AMATEUR TRANSMITTING—See Page 413

Practical and Amateur Wireless

AND PRACTICAL TELEVISION

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 9. No. 221. December 12th, 1936.

Two Fine "ALL-WAVERS"

The "COLT" Battery 3

The "RECORD" 3 Mains

THE SIMPLEST SHORT-WAVER—See Page 422

Practical and Amateur Wireless

Edited by
F. J. CAMM.
Technical Staff:
W. J. Delaney, H. J. Barton Chapple, Wh.Sch. B.Sc., A.M.I.E.E., Frank Preston.
Vol. IX. No. 221. December 12th, 1936.

'Round the World of Wireless

Obituary

THE death has occurred at Upstreet, in Kent, of Mr. William Snowley Entwistle, who, in August, 1901, transmitted the first wireless telegraphy message to be sent across the North Atlantic. As chief engineer and assistant to Marconi he was in charge of the land station at Clifden, Ireland, and it was he who tapped out the momentous message in Morse received at Glace Bay, Newfoundland, by Marconi, and which was the forerunner of world-wide radio communications. He travelled all over the world with the great wireless pioneer, and retired from the service of the Marconi Company three years ago. He was buried at Shirley, Surrey, after cremation at Charing.

Amateur Two-way Air Communication

TWO Cape Town amateurs recently succeeded in achieving two-way telephonic communication on the ultra-short wavelengths at the Cape Town airport. Once again this shows the remarkable success which often attends the experimental work carried out by amateurs, and although full details of the apparatus used are not yet to hand, it was all home-made, and is, therefore, a remarkably successful venture.

A "Movie" Dial

FROM America another new tuning dial is announced, this time on the Airline receivers. It consists of a rectangular "frosted" screen surmounted by an electric-eye tuning device, and as the tuning control is operated it flashes on to the screen (in a similar manner to a cinema projector) the names of the main American stations. The tuning eye also helps to ensure accurate tuning.

Radio for Aerial Police

ALTHOUGH the police in this country often employ the auto-gyro equipped with radio for traffic control and other emergencies, they have not so far adopted the airship for such purposes. In America, however, a demonstration was recently given at Cleveland in which the police employed an airship of the blimp type, equipped with a 50-watt transmitter built by the G.E.C.

Air-raid Televised

TO-DAY (December 12th) an ambitious attempt is to be made to televise a mimic air-raid on London, in which Territorials will take part. This makes yet another remarkable addition to the many novel transmissions which have already taken place in this new art, and it would appear that the modern television transmitter can deal with practically any type of subject. The success of all these transmissions is undoubtedly due to the ingenious electron camera.

The Welsh Region

THE Committee appointed three years ago by the Council of the University of Wales for the consideration of broadcasting questions of Welsh interest, held its last half-yearly Conference recently. Warm appreciation was expressed on behalf of the B.B.C. of the Committee's valuable co-operation since its appointment.

Now that Wales has been formed into a self-contained Region, with a Regional Director of its own, it has been arranged that any future conferences that the Committee and the B.B.C. may agree to be desirable should be held in Wales, and should take the form of meetings between the Committee and the Regional Director, Mr. Hopkin Morris.

Aid for S.W. Durham

WE are asked to make an appeal for parcels of clothing, blankets, boots, etc., and also cash donations for the distressed areas of South-West Durham. The unemployment in this part of the country approaches nearly fifty per cent. of the number of insured workers, against an average of 12 per cent. for the country as a whole, and all gifts sent to the following address will be distributed personally to the local organisations and senders may be assured that their help will meet a real need. All gifts, which will be personally acknowledged, should be forwarded to Mr. E. H. Taylor, Managing Director, Messrs. Joseph Lingford and Son, Ltd., The Model Factory, Bishop Auckland.

G.E.C.

IN America the General Electric Company's transmitters use as an identification signal the three musical notes, G. E, and C. In England the G.E.C. have just built an interesting electric sign in which the Osram architectural lamps have been arranged to present an illuminated bar of music, complete with the treble signature, and the three notes are clearly depicted in brilliant outline against a dark background.

Plug-in Wireless

ALTHOUGH stated to be of great interest to users of hotel wireless systems and similar plug-in listening points, the recent action by the G.P.O. against twelve tenants of a block of flats in London has not yet been settled. The Post Office lost the case, but are appealing against the decision. The magistrate found that the loudspeakers were not "wireless apparatus" as defined by the Act, but were "instruments," and, therefore, did not come under the Wireless Telegraphy Act.

"Songs of a Roman Legion"

THE blind English composer, Herbert Ferrers, author of the operas "Penelope" and "The Piper," will conduct in the studio on December 11th (Regional) a performance of his "Songs of a Roman Legion," with poems by Rudyard Kipling, which will be sung by the B.B.C. Men's Chorus accompanied by the B.B.C. Orchestra, Section E. Choral works by another English composer, Leslie Woodgate, will be broadcast in the same concert. These are "Hymn to the Virgin" and "White Island," and they will be sung by Henry Cummings, supported by the B.B.C. Men's Chorus, string orchestra, organ and pianoforte.

THE PICK of the PROGRAMMES

The "Christmas Cracker"

A ROLLICKING broadcast with a strong Yuletide flavour will be given in the Scottish programme on December 19, when "Christmas Cracker" will be pulled by Jack House and Allan MacKinnon, who confidently expect that it will go with a bang. Seasonable novelties will be distributed by Grace McChlery, Allan MacKinnon, Ian Sadler, James K. Urquhart, and Eric Wightman.

MAKE THESE DATES WITH YOUR RADIO

Mabel Draper (pianoforte). The work to be broadcast on December 19th is the "Quintet, Op. 34," by Brahms.

A DOUBLE ATTRACTION

The charming listener in this picture obviously enjoys the performance of the Cossor All-wave receiver. This 4-channel 6-valve superhet, in the new-style cabinet, costs only fifteen guineas.

Pantomime Variety

THE Christmas season of pantomime approaches again, and on December 16th Victor Smythe hopes to bring to the Northern studios the principals from a number of pantomimes which are to be performed in the North shortly.

Concert from Torquay

JESSIE KING (contralto) will be the soloist in a concert by the Torquay Municipal Orchestra, conducted by Ernest W. Goss, which is to be broadcast from the Pavilion, Torquay, on December 15th.

Fire Brigade Band

BIRMINGHAM has the only provincial Fire Brigade Band in the country. It was formed eight years ago and now has thirty members, with Station Officer R. Ward, an ex-Army musician, as the conductor. It is to broadcast for the first time on December 16th, in the Midland Regional programme. The bandsmen are all regular officers of the Brigade, and apart from concerts at headquarters the public rarely hear them play.

A Popular Quintet

THE Cardiff Ensemble will broadcast from the National Museum of Wales on December 19th. The members of the Ensemble are: Frank Thomas (violin), Nina Rochard (viola), Gwen Griffiths (violin), Ronald Harding (violoncello), and

Santley's Songs

JOSEPH FARRINGTON, the well-known bass singer, who comes from Preston, is to broadcast from the Northern Regional on December 17th a programme of the songs which were popularised by Sir Charles Santley (1834-1922), the great Liverpool singer. Santley, whose fame was world wide, is closely associated with songs such as "Simon the Cellarer"; "The Water Man" and "The Erl King."

Christmas Party Broadcast

CHARLES BREWER has, for the last three years, been responsible for the informal Party on Christmas Day, and it is hoped that the old Christmas Gang will again be present for the broadcast on December 25th, which will be given in the National programme.

Tommy Handley, the ace of radio comedians; Clapham and Dwyer and the Two Leslies, will again gravitate to St. George's Hall on Christmas afternoon. Charles Brewer possesses a perpetual challenge cup for musical chairs presented by a listener in Sheffield. This will again be competed for to the running commentary of the Old Christmas Party Gang. Last year it was won by Leslie Sarony.

West Calder Brass Band

ON December 17th the West Calder Brass Band, conducted by Herbert Bennett, will play: March, "Washington Greys," by Grafulla; Overture, "The Arcadians," by Monckton and Talbot; "'Neath Austral Skies," by Percy Code; Selection, "Standard Melodies of Hibernia," arranged Ord Hume; and Excerpts from "The Geisha," by Sidney Jones.

Orchestral and Vocal Concert

THE Midland tea-time concert on December 13th will be given by the Birmingham Hippodrome Orchestra, conducted by Harry Pell, with two well-known Midland singers, Helmar Fernback, tenor, and Gabriel Lavelle, baritone. Each vocalist will sing a group of songs and together they will give two duets.

Pantomime Rehearsals

AS usual just before Christmas there is to be a glimpse of Midland pantomimes under rehearsal. Forty minutes will be given to the programme on December 18th, and it is to be divided between three Midland pantomimes. These are "Dick Whittington," at the Royal, a Tom Arnold pantomime with George Formby, junior, Jack Williams and Helen Breen; "Mother Goose," a Leon Salberg pantomime at the Alexandra, with Barry Lupino and Eric Le Fre; and the Emile Littler pantomime at the Prince of Wales, with June and Gene Gerrard, Bobbie Comber and Helen Gilliland.

Orchestral Concert from Weston-super-Mare

THE Weston Municipal Orchestra, conducted by H. C. Burgess, will broadcast from the Winter Gardens Pavilion, Weston-super-Mare, on December 15th, when Mercia Stotesbury (violin) will be the soloist. This is the third occasion on which Western listeners have heard the Orchestra broadcast under this title, although it has been heard many times before in broadcasts from Weston-super-Mare, under the title of "H. C. Burgess and his Orchestra."

Light Music and Variety

ON December 18th in the Midland Regional programme, Jack Wilson and his Versatile Five are to play light music including Jack Wilson's arrangement of Mabel Wayne's compositions. In an interlude Colinson and Dean, the well-known music-hall and pantomime artists, will entertain.

SOLVE THIS!

Problem No. 221.

Miller decided to connect an extension speaker to his commercial four-valve superhet, and obtained a permanent magnet model with an output transformer attached suitable for matching the pentode output valve in his receiver. Volume from the extension was very low, however, although satisfactory results were obtained when it was used as a principal speaker in another set. What was the trouble? Three books will be awarded for the first three correct solutions opened. Address your solutions to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2. Envelopes must be marked Problem No. 221 in the bottom left-hand corner and must be posted to reach this office not later than the first post on Monday, December 14th, 1936.

Solution to Problem No. 220.

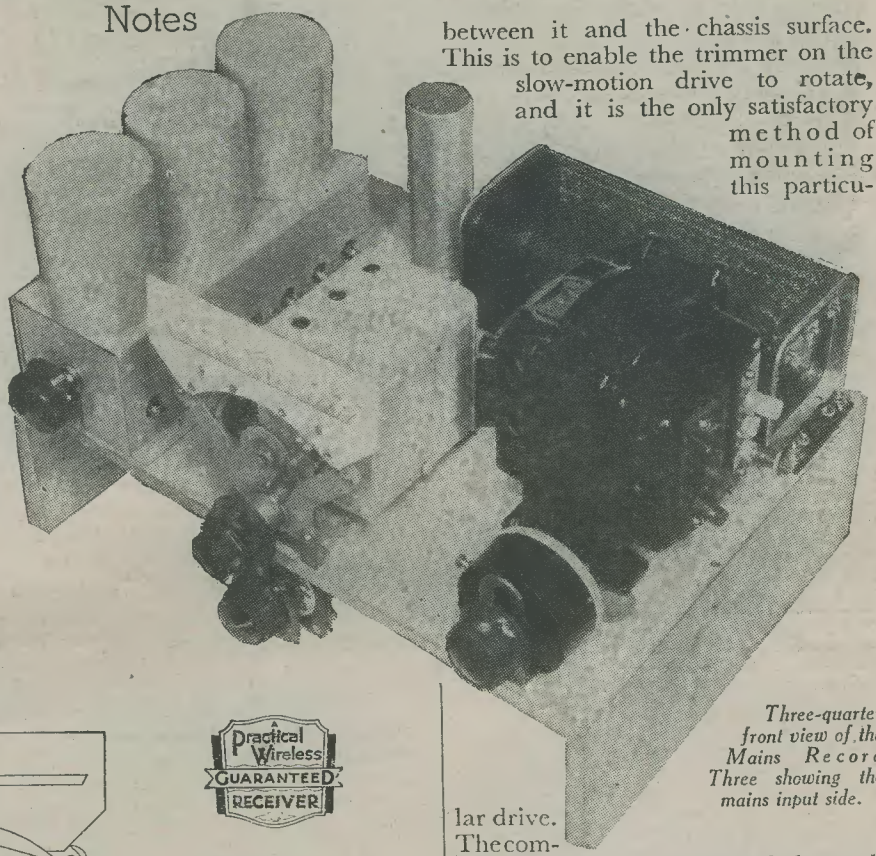
The fixed vanes of the tuning condenser were touching the moving vanes at the London Regional setting thereby short-circuiting the H.T. battery through the tuning coil.

The following three readers successfully solved Problem No. 219, and books are accordingly being forwarded to them: E. J. White, 118, Beech Hill Lane, Wigan, Lancs.; A. E. Moseley, 173, Tretworth Rd., Gloucester; G. T. Storey, 14, Tunsley Close, Newton, W. Kirby.

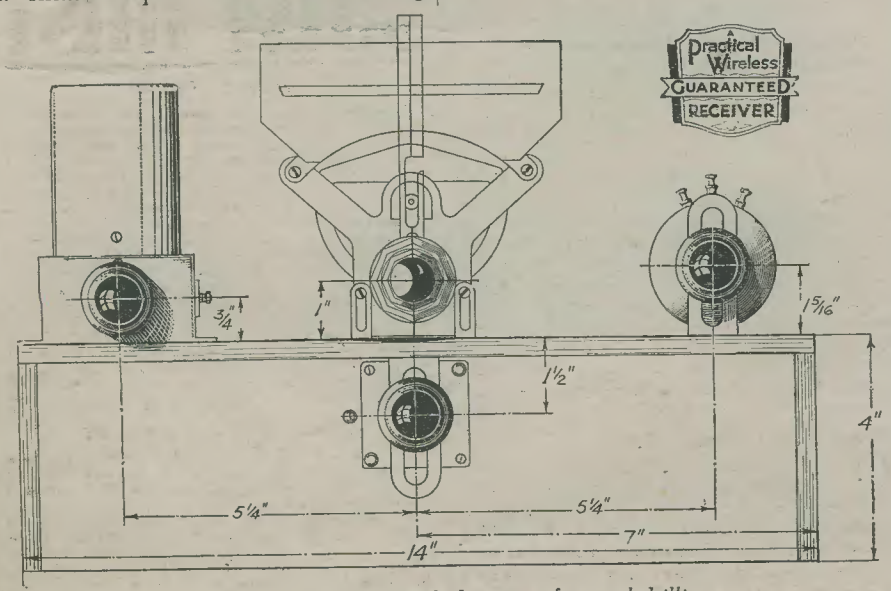
F. J. Camm's "Mains RECORD" All-Wave 3

Constructional Details for the Mains Version of This Year's Most Popular Battery Receiver, and Preliminary Operating Notes

THE main details of the circuit given last week show that this receiver will give to the listener who has the electric mains facilities the same high standard of performance which has been afforded to the battery user of the Record All-Wave Three. But the higher efficiency of the A.C. type of valve will enable this receiver to give an even better performance, and in spite of the simplicity of construction and operating adjustments, the receiver will be found to put up a very good performance. There is only a single control, and this is the main three-gang tuning condenser. The makers supply with this three fixing screws by means of which it is attached to the packing container. In a separate envelope will be found three longer screws and these should be employed in order to mount the condenser with a small strip of wood intervening between it and the chassis surface. This is to enable the trimmer on the slow-motion drive to rotate, and it is the only satisfactory method of mounting this particular drive. The component which is mounted beneath the front edge of the chassis prevents the wood from being cut away to allow the trimmer plates to clear, but by using the mounting plate which accompanies the gang condenser three holes may be drilled in the small piece of wood, which need only be the same size as the bottom of the condenser, and three similar holes may then be drilled in the chassis. The long bolts can then be passed up and screwed into the tapped holes in the condenser.



Three-quarter front view of the Mains Record Three showing the mains input side.



Layout of the controls, with dimensions for panel drilling.

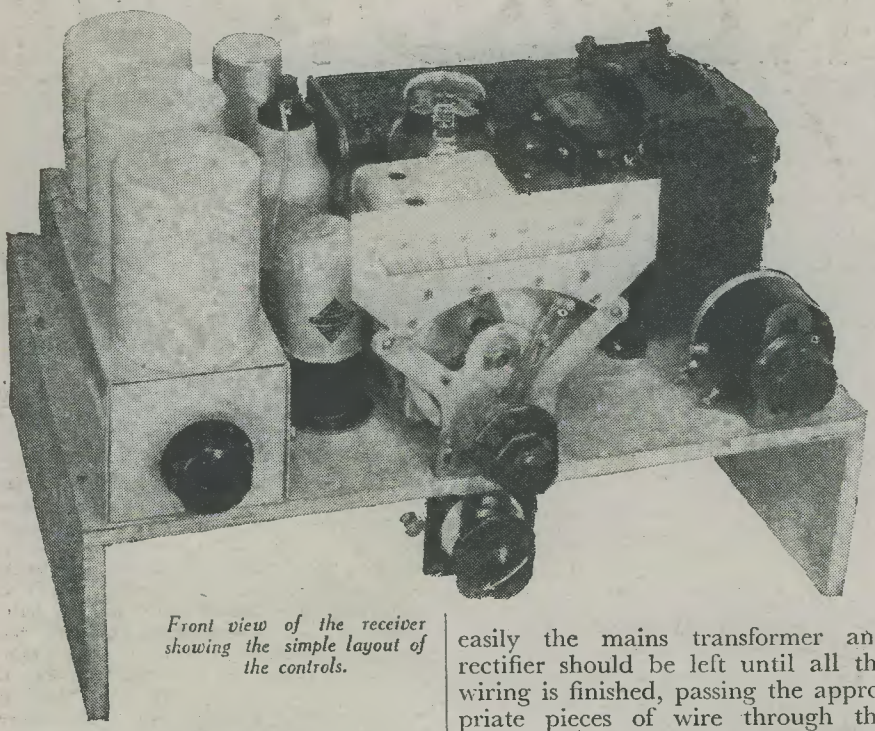
Method of Assembly

The condenser should, therefore,

be the first component to place in position, after which the valveholders may be attached. If a ready-drilled chassis is obtained no difficulty will be experienced in placing everything in its right position, but if an unprepared chassis is obtained, three holes must be drilled for the valveholders and a further hole for the electrolytic condenser. This should be $\frac{5}{8}$in. in diameter, and for the valveholders, two $1\frac{1}{4}$in. holes are needed for the seven-pin holders (V1 and V3) and a 1in. hole for V2. For the interconnecting wires between the top and bottom of the chassis $\frac{1}{8}$in. holes should be drilled. For the aerial and L.S. socket strips on the rear edge of the chassis two $\frac{3}{8}$in. holes will be needed for each socket, or a slot may be cut to accommodate both sockets on each strip.

