round Dual-amplification Circuit.



to an ordinary two-valve set. The resultant saving in the initial outlay and upkeep costs of a single valve and crystal, as against two valves, is quite sufficient to account for the increasing popularity of dual amplification. In addition, some of the later circuits are extremely selective and efficient in operation. Broadcast-reception on the phones over a distance of 150 miles is well within the range of a single-valve reflex set using the standard length of aerial.

The photograph and Fig. 6 show the original circuit first designed by the Telefunken Company in April, 1913.

led back to the valve *V*. It will therefore be seen that the latter really does the work of two valves, the crystal being in fact a more efficient detector than the average valve.

It is obvious that a still greater effect could be secured by utilising ordinary high-frequency reaction between the grid coil *L* and the plate coil *L2*. This is shown in Fig. 7, which illustrates a principle used by Mr. H. J. Round as early as 1915. A further improvement lies in the use of what is now popularly known as the tuned-anode circuit *CL*, which in itself provides a certain degree of reaction.

strengthened, the intensifying effect of high-frequency reaction being thus added to the existing combination of high- and low-frequency amplification. It should be noted that both the primary and secondary coils of the low-frequency transformer *T*, *T1* are shunted by fixed condensers, which afford a passage for the high-frequency currents necessary to maintain the proper action of the set.

M. A. L.

(To be continued)

6JO and 5TU, both at Falmouth claim to be the farthest south transmitters Any other claimants?

JUST FOR THE BEGINNER.—IV

COMPLETING THE SIMPLE RECEIVER

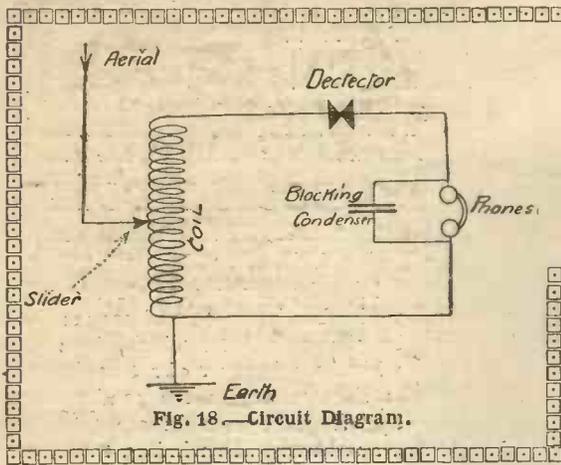


Fig. 18.—Circuit Diagram.

Telephones

THE telephones must be bought. Those required for use with a crystal set must be of high resistance, not less than 2,000 ohms each receiver. A great deal of the efficiency of the set depends upon the telephones, and therefore a really good pair should be obtained.

Fig. 18 is a diagram of the connections

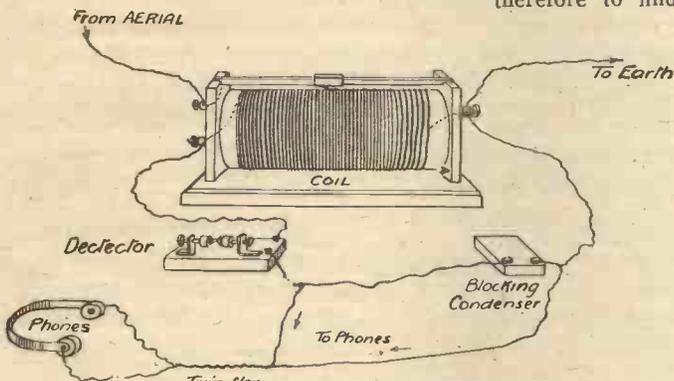


Fig. 19.—The Complete Receiver.

of the apparatus, and Fig. 19 a picture of the set for the benefit of those who have difficulty in working from a diagram.

Blocking Condenser.

A small condenser is required to be placed across the telephones. This may be made from sheet mica and tinfoil. Cut five sheets of mica 2 in. square. Now cut four pieces of tinfoil 1½ in. square, but with a "tag" on the end of each, as shown

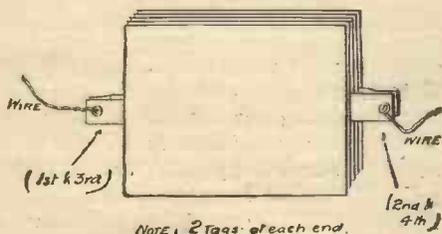


Fig. 22.—Blocking Condenser.

in Fig. 20. Stick each of these on the mica sheets with shellac varnish, as shown in Fig. 21. When dry lay No. 1 on the table, mica downwards, with tag to the left; lay No. 2 upon it, mica downwards, tag to the right; similarly No. 3 with tag

to the left; No. 4 tag to the right, and the fifth sheet of mica on the top. We now have two tags at each end. A gentle pressure with a warm iron will press them into close contact. Fix this up on a little cardboard box with wires taken from each pair of tags. The condenser will appear as by Fig. 22.

Forming Buzzer

When using a crystal as a detector it must be remembered that there are only certain parts of the crystal which are sensitive. A device called a buzzer is used therefore to find those parts. This may

Tuning

The tuning is accomplished by moving the slider gently up and down the coil and carefully listening.

Some Improvements

The apparatus described in the previous articles in this series is the simplest type that can be made, and though it is quite satisfactory it can be improved upon by some slight modifications.

One simple addition which can be made to the coil already described, and which will improve it somewhat, is an extra slider. For this purpose the insulation will require to be removed in exactly the same way as for the first slider, but this

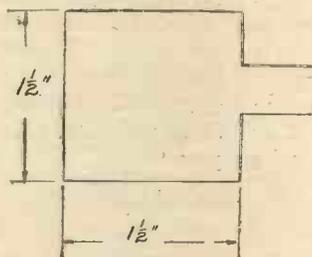


Fig. 20

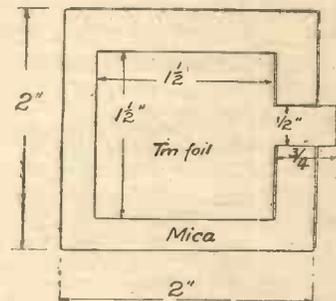


Fig. 21

Figs. 20 and 21.—Details of Condenser.

consist of an old electric bell with the hammer and gong removed, a small flash-lamp cell, and a push button. If the contact on the buzzer (as it now is) is observed when connected up, as shown in Fig. 23, a tiny spark will be noticed. This spark sends out ether waves. It is a good plan to have the buzzer fixed some distance from the set and lead wires to it, having only

time on the front side. A second slider rod and slider can then be fitted in the same way as the first, as shown in Fig. 24. This will necessitate a slight alteration in the circuit, which must be arranged as shown in Fig. 25. To tune, place the second slider at the end of the coil, to the right, tune with the first slider, and when signals are heard gradually bring the second slider

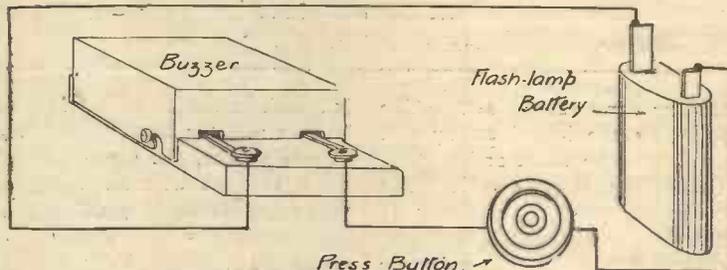


Fig. 23.—Arrangement of Testing Buzzer.

the push at hand. To adjust the crystal place the telephones on the head, press the push, and move the crystals about until the buzzing is heard in the telephones at maximum loudness. The detector is now at its sensitive point.

up the coil until the maximum strength is obtained.

It is possible to add a further refinement with a third slider on the other side of the coil, in exactly the same way as the others.

(Concluded at foot of next page)

A WELL-DESIGNED INTERVALVE TRANSFORMER

I HAVE recently had the opportunity of putting both to measuring tests on the bench and to practical trials on the receiving set the latest pattern of low-frequency intervalve transformer made by the Igranic Company. This is quite one of the best-looking of the many transformers that have been tested on behalf of AMATEUR WIRELESS.

Insulation

The insulation resistance, measured by megger, is 310 megohms between winding and winding, and 315 between winding and core. A high insulation value such as this produces a silent and efficient transformer if coupled, as is the case in an Igranic instrument, with soundness of design. The core is of ample size and its laminations are properly insulated from one another.

A further good point as far as insulation goes is to be found in the ebonite moulding at the top of the case, which carries clips and screws to which the connections are made. As will be seen in the photograph, the moulding is serrated, the clips being separated from one another by high ridges. Oscillating currents flow purely over the surface of materials, and by adopting a saw-edged moulding the length of surface between two points is very greatly increased. Thus in the Igranic transformer the straight-line distance between any two terminals is $\frac{1}{2}$ in., but the electrical distance, that is to say, the path that must be followed by any oscillating current between clip and clip, is more than double this distance. Insulation is therefore as good as if the clips were placed more than one inch from each other. The ridges also act as protectors for wiring, preventing bare leads from coming into contact with one another. The clips are so arranged that connecting wires may be attached either by screws or by soldering. The latter is, of course, by far the better method.

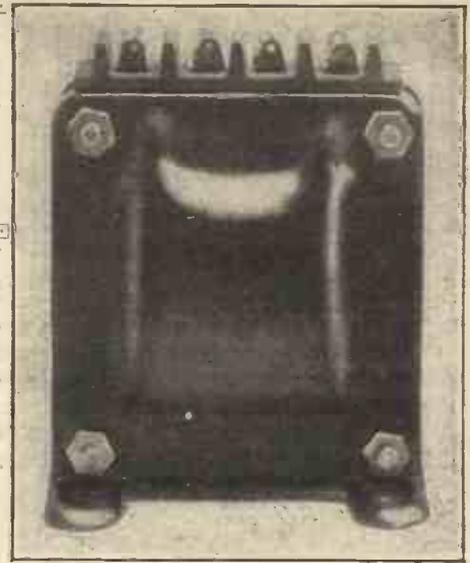
Tests

The dimensions of this transformer are: Length 1.7 in., height over all 3.3 in., width 2.1 in. The winding ratio shows a step up of 1 to 5, and the transformer contains sufficient wire to give its primary the high impedance that is so desirable for use with amplifying valves. It will stand easily 300 volts, and is therefore suitable for use with high anode voltages.

When tried out on the set the Igranic transformer did extremely well. The volume of sound was equal to that produced by any transformer that has been tried; there was no distortion, and music

was received with remarkable purity. The step-up ratio is rather high if the transformer is to be used as the first of a pair. I have always found that better results were obtained by using in this position a transformer with a comparatively small step-up, such as 1 to 2, or 1 to $2\frac{1}{2}$, and I believe that the performances of a transformer wound 1 to 1, or 1 to $1\frac{1}{2}$, would be even better. The second transformer should have a high step-up ratio, and for this purpose the Igranic, with its winding proportion of 1 to 5, is excellent. This is about the highest step-up that is made in this country, though the Americans make use of 1 to 8 and even 1 to 10 transformers, which must, one would think, give rise to considerable distortion unless a special valve with a long straight part to its characteristic curve is used. With even a 5 to 1 ratio in the second transformer it is important that biasing cells should be used to keep the working point of the valve off the upper bend.

The metal shrouding is a very good feature. Its purpose is to absorb stray fields, which would affect any other transformer placed close by and cause inter-



The Igranic Transformer.

action; such is apt to give rise to low-frequency howling. The Igranic transformer may be placed quite close to another without any appreciable interaction being noticeable. It would, however, be an improvement if the case were designed so as to cover completely the edges of the core.

This transformer is a first-rate instrument, such as one would expect to find turned out by a firm with such an excellent reputation as makers of wireless components as the Igranic Company.

J. H. R.

"JUST FOR THE BEGINNER" (continued from preceding page)

Fig. 25.—Circuit Diagram of 2-slider Tuner.

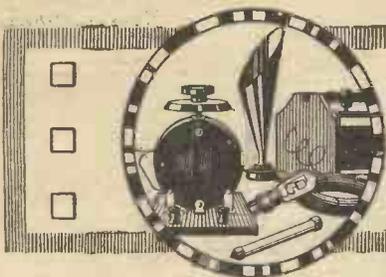
The circuit will then be as shown in Fig. 26.

When tuning the sliding contact connected to the crystal detector should be pushed to the aerial end of the coil. For broadcasting the earth slider should be pushed away from the aerial terminal until 40 to 60 turns of wire have been covered. The third slider should be moved until it is about twice as far from the aerial terminal as is the earth slider.

W. I.

Fig. 26.—Circuit Diagram of 3-slider Tuner.

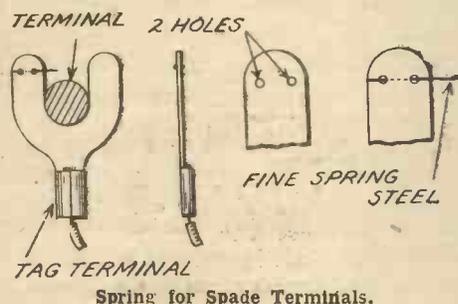
Fig. 24.—Two-slider Tuner.



PRACTICAL ODDS AND ENDS

Spade Terminals with Springs

WHERE two or more connections are made with spade terminals inserted under one terminal-nut they are liable to slip out during the tightening-up process. A small device that will overcome this difficulty is shown in the diagrams. Obtain



Spring for Spade Terminals.

a spade terminal and drill two very fine holes on one arm. Next take some fine-gauge spring-steel wire and insert it through the two holes as shown, leaving a small portion projecting on the inside. It will be seen that when the spade part is pushed on to an ordinary terminal the projecting piece of spring prevents the spade from slipping off. H. B.

A Condenser Unit

IT is always an advantage for experimenters to have at hand variable condensers of all capacities. A useful condenser unit can be built up in the way described. Two switches are required, one with two blades. Condensers of .001 microfarad (variable), .001 and .0005 microfarad (fixed) are also required. They are connected as shown in the diagram.

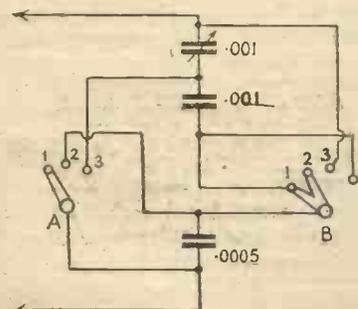


Diagram of a Condenser Unit.

By means of these switches it is possible to obtain five different capacities, as follows: When the arms are in positions A1 B1 a capacity of .00025 microfarad is obtained. A2 B1 gives .0005 microfarad.

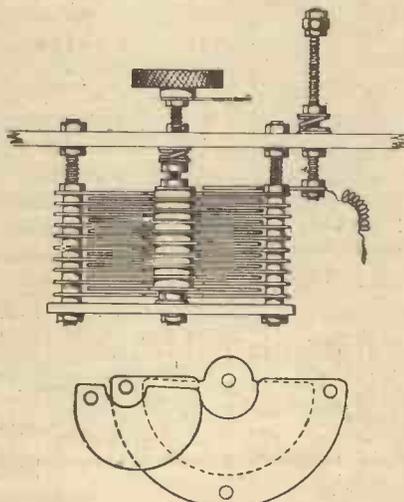
A3 B1 gives .001 microfarad, and A3 B2 gives .0015 microfarad. For special uses a capacity of .0025 microfarad can be obtained by putting the arms in positions A3 B3. D.

When Phones Get Rusty

IT sometimes happens that, through being kept in a damp place, the diaphragms of phones become rusted after long use. Even the pole-pieces become slightly covered with rust that interferes with the vibration of the diaphragm. When this is noticed, remove the cap and wipe the magnets and diaphragm with a soft cloth smeared with some fine oil. Care should be used not to bend the diaphragm at all. In order to avoid rusting some makers now fit ferrotype (unrustable metal) diaphragms. S.

A Fine-tuning Device

IN the diagrams are shown details of a new vernier device that can be fitted to a main tuning condenser. Frequently a three-plate vernier is too large. The method is to fix up an additional plate as shown. This is placed in parallel with the main condenser. The materials required are 3-in. 2 B.A. rod, six 2 B.A. nuts, washers, one fixed-condenser vane, and an odd piece of ebonite for an extension

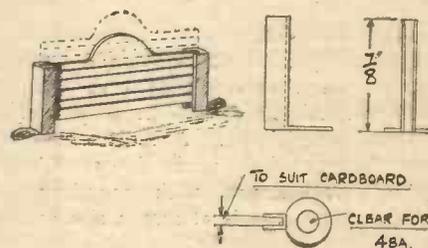


A Fine-tuning Device for Condensers.

handle. Using a fixed-condenser vane is advantageous, as seen from the plan, as the centre hole is large enough to clear the side spindle of the main condenser. H. W.

A Variable Grid Leak

IN many of the most popular circuits at present in use a variable grid leak is not merely a luxury but a necessity. A type that can be easily constructed is shown by the diagrams. The indian ink or pencil lines are marked fairly close together on a stiff card (a visiting-card serves admir-



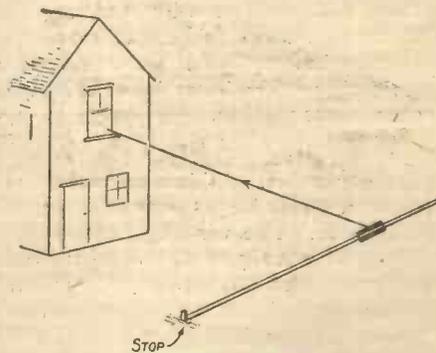
Details of Variable Grid Leak.

ably). The length, of course, depends on the centres of terminals on the panel or grid condenser, and must be marked when the brass or copper clips are made and mounted. The variation of resistance is made by regulating the number of lines in circuit. H. W.

Raising Flexible Masts

WHEN raising thin wood or flexible metal aerial masts by means of hoisting tackle they will not be so liable to break at the point of suspension if some pieces of fairly thick wood are bound round the mast at this place. The arrangement will be quite clearly understood from the diagram.

Some sort of stop should be placed against the foot of the mast to prevent it from sliding along the ground. With a



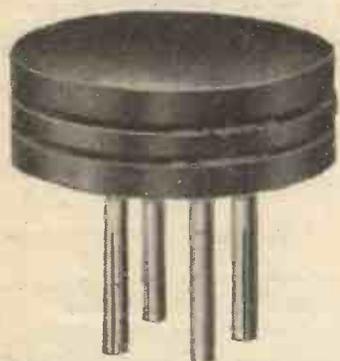
Method of Raising Flexible Mast.

little ingenuity it is possible to arrange things so that when the mast has been secured in position the pieces of wood can be pulled away, as they are not then necessary. D.

Silvertown

WIRELESS ACCESSORIES

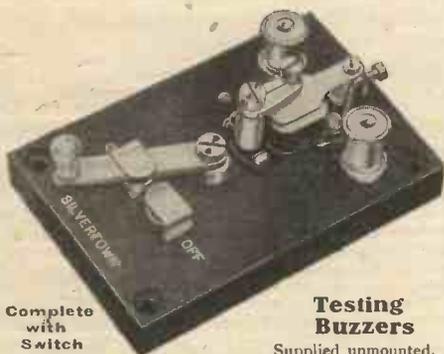
FOR more than 50 years we have been manufacturing electrical apparatus, a period of experience that guarantees consistently high quality in our wireless accessories. There can be no better assurance of reliability than the name "Silvertown."



Ebonite Transformer Formers
No. 2, Complete with metal legs, 1/3 each.
Made in other sizes.



2-valve Type
Mounted Valve Sockets
Single, Double and Triple. Suitably engraved for use with valves or for plug-in type high-frequency transformers. 5/6, 9/- and 13/6 each.



Complete with Switch
Testing Buzzers
Supplied unmounted, mounted on ebonite base with terminals and shunt or mounted with terminals, shunt and switch, 3/6, 7/- and 8/- each.



Silvertown "Featherweight" Insulators

Weight 1 oz.
Length 5 ins.
Price 2/- each

Small in diameter. Small area for surface leakage.

Cup in centre keeps a portion of the insulator dry in wet weather.

Ends are made of Duralumin, to reduce weight; Electrical efficiency is superior to that of a number of porcelain insulators in series. The capacity effect of Silvertown Insulators is very small.

These are the best and most effective insulators ever devised.

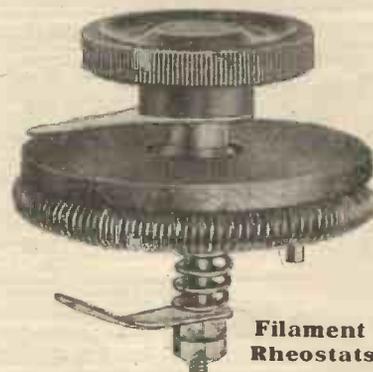


Silvertown "Everdry" Insulators

Weight 2 1/2 ozs.
Length 7 ins.
Price 3/- each



Silvertown Intervalve Transformers
Tested 1,000 volts between windings and 2,000 volts between winding and frame. 2 1/2 in. high x 2 1/2 in. wide x 2 1/2 in. deep overall. Weighs 1 lb. 3 1/2 ozs.
Price 21/- each



Filament Rheostats
With finished and lacquered brass bush for panel mounting. Resistance wire wound on insulating rod, thereby giving perfectly smooth adjustment. Each supplied with diagram giving drilling dimensions.
3/6 each.



Fixed Mica Condensers
Built up with copper foil and best ruby mica dielectric. High insulation and capacity adjusted to within 5%. Stocked in capacities from 0.0001 to 0.01 mfd. 2/- to 3/6 each.

"Silvertown" Ebonite Sheet, Rod and Tube—British and Best.

Silvertown accessories are obtainable of all dealers.

Makers: The Silvertown Company, 106, Cannon Street, London, E.C.4.

DUBILIER CONDENSERS

WHEN you buy a Vanicon, you pay slightly more, but when you consider the improvement which it will make to the results from your set, you agree with thousands of other users of Dubilier Condensers, that it is WORTH IT.



THE VANICON

PRICES

Capacity	PRICE	Extra for Ebonite Box
·0003 mfd.	17/6	7/6
·0005 „	£1 0 0	7/6
·0007 „	£1 2 6	10/-
·001 „	£1 5 0	12/6

Each Condenser can be supplied with a calibration Chart at an extra charge of 10/6.

Write to us to-day for our Trade Terms and Descriptive Leaflets.

THE DUBILIER CONDENSER CO. (1921) Ltd.

Dept. A

DUCON WORKS, GOLDHAWK ROAD, LONDON, W.12

Telegrams—"Hivolcon, Phone, London."

