MORE ABOUT AUTOMATIC VOLUME CONTROL

SEE PAGE 617

Practical and Amateur Wireless

AND PRACTICAL TELEVISION

3d EVERY WEDNESDAY

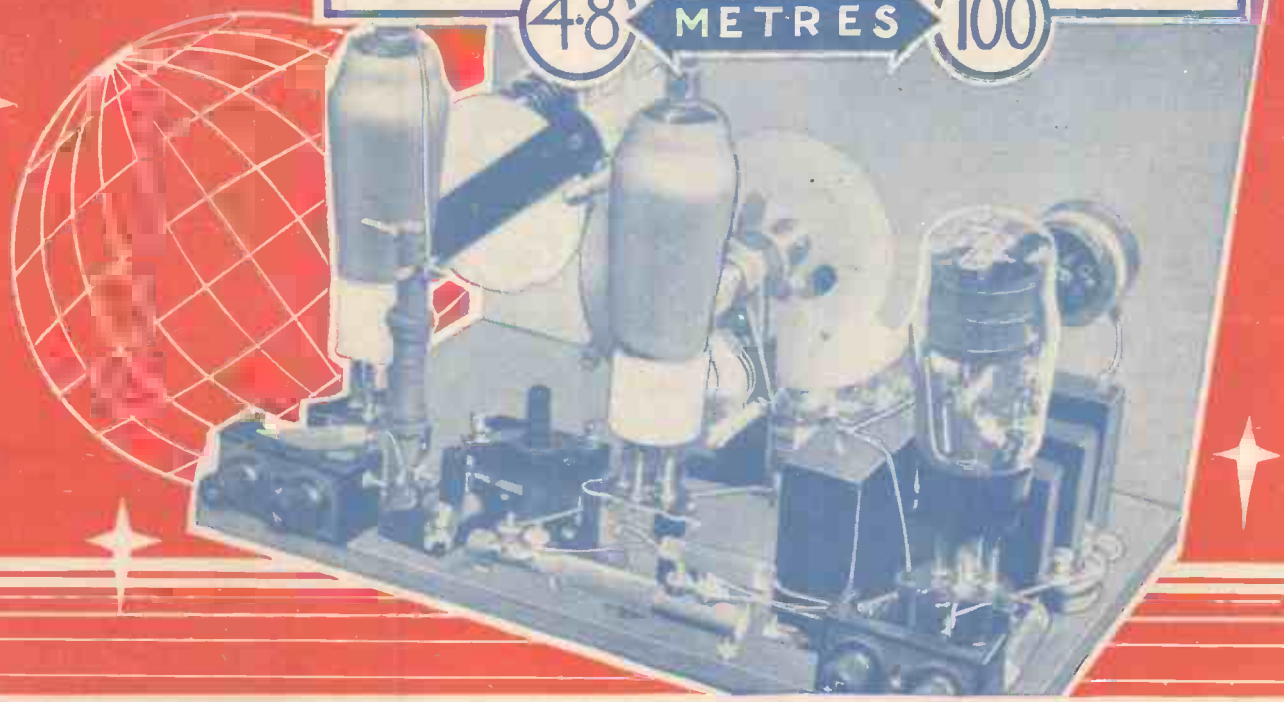
Edited by F.J. CAMM

A GEORGE NEWNES Publication

Vol. 9. No. 229. February 6th, 1937.

More about the "TELE-CENT"

4·8 METRES 100



1937 CRYSTAL SET AMPLIFIER

—See Page 624

Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff:
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VOL. IX. No. 229. February 6th, 1937.

ROUND *the* WORLD *of* WIRELESS

By Easy Stages

THERE is little doubt that more can be learnt by actual construction than by simply reading about a subject. The keen wireless amateur is anxious to begin at the very bottom and progress by easy stages through the entire realm of wireless, both in theory and practice, and the logical beginning is the crystal set. This is often sneered at in these days of multi-valve receivers, but there is ample evidence that it represents the only method of hearing the wireless programmes in hundreds of homes in this country, and apart from this it represents a simple receiver which the average schoolboy can make. The 1937 receiver recently described has met with tremendous popularity, in spite of its simplicity, and in this issue we describe a simple amplifier which may be added to it, thus providing the first step towards the construction of a larger receiver. The information and diagrams given will assist the beginner in grasping the elementary principles of construction and understanding of the theoretical symbols, and each month we shall carry the receiver a stage further. In this issue, also, will be found some interesting information regarding automatic volume control, as well as some further constructional notes on the Tele-Cent short-wave receiver.