To enable the receiver to be wired easily the mains transformer and rectifier should be left until all the wiring is finished, passing the appropriate pieces of wire through the chassis where required and afterwards cutting these to fit neatly to the transformer and rectifier terminals. The wiring diagram was given last week and is a straightforward task. The only points to be noted concern the earth return leads and the use of the screened sleeving which was specified. It will be noted that a wire runs from the point M.B. on the coil chassis nearest terminal No. 6 beneath the electrolytic condenser C.16 to the M.B. terminal on the H.T.9 rectifier. This should be a length of bare wire, and the ends are anchored beneath the fixing screws for the coil and rectifier, placing the ends between a washer and the holding-down screw. This ensures that the wire makes a good electrical contact with the metal surface of the chassis, and it is passed near to the hole into which the electrolytic condenser is mounted. When the latter is firmly fixed it will be in contact with the wire and this ensures that a good earth return is made—a point which is important, as it has been found that in some cases the constructor uses undue force when tightening the locking-nut for this condenser, and the result is that the metallised surface of the chassis is broken, resulting in poor contact.

The screened sleeving should be slipped over the lead to the anode of V1, and also over the wire end of resistor R11 which is connected to the grid of V4, and also over the lead from terminal No. 4 on the coil unit.



Front view of the receiver showing the simple layout of the controls.

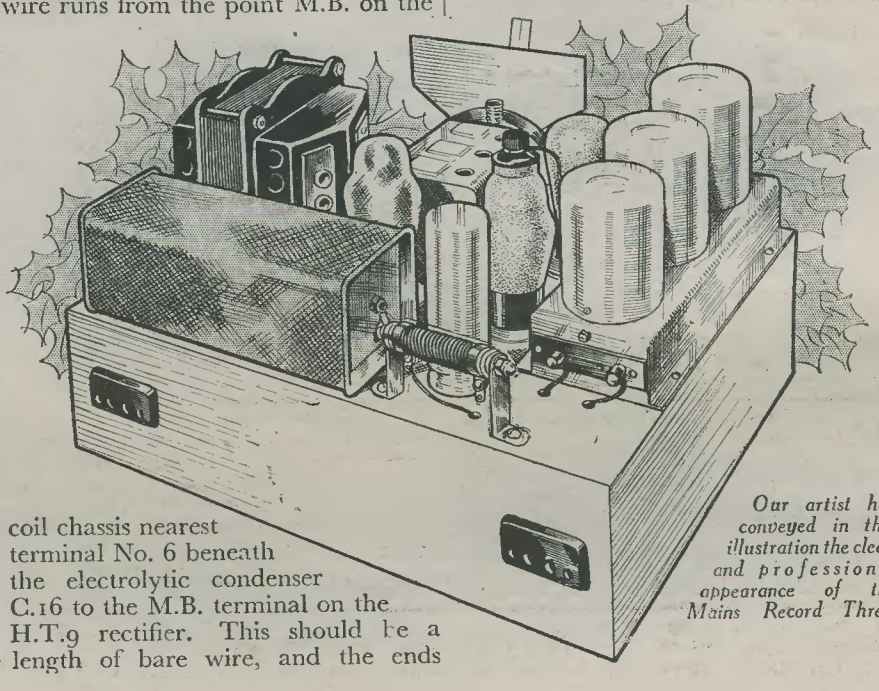
Mains Connections

The mains on-off switch is shown separate, and this may be mounted on the side of the cabinet in any convenient position, and the leads from the mains and the switch should be inserted into the appropriate mains sockets on the transformer. One lead is connected to the terminal marked 0 (or 50), and the other lead into the nearest socket to the mains voltage. If the mains are 240 volts, the 250 socket should be employed, and if 220 volts the 230 socket should be used.

The operation is the same as for the battery Record receiver, the wave ranges being identical.

LIST OF COMPONENTS

One all-wave coil unit (No. 4BTU) (B.T.S.).
One 3-gang (.0005+.00025+.00025) condenser (C2, C8, C9) (J.B.).
One drive with trimmer (SL9) (C3) (J.B.)
Twelve fixed condensers: 8 mfd. (F2920) (C16), 4/4 mfd. block (BE355) (C17, C18), 2 mfd. (BB) (C12), .02 mfd. (C11), .005 mfd. (C15), .0003 mfd. (C7), two .0001 mfd. (4421/E) (C10, C13), three .1 mfd. (4423/S) (C4, C5, C6), 25 mfd. (3016/25v.) (C14) (Dubilier).
Eleven fixed Resistors: 40,000 (R7), 30,000 (R1), 25,000 (R2), 10,000 (R8), 5,000 (R5), 250 (R3), 150 (R12) (F1), 500,000 (R6), 250,000 (R10), 100,000 (R9), 2,000 (R11) (F½) (Dubilier).
One all-wave H.F. choke (HF15) (Bulgin).
One power Resistor, 25,000 ohms (R13) (PR14) (Bulgin).
One Potentiometer, 5,000 ohms (R4) (CP157) (Varley).
One L.F. choke (DP11) (Varley).
One metal rectifier (HT9) (Westinghouse).
One mains transformer (W31) (Heayberd).
One fuseholder with 1 amp. fuse (Microfuse).
One Q.M.B. switch (S80) (Bulgin).
Two terminal sockets L.S. and A.E. (Belling-Lee).
Two component brackets (Peto-Scott).
Three valveholders: Two 7-pin, One 5-pin (Standard) (Clix).
One metallised chassis 14 in. by 10 in. with 3½ in. runners (Peto-Scott).
Two ft. length metal-screened lead (Ward and Goldstone).
Three valves: MVS/Pen 7-pin, 41MHL, 42MP/Pen (Cossor.)
One P.M. speaker (37S) (W.B.).



Our artist has conveyed in this illustration the clean and professional appearance of the Mains Record Three.

NEW SERIES

Amateur Transmitting

The Various Characteristics of Valves are Dealt With in this Third Article of the Series—By L. O. SPARKS

WHILE the property of inducing currents in other conductors is often turned to good advantage (as in L.F. and "mains" transformers) it can account for serious losses and trouble, if due consideration is not given to the layout of components and screens.

Reactance

Reactance can be likened to resistance in a D.C. circuit; in fact, it is measured in "apparent ohms," but it differs, inasmuch that it does *not dissipate any energy*, although, like resistance in a D.C. circuit, it *does limit* the A.C. current flowing. There is the reactance of a condenser and of an inductance, both of which depend on the frequency of the current for their value of opposition to current flow.

The reactance of a condenser is given by:

$$Xc = \frac{1}{6.28 \times f \times C}$$

where "f" is the frequency and "C" the capacity in *farads*.

For an inductance the reactance $X1 = 6.28 \times f \times L$ where "f" is frequency and L inductance in Henries. The result, in each case, being in "apparent ohms."

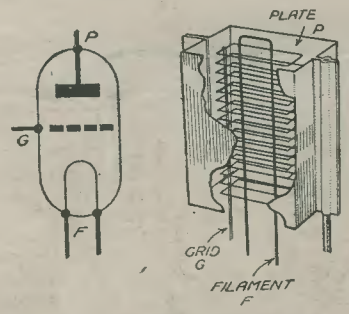
If, in a circuit, there is resistance and reactance in series, the total of the two will *not* give the total resistance or opposition, the same as series resistances in a D.C. circuit. It is necessary to use the formula:—

$$Z = \sqrt{(R)^2 + \left(6.28fL - \frac{1}{6.28fC}\right)^2}$$

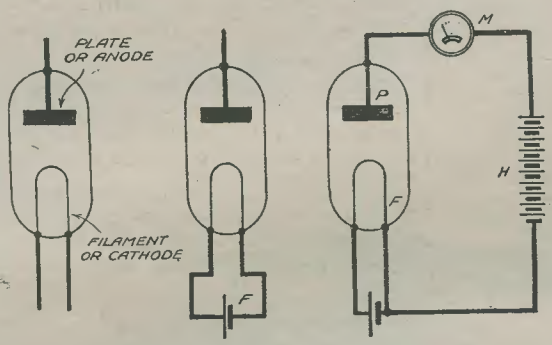
which is known as the "*impedance*" of the circuit.

If the above formula is examined, it will be seen that the reactance of the condenser is subtracted from that of the inductance; in other words, their oppositions are of different kinds, and the capacity reduces the inductance effect. It is obvious, therefore, that if their values are equal, the resultant reactance will be zero, and the impedance of the circuit becomes the pure resistance. Now, like D.C. circuits, the current in the circuit depends on the impedance, so, if the values of the capacitative and inductive reactances are such that the resultant reactance is zero, the current will be at its maximum. This means that the conditions for maximum current are when $\frac{1}{6.28fC} = 6.28fL$ or, if the values of the capacity and inductance are fixed, the frequency at which maximum current will flow can be written:—

$f = \frac{1}{6.28\sqrt{LC}}$ which is the frequency at which the circuit will be at "resonance."



Figs. 4. & 5.—Theoretical and practical assembly of the triode valve.



Figs. 1, 2 & 3.—Diagrams showing the diode valve and the method of applying cathode and anode supplies.

Providing the formulæ given above and in the previous article have been studied, so that their applications are, at least, clear, the question of the valve in relation to transmitting can be considered.

It will be appreciated, from future articles, that the valve plays a vital part in the design and construction of transmitting gear; therefore, it is essential to have a reasonable knowledge of its operation.

Let us consider the most simple type of valve, namely the "diode," which consists of *two* elements, housed in the familiar glass bulb common to practically all wireless valves.

One element is known as the "plate or anode," and the other is the filament or, if mains operated, the "cathode," and they are shown diagrammatically in Fig. 1.

I have already explained the relation between the movement of electrons and an electric current, so the operation of a "diode" valve should not be difficult to follow.

If the filament is heated by the battery "F," shown in Fig. 2, electrons will be emitted into the space enclosed by the glass bulb, but if another battery is connected in the manner of H, as in Fig. 3, so that the "plate" "P" is *positive* with respect to the filament, then the milliammeter "M" will indicate current flowing, showing that the electrons emitted from the filament are rushing across the space to the "plate," and round through the circuit, back to their starting point, forming a continuous flow or current.

Supposing, instead of a battery, a source of *alternating* current is placed across the filament and plate, thus causing the plate to be alternately positive and negative, it will be found that when the plate is *negative*, no electrons will flow across to it, or, in other words, no current flow will be indicated, but, during every *positive* half-cycle of the alternating current, the electron movement will take place, and a current will flow in the circuit. From this it will be seen that the valve only allows current to flow in one direction, and that it actually "rectifies" the alternating current, leaving, so to speak, a pulsating continuous or direct current. One common application of the "diode" is the rectifying of A.C. supplies in a mains-operated receiver. Fortunately, however, the diode will rectify alternating currents having very high frequencies as well as the usual 50 cycles of electricity supplies; therefore, it can be used as a "detector" or "rectifier" of the radio frequencies in a wireless receiver.

The Triode

If Fig. 4 is examined, it will be seen that a third element has been added to the diode, converting it to what is known as a "triode," which has different characteristics and greater applications than the diode.

The arrangement of the elements or electrodes is shown in Fig. 5, G being the grid, which is literally a grid formed by a fine wire wound round one or more rigid supports; F the filament, located inside

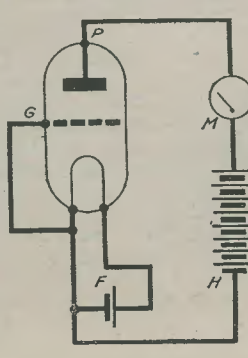


Fig. 6.—The complete circuit of a triode to show the flow of current as mentioned on the next page.

(Continued overleaf)

WIRELESS TRANSMISSION FOR THE AMATEUR

(Continued from previous page)

the grid; and P the plate surrounding the grid. The "mesh" of the grid, and its position in relation to the other elements play a most important part in valve design and construction, as they directly affect the characteristics of the valve. If the grid is connected to the filament, Fig. 6, and the circuits completed with the batteries F and H, a current will be indicated by the milliammeter, showing that the electrons are passing through the "grid" to the plate.

Now let us take the matter a stage further, and re-draw the circuit as Fig. 7, which will be recognised as a "resistance-capacity coupled" L.F. amplifier.

The battery, G.B., is so arranged that the grid can be made negative with respect to the filament.

It will now be found that, when the grid is made more negative by increasing the value of G.B. (grid bias), the "space" round the grid becomes more negative, and the electron flow is hindered, with the result that less electrons will get across to the plate and, therefore, less current will flow in the plate circuit. Those not familiar with valve operation should carry out these simple experiments, and prove these statements.

Now supposing across the points "g" and "e" (dotted lines, Fig. 7), we apply an "*alternating*" voltage, equivalent to a signal coming from V.1, the effect will be to make the grid more or less negative, in relation to its *normal mean value*, i.e., the bias. This "more or less negative" arrangement may not be too clear. One might say, why negative—what about the positive cycles of the alternating current (signal)? Think of it thus. The grid *is* negative—in this case—because of the applied grid-bias, so the negative half-cycles make it *more* negative, while the *positive* half-cycles make it *less* negative.

The variation of the grid voltage will have its effect on the plate current by causing it to fluctuate about its "mean" value, according to reason given for Fig. 6.

Voltage Drop

Turn now to the plate circuit of V2., where R is a resistance or impedance (coil) forming what is known as the "load." Reverting to the second article, and Ohm's Law, it will be understood that a resistance in a circuit can cause a "voltage drop" according to the current flowing.

In the case in question, the variation in the plate current will cause a variation in the voltage dropped across the resistance R and, now, the next two facts are *very important*, assuming the valve to be operating correctly the voltage variations will be identical to the grid variations, but they will be larger or, in other words, they will be *amplified*, showing that the three-element valve differs from the two-element type inasmuch that it not only acts as a rectifier of alternating current but it also acts as an "amplifier."

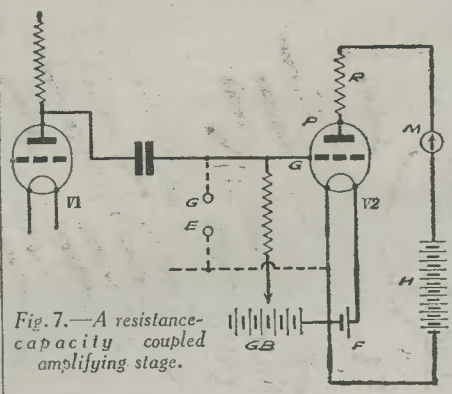


Fig. 7.—A resistance-capacity coupled amplifying stage.

Certain valves are better than others as amplifiers, and as it is necessary to have some term to denote their capabilities in that respect, we speak of the "amplification factor" of a valve, and use the term "Mu" and the sign μ to denote it.

It is possible to calculate the "amplification factor," and it is advisable for all experimenters to be familiar with the procedure, so that they can check their valves from time to time.

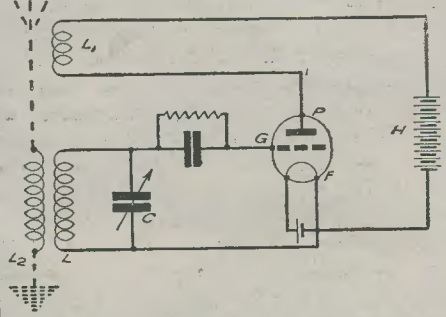


Fig. 8.—The simplest valve oscillator circuit.

As it relates to actual magnification, the factor can be expressed as the ratio between the change in plate voltage necessary to produce a given change in plate current; and the change in *grid* voltage necessary to produce the *same* change in current. The formula can be written:

$$\frac{\text{Change in plate volts}}{\text{Change in grid volts}}$$ The plate current being constant.

There is no unit of measurement, as Mu or μ is simply a number. The Mu of a valve is only one of its characteristics and it is necessary to consider the "Mutual Conductance or Slope" and the "Impedance."

Mutual Conductance

The "Mutual Conductance," denoted by the letter "g," is an indication of the "goodness" of the valve, as it is the ratio between the *change in anode current* and the *change in grid volts*, the plate volts remaining *constant*. It can be written:

$$\frac{\text{Change in plate current}}{\text{Change in grid volts}}$$ the unit of measurement being in milliamps (plate current) per volt (on grid). The "Impedance" or, sometimes quoted as, "A.C. Resistance" of a valve is another ratio, but this time concerned only with the plate circuit, the *grid* being maintained as a *constant voltage*. It is denoted by the letters "Ro," the unit being ohms. and the formula:

$$Ro = \frac{\text{Change in plate volts.}}{\text{Change in plate current.}}$$

The three characteristics quoted are all related, and it is useful to note that:

$$g\ (\text{Mutual Con.}) = \frac{\text{Amplification Factor.}}{\text{Impedance.}}$$

$$\text{or Impedance} = \frac{\text{Amplification Factor}}{\text{Mutual Conductance}}$$

but, it *must be remembered* that for the above formulæ to hold good, g must be expressed in *amperes per volt*, not milliamps.

The Valve as an Oscillator

The first requirement of a wireless transmitter is some source or generator of oscillations, and it is of vital importance that the frequency of the oscillations can be controlled.

The valve is ideal for this purpose, in fact, it may be said that it has superseded all other forms, and is the only method suitable for amateur requirements, bearing in mind regulations. Fig. 8 shows the most simple circuit, and many of the older experimenters will recognise in it the early one-valve receiver. Across the grid filament circuit is connected the inductance L tuned by the variable condenser C. In the plate circuit is another inductance, L.1, in series with the H.T. battery, and it is so placed that it is inductively coupled (article No. 2) to the grid circuit.

If the inductive coupling is sufficient, a certain proportion of the energy in L.1, will be fed back into the grid circuit, and if the transference of energy is great enough, oscillatory currents will be set up in the grid circuit, and a state of oscillation will be reached.

The effect is known to all users of receivers, when oscillation is produced by the excessive use of reaction, the usual name for the method of feeding back energy from the plate circuit. The frequency of the oscillations will be very nearly the resonant frequency of the tuned grid circuit, formed by L and C, and if an aerial is coupled to the circuit by the Coil L.2, then oscillations of the same frequency will be introduced, inductively, into it, the oscillatory current rising to its maximum when L.2 is in resonance, i.e. (article No. 2), when its reactance is at zero.

While the circuit under consideration is capable of producing oscillations, it is hardly suitable for transmitting purposes as will be explained in the next article, which will deal with the requirements of a complete transmitting circuit.

Midland Parliament

ON December 12th, at the third meeting of "Midland Parliament" this winter, the subject to be discussed is Non-Union Labour. Sir Charles Mander, Bt., Mayor of Wolverhampton, will be in the chair. W. M. W. Thomas and Austin Hopkinson, M.P., will speak as employers, and the trade union side will be represented by George Jones, of Midland Miners' Federation, and Arthur Henderson, M.P., for the Kingswinford Division. The discussion will also be heard in the Regional programme.

PROGRAMME NOTES

Concert from Edinburgh

THE Scottish Orchestra, conducted by Georg Szell, will give a concert in the Usher Hall, Edinburgh, on December 14th The broadcast portion of the programme will include "Symphony No. 4 in D Major," by Dvořák, and "Bolèro," by Ravel.

"The Narrow Gauge"

THIS is the title of an interesting programme to celebrate the centenary of the Ffestiniog Toy Railway—the pioneer of narrow-gauge railways—which will be broadcast from Bangor on December 12th. The programme will be produced by Sam Jones.

Alfred Cave Quartet

ON December 17th the Alfred Cave Quartet is to play the Haydn Quartet in E flat and Dvořák's "Nigger" Quartet. This combination consists of Alfred Cave, leader of the B.B.C. Midland Orchestra; Ernest Element (2nd violin); Frank Venton (viola) and Harry Stanier ('cello).