Telephone—Hammersmith 1084

[E.P.S 22

TO THE TRADE

We have been appointed wholesale distributors BY THE MAKERS of the following:

FRENCH THOMSON HOUSTON HEADPHONES. 4,000 and 8,000 ohms.

NOTE.—Each phone is supplied with a 2-year guarantee form. (A splendid selling line.)

F.T.H. SINGLE RECEIVERS. 2,000 ohms.

PIVAL HEADPHONES. 4,000 and 8,000 ohms.

PIVAL SINGLE RECEIVERS. 2,000 and 4,000 ohms.

ECCENTRO DETECTORS. (The best on the market.)

WE GUARANTEE DELIVERY AT ONCE FROM STOCK

(Orders for dozen or more sent passenger train, carriage paid.)

FACTORS SUPPLIED

THE W. J. MODELS. A good Xmas Line for Wireless Stockists. Send at once for our Lists and obtain your share of Xmas Trade.

W. JOANES Wholesale Distributors

42, Jenner Rd., Stoke Newington, London, N.16

Phone: Dalston 4741.

Telegrams: "Creneva Stoke," London

Wireless is attracting all men. The Amateur is entering the field in great numbers, and he wants to know all about it. He will require Materials, Parts, Tools. He will also want to sell surplus material.

"AMATEUR WIRELESS"

is out to cater for this class of reader, who will be eager for knowledge and bargains. To meet him, use the Sale and Exchange columns, which he is sure to search. Rate 3d. per word, 3s. minimum, prepaid. Latest date Friday mornings.

Address:

The Advertisement Manager,
"Amateur Wireless,"
La Belle Sauvage,
Ludgate Hill, London, E.C.4

EXPERIMENTERS & CONSTRUCTORS

Ex-Army Reed Buzzers, high-toned, 2/9 each, postage 3d.

Ex-Army Morse Keys, 1/3 each, postage 2d.

Ex-Army Single Earpieces, 150 ohms, 3/6 each, postage 4/-

1/2 oz. Reels 47 D.S.C. Wire, 1/- each. Enamelled, 10d. each.

1/2 oz. Reels 47 Enamelled, 1/6 each. Suitable for rewinding above Earpieces.

Stalloy Diaphragms, 2 1/2" diam., 4d. each.

Telephone Cords, 1/9, 1/6 and 1/3 per pair.

Aluminium Headbands, with Stirrup, 1/9; French Pattern, 1/6 per set.

Crystal Detectors, Glass Cover, New Pattern Cup, 2/- each.

Self-Gripping Crystal Cup, no Woods' metal or screws required; Crystal mounted or changed in an instant, 3d. each.

Nickel-plated Switch Mountings, suitable for all change-over and amplifier circuits, length of throw, 1". S.P.D.T., 1/3 set; D.P.D.T., 2/- set. Mounted on Ebonite, but not nickel-plated, same prices.

SCIENTIFIC SUPPLY STORES,

126, NEWINGTON CAUSEWAY, LONDON, S.E.1

Phones 8, Newington Causeway, S.E.1

HOP 4177 7c, St. George's Circus, S.E.1

GER. 372

posite Darewski's

16, MANETTE STREET, CHARING CROSS ROAD, W. (op-

HULLO EVERYBODY!!

CALLERS' COLUMN

Buy Best Goods at Low Prices

No Post Orders at these Prices

Terminals (comp. with Nuts), Telephone, doz.	1/-
Large W.O. ... 4 for 5d., doz.	1/3
W.O. Pillar ... 4 for 5d., doz.	1/3
Small Pillar ... 1d. each, doz.	9d.
Switch Arm, 12 Studs and Nuts, the lot	1/-
Small Variometers, 250/650, with knob and bush	2/4
Larger Variometers, 250/650	2/8
Igranic Variometer, Ebonite, 350/650	15/-
2-Way Coil Holders, for Duolateral Coils, 5/6,	4/6
3-Way Coil Holders, for Duolateral Coils, 6/11,	5/11
Phillips R. Type	8/-
Stop Pins, with shoulder ... 2 a 1d., doz.	5d.
Fixed Condensers to .001	10d.
Fixed Condensers to .005	1/3
Fixed Condensers .006 up to .01	1/6
Valve Pins	6d.
Valve Sockets	9d.
2, 4, 5 B.A. Nuts	3 doz. 6d.
Basket Coils	Set of 6 2/-
Spade Terminals	4d.
Vario Couplers, with Knob, Wound, D.C.C.	4/11
Glass Enclosed Whisker Detector	1/6
High-Class Whisker Detector (large), enclosed	2/6
Fine Perikon, 2 Crystals, enclosed	3/-
Small Perikon, 2 Crystals	2/-
Bell Wire, D.C.C., 1.C. 2 og. ... 10 yds.	6d.
Twin Flex ... 12 yds. 1/7, 4 yds.	7d.
Plug Coils, Ebonite	1/-, 9d.
Extra Quality, ditto on base	1/-, 1/3
Pillar Terminals, Nut and Washer, 2 B.A., large	2 for 6d.
Switch Arms ... 8d., 9d., 10d.,	1/-
Filament Resistances ... 1/8, 1/10, 2/-,	2/3
Igranic Resistances	4/6
Igranic Vernier	7/-
4 Cat's-Whiskers, one gold	4d.
Single Basket Coil Holders	1/4
Variable Grid Leaks	1/5
Bretwood Variable Grid Leaks, guaranteed 3 years	3/-
Pin Terminals, screw pattern, 1/3 doz., 2 for	3d.
Spade Terminals, screw pattern, 1/3 doz., 2 for	3d.
Shaw's Genuine Hertzite	9d., 1/-
Grid Leaks and Condensers, .0003, 3/-, 2/3,	2/-
Valvet Sockets, with shoulder	1/- doz.
Basket Coils, Duplex Waxless, set of 5 for	2/-
100,000 ohm Resistance	1/6
Variometer on Ebonite, ball rotor, wound, D.C.C.	7/9
Accumulator, 6 v. 80 amp.	33/-
D.C.C. Wound Tapped Coils	2/-, 1/9, 1/8
Double Phone Cords	pair 9d.
Wound Coils, 12 x 4, best quality	2/6
Wound Coils, 6 x 3, best quality	1/9
D.P.S.T. Switches, special	2/3
S.P.D.T. on Ebonite	1/8 to 2/3
D.P.D.T. on Ebonite	1/11 to 2/9
2 B.A. Rod, 12 in.	2 for 5d.
Basket Coil Holders, for 3 coils	5/6
Plug and Socket, brass	pair 1 1/2d.
Fixed Condensers .01	1/6
Pocket Lamp Batteries (best)	6 for 2/3
Special Filament Resistance, very fine value	2/6
D.P.D.T. Nickel Switches for panel mounting	2/6
FIL. RES. DIALS, 0-10	7d.
4 v. 40 a. Accumulator, callers only	16/6
Real Ebonite Slider Knob and Plunger	6d.
Set of Names (12), engraved black or white	6d.
Insulated Hooks	each 1d.
Copper Foil	per foot 4d.
Best Zincite and Bornite	pair 1/-
Dutch Valves (vertical)	6/8
Dutch Valves (horizontal)	6/11
Xtraudion Valves (E.E.C.)	15/-
Ebonite Turned Valve-Holder and Nuts	1/-
Shellac	5 1/2d
Tinned Copper, 16, 18, 20 gauge in stock.	
Fermo Fil. Resistances, best	2/0

RAYMOND

Variable Condensers



BRITISH MAKE Fully Assembled. Aluminium Ends. Ebonite Bushes. Narrow Spacers. Metal to Metal Bearings.

Ebonite Dial and Knob, complete as sketch.

Without Dial.	
*001 ...	6/6
*00075 ...	5/6
*0005 ...	4/9
*0003 ...	4/2
*0002 ...	3-
*0001 ...	2/8
*001 ...	7/6
*00075 ...	6/9
*0005 ...	5/9
*0003 ...	5/2

Fully assembled with knob, pointer, bush, screws and connections, aluminium end plates.

Reg. Post and Packing, 6d. Set. Foreign Post 2s. Set

HEADPHONES

4,000 ohms "Sidpe" genuine	14/9
8,000 " Brunet	16/-
4,000 " Brunet	17/6
4,000 " N. & K.	14/9
4,000 " Lightweight	11/11
Premier B.B.C. 4,000 ohms, very fine value	16/11

ERICSSON EV Type Phones

4,000 ohms. Thousands sold last season. Love y tone. 13/9 per pair. Post, 1/- pair.

1,000 VALVES (NEW)

NOT BANKRUPT STOCK, but purchased from a firm going out of business. EDISWAN DULL EMITTER ... 25/9 EDISWAN, COSSOR, MARCONI R ... 12/6 MULLARD "ORA" ... 12/6 WHILE THEY LAST. NO POST.

L.F. Intervalve Transformers

5-1 Radio Instruments, Ltd. (1)	25/-
5-1 Igranic (shrouded)...	(2) 21/-
5-1 Formo (shrouded 18/-)	(3) plain 15/-
5-1 Raymond	12/6

On Transformers (1), (2) and (3) goods to the value of 1d. in the 1/- given free to callers.

H. T. Batteries— 60 v. ... 9/6, 10/6 & 12/6 36 v. ... 5/- & 5/6

The Simplex Broadcast Crystal Set

The most efficient, simple and inexpensive crystal set made, range, 200-600 metres. Will receive all broadcasting stations within a radius of 40 miles, using telephones of average sensitivity with a standard P.M.C. aerial. Very fine tuning obtainable using basket coils of very low self-capacity. Every set sold has been tested, and is guaranteed SIMPLE, CHEAP and EFFICIENT.

12/6 Per Set. Post, 1/- ALL PREVIOUS LISTS CANCELLED.

POST ORDER COLUMN

NO POST ORDERS except for goods in this column, and at prices marked, which include all post, rail and packing charges, U.K. only.

ALL ORDERS EXECUTED AT THE EARLIEST POSSIBLE MOMENT, IN STRICT ROTATION.

Accumulators, high-class goods, 4 v. amps	20/-
Fixed Condensers, .003 to .001	1/4
Fixed Condensers, .002 to .005	1/8
Fixed Condensers, .006	2/-
Ebonite Valve Holders, 8 nuts, each 1/8, 3 for	4/-
Ebonite Dials and Knob, turned ebonite	2/- 2/6
D.P.D.T. Switches, small size, on ebonite base	3/3
S.P.D.T. Switches, small size, on ebonite base	2/9
Variable Grid Leak (Bretwood), guar. 3 years	3/6
Variable Grid Leak, usual pattern	2/6
Two-way Coil Holders, 3 qualities, all good value	5/6, 6/6, 7/6
Three-way ditto, as above	6/9, 7/6, 8/9
Twin Flex for Extension Leads 12 yds.	2/3
Grid Leak and Condenser, .0002, .0003, .0005	2/9
Grid Leak, 2 megohms	1/4
Pin Terminals, screw pattern, for phone leads	6 for 1/-
Spade Terminals, screw pattern, for phone leads	6 for 1/-
Ebonite Coil Plugs, high-class article, each 1/3,	6 for 6/9
4 Cats-whiskers (gold, silver, etc.)	6d.
Bell Wire, D.C.C., I.R.C.	10 yds 1/-
100,000 ohms Resistance	2/-, 2/6
Switch Arms, very good quality, complete with 12 studs	2/-
Valve Sockets, polished, with shoulder and nuts	doz. 1/6; 3 doz. 4/-
Shaw's Genuine Hertzite Crystal	1/6
Double Phone Cords, with screw terminals	1/6
Basket Coil Holders, for 3 coils, on stand	6/-
Basket Coil Holders, single, with coil plug	2/9
Filament Resistances (not cheap rubbish) 2/8, 2/8, 3/-	
Very Special ditto (limited number)	2/9
Terminals, Telephone, with nut doz. 1/9; 6 doz. 8/-	
Terminals, Large W.O. pattern, with nut doz. 1/9; 6 doz. 8/-	
Terminals, Extra Large 2 B.A., with nut 6 for 2/8; doz. 4/6	
Variometers and knob, 250/650	4/6
Basket Coils up to 3,500 metres	set of 6 2/6
Spring Washers	3 doz. 2/-
Crystal Detectors, all best quality, not Junk. Enclosed, large whisker	3/3
Crystal Detectors, enclosed, smaller whisker	2/9
Crystal Detectors, enclosed, large, Perikon, 2 crystals	3/9
Crystal Detectors, enclosed, slightly smaller ditto	3/3
Many Other Detectors, open type	2/-, 2/6, 2/9, 3/-
L.F. Intervalve Transformers, Radio Instruments, Ltd.	25/-
L.F. Intervalve Transformers, Igranic (shrouded)	21/-
L.F. Intervalve Transformers, Formo, 18/- & 15/-	
L.F. Intervalve Transformers, Raymond	13/9
Variometer on Ebonite Ball Rotor	10/-
Igranic Variometers, Inside Winding	15/-
Sets of 12 name tabs, black or white	1/-
2 B.A. Nuts	per gross 1/10
Real Ebonite Slider Knob and Plunger	1/-
Insulating Sleeving, all colours	6 yds. 2/9
Amplion Junior Loud Speaker	52/6
Best Knobs, Bushed 2 B.A	4 for 1/6
Brunet Phones, 4,000 ohms	18/6
N. and K. Standard, 4,000 ohms	15/9
N. and K. Lightweight, 4,000 ohms	13/9
B.B.C. Best Phones, 4,000 ohms	17/11

TRADE AND RADIO CLUBS SUPPLIED.

I advertise what I sell, and sell what I advertise.

HONEST GOODS AT THE RIGHT PRICE.

Right Reserved to Return Cash.

RIGHT OPPOSITE DALY'S GALLERY DOOR

K. RAYMOND

27, LISLE STREET, W.C.2

HOURS OF BUSINESS: DAILY - 9 to 7.45 SUNDAYS, 10.30 to 1

MARCONI VALVES

MADE AT THE OSRAM LAMP WORKS

For Broadcasting

Important Announcement
to users of

WIRELESS VALVES

REDUCED PRICE

On and after December 5th, 1923
the Price of



D.E.R.

TYPE

WILL BE REDUCED

from 27/6 to

21/- each

Large Stocks

IMMEDIATE DELIVERY



BUY
BRITISH GOODS
ONLY

Sold by ALL LEADING WIRELESS DEALERS
ELECTRICAL CONTRACTORS, STORES, &c.

Manufacturers and Wholesale only :
The General Electric Co., Ltd.
Magnet House, Kingsway, London, W.C.2

JOHN BRAHAM DON'T PAY MORE!

We sell Single Articles at Wholesale Prices to the Public.

BRUNET PHONES, 4,000 ohms	13/11	MAGNETIC AMALGO (Crystal Fixer) ... each	4 1/2 d.
STERLING NEW LIGHT-WEIGHT PHONES, B.B.C. stamp, 4,000 ohms, our price	19/3	CRYSTAL DETECTORS	each 1/-
FRENCH THOMSON-HOUSTON PHONES, 4,000 ohms, our price	12/9	(enclosed in glass) each	1/6
SPECIAL OFFER.			
WESTERN ELECTRIC PHONES, B.B.C. stamp 4,000 ohms, our price	19/6	W.O. TERMINALS, with nuts and washers	each 1 1/2 d.
FAMOUS TUNCHEN PHONES, 4,000 ohms, our price	10/6	TELEPHONE TERMINALS, with nuts and washers	each 1 1/2 d.
WOUND VARIOMETER FORMERS per pair	10 1/2 d.	TERMINALS ... each	1d.
ERICSSON E.V. TYPE SMALL EAR, (Ebonite Continental)	13/9	GOLD CAT'S WHISKERS	each 2d.
FAMOUS N. AND K. PHONES	12/9	SILVER CAT'S WHISKERS	each 1d.
BARBION HEADPHONES, British make, Stamped B.B.C. 4,000 ohms	12/6	FIXED CONDENSERS, all Capacities	each 8d.
GOSSOR VALVES	11/6	CONDENSER VANES, doz.	4d.
MARCONI "R" VALVES	11/6	L.F. TRANSFORMER, Ratio 5-1, best quality	each 11/-
MULLARD "ORA" VALVES	11/6	ADJUSTABLE CRYSTAL CUPS	each 2 1/2 d.
AERIAL WIRE, 7/22 bare copper, 100 ft.	1/10	CONTACT STUDS, with nuts and washer	doz. 4d.
All D.C.C. Wire at Lowest prices.		SWITCH ARMS	each 6d.
GEOSITE CRYSTALS each	1/6	SCREWED ROD, 2 B.A., 12 in. long	each 2 1/2 d.
TALITE (Genuine) each	1/-	EBONITE KNOBS, 2 B.A.	each 2d.
HERTZITE (Genuine) each	1/-	VARIOMETERS 1/11 and 2/11	each 2/11
GENUINE MIDITE, The Super Crystal, in glass phial	1/-	MATCH-BOX WIRELESS SET	10 1/2 d.
SHAW'S GENUINE MOUNTED HERTZITE CRYSTAL	9d.	PACKET OF 4 ASSORTED CAT'S WHISKERS	4 1/2 d.
		WINOPHONE POCKET WIRELESS SET	1/-
		CALVANIZED PULLEYS	4 1/2 d.
		MOUNTED TALITE	9d.
		BASKET COILS, set of 4 up to 2,000 metres	1/9

Wholesale Warehouse,
BRAHAM (Houndsditch), Ltd.
90, Houndsditch, E.1.

Please send sufficient in stamps to cover postage

City—
200, BISHOPSGATE, E.C.2 (Next door to "Dirty Dick's.")
Open All Day Saturday. 'Phone—London 11/alt, 4094

West End—
23, NEW STREET, St. Martin's Lane, W.C.
Open All Day Saturday. 'Phone—Gerard, 6183



The
**Popular Gift
this Christmas**

will be wireless. "Abbiphone" Products offer a wide choice, the certainty of satisfaction and reasonable price. Moreover, your friends will appreciate the graceful compliment an "Abbiphone" gift conveys.

Here is an example: the "Abbiphone" Occasional Table Crystal Receiving Set. On a standard aerial the range is approximately 30 miles. It incorporates many special features, including a Tuning Buzzer, enabling the crystal to be adjusted prior to the commencement of Broadcasting. Price £5 (B.B.C. Tax 1/-).

There is a complete range of "Abbiphone" Receiving Sets, prices from 10/6 to 85 guineas. Write to-day for complete descriptive catalogue.

ABBNEY INDUSTRIES, LIMITED,
Abbey Wood, London, S.E.2.

West End Depot:
50a, Strand

City Depot:
80, Mark Lane.



Telephone:
Woolwich 538.
Telegrams:
"Abbindries," Ab-wood, London.

"ABBIPHONE"
Regd. Trade Mark

Oh Your Wavelength!

A Wonderful Feat

THE most outstanding feature recently has been the B.B.C.'s marvellous performance in transmitting opera from the Old Vic. There is nothing very wonderful or novel, of course, about the actual broadcasting of opera, for that has been done now for nearly a year; but what is wonderful is the way in which it was done. Finding it very difficult to lay a cable from the theatre to Savoy Hill owing to the fact that the river intervenes, Captain Eckersley decided that the first stage of the transmission's journey should be by wireless instead of over the land line. A small transmitting plant was installed at the Old Vic. and a receiving set at 2 L.O. This set was connected to the main transmitter from which the performance was broadcast.

Probably very few of you listened to the afternoon transmission, which, being of an experimental nature, was not advertised, though it was announced during 2 L.O's Friday evening programme that it would take place. Judging by the complete absence of oscillation, I deduced that Oscillating Oswald and Ham-handed Henry knew nothing of it (for which I was devoutly thankful) and had probably gone to watch other people playing football, which would give them the opportunity of howling to their hearts' content without doing any harm to anyone.

The Super-howl

Saturday afternoon's transmission was most interesting. It began rather weakly, but before it was over it had assumed a very respectable strength. In the evening everything went very well indeed during the one act, at any rate, of *La Traviata*, which was all that I was able to listen to. *Faust* in the afternoon was rather marred, as I expect you found if you heard it, by a persistent whistle, which was apparently caused by the harmonic of some other station heterodyning, not 2 L.O's wave but that used by the set installed at the theatre. Either the offending station had closed down or the wavelength had been changed during the evening, for the whistle was not heard.

The most amusing incident during the afternoon was provided by the wildest howl I've ever heard, which, as the Americans would put it, is saying a mouthful. The wavelength upon which transmissions from the theatre are made is kept a secret so that enterprising amateurs shall not be able to "tap" it directly. For the same reason it is frequently changed so that if some ambitious searcher of the ether does succeed in picking it up he is very shortly foiled by finding that he has lost it again.

How It Happened

This prince of howls was caused apparently by some miscreant in London dropping on to the wavelength and then using reaction for all that he was worth. His effort was picked up by 2 L.O's receiver, amplified, and passed on to the transmitting gear, whence it was radiated with $1\frac{1}{2}$ kilowatts behind it!

We wireless people are like that; we always want to attempt the most difficult things just to see what our sets can do. The very fact that the wavelength is secret makes us itch to find it and tune it in. May I, however, appeal to wireless folk in and around London to fight down their natural desire to do so in the interests of their fellows all over the country. A single oscillating receiver misused in this way could spoil entirely the pleasure of hundreds of thousands of people listening in over the length and breadth of the country.

A New Station

Another recent interesting event of the week was the opening of the Brussels broadcasting station operated by the Société Belge Radio-Électrique. The opening ceremony was performed by M. Nugent on Saturday morning at eleven o'clock. The transmission though not strong was extremely good, and as neither Birmingham nor Glasgow was working there was no difficulty in tuning it in.

In the evening, however, things became considerably more difficult, for the new station's wavelength is 410 metres, which is too close to Newcastle (400 metres) and Birmingham and Glasgow (423 and 415 metres) to be comfortable. The Belgian station is to work from eight o'clock each evening onwards, and probably there will be other programmes during the day, which will give amateurs a chance of picking him up.

A Curious Short

I was rather surprised to find the other day that despite the fact that a new high-tension battery had been fitted which was all that it should be, signal strength began to show a very marked falling off as the evening progressed. Having so frequently advised others to take things calmly when this sort of thing happens, I naturally proceeded to lose my temper at once and to suspect everything at the same time. A calmer outlook prevailed at length, and I methodically eviscerated the set in an endeavour to discover the cause of the trouble. Need I say I went to bed completely baffled?

Next morning, however, I discovered the solution of the mystery in my bath. The cause was not actually in the tub, but

lying there I could see through the window my aerial wires and insulators thickly covered with a woolly coating of rime frost, which, of course, provided quite a good short from the aerial to the wire rope by which it is suspended. A little shaking soon put matters right and signal strength returned once more.