Improved Insulation

EVERY electrician, as well as every constructor, knows how ordinary insulation tape of the adhesive type has to be wrapped round a joint in flexible or similar leads, after a repair has been made. At the forthcoming Leipzig Fair a new idea is to be seen where a special pair of "three-prong pliers" is employed to slip a piece of rubber tubing over the end of the wire and this sits firmly on the cable, is simpler to attach, and is much more effective.

For "Swing" Fans

SOME well-known figures in the dance-band world have consented to talk in the new series of Monday programmes dealing with swing music. These will include Nat Gonella, Lew Davies (trombonist of Bert Ambrose's band), Leonard Feather, and others. Demonstration records are to be chosen by each speaker to illustrate the points dealt with in the talk.

Television Vans

IT now seems that plans for the perfecting of the outside television broadcasts are so well advanced that the B.B.C. have ordered no less than three television vans. One of these is to be a control room, the second an ultra-short-wave transmitter (wavelength as yet not stated) and the third will carry the power plant. It is stated that the wavelength to be used in this portable transmitter will be of the order of "micro-waves."

Soldering Aluminium

HITHERTO it has been found difficult to make a satisfactory joint in aluminium, and rivetting or some similar scheme has had to be adopted. A new "solder" has, it is claimed, now been perfected, which enables aluminium to be joined in a similar manner to other metals. No flux is employed, but the parts to be joined are "tinned" with a stick of the new material and are then clamped together with the solder in a liquid state on each side of the joint. A temperature of 225 degrees C. is required and the joint is wiped clean and left undisturbed until cool. The new solder is known as Alunize.

For Motorists

CAR-OWNERS who tune in to the Midland programme on February 12th will hear Graham Walker, T.T. race commentator speaking on "Maintenance" in which he will deal with the various kinds of attention which the car requires weekly and monthly and at longer periods.

Pantomime in the North

PANTOMIME still goes on in the North. On February 10th an excerpt from Francis Laidler's production of "Babes in the Wood" will be broadcast from the Theatre Royal, Leeds. The cast includes Archie Glen, Ivor Vintor, Helen Bruce and Roma Beaumont, and listeners have already heard an except from this pantomime in the series of "Pantomime Variety" broadcasts during December last.

Down to 7 Metres

AS forecast many months ago in our pages, there is a possibility that the ordinary programmes broadcast by the B.B.C. will be radiated on a wavelength in the neighbourhood of 7 metres, in addition to the medium and long wavelengths. This will give users of television receivers the benefit of hearing the ordinary programmes and avoid the necessity of designing an all-wave television receiver. It will cheapen production, increase the interest in television, and lead to a general improvement in quality, as a wider band of frequencies can be transmitted on these low wavelengths.

Violin and Pianoforte Recital

ARTHUR CATTERALL formerly leader of the B.B.C. Symphony Orchestra, and Michael Mullinar, the Birmingham pianist and composer, will give a violin and pianoforte recital on February 13.

Organ Recital

HAROLD BALAAM will be heard for the first time in the Western programme when he gives an organ recital at the Gaumont Palace Theatre, Exeter, on February 11.

Concert From Bath

A CONCERT by the Bath Pump Room Orchestra, conducted by Maurice Miles, will be broadcast from the Pavilion, Bath, on February 13.

ROUND the WORLD of WIRELESS (Continued)

Wireless for Lifeboats

THE Royal National Lifeboat Institution are conducting experiments with wireless apparatus for use on lifeboats.

It is possible for scanty information received ashore to cause a lifeboat to go to the wrong area, and for her to be out of signalling range when amended information arrives.

The Institution is hoping, therefore, to equip its boats with wireless so that they can keep in touch with the shore.

Increase in Wireless Licences

THE official figures for December show that during that month there was an increase of 63,055, bringing the total to 7,960,573.