On Your Wavelength

By THERMION

Long Distance Television

A TELEVISION and sound broadcast from London was picked up in Cape Town on the ultra-short-waves recently, the experimenter in question being Mr. C. G. J. Angilley. He said that on 6 metres he heard a kind of buzzing sound and on 7 metres the musical theme which comes at the end of the Gaumont British News Film. Then followed a voice stating: "This is the London Television Station at Alexandra Palace, North London." Several cases have been reported of successful television reception in Ireland and the North of England which somewhat destroys the optical spectrum theory. Television is very much in the news nowadays. The King has asked for the possibilities of television reception at Belvedere to be investigated. Stores round London are installing sets, and scarcely a day goes by without some interesting item appearing in the daily papers. This carries me back to the early days of wireless, but whereas in those days wireless was very imperfect, television commences its career in a somewhat advanced stage.

Prices at present are high because costs must be covered on a comparatively small output. Things will get cheaper as demands grow, and we can safely look forward to a television receiver at about £15 within five years.

When will our component manufacturers get busy and realise that a valuable market amongst home constructors awaits their wares, in the form of the necessary transformers, resistances, tuning coils, and special condensers which are necessary for television? For, whether manufacturers like to believe it or not, television at the present time is more suited to amateur construction than to commercial exploitation. After you have seen a television demonstration, and you go back to listen to your radio, you sense the missing link. Everything is good until something better comes along with which to make comparisons. A few years ago wireless seemed to have reached the zenith of development, and it seemed impossible to improve it. Since television has been demonstrated there is a feeling of something lacking in radio entertainment. The transmissions are extraordinarily good; my only quarrel being with the composition of the programme. It is being used for education and uplift when its main purpose should be to entertain. I realise that there are difficulties in the way of obtaining artistes, owing to the opposition of the theatrical profession, and that the film companies with perhaps understandable jealousy are refusing to lease their high-class films for television purposes. These difficulties will be overcome, and we must regard the present transmissions as being experimental and as a sort of a gauge of public interest.

Specified Parts

I HAD a crack or two to make the other week about a dealer who objected to specifications on the grounds that he preferred to sell a customer what he had in stock.

A. H., of Yeadon, enters the arena with the following epistolary effort:—

"Dear Thermion,—Whilst I agree that it is almost essential to use specified parts in the home-constructed receiver if results are to be guaranteed, I do not agree with your attack on the radio dealer, who, if he has not the specified part in stock, tries to sell the customer another part, which is 'just as good.' After all, the dealer is in business to sell what he has in stock, and the final choice *does* rest with the customer. Should the set not function correctly, the customer should say to himself: 'Well, it is my own fault for allowing that dealer to persuade me that "so-and-so" is just as good.' And that's all there is about that. Another point; you suggest the customer should ask the dealer to prove that the merits of the component offered are equal to the specified component, and go on to state that the dealer could not do so for lack of knowledge and/or lack of instruments. Supposing, however, the dealer could. Would the customer be able to appreciate the proof? I doubt it. I have met too many home constructors who have not the slightest knowledge of wireless theory, but unfortunately consider themselves to be 'experts' because they have successfully built a receiver with the aid of a blueprint. I say 'unfortunately,' because a radio engineer has, first of all, to dispel their weird notions, before he can instil a little true knowledge. No, 'Thermion,' leave the dealer alone in this respect, for if a customer buys a wrong make of any part he should himself have sufficient knowledge to assure him that the part will be equivalent to that specified. If he has not, well, he must insist on the part specified, and should one dealer not be able to supply, there are other dealers."

Skilled Labour

I DROPPED another bomb recently in drawing attention to the shortage of skilled labour, and this has incited T. R. D., of Ballymoney (horrible sounding name), to indite the following screed:—

"Dear Thermion,—Your discussion on the lack of skilled labour interests me.

"The radio trade happens to be filled with misfits from every calling on earth. At the present moment not 1 per cent. have had any training. May I let you into a secret?

"The technician at a sales counter is a clog rather than a cog in the wheel. It's not his fault. It's the public's. All the amateur constructors for miles around seek out the technician for advice on this and that. Conversa-

tions often taking anything up to an hour end in the sale of two wander plugs, an egg insulator, or a G.B. battery. Value of technician's time as a commercial proposition, 1d. to 1½d. per hour!

"The ex-fish-hawker can sell an £18 18s. super-plop-o-dyne in that time (possibly at £18, or *even* £15). (That's a secret, too, of course.)

"Then the technician can loan a valve costing him say the best part of 10s., 'in the hopes of future business.' The valve may be returned with the emission off colour or not returned at all.

"The ex-fish-merchant would have the nerve to try to sell the valve and leave hopes where they belong.

"Not until all radio shops are run under Government licence by technicians qualified by rigid examination can your dream of the revival of craftsmanship in radio become a reality.

"To cover the nakedness of a new idea I offer the old mantle wrapped around the gunsmith."

Perhaps the reader can explain what he means by his last sentence; it has got me guessing.

The Component Shortage

AND here is another correspondent who wishes to air a grievance. This time it is A. B., of Neasden :—

"Dear Thermion,—Turning as I do, immediately after I procure my weekly copy of PRACTICAL AND AMATEUR WIRELESS, to your special articles, I note the headline 'The Component Shortage.' This I read with even more than usual interest, for I have a grouse, which, although not on all fours with the case which you cite, is unfortunately a genuine one. I am constructing the 'Add on Superhet Unit' recently described in PRACTICAL AND AMATEUR WIRELESS. The difficulty I have had in obtaining the various components is almost sufficient to outweigh the pleasure of construction. Take, for instance, one small article in particular — a Westector 4. I have tried no less than a dozen stores in the W.C. and E.C. districts to obtain this, but without success. In the end I wrote to the makers telling them the facts and with remittance. The stores referred to include several of the leading suppliers of components. In one of such stores there was another customer endeavouring to procure the necessary kit to construct the all-wave set recently described in your columns, and I do not think it any exaggeration to say that he was unable to procure more than half what he required. Presumably the tendency is to push ready-made sets. It's true a larger profit is made by the dealer, but I think you will agree that if components were more easily procurable, more interest would be taken in home construction, and sales thereby increased.

"I have been a home constructor since pre-war days—when I had both transmitting and receiving licence, and am not writing as a casual constructor.

"However, notwithstanding my somewhat 'dumpy' letter, I have derived many hours'—in fact, years'—pleasure from my experiments, and from your very excellent paper."

Many other readers have written to me in similar strain, so let us agree that it is difficult to purchase components, that dealers will often try to fob you off with anything, and that there is room for considerable improvement in the distribution methods of component manufacturers. Let us also agree that travellers are not always met courteously by the radio dealer, who thinks that home construction is dying, and that he is not going to take financial risks of stocking components. The poor mutts do not realise that by this policy they are killing it. If a man finds it difficult to obtain parts he loses enthusiasm. Many readers have told me that they have visited more than a dozen dealers, not only without purchasing what they wanted, but even without being offered an alternative. Some of the readers tell me that the Mail Order Houses are just as slow, but you must remember that they are very much in the hands of the manufacturer, who prefers to supply his direct orders first. Television will create an enormous demand for components, and my readers might usefully bear in mind, when that happy time arrives, those dealers who have served them faithfully, and ignore those who have not.

Notes from the Test Bench

The Limit Four

SOME readers have experienced difficulty with the Limit Four. Satisfactory results are obtained on the medium and long wavebands, but when the switch is rotated to the short-wave settings the fuse blows. We have investigated this fault and find that it is due to the K and J contacts of the switch being too near each other. There should be a definite break between each contact when wave-changing, but if excessive heat is applied when soldering external leads to the switch tags these are loosened and are liable to move too near each other. When the moving contact is rotated, momentary connection will then occur between the adjacent fixed tags. If this occurs with contacts K and J the fuse blows. The same fault could be due to the fixed and moving vanes of the gang condenser touching each other, but this is not likely to happen with a reliable modern component.

D.C. Mains Receivers

WHEN a receiver is to be supplied from D.C. mains only, a rectifier is not required, and the reservoir condenser can be dispensed with. Very few commercial receivers of this type are available nowadays, as most people want their sets to be suitable for A.C. or D.C. mains operation. When the receiver is home-constructed, however, the rectifier and condenser can easily be omitted, space being left on the chassis for these components so that they can be added should the mains supply be changed to A.C. The omission of the rectifier entails no disadvantages, and the initial cost of the receiver is reduced by approximately £1. The voltage drop of approximately 20 volts which occurs in the rectifier is also avoided and therefore it is possible to apply a higher voltage to the valve anodes. In a receiver incorporating a series rectifier it is only necessary to join the anode and cathode sockets of the rectifier valveholder in order to produce this increase of voltage. The valve can then be removed, but it will be necessary to connect a wire across the heater terminals in order to produce heater circuit continuity. It will also be advisable to increase the value of the heater dropping resistance so that the total heater circuit resistance is not affected by the removal of the rectifying valve.

The Crystal Palace

THE almost total destruction by fire of this historic edifice will fill many with pangs of regret. It has played its part in the development of radio and television, it has seen enormous social gatherings, and that it should come to such an ignominious end is too bad. Whether it will be rebuilt is in the lap of the gods, but there can be no denying the fact that of recent years its claims as an ideal venue for national exhibitions have been sadly overlooked. The new track will, however, be completed, and on it we may hope to see some epic motor races, as well as cycle and motor-cycle races, which will form the subject of interesting broadcasts.

Practical Television

December 12th, 1936. Vol. 3. No. 28.

Ediswan Television

LAST week we had the pleasure of visiting the television research laboratory of the Edison Swan Electric Company, and in addition to a demonstration of three separate receivers which were used to pick up the B.B.C. programmes from Alexandra Palace, we were shown some of the interesting experimental apparatus and developments which have been made in this laboratory. This was built for the express purpose of carrying out research and experimental investigation into the design and production of cathode-ray tubes. For some years this work was carried out in the special valve department, but progress in television has rendered necessary a separate laboratory devoted entirely to this highly specialised work. It is interesting to note that the laboratory is but a few steps from the original building in which Sir J. A. Fleming produced the first radio valve. The cathode-ray tube has therefore overcome many of its teething troubles in the same nursery as its famous ancestor.

Ediswan Cathode-ray Tubes

The range of Ediswan cathode-ray tubes consists of the types 5H, 7H, 10H, and 12H, having screen diameters of 5, 7, 10, and 12ins. respectively. The 5H and 7H are intended for ordinary cathode-ray oscillograph work, or in monitoring positions in connection with television transmitters or experimental scanning equipments. The 10H and 12H are essentially for use in domestic television receivers. They have been designed to give bright, well-defined black and white pictures, similar in tone to the modern cinema picture. All tubes incorporate two pairs of deflector plates for electrostatic deflection of the electron beam. The latest types of high-vacuum tubes possess high luminosity screens, improved focusing properties, freedom from cathode disintegration due to ionic bombardment, and improved modulation characteristics so necessary for satisfactory television picture reproduction.

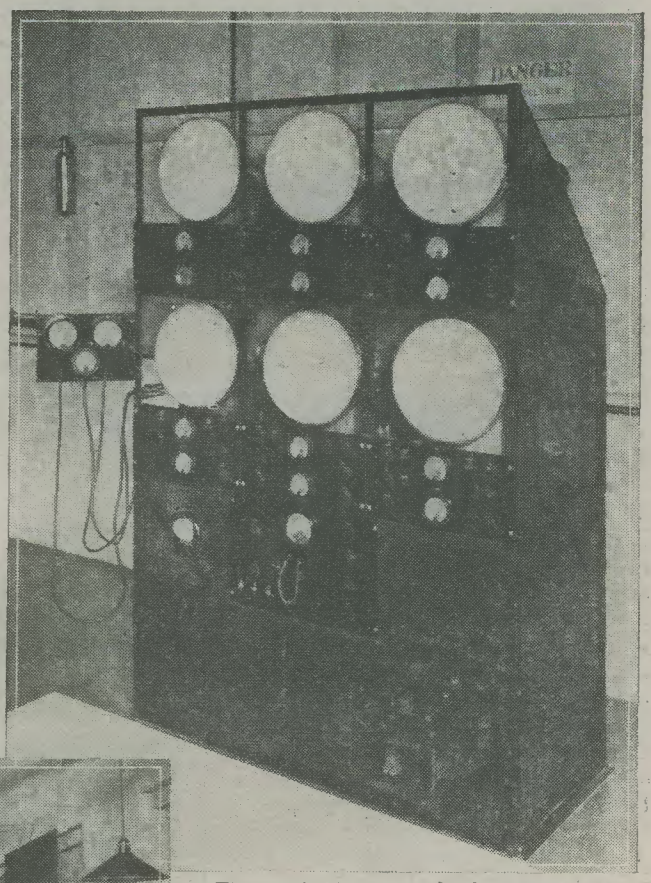
Manufacture

The tubes are manufactured in the special valve factory also situated at Ponder's End. The clear glass bulbs which are blown at the Chesterfield factory are sprayed with the fluorescent compound by a special process, and the nickel cathode is of the indirectly-heated type coated with a barium compound. The coating is at the top end of the cylinder and not along the sides, as in the ordinary radio valve. The complete electrode assembly is mounted on a glass pinch similar to that in the radio valve.

Each tube is subjected to rigorous tests, which include the checking of the cathode emission, screen brightness, shape of raster or scan modulation characteristics, cathode heater voltage and current, and shift of scan with grid control. Care is also taken to see that the variations in anode volts for spot focus are within prescribed limits. All tubes are tested at excessively high voltages to ensure that no breakdown or flash-over can occur when the tube is in normal use. A number of tubes are taken from each batch produced and run under television scanning conditions at full operating voltages and current on the life-test rack, and one of the accompanying illustrations shows six tubes in this rack undergoing the life test.

Television Reception Valves

In use in this laboratory are a number of Mazda valves specially suitable for television work. They include the AC/TH.1, a triode-hexode frequency changer for short- and ultra-short-wave work; the AC/SP3, a high-slope screened pentode for R.F., I.F. and video amplification; the V925, a midget shortpath diode for general diode purposes in television receivers, and the



This is the life-test rack, showing six tubes in position undergoing test.

T31, a gas-filled thyratron, for use in sweep voltage generators.

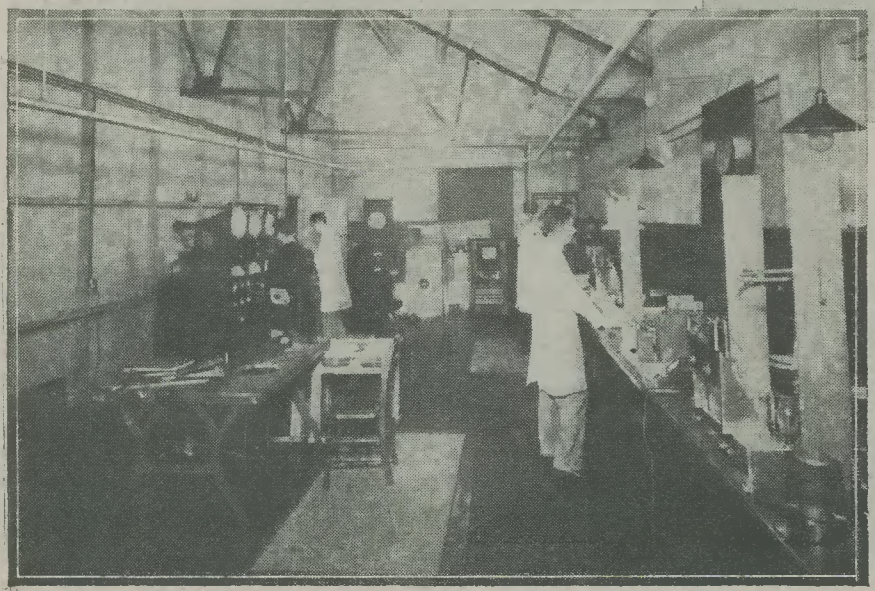
Experimental Receivers

The three receivers used in the laboratory were developed with the sole object of testing, under actual working conditions, television components, i.e., cathode-ray tubes, valves, etc., made by the Edison Swan Company and its associated companies.

These components consist mainly of cathode-ray tubes, receiving valves, rectifiers, thyratrons, transformers and loudspeakers.

One receiver is an experimental model made up on the rack assembly system, and was developed with the aid of a film scanner situated in the laboratory. The second receiver employs the superhet feature in which tuning to the sound

(*Continued overleaf*)



A general view of the Ediswan television laboratory. The life-test rack may be seen on the left, and the three experimental receivers referred to in the above text are at the far end.

PRACTICAL TELEVISION

(Continued from previous page)

automatically tunes correctly on the vision section, a single frequency-changer being employed. In this model sensitivity was sacrificed to quality in the vision section, in which six band-pass circuits are arranged to provide a 2 mc/s bandspread. The H.F. amplifier is followed by a special diode detector and one D.C. type video amplifier stage, which is connected direct to the control electrode of the cathode-ray tube, thus controlling directly the D.C. bias on which is superimposed the modulating picture frequencies. The sound section utilises a push-pull output stage (two PP.3/250's), and to take full advantage of the high quality of the special ultra-short-wave broadcasts, a dual speaker assembly is employed. The speakers consist of a 12in. and an 8in. model employing the Alnico magnet, giving a useful flux density of over 12,000 lines per square centimetre, and it is claimed that the response is practically flat from 90 to 6,000 c.p.s. The reproduction certainly sounded remarkably good and justified the claims which were made.

A Straight Circuit

In the remaining receiver a straight H.F. circuit is employed, with five special H.F. pentodes preceding the special diode detector, and the H.F. couplings consist of alternate transformers and chokes, the resonant point of the choke coupling being designed to fall in the small trough formed in the bandpass transformer coupling, thus providing a perfectly square form response curve for the full bandwidth required for high-quality pictures.

Other interesting developments which were shown included a special reflector arranged in the lid of one cabinet model which housed the cathode-ray tube in a vertical position. To avoid distortion and reflection difficulties this reflector did not consist of the usual mirror, but was a special component made up by one of the Ediswan company's associated companies, and which consists of a flat glass plate coated on the front with a special chemical, resulting in increased brightness and avoidance of all optical difficulties.

Television Notes

American Television

NOW that Britain has established its high-definition television service, other countries are making an effort to take up the challenge that this country leads the whole world in the quality of its pictures and the engineering soundness of its installation at Alexandra Palace. Details of American work keep filtering through, and if the reports are true efforts are being made to establish stations at New York, Hollywood, and Philadelphia. The R.C.A. have been conducting experiments and demonstrations from the Empire State Building which has an aerial over 1,200 feet above ground level. This great height is essential owing to the very tall buildings in New York. This causes difficulties of shielding and reflections, which latter produce multiple images and mar the picture quality. The R.C.A. still use a standard of 343-line definition with interlaced frame scanning, but so far the largest size cathode-ray tubes shown have a 12in. diameter screen, this producing a picture about 10in. by 8in. On the other hand, Farnsworth claims to be using a 441-line scan. These higher definitions necessitate a very wide sideband, and station range may be reduced if ultra-short wavelengths of from three to four metres become necessary owing to this fact. It is certain, however, that the inauguration of the B.B.C. service has stimulated activities in those countries which are carrying out their own television investigations on a fairly large scale. The smaller countries are holding a watching brief in order to gauge the results obtained and popularity achieved before building or ordering their own television equipment.