Wonderful Valves

I have just finished rigging up a set which must come near to creating a record in this country for smallness of current consumption. Though it has four valves—two high-frequency, a rectifier and a note magnifier—the ammeter in series with the accumulator shows that the current flowing is a shade under a quarter of an ampere! The E.M.F. is 3 volts. As a matter of fact the whole set works excellently off two ordinary electric-bell cells in series.

The valves are a quartette of American UV 199's, queer little fellows which look as though they were made of bright metal. This is due to the way in which they are pumped, magnesium being used as a "getter" for the last traces of gas. The metal is volatilised and deposits itself on the inside of the glass. They are not particularly efficient, for no two seem to be quite the same, but they are most useful when one wants to make up a portable set.

Separate H.T. Supply

Every experimenter or constructor who has a critical ear and likes undistorted speech as well as good "body" in loud-speaker reproduction splits his high-tension positive supply so that just the right amount of plate current can be fed to each note-magnifier valve; but why, I wonder, is the same most excellent principle not more often met with on H.F. amplifier and detector panels? The reason separate H.T. positive supply is not a feature of commercial sets is sufficiently obvious, but the reason the experimenter—save in a few cases—neglects it is further to seek. It must be because some valves are not apparently susceptible to individual plate feed. On the other hand, there are many valves that are, the valve used as a radio-frequency amplifier usually operating much more efficiently when given a higher plate voltage than is necessary on the detector valve. Of course, a different part of the characteristic curve of the valve is used in the two operations, and both amplification at radio frequency and rectification can be rendered more efficient by fairly critical anode control.

More About Soft Valves

Separate high-tension supply on the H.F. detector portion of any set makes

:: :: *On Your Wavelength (continued)* :: ::

possible the use of soft valves, such as the Dutch, as detectors. It is, generally speaking, impossible to use a soft valve efficiently as a detector in a two-valve set because the soft valve "blucs" at any plate voltage high enough for good amplification; but soft valves make the best detectors possible, as has been pointed out again and again in these pages. There is, however, another advantage that I have not seen discussed anywhere. A soft valve used as a rectifier in an H.F. tuned-anode-detector combination renders the combination far more stable, far less likely to develop self-oscillation—that bugbear of the user of tuned-anode amplification. A soft valve is often far less noisy than a hard valve when used as a rectifier. It can be less noisy even than a dull-emitter, which is a type of valve remarkably free from noise in working.

Is That Oscillation?

A short while ago business took me into the wilds of Yorkshire. I was welcomed more than usually warmly, and, business done, I learned the reason. The managing director of the firm had been bitten by the "wireless worm" and the consequent fever was raging in him. He had constructed a set. Could I spare the time to come and spend the night with him and tell him what I thought of his handiwork. It is difficult for me to turn a deaf ear to that kind of appeal, and I went. Incidentally, it was a treat to listen to the excellent transmission from Manchester, for some reason a difficult station for me down south. But that is not the point of this narrative.

"What is this oscillation they talk so much about?" inquired my friend. "I don't think my set oscillates. But make it do the trick if you can; I should like to hear it."

The set was a two-valver, tuned-anode and detector, and, of course, I made it oscillate as easily as possible.

"Great Scott! Is that oscillation? I thought that row was the carrier wave! It is always doing that," said the disillusioned owner of the "non-oscillator."

He was even more disillusioned and surprised when I gently explained that the owner of a really efficient set hardly ever hears a carrier wave. An hour spent in re-wiring made a vast difference to that set. But I wonder how many thousands more there are who think the yelping screech of self-oscillation is the "carrier wave"?

A Curious Valve Freak

A dull-emitter valve was delivered to me the other day. I had been anxiously awaiting it because I needed it urgently to complete some experiments. At once I placed it in my panel and switched on. The filament was dull even for a dull-

emitter. In fact it refused to light up at all. "Another dud!" said I, and took it back to the retailer. He informed me that it was all right when he sent it up to me, and slipped it into a panel on his counter. It lit up at once. Thinking something must have gone wrong at my end, I took it home again and tried it in every position. There was nothing doing.

I wonder if any of you can think of the solution? It took me some time to arrive at it, I must confess. The interior leads of that valve had been transposed so that one filament leg was connected to the grid and the grid lead to a filament leg. In the retailer's set the connections were so made that the filament lit up by way of the aerial tuning coil. Had he put the valve for test into any position but the H.F. amplifier holder there would have been no filament glow, because there would have been no possible passage for the current through the misplaced lead. If you don't understand, look at a wiring diagram and the whole thing will be quite plain to you.

The Perfect Programme

During the last week there has been a marked tendency towards increasing the classical nature of the programmes.

There is no doubt that, reckoned from a purely entertainment standpoint, a predominance of classical music is bound "to raise trouble," for necessarily the audience is a small one in percentage; but there is this to be said, in moderation it is a stimulus to many who are studying music and to whom the works of the great classical masters are the text-books of their art. Next to actually playing the work, listening to it, as rendered by a master-hand, is a lesson in itself, and there are many students who, having wrestled in vain with Liszt, Chopin or Schumann, having once heard the works properly interpreted, will summon up courage to try again, and at first by imitating and at last by understanding will learn easily and quickly.

Still the problem of the programme must be an ever-increasing difficulty, for as the price of receiving apparatus decreases a far greater audience will be found.

A compromise might be arrived at, if the British Broadcasting Company followed the example of many another concert manager and arranged a plebiscite programme, so that if only on one night in the week, there would be the "greatest good for the greatest number."

A Night of Nights, Ye Ken

Friday last being St. Andrew's Day, it was a fine idea on the part of 2LO to make every Scottish citizen of London and elsewhere homesick for "the Land of Cakes." An orchestral programme under Mr. Stanton Jefferies included some real

gems, with the "Fingal's Cave" Overture of Mendelssohn and the selection of Scottish Melodies. With the bagpipes played—or should it be manipulated?—by Andrew Macintosh, Pipe Major of the 2nd Battalion Scots Guards, Scotch songs of his own composition, and very good ones, too, by William Cochrane, there was no lack of the native element, while in addition Miss Carmen Hill, one of the sweetest-toned of our singers, gave us "Robin Adair," "Annie Laurie," and "Comin' Thro' the Rye." Scotland has a music, like a humour, all its own, and it is safe to say that this programme showed the best side. There was one point to be raised: having got Mr. Palmer as the announcer, why not have made him go a step farther and render us one of the songs, for he is one of 2LO's best?

"The Old Vic"

Fighting through hard times and under almost insuperable difficulties to preserve the sacred lamp of opera in London, now comes the success of actual transmission by wireless of the opera direct to listeners-in. It is little wonder that Captain Eckersley called November 24 an historic night, for *La Traviata* came over to perfection. This was speedily followed up on November 29 with Bizet's *Carmen*. A noteworthy point apart from the general excellence of the actual singing, was the tonal balance preserved and the absence of that hollow echoing sound so often found when broadcasting by means of land-lines is carried out.

As regards the opera itself, it is the only one that has really taken the imagination of the public. Bizet was a wonderful musician, commencing his musical career at the early age of ten, when he entered the Paris Conservatoire and studied under Halevy, winning in 1857 the Prix de Rome. His first opera was *Les Pecheurs de Perles*, produced at the Theatre Lyrique in 1863. Then there was *La Jolie de Perth* and *Djamileh*, but it was not until *Carmen* was produced that Bizet became really known, although his suite "L'Arlesienne," so often heard now, came before the gipsy opera. Bizet died suddenly on the night of its twenty-third performance, 1875, having lived to see his genius recognised.

Round the Provinces

Special praise is due to Birmingham for including in their repertoire the beautiful song cycle of Liza Lehmann, "In a Persian Garden." The idea of setting the "Rubaiyat" of Omar Khayyam has appealed to many musicians. Granville Bantock composed a fine work, and another well-known composer and violinist, Zacharewitch, set many verses to music and called it a "Phantasy of Life."

THERMION.

LOOK AFTER YOUR ACCUMULATOR!

MOST of us are rather too apt to regard the accumulator as a mere reservoir of electricity ready to supply the needs of our valves when a switch is turned over and requiring no attention beyond an occasional visit to the charging station when the coming of weak signals shows that its E.M.F. has fallen below par.

As a matter of fact accumulators do demand a certain amount of care if they are to give consistently good results and not be a source of annoyance to the user. The most important period of an accumulator's life is its first three months on the set, for during that time the plates become properly "made" if the battery is well treated. Once this has happened it will stand a certain amount of ill usage. If, however, it is neglected during the early part of its life old age will come upon it very rapidly and it will never be robust.

There are garages and charging stations that can be trusted implicitly, but there are many others that cannot. It is best, therefore, to keep a very sharp eye upon their doings and to check them as often as possible.

Testing

The voltmeter test made across the terminals of an accumulator alleged to be charged is of absolutely no value whatever as an indication of its condition. Even in a semi-run-down condition an accumulator will often show its full voltage if it is *not under load*. One can keep a useful check by having an ammeter constantly wired in series with the set and making a note after each reception of the discharge rate and the length of time.

The only reliable test for accumulators is that made with a hydrometer, an instrument which shows the specific gravity of the acid solution.

On the label on the outside of the case usually are found instructions for mixing the acid solution to the correct specific gravity for that particular accumulator. This, as a rule, will be somewhere about 1.200, but the exact figure varies considerably for different makes of cell.

Electrolyte

The solution should be made of the best *brimstone* sulphuric acid and *distilled* water. Tap water or commercial sulphuric acid will have a very bad effect upon the plates.

During charging, which in the first instance is a long, slow one, the specific gravity will fall off rapidly at first and then begin to rise until it reaches 1.215. During discharging the specific gravity will gradually decrease.

Give a new accumulator plenty of work. This does not mean that you must dis-

charge it at a high rate, for that would probably lead to the plates being damaged. It means that the accumulator should be put into use as soon as it comes from the charging station and that it should be employed every day for a week or more. Never run a new accumulator right down, but always take it to be charged some little time before it really needs it.

Maintenance Hints

Keep an eye upon the colour of the plates. When fully charged the positives should be a rich chocolate brown and the negatives a slate grey. Watch carefully for any signs of a whitish deposit upon the plates. This is known as sulphating. It is due to the presence of an inordinate amount of lead sulphate, which if not

attended to at once will form a hard insoluble mass, putting certain portions of the plates completely out of action. Sulphating may be caused by using a solution of incorrect specific gravity and allowing it to remain in an uncharged condition.

As the accumulator is used particles of the paste which fills the compartments of the plates may work loose and be deposited upon the bottom of the cell. This sediment consists of conducting material. The greatest care must therefore be taken to see that it does not become so extensive as to reach the bottoms of the plates, for if it does so it will short-circuit them.

Always keep the terminals greased, and see that they are turned down really hard.
J. H. R.

SIMPLE FIXED CONDENSERS

THE construction of a neat type of condenser is described in this article. The facility and speed in which they can be made will be clear from the following description of a grid condenser, no attempt

diameter, drill and tap to a depth of about $\frac{3}{8}$ in. an $\frac{1}{8}$ -in. thread at each end of the rod, and screw home a piece of $\frac{1}{8}$ -in. brass rod of sufficient length to allow for a washer and two nuts.

Cut four pieces of thin sheet celluloid; that used for photographic films will answer the purpose (the film and gelatine having previously been removed), $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in., and three tinfoil sheets 2 in. by $1\frac{3}{4}$ in. Place the celluloid on a flat surface, and one of the foils on top, repeat with celluloid sheet and foil until all the pieces are used up, giving the foils an overlap of 2 in. by $1\frac{3}{4}$ in.; see Fig. 1.

Roll the whole round the rod tightly, finally securing the celluloid sheet by means of celluloid cement. The pretruding foils must now be crimped over the end of the rod and a washer placed over the brass rod, which must be screwed down tightly with a nut. Silk thread may be wound over the entire length of the condenser. If this is done, it will considerably improve the general appearance; see section, Fig. 2.
W. P. G.

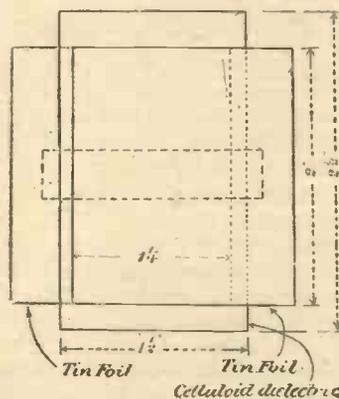


FIG. 1

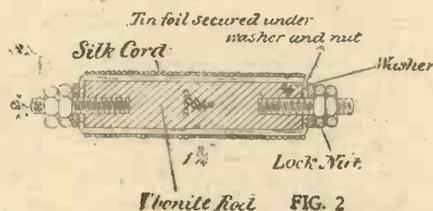


FIG. 2

Fig. 1.—Constructional Details of Condenser.
Fig. 2. Section of Condenser.

being made at actual capacity, which can only be arrived at accurately by experiment.

The one about to be described, however, has a capacity of approximately .00025, or .0003 microfarad. Obtain a piece of ebonite rod (or erinoid) $1\frac{3}{4}$ in. by $\frac{3}{8}$ in.

LETT'S Amateur Wireless Notebook and Diary

The Handy Guide and Reference
for all Wireless Enthusiasts.
Over 800 Call Signs.

Cloth, 1/6. Leather with back-loop
pencil, 2/6.

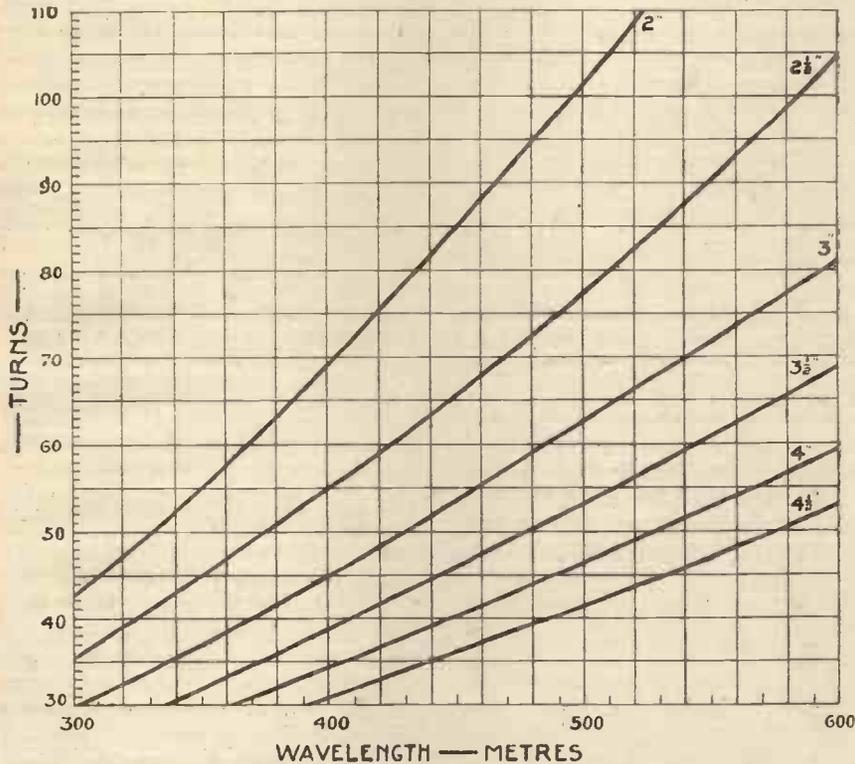
CASELL'S LONDON

WAVELENGTHS AND WINDINGS AT A GLANCE

THE accompanying wavelength-winding graph will prove of use to constructors when estimating the amount of wire closely wound on single-layer cylindrical formers.

The graph has been designed primarily

met. At this point proceed to trace a second imaginary line horizontally to the left until the left-hand boundary of the graph is reached where the figures under heading—Turns—give the required answer—in this case 55 turns.



A Broadcast Wavelength and Windings Graph.

to suit windings made with 22 S.W.G. enamelled-copper wire, but the results given may be applied to other gauges providing due allowance is made; that is, for thicker wire the resulting wavelength will be slightly less, while for thinner the wavelength will be greater.

Method of Working

Suppose that the would-be constructor resides in Newcastle and requires to know the amount of 22 S.W.G. enamel-insulated wire which should be wound on a former $2\frac{1}{2}$ in. in diameter in order to tune in the local broadcasting, no parallel condenser being used with the coil and the aerial being of the full P.M.G. permissible length.

Looking at the lower portion of the graph just above the heading—Wavelength-metres—note the position of the figure representing the wavelength in metres of the required station (400), and trace a vertical imaginary line until the curve terminating in the figures $2\frac{1}{2}$, denoting the diameter of the former to be used, is

In making use of the results given by the graph due allowance should be made for the variation in aerials and lengths of earth wire, as the position of the curves is calculated on the assumption that an aerial of the full permissible length will be used. Constructors who have a small outside or indoor aerial should add more turns of wire.

CALCULEX.

The Variable Grid Condenser

THE variable grid condenser does not appear to be much used by amateurs, but as it makes the handling of a set much easier, especially on short wavelengths, it deserves a trial.

One very useful purpose to which it can be put is to control reaction. If the reaction coil is placed in such a position

that with all the condenser in the set is just oscillating, the critical point where the set is just not oscillating can easily be reached by decreasing the capacity of the condenser. This is exceedingly useful when receiving long-distance telephony. On short-wave work the reaction coil need not be moved at all once it is set, the reaction being controlled by the grid condenser, the variation of which does not necessitate retuning as does the movement of the reaction coil. Again, as the set can be made to only just oscillate, if reaction coupled to the aerial circuit is being used, there is less chance of radiation. This latter is a great point, as sometimes signals are completely blotted out by somebody with reaction coupled as tight as possible.

A suitable value for a variable grid condenser is .003 microfarad maximum. An extension handle to the condenser will sometimes be found an advantage, but, on the whole, there is not much trouble from capacity effects.

2 G F.

STATIC AND TELEPHONY

AS a matter of fact static does not hinder wireless telephony reception to an alarming extent. In this respect telephony has one great advantage over telegraphy. For instance, ordinary speech can be carried on after a fashion in extremely noisy public assemblies. The ease in understanding speech under such circumstances is due to our lifelong experience. Then, too, there is that which may be termed the "assistance of context." By this is meant the ability of the average listener to fill in lost words which make sense to the whole sentence. However, static is disagreeable, especially when listening to something specific such as stock exchange reports or sport results. Since static and signal are both amplified, it would seem advisable to suggest less frequent use of the loud-speaker in favour of headphones when intense static exists. Valve amplification should be reduced to a minimum consistent with signal strength. Amplification generally serves to increase the troublesome static in greater proportion, so it seems, than the music or speech being broadcast.

F. C. L.

SOUND AMPLIFICATION

WHILE receiving fairly loud broadcast music recently, using a single earpiece telephone, experiments were made in sound reflection. The receiver was held facing a small tea plate, but the results were not very good. Next, a deep soup plate was used and signals were decidedly stronger. When the receiver was held in front of a large breakfast cup the most pronounced amplification took place, but it was noticed that the distance between the receiver diaphragm and the bottom of the cup had to be carefully regulated for optimum results. The experiment was also tried using a large pudding basin, but amplification was negligible.

L. A. W.

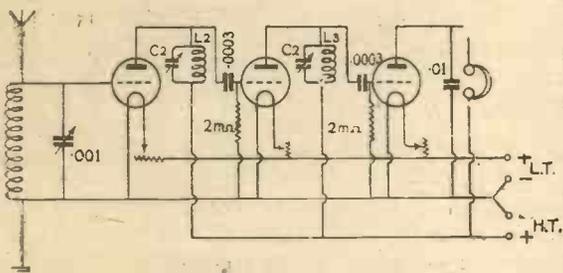
OUR INFORMATION BUREAU

RULES.—Please write distinctly and keep to the point. We reply promptly by post. Please give all necessary details. Ask one question at a time to ensure a prompt reply and please put sketches, lay-outs, diagrams, etc., on separate sheets containing querist's name and address. Always send stamped addressed envelope and Coupon (p. 659.)

Special Variable Condensers for Controlling Two Tuned Anodes

Q.—I am about to construct a valve receiver with two stages of high-frequency amplification by the tuned-anode method of coupling. I understand that with special variable condensers now on the market it is possible to tune the two stages simultaneously. Can you recommend this method as being likely to give results and simple of operation? Please give a diagram.—C. M. R. (Blackpool).

A.—The diagram shows the circuit where C₂ is the double variable condenser. For the sake of clearness this condenser is shown as two separate condensers, having both sets of fixed plates connected together, and



Dual-condenser for Control of Two Tuned Anodes.

joined to the anode coils L₂ and L₃ on the high-tension positive side. The two sets of moving plates are connected separately to the plate sides of the anode coils. In the condenser itself, of course, the two sets of moving vanes are insulated from each other, but are operated by the same handle. This simultaneous method of tuning is very convenient, but is only efficient if both halves of the double condenser are of exactly the same value, and the anode coils are exactly matched. Another point to be watched: see that all connections to the coils and the condenser are well spaced, and that these components are kept well away from any other parts of the receiver. It will be readily seen that the presence of any metallic mass near one coil will affect the wavelength of that coil, and consequently it will be impossible to get both anode circuits exactly in tune, resulting in a great loss in amplification.—B.

The "Portable Telephony Transmitter"

Q.—With reference to the "Portable Telephony Transmitter" published in "A.W." No. 76, I have tried this transmitter, using a Marconi "R"-type valve and varying the plate voltages up to 200 with not particularly efficient results. I assumed that the instruction to wind one half of the variometer with No. 32 s.w.g. d.s.c. wire was a misprint and used No. 22 s.w.g. d.s.c. wire through the whole of the aerial coils. Is this correct? What dimensions for the air choke is recommended?—H. B. (Birmingham).

A.—Referring to your query re gauge of wire with which aerial, grid and variometer coils of the portable telephony transmitter should be wound, 32 s.w.g. is the correct gauge and not a misprint, but 22 s.w.g. might be advantageously used throughout if desired: the bulk of the coils would, however,

be considerable and for that reason the finer gauge was selected. These coils must all be lightly coupled to each other. The H.F. choke may have from 250 to 350 turns of No. 30 s.w.g. insulated copper wire wound on a 2-inch former, or may alternatively (as in the instrument described) be a No. 300 "Igranic" coil. A Marconi "R" valve will not give you good results in this transmitter without most critical adjustment of the grid coil.—A. L. M. D.

Coils for Broadcast Range

Q.—Would you oblige by informing me the number of turns the primary, secondary and reaction coils should have to tune over the broadcast range of wavelengths. What variable condensers should be used?—F. W. (Balham).

A.—Querist does not state the type of coil he proposes to use, for instance, honeycomb or basket coils. The following specifications will be found approximately correct, however, for all types of coils. Primary coil should have 30 to 35 turns with .001 microfarad variable condenser in parallel with aerial. Secondary coil 50 to 60 turns with .005 microfarad variable condenser in parallel. 50 to 75 turns will be sufficient for the reaction coil. A vernier condenser may be used to tune the reaction coil, but it is not essential. All the above coils should be wound with No. 24 s.w.g. d.c.c. copper wire.—W.