Britain is second to Germany among European countries in the number of licence holders. In Germany there are 8,167,957 licences in issue, but 570,000 are granted free to unemployed, War invalids and others.

One reason for the recent acceleration in the rate of increase has been the Post Office campaign against "pirates" who listen without paying. During December there were 266 successful prosecutions.

Concert from Torquay

OLIVE GOFF (soprano) and Edwin Benbow (pianoforte) will be the artists in a concert to be broadcast on February 9, from the Pavilion, Torquay, by the Torquay Municipal Orchestra, conducted by Ernest W. Goss.

Theatre Variety

THE chief item in the variety bill from the Aston Hippodrome on February 9, will be a turn by Billy Costello, the creator of "Pop-Eye the Sailor."

Frances Day before the microphone at the "His Master's Voice" studios during the making of her "H.M.V." record, "Love's Melody" and "So Must Our Love Remain" (HMV.BD 366).

Coventry Hippodrome Orchestra

ON February 7 William Pethers is to conduct the Coventry Hippodrome Orchestra in an early evening programme

INTERESTING and TOPICAL NEWS and NOTES.

which will include selections from "Heart's Desire" and "The Love Parade." Nora Savage (soprano) will sing two groups of songs.

A Debussy Concert

THE chief feature of the concert to be broadcast on February 5 will be the Debussy setting of Rossetti's poem "The Blessed Damozel" Noel Eadie is to sing the part of the Blessed Damozel, and Muriel Sotham that of the Narrator. Female voices from the B.B.C. Midland Singers will supply the chorus. Leslie Heward will conduct the B.B.C. Midland Orchestra. The other Debussy works to be given are the Scottish March, a waltz, and the Petite Suite, with Margaret Ablethorpe and George Mantle-Childe, pianists.

Italy's Bid for World-wide Transmissions

The Rome short-wave transmitters at Prato Smeraldo are to be endowed with two more powerful stations, of which one will be devoted solely to a radio service to Tripoli, Libya and Ethiopia. The sixth transmitter will be used for extended broadcasts to the Far East.

Increased Power on the Short Waves

EUROPEAN short-wave listeners will be pleased to know that a big improvement in the signals of W3XAL, Boundbrook, is expected towards the end of this month. Already one of the most popular U.S. stations, W3XAL is having a new directional aerial system built which should increase its strength sixfold.

Television Range

IT was originally anticipated that the service area from Alexandra Palace would be about twenty-five miles, but practice has shown that this area is much larger, even when using an ordinary dipole. With the use of a dipole aerial with the reflector system, the area has been very considerably increased, and covers nearly one-fourth of the population. Cossor television receivers are working satisfactorily at Southend-on-Sea,

Royal Philharmonic Society

ON February 11, the Royal Philharmonic Society's concert, conducted by Dr. Malcolm Sargent, will be broadcast from the Queen's Hall (Regional). The programme will consist of two works: William Walton's "Belshazzar's Feast" and Mozart's unfinished Mass in C minor, which will be sung by the Huddersfield Choral Society, Isobel Baillie, Elsie Suddaby, Webster Booth and George Hancock.

An attractive display on the G.E.C. stand at the Radio Exhibition held recently in the new broadcasting station at Dairen, Manchuria, to mark the official opening.

SOLVE THIS!

Problem No. 229

Alexander's A.C. three-valve receiver suddenly developed a curious fault. Volume remained at maximum regardless of the setting of the H.F. volume control connected in the cathode lead of the H.F. valve, and it was found that replacement of the control did not provide a remedy. What was the fault? 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., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 229 in the top left-hand corner, and must be posted to reach this office not later than the first post on Monday February 8th, 1937.

Solution to Problem No. 228

The excessive voltage was due to shorted turns on the field winding of the moving-coil speaker.

The following three readers successfully solved Problem No. 227 and books are accordingly being forwarded to them: F. Wallington, 21, Deakin Rd., Erdington, Birmingham; J. H. Cook, The Vicarage, Stratford-sub-Castle, Nr. Salisbury, Wilts.; C. S. Jones, Lowick, Wolseley Rd., Rugeley, Staffs.