A Little Cramped

WITH the prospect of increased hours of television transmission the programme staff at Alexandra Palace are finding themselves rather cramped for studio space in order to carry out rehearsals. Is is stated that the adjoining theatre is to be employed in order to relieve the situation. There are only two large studios at the B.B.C. station, one for each system of television, and rehearsals for either system quite naturally can only be undertaken in the correct studio at the moment. On the programme side it is very noticeable that a direct feminine appeal is being made. Items are being included, especially in the afternoon, which are designed to captivate the taste of women. It is natural that at all the large stores the women outnumber the men in the audience at this time of the day. Many domestic subjects are being illustrated, while beauty experts are scheduled to appear very shortly, and even talks on mothercraft.

Baird's Loss

AS we go to press the news of the destruction of the Crystal Palace is to hand. Apart from its many historic associations the wireless amateur associates this old building with the development of television, as it was here that the Baird company transferred its activities when high-definition systems were tried out. The dipole aerials erected on the South tower may be seen in the illustration below, which was taken when daylight dawned on the remains of this fine old building, and much of the Baird experimental and research apparatus had been, unfortunately, destroyed. Full details of the damage are not yet to hand.

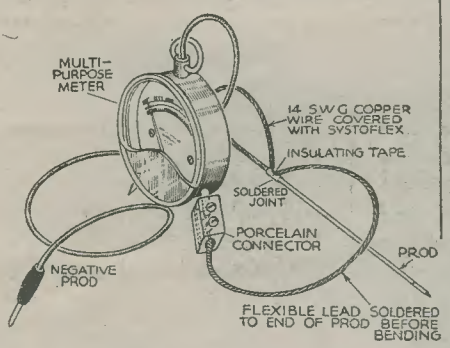
The remains of the historic Crystal Palace on the morning after the great fire. Note the Baird television aerials on the top of the tower nearest the camera, silhouetted against the background of smoke.

A PAGE OF PRACTICAL HINTS

SUBMIT YOUR IDEA — READERS WRINKLES — THE HALF-GUINEA PAGE

A Test-prod Improvement

SOME types of multi-purpose meters are equipped with a flexible common negative lead and two positive prods—one for each voltage scale—which are often too short to reach into the set at the exact point required without some risk of a short, especially if the set is at all compact. The following simple device, illustrated, overcomes these difficulties. A short piece of stout copper wire, about 8in. long, is slipped into a length of Systoflex sleeving, which is cut off to leave about ¼in. bare at each end. On to one end a piece of flex is soldered, and the end of the wire is then bent to form a loop and taped in position,

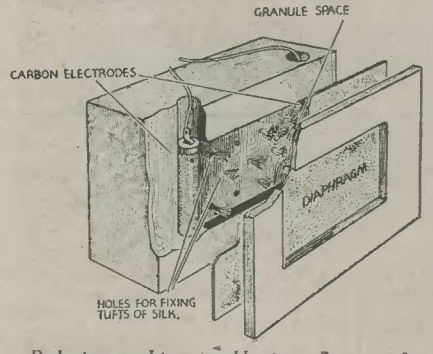


A useful test-prod improvement.

at the same time covering the joint. The other end of the flex is then connected to the meter prod by means of an ordinary porcelain connector. It will be found that the most inaccessible anode terminals "rise to the surface" with this simple gadget.—L. DU PLERGNY (Birmingham).

An Improved Microphone

THE accompanying sketch shows a useful method of reducing packing trouble, and also diaphragm resonance, in a home-made transverse current microphone. The microphone body is made from a piece of hardwood, and the actual details have been explained in these columns before.



Reducing packing trouble in a home-made microphone.

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL AND AMATEUR WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL AND AMATEUR WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

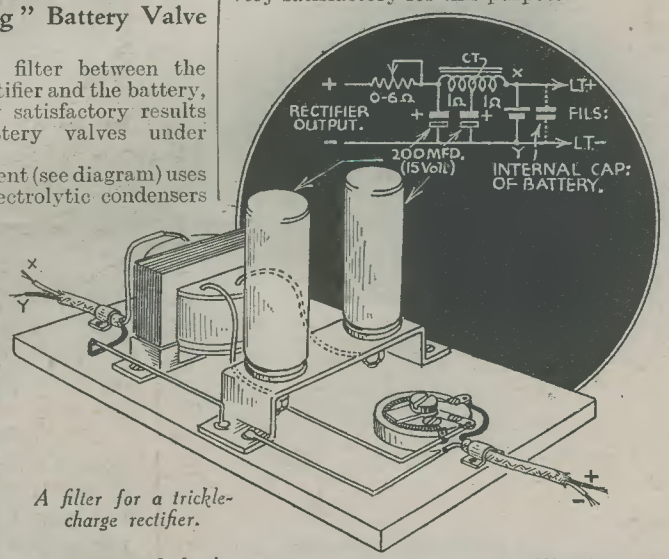
The variation in the design of this model is effected by drilling a series of holes in the surface cut away to form the granule space, and fixing in these holes, with a touch of glue, small tufts of frayed out silk floss. It will be noticed that adjacent rows are staggered vertically, which has the effect of keeping the granules in place when the microphone is in use. Care must be taken that the tufts just touch the diaphragm without bearing heavily against it, otherwise the frequency range of the instrument will suffer.—JOHN HADDON (Glasgow).

Filter for "Floating" Battery Valve Filaments

BY incorporating a filter between the trickle charge rectifier and the battery, I have obtained very satisfactory results whilst operating battery valves under "float" conditions.

The circuit arrangement (see diagram) uses two 200mf 15-volt electrolytic condensers and a centre tapped 1Ω+1Ω choke. The rectifier output is regulated by the rheostat to yield the correct smoothed output for the filament load. The battery, remaining across the filaments, acts as a "buffer" thus ensuring an output of 2 volts, and at the same time allows its large internal capacity to behave as a final smoothing element. The winding data for 1Ω+1Ω choke is as follows:—

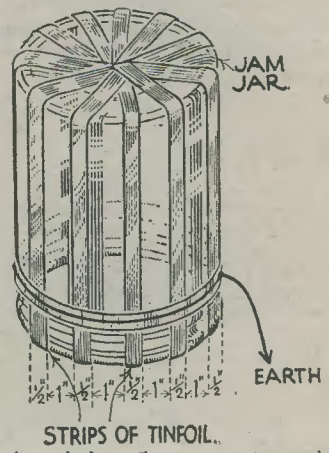
Core—36 No. 5 Stalloy stampings, wound with 660 turns of 20 s.w.g. enamelled copper wire centre tapped at 330 turns, giving approx. 1Ω per section at a safe current rating of 1 amp. to cater for a wide range of multi-valve battery sets.—WM. S. HARRISON (Aintree).



A filter for a trickle-charge rectifier.

An Effective Screening Method

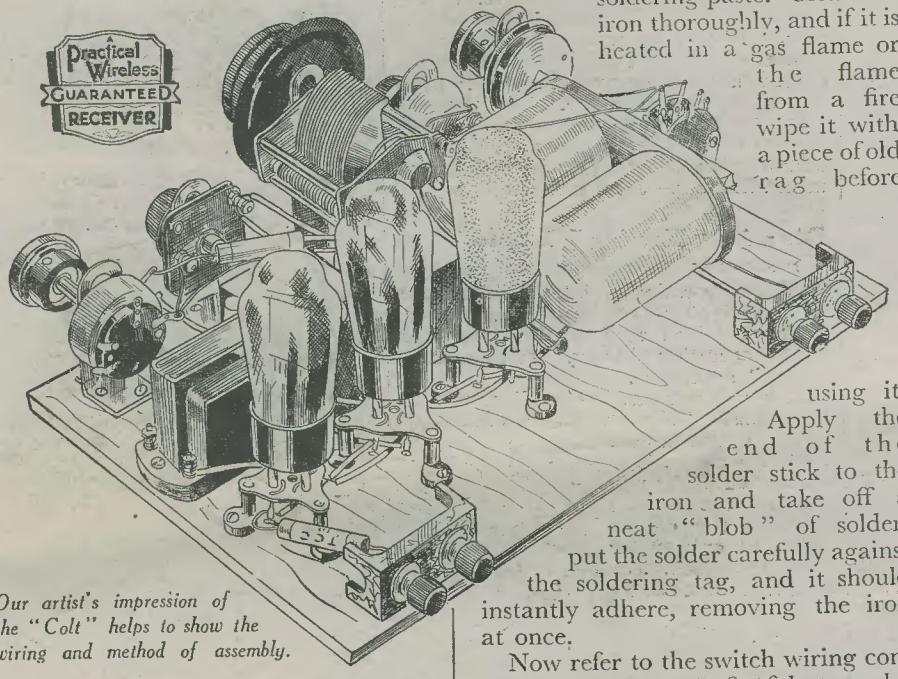
IT is often found necessary to screen instruments from external electrical influence, and yet be able to see the apparatus. I have found the following method very satisfactory for this purpose.



A simple but effective screening method.

Take a glass jam jar of the 2lb. size, and round it stick strips of tinfoil ½in. wide, as shown in the sketch, and leave about 1in. between each strip and the next. Glue another piece of foil ½in. wide round the bottom, making sure that this last strip makes good electrical contact with all the others. Take a connection from this strip to earth. This method of screening, although simple and cheap, will be found very efficient, and by using the various small glass jars which are used for various packings, screens for all kinds of components may be made up in a similar manner.—J. BLAKE (Palmers Green).

THE experienced constructor may have been able to carry on with the construction of this interesting receiver from the diagrams and brief details given last week, but the following notes will describe fully the actual process of building, and therefore those who have already finished the main part of this work will be able to turn to the end of these notes for the operating details. As mentioned last week, the coil and switch assembly should be carried out before these parts are mounted on the baseboard. When purchased, the switch units and the operating rod will no doubt be separated (unless a complete kit is obtained), and this facilitates the wiring to the coil unit. If they are assembled the operating rod and locator plate may easily be withdrawn, as there is no locking device to keep the switch unit in position on the square rod.



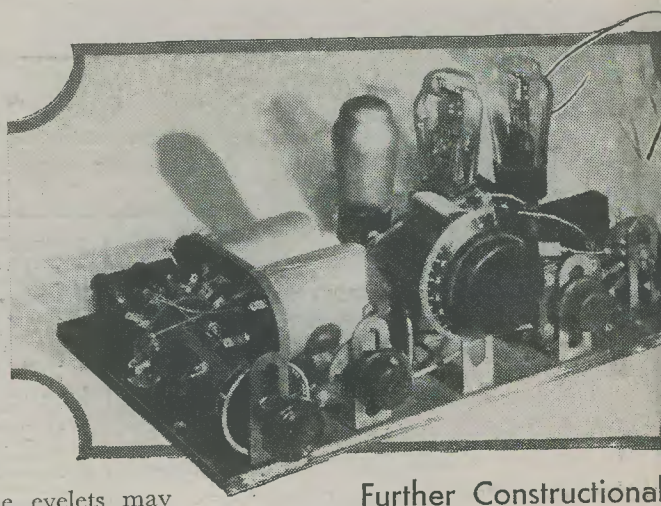
Our artist's impression of the "Colt" helps to show the wiring and method of assembly.

The best way of wiring the coil is to attach to each of the contacts on the base, with the exception of No. 4, and that marked E, a good length of tinned copper wire. To avoid the trouble of measuring each length make these wires about 12ins. long. Insulated sleeving may be passed over some of these wires, although it is not essential for all of them. It will be noted as the contacts on the switch unit are wired up, which of these leads run close together and a length of sleeving may then be cut to avoid the risk of short-circuits.

Making Good Connections

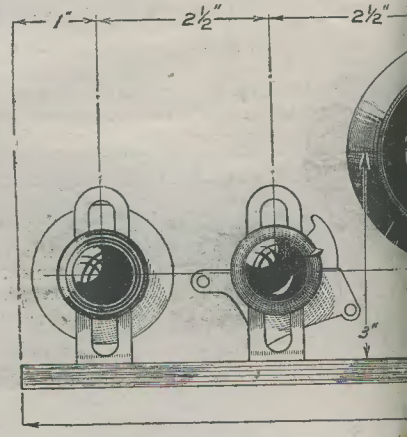
The switch plate and the coil unit utilise soldering tag connections, and therefore soldering has to be resorted to in this receiver. Remember, however, that the tags are attached to soft material and make quite certain that a really hot iron is employed and leave it in contact with the tags for the very minimum of time. If this point is not attended to the eyelets may be loosened and the switch will fail to operate satisfactorily. Carefully clean each contact with a piece of well-worn emery cloth and apply the merest trace of Fluxite or similar soldering paste. Clean the iron thoroughly, and if it is heated in a gas flame or the flame from a fire wipe it with a piece of old rag before using it. Apply the end of the solder stick to the iron and take off a neat "blob" of solder, put the solder carefully against the soldering tag, and it should instantly adhere, removing the iron at once.

Now refer to the switch wiring connections on page 376 of last week's issue. It will be noted that there are two plates, marked A and B, and on the switch unit, plate B is the one attached direct to the mounting bracket, and when screwed down this is the one farthest from the control panel. The contact points are not lettered on the actual component, and the letters on the wiring diagram are, therefore, reference points to the remainder of the wiring. Connect together the three lower contacts on each plate leaving about one inch of wire projecting from the front plate (plate A), and four inches of wire from plate B. To one of the fixing nuts a soldering tag must now be



Further Constructional Details of this Interesting

attached, and the most convenient nut is that on the left, viewing the switch from the front. A two inch length of wire is then attached to this tag. The switch unit may now be wired to the coil tags, and it will be noted that in four cases there are two wires attached to the coil contacts. Terminal 4 and terminal E nearest to it are now joined together and the coil unit is ready to attach to the baseboard. An ordinary component-mounting bracket is employed for this purpose, with a bolt passed through one of the two fixing holes in



Use this diagram when mounting th

LIST OF COMPONENTS FO

One four-range coil, No. C56 (Bulgin).
One driver-locator unit, No. S150 (Bulgin).
One five-way contact unit, No. S153 (Bulgin).
One .0005 mfd. condenser, No. 2SM (C2) (Pol
One .0003 mfd. diff. reaction condenser (Polar).
One .0001 mfd. Compax condenser (C1) (Pola
Four fixed condensers: .0001 mfd. (type M) (
.005 mfd. (C7), .01 mfd. (C6) (type 300 tubu
2 mfd. (type 65) (C5) (T.C.C.).
Three fixed resistors: 2 meg. (R1), 40,000 (
10,000 (R3) (1 watt type) (Erie).
One potentiometer, 1 meg. with two-point sw
(R4) (Erie).
One L.F. transformer, 3/1, No. LT135 (B.T.S

The "COLT" All-Wave 3

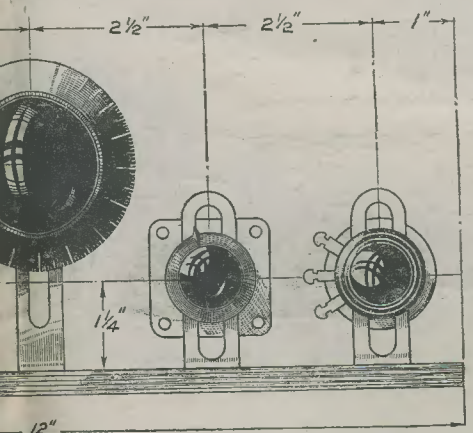
Notes and Preliminary Operating Simple-to-build All-wave Set

the foot of the bracket and through the fixing hole in the coil unit. A screw and large washer may then be used to hold down the bracket through the long slot in the arm and this enables the coil to be accurately positioned when mounting the bracket.

Finishing the Wiring

The one-hole fixing bush attached to the driver-locator unit should now be attached to a component-mounting bracket, and locked into position with the single nut and indicating plate left off. This may afterwards be attached to the front of the panel by means of the second nut which is provided with the unit. The square driving rod is now pushed through the switch unit, and when the front of the bracket is level with the front edge of the baseboard, the bracket should be screwed down. When the indicating plate is to be attached to the panel the switch should be turned to the extreme left, and then an indicating pointer may be attached to the front so as to give a clear indication of the actual setting of the switch.

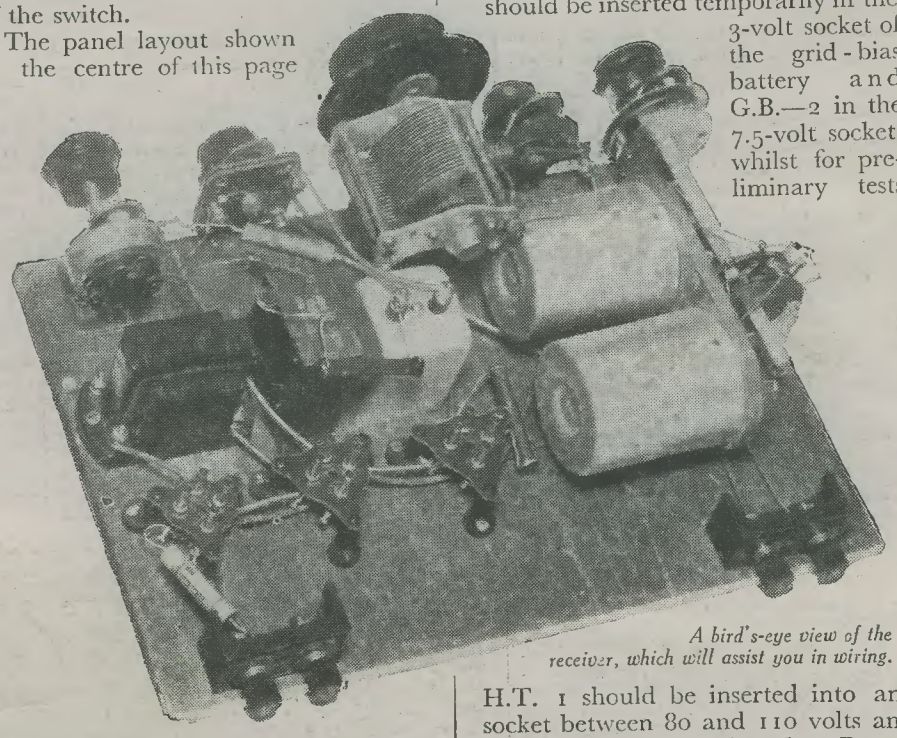
The panel layout shown in the centre of this page gives the mounting positions for the various controls and the four remaining component-mounting brackets should be placed in the appropriate positions. To avoid cutting the spindle of the volume control, and to enable the control knobs all to remain at an equal distance from the panel, the bracket for this component should be mounted slightly back from the front edge of the baseboard. Mount the valve-holders first and carry out the wiring to the legs, as these may prove inaccessible when the transformer and remaining components have been fitted. A single length of wire is employed for each filament run, and lengths of sleeving are cut off to slip over between the valve-holders, passing the wire through the centre holder and finishing off at the other end. Attach the grid leak to the first valve-holder, and lengths of wire to the remaining legs, after which the remaining components may be attached in the positions shown in the wiring diagram, and in the illustrations on this page.



brackets and for drilling the panel or cabinet.