Frame Aerial for Broadcasting!

Q.—I have a three-valve set (1 H.F., Det., 1 L.F.). Would it be possible for me to receive 2 L.O. (22 miles distant) on a frame aerial? If so, please give me directions regarding amount of wire and size of frame.—T. L. (Windsor).

A.—A frame 3 ft. 6 in. square wound with about 5½ turns of No. 24 s.w.g. s.c.c. spaced ½ in. apart will cover the broadcast range of wavelengths.—W.

Determining Wavelength

Q.—How can I judge the wavelength to which various coils will tune without recourse to mathematics?—W. H. (Reading).

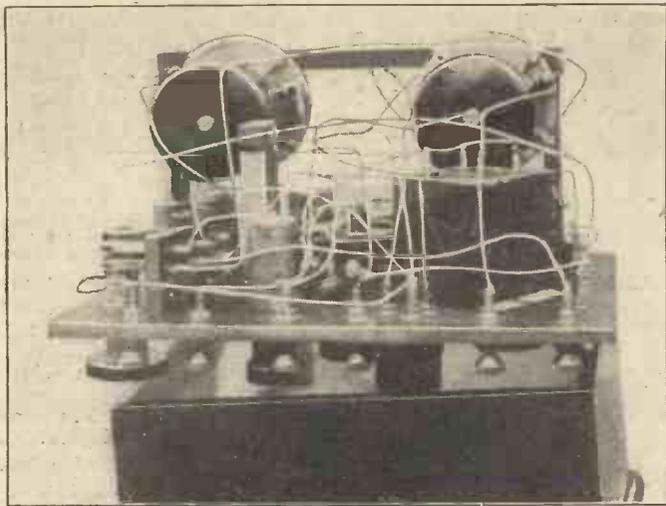
A.—The simplest way is to tune in well-known stations and find their wavelengths in a directory. Thus suppose one coil brings in The Hague on a very small condenser reading, and Paris (F L) comes in near the end of the condenser scale, you will know that that particular coil, in conjunction with the condenser, tunes from about 1,000 metres to about 2,600 metres.—P.

Accumulator Charging from A.C.

Q.—I wish to charge a number of 2-volt and 4-volt accumulators from 100-volt 50-cycle single-phase supply. I understand that this may be done with jam jars and aluminium sheet.—T. K. (Sale).

A.—What querist evidently wants is some form of Nodon valve or chemical rectifier, but he is not going to get satisfactory results by employing "jam jars and sheet aluminium." Nor is it possible to deal with currents up to 10 amperes as asked for, unless a considerable

sum is laid out on a large and substantially built rectifier. Without going in for any abnormal sizes, the largest current that can be dealt with satisfactorily for continuous work is 2 or 3 amperes, otherwise the valves heat up and lose their rectifying properties when the temperature much exceeds 70° F. unless some artificial cooling system is adopted. As to constructional details, ordinary stone jars are useless, as the glaze does not withstand the chemical action of the solution for very long. The best thing to use is the special acid-proof stoneware battery jars with straight sides, such as made by Doultons; four of these of ½ gal. capacity will be required. The other materials needed are: four pure aluminium rods ⅝ in. in diameter by about a foot long, each with a terminal at the top; four sheets of pure lead ⅞ in. thick, sufficiently large to line the inside of the jars to about half their depth, with an extension strip rising out of the jar and bent over its edge to form the terminal connection; four 8-in. lengths of pure black rubber tubing (not red); 3 lb. of ammonium phosphate; 1 pint of strongest ammonia; some blue litmus paper for acid testing; and a few 100-volt 32-c.p. carbon-filament lamps as resistance. The four jars are washed perfectly clean and packed together either in single file or in two pairs side by side for preference. They are then lined with sheet-lead in the manner referred to, and hard-wood lids fitted, each with a centre hole to take the aluminium rod and keep it away from contact with the leads. The wood tops should be soaked in melted paraffin wax. Make up the solution by mixing the 3 lb. of ammonium phosphate salts with 1½ gal. of perfectly clean hot water, stirred with one of the aluminium rods until dissolved. Let it stand until cold, and then test with a small piece of blue litmus paper. If it turns red when dipped into the solution, as it generally will (most commercial samples of ammonium phosphate being decidedly acid), it must be neutralised by pouring in small quantities of liquid ammonia, and well stirring all the while until the test paper on being applied is found to remain blue. Pour the neutral solution into each jar in equal quantities, but do not fill nearer than 2 in. from the top. Lastly pour 2 oz. of ordinary paraffin oil on the top of the liquid in each jar. This prevents evaporation and checks creeping of the salts. Before putting the aluminium electrodes in place slip on the sleeves of black rubber tubing until only 2 in. of rod is exposed to the action of the solution when they are in position. The rectifier is then ready to be connected up and put to work. Two aluminium electrodes are to be coupled together of one pair of jars side by side, and two lead electrodes of the other pair of jars are coupled together. These junctions form the positive and the negative terminals respectively to which the battery is to be connected when on charge. The remaining unconnected terminals in the four jars are coupled each lead-to-aluminium, and each of these mixed couples forms one terminal for attachment to the alternating supply. The 100-volt supply, however, must not be coupled direct to these terminals or it would blow the fuses. A lamp resistance consisting of 1, 2 or 3 lamps joined in parallel, must be employed.—Q.



Side View of Under Side of the Note-magnifier Panel.

The Amplifier Detector Unit

THE unit containing the high-frequency amplifier and detector valves is made up on a panel and mounted on a box of the same dimensions as that of the tuner unit. It could have been built up on an ebonite panel of smaller size by mounting the coil holder on the side of the box, but experiment showed that with the two coil holders mounted side by side there was a certain amount of interaction between anode and aerial coils, to the detriment of clarity in the signals. Also, it was thought better to have all three units of the set exactly similar in size for the sake of appearance. In addition, the rather generous dimensions allow the components to be distributed to allow of efficient wiring.

High-frequency Amplification

The high-frequency amplification of the incoming signals is on the very efficient and popular "tuned-anode" system of coupling. In choosing this system, rather than transformer coupling, regard was had to the fact that less wiring is needed in this system than for transformer coupling, and less wiring means less difficulty for the beginner in construction work and less likelihood of capacity losses. Consideration was also given to the ease with which resistance coupling can be substituted for the inductance for amplification on high wavelengths.

The diagram of the circuit is shown in Fig. 1. It is a quite conventional tuned-anode circuit, the only difference being that a potentiometer is shown bridging the low-tension leads. This potentiometer is to control the potential of the grids of both valves. As will be seen, the moving arm is connected with the terminal which is joined to the lower part of the aerial- or closed-circuit inductance (see Fig. 2 above), and to the lower part of the grid leak between the first and second valves. This potentiometer is necessary to prevent the self-oscillation of the valves.

Between the moving arm of the potentiometer and the negative side of the low-tension feed a fixed condenser of generous proportions is bridged. The value of this is not critical, but it should not be smaller than .004 microfarad. In the set as built up this condenser is a "Mansbridge" of 2-microfarad capacity.

Generally speaking, the larger this condenser the better. The anode-coil tuning condenser is shown as of .0003-microfarad maximum capacity. If the set is to be used mainly for the reception of broadcast telephony on short wavelengths (B.B.C. transmissions), this variable condenser can usefully be replaced by one of smaller capacity, say .0002 microfarad. This will render short-wave tuning rather easier than it is with the condenser of larger capacity. The .0003 condenser is suggested as a compromise between the ideal of .0002 for short-wave tuning, on the one hand, and the ideal of .0005 for longer waves on the other. In the set as built up a vernier condenser is in parallel with the main condenser, which makes tuning nearly as easy as it would be with a .0002-microfarad condenser.

Components

The components necessary for building up this panel are: One piece ¼-in. ebonite sheet, 9½ in. by 7¾ in.; two filament resistances; one potentiometer of about 300 ohms resistance; one three-coil holder; one variable condenser .0003 microfarad; two fixed condensers of .002 and .0003 microfarad; one fixed Mansbridge condenser of 2 microfarads; one grid resistance (leak) of 2 megohms; one resistance (anode) of 70,000 ohms; three coil-holder plugs; two valve holders; ten terminals; quantity of 16-gauge tinned-copper wire; wood for case.

The .0003-microfarad condenser that tunes the anode-coil is similar to those used in the construction of the tuner unit. It is a U-type, with vernier incorporated,

AN ALL-PURPOSE

THE H.F. AMPLIFIER, DETECTOR AND NOTE-MAGNIFIER UNITS

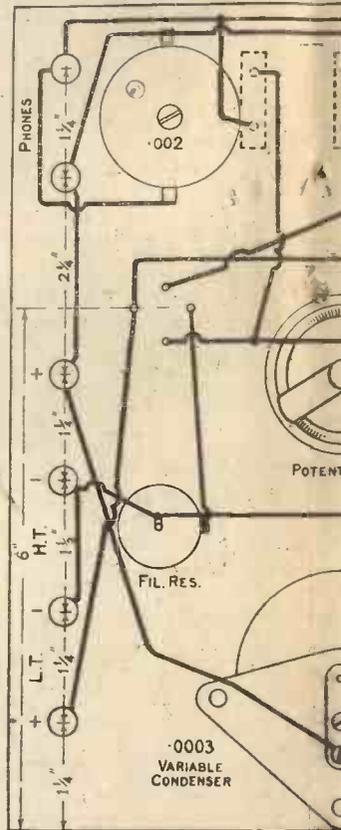


Fig. 2.—Wiring Diagram

obtained from Messrs. McMichael. The filament resistances are the excellent "Lissenstats" made by Messrs. Lissen, Limited. Very fine adjustment of filament heating can be obtained with these resistances. The potentiometer is also of Lissen manufacture. It is of 320 ohms resistance. The grid condenser and leak are Dubilier make, as also is the anode-resistance. The .002-condenser across the phones is of mushroom shape. Any good condenser can be put in here. The Mansbridge condenser of 2-microfarad capacity is an ex-W.D. part obtained some time ago. Such condensers are still to be obtained quite cheaply. If the unit is to be used without the note-magnifier unit, to be described later, a second Mansbridge condenser of the same

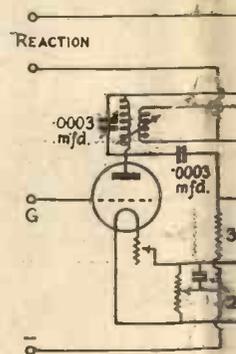
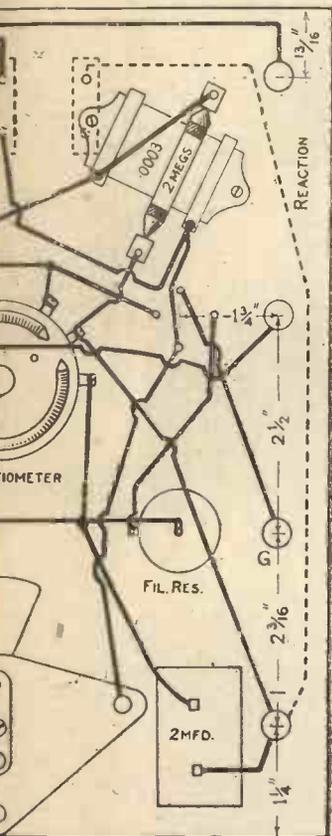


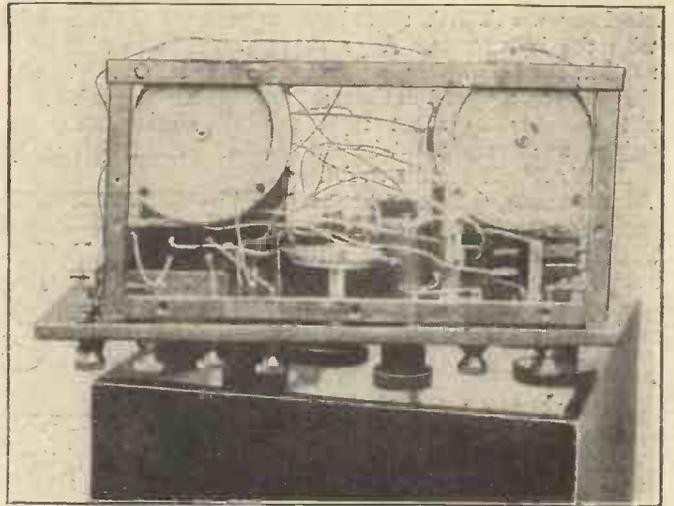
Fig. 1.—Circuit Diagram of the amplifier and detector units.

E RECEIVER.—III

The Third Article on the Building of a Four-valve Unit Set



of H.F. and Detector Unit.



Another View of Note-magnifier Panel.

brought more towards the middle of the panel.

The parts having been disposed to the best advantage, centres should be marked on the card, which can then be transferred to the panel and secured to it through two terminal holes. The centres may then be marked on the panel through the card with a centre-punch. The drilling should be done from the face of the panel.

When the drilling is completed both faces of the panel should be carefully rubbed down with fine emery and oil. When finished the ebonite should have a fine-grain matt appearance and show no sign of scratching. If desired labels can be fixed to the panel with Chatterton's compound.

Wiring

This panel is fairly easy to wire up, and therefore all the components can be fixed in place before any wiring is started. The wiring diagram, Fig. 2, and photographs of the panel show the way the various leads are bridged across one another. High-frequency leads are to be kept as far apart as possible and run at right angles or nearly so where they cross. All terminal ends should be carefully cleaned with a fine file and well tinned. As the connections are made check them off on the wiring diagram.

Some little difficulty may be experienced in the fixing of the Mansbridge condenser or condensers. They are rather large and occupy rather much room if placed lengthways on the panel. A bridge might be constructed to carry them, but they can be secured in position very easily by smearing the small end opposite the connection tags with Chatterton's compound. The condenser shown in the photograph was fixed by this method and shows no signs of any disposition to work loose.

If the aerial-earth system with which the set is used is efficient, and if care has been taken with the wiring, it will probably be

found that many of the B.B.C. stations will come in well without reaction, with a consequent improvement in signal quality. As was explained earlier, switches unless very carefully wired up, are a source of much loss in signal strength. To cut out reaction a short-circuiting plug is provided instead of a switch. This is simply a coil plug with the tag and socket joined. When placed in position on the coil holder, displacing the reaction coil, it allows the rectified impulses from the detector valve to go straight from the plate to one side of the phones.

Coils of large dimensions for tuning on long wavelengths are expensive, and there is no necessity to duplicate the set beyond, say, those necessary for tuning in the Paris concerts from F L (2,600 metres). For all wavelengths over 2,000 metres the anode coil can be replaced by a resistance of 70,000 ohms, with very little loss in signal strength. No provision need be made for short-circuiting the tuning condenser in the anode circuit, as if it is placed at zero the small minimum capacity has little or no effect on the strength of signals. The anode resistance is mounted on a coil holder so that it can be plugged in in place of the anode coil.

In the wiring diagram (Fig. 2) a dotted line is shown from one side of a three-coil holder to the earth terminal of the unit. This is provided in case the constructor wishes to make use of a damping plate. A damping plate is simply a sheet of brass or zinc mounted on a coil holder so that it can be approached to the anode coil. When it is tight up against the coil, tuning is broadened and the tendency of the set to self-oscillation is much reduced. Stations that are difficult to tune in can often be got easily by this method. When the plate is about 1 in. away from the anode coil it can be used very conveniently for fine tuning.

In use the set should be found very stable and easy to work. The unit that

capacity should be shunted across the H.T. supply (shown dotted in Fig. 1). This should also be done if separate H.T. supply is to be used for the note-magnifier unit.

No attempt should be made to proceed with construction until all the components have been obtained. They should then be arranged on a piece of card of the same dimensions as the ebonite panel. If components as specified are to be used the arrangement shown in Fig. 2 can be followed. If the round R-type valve is used, the valve holders should be arranged a little lower on the panel to allow clearance for the reaction coil. If coils of large dimensions are used in the reaction holder, a similar alteration will have to be made, the valve holders being

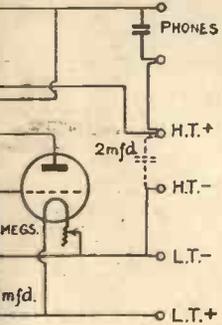


Diagram of Amplifier-Unit.

has been described is coupled up to the tuner unit by means of stout copper wire or short lengths of brass strip. For short-wave telephony the A.T.C. should be in series with the inductance. A 50 or 75 Igranite coil in the aerial plug, a 75 coil in the anode plug and a 35 coil in the reaction plug will probably be about right for broadcasting wavelengths. The writer uses Gambrell's B coil for the A.T.I. and C coil for the anode, with no reaction (or a 50 Igranite for the largest), and finds on this combination all B.B.C. stations (except Aberdeen, which needs the C coil in the aerial plug and a 75 Igranite or similar coil in the anode).

Tuning

Tuning should first be done with the secondary coil out of circuit, that is with the switch on the tuner unit in the "stand-by" position. When signals are heard and fairly well tuned-in for maximum strength, the secondary coil, which should usually be one size larger than the aerial coil, should be switched in, together with the secondary-tuning condenser. The coupling should be as loose as possible, and the secondary condenser should be manipulated until the signal comes again. Secondary and aerial condensers should then be moved together until maximum strength is obtained.

A secondary should be used whenever possible when working with tuned-anode coupling, as results are much better than when working straight off the aerial. It will often be found that stations on much the same wavelengths as that originally tuned-in can be brought in by manipulation of the secondary condenser alone.

The Note-magnifier Unit

As a general principle it may be laid down that two stages of transformer coupled low-frequency amplification are all that are required for any ordinary purpose. This unit, therefore, provides for two transformer-coupled low-frequency valves.

Most of the constructional details of the note-magnifier unit can be seen in the two photographs on the preceding page.

The size of the cabinet and the ebonite panel are exactly the same as in the two other units of the set. As there is rather more apparatus in the unit than in either of the other two some ingenuity has had to be exercised in the disposition of the components, particularly to keep grid and plate leads well apart and to obtain the most advantageous placing of the two transformers.

Provision has been made for using the unit as a semi-power amplifier. By means of two extra terminals, which should be connected with plugs to the battery, the anode potential of the valves can be increased. By this means a very considerable volume of sound can be got from an ordinary loud-speaker without distortion. If ordinary Marconi R valves are used as much as 150 volts can be put on the plate of the last valve. Special valves for power amplification can be used, but they

are not necessary for ordinary loud-speaker work. As an experiment the writer has used a dull-emitter with a plate voltage of about 50 for the first valve, and an R valve with a plate voltage of 150 for the second. The results were extraordinarily good. Both valves were fed off the same 4-volt accumulator, the precision of control given by the "Lissenstats"

rendering this possible. If anything in the nature of power amplification is attempted it will probably be found more satisfactory to provide separate H.T. and L.T. supply for the unit, though it is quite possible to use a common supply if care is exercised and all the controls are made full use of.

5 Y.M.

(To be continued)

A NOVEL PORTABLE CRYSTAL SET

OUR cover photograph shows a set that embodies several novel features. It should appeal to the constructor who wishes to try his hand at building a broadcast receiver. There is no cardboard tube to be wound and mounted, and no

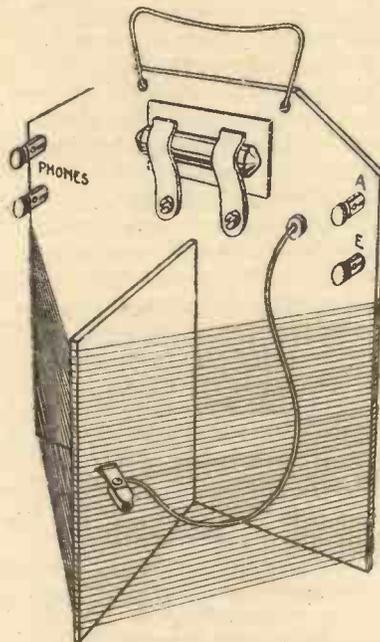
is suitable for the winding and should be wound on with an appreciable tension so that the contact clip, which consists of two pieces of flexible brass mounted on a strip of ebonite or fibre, may be pushed on to any of the turns without trouble. The insulation on the wires must be removed for a short distance, preferably close to one of the edges of the wood frame, so that electrical contact can be made.

Any type of crystal detector may be mounted on the set, or a cartridge detector as shown in the diagram may be used. The circuit used is of the usual simple single-contact type, that is aerial to contact clip and detector, detector to phones, phones to earth and lower end of winding.

As regards insulation, no trouble will be experienced provided that well-seasoned dry wood is used; a coat of shellac varnish will give sufficient protection for ordinary purposes.

Using this set at a distance of three miles from a broadcasting station with 8,000-ohm phones no aerial was found to be necessary for efficient reception in a ground-floor room, the earth lead being taken to a water-pipe and the aerial terminal connected by a short piece of wire to any metallic object in the room, such as the fender, fireguard or even the fireplace itself. No attempt was made to insulate these objects from the floor or, in the latter case, from the brickwork of the house.

CALCULX.



Details of Novel Crystal Set.

sliding contact which requires careful and accurate fitting to be efficient; all the wiring is visible, and the connecting-up should present no difficulty to the beginner.

The foundation of the set consists of two pieces of three-ply or hard wood $\frac{1}{8}$ or $\frac{3}{8}$ in. thick, one piece measuring 8 in. by $6\frac{1}{2}$ in., the other $6\frac{1}{2}$ in. by $5\frac{1}{2}$ in.; a slot $2\frac{3}{4}$ in. long and of the same width as the thickness of the wood used is cut in each and the pieces pushed together to form a cross.

Fifty cuts, which can be made with a sharp penknife or fretsaw, are required along each of the four edges of the frame, as seen in the diagram. Place the first cut $\frac{1}{8}$ in. from the top of the smaller section of the frame.

Enamelled wire of about No. 26 S.W.G.

Condenser with Mica and Oil Dielectric.

—A correspondent, Mr. C. E. Raeburn, of Old Trafford, informs us that he, with another inventor, has provisionally protected a condenser which, like the one described in AMATEUR WIRELESS dated November 17, employs a mica and oil dielectric.

From correspondence in local papers it seems that residents are not satisfied with the programmes transmitted from 5 N.O. Complaints are made with regard to the small number of artistes that perform at the Newcastle station.

PLASTIC METALS FOR SETTING CRYSTALS

A FEW NOTES ON SUITABLE METALLIC CEMENTS

THE expression plastic is generally understood to refer to a metal which exhibits plasticity at ordinary temperatures and which can be kneaded and worked up into various shapes in a similar manner to wax or putty.