The Beginners' Tele-Cent Three

By F. J. CAMM

This Article Deals with the Completion of the Receiver, and Operating and Adjusting Notes are Given

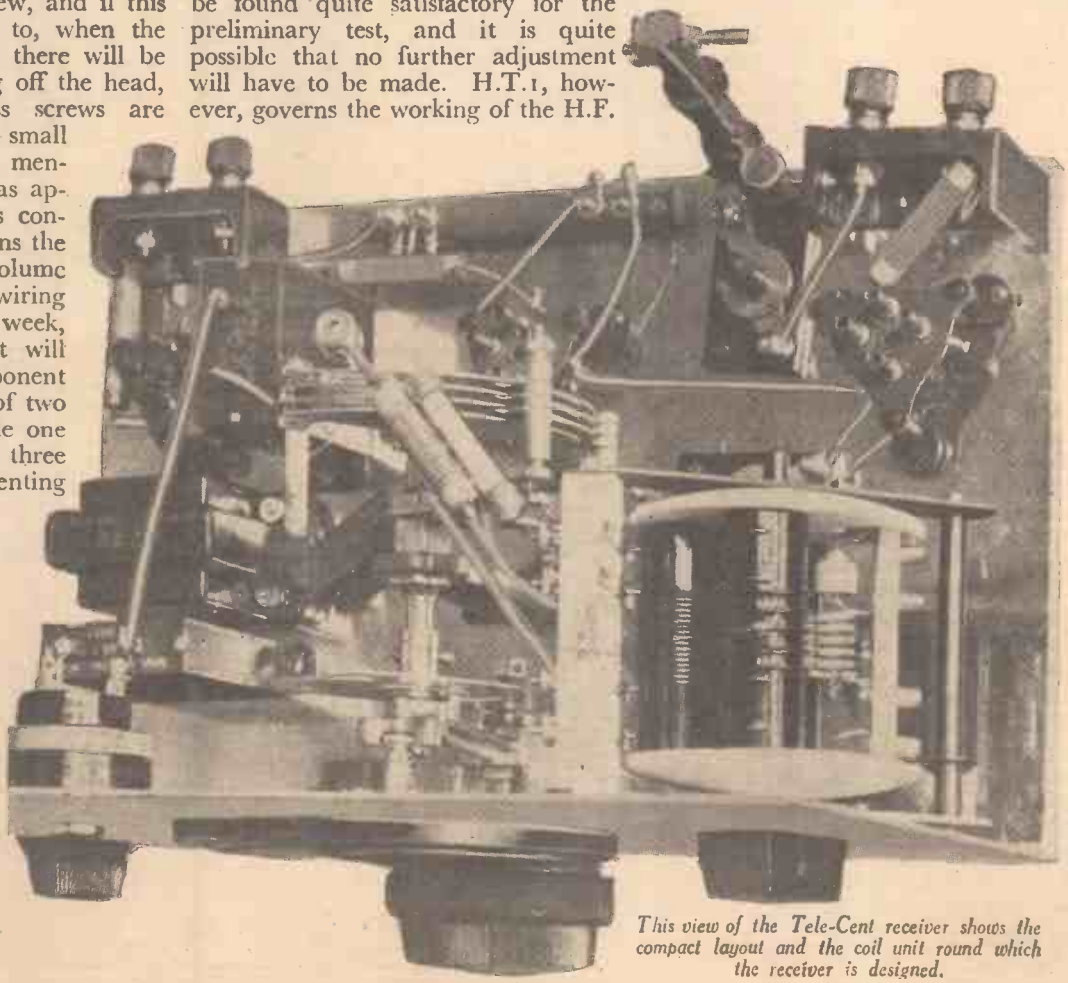
THE constructional details which were given last week should enable everyone to build the receiver, and there is very little additional information which can be added in this connection. It is presumed that the constructor will not attempt to drive ordinary screws through the metal surface of the baseboard, and the correct procedure is to mark the position of a screw-fixing hole, and then, with a small drill or an awl, make a hole in the aluminium surface. This hole must be capable of accommodating the plain shank of the screw, and if this point is not attended to, when the screw is nearly home, there will be a possibility of turning off the head, especially when brass screws are employed. Another small point which must be mentioned, as confusion has apparently arisen in this connection before, concerns the combined switch and volume control. In the wiring diagram published last week, or on the blueprint, it will be noted that this component is drawn in the form of two concentric circles, inside one of which there are three smaller circles, representing contact points. To these three points battery leads are attached— L.T.—, H.T.—, and G.B.+.