Testing Out

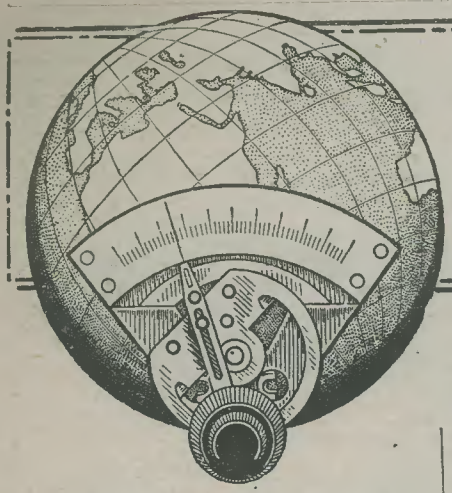
Complete the wiring and attach the battery leads, making quite certain that the correct indicating plugs are attached to these. When the receiver is checked and ready for test, the L.T. leads should be attached to the accumulator, and the H.T.—and G.B.+ should be inserted into the appropriate sockets on these batteries. G.B.—1 should be inserted temporarily in the 3-volt socket of the grid-bias battery and G.B.—2 in the 7.5-volt socket, whilst for preliminary tests H.T. 1 should be inserted into any socket between 80 and 110 volts and H.T.2 into the 120-volt socket. Rotate the right-hand control in a clockwise direction and the switch will be heard to snap over after a short movement, in which condition the set is on, but the L.F. volume control is in the position of minimum volume. As this control is turned further the volume will be gradually increased. The reaction control should be set to minimum for preliminary tests, and the wave-change switch set to the medium-wave position. The local should be heard and there are no trimming adjustments to be carried out. The voltage at H.T.1 should be adjusted until smooth reaction effects are obtainable over all wavebands.



A bird's-eye view of the receiver, which will assist you in wiring.

R THE "COLT" ALL-WAVE THREE

One all-wave choke, No. A.W.C1 (B.T.S.).
Three four-pin S.W. type baseboard mounting valveholders (Clix).
Two terminal blocks with A.E. and L.S. terminals (Belling-Lee).
Six plugs: H.T.—, H.T.1, H.T.2, G.B.+, G.B.—1, G.B.—2 (Belling-Lee).
Two spades: L.T.—, L.T.+ (Belling-Lee).
One baseboard, 12in. by 8in. (Peto-Scott).
Six component brackets (Peto-Scott).
Three valves: D210, L210, P215 (Hivac).
One speaker, type 37J (W.B.).
H.T. Battery, 120 volts (Drydex).
G.B. battery, 9 volts (Drydex).
L.T. accumulator (Exide).
One tin Filt (Graham Farish).
One slot aerial filter (Graham Farish).



SHORT WAVE SECTION

THE SIMPLEST SHORT-WAVER

In Response to Many Requests We Give in This Article the Constructional Features of One of Our Most Popular One-valve Short-wave Receivers

IT has already been stated that many amateurs appear to obtain the best results on the short waves with the simplest type of receiver. Some of the extensive short-wave logs which have been published bear witness to the fact that a good one-valve set can give a remarkable performance when correctly designed and built, and in 1935 we described a receiver

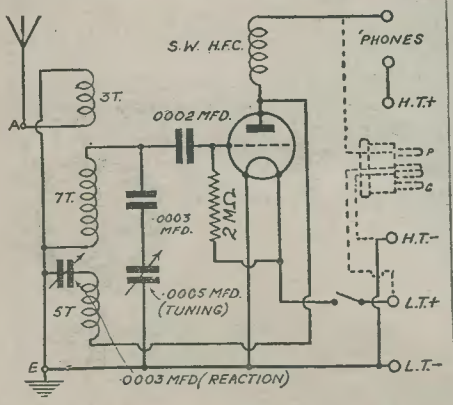


Fig. 1. Theoretical circuit of the simple one-valve set

of the "home-made" type in which the coil and H.F. choke were constructed by the amateur. This particular receiver appears to have given phenomenal results, and we have repeatedly received requests for details of construction. Unfortunately, the issue in which this receiver was described is now entirely out of print, and no further copies are obtainable. We have decided, therefore, to reprint the main part of the article in question so that those readers who were unable to take advantage of the earlier issue, or who have since decided to make up this receiver, can now do so.

The Circuit

The circuit is shown in Fig. 1 and the practical wiring diagram in Fig. 2. It will be seen that quite a straightforward arrangement is employed. A standard .0005 mfd. tuning condenser is employed instead of a special low-capacity, short-wave condenser, but to make tuning simpler a fixed condenser is joined in series with it. Of course, if desired, the fixed condenser may be omitted and a special low-capacity condenser used for tuning. The value of this should be .00016 mfd. or .0002 mfd.

Making the Coil

The coil, it will be seen, consists of 15 turns of wire—in three sections of 3, 7, and 5 turns each—wound on a length of 2in. diameter cardboard tube. Ordinary postal tube is quite suitable for use as the former, and this should, for preference, be given a liberal coating of shellac varnish before use. The 3-turn winding is for aerial coupling, the 7-turn winding is for tuning the grid circuit, and the 5-turn winding is for reaction. The grid coil is wound with 20-gauge enamelled wire, the turns being equally spaced by the diameter of the wire used, but the other two windings have side-by-side turns of about 26-gauge enamelled wire. Actually, it is not essential that these exact gauges be employed, but they are probably the most suitable. All the turns are wound in the same direction, and the ends of the windings are anchored by passing the wire through pairs of small holes made in the tube with a drill or a pricker. As to the connections, these are as shown, and care is needed only to see that the coil leads are connected in the order shown; that is, the leads from any winding must not be reversed.

The coil can be attached to the small baseboard either by fitting a small angle bracket to the former, or by making the latter a push fit over a wooden disc or large cork screwed to the baseboard. The reaction condenser may be any ordinary component having a capacity of .0003 mfd., but it is better to use one of the air-spaced variety if this is to hand. The grid condenser and leak are standard components which nearly every constructor will have in the junk box, but even if they are to be bought new they will not cost more than two shillings. A valve-holder of normal baseboard-mounting type is shown, but, if desired, one of the special short-wave valveholders, such as the Clix, Eddystone, or B.T.S., may be employed. Any on-off switch will serve perfectly well.

The H.F. Choke

The next item is the H.F. choke, and this can be made very easily by winding 150 turns of 36-gauge enamelled wire on a ¾in. diameter test tube (obtainable from a chemist's for a penny or so). The turns are continuous (electrically), but are wound in five sections of 30 turns each. No special care is called for here, for you simply wind 30 turns in a pile about ¼in. wide, leave a gap of ¼in., wind 30 more turns, and so on. As will be seen, the two ends of the winding are held in position by winding a strip of adhesive tape or insulating tape round the tube. On completion, this simple choke can be fixed to the baseboard by means of a cork which fits the open end. When desired, an Eddystone type 948 choke can be bought to replace the simple home-made one.

(Continued on facing page)

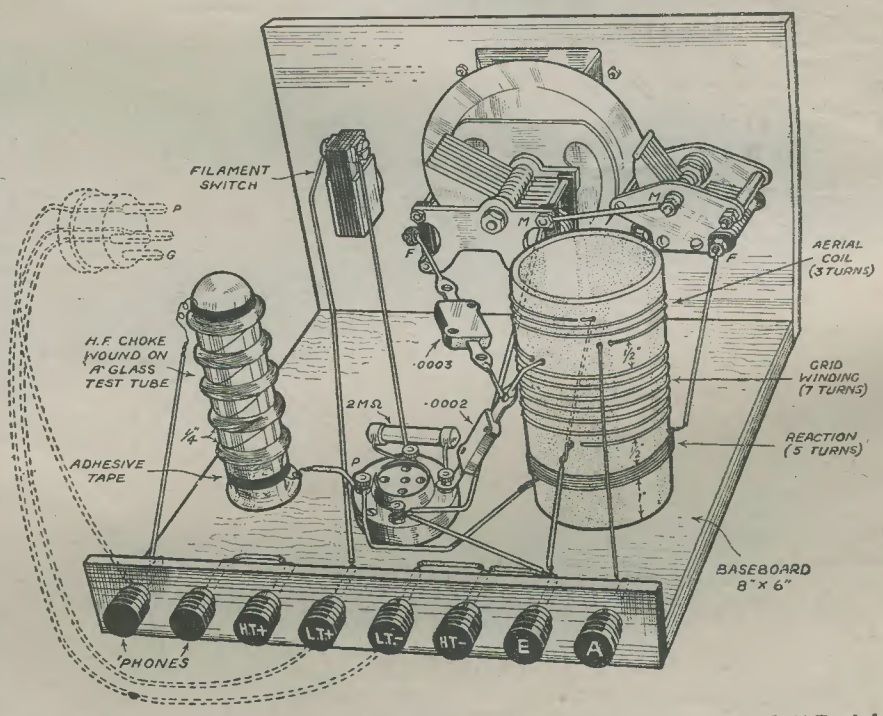


Fig. 2.—Practical wiring diagram showing the constructional details of the coil and H.F. choke.

SHORT-WAVE SECTION

(Continued from facing page)

Eight terminals are fitted to the rear edge of the baseboard, and are mounted on a strip of ebonite 1½ins. wide. In connecting up, see that all the leads are as short as possible, and cut those from the coil and choke so that they are just long enough to reach to the appropriate terminals.

Wavelength Covered

The finished receiver will tune from about 20 to 40 metres, and will, therefore, cover the wavelengths used by many amateurs (working on about 40 metres) as well as by a number of short-wave broadcasting stations working on wavelengths in the region of 31 metres. Probably the transmissions which will be received most easily are those of Rome, on 25.4 metres, Zeesen (Germany), on 25.57 metres, and Radio Nations (Switzerland), on 31.26 metres, but there are many American stations which are well within range when conditions are favourable.

The method of operation is the same as that in the case of a det.-L.F. receiver designed for medium- and long-wave reception, except that greater delicacy of operation is necessary. This means that the tuning condenser—which must have a reasonably good slow-motion drive—must be controlled slowly, and that the reaction condenser must be employed more frequently, so as to keep the set just on the verge of oscillation; this is indicated by a faint "breathing" sound in the 'phones.

For Loudspeaker Reception

Should it be desired to operate a loudspeaker the set can be used as an adapter by fitting an old valve base or an adapter plug to the two L.T. terminals and to one of the 'phone terminals, as shown in broken lines in Figs. 1 and 2; a convenient length of four-strand cable is suitable for connection. The detector valve of the broadcast receiver is then removed and the plug inserted in its place. It might be added that the most suitable valve for use in the short-wave set is a type H.L. or L., but, in any case, the detector valve from the broadcast receiver can be used satisfactorily.

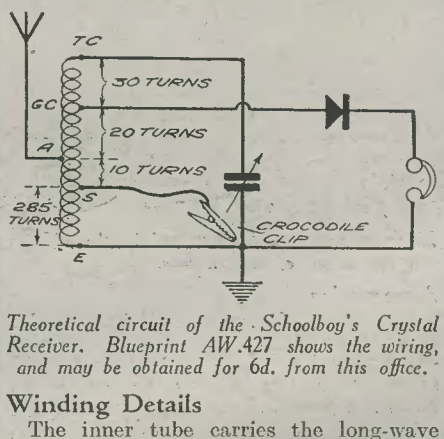
DIFFICULT IDENTIFICATION

If recognition of a station is to be assured and the signal is weak it is essential that the listener should make every effort to pick up the exact call. Unfortunately, many of the South Americans possess almost identical call-letters, differing only in the number following the international prefix. A case in point is that of HJ4ABP, Medellin (Col.), on 48.90 m. (6,135 kc/s), and HJ1ABP, Cartagena (Col.) on 31.25 m. (9,600 kc/s). In this instance no mistake should occur if at the time the difference in frequency is taken into consideration, as the position of the respective stations in the waveband will abolish all uncertainty. But, if the signal is faint it is easy to mistake a P for a D or a B and this is where accuracy is necessary. Personally, when in doubt, if loudspeaker strength is poor, I switch over to headphones. Bear in mind, however, that when a mains-fed set is used adequate protective precautions must be adopted both to reduce signals to suit your eardrums, and also to ensure that no high tension current is allowed to filter through to the headphones.—G. A.

THE SCHOOLBOY'S CRYSTAL RECEIVER

How to make the coil for the receiver which is shown in Blueprint AW.427

As the copy of AMATEUR WIRELESS in which details for building this crystal receiver is now out of print, we are reprinting here the constructional details of the coil, as many readers are desirous of making up this interesting and simple receiver. The coil is a very efficient unit, covering both medium and long wavebands, and is made up on two separate formers. These are of paxolin, and are 4ins. in length. The larger of the formers is 2½ins. in diameter, and the other 1¾ins. in diameter, the latter being held in position in the centre of the large former. For this purpose small spacers of ebonite are employed, and are held in position with short screws. Alternatively a disc of wood may be cut and screwed to the baseboard to which the inner tube may be attached, and the outer tube may be held in position with small metal angle brackets.



Theoretical circuit of the Schoolboy's Crystal Receiver. Blueprint AW.427 shows the wiring, and may be obtained for 6d. from this office.

Winding Details

The inner tube carries the long-wave winding, consisting of 285 turns of 36 gauge enamelled wire, arranged in the centre of the tube. On the large tube are wound sixty turns of 26 gauge enamelled wire, also exactly in the centre of the tube. When placing this winding on, however, you must make a tapping at the tenth and twentieth turns from the lower end. Anchor the ends of the windings by passing the wire through two small holes pierced about ¼in. apart. To the top of the larger tube a single terminal is fitted, and this should be immediately above the holes where the end of the winding comes. At the bottom of the larger tube four terminals are mounted, and the connections to these are as follows: The top of the inner winding is joined to the bottom of the inner winding, and the two wires are joined to the terminal on the bottom marked S in the blueprint (one side of the wave-change switch). The bottom of the inner winding is connected to the next terminal marked "E" (Earth). The top of the outer winding is joined to the top terminal marked "TC" (fixed plates of the tuning condenser), and the tapping points on this winding are joined to the remaining terminals in the following order. The lowest tapping, that is, the one which is ten turns from the bottom of the coil, is joined to the A terminal, and the centre tap is joined to the GC terminal, which in this set is connected to the crystal detector.

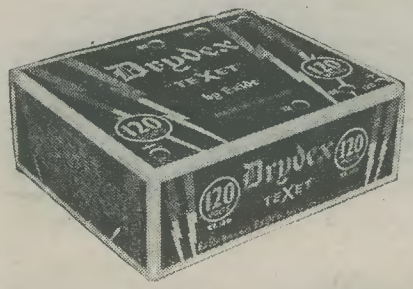
The theoretical diagram of this receiver is given here for those who wish to make up the circuit, and who are interested in the theoretical connections.

Radio Gifts for Christmas

Some Brief Suggestions for Presents Suitable for the Wireless Amateur. There is an Unlimited Range of Gifts, and the Following Hints Will Enable You to Make Your Selection

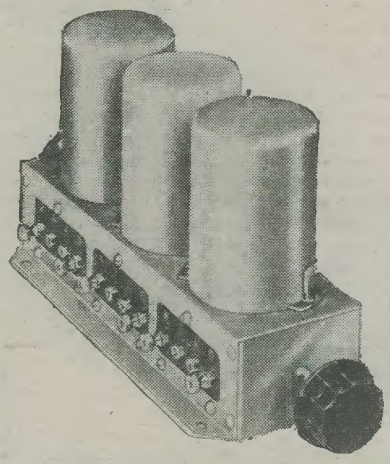
IF you are giving presents to radio friends this year, or are asked to choose a suitable gift for yourself, you will find that the range of accessories which is now available will cater for practically every possible taste. It is possible to obtain components for a few pence, many of which may be included in a ready-made receiver, perhaps to improve its efficiency, or at least to improve its ease of handling or control, and at the other end of the scale there are complete units costing as much as £6, which may be used as the nucleus of a new receiver. Of course, in addition to these separate components, there are extension speakers, cabinets and similar items.

Where a component is required for addition to a ready-made receiver, there are such items as transformers, the addition



A new H.T. battery is a very acceptable gift.

of a modern component of this nature being ideal for old-fashioned receivers. An improvement in quality is almost certain to be obtained when this change is made, but it may be found that the replacement of the tuning coils is a more efficient arrangement. There are now dozens of different types of coil, and no doubt many old sets may be considerably improved by the incorporation of a band-pass circuit, or simply by iron-cored coils in place of old air-core types. A modern coil may be obtained for 5s. or so, and ganged units vary in price from 12s. Some good examples may be found in the Bulgin, Varley, Wearite and B.T.S. range.



Many old sets may be improved by the addition of modern coils.

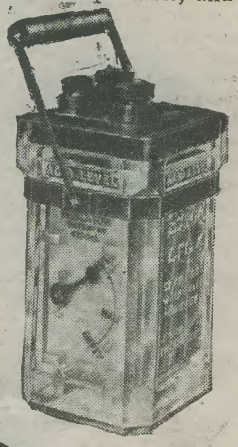
Accessories

Outside of the receiver there are also many items which will be found acceptable as gifts, and a new H.T. battery or L.T. accumulator can always be employed. Even if a good L.T. battery is now in use, a new one will prove a valuable stand-by, and the latest patterns may be obtained

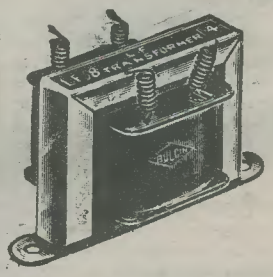
An extension speaker such as this W.B. model can be used with any receiver.

supply. There are also such items as meters and other measuring instruments, without which no experimenter is worthy of the name, and a simple instrument for testing the ordinary battery supplies may be obtained for six or seven shillings, whilst complete testing apparatus is available at prices ranging up to several pounds.

Where a lot of experimenting is carried out, a soldering iron is indispensable, and

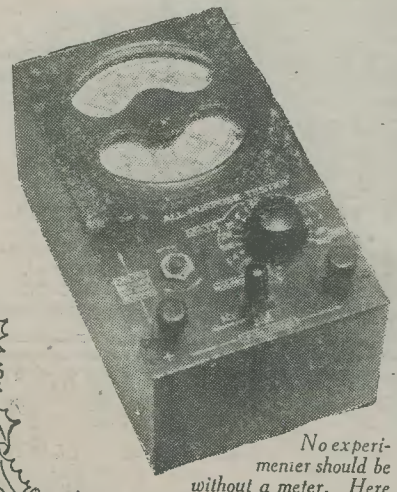


One of the latest L.T. accumulators complete with indicating clock is an ideal gift for the battery user.



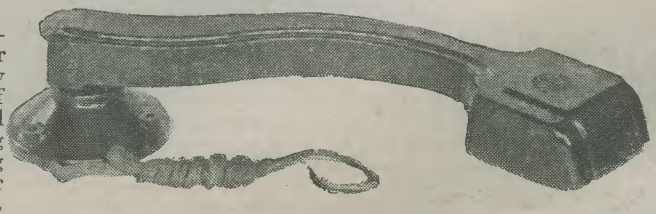
An old set will be improved if a modern transformer is fitted.

the Solon irons need no introduction. For 10s. 6d. one of the latest irons with pencil-bit (which is replaceable) may be obtained. Gramophone pick-ups may be obtained from 5s. upwards, and there are many different makes from which to choose. Amongst these may be mentioned, Cosmocord, Morphy-Richards, B.T.H., etc. Gramophone motors may also be obtained in various forms, from the simplest clockwork models up to the elaborate automatic-changing apparatus costing £10 or so. Suitable models may be found in the Garrard and Collaro range. Accessories for the radiogram may be found in the Bulgin range, and include such items as needle cups, turntable illuminating and signal lamps, and change-over switches.



No experimenter should be without a meter. Here is an all-purpose tester from the Everett-Edgcumbe range.

with a self-indicating pointer showing exactly the condition of the battery and thus avoiding risk of missing a programme or item due to a sudden failure of the L.T.