Generally speaking it is mercury which imparts to the metal the property of plasticity, and all the plastic metals known at present contain a certain proportion of mercury. All mixtures of metals which contain mercury are called "amalgams." An amalgam is simply an alloy which contains a certain amount of mercury.

The chief advantage of employing plastic metals for mounting crystals is because it is not necessary to heat the metal in any way at all, and thus the sensitiveness of the crystal is not affected. The use of plastic metals in this direction, however, is attended with one disadvantage which, in the writer's opinion, is rather serious, especially in cases where "treated" galena crystals are being employed for rectifying purposes. This drawback lies in the fact that the mercury which is contained in the metallic cement may tend to amalgamate with the crystal itself, and in so doing may destroy, or at least diminish, its rectifying powers.

With crystals such as tellurium, which is of an entirely metallic nature, an amalgam of that metal may result from the use of plastic cement, with the complete destruction of the crystal. In the case of crystals such as zincite, carborundum, or silicon, these unwanted results cannot take place, and thus the employment of plastic metals in cementing crystals of this type to their detectors is not fraught with this disadvantage.

Copper Amalgam

The best method of preparing this material is as follows: Place a few strips of clean zinc into a fairly strong solution of copper sulphate, and after a very short time metallic copper will be precipitated from the solution in a "spongy" or finely-divided form. It is then collected, and whilst still moist it is placed in a mortar and hot water is poured over it. Mercury is then added, and the whole mass is kneaded with a pestle or a wooden stick until the copper and the mercury mingle together and form a plastic mass. The best proportions of the two metals to employ are 3 parts of copper to 7 parts of mercury.

After the amalgamation of the metals has been completed, the water is poured off, and the amalgam is rolled into small cylinders about 2 in. long and 1/8 in. in thickness, and kept in that form until it is required for use. It sets to a hard mass

in a few hours, but it can easily be softened and made plastic again by placing it in a dish of warm water.

A similar amalgam, but consisting of 25 parts of copper and 7 parts of mercury, makes a very good solder for joining together very fine wires. It is workable at very low temperatures, and thus prevents the oxidation of the fine copper wires which usually takes place when they are soldered by the ordinary methods. The amalgam will also adhere to glass and china.

Tin Amalgam

This can be made by rubbing together 1 part of tinfoil and 4 parts of mercury, and by removing the excess of mercury by squeezing the mixture through a chamois bag. A plastic metal is thus obtained which takes a few days to harden. It is not as hard as the copper amalgam.

Two other plastic metals which contain tin, and which may be prepared by a similar method, are Kienmayer's metal, which consists of tin 1 part, zinc 1 part, mercury 2 parts; and Singer's amalgam, which contains tin 1 part, zinc 2 parts, and mercury 5 parts.

Cadmium Amalgams

Amalgams containing the metal cadmium are very easily prepared, and they are extremely plastic. They are made by mixing together various proportions of cadmium and mercury. The cadmium is melted in an iron spoon and poured into the mercury. Cadmium is not very expensive, and it may be obtained from any firm of manufacturing chemists.

An amalgam containing equal quantities of cadmium and mercury is about the most suitable for wireless purposes.

The preparation known as Evans's metallic cement contains 25.5 parts of cadmium and 74.5 parts of mercury.

Generally speaking, all these metallic cements set hard in a few hours' time, but in some cases they remain in a plastic condition for one or two days. They may be easily softened, however, by immersing them for a few moments in a basin of warm water. They have the advantage over Wood's metal and other similar alloys in that they do not require even a medium temperature in order to melt them or to render them extremely plastic. When they get hard, warm water, and in some cases merely the natural heat of the hand, is quite sufficient to bring them back again to their original plastic and "workable" condition.

The preparation of plastic amalgams is very interesting, and many other uses to which they may be applied may present

themselves to the mind of the wireless amateur.

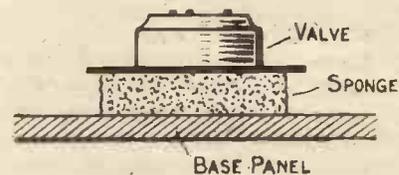
As a rule the crystals to be avoided when using this method are those which are composed of galena, tellurium, molybdenite, and probably copper pyrites. Other minerals may be cemented in this manner with perfect safety, and a few trials of the use of plastic metals may be recommended to amateurs with the full knowledge that the results which will be obtained will be entirely satisfactory.

METALLOS.

Mounting Dull-emitter Valves

DULL-EMITTER valves are extremely sensitive to jars and vibrations. Touching the panel or moving control handles often cause a disagreeable noise in the earphones. This makes it desirable to mount the valves in such a way as to prevent them from being jarred.

To accomplish this, use a rubber bath



Method of Mounting Dull-emitter Valves.

sponge with a flat base and top, cut a piece slightly larger than the base of the valve socket and varnish it with shellac and fix it to the baseboard of the set where the valve is to go.

On it place a small square of very thin ebonite and then bore the holes of the valve socket, which should then be put in place.

The shellac varnished sponge will be found, when perfectly dry, to be firm and yet flexible enough to absorb ordinary jarrings and vibrations. F. C. L.

JUST PUBLISHED

WIRELESS TELEPHONY EXPLAINED

By J. HARTLEY REYNOLDS & G. L. MORROW

A simple explanation of Wireless that should be in the hands of every amateur.

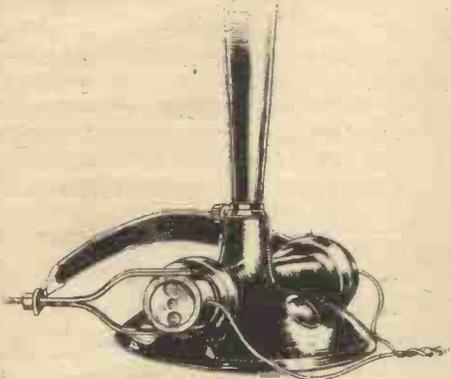
Its price is only 1s. 6d.

CASSELL & Co., LTD., LA BELLE SAUVAGE, E.C.4.

AROUND THE SHOWROOMS

Adapting Phones to Loud-Speaker

FOR amateurs who like to use either phones or a loud-speaker, but not the two together, a device made by the British Thomson-Houston Company, Ltd. (Rugby),

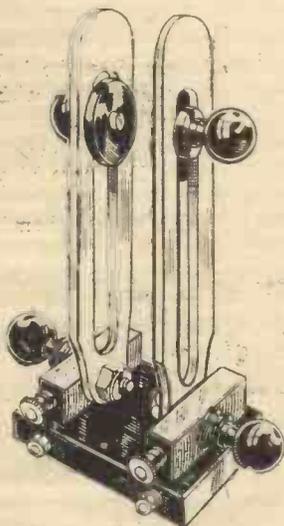


B.T.H. Adaptor for Phones.

is useful. This takes the form of a loud-speaker horn provided at the bottom with two recesses, as seen in the sketch, that take ordinary earpieces. Thus it is possible for anyone to tune in with the phones until the best results are obtained, when, by placing the earpieces in position in the recesses, an efficient loud-speaker is produced.

Ingenious Coil Holders

THE new basket-coil holders made by J. Burns, Ltd. (Chadwell Heath, Essex), work on a new principle. Each holder, which is provided with the standard plug-and-socket fitting, is slotted, as shown in



A Holder for Basket Coils.

the sketch, and provided with a movable disc and knob, by means of which the basket coil is held in place and also moved

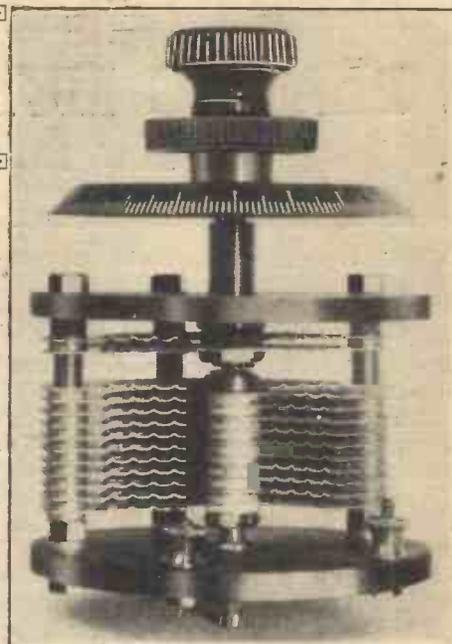
up and down. More than this, each arm is also pivoted at the bottom so that by suitably adjusting both knobs a coil can be placed in almost any position. This means that, when necessary, an extremely fine coupling can be obtained. These holders fit into ordinary two- or three-way coil holders and in this way provide a finer degree of coupling. Such holders should be of use to all experimenters.

New Agency

WE learn that Eustace Watkins, Ltd., of 91, New Bond Street, have completed arrangements to represent Gambrell Bros. in the West End. A complete range of Gambrell apparatus is on show at the above address.

The New "Formo-densors"

A VERY small air dielectric is the feature of the new "Formo-densors." It does not exceed .029 in. As can be seen in the photograph, the plates are corrugated; this gives them rigidity, and the small air gap makes them compact.



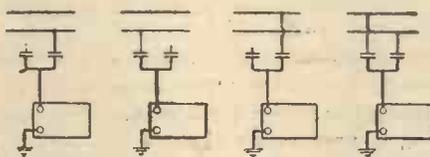
The New "Formo-densor."

It will be noticed that a vernier condenser is provided above the main instrument. This is rotated by a rod passing through the main spindle, which is hollow. An extra knob is provided for adjusting it. These condensers are made by the Formo Co., of Cricklewood Lane, N.W.2.

PROGRESS AND INVENTION

Lighting Mains as Aerial

A N adaptor for using the lighting mains as an aerial is the subject of Patent No. 198,318/23. (W. Dubilier, of New York, U.S.A.). Two condensers are



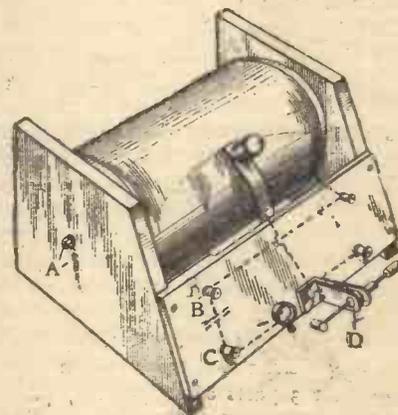
Lighting Mains as Aerials (No. 198,318/23).

mounted in some device that will fit an ordinary lamp-holder, one side of each being connected to a pole of the lighting mains and the other sides being provided with terminals. The capacities of the condensers, which may not each have the same value, can be about .003 microfarad, the object being to pass the H.F. currents and not the L.F. currents in the mains. By means of such a device an unskilled operator can use the lighting mains as an aerial without personal injury or harming the receiving apparatus. The diagram shows four methods of making connections.

A Simple Receiver

TO provide a receiver that is cheap to make and compact in arrangement is the object of Patent No. 205,717/23 (B. G.

Calver, of Hurlingham, London). The coil is supported by a central bolt A which is fixed to the end pieces of the frame. In front is an insulator panel carrying four terminals, which are connected as shown by the dotted line. A telephone condenser is mounted behind the panel, between the terminals B and C. For clearness the catwhisker is omitted. Note



A Simple Receiver (No. 205,717/23).

should be made of the type of slider used. It is pivoted and connected electrically under the catwhisker support D.

A Sensible Gift to buy for yourself

No better gift could be found for the practical man than "The Amateur Mechanic." It is the book to save and make money. From mending or making boots and shoes to redecorating the house inside and out, it will show you how to do everything about the house and garden.

To
**Save Money
and
Make
Money**

It is the odd jobs that take up the money when you pay outsiders to do them for you. Make up your mind to do them yourself and keep the money in your own pocket. With this book to guide you you will be surprised at the number of jobs you will be able to do and the amount of money you will be able to save by doing them yourself.

To
**Reduce
Your
Household
Expenses**

THE

AMATEUR MECHANIC

Edited by BERNARD E. JONES

Teaches you how to do over Four Hundred Mending, Making and Repairing jobs about home and garden

There isn't a city, town or village in the whole British Isles without this book. Everyone who has it regards it as an indispensable household necessity. No matter what you want to do, you will find in its pages all the guidance, help and instruction you could wish for. You can not only save money by doing the jobs it includes, but you can make money by taking up a well-paid trade or useful hobby from its pages. Electricity, Ornamental Metal Working, Marquetry and scores of other trades and hobbies are included. It is the only work of its kind in existence.

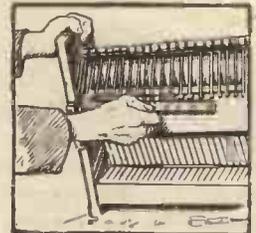
How to Make

A Pair of Riveted Boots. A Garden Path. Glues and Varnishes. Locked Doors Extra Secure. A Model Flying Machine. A Hot Water Towel Rail. A Gramophone. Perambulator Hoods. Theatrical Scenery. A Mattress. Frames for Pictures. Furniture Revivers. Plaster Casts. Invisible Inks. Fine Fretwork. Line Blocks. Gramophone Cabinets. Dextrine Adhesives. Artistic Bedroom Fitments. A Clothes Post. A Pair of Hand-sewn Boots. Signs in Chipped Glass. Cements. Door Bolts, Hinges, etc. Acids for Etching Metals. Anti-Freezing Solution. A Self-Closing door. Castings in Metal. Celluloid Varnish. Roller Blinds. Machines for Stoning Raisins. Bent Ironwork. A Sundial Pedestal. Stencil Plates, etc., etc.

It
**will save
you
money all
the year
round**

How to Mend

Leather Couches. Cane-seated Chairs. Old China. Chair Bottoms. Modern Watches. Old Clock Dials. Step-ladders. Oilcloth. Hot Water Pipes. Windows and Doors. Picture Frames. Pianos. Knives and Forks. Plastering. Gas Fittings. Speaking Tubes. Cooking Ranges. Metal Vessels. Pocket and Pen Knives. Leather Bags. Grandfather Clocks. Defective Floorboards. Spectacles. Excessive Outflow at Taps. Dining Chairs. Mirrors. Mantelboards, etc. Violin Bows. Dutch and French Clocks. Floor Tiles. Typewriters. Iron and Brass Bedsteads, etc., etc.



How to repair Pianos.



How to fix Electric Bells.

Over 6,000 How-to-do-it Pictures

The pictures actually show you every stage of every job, so that you cannot possibly go wrong. Every step that you take is directed with the clear instructions given in the text. The pictures make this book the most definitely practical you could ever hope to obtain.

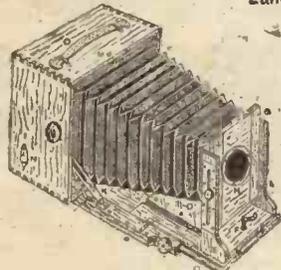
What Purchasers say:

"What I like about them is the simple way in which they describe how the different works are done, and they quite endorse what are said about them in the various testimonials."

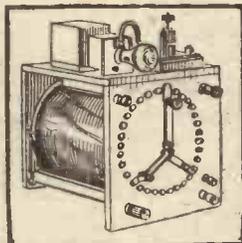
Mr. Thomas Thornton, Earby, Lancs.

"I am an ex-Service man, and it has increased my income by showing me how to do odd jobs for the neighbours and my own household repairs at very small cost. I cannot find words to praise THE AMATEUR MECHANIC."

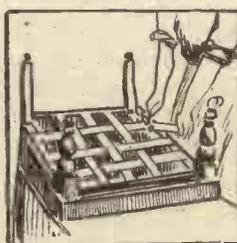
J. Hawkswell, Hammersmith:



How to make and repair Cameras.



How to make a Wireless Set.



How to mend and re-upholster Chairs

FREE

Tear off and Post To-day

To the WAVERLEY BOOK CO., LTD.
(A.W.G.),
96, Farringdon Street, London, E.C.4.

Please send me without charge, your Free Illustrated Booklet, containing all particulars as to contents, authors, etc., of the "AMATEUR MECHANIC", also information as to your offer to send the Complete Work for a merely nominal first payment, the balance to be paid by a few small monthly payments, beginning after the work is delivered.

NAME
(Send this form in unsealed envelope with 3d. stamp.)

ADDRESS

A.W.G 1923



RADIOGRAMS

It was announced in Parliament recently that application for permission to broadcast the King's Speech at the opening of Parliament would be considered.

Professor Joseph Henry transmitted signals in 1831 which were made audible by the ringing of a bell. On December 17 the sounds of the same bell will be broadcast from New York.

The Metropolitan Asylums Board have decided to install wireless sets in their sanatoria, which are situated in various parts of the country.

Two wireless stations at Aitutaki and Mangaia, two of the Cook Islands in the Eastern Pacific, are to be erected for communication with shipping.

There is a French regulation to enforce that all ships of between 500 and 1,600 tons register shall be fitted with receiving apparatus.

Extensive experiments are being carried out in certain American laboratories in connection with the transmission of power by wireless.

From an article in a certain daily paper: "We pass round the panels containing these valves. . . . We hasten from these panels as the heat emitted reminds one of a stokehole"! Broadcasting "hot stuff" perhaps?

Two enthusiasts lived in houses backing on to one another. The distance between them was too great for only one aerial. What could be simpler than to put a long wire between the houses, insulate it in the middle, and make a two-in-one aerial?

"The industry is only a year old, and look at the child now; we have already thrown away the bottle!" Thus Mr. Guy Burney, chairman of the National Association of Radio Manufacturers, speaking of the progress of the wireless industry.

Reports from Vancouver state that experiments have been conducted throughout

the summer by the Pacific Cable Board with a view to devising a system of trans-Pacific wireless. It is reported that this is the reason for the delay in negotiations for the Empire wireless chain. Reports of the tests are secret up to the present.

Acts I. and II. of *Maritana* will be relayed from the "Old Vic." on December 6. The Savoy Orpheans and Savoy Havana Band will provide an hour's dance music during the same evening.

"Uncle Rex" will delight listeners-in with his really fine voice every Monday evening in future, beginning on Dec. 10.

"I don't think the idea can be looked upon from a favourable point of view; atmospherics are bad enough now without adding to their number," is the comment of a writer dealing with the use of wireless for election purposes!

The band of H.M. Royal Air Force is down to "appear" at 2 L O on Sunday, December 9. *Atlantis* or *The Lost Continent* by Safranek, a usually unperformed suite, will feature in the programme.

From the amount of correspondence on the subject in the provincial Press, it appears that all over the country people are experiencing interference from oscillation. What are you doing about it?

How many listeners rise when "The King" is proposed at the end of any night's transmission?

Writing of the possibilities of wireless in warfare, a provincial paper uses the expression, "if it be possible to throw a wireless wave. . . ."

It will be remembered that some time ago it was decided that tenants living on the Bellingham Estate would have to pay £1 to the L.C.C. as a deposit against damage to property caused by the erection of aërials. Owing to the activities of the radio society connected with the "Bellingham Estate Tenants' Association," the

L.C.C. have reconsidered their decision, and the £1 will be refunded to those who paid it.

"Aunt Priscilla" is to tell the children "How to Arrange a Picnic" on December 11. A very seasonable subject!

It is suggested that a relay station should be erected at Ipswich for the benefit of East Anglians.

Several leading politicians used "Magnavox" loud-speaker equipments, including "Sterling" power-amplifiers and microphones, for use at election speeches in various parts of the country (we are informed by the Sterling Telephone and Electric Company, Ltd.). The first of these equipments was employed on November 26 on the occasion of Mr. Baldwin's address to about 6,000 persons at the Colston Hall, Bristol. Viscount Curzon used this equipment throughout the campaign, having found it extremely useful during the previous electioneering period.

General Ferris, who is in charge of the Eiffel Tower wireless station, which is, of course, a French Government station, when describing the results of some experiments he had been conducting before the Academy of Science, stated that it had been found possible to transmit signals for a distance of over one and a quarter miles on a wavelength of two metres. The aerial used was one metre (39 in.) in length.

At the wireless demonstration organised by the Hackney and District Radio Society on Wednesday, November 21, both Mr. Arthur Burrows and Captain Eckersley were present. Uncle Arthur said that, as director of programmes, he was very much in the position of a man in the Far East some time back. There had been a pretty serious earthquake, and there was only one man who knew nothing at all about it. He was riding in a Ford car at the time! The speaker considered that he was in the car in the sense of broadcasting. The secretary has informed us that the event was most successful, over 1,000 persons attending the demonstration.

Lord Athlone broadcast a speech on behalf of the British Empire Cancer Campaign from 2 L O on November 27.

In connection with the Transatlantic tests, the *Daily Express* says: "The Post Office was at first prepared to permit transmission by each amateur for only a quarter of an hour a week—not even sufficient time to obtain communication with Americans." What does this mean?

A High Class VARIABLE CONDENSER

AT A LOW PRICE

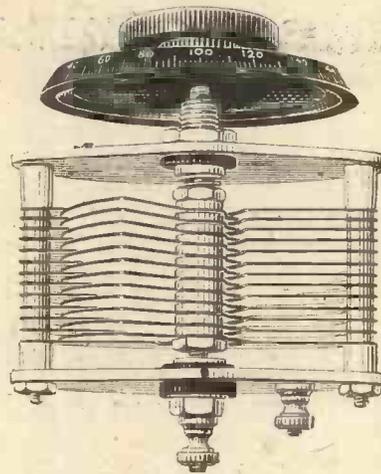
Having been engaged largely on condenser work for the last eighteen months we have realized the wireless amateur's need of an instrument giving the maximum efficiency for the very minimum of cost.

This we have succeeded in producing, and are now able to place on the market a condenser far in advance of any to be obtained and at a lower price.

It is smooth in action, the revolving plates moving freely, with none of the jolts and jars common to most condensers.

The top and bottom plates, which are of aluminium, are made with long bosses giving absolute accuracy, strength and rigidity, and will not wobble to pieces after a few weeks' use. All parts plated.

We are neither Factors nor Retailers, but
THE ACTUAL MANUFACTURERS



PRICES
(as illustrated)

Vernier	2/3
.0001	2/9
.0002	3/3
.0003	4/3
.0005	4/9
.00075	5/9
.001	6/9

Ebonite Dial and Knob, 9d. extra.

Also supplied, Variable Condensers with round turned ebonite tops and bottoms:

Vernier	4/-
.0001	4/6
.0002	5/-
.0003	5/6
.0005	6/-
.00075	6/6
.001	7/6

Knob and Dial 9d. extra.

POSTAGE FREE
in U.K.