Operating

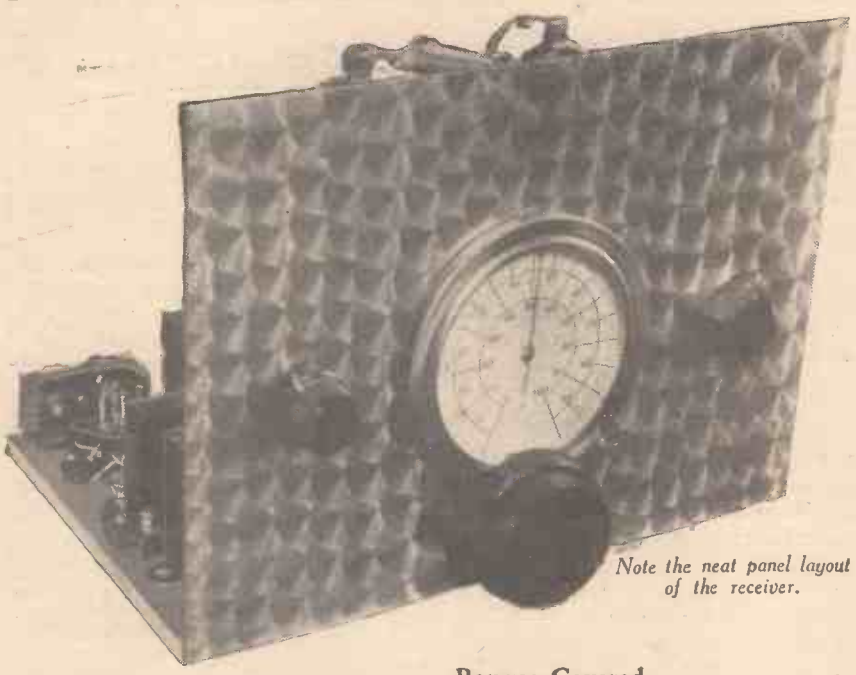
These three points are the contacts to the switch, and the three contacts shown on the side of the larger circle are the volume control contacts.

So far as operating is concerned, the receiver is just as simple to handle as a one-valve set. First of all, insert the battery leads at approximate points, a final adjustment being made when the receiver has been found to function and no wiring mistakes exist. H.T.1 should be placed into the 52-volt socket, H.T.2 into the 96-volt socket, and H.T.3 into the maximum (120-volt) socket. G.B.— should be inserted into the 4.5-volt socket on the bias battery, and G.B.+ into the positive socket. H.T.— and the two L.T. leads should, of course, be connected to the terminals bearing these markings. These values will be found quite satisfactory for the preliminary test, and it is quite possible that no further adjustment will have to be made. H.T.1, however, governs the working of the H.F. valve and it may be found that an alternative voltage will give greater sensitivity, or less background noise, and accordingly the plug may be moved about in the H.T. battery between, say, 48 and 66 volts.

Connect the aerial and earth, and operate the Clix loudspeaker switch so that the headphones are brought into circuit, and then unscrew the aerial series condenser and the other pre-set (C_4) until the plates are a fair way apart. These two settings will not be critical to start with, but, as in the case of the H.T. voltages,



This view of the Tele-Cent receiver shows the compact layout and the coil unit round which the receiver is designed.