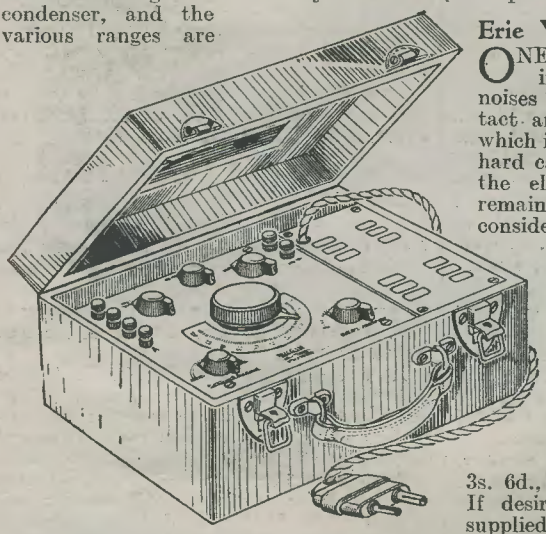
This is the Morphy-Richards pick-up, which can be obtained for 14s. 6d.

Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

Bulgin All-mains All-wave Oscillator

THE service-man cannot do without an oscillator, and the keen experimenter will also find that such a piece of apparatus will prove invaluable in calibrating a receiver or aligning various circuits. The output may be measured, and the response curves of speakers, etc., carefully tabulated when a constant signal is applied to a receiver, and for such a purpose a fairly simple piece of apparatus may be employed. The main essential of this type of oscillator is a neon discharge device, and in the oscillator shown below this type of accessory is employed, together with two valves of the mains-voltage filament type. A switch is fitted so that the note provided by the neon oscillator may be employed, or, alternatively, the oscillator may be modulated by a pick-up connected to suitable sockets. Tuning is carried out by a standard condenser, and the various ranges are chosen by means of a multi-contact switch. Separate controls are provided for H.F. and L.F. attenuation, and owing to the use of the special mains valves there is no undue heat dissipation, and the apparatus is instantly ready for use where either A.C. or D.C. mains are available. Fitted in the lid of the oscillator is a complete tuning graph showing the correct dial setting for any desired frequency for calibation purposes, and the range covered embraces both of the normal medium and long-wave broadcast bands in addition to a separate range from 100 to 1,500 kc/s suitable for tuning intermediate-frequency transformers or other similar equipment. The price of the complete oscillator, inclusive of valves, is £10, and a kit of parts for its construction may be obtained (less valves) for £5. The construction of the unit is fully described, with wiring diagrams, in the interesting publication, "Radio Progress," obtainable from Messrs. Bulgin, price 1s.



A useful all-mains oscillator obtainable from Messrs. Bulgin, complete, or as a kit of parts to build yourself.

Mazda High-voltage Rectifier

FOR use in high-voltage apparatus, such as television receivers, the Mazda MU.2 will be found a desirable rectifier. This is of the low-rating filament type, requiring 2 volts for attaining a suitable emission at a current of 2.4 amps., the peak inverse voltage is 11,000, and the maximum anode voltage and current is 4,000 at 300 milliamps. The valve is of the half-wave mercury vapour type, and the anode connection is brought out to a cap on top of the valve, so that a high insulation factor is obtained. A standard four-pin base is fitted, and the price is 20s.

The range of rectifiers is now reduced owing to the substitution of the type UU.3 by the UU.4. This is an indirectly-heated valve with a higher current rating, and it may be substituted for the UU.3 in all circuits in which that valve is now employed. The heater is of the 4-volt 2.2-amp. type, and the rated output is 350 volts at 120 mA. The price is 10s. 6d.

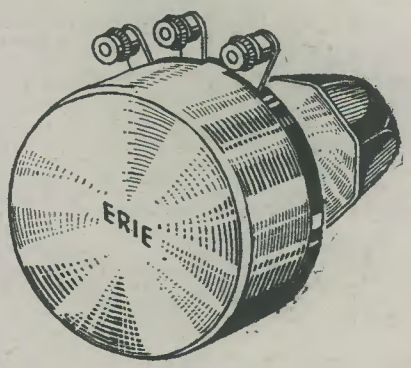
Erie Volume Control

ONE of the main difficulties in designing a volume control is to avoid noises due to wear of the element or contact arm, and in the Erie component which is illustrated on this page a special hard carbon compound is employed for the element, and this is designed to remain noiseless and consistent over considerably more than the normal life of a standard radio receiver. Under a life test in the factory the standard attained is 100,000 revolutions, with a full current load. This particular component is totally enclosed to avoid changes due to climatic conditions, and is available in eight separate ranges, 5,000, 10,000, 25,000, 50,000, 100,000, 250,000, 500,000, and 1,000,000 ohms. The price is 3s. 6d., or 5s. with a single-pole switch. If desired, any of these models may be supplied with a double-pole switch for an extra 2s. 6d. The switches are rated to break 125 volts at 2 amps., or 250 volts at .5 amps.

Marconiphone All-wave Aerial

YET another interference-free all-wave aerial kit has now been produced, this time from the Marconiphone laboratories. This particular equipment is, however, designed to function down to the present television wavelengths and thus covers the extremely wide wave-range from 7 to 2,000 metres. It consists of three lengths of standard 7/22 aerial wire, in 60ft., 39ft., and 5ft. lengths, ready attached to "egg" type insulators and to a special aerial transformer fitted with a spark gap. Attached to the transformer is a 60ft. length of rubber-covered screened cable, to the end of which a receiver transformer is fitted. The output from this consists of two leads in the same rubber and screened covering, provided with two plugs for attachment to the aerial and earth terminals of a receiver. The aerial wire must not be shortened, as the characteristics of the two transformers are designed to operate at maximum efficiency with certain loads, and, therefore, the maker's instructions regarding the use of the assembly must be carefully adhered to. The 5ft. length of wire must be maintained in a vertical direction, but if a "V" type aerial is required, it is permissible to cut the end of the 39ft. length of wire and transfer it to a pair of holes on the other side of the aerial unit.

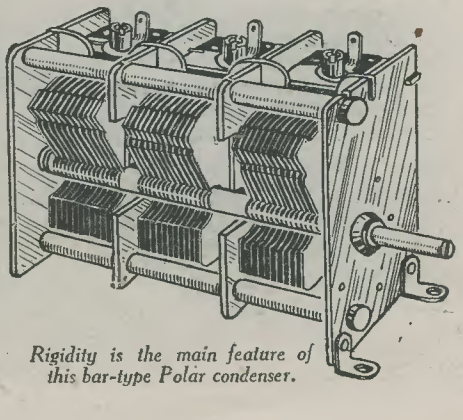
The screened down-lead may be adjusted to suit the requirements of the house, and the book of instructions gives clear details and a diagram showing the method of arranging the connections when the required length has been ascertained. The receiver transformer is fitted with a selector switch, so that the aerial may be matched for use on the desired waveband, and it is stated that although on the broadcast band the switch should be set to the 200-2,000 metre position, it may be found that either of the remaining positions offers best results on the short waves, and, therefore, the switch should be adjusted to provide the best results under actual conditions. The price of this equipment is £1 17s. 6d.



This volume control from the Erie range is noiseless and efficient.

Polar Bar-type Condenser

IN a modern receiver, with sharply-tuned circuits, it is essential to make certain that all components, as well as wiring, shall remain rigid to avoid losses due to mis-alignment of the various circuits. A common source of trouble is the ganged condenser, where this becomes distorted during the mounting process owing to the fixing screws being driven in at an angle, or through bolt-holes being drilled slightly out of place. The Polar condenser shown below is of a massive type, and the main feature is the bar or rod running from end to end at top and bottom, and this ensures that the frame cannot become distorted due to mishandling, and thus the three sections will remain perfectly matched after it leaves the factory. This condenser may be obtained in 2-and 3-gang units, the prices being 12s. and 17s. 6d.



Rigidity is the main feature of this bar-type Polar condenser.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

Salisbury and District Short-wave Club

A MEETING of the above club was held on Tuesday, November 17th, at the Bemerton Labour Hall, Wilton Road, Salisbury, when a lecture was given by Mr. C. A. Harley (2ACC) on "Short-wave Superhet Design."

A brief survey of the superhet was given, explaining the reason for, and the advantages of, the superhet principle. An example of modern short-wave superhet design was exhibited, consisting of a five-valve battery receiver with octode frequency changer, two variable-mu H.F. pentodes, double-diode-triode and pentode output. An explanation of the circuit and details of how to gang the receiver with a modulated H.F. oscillator were given, whilst with the aid of a blackboard, diagrams were given to illustrate the various remarks.

The Club regrets that they cannot still listen to the interesting talks which were given by VS3AC on transmission. Unfortunately Mr. Laver is returning this month to Malaya, but it is hoped to arrange tests with CW and 'phone on the 14 mc. band. The Hon. Secretary would be grateful for reports of VS3AC which may be heard at a later date by either members or non-members, and can promise that a QSL card will be forthcoming. All inquiries should be addressed to the Hon. Secretary, C. A. Harley, 85, Fisherton Street, Salisbury, Wilts.

Radio and Television Society (Northwood)

THIS Society had its first meeting on Sunday, November 8th, when the committee was appointed and the activities of the society discussed. It was decided that a review of modern sets would be made at each meeting. On Sunday, November 15th, Mr. Wallace read a paper to the society on "Short-wave Adapters and Converters," in which he pointed out the natural disadvantages of the apparatus due to stray capacities, and concluded his talk with a practical demonstration on a Marconi receiver, utilising an adapter he had constructed. At the next meeting details of a high definition television set will be discussed, with a view to the formation of a vision section.

Details of further activities may be obtained from the Hon. Secretary, R. B. Gardner, 91, Clarence Gate Gardens, London, N.W.1. Membership is confined to the Merchant Taylor's School for the most part, but correspondence on the club's action, with suggestions, will be gratefully accepted.

The Exeter and District Wireless Society

A LARGE and enthusiastic audience at a recent lecture of the Exeter and District Wireless Society heard a very lucid and interesting talk, illustrated with lantern slides, on the maintenance and care of modern batteries, the talk being given by Mr. Stanley Brown, A.M.I.W.T. The lecturer took his audience through the complete manufacture of the battery from the lead in its raw state to the completed plates as they appear in a cell, either of a starter or a radio battery.

A feature which was stressed was the tell-tale gravity clock, which is incorporated in most radio batteries of to-day, the error in this piece of mechanism being demonstrated to be less than one half of 1 per cent.

The Society's meetings are held every Monday at No. 3, Dix's Field, Exeter, and prospective members are asked to contact with the Secretary, W. J. Ching, Sivell Place, Heavitree, Exeter.

Radio, Physical and Television Society

DURING the past year the Radio Physical and Television Society has made considerable progress; since January its membership has increased by nearly 75 per cent. The success of the Society is due, in no small degree, to the excellence of recent lectures.

At a recent meeting Dr. C. G. Lemon lectured on "Cathode-ray Tubes." The use of the oscillograph for investigating distortion in amplifiers was explained and demonstrated by deliberately introducing distortion into an amplifier. Other recent lectures have included "Bacteriological Methods," by Lt.-Col. C. J. Coppinger, and "Short-wave Receivers," by Mr. J. G. Hobbs. Meetings are held every Friday during the winter months at 8 p.m., at 72a, North End Road, when lectures and demonstrations are given on various radio and physical subjects.

Those requiring further details are invited to write to the Hon. Secretary, Mr. V. R. Walker, 49, Fitz-James Avenue, London, W.14.

Bradford Short-wave Club

THE above club recently had a demonstration of Lissen short-wave and all-wave sets.

On Friday, December 11th, Mr. G. A. Briggs, of the Wharfedale Wireless Works, will give a lecture entitled "How to Judge a Loudspeaker." The lecture will be held in the club-room at Bradford Moor Council School, Leeds Road, Bradford, to commence at 8.30 p.m. An application is being made for an A.A. licence, and a very interesting programme is in store for the winter. A cordial invitation is offered to anyone interested in amateur radio, who is desirous of attending any of the club's meetings which are held every Friday in the above school. The Hon. Secretary is Mr. G. Walker, 33, Napier Road, Thornbury, Bradford, Yorks.

(*Continued on opposite page*)

FREE ADVICE BUREAU

COUPON

This coupon is available until December 19th, 1936, and must be attached to all letters containing queries.

PRACTICAL AND AMATEUR WIRELESS, 12/12/36.

CLUBS AND SOCIETIES

(*Continued from opposite page*)

Swindon and District Short-wave Society

THE above society still continues to progress. Formed just over twelve months ago with a very small membership, it has now grown to be a very active concern. Meetings are held fortnightly, when lectures are given and also discussions and morse practice. The Society are making application for an A.A. transmitting licence, and are also constructing a club short-wave receiver. The President of the Society is W. W. Wakefield, M.P., and Vice-Presidents are G6LM and G2HN, both of Chippenham, whose signals are well-known in various parts of the world.

At the meeting on November 26th, Mr. E. W. Mortimer gave a very interesting lecture on "Condensers, their Manufacture and Uses." This was very much appreciated by the members. F. A. Jefferies, Radio 2AKB, of Oxford, is to give a lecture on 5-metre transmitters and receivers in the near future. The Society welcome new members, and anyone interested is invited to communicate with the Hon. Sec., W. C. Barnes (2BWR), 7, Surrey Road, Swindon.

The Croydon Radio Society

"THE Emotional in Music" was the lecture given on Tuesday, November 24th, in St. Peter's Hall, South Croydon, by "Amphion," music critic of *The Croydon Advertiser*. It required, he said, a good deal of experience to tell the difference between a top flight violinist and the second rank merely by ear. In fact, only a limited number of people could dissociate the music from the performer and listen to it just for its own merits. He went on to emphasise that music spoke a language amply sufficient to convey all it meant, and need not be translated into a story to be intelligible.

Summing up, "Amphion" insisted that expression of profound emotion was peculiarly the province of the great masters. What passed for emotion in so-called "popular" music was really only superficial sentiment, and as exemplified in the output of crooners, was more appropriate to certain forms of mental disease than to emotion of normal humanity. On Tuesday, December 15th, one of the Hon. Secretary's ever-popular musical programmes on gramophone records will be given, to which readers are invited. Hon. Pub. Sec., E. L. Cumbers, Maycourt, Campden Road, South Croydon.

Harco Radio Club

THE above club is progressing favourably, and most of the members are interested in short-wave adapters and learning the Morse Code. All readers of PRACTICAL AND AMATEUR WIRELESS are welcome at any of our meetings, which are held every Tuesday at 8 o'clock. In the near future we are having a television demonstration, to be given by a well-known manufacturer of television material. Sec. C. W. Kemp, Dept. (HRC), 124, River Way, Greenwich, London, S.E.10.

Wirral Amateur Transmitting and Short-wave Club

THE usual monthly meeting was held on November 25th, at King's Square Café, in Birkenhead, at which a junk sale and a raffle were held. Great amusement was caused by Mr. Rogers, who auctioned the junk. The next meeting will be on Wednesday, January 6th, 1937. All details from the Hon. Secretary, B. O'Brien, Caldy, Irby Road, Heswall.

LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents.

All letters must be accompanied by the name and address of the sender (not necessarily for publication.)

"On Your Wavelength": Baseboard versus Chassis

DEAR THERMION,—Having been a reader of PRACTICAL AND AMATEUR WIRELESS for some time I have taken the pleasure of turning to my favourite page, "On your Wavelength," every week. What I want to know is: Why all this bother about Baseboard versus Chassis? I really think that panel mounting holds the record of construction as far as wireless dates back. A chassis was never heard of until some "secret" kind of fellow dropped into this world. My set at present is one taken from the first number of PRACTICAL WIRELESS. It is a one-valver, and I can get anything, within reason, from the Empire stations to Australia, and some American stations. The set is built in a large cigar box which provides both baseboard and chassis. As far as neatness goes I prefer a chassis.

I still think that "On your Wavelength" is still as good as it was years ago. Wishing your page all success and support.—S. G. Lewcock (Fyzabad, India).

An Enthusiastic American Reader

SIR,—I wish to thank you for publishing my letter in the October 10th issue of PRACTICAL AND AMATEUR WIRELESS, and also to express my thanks to those who write me. I have gained about two dozen new friends "across the pond," and still receive a letter from a new one occasionally. My list of QSL's has increased somewhat since my last letter. The latest DX cards received are CO2XF, TI3AV, VE1CR, VE2BE, VE4SS, VE4WR, NY2AE, ON4VK, HI5X, HI7G, XE1BT, XE1FY, XE1G, VP6YB, VPD2, HI1A, and PY2AK. If any SWL has written PY2AK in the past month, don't be impatient; I waited from July 25th to November 14th, but the QSL finally showed up!

The latest American QSL's received are W1FNW, W2BTV, W2CVI, W2DH, W3AKE, W3BOS, W3DMR, W3EWW, W4EBW, W5CRG, W5DWP, W6CQG, W6NUP, W7DNB, W7EKA, W7EUZ, W8JO, W8MMH, W9HBP, W9PWU, W9RBG, W9WSI, W9XBY, and W9WZW. All of these stations were heard on 20 metres, with the exception of one or two. W9PWU, Arvada, Colorado, sends a beautiful card. Anyone hearing him should get his card; it's the most beautiful in my American collection. CO2XF, Havana, also on 20 metres, sends an excellent card.

Regarding that Ambato (Ecuador) station reported last week, the call letters are HCDT, and they verify. JVH has been coming in the past two evenings, but has dropped from QSA5 R7/8 to QSA4 R4/5. VK2ME is slowly fading out as winter approaches, but 3LR and 3ME continue to come in at QSA5 R8/9.

Now that I have heard from several British SWL's, I would appreciate it very much if some of the boys in India, Africa, Fiji, New Zealand, and Australia would drop me a line! Also, I hope some G ham will get in touch with T. E. Lowe, 28, Allenby Road, Cadishead, M/C., so that we can arrange a sked for a QSO *via* a W9 station here in Wauwatosa.—WARREN H. STARK (2117, North 62nd Street, Wauwatosa, Wis., U.S.A.).

QSL Cards and Reports

SIR,—Having keenly followed the QSL controversy carried on in your columns, I feel perhaps a few words from an "Old Timer" might be acceptable. Mr. E. de Cottignies, I think, gives the clue to the position. He says: "My aim in collecting . . . is the verified All Continents Certificate." Quite a legitimate course to follow I will admit. But pity the amateur transmitter who is expected to supply all these veri's. Is it surprising that he feels the QSL card craze is approaching the cigarette coupon collecting stage? To him, the vast majority of reports are of little practical value. There are so many amateur transmitters on the air these days that he can get what reports he needs by direct QSO.

Apart from any expense, think of the work incurred if all reports received are to be conscientiously checked against the station log. The necessity for such a check is evident when I mention that I receive a fairly regular supply of reports, most of them very scrappy, on my 20 metre 'phone, although I never use 'phone and never work in the 20 metre band!

On the other hand a real DX report on a 56 mc. signal would be worth a gold-plated QSL. It is extremely difficult to get regular and reliable observers on the frequency bands where their co-operation is most urgently required. My advice to those transmitters who are nearly buried under an avalanche of listeners reports, is, use CW more, and try the other frequency bands. To the listeners, I would suggest: Learn to read Morse, and try the 56, 28, 3.5 and 1.7 mc. bands.—W. D. Keiller (G6HR, Edmonton).

CUT THIS OUT EACH WEEK

Do you know

—THAT special adapters are obtainable which enable any type of valve to be tested in an instrument fitted only with a standard 9-pin valveholder.

—THAT vibration of the vanes of a tuning condenser can cause "fading" in a superhet or similar sharply-tuned receiver.