	Price.
L.F. TRANSFORMERS. Postage 9d.	
W.S.	11/6
W.S. super.	18/-
H.F. TRANSFORMERS:	
300-600 metres	4/-
600-1,000 "	4/3
900-1,900 "	5/6
1,800-2,500 "	6/-
DUTCH VALVES, hard and soft. 6/9 and 7/9	
All other makes of valves supplied.	
AERIAL WIRE, 7/22, hard-drawn copper,	
100 ft. (postage 1/-)	1/10
CRYSTAL DETECTORS	10d., 1/2, 1/6
CRYSTAL DETECTORS, enclosed in	
glass	1/3, 2/-, 2/6
CONDENSER VANES, fixed or moving,	
per doz.	3 1/2d.
IVORINE LABEL SETS, 12 different titles,	
per set	6d.
SLEEVEING, 3 yds. assorted colours	11d.
EBONITE KNOBS, 2 B.A. each 2d. and 3d.	
CRYSTAL CUPS each 1 1/2d. and 2d.	
EBONITE, cut to any size by machinery,	
per lb.	3/3
SWITCH ARMS, with ebonite knob, complete	
with panel, bush, nuts or spring	
washer	8d.
RUBBER-INSULATED LEAD-IN WIRE	
per yd.	1 1/2d.
INSULATORS, white reel, each 1d., per	
doz.	10d.
INSULATORS, egg type, each 2d., per	
doz.	1/8
WOUND INDUCTANCE COILS:	
12x4 9x4 8x2 1/2 6x3 6x2	
2/6 2/2 1/9 1/8 1/2	
TAPPED INDUCTANCE COILS, 20	
tappings	2/3
VARIOMETERS (Tube type), complete	
with knob and dial	4/- and 2/9
TWO-WAY COIL-HOLDERS	5/-
THREE-WAY COIL-HOLDERS	7/-
VALVE HOLDERS	8d. and 1/-
FILAMENT RESISTANCE DIALS	6d.

	Price.
FILAMENT RESISTANCES, very smooth	
action, cheapest in the market	1/6
FILAMENT RESISTANCES, with vernier	
attachment	3/-
IVORINE NAME PLATES, all readings,	
each 1d., per doz.	9d.
PLASTIC METAL, for fixing crystals	6d.
POTENTIOMETERS, superior make	7/-
COPPER FOIL, 6 in. wide per ft.	4d.
ENAMEL WIRE:	
per lb. 22 24 26 28	
2/4 2/8 3/2 3/4	
CONNECTING WIRE, 20, copper per yd.	1/2d.
GRID LEAKS, 2 1/2 and 2 meg. each	9d.
VARIABLE GRID LEAKS, 0.5 meg., with	
guarantee for two years	3/-
GOLD CAT'S WHISKERS	2d.
SILVER CAT'S WHISKERS	1d.
CONDENSER SCALES, 0-180	3 1/2d.
BASKET COILS, set of 4 up to 2,000,	
metres	2/3
BELL WIRE, tinned copper 12 yds.	6d.
SLIDER KNOBS	2d.
DOUBLE PHONE CORDS	11d.
GENUINE HERTZITE	6d.
TALITE	7d.
ZINCITE	8d.
BORNITE	5d.
MIXED, six kinds	9d.
CARBORUNDUM	5d.
PERMANITE	7d.
EBONITE CONDENSER KNOB AND	
DIAL	1/3
HIGH-TENSION BATTERIES:	
30 volts, 5/6; 60 volts, 9/-	
SHELLAC per bottle, 4 1/2d. and 9d.	
NUTS, 2 B.A. per doz.	2d.
NUTS, 4, 5, 6 and 8 B.A. per doz.	1 1/2d.
WASHERS, 4 B.A. per doz.	1/2d.
WASHERS, 2 B.A. per doz.	1d.
CONTACT STUDS, with nuts and	
washers per doz.	3d.

	Price.
TERMINALS, with nuts and washers,	
each 1/2d., 1d. and 1 1/2d.	
LARGE SPACER WASHERS ... per doz.	2d.
SMALL SPACER WASHERS ... per doz.	1 1/2d.
TELEPHONE TERMINALS, with nuts	
and washers each 1d., per doz.	1/-
W.O. TERMINALS, with nuts and	
washers each 2d., per doz.	1/6
PANEL BUSHES, drilled	
each 1 1/2d., per doz.	1/2
CONDENSER BUSHES each 1d., per doz.	8d.
CONDENSER BUSHES, bottom	
each 1d., per doz.	7d.
STOPS, with nuts per doz.	6d.
VALVE LEGS, with nuts and washers,	
each 1d., per doz.	9d.
VALVE PINS, with nuts and washers	
each 1d., per doz.	9d.
SLIDER ROD, brass, 13 ins. long, 1/2 in.	
square, drilled each	3d.
CONDENSER SPINDLES, vernier	1d.
CONDENSER SPINDLES, .001	3d.
SCREWED ROD, 2 B.A., 12-in. lengths	2d.
SCREWED ROD, 4 B.A., 12-in. lengths	2d.
KNIFE SWITCHES, on polished ebonite	
base:	
S.P.S.T.	1/4
S.P.D.T.	1/8
D.P.S.T.	2/6
D.P.D.T.	2/8
FIXED CONDENSERS, any capacity	9d.
GRID LEAK AND CONDENSER	2/-
EBONITE COIL PLUGS each 1/2, 6 for	
COIL CONTAINERS FOR BASKET	
COILS	3/-
AERIAL PULLEYS	6d.

Headphones, all makes,
at standard prices.

All Mail Orders executed in strict rotation. Goods sent to all parts of the world. Please remit sufficient to cover postage. All goods are of reliable quality. Write for our full list.

THE WIRELESS TRADERS' SUPPLY Co.,

80, Hampstead Road, London, N.W.1.

Tele. No.
Mus. 3483

Three Minutes from Warren Street (Hampstead Tube), Right opposite Oetzmann's,



Wireless Inventions

SIR,—In the article "Wireless Inventions Wanted" which appeared in No. 78, the writer mentions that a substitute for ebonite is required.

I have been using for the last nine months as the base of a crystal set a sheet of slate, which after being rubbed down with sandpaper was painted with two or three coats of shellac varnish.

This appears to be quite as good an insulator as ebonite; a fine glaze, which can easily be kept clean, is produced by the shellac. It has the advantages of being very cheap (a sheet 1 ft. square can be obtained at any builder's for less than a shilling), it is more easily worked than ebonite, being cut quickly with a fret-saw, and its brownish grey appearance is not unpleasing to the eye.—S. C. C. (Wood Green).

The Aberdeen Broadcasting Station

SIR,—From a paragraph in your paper there is a strong suggestion that the power of the Aberdeen station is not up to standard.

The mail received here this morning includes letters of congratulation on strength of transmission from Folkestone, Yeovil, Bristol, London, Leicester, Lerwick (Shetland), Holland, Norway, Sweden, Neath (Ireland), and other places. From this I think your correspondent will realise that it is not the transmission which is at fault. I should suggest to him and to others who have the same complaint to make that the wavelength of 495 metres is almost out of the range of the sets they may be using, although the set may be nominally stated to bring in transmissions from 300 to 500 metres. We have found that a number of these sets, although otherwise calibrated, will not go up to more than 450 metres. This, of course, would only allow the users to receive a very faint reception of the strong and constant transmission which is maintained from 2 B D. A few more turns of wire or the use of a suitable loading coil will, I think, do away with any doubt your correspondent may have on the above question.—Yours faithfully, R. E. JEFFREY (Broadcasting Station Director, Aberdeen).

American Reception

SIR,—It may interest you to know that, with the four-valve circuit described under the heading "How to Get the Long-distance Stations" in your issue of November 17, I received American telephony thrice within a little over twenty-four hours.

The set consists of components, some home-made, others bought, the whole having been wired up with No. 24 wire on a kitchen table in three-quarters of an hour. I shunted the .001 condenser across

A GREAT Christmas Number!

THIS WEEK'S

"WORK"

NOW ON SALE, PRICE 3d.
has the following special
CONTENTS:

- Living Marionettes Up-to-date*
- Orange Wizardry*
- The Multiplying Billiard Ball*
- Sound-wave Toys*
- Scene Painting for a Christmas Play*
- The Mysterious Card Frame*
- The Swallowing Wand*
- A Tut-ankh-amen Toy*
- The White Magic of Chemistry*
- Making a Doll's House*
- Some Novel Tricks for Christmas*
- The Insatiable Canister*
- Figurography—the New Game of Skill and Dexterity*
- Toys for the Christmas Stocking*
- A Four-ace Puzzle*
- New Chinese Coin and String Trick*
- An Amateur Stage Illusion*

OVER 100 ILLUSTRATIONS

Get Your Copy at Once!

the aerial coil, and used as the first three coils Nos. 35, 50, 50, the others being both No. 75 (all Igranic). Small variable condensers were .0003 and .0002 microfarad respectively. The potentiometer, as stated by you, is most necessary, its proper adjustment tending greatly to stabilise and render intelligible the reception. The valves are all of the dull-emitter type (G.E.C.) and function exceedingly well.

I have heard all the B.B.C. stations with this circuit, London and Bournemouth in particular coming through very well.—A. J. J. C. (Coatbridge, nr. Glasgow).

Crystal Detectors

SIR,—In glancing through "A Practical Guide to Wireless" given with this week's AMATEUR WIRELESS, I was astonished to read the following, "Usually perikon detectors are more sensitive than other types, but are more likely to be jugged out of adjustment." With regard to the sensitivity I agree, but we used either carborundum or perikon in the portable army sets simply because they were *not* easily jugged out of adjustment. I always used perikon, and always found it extremely stable.—A. S. B. (London).

American Reception

SIR,—On Tuesday, November 20, at 12.54 a.m., I picked up WGY (General Electric Company, New York) and heard very clearly and with ample volume fifteen items of their programme with a two-valve set of my own construction (one H.F. and detector), using a twin aerial 35 ft. long, lead-in 20 ft., height 27 ft.

The transmission was so loud that I turned out the H.F. filament and still received the pianoforte solo "Poor Old Joe."

Reaction on the aerial was not used, and no secondary circuit was used, only reaction on the anode coil (plug-in basket).—C. H. (Birmingham).

Accumulators

SIR,—My attention has been drawn to the information on accumulators given in the very interesting and instructive book presented with AMATEUR WIRELESS No. 77.

On page 60 it is stated that the "average capacity of an accumulator is 10 ampere hours per square foot of positive plate surface reckoning both sides of the plates." The capacity will vary with the thickness of the plates, but for all practical purposes a positive plate measuring 4 in. by 4 in. will have a capacity of 10 ampere hours at the 20-hour rate.

On the same page it is stated that the usual voltage of a charged cell ranges from 2.3 to 2.5 volts. Readers may not appreciate that this refers to the voltage on charge, although it would be more correct to give the value as 2.5 to 2.7 volts. As soon as ever the charging current is switched off the voltage of the cell drops to about 2.15 volts, quickly falling to 2 volts when the cell is put on discharge.

The rate of discharge is stated to be one-

fourth of the capacity of the battery. A properly-made accumulator will not be affected by rates of discharge, otherwise it would not be suitable for starter batteries, which are discharged at five or six times (in amperes) their capacity in ampere hours.

Although the methods described in the book—pages 66 and 68—for charging accumulators from primary cells and from the motor-car are practicable, they are not very convenient. For instance, if a motor-car starter battery with a capacity of 50 or 60 ampere hours is required to charge a wireless battery of 30 or 40 ampere hours capacity, this is imposing additional work on the motor-car battery, which may lead to unsatisfactory self-starting.—E. C. MCK. (Clifton).

[With regard to our correspondent's remarks, it should be noted that the information contained in the book refers to the light type of battery used for wireless work. The heavy-discharge accumulator used for engine starting has been specially designed for very large outputs.—ED.]

Other Correspondence Summarised

R. H. (Teddington) received a station transmitting, apparently in French, on about 450 metres. It was not Ecole Supérieure. Strength was good, using three valves (1 H.F., D., 1 L.F.). Programme finished at 10.45 p.m.

Ask "A.W." for List of Technical Books.

THE NEW CRYSTAL ERA

IN the past quite a number of enthusiasts have consistently pinned their faith to the simple crystal, and now it would appear that they have been quite justified in so doing. According to no less an authority than Senatore Marconi, it is confidently believed that at a very early date owners of crystal sets in this country will be able to keep in touch with America and vice versa. This, of course, does not mean that the crystal receiver has become imbued with any remarkably new virtue, but rather that transmitting and relaying arrangements are attaining such a degree of perfection that the receiver hardly matters.

A case in point of an experimental nature was the relaying by wireless of portions of the performances of *Faust* and *La Traviata* from the Old Vic. to 2LO, on the other side of the river, from where the performances were broadcast as though they had taken place in the studio at 2LO.

Previously, relaying has been carried out over land lines, and the point of location of the matter to be broadcast has naturally been a matter of consequence. In relaying by wireless this disability is swept away, the location of the point of origin being of little or no account. In the first experiment the power of the transmission was low—about 30 watts—and the wavelength differed greatly from the broadcasting

wavelength, but with increased distances that are promised for the future the power would be increased.

It is never safe to prophecy, but possibly by the time these lines appear in print owners of crystal sets in this country will have received American broadcast.

HAMPTON & DISTRICT RADIO SOCIETY

A New Society Now Forming

AT a well-attended meeting on the 26th ult., held at "Castlemaine," Hampton, under the chairmanship of Mr. E. Hill-Adam, it was unanimously decided to form the above society.

All interested in wireless are cordially invited to attend a public meeting to be held on Monday, December 10, at 8 p.m., at the 3rd Hampton Boy Scout headquarters, Percy Road, Hampton, to appoint officials and consider and adopt rules and matters arising therefrom.

Persons wishing to join this society are asked to send in their names and addresses at once to the Hon. Sec. (pro tem.), A. MILLWARD FLACK, "Castlemaine," Hampton.

"Wireless Telegraphy and Telephony"

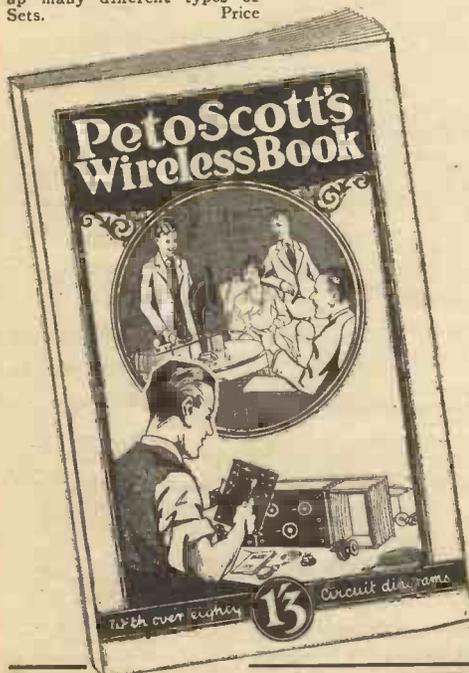
The most Practical Handbook for the Amateur. The price is 1/6 net.

Cassell & Co., Ltd., La Belle Sauvage, London, E.C.4.

Why not enjoy all the Xmas programmes this year?

Here is just the Book you have been needing. It gives a full explanation of the principles of Wireless and shows by means of over 80 circuit diagrams how to wire up many different types of Sets.

1/3



To receive only one B.B.C. Station when you have a Valve Receiver is to deprive yourself of more than half the pleasure of Radio, and yet this is what is happening in a good many homes today.

Owners of quite good Receiving Sets employing several Valves are finding it practically impossible to tune out their local Station and must perform wait for intervals during transmission in order to pick up other B.B.C. Stations.

This state of affairs can now be remedied by the use of the P.2 Eliminator. Merely attach it according to the marking on the terminals and your local B.B.C. Station can be reduced to dead silence even if you are within a couple of miles of it.

Self-contained for all wavelengths up to 600 metres, but provision is made for higher wavelengths.

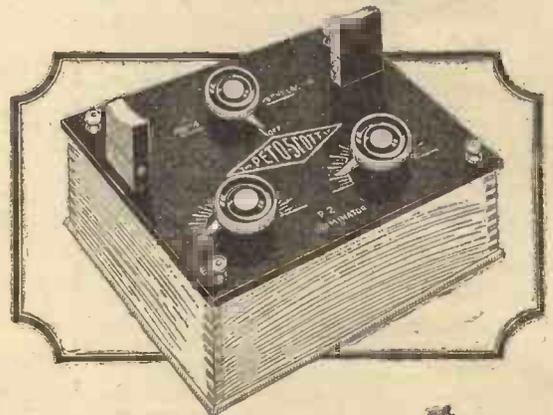
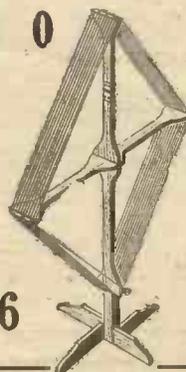
Send for one to-day—your Set is not complete without one.

Carriage paid **£3 3 0**

Frame Aerial

Highly finished frame Aerial, folds into small compass and packed in neat box. Special design enables it to be swung to point in any direction without lifting it off the table.

27/6



Dull Emitter Batteries

Specially designed for the new Valves, these batteries will give a continuous output of .5 to .8 ampere for a period of 3 to 5 hours at a stretch.

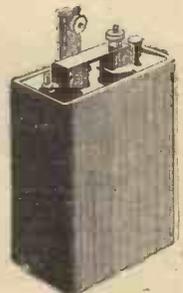
Their voltage is constant at 1.5 volts per cell.

To start the battery working it must be filled with water and allowed to stand for 2 hours before use. These cells will outlast at least three dry batteries.

In ebonite case each

7/6

(special price)



Peto-Scott Co., Ltd.

Head Office: **64, High Holborn, W.C.1**

(For all mail orders)

Branches: 3, Wellington Street, Strand, W.C.2
99, High Holborn, W.C.1.

Liverpool: 4, Manchester Street
Cardiff: 94, Queen Street.

SITTING UP TO HEAR AMERICA

Hulloa, America Calling!

I DID not manage to hear a great deal of the very successful transmission from the States which took place in the small hours of Tuesday, November 27. I had to come back by the last train, which owing to the dense fog was the best part of two hours late; hence I landed home cold and shivering and with fingers so numb that they could hardly move a condenser! Having thawed a little, I managed to pick up the last part of a cheery speech by Mr. Owen D. Young, which was transmitted by our old and tried friend W.G.Y.

It is reported that the transmission was received by amateurs as well as those professionally engaged in wireless all over this country. Truly a splendid performance, which reflects the greatest credit not only upon the sending stations, but also upon the very efficient receiving sets, many of them home-made, that are to be found everywhere to-day. These few nights have made history. It cannot be long now before Transatlantic telephony comes into everyday use. Before many months have passed we may be able to hear singers in

the Metropolitan Opera House at New York, whilst to reciprocate we send melody from Covent Garden across the Herring Pond.

The Reply

A second late-night—or early morning!—was not a prospect to be faced without a yawn or two. But enthusiasm kept me awake to hear what we could do in the small hours of the Wednesday morning. In case any of your friends in America should write to ask for confirmation of what they heard, here is the programme sent simultaneously from all stations as I noted it down:

- 3.5.—Call up by Captain Eckersley. "Hulloa, America!" and so on for three minutes.
- 3.8.—Senatore Marconi. Greetings to America, some account of his new short-wave directional system, and messages to personal friends.
- 3.15.—Georges Carpentier. Probably the shortest broadcast speech on record: "My best wishes to all American friends. I hope to come to America soon again."
- 3.16.—Pianoforte solo, "Three o'Clock in the Morning." (Very appropriate!)
- 3.19.—Second pianoforte solo (unnamed).
- 3.25.—Mr. J. C. W. Reith. Short speech, with messages to friends in Philadelphia, and request that those who had received the transmission would

- telephone to certain gentlemen in the morning.
- 3.28.—Gramophone record (unnamed).
- 3.32.—"The Stars and Stripes" played on the piano.
- 3.35.—End of simultaneous broadcasting.
- 3.36.—Individual broadcasting from all stations save Birmingham and Manchester.

2 L O had a fine supply of "juice," so much so that as I burned the midnight amp I had to detune considerably to avoid waking the sleeping household. He must have been heard well in many parts of the States.

J. H. R.

RADIO TRANSMITTERS' SOCIETY

AT the London School of Economics (Room 58B), on Friday, December 7, at 6.30 p.m., a discussion on "Aerial Design for 200 Metres Transmission" will be opened by Mr. George Leslie Morrow (6 U V).

All members of the Radio Transmitters' Society are asked to make an effort to attend this meeting, bring their friends, and join in the informal discussion which will follow Mr. Morrow's opening remarks.

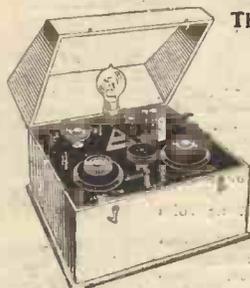
Interference is being caused in various parts of the country, it is reported, by persons "pumping out" crude Morse on spark sets during broadcasting hours.

Radiax Reflexive Receivers and Quality Accessories

Very much in the air just now are the various Dual Amplification or Super-imposition Circuits. In these circuits one or more of the valves is made to do double duty. This is a distinct gain, as tending towards economy of operation, reduction of prime cost, and compactness. We have produced a range of sets on this principle, which we believe embody the best points and circuits, and are, therefore, right up-to-date.

No. 27 (REFLEX) 3-VALVE

with one high and two stages of Low Frequency Amplification. This is an excellent Loud Speaker Set. Size 14 1/2 in. by 10 in. £12-15-0. Plus Marconi Royalty, 37/6.



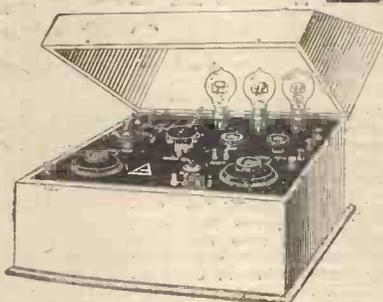
The RADIAX LATEST No. 31 REFLEX

A Splendid 1-Valve Crystal Combination, giving both high- and low-frequency amplification. At 20 miles good Loud Speaker results are obtained, and Glasgow is well received on 'phones at 300 miles. Aerial circuit tunes to 1,100 metres and has loading sockets for longer waves. Radiax plug-in anode coils enable all ranges to be used. Reception is of perfect purity, and this set marks a big jump in efficiency.

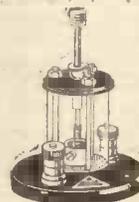
If a D.E. Valve is used Accumulators may be dispensed with. This Set is essentially "up to the minute." It makes its own valve do double duty—work overtime. And it does it well. Price £7-10-0. (Plus Royalties, 13/6.)

PRICES OF RADIAX REFLEX SETS IN PARTS FOR CONSTRUCTORS. The prices given below include the panel, the cabinet, all components, terminals, screws, switches, intervalve transformers or plug-in anode coils, reactance coils, connecting wire, insulating sleeving—everything to make the set. But 'not' phones, batteries, valves and aerial.