Note the neat panel layout of the receiver.

subsequent experiment will show the most appropriate settings for your individual local conditions. Turn the switch on the coil unit so that the largest coil is brought into circuit. You can see which coil is in circuit by its position relative to the contact points on the terminal strip attached to the unit, and may mark the control knob if you so desire. Now turn the volume control to its maximum position, and slowly rotate the tuning condenser through its entire range. At various points signals should be heard, but if they are brought in in the form of a high-pitched whistle which slowly sinks to inaudibility and then rises again, the volume control should be turned a short way back. Alternatively, you can carry out the adjustment by using both hands in the following manner. Hold the volume control knob with the left hand, and the tuning control with the right, and advance the former knob until a slight hiss can be heard in the 'phones. As the tuning control is then adjusted, the hiss will increase in volume, and the left-hand control should then be slackened back until the hiss is reduced. In this way tuning throughout the entire range proceeds, always keeping the hiss at its lowest pitch. If the control is advanced too far or is not advanced far enough, no signals will be obtained, and therefore do not be disappointed if at first you are unsuccessful in obtaining results. Once you have tuned in two or three stations, you will get the idea of the adjustment and thereafter the handling of the receiver will be so simple that stations can be tuned in direct on the loudspeaker on any waveband.

Ranges Covered

The four coils fitted to the coil unit cover the following ranges: 4.8 to 7 metres, 6.6 to 17 metres, 16.6 to 42 metres, and 37 to 91 metres. Thus, the television programmes will be found near the lower part of the dial when the second coil is in circuit, and this will form the simplest tuning point for those within range of the Alexandra Palace. This is the coil with five turns of wire on a black former, the air-spaced silver coil being the first coil covering the 4.8 to 7 metre band. It will be found that when using this coil a slightly different adjustment of the volume control is required, and if the series aerial condenser is adjusted it will be found that there is a rather critical value for it, dependent upon the aerial and earth which is in use. Thus, when once a station or two has been heard, one of the weaker ones should be tuned in carefully, and this pre-set condenser, as well as C4, should be adjusted, re-tuning after each adjustment, and modifying the setting of the volume control in order to counteract the effects of the new adjustment. In this way you will be able to find the best working points, after which these controls may be ignored until the valves are changed, or some alteration is made in your aerial-earth system.

Modifying the Range

The highest wavelength covered with the coil unit as specified is 91 metres. On a wavelength of 160 metres, there will be found a number of American police radio stations, some of the fixed-station type, and some of the mobile type, and these afford quite a considerable degree of entertainment. In addition to this, on 140 or 145 metres, some English police transmitters may be heard, whilst many amateurs and commercial stations are audible on wavelengths between 100 and 200 metres. Therefore, the constructor may feel that this waveband offers more scope than one of the others, probably the lowest, in view of the shorter range of the ultra-short-wave stations, and the more difficult tuning and adjustments which are necessary. The makers of the coil unit can supply a coil wound to cover a band from 75 to 175 metres, price 2s. 6d., and this may be mounted on the coil unit in place of the ultra-short-wave coil. Alternatively, unwound coil formers may be obtained from Messrs. Lissen for 9d. each.

PRICE LIST OF COMPONENTS

		£	s.	d.
One rotary coil unit (type Hi-Q 5649)	*Lissen*	15	6	
One tuning condenser, 160 mmfd. (C1) (type 922)	*Eddystone*	8	6	
One slow-motion drive, No. 1070	*Eddystone*	8	9	
One mounting bracket (type 1007)	*Eddystone*	1	6	
Three H.F. chokes—one Hi-Q 5645 (2s. 6d.), two Hi-Q 5656 (2s. each)	*Lissen*	6	6	
One L.F. transformer, ratio 3 : 1	*B.T.S.*	4	6	
One potentiometer with 3-pt. switch, 100,000 ohms (R5) (type VM.61)	*Bulgin*	5	6	
Eight fixed condensers: 2 mfd. (C7), 1 mfd. (C8) (type 65), .1 mfd. (C10), .005 mfd. (C11), two .001 mfd. (C3, C6), .0005 mfd. (C9), .0003 mfd. (C5), all tubular	*T.C.C.*	11	0	
Two pre-set condensers, .00005 mfd. (C2, C4) (type No. 1087)	*J.B.*	2	0	
Three valveholders, two 4-pin and one 5-pin (baseboard S.W. type V8)	*Clix*	5	6	
Four fixed resistors: 5,000 ohms (R3) and 30,000 ohms (R2) (type F1); and .5 meg. (R1) and 100,000 ohms (R4) (type F½)	*Dubilier*	3	0	
Two terminal mounting blocks	*Belling and Lee*	1	0	
Four type R terminals