—THAT instability can be caused by the radiation from the lead attached to the anode terminal of an S.G. or H.F. pentode valve.

—THAT crystals ready ground to oscillate at fixed frequencies may be obtained for transmitting apparatus.

—THAT these crystals are not of the same type as are used for modern crystal pick-ups and speakers.

—THAT special constant-frequency records are obtainable for testing receivers and L.F. equipment.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL AND AMATEUR WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL AND AMATEUR WIRELESS, *George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

J. M. H. (Penarth). You will find Blueprint numbers in the list of blueprints published on page 404 of issue dated Dec. 5th, 1936.

H. W. (Audenshaw). Although the set could be used as an adaptor a converter would be of greater use in your particular case.

W. L. (Belfast), B. B. (Romford), and Others. We are reprinting in this issue (see page 422) full constructional details of the one-valve short-waver, and you will find all the essential details are given on that page.

H. T. (S.W.16). The construction is very simple, and you can hardly have gone wrong there. Have you adjusted the crystal correctly? A good aerial is also essential.

R. G. (Cheltenham). Messrs. Mullard can recommend alternatives from their latest list. Your method of adjustment simply altered the inductance of the coil (due to the presence of the metal in the torch), and this is similar to tuning. It also, no doubt, acted as a partial screen, and thus reduced the coupling between the aerial and grid coils.

H. L. (Isle of Man). The N.T.S. receiver reviewed in last week's issue, costing £2 2s. is, no doubt, the nearest receiver to the type referred to in your letter.

J. H. (Carragh Camp). You could alter the output, but must be on your guard against overloading of the input valve. The double-diode-triode is generally employed in order that A.V.C. may be obtained, but this feature was not included in our receiver. Hence the use of a simple triode. Q.P.P. could also be used here.

H. W. (Stockport). We cannot recommend any blueprint from the details given in your letter. We only recommend our receivers when the specified parts are used.

W. H. (Clydach). We have several "straight three" circuits in our blueprint list, but cannot send C.O.D. Neither can we recommend one from the few details given in your letter.

V. R. R. (Madras). You would apparently need a wholesaler's catalogue, but we are not clear from your letter whether you require parts for building sets, or replacements for commercial sets received for repair.

H. B. (Houghton). The coils are made by Messrs. Colvern. Write direct to this firm at Romford, Essex.

A. G. (Bulawayo). The Simpson turntable is a synchronous model and thus must be used on a 50-cycle A.C. supply. The other motor referred to is a simple type, and is independent of the frequency of the supply. We do not know the prices in Southern Rhodesia.

S. D. K. (Edinburgh). We refer you to the article on short-wave coils given in our issue dated May 9th, 1936.

T. C. L. (Merthyr). You can use the coils in question in the Universal Superhet.

W. A. C. (Leix). The wiring is not complete. The filament circuit is not joined to the Earth line. When this has been done the G.B. positive lead should be joined to the same point, and the H.T. plus 2 lead should be attached to the other side of the speaker.

D. M. (Liverpool 9). A reversal of the connection at the points A and B on your sketch should not make a great deal of difference. However, you can try it. No damage can arise. The circuit is, in all other respects, quite in order.

S. S. (Shottan). We have no details of the transformers in question, and the makers did not supply the characteristic curves of them.

J. B. J. (Reigate). We have no blueprint which would enable you to use the parts. What type of coils do you refer to? We only guarantee our receivers when the specified parts are used.

F. T. H. (Thornton Heath). Perhaps a transformer is required between the speaker and the output of the set. If one is not fitted, the 15-ohm speech coil would not match the output valve of the amplifier, and you should, therefore, fit an output transformer. If there is already one in position, the hum may be due to pick-up on the speaker leads, or acoustic feed-back from the vibrating diaphragm to the valves in the amplifier.

B. B. (Tiverton). The issue is now out of print.

D. C. (R.F.A., "Elmol"). The only modification, short of rebuilding or re-fitting the receiver, is to parallel feed the L.F. transformer, using a 2-mfd. condenser to obtain a certain amount of bass resonance. Any change in the value of the decoupling condenser referred to will not affect tone. You show no tone control across the pentode output circuit, and should connect a .01 mfd. fixed condenser in series with a 10,000 ohm variable resistor and join these two across the loudspeaker terminals. The variable resistor will enable you to adjust tone with fairly wide limits.

V. M. R. (S.W.8). The combination should certainly function, and we should be glad of more details in order to try and trace your trouble.

W. L. M. (Codnor). We shall publish the details again in the near future. We give in this issue details for the other crystal receiver.

THE BRITISH LONG DISTANCE LISTENERS' CLUB

Station Reports

AN interesting suggestion has been put forward to Mr. Barrs concerning the station reports which he undertakes each month. In putting forward this suggestion Mr. Barrs writes as follows: "Here is an idea. Mr. C. G. Collett suggests that we get two S.-W.L.'s in six or eight different counties of Great Britain and ask them to keep a regular log of the station we are checking, so that we will be certain of having a very accurate report for the station. What do other S.-W.L.s think of this idea? I think it is the one sure way to success. I suggest that two S.-W.L.s in the following counties listen to the stations chosen for December: Norfolk, Glamorgan, Stafford, Northumberland and Warwick. We have one S.-W.L. reporter in each of the following counties, Lancashire, Yorkshire, Lincoln, Gloucester, Glamorgan, London and Surrey, so if we get one more S.-W.L. in these, that will make it two S.-W.L. reporters in fourteen counties.

"We have two in Hampshire already, so will S.-W.L.s in the above counties please try to help with this idea. Their assistance will be appreciated very much."

A Club for Edinburgh

THE proposal for a short-wave club for Edinburgh and District has met with a fair amount of success since the idea was put forward a few weeks ago. There are now several prospective members, but at the present the membership would not be large enough to permit the inauguration. We should be glad if interested readers would get in touch with Mr. S. D. Keeble, at 118, Craiglea Drive, Edinburgh 10. This club is for short-wave enthusiasts of South-east Scotland, and inquiries are invited from B.L.D.L.C. members and otherwise in this sector. Full details will be sent to all prospective members before the first meeting.

For Middlesbrough Readers

WE have received a request from a new member, Mr. G. Ralston, of 18, Bowley Street, Middlesbrough, concerning the learning of the Morse code. He would like to get into touch with a fellow member in his district with a view to forming a practice class, and perhaps if any local reader is desirous of helping he will get into touch direct with Mr. Ralston.

A Problem Solved?

A MEMBER in India, Mr. A. B. Hulme, sends us some interesting information regarding stations. He says: "I have read the request of Mr. Austin S. Read, Aden, in the issue of PRACTICAL AND AMATEUR WIRELESS dated October 31, and am able to make two suggestions as to the station which this fellow-member has heard on about 6,780 kilocycles.

"The station may be JVT, Nazaki, Japan, on a frequency of 6,750 kc/s. I have no veri from this station, but am able to receive it regularly at R8. In the list of stations I use the power is given as 20 kW. The second suggestion is that the station is XGOX, Nanking, China, on a frequency of 6,820 kc/s. This, of course, assumes that the calibration of Mr. Read's receiver is at fault, but I mean no offence by this, as I have found that my receiver requires fairly frequent adjustment on the frequencies from 6,000 to 8,000 kc/s in this tropical climate. I have a veri from Nanking giving their frequency, the address being The Central Broadcasting Administration, Nanking, China.

"It may be of interest to members to know that as from January 1st, 1937, no verifications of the N.I.R.O.M. stations in Java will be sent. In a recent issue of PRACTICAL AND AMATEUR WIRELESS I noticed a member with a grievance against SM5SX about the time taken for them to send a verification. This is exactly the opposite experience to mine as I had a veri in the form of a very nice letter and a QSL card within a very short time of sending my report. This station asked for further reports when verifying my reception.

"If you can put me in touch with any members of the B.L.D.L.C. who would care to correspond with me on the subject of short-wave radio I shall be very glad indeed. I have a six-valve superhet receiver and am able to listen to countries all over the world on it. This will enable me to compare notes with correspondents in many parts of the world. My address is: P.O., Seorahi, District Gorakhpur, United Provinces, India."

QUERIES and ENQUIRIES

The "R" Code

"In the Letters from Readers section I have noticed that certain readers say they heard a certain short-wave station at a steady 'R.9.' What is meant by that?"—J. W. (Inverness).

THE "R code" is an arbitrary code of signal strengths which is in use by amateurs and has been adopted in order to give an indication of the strength at which a signal is received. Unfortunately, it is not a measured strength but is based upon audibility, and the table is as follows:

R1—Faint signals—just readable.
R2—Weak signals—barely readable.
R3—Weak signals—can just be copied.
R4—Fair signals—easily readable.
R5—Moderately strong signals.
R6—Good signals.
R7—Good strong signals, readable through interference.
R8—Very strong signals. Audible several feet from 'phones.
R9—Extremely strong signals—good loudspeaker volume.

Screen-grid Voltage

"I notice that in most battery circuits that have been drawn up the auxiliary grid on the S.G. valve has its voltage supplied from a separate tapping on the H.T. battery. Could not this be dropped and decoupled by a resistance in the usual manner? Also, I should like to know if it is possible to calculate the correct value for the anode or extra grid in any valve, only knowing the valve manufacturers' data."—F. G. (Rugby).

THERE are two reasons for using a separate battery tapping for the S.G. voltage, one being that it is cheaper, as the decoupling components are dispensed with, and the second being that it enables the user of the receiver to experiment and find the most suitable working voltage. It is quite permissible to use an automatic supply and this has been done in several of our receivers. The manufacturers' data sheet generally gives the screen and anode current and thus it is quite simple to work out the value of the voltage dropping from Ohms law.

Varley Coil Connections

"I have in my possession two Varley Nicore tuning coils, type B.P.30. These are marked 1 to 8 and I should like to know the connections. Also, what kind of switch is needed for wave-changing and what range would they cover if combined?"—F. C. (Radcliffe).

THE coils are fitted with a wave-change switch in the base, and a switch rod has to be passed through them for wave-change purposes. They are simple tapped aerial coils, with a tapping on the medium- and on the long-wave section. Terminal 1 is joined to the grid, terminal 2 to earth, and the aerial or anode is joined to terminal 3, and this point is automatically transferred to the medium- or long-wave tapping when the switch is operated. The reaction winding is joined to terminals 7 and 8. These two coils were employed in our Three-Star Nicore receiver.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters.

We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.
(5) Grant interviews to querists.

Please note also, that queries must be limited to two per reader, and all sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a different department.

If a postal reply is desired, a stamped addressed envelope must be enclosed. Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.

The Coupon must be enclosed with every query.

Double Push-pull

"Would it be possible to have two push-pull stages as an L.F. amplifier, two power valves and then two super power valves? What would be the approximate output of such a hook-up?"—G. D. B. (Bournemouth).

IT would be quite in order to make up a circuit of the type mentioned, and this is, in fact, done in certain power public-address outfits. The only point is that the second push-pull stage must incorporate valves capable of taking the large grid voltage which will be delivered by the first push-pull stage, and very often it is necessary to use two valves in parallel in each "leg" of the second push-pull stage to enable this to be done. The output is, of course, dependent upon the output valve and the fact that a push-pull stage precedes it does not affect the matter. The maximum output of any push-pull stage is approximately 25 per cent. greater than the combined amplification of the two valves employed in that stage. That is, of course, when the valves are fully loaded.

Accumulator H.T. Supply

"I have a D.C. supply of 120 volts, and I wish to use this for my H.T. supply. Could you please give me information regarding the building of a D.C. mains unit? The supply is obtained from 60 2-volt accumulators. What dropping resistance would be necessary if the detector valve consumes 1.3 mA at 70 volts, and the power valve 6 mA at 120 volts?"—A. R. (Cheltenham).

AS the supply is obtained from accumulators there should be no necessity for chokes or other smoothing apparatus and the supply should be quite suitable for H.T. No resistor is required for the output valve, which should be connected direct to the supply, but the detector valve should be fed through a resistance of 40,000 ohms in order to provide the necessary 70 volts. This value is obtained by subtracting 70 from 120 and dividing the answer by the number of milliamps. This gives the resistance in thousands of ohms, and 40,000 is the nearest approximate value which may be purchased.

Television Valves

"I am keen to start experimenting with a television receiver, but there seems to be a dearth of data concerning the available equipment. For instance, I believe that inter-electrode capacities can play havoc with certain types of picture receiver, and also that the question of insulation must receive considerable attention in designing a receiver. Is it not possible to give us any data concerning the subject of home-construction for this particular type of apparatus?"—G. S. (Pinner).

UNTIL manufacturers release details of components which they have available we are obviously unable to publish any such data. You will note, however, in this week's issue that details of some of the recently developed Mazda valves are given, and fuller characteristics will be published as soon as they are received. No transformer manufacturer has yet supplied details of a suitable transformer, nor, so far as we can trace, has one been designed for the home-constructor. No doubt one reason for the delay is in the fact that the manufacturer of such a component does not know the circuit the user intends to adopt for his cathode-ray tube, i.e., whether the anode or the cathode will be earthed, and thus the problem of insulation arises. However, the constructor kits referred to last week show that some move is now being made to meet the demands of the home-constructor.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," 8, Southampton Street, Strand, London.

RECEIVERS, COMPONENTS AND ACCESSORIES

Surplus, Clearance or Secondhand, etc.

RADIOMART

SHORT-WAVE SPECIALISTS

Announce 1937

SHORT-WAVE MANUAL

Packed with short-wave information and circuits of mains and battery receivers, including straight, superhet and 5-metre transmitters, modulators, etc. Information on transmitting licences, aerials, Class B amplification, neutralization, superhet alignment, etc. The most comprehensive manual published, written by practical engineers, price 6d., post free 7½d., including catalogue.

1937 Catalogue only (3 times enlarged) price 1½d. post free.

TELSEN screened dual range coils, 2/6. Pair, 4/6.

Milliammeters, 25 ma. upwards, 5/9. Super, 6/9.

AMERICAN mains transformers 230v. fully shrouded, 350/350. 6.3v., 5v., 6/11. Majestic 250/250. 2.5v., 5v., 4/11.

HEAVY DUTY mains transformer worth 35/-, 350/350. 150 ma.; 4v. 2.5ACT., 4v. 6ACT., 12/6.

465 KC/S., IF transformers, 2/11. Telsen Ace, 11/11. RG4, Radio grands, 2/9. 2mf. 300v., 9d.

UTILITY straight line wavelength dials, 3/11, Telsen H.F. chokes, 1/11.

UTILITY 2-gang uniknob and dial, 3/11; 1,500-volt tubular condensers, all sizes, 6d.

ELECTROLYTICS 500-volt 8mf., 1/6; 4mf., 1/6; 4×4, 1/11; 8 × 8, 3/6; 25 mf. 25v., 1/-, etc.

SMOOTHING chokes, 20 hy. 120 ma., 3/11; 100 ma., 2/11; 40 ma., 1/11.

PUSHBACK wire, 6 yds., 6d.; heavy, 9d.; 2 gross solder tags, 6d.; resin-cored solder, 9ft., 6d.

CENTRALAB pots, all sizes, 1/6; switched, 2/-; tubular glass fuses, 2d.

JENSON PM speakers, 12/6. Varley Iron core coils, 2/6; matched pair, 4/6.

SPECIAL OFFER Class B valve, driver transformer and valveholder, new, lot 5/-.

LISSEN 3-gang bandpass, 3-gang superhet, 2-gang all-wave coils, any set, price 7/6.

TRADERS' monster bargain parcels, value £4/10/-, for 10/-; also 5/- parcels.

FAMOUS Continental A.C. valves, 4/6; American Duotron, etc., all types, 3/6; battery from 2/3.

UTILITY 8/6, microdise dials, 3/11; Radiophone, 0.00016 short-wave condensers, 3/6; series gap, twin, 3/9.

CERAMIC all brass microvariables, 15 mmfd., 1/4; 40 mmfd., 1/7; 100 mmfd., 1/10; short-wave H.F.C., 9d.

CLEARANCE catalogue 1½d. Goods over 5/- post free. All enquirers must send stamp.

Branches: 19, John Bright St., 44, Dale End. Mail Orders, 44, Holloway Head, Birmingham. Telephone, MID 3254.

3/- EACH—American valves all popular types. 90-day guarantee. Full range in stock. National Union, Hytron, Triad, Metal, Glass and M.G. Send for lists.

3/- EACH—Mullard, Cossor, Mazda, Marconi, Osram valves for D.C. receivers: all perfect. 90-day guarantee. State type: Send cash or C.O.D. RADIOGRAPHIC, LTD., 66, Osborne Street, Glasgow, C.1.

ALL goods previously advertised are standard lines, still available. Post card for list free. VAUXHALL UTILITIES, 163a, Strand, W.C.2. Over Denny's the Booksellers. Temple Bar 9338.

CONVERSION UNITS for operating D.C. Receivers from A.C. Mains, improved type, 120 watts output, at £2/10/0. Send for our comprehensive list of speakers, Resistances and other components. **WARD**, 46, Farringdon Street, London, E.C.4. Telephone: Holborn 9703.

VALVES

NOTHING better available. Six Months' Guarantee. Complete range of Battery, A.C. Mains, Rectifiers, always in stock. 2 volt Det., H.F., L.F., 2/3; Power, 2/9; Screen-Grid, Pentode, H.F. Pentode, 5/-; American types, fully guaranteed, 5/6 each. Nos. 80, 42, 43, 57, 58, 77, 78, 6C6, 6D6, 25Y5, 25Z5. Write for other prices to Dulci Electrical Co., Ltd., 7, Lizard Street, London, E.C.1.

PREMIER SUPPLY STORES

Get our quotation for your Short-Wave and Television Gear

Offer the following Set Manufacturers' Brand New Surplus Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carr. paid over 5/-; under 5/- postage 6d. extra. Orders under 5/- cannot be sent C.O.D.

ALL POST ORDERS TO **JUBILEE WORKS, 167, LOWER CLAPTON RD., LONDON, E.5**

CALLERS, AS USUAL, TO 20-22, HIGH ST., CLAPHAM, S.W.4 (Macaulay 2381). 'Phone: Amherst 4723
And 165 & 165a, FLEET ST., E.C.4 (Next door to Anderton's Hotel.) **Central 2833.**

MAINS VALVES

MAINS VALVES, famous Europa 4 v. A.C. types, 4/6 each. HL., L., S.G., Var.-Mu-S.G., H.F.-Pens., Var.-Mu-H.F. Pens. 1, 3 and 4-watt A.C. directly-heated output Pentodes. Full-wave rectifiers, 250 v. 60 m.a. **A.C./D.C.** types. 20-volt. .18 amp. S.G., Var.-Mu-S.G., H., HL., Power.

Following Types all 5/6 each. Full-wave rectifiers, 350 v. 120 m.a. and 500 v. 120 m.a. 2½ watt indirectly-heated Pentodes. Frequency Changers, Octodes and Heptodes.

BATTERY VALVES. 2 volts, H.F., L.F., 2/3. Power, Super-Power, 2/9. S.G., Var.-Mu-S.G., 4- or 5-pin Pentodes, H.F. Pens., V.-Mu-H.F. Pens., 5/-. Class B, 3/6.

AMERICAN VALVES. Genuine American **HYTRON** and **TRIAD** first-grade Valves. 3 months' guarantee. All types in stock, 5/6 each. 210 and 250, 8/6 each. New Metal-Glass Valves, all types, 6/6 each. Genuine American **DUOTRON** Valves, all types, 3/6 each. Valve holders for all above types, 6d. each. Metal bases, 9d. each.