- No. 27P (3-Valve), £8-5-0 } Plus Royalty and Licence Plate, 37/6.
- No. 31P (1-Valve & Crystal), £5-5-0 } Plus Royalty and Licence Plate, 12/6.



Crystal Detector without large terminals on base for panel mounting, 1/9. Horizontal pat. heavy enclosed, 3/6. Opentype one-ebonite base, strong, 1/9. Set of same parts, 10/6.



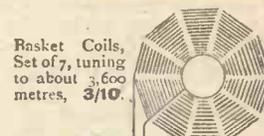
Everset Crystal to Crystal Detector, 2/9.



Basket Coil Mount, 1/3.



Standard Coil Socket, 1/-.



Basket Coils, Set of 7, tuning to about 3,600 metres, 3/10.



Radiax super-sensitive Headphones, 4,000 ohms, 22/6, with cords. French Headphones, well finished and efficient, 4,000 ohms, 13/9.



Variometers on tube formers with knob and pointer, as illustrated, 3/-. Better quality on ebonite with ball rotor, 10/6.

COIL HOLDERS.—3-way, 1 fixed, 2 variable, with long tuning handles, 7/6. 2-way, 1 fixed, 1 variable, 6/-. 2-way, cheaper set, 4/3. Coil mounting, strip fibre, per yard, 9d.



Filament Resistances, 6 ohms 4/-. 13 ohms Dull Emitter Resistance, 4/-. 300 ohms Potentiometer on the same principle, 4/-.
ACCUMULATORS
4 Volt 40 Amp. ... 19/6
6 " 60 " ... 36/6
H.T. BATTERIES
54 Volt ... 9/6
66 " ... 11/9



Variable Grid Leak, steadily variable 1 to 5 megs., 2/6.

Literature of all Sets, Components and Accessories, 3d. stamps. All applying will receive Complete New Catalogue free on January 1st, 1924.

RADIAX LTD.

20, RADIO HOUSE, PERCY ST., TOTTENHAM COURT ROAD, LONDON, W.1.

(3 minutes Tottenham Court Road or Goudge Street Tube). Museum 490.





Some of these transmissions are commercial or official. Wavelengths and times are liable to alteration without notice. The times given are according to Greenwich Mean Time.

London B.B.C. Station (2 L O), 363 metres. Weekdays, 11.30 a.m. to 12.30 p.m., concert; 5 p.m. to 5.30 p.m., women's half-hour; 5.30 p.m. to 6.15 p.m., children's stories (Mondays, 6.15 p.m. to 6.25 p.m., Boys' Brigade and Boys' Life Brigade news); 7 p.m. to 10.30 p.m., concert and news. Sundays, 3 p.m. to 5 p.m., concert; 8.30 p.m. to 10.30 p.m., concert and news.

Manchester B.B.C. Station (2 Z Y), 370 metres. Weekdays, 3.30 p.m., concert; 5 p.m., women's half-hour; 5.25 p.m., farmers' weather report; 5.30 p.m., children's hour (Mondays, 6.10 p.m., Boys' Brigade and Boys' Life Brigade news); 6.20 p.m. to 7.15 p.m. and 7.45 p.m. to 10.30 p.m. concert and news. Sundays, 8.30 p.m. to 10.25 p.m., concert and news, etc.

Birmingham B.B.C. Station (5 I T), 423 metres. Weekdays, 3.30 p.m. to 4.30 p.m., concert; 5.30 p.m. to 6 p.m., women's half-hour; 6 p.m. to 6.45 p.m., children's hour (Mondays, 6.45 p.m., Boys' Brigade and Boys' Life Brigade news); 7 p.m. to 10.30 p.m., concert and news. Sundays, 8.30 p.m. to 10.30 p.m., concert and news, etc.

Newcastle B.B.C. Station (5 N O), 400 metres. Weekdays, 3.45 p.m., concert; 4.45 p.m., women's half-hour; 5.15 p.m., children's hour; 6 p.m., scholars' half-hour (Mondays, 6.30 p.m., Boys' Brigade and Boys' Life Brigade news); 7 p.m. to 10.30 p.m., concert, news. Sundays, 8.30 p.m. to 11 p.m., concert and news, etc.

Cardiff B.B.C. Station (5 W A), 353 metres. Weekdays, 3.30 p.m. to 4.30 p.m., concert; 5.30 p.m. to 6 p.m., women's half-hour; 6 p.m. to 6.45 p.m., children's hour (Mondays, 6.45 p.m., Boys' Brigade and Boys' Life Brigade news); 7 p.m. to 10.30 p.m., concert and news. Sundays, 8.10 p.m. to 11 p.m., concert and news.

Glasgow B.B.C. Station (5 S C), 415 metres. Weekdays, 3.30 p.m. to 4.30 p.m., concert; 5 p.m. to 5.30 p.m., women's half-hour; 5.30 p.m. to 6 p.m., children's hour (Mondays, 7.15 p.m., Boys' Brigade and Boys' Life Brigade news); 7 p.m. to 10.30 p.m., concert and news. Sundays, 8.30 p.m. to 10.45 p.m., concert and news, etc.

Bournemouth (6 B M), 385 metres. Weekdays, 3.45 p.m. to 4.30 p.m., concert; 5.15 p.m. to 10.15 p.m., concert and news. Sundays, 8.30 p.m. to 10.15 p.m., concert and news.

Aberdeen (2 B D), 495 metres. Weekdays, 3.30 p.m. to 4.30 p.m., concert; 5 p.m. to 6 p.m., women's half-hour and children's corner; 7 p.m. to 10.30 p.m., concert and news. Sundays, 8.30 p.m. to 10.30 p.m., concert and news.

Croydon (G E D), 900 metres. Daily.

Eiffel Tower (F L), 2,600 metres. Daily, 6.40 a.m. to 7 a.m., weather forecast; 11.15 a.m. to 11.30 a.m., weather forecast; 12.0 noon, news; 3.40 p.m., Stock Exchange news; 5.30 p.m. (Saturdays excepted), Bourse closing prices; 6.10 p.m., 7 p.m., and 7.20 p.m. (Sundays only), concert and news; 10 p.m., weather forecast.

Paris Concerts Radiola (S F R), 1,780 metres. Daily, 12.30 p.m., concert and news; 1.45 p.m., first Bourse report; 4.30 p.m., Bourse closing prices; 4.45 p.m., concert and news; 6.45 p.m., news; 8.30 p.m. to 9.30 p.m., concert; also concert from 2 p.m. to 3 p.m.; 10 to 10.45 p.m. on Sundays.

(Continued on page 656)



Gilbert Ad.

"BROADCAST TELEPHONY" (continued from p. 655)
 Rome (I C D), 3,200 metres. Daily, 10 a.m.
 Königswusterhausen (I. P), 2,800 metres.
 Daily, 7 a.m. to 8 a.m., Stock Exchange news;
 11 a.m. to 12.30 p.m., news and concert;
 4 p.m. to 5.30 p.m., Stock Exchange news.
 Ecole Supérieure des Postes et Télégraphes,
 450 metres. 3.30 p.m. to 4 p.m. (Wednesday
 and Friday), 7.45 p.m. to 10 p.m. (Tuesday
 and Thursday), 2.30 p.m. to 7.30 p.m. (Saturday),
 concerts.

THE TEST WITH AMERICA

THE tests with America that the B.B.C. have been conducting recently have been, on the whole, very successful. The first test was transmitted simultaneously from all stations at 3 a.m. on Monday (November 26), which coincides with 10 p.m. on Sunday (November 25) in America. Reports were received from New York, Long Island and Chatham with reference to this transmission. London, Bournemouth, Glasgow, Cardiff and Newcastle were all heard in the States when each station broadcast a short programme separately. It was also reported that Liverpool had been received, and as there is no broadcasting station there it would appear that some amateur transmitter "got across."

America was heard by many listeners in this country on Tuesday morning (November 27). The following stations were logged by amateurs residing in

different parts: WGY, WHAZ, KDKA, WMAF, KSD and WQR. Atmospherics were bad, and interference from oscillating sets spoilt reception in many districts.

On Wednesday (November 28) both Senatore Marconi and Georges Carpentier spoke for a few minutes at 3.5 a.m. M. Carpentier's speech consisted of but eighteen words, probably the shortest speech that has ever been broadcast.

Senatore Marconi stated in his speech that "With a strikingly small power we are paving the way for future developments which may make a striking difference to the world's history. I have been making experiments with short wavelengths, and it may be possible to send between Britain and the United States wireless beams which cannot be tapped except at points between the two stations. Although it is true that the wireless telephone has formerly bridged the Atlantic, never before have actual messages been exchanged in the way that we are exchanging them in this series of tests."

The first broadcasting station in Australia to commence operations is situated in Sydney, and has a range conservatively estimated at 500 miles. Messrs. Farmer and Co., a leading firm of drapers, are supplying the service. Other stations contemplated are to be erected in Melbourne, Adelaide and Brisbane.

RADIO SOCIETY OF GREAT BRITAIN

T. and R. Section

DURING the week ending November 25 many members of the T. and R. Section were endeavouring to work relays. This was the first attempt at forming organised chains of communication. Acting on experience gained in the preceding tests, the chains were formed when possible of members resident within fifty miles of each other. The results show that it is not easy to establish perfect relay communication. It is a striking fact that several of the stations which are received well at considerable distances cannot always be heard at distances of only 50 or 100 miles.

Concurrently with the Franco-British tests, arrangements have been made with the Cercle Vervietoix d'Etudes Radio-electrique to listen-in for signals on about 400 metres which will be sent out by members of the T. and R. Section early in December.

Reports regarding the reception of the French amateur signals are being received and the substance of these will be published after the conclusion of the tests.

At least one amateur by connecting-up a set wrongly has improved results in comparison with the standard circuit by at least 100 per cent.



Get the Best from your Set

THE "M-L" Twin-Coil Intervalve Transformer will give you the best possible results from your set.

Signals will come in with great strength and without that distortion so detrimental to good reception.

Stoutly built, it is perfectly insulated and proof against dust and damp.

It possesses high primary inductance combined with very low self-capacity, and does not distort even when the Anode Voltage is raised.

Price 30/- carriage paid.

Ready for mounting.

We invite applications from traders for terms.



Write for full particulars.
 The M-L MAGNETO
 SYND., Ltd.
 (Wireless Dept.),
 Victoria Works, Coventry.

The following is an extract from a letter we have received from a satisfied user:

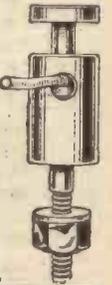
"I am more than pleased with the results. The greatly improved reception since fitting these transformers is indeed amazing....."



PRICES REDUCED

from December 1
 SPRING TERMINALS
 AND CUPS

4½d. each.



The superiority of the new super-sensitive
REFTONE CRYSTAL
 is as marked as that of the cups and terminals
 Prices 6d., 9d. and 1s.

REFTY ELECTRICAL LTD

2, FEATHERSTONE BUILDINGS, HOLBORN, LONDON, W.C.1
 Phone: Chancery 8264

A BOOK BARGAIN

Technical Instruction for Wireless Telegraphists

A Handbook by HAWKHEAD & DOWSETT. Full descriptions of both old and new type apparatus. A complete theoretical course. 344 pages; 240 illustrations. 2nd Edn., 1918. Pub. 6/6. Army surplus. Our offer (as new) 3/6 post free. Mention offer 104.

FOYLES, 121, Charing Cross Road, London.
 Immense Stock (Second-hand and New) on all subjects.



Price 2/6 each

THE BEST VARIABLE
 GRID LEAK MADE

WATMEL VARIABLE GRID LEAK

THE Resistance is steadily variable between ½ to 5 megohms - this is attained by the compression of high resistance pellets. Only requires a ½-in. hole in panel for fitting. Suitable for use in any circuit, and improves the working of any valve detector. Also 50,000 to 100,000 ohms. 3/6. Beware of imitations, see the name Watmel on every grid leak.

WATMEL WIRELESS CO.
 Connaught House, 1a, Edgware Rd., Marble Arch, W.2
 Telephone: 4575 Paddington.

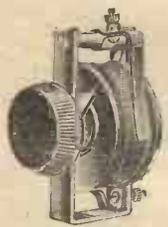
For dependability use

"IGRANIC" RADIO DEVICES



INTERVAL TRANSFORMERS
(Patent Applied for)
Correctly designed for minimum distributed capacity. Low core losses. Coil wound by patent cotton interweave process. Maximum amplification without distortion.
Open type 20/-
Shrouded Type 21/-

FILAMENT RHEOSTATS
(Patent No. 195903)
These Rheostats are supplied in two types—Vernier Type for Detector Circuits and Plain Type for Amplifying Circuits. Both types designed for individual valve control.
Price with Vernier, 7/- Without Vernier, 4/6
Obtainable from all High-class Dealers.
WRITE FOR LISTS Z 135.



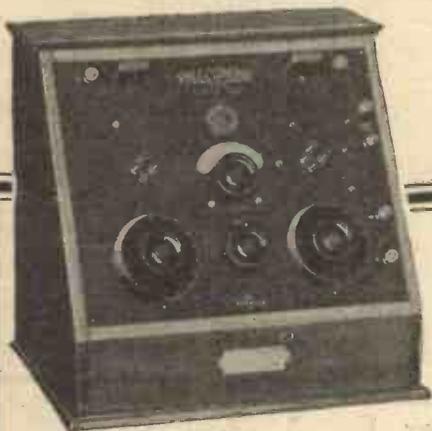
BATTERY POTENTIOMETERS
(Patent Applied for)
"Igranic" Battery Potentiometer furnishes the precise control of the plate potential so necessary for the successful operation of the sensitive detector valve. Resistance—300 ohms.
Price 7/-

149, Queen Victoria St., **IGRANIC** Elstow Road, Bedford
LONDON ELECTRIC Co. Ltd.

FELLOWS

AMUSEMENT ALWAYS.

Wherever you are, under whatever conditions, the Fellows Super 2-Valve Set will bring the real pleasures of good entertainment produced in the best possible form to your door.



A 2-Valve Set of Superior quality mounted in a highly-finished case, that will receive any British or Continental telephony even though the nearest Broadcasting Station is working.

PRICE: COMPLETE WITH H.T. BATTERY ACCUMULATOR, 300 ft. 7/22 STRANDED COPPER WIRE, 2 INSULATORS, 2 pair 4,000 ohm HEADPHONES.

£9

plus B.B.C. tax, 15s.; Marconi tax, £1 5s.; and 2 valves.
A new 2-valve amplifier mounted in cabinet uniform with super 2 set **£5 10s.**, plus B.B.C. tax, 10s., plus 2 valves.

Fellows Magneto Co., Ltd., London, N.W. 10

Telephone: Willenton 1360-1 Telegrams: "Quifmag," Phone, London.



RADIOHM SPARKS RADIO SUPPLIES

Something for Everybody

For the Beginner.—A first-class Crystal Detector, with Ebonite Ball rotor Variometer, range 30 miles **30/-**

For the Critical Music-lover.—A Perfect tone Crystal-valve receiver. Wonderful Reception, Long Range: Loud Speaker at 10 miles **£7:7:0**

For the Experimenter.—Army condensers .0005, Square section Copper Rod 1/8 in. tinned, 2 ft. lengths. Fine for wiring, it stays put **3d.**
All parts for any circuit.

SPECIAL! "RADIOHM" RIBBON AERIAL, better than wire, gives 25 per cent. improved signal. 100 ft. **3/-**
Send for List. Trade Supplied.

Complete Receiving Outfits supplied on Deferred Payments.
SPARKS RADIO SUPPLIES, Dept. A,
43, GREAT PORTLAND ST., LONDON, W. 1.

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

The **"BROWNIE WIRELESS"**

CRYSTAL RECEIVER.
7/6 COMPLETE. BY POST 8/6.

Contains every part necessary for simple erection. A scientific achievement. Guaranteed equal to our staff in the north of London, and with four pairs of headphones attached in parallel gave clear and sufficiently loud speech. We can answer for the excellent results to be obtained.

Send postcard for folder "The Brownie Wireless and all about it."

The J. W. B. WIRELESS COMPANY,
19, GARRICK STREET, LONDON, W.G.2.
(First Floor). Near Leicester Square Tube Station.





CLUB DOINGS

Mount Pleasant Radio Research Society

Hon. Sec.—G. H. VINE, 23, Melville Road, Walthamstow, E.17.

On Nov. 4 this society visited the Croydon Aerodrome and spent several hours in the wireless buildings, where the operator explained and demonstrated the apparatus in use.

The Bellini-Tosi system of direction-finding aroused much interest, as did also the nine-valve set in use.

Manchester Radio Scientific Society.

Hon. Sec.—G. A. F. MERCER, 116, Burton Road, Withington, Manchester.

The weekly meeting of the above society was held on Oct. 31. Mr. Jackson lectured on "Battery Charging from D.C. Mains."

Barking and District Radio Society

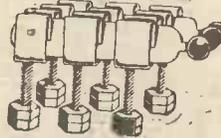
Hon. Sec.—E. R. WILLETT, 16, Monteagle Avenue, Barking.

The secretary of this recently-formed society will be pleased to communicate with intending members.

SMALL NICKELLED SWITCHES

D.P.D.T.
2s. each.

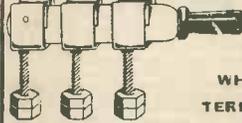
Illustrations 1/2 size



O. H. OSBORNE
WIRELESS ENGINEER

816-818, GARRATT LANE, TOOTING, S.W. 17

S.P.D.T.
1s. 6d. each



WHOLESALE & RETAIL
TERMS ON APPLICATION

ANNOUNCEMENTS

"Amateur Wireless and Electric." Edited by Bernard E. Jones. Price Threepence. Published on Thursdays and bearing the date of Saturday immediately following. It will be sent post free to any part of the world—3 months, 4s. 6d.; 6 months, 6s. 9d.; 12 months, 17s. 6d. Postal Orders, Post Office Orders or Cheques should be made payable to the Proprietors, Cassell & Co., Ltd.

General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheet.

Contributions are always welcome, will be promptly considered, and if used will be paid for.

Queries should be addressed to the Editor, and the conditions printed at the head of "Our Information Bureau" should be closely observed.

Communications should be addressed, according to their nature, to The Editor, The Advertisement Manager, or The Publisher, "Amateur Wireless," La Belle Sauvage, London, E.C.4.

ELECTRADIX RADIOS

IMMEDIATE DELIVERY FROM OUR HUGE STOCKS

Everything from a Wavemeter to an Earth Clip. The best equipped City depot.

WAVEMETERS, all types, 100 to 10,000 metres Govt. calibrated. Limited number, special prices

COME AND SEE US
9, COLONIAL AVENUE is first opening on left in the Minories, near Aldgate Station, Metropolitan Railway.

LESLIE DIXON & CO.,
9, COLONIAL AVENUE, MINORIES, E.1

ACCUMULATORS

C.A.V. Fullers, etc. Guaranteed brand new and perfect but slightly soiled. We refund cash with carriage both ways if returned within 7 days.

1V-40a	17/-	6V-40a	25/-
4V-60a	21/6	6V-60a	32/6
4V-80a	27/6	6V-80a	40/-
4V-100a	32/6	6V-100a	47/6

Teak cases, polished and fitted with fuses and switch for 6/6 or 4/60, only 6/6 each. Original cost, 2/11.

Special Line. Best English Make, 6v. 60 amp. h.dur. 22/9 each
MAUDE RUBBER CO., 58, Praed St., W.2.

FOUR "AMATEUR WIRELESS" HANDBOOKS—1s. 6d. each

WIRELESS TELEPHONY EXPLAINED
By J. HARTLEY REYNOLDS & G. L. MORROW
A simple explanation of Wireless that should be in the hands of every amateur.

WIRELESS COMPONENT PARTS
Tells how to make all the parts used in the construction of receivers.

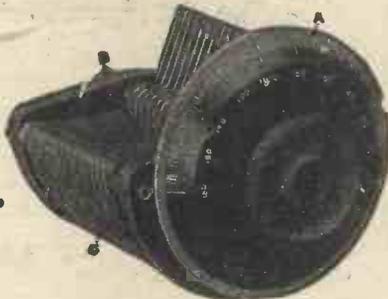
CRYSTAL RECEIVING SETS
Constructional details of useful Crystal Sets for amateur construction.

SIMPLE VALVE RECEIVING SETS
One-, two-, three- and five-valve sets can be made with the help of this book.

CASSELL & COMPANY, LIMITED, LA BELLE SAUVAGE, LONDON, E.C.4.

"As good as the best!"

Our Famous Type A II Condenser



—for Panel Mounting

—is UNSURPASSED for Workmanship, Quality of materials Employed and Efficiency
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.—Stout, well-cut Aluminium Vanes.

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 3/4 in. thick by drilling 3 holes. Supplied with screws for fixing.	Plates	Retail Selling Prices
57	... .001	10/-
29	... .0005	8/6
19	... .0003	6/9
13	... .0002	5/6
15	... .00025	6/-
3 Plate	Vernier	3/9
5 Plate	Vernier	4/6

Our Motto is **QUALITY FIRST**, and every Condenser carries our money-back guarantee.

Cash with Order. Please include postage on each article.

Stockists everywhere. Too numerous to mention in this space.

Our motto is **QUALITY FIRST**, and every Article carries our money-back guarantee.

REVISED TRADE TERMS

REPUTATION

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

London Agen's: Vanstones, Ltd., 61, Chandos Street, London, W.C.2.
Sole Trade Distributors—Messrs. G. W. I. Ltd., Shanklin Road, Crouch End, London, N.8, to whom all Trade Enquiries should be sent.

FIXED CONDENSERS



Guaranteed .0001, .0002, .0003, .0005, .001, .0015. Moulded cases fitted with nuts and soldered tags.
Price 1/9 each.
Post Free.

VARIOMETER



The finest Variometer on the market at any price. Inside winding. Suitable for broadcast reception on any P.M.C. Aerial, extraordinary close coupling, ensuring large tuning range. On a 30 ft. indoor aerial the max. wave-length exceeds 420 metres (and the minimum on a 100 ft. aerial is below 350 metres. The max. on a full size outdoor aerial is 700 metres and the min. on a 30 ft. is 200 metres. Inductance, the highest possible—9.5 to 1. Metal feet can be adjusted to four different positions.
Price 15/-

"DUANODE CONDENSER"

Realising the difficulty of tuning a circuit in which two stages of tuned anode H.F. Amplification is used, we have designed the "DUANODE" Condenser, as illustrated. This Condenser consists of TWO matched Condensers, operated by one knob, thus by using matched COILS it is possible to tune BOTH Circuits perfectly with



one operation only. If any difficulty is experienced in matching the coils they may be roughly matched and a Vernier Condenser connected in parallel with the smallest. The two sets of fixed Vanes are carefully insulated one from the other, and the moving Vanes connected electrically; the spindle can thus be connected to H.T. Positive. This condenser can also be used for other purposes. The two halves (each of .0002 mfd.) can be used in series or parallel, giving capacities of .0001, .0002 and .0004 mfd. This condenser has been used with great success in Trans-Atlantic tests. Price 25/-

ALL BRITISH MANUFACTURE. Prompt Delivery.

FALLON

THE CONDENSER PEOPLE,
230a, Hermitage Road, London, N.4.
FALLON CONDENSER MFG. Co., Ltd. Telephone: Tottenham 1932.

-Buy British Goods Only-

EDISWAN

THE LATEST
DULL EMITTER VALVE



TYPE AR-06
30/-

This valve can be run off dry cells, thus banishing accumulator troubles and reducing the upkeep cost to a minimum. The current consumption at a filament voltage of 2.5 volts is only .06 of an ampere. Another feature of this valve is the special safety cap (Prov. Pat.). The filament pins are shorter in length than the plate and grid pins. It is therefore impossible for the filament pins to make surface contacts on the wrong sockets. This, however, does not prevent the valve being used in a standard holder.

SPECIFICATION:

Filament voltage 2.5 volts. Bulb diameter, 31 m/m.
Filament current .06 amps. Overall length, 120 m/m.
Plate voltage . . . 20 - 50 volts. Cap (Prov. Pat.) 4 pin safety.

Write to-day for leaflets fully describing our range of Sets & Parts. If your dealer does not stock send us his name & address. We'll see that you get what you want.

Free on Request. Just send a postcard for our Illustrated Booklet "The Thermionic Valve."

The EDISON SWAN ELECTRIC Co. Ltd.
123/125, Queen Victoria Street, E.C.4,
and 71, Victoria Street, S.W.1.

Branches in all Principal Towns. Works: Ponders End, Middlesex.



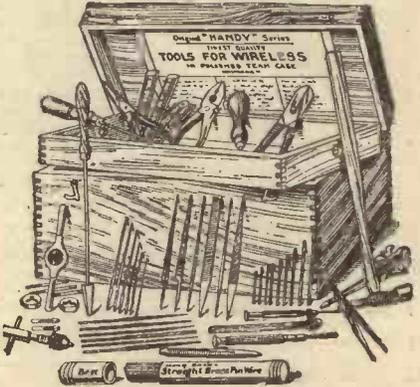
Contractors to H.M. Admiralty, War Office, Royal Air Force

Your parts will cost less at GAMAGES

Everything from a complete set to the smallest accessory at Gamages. Write for the New Illustrated Wireless List. We will send you a copy post free upon application. Orders by post receive the same careful attention as is accorded to personal buyers.

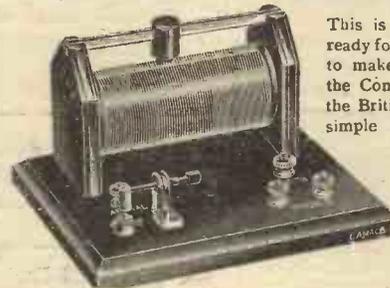
Special Set of Tools for Wireless

Set 1, comprising 1 set of B.A. stocks and dies, with taps Nos. 2 and 4; 1 set of carbon steel twist drills, 1/16, 5/64, 3/32, 1/8, 5/32, 3/16; Set of 6 engineer's files; pair of polished combination pliers, combination drill chuck, tap wrench and tool holder; soldering iron; solder; bradawl; box 70 lengths hard brass wire; centre punch; jeweller's turn-screw with three extra blades; forged steel metal snips; nickel-plated fixed turnscrew. Price, complete in Teak Box, **30/-**



Set 2, comprising 1 set of B.A. stocks and dies, taps; 1 set of twist drills; 1 set of 6 engineer's needle files; 1 set of 3 1/2" files; 1 combination drill chuck, tap wrench and tool holder; Lancashire brooch, solder iron; solder 2' rule; electrician's turnscrew; pliers; long-nose pliers; bradawl; 1 box of 70 lengths hard brass wire; pattern-maker's hammer; pin tongs; pin vice; jeweller's turn-screw with 3 extra blades; nickel-plated fixed turnscrew; tweezers, etc. Price, complete in Teak Box **52/6**

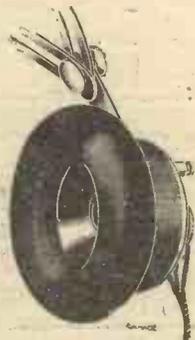
THE IDEAL CHRISTMAS PRESENT



This is a real Crystal Set supplied in parts ready for you to assemble so that you are able to make your own Wireless Set and receive the Concerts from within 20 miles of any of the British Broadcasting Stations. The Set is simple and instructive, and something more than a toy when finished. Included with this Set is a piece of our famous "Permanite," the most sensitive Crystal in the world. Supplied complete in box, with full instructions, Price **12/6**

Brown's Featherweight Phones, 4,000 ohms 25/
Sterling Phones, 4,000 ohms 25/
Aerial Wire, 100 ft. 2/9. Insulators, each . . . 2d
Postage gd. extra.

Pneumatic Ear Pads



To fit Standard Receivers. Ensures maximum comfort. Price per pair. **4/-**
Post 6d.

USERS OF "PERMANITE"

Regd. Trade Mark No. 438911

CRYSTAL

as supplied by Gamages (and there is a difference) always get the maximum results. It is the only crystal that can guarantee this efficiency. Highly sensitive and remains in adjustment longest. Clear, powerful results. PRICE per large Specimen **1/6**
Post Free

We have hundreds of testimonials testifying to its **WONDERFUL EFFICIENCY.**

Watch Type Combined Dead Beat Volt-ammeter



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

A. W. GAMAGE, Ltd., HOLBORN, LONDON, E.C.1
City Branch: BENEFINKS

Amateur Wireless

COUPON
Available until Saturday,
December 15, 1923.



Getting at the bottom of it

BEFORE you can hope to understand the working of your Set you must first master the theory of the Valve. The easiest way to do this is to read the excellent books on the Valve written by John Scott-Taggart, F.Inst.P. (Editor of "Modern Wireless"). A new one has just been issued entitled "Radio Valves and How to Use Them." It deals with its subject in a most interesting manner. You cannot fail to understand how the Valve works after reading it. Why not get a copy to-day—it will be half-a-crown well spent.

ABRIDGED LIST OF BOOKS:—

Wireless for All. By John Scott-Taggart, F.Inst.P.	6d
Simplified Wireless. By John Scott-Taggart, F.Inst.P.	1/-
How to Make your Broadcast Receiver. By John Scott-Taggart, F.Inst.P.	1/6
How to Erect Your Wireless Aerial. By B. Mittell, A.M.I.E.E.	1/-
The Construction of Wireless Receiving Apparatus. By P. D. Tyers	1/6
The Construction of Crystal Receivers. By Alan L. M. Douglas	1/6
How to Make a "Unit" Wireless Receiver. By E. Redpath	2/6
Pictorial Wireless Circuits. By Oswald J. Rankin	1/6
Wireless Valves Simply Explained. By John Scott-Taggart, F.Inst.P.	2/6
Practical Wireless Valve Circuits. By John Scott-Taggart, F.Inst.P.	2/6
Radio Valves and How to Use Them. By John Scott-Taggart, F.Inst.P.	2/6
500 Wireless Questions Answered. By E. Redpath and G. T. Kendall	2/6
12 Tested Wireless Sets. By P. W. Harris	2/6
More Practical Valve Circuits. By John Scott-Taggart, F.Inst.P.	3/6
Home-built Wireless Components	2/6

Postage
2d. per
Volume
extra

SOLD BY ALL BOOKSELLERS
Radio Press, Ltd.,
Devereux Court, Strand, W.C.2.

HEALPHONES, 4,000 OHMS.
Great Bargains—11/6, 12/6, 14/6. Guaranteed Perfect.
Newington Trading Co., 1, Adelaide Street,
Charing Cross, W.C.2:

BEGINNERS' GUIDE TO WIRELESS...
BEST BOOK OBTAINABLE.
Explains in plain everyday language, everything you wish to know about **WIRELESS TELEGRAPHY**. How to **ERECT, CONNECT** and Make Aerials, complete circuit and valve sets, tuners, coils, etc., also the latest two and three-valve tuned anode receivers, and one and two-valve amplifiers.
144 pages including 28 diagrams. 1/3 post free.
SAXON RADIO CO. (DEPT. 12), BLACKPOOL.

WIRELESS OPERATORS
THE Royal Air Force requires skilled and semi-skilled Wireless Operators of good education. Age limits:—Ex-Service men 18 to 30; non-ex-Service 18 to 26; highly skilled operators up to 35; ex-N.C.O.s up to 38 (with rank according to trade ability). Commencing rate of pay 27/- to 59/6d. per week and all found. Allowance for wife and children to men 26 and over. Write, stating age, or call:—Inspector of Recruiting, R.A.F., 4, Henrietta Street, Covent Garden, London, W.C.2.

1,000 Single receivers made in London
Trade supplied 4/6
(Post 4d.)
2,000 Single receivers made in London
2,000 ohms
EVERY ONE GUARANTEED TESTED ON CRYSTAL
F. HOWE, 67, Little Heath, CHARLTON, S.E.7.

T. O. BUSS,
77, CLERKENWELL RD., E.C.1

VARIOMETERS.
Brushed Bearings, Ebonite Dial 0-100, and Knobs. Metal Parts Plated. Wavelength 30 to 560 metres. Adequate provision is made for mounting on a panel, and the dial is neatly and clearly engraved.

Marvellous Price 4s. 6d.
Trade Supplied Post 6d. extra.

DEC. 29

ISSUE

GOES TO PRESS

DEC. 19

BURNT-OUT PHONES
and transformers rewound to high resistance. Phones, 4,000 ohms, 5/- pair. Post 6d. Loud Speakers 5/- Post 6d. Guaranteed.
JOHN W. MILLER, 70-71, FARRINGTON STREET, E.C.4.

EBONITE PANELS
DIRECT FROM MAKERS. THE FINEST QUALITY
1" thick. MATT FINISH
8" x 5" ... 2/6 each. 12" x 6" ... 4/6 each
9" x 6" ... 3/4 " 12" x 12" ... 9/- "
Any size supplied at 1d. per square inch.
POST AND PACKING FREE
W. CHILD, 18, Corporation St., Manchester

CRYSTAL USERS READ THIS
Make an Amplifier and increase your Signals 5 times. Glasgow and Newcastle heard in London. Complete set of parts, including Cabinet, Drilled Ebonite Panel, Rheostat, all Terminals, Labels, Wire etc., with clear Wiring Diagram, 16/6 Carr. paid. Cash with order.
F. H. GOBLE, 50, Tottenham Court Rd., LONDON, W.1

CABINETS YOU WANT
PICKETT'S CABINETS—they're good value, from 1/6 each, highly polished.
Cabinet (A.M.) Works, Albion Rd., Bexley Heath, S.E. Write for Lists.

VALVELESS AMPLIFICATION
The "Varos" Relay magnifies crystal (or Valve) reception 3 to 5 times without valves, magnets, etc., and renders it audible in the room. A dry cell runs it for months. Cheap, simple and very interesting to make from our detailed instructional drawings of relay, loud speaker and circuit 2/6, including one "Carbox" piece.
DEBENHAM & CO.,
Letters only to: 6, LOAMPIT VALE, LONDON, S.E.13

ADVERTISEMENT INSTRUCTIONS for "Amateur Wireless" are accepted up to **first post on Friday morning** for following week's issue, providing space is available.

PREPAID ADVERTISEMENTS.
Advertisements under this head are charged **THREEPENCE PER WORD**, minimum charge **THREE SHILLINGS.**

DEPOSIT SYSTEM.
As the Publishers cannot accept responsibility for the bona fides of Advertisers in this publication they have introduced a system of deposit which it is recommended should be adopted by readers when dealing with persons with whom they are unacquainted. It is here explained.
Intending purchasers should forward to the Publishers the amount of the purchase money of the article advertised. This will be acknowledged to both the Depositor and the Vendor, whose names and addresses must necessarily be given. The Deposit is retained until advice is received of the completion of the purchase, or of the article having been returned to and accepted by the Vendor. In addition to the amount of the Deposit, a Fee of 6d. for sums of £1 and under, and 1s. for amounts in excess of £1, to cover postage, etc., must be remitted at the same time. In cases of persons not resident within the United Kingdom, double fees are charged.
The amount of the Deposit and Fee must be remitted by Postal Order or Registered Letter (Cheques cannot be accepted), addressed to "AMATEUR WIRELESS,"
ADVERTISEMENTS DEPARTMENT,
LA BELLE SAUVAGE, LONDON, E.C.4.

WIRELESS INVENTORS.—Patents and Trade Marks advice. Handbooks and Consultations free.—King, Regd. Patent Agents, 144, Queen Victoria Street, London. Phone, 681 Central. [1a]
RECEIVERS and loud speakers re-wound up to 2,000 ohms. 8s. 6d.—M. E. Hampshire, 130, Sydenham Road, S.E.26. [3r]
AGENTS WANTED.—To collect burnt-out wireless valves for repair. Write Trade terms, also burnt-out valves bought for cash at 9d. each. M. & G., 60, Churchfield Road, Acton, W.4. [1r]

LOUD SPEAKER HORNS. Guaranteed perfect acoustics. Enamelled Black Matt, complete with Polished Aluminium Base for Receiver, 4s. 6d. Post, etc., is Midland Radiophone Co. 43, St. Pauls Church, Coventry. [6c]
B.B.C. CRYSTAL SETS (stamped). Agents wanted for districts within 25 to 30 miles of any broadcasting station. Prices from 7s. 9d. to 13s. 9d. each. Every set guaranteed.—Simons, 100, Houndsditch, London E.1. [7r]

SEND 2s. for one doz. Nisso Gillette razor blades and receive another dozen free.—Chiswell.
MOULDED SINGLE RECEIVERS, 2,000 ohms. 8s. 11d. Postage 4d.—Chiswell, 21, Rowena Street, Bolton. [1s]
AMPONITE crystal intensifying solution, clarifies crystals, makes them highly sensitive. "Don't scratch," 9d. per bottle, post paid.—Sole Proprietors, Homan Bros., 8, Mansfield Road, Hampstead, London, N.W.4. [6c]

"KENITE" highest insulating panels, freedom from leakage. 12 in. x 9 in. x 3/16 in., 2s. 6d.; 9 in. x 6 in. x 3/16 in., 1s. 5d. post free. Trade quoted 7 lb. upwards.—Crosonia Co., 10, South Street, E.C.2. [8s]
CABINETS to hold wireless receiving sets. Made in Oak, Mahogany, etc. Any quantity.—Swift and Goodinson, Ltd., Headford Case Works, Sheffield. [14s]

HOME CONSTRUCTORS.—For parts at lowest prices and quick delivery send to Webb and Goward, Caxton Street, Market Harborough. Lists free. [5s]
LIVERPOOL AMATEURS—NOTE.—Cheapest wireless house. One valve (unit system), elegant instruments. Valve, aerial, Accumulators, phones, etc., included, £4 19s.; high frequency panels 45s. 6d.; low frequency panels 10s. 6d. with valves. List free. Hundreds testimonials.—Liverpool Radio Supplies, 110, Myrtle Street, Liverpool. [13s]
CABINETS made to order, mahogany or oak. Price on receipt of sketch.—Carter, T. Pembroke Road, North Wembley. [9r]

LOUD SPEAKER Crystal Set. Customer writes: "I have constructed set as per your diagram, and results are by far the best I have obtained." Full instructions 1s. 2d.—Hayes Manufacturing Co., 15, Summer Row, Birmingham. [16s]
CHEAP SHELL LOUD SPEAKERS.—Finest in tone and articulation—See "Popular Wireless," 24 November. Fitted complete with 4,000 ohms receiver, £1.—Wilshire Wireless Stores, Coombe Road, New Malden. [17s]

SPENCER'S STORES
4-5, MASON'S AVENUE,
BASINGHALL ST., LONDON, E.C.2
TELEPHONE:—LONDON WALL 2292

VALVES REPAIRED
7/6. Postage 6d.
NOTE.—BRING OR SEND ALL VALVES DIRECT TO ADDRESS AS ABOVE

CRYSTAL SETS
with this mark are of guaranteed efficiency, long range, and high-class finish (London made).
Send for Details
F. BROWN, Limited,
Langley Works, Long Acra, W.C.2

THE THRILL OF DISTANCE

THERE IS NOTHING LIKE

LISSEN radio frequency amplification for bringing in distant stations. Concerts from many cities come in with a certainty which has to be experienced to be understood.

With aerial reaction, always use one stage of LISSEN REACTANCE (Prov. pat.): It obviates the need for using a tight reaction coupling, and brings in the messages of distant stations clear and strong, because there are no peaks and depressions in the amplification range.

Its rapid tuning, ease of handling, simple adjustment and its extraordinary efficiency, have made LISSEN REACTANCE (Prov. pat.) the most widely used H.F. coupling. Every stage added to a receiver gives great range and power. It MAKES H.F. AMPLIFICATION EXTREMELY EASY.

Takes the place of plug-in coils, inconvenient plug-in transformers, and bulky anode coils. As well as adding great range LISSEN REACTANCE (Prov. pat.) steps up even the loudest of signals almost as much as a good audio frequency transformer.

Diagram with each shows the two easy connections—LISSEN ONE-HOLE FIXING, OF COURSE—switch already mounted dispenses with drilling and soldering.

These prices now bring LISSEN Reactance within the reach of all.



Sold previously for 32/6 and 27/6 respectively. Large production, brought about by greatly increased demand, have now made it possible to sell LISSEN Reactance at

17/6 for 150-600 metres range, with 6-point switch complete.

19/6 for 150-10,000 metres range, with 11-point switch complete.

Successfully used in the Reception of AMERICAN TELEPHONY

LISSEN REGENERATIVE REACTANCE (prov. pat.) makes a receiver extremely sensitive. It replaces aerial reaction—is non-radiating—replaces plug-in coils—it is lower in cost than a set of coils to cover the same wide range—it is easier to handle, one knob controls tuning and reaction—reception is often possible with both aerial and earth connections dispensed with—cuts out the local station and tunes in the others with full built-up strength—Continental stations come in easily. Introduced into the anode circuit, it forms an unequalled first stage H.F. Blue print with each shows easy connections—unbroken regeneration possible over the whole range—150 to 4,000 metres.

Complete with internally connected switch—no soldering—LISSEN one-hole fixing, of course.

£2 : 12 : 6

Tune always with a Vernier (preferably use the LISSEN VERNIER, barely 1 in. diameter, specially designed for fine tuning in H.F. circuits, 3 1/2 in. long, 12/6).



A Sentinel beside your Receiver—the LISSENCEPTOR (Prov. pat.)

It stands beside your receiver and acts as an impassable barrier to any unwanted signals and all interference. May be built into a receiver or used outside it without a single alteration in the wiring of any set being necessary. No losses owing to its design and windings. It is, however, important to use a condenser to tune it which has low losses (preferably use the LISSEN MICA VARIABLE CONDENSER, .0005 capacity, 17/6). Attach this combination to any receiver and—FORGET THE INTERFERENCE!



LISSENCEPTOR, Mark 1 type, for broadcasting ... 7/6
 " " " " " " 600 metre traffic ... 7/6
 Note the price.
 LISSEN ONE-HOLE FIXING—table or panel mounting.

The LISSENCEPTOR intercepts unwanted frequencies.

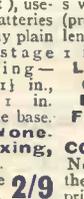
LITTLE SWITCHES THAT "CLICK" HOME

New LISSEN lines—two little switches that are the neatest, handiest little things of their kind—small, easily fixed, robust, positive movement—they "make" with a reassuring "click." No capacity effect at all—contacts which are self-cleaning and which do not short when changing over.

LISSEN plunger type com- LISSEN plunger type binced on and off and two SERIES PARALLEL way switch (prov. pat.), use switch (prov. pat.), or for any plain length 2 in., inter-stage 1 in. base, switching—length, 1 1/2 in., barely 1 in. across the base. LISSEN one-hole fixing, of course. Note the price ... 2/9



LISSEN ONE-HOLE FIXING, OF COURSE. Note the price! 3/9



Note the price! 3/9



Have you been using the wrong filament control?

The beautiful stepless, noiseless operation of the LISSENSTAT will be a revelation to you.

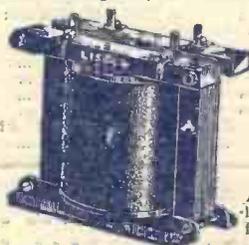
See how quiet your valves have now become. Notice how gradually you can increase your valve current. See how quietly your valve

lights up, how quietly it goes out. Notice how you can pass such a fractional current through the filament that there is not the slightest trace of a glow in the metal. Here is a control at last which gives perfect tuning adjustment. For long distance work your LISSENSTAT will be essential—it will add range to your receiver in a way you never thought filament control could. The LISSENSTAT saves your valves too. It is easy to fit—goes in between anything. LISSEN one-hole fixing, of course. LISSEN-STATS are sold at 7/6

LISSEN variable anode resistance, 20,000 to 250,000 ohms, positive stops both ways. 2/6

Build up beautiful tone quality—the LISSEN T1 transformer has a coil which would amplify by itself without any iron core at all. It should always be used immediately behind the detector valve, price 30/-

Why the LISSEN T2—use a good transformer for the 2nd and 3rd stages—impedance may be lower and ratio higher—the LISSEN T2 is recommended—may be used throughout, of course. 25/-



An excellent light transformer—the LISSEN T3 is one of the best light transformers made. Compares with many expensive transformers because of its skillfully balanced design. 16/6



Correct Grid Potential

Use the LISSEN VARIABLE GRID LEAK—resistance continuously variable, 1/2 to 6 megohms. You can select the exact value of leak resistance. In this way the charge that can accumulate on the grid can be closely regulated so that the free negative grid potential is always at the correct value for the best operation of the detector valve. The LISSEN VARIABLE GRID LEAK gives great sensitivity in some circuits—in others and with some valves variable grid control is not so important.

Positive stops at maximum and minimum resistance. Length 3 1/2 in.—pencil thickness—LISSEN one-hole fixing, of course. Note the price for a LISSEN part 2/6

LISSEN LIMITED

16-20, Woodger Rd., Goldhawk Rd. SHEPHERD'S BUSH, LONDON, W.12.

N.B.—Close to Goldhawk Road (Met.) Station, Shepherd's Bush (Central London), Hammersmith Tube. Phone 2339 Hammersmith

LISSEN PARTS—WELL THOUGHT OUT, THEN WELL MADE