SHORT WAVES

SHORT-WAVE COILS, 4- and 6-pin types, 13-26, 22-47, 41-94, 78-170 metres, 1/9 each, with circuit. Special set of 3 S.W. Coils, 14-150 metres, 4/- set, with circuit. Premier 3-band S.W. Coil, 11-25, 19-43, 38-86 metres. Simplifies S.W. receiver construction, suitable any type circuit, 2/6.

COIL FORMERS, in finest plastic material, 1¼in. low-loss ribbed, 4- or 6-pin, 1/- each.

SUPER CERAMIC CONDENSERS, S.L.F. .00016, .0001, 2/9 each; double-spaced, .00005, .000025, .000015, 3/- each. All brass with integral slow motion, .00015 tuning, 3/9; .00015 reaction, 2/9. British Radiophone 2-gang .00016, 5/6.

H.F. CHOKES. S.W. 10-200 metres, 9d.; S.W. screened, 1/6; standard screened 180-2,000 metres, 1/6.

CERAMIC S.W. VALVE HOLDERS, 4-, 5- or 7-pin, Chassis types, 6d.; B.B. type, 8d. **GLASS AERIAL INSULATORS**, 4d. each. **BEEHIVE STAND-OFF**, 6d. each. **SCREENED FLEX**, single, 3d. yd.; twin, 4d. yd.

PREMIER AMPLIFIER KITS

3-WATT A.C. AMPLIFIER, 2-stage, for mike or pick-up. Complete kit of parts with 3 valves, 40/-.

7-WATT A.C./D.C. AMPLIFIER, 3-stage, high-gain, push-pull output. Complete kit of parts with 5 specially matched valves, £4 4s.

10-WATT 3-stage A.C. Amplifier Kit with 5 valves, £5 5s.

20-WATT 3-stage A.C. Amplifier Kit with 5 valves, £8 8s.

ELECTROLYTICS. U.S.A., 4, 8 or 12 mfd. 530 v. peak, 1/9 each. **Dubilier**, 4 or 8 mfd. 500 v., 3/-; 50 mfd. 50 v., 1/9; 12 mfd. 20 v., 6d.; 25 mfd. 25 v., 1/-. T.C.C. 4 or 8 mfd. 650 v., 4/-; 15 mfd. 50 or 100 v., 1/-; 50 mfd. 12 v., 1/-. **Paper Condensers.** W.E., 250 v. working 4 mf., 2/-; 2 mf. 1/-; 1 mf. 6d.; 350 v. working 4 mf., 2/6; 2 mf., 1/6.

Dubilier 500 v. working 4 mf., 4/-; 800 v. 4 mf., 6/-.

Wego 450 v. working 1 mf., 1/-, 2 mf. 1/9, 4 mf. 3/-; 700 v. working 2 mf. 2/-, 4 mf. 3/6.

COSMOCORD PICK-UPS, with tonearm and volume control, 10/6 each.

PICK-UP HEADS only, 4/6 each.

MAINS TRANSFORMERS

PREMIER wire-end type with screened primaries, tapped 200-250 v. Centre-tapped Filaments. Guaranteed one year. **H.T. 8 & 9** or **H.T. 10** with 4 v. 4 a. C.T. and 4 v. 1 a. C.T., 8/6. **250-250 v. 60 m.a.**, 4 v. 1 a., 4 v. 2 a. and 4 v. 4 a., all C.T., 8/6. **350-350 v. 120 m.a.**, 4 v. 1 a., 4 v. 2 a. and 4 v. 4 a., all C.T., 10/6. Any of these transformers with engraved panel and N.P. terminals, 1/6 extra.

500-500 v. 150 m.a., 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 3-4 a., all C.T., 17/6. **AUTO-TRANSFORMERS**, step up or down, 60 watts, 7/6; 100 watts, 10/-. Super Model, 19/6.

FILAMENT TRANSFORMERS, Tapped Primaries, 200-250 v. All secondaries C.T. 4 v. 3 a., 7/6; 4 v. 5 a., 8/6; 7.5 v. 3 a., 7/6; 6 v. 3 a., 7/6; 2.5 v. 8 a., 7/6; 6.3 v. 3 a., 7/6; 5 v. 3 a., 7/6.

SMOOTHING CHOKES, 25 m.a., 2/9; 40 m.a., 4/-; 60 m.a., 5/6; 150 m.a., 10/6. 2,500 ohms, 60 m.a. Speaker Replacement Chokes, 5/6.

MILLIAMMETERS, moving-iron, flush 2½in., all ranges from 0-10 m.a., 5/9. Visual tuning, 6 or 12 m.a., 5/9. Moving-coil meters, 2½in. 0-1 m.a., 18/6; 3½in. 0-1 m.a., 22/6. Multipliers, 1/- each.

AMPMETERS, all ranges, from 0-1 amp., 5/9.

TRANSFORMERS, latest type Telsen R.G.4 (list 12/6), 2/9. Lissen Hypernik Q.P.P. (list 12/6), 3/6.

OUTPUT TRANSFORMERS for Power, Pentode and Push-Pull, 2/6; Multi-Ratio, 4/6; Push-Pull Input Transformers by prominent manufacturer, 4/6 each.

ELIMINATOR KITS for A.C. mains. 120 v. 20 m.a., or 150 v. 25 m.a., 15/-, tapped S.G., det. and output. Complete Kit with long-life valve rectifier (replacement cost only 2/-).

PREMIER L.T. CHARGER KITS for A.C. mains, including Westinghouse Rectifiers and Tapped Mains Transformers. 6 volts at ½ amp., 14/6; 8 volts 1 a., 17/6; 15 volts 1 a., 19/-; 15+15 volts 1 a., 37/6; 15+15+15 volts 1 a., 50/-; 8 volts 2 a., 29/6.

TELSEN iron-cored screened coils, W.349, 4/- each.

Electric **SOLDERING IRONS**, 200-250 v., A.C./D.C., 2/3.

LOTUS JACKS (and Jack-switches), all types, 1/- each. Lotus Plugs, 1/- each.

PREMIER H.T. KITS, all with Westinghouse rectifiers; tapped transformers and adequate smoothing. All Kits absolutely complete. 120 v. 20 m.a., 20/-; with ½ a. L.T. Charger, 28/-. 150 v. 30 m.a., 25/-; with ½ a. L.T. Charger, 31/6. 250 v. 60 m.a., with 4 v. 3 a. C.T., 30/-.

SHORT WAVE KITS

SHORT-WAVE KIT for 1-valve receiver or adaptor, complete with chassis, 4 coils, 14-150 metres, condensers, circuit and all parts. 12/6. **VALVE GIVEN FREE! DE LUXE MODEL**, 17/6. SUPERHET CONVERTER KIT, 13/6. **S.W. SUPERHET CONVERTER**, for A.C. Mains Receivers, 20/-. A.C. Valve given **FREE!**

2-VALVE S.W. KIT, 19/6. **VALVES GIVEN FREE! 3-VALVE S.W. KIT**, S.G. Det. and Pen., 42/-. **VALVES GIVEN FREE!**

ALL-WAVE "ALL-WORLD RANGE" 3-valve Kit, 12-2,000 metres in 4 wavebands without coil changing, complete kit of parts with 3 valves, S.G., H.F., S.G., det. and pentode (2 volts); 50/-. Q.P.P. Model, 6/6 extra.

BAND-PASS TUNING PACK, comprising set of Telsen 3-gang iron-cored coils with switching, mounted on steel chassis with 3-gang condenser, illuminated disc-drive and 4 valve holders. 25/- the lot. All Mains or Battery circuit. **FREE!**

LISSEN ALL-WAVE COILS, 12-2,000 metres, complete with switching and wiring diagram, 12/6.

3-VALVE BAND-PASS KIT, 200-2,000 metres. Complete kit of parts, including chassis, all components, valves, M.C. speaker and wiring diagram. Battery Model, 50/-. A.C. Mains Model, 70/-.

MOVING COIL SPEAKERS

MAGNAVOX. Mains energised. 154, 7in. cone, 2,500 ohms 4 watts, 12/6; '152,' 9in. cone, 2,500 ohms, 17/6; 152 'Magna' 9in. cone, 2,500 ohms, 6 watts, 37/6. **Magnavox** P.M.s—'154' 7in. cone, 16/6; '252,' 9in. cone, 22/6. Reliable P.M.s, 10/6.

ROLA latest type P.M.s, 18/6. **KB** 7in. mains energised, 1,500 or 2,500 ohms, 7/9. **GOODMANS'** 8in. mains energised, 1,000 ohms field, 10/6 each.

DIALS.—Clarion Illuminated S.W. slow-motion Dial with 2in. knob, 2/-. **Premier** All-Wave 2-speed Dial, full vision straight-line, dual ratios 10-1 and 150-1, 6/6, with escutcheon.

Potentiometers by well-known makers. All values up to 1 meg., 2/-; with switch, 2/6.

GRAMOPHONE MOTORS. Collaro Gramophone Unit consisting of A.C. motor, 100-250 v. high quality pick-up and volume control, 45/-; Collaro motor only, 30/-; Collaro Universal Gramophone Motor, 100-250 v. A.C./D.C., with high quality pick-up and volume control, 67/6; Collaro Universal Motor only, 49/6; Edison Bell double-spring motors, including turntable and all fittings, 15/-; Cosmocord Gramo unit, comprising A.C. motor, pick-up and volume control (list 55/), 35/9.

TUBULAR CONDENSERS, non-inductive, all values up to .5 mfd., 6d. each.

Wire-end **RESISTORS**, any value, 1 watt, 6d.; 4 watts, 1/-; 8 watts, 1/6; 15 watts, 2/-; 25 watts, 2/6 each.

Reliable **MORSE KEYS** with Morse Code engraved on bakelite base, 2/- each.

Bakelite case **BUZZERS**, 1/6; Walnut case "Loud-tone," 2/6 each.

Super Quality lightweight **HEADPHONES**, 3/9 pair.

PREMIER (Reisz Pattern) Transverse-current MIKE, High Output, Straight Line Response, 30/-. Transformer, 5/-. Table Stand, 7/6.

HAVE YOU HAD OUR LATEST GIANT ILLUSTRATED CATALOGUE AND VALVE LIST? IF NOT, SEND 4d. IN STAMPS FOR THIS AMAZING LIST OF BARGAINS!

RADIO CLEARANCE

63, HIGH HOLBORN, W.C.1.

TEL. : HOLBORN 4631.

LISSEN 4-VALVE A.C. BAND PASS RECEIVER, a splendid job, fitted in handsome Walnut Cabinet complete with Energised Moving Coil Speaker, Connection for Pick-up; listed **9 guineas**; sent out aerial-tested by our own engineers, **70/-.**

8-VALVE A.C. MAINS SUPERHET RECEIVER, by well-known manufacture incorporating many refinements. Visual Tuning, illuminated colour coded Volume Control, Local Distance Switch, etc. Fitted in Handsome Bird's Eye Maple Cabinet, Size 16" Wide, 12" Deep and 23" High. Comprising the following Valves: AC/VPI, FC4, AC/VP1, AC/VP1, AC/HLDD, V914, AC 2 Pen, IW3. Pre H.F. Stage, 2 I.F. Stages, Full A.V.C., etc. Limited Quantity, **£7 15s.**

EXCLUSIVE BRITISH RIGHTS HELD BY US FOR CONSTRUCTRAD SHORT-WAVE KITS; all Kits supplied, Valves free, 5 Interchangeable Coils, covering a range from 15-600 metres; complete set, not a converter.

ONE-VALVE BATTERY KIT, 29/6.
TWO-VALVE BATTERY KIT, 32/6.
ONE-VALVE A.C./D.C. KIT, 37/6.
THREE-VALVE A.C./D.C. KIT, 50/-.

EVER READY 5-VALVE BATTERY SUPERHET; an up-to-the-minute modern receiver fitted 5 Valves (ring), etc., A.V.C., provision for Extension Speaker and Pick-up, latest square type dial calibrated in metres and station names; listed 12 guineas; last few to clear, **£5 10s.** Carriage Paid.

LISSEN BATTERY BAND PASS 3, a Handsome Receiver in Walnut Cabinet of upright design, complete with Valves as follows: Var. mu Screen Grid, Detector, Pentode output; sent out aerial-tested and guaranteed, **57/6.**

BRYCE MAINS TRANSFORMERS AND CHOKES, standard for the season, finest made, British and Guaranteed.
250-0-250, 80 m.a., 2-0-2 volts, 2.5 amp, 2-0-2 volts, 4 amp., **8/6.**
350-0-350, 120 m.a., 2-0-2 volts, 2.5 amp, 2-0-2 volts, 4 amp, **10/6.**
350-0-350, 150 m.a., 2-0-2 volts, 2.5 amp, 2-0-2 volts, 4 amp, 2-0-2 volts, 2 amp, **12/6.**
500-0-500, 150 m.a., 2-0-2 volts, 2.5 amp, 2-0-2 volts, 6 amp, 2-0-2 volts, 2 amp, 2-0-2 volts, 2 amp, **17/6.**
H.T.8 TRANSFORMER, 250 volts, 60 m.a., 2-0-2 volts, 4 amp., **8/6.**
Ditto with H.T.8 Metal Rectifier, **17/6.**
All Transformers are fully shrouded.

BRYCE MAINS CHOKES.
40 m.a. 30 Hys., 500 Ohms, **4/6.**
60 m.a. 40 Hys., 500 Ohms, **6/-.**
150 m.a. 40 Hys., 200 Ohms, **10/6.**
250 m.a. 15 Hys., 200 Ohms, **21/-.**
60 m.a. 80 Hys., 2,500 Ohms for Speaker Replacement, etc., **6/-.**

SPECIAL CLEARANCE CHOKE, 250 m.a., 12 Hys., 100 Ohms, heavy duty type, interleaved windings, etc., cannot be repeated, **11/-.**

TRIAD AMERICAN VALVES, highest quality, all types, **5/6,** as follows:
01A, 24A, 27, 30, 31, 37, 38, 39, 41, 43, 45, 46, 47, 53, 55, 56, 57, 58, 59, 71A, 75, 78, 80, 6A6, 6F7, 2A3, 5Z3, 12A7, 6A7, 6C6, 6D6, 12Z3, 25Z5.
All these Valves carry a 90-day guarantee, and free replacement, provided that the filament or heater is intact, and the glass not broken when returned to us.

AMERICAN 5-6-7 PIN VALVE HOLDER, Chassis Type, **6d.**

LISSEN 126 SUPERHET ASSEMBLY, comprising 3-gang Coil Unit fully screened (2 Band Pass Coils, 1 Oscillator), 2 I.F. Transformers, fully screened, 1 only 3-gang semi-screened condenser with drive, **8/11.**

CENTRALAB VOLUME CONTROL WITH SWITCH, 5,000, 10,000, 25,000, 50,000, **2/6** each.

LISSEN ALL-WAVE COILS, complete with circuit, switching, etc., sent out in matched pairs, covering 2 short bands, 1 medium and 1 long, **8/-.**

DITTO SINGLE COILS, 4/6.

LISSEN 126 K/Cs IRON CORED OSCILLATOR COILS, screened, **1/-.**

ONE DOZEN PEAK METAL CASED CONDENSERS, paper type, all useful sizes, 0001 plus 0001, .1, .2, **2/6** Dozen.

8 mfd. 500 volt working, 550 volt Surge, Heavy Duty Electrolytic CONDENSER by well-known manufacture, **2/11.**

8 mfd. and 4 mfd. ELECTROLYTICS, 450 volt working, 500 volt Peak, **2/6.**

8 plus 8 Cardboard, Wire Ends, ELECTROLYTICS, 450 volt working, 500 surge. By well-known manufacture, **3/6.**

50 mfd. 12 volt working CONDENSERS. Well-known manufacture, **1/-.**

50 mfd. 50 volt working CONDENSERS. Well-known manufacture, **1/6.**

50 mfd. 25 volt working CONDENSERS. Well-known manufacture, **1/3.**

25 mfd. 50 volt working CONDENSERS. Well-known manufacture, **1/-.**

8 plus, 8 plus 4 Electrolytic CONDENSERS, Wire Ends, 450 volt working, **3/11.**

14 plus 8, 450 volt working, Electrolytic CONDENSERS, Metal Case, Wire ends, by well-known manufacture, **2/6.**

25 volt, 25 mfd. Electrolytic CONDENSERS, Tubular type, by well-known manufacture, **1/-.**

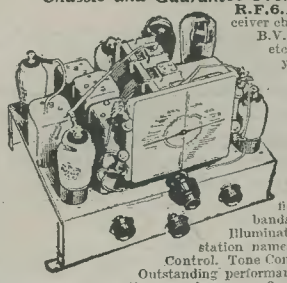
P.O. TYPE PAPER CONDENSER, 6d. each.

(Continued at top of column three)

McCARTHY

6 VALVE ALL-WAVE RADIO ON EASY TERMS

WE CARRY STOCK of most of the McCarthy Chassis and Guarantee Prompt Delivery.



R.F.6.A.W. Complete receiver chassis supplied with all B.V.A. valves, knobs, leads etc., ready for fitting in your own cabinet (or suitable cabinet and, speaker supplied if required) for only **£8 10** complete; or **27/-** WITH ORDER and 10 monthly payments of 16/-. Specification in brief: 3 wave-bands—long, medium, short. Illuminated dial with principal station names. Automatic Volume Control. Tone Control. Switch for gram. Outstanding performance on home and world stations equals average 8-valve receiver. **Write for full 1937 Range of McCarthy All-Wave Chassis from £6.15.0.**

CASH or C.O.D. ORDERS DELIVERY BY RETURN

W.B. STENTORIAN SPEAKERS

These splendid speakers are available on Easy Terms:—

37S. Cash or C.O.D. 42/-, or 2/6 with order and 11 monthly payments of 4/-. **2/6** DOWN

PLEASE NOTE OUR EASY PAYMENT TERMS.

37J. Cash or C.O.D. 32/6, or 2/6 with order and 11 monthly payments of 3/-. **2/6** DOWN

CABINET and EXTENSION SPEAKERS on similar terms.

FULL LIST ON REQUEST.

Estd. 1925 **THE** **PHONE: NATIONAL 1977**

LONDON RADIO SUPPLY COMPANY

11 OAT LANE · NOBLE STREET · LONDON, E.C.2

ELECTRADIX SPEAKERS

GENUINE BARGAINS in high-grade moving coil speakers by famous makers. All new and offered at less than half price. Quality reproduction of speech and music guaranteed.

7/6

MAINS ENERGISED SPEAKERS.—6in. R. & A., 2,500 ohms, with speech transformer, **7/6.** Hegra, 9in. with transformer, **12/6;** Magnavox, 6in. type, "144," 2,500 ohms, **12/6;** R.K., 8in., cone, 1,000 ohms., **10/6.**

A.C. MAINS SPEAKERS, WITH RECTIFIERS. 100/250 volts, 11in. cone with transformer, **30/-.** Jensen, 220 volt, 7in. cone and transformer, **25/-;** 100 volt, ditto, 7in. cone, **20/-;** 100 volt A.C., 8in. cone with transformer, **21/-.**

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COILS.—Short Wave Coils, plug-in type, **1/6** each; Ribbed low-loss formers, **9d.;** Long wave 2-pin coils, **1/-;** Reaction Tuners, **9d.;** Mains interference, H.F. twin chokes, **2/-;**

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(Continued from foot of column one)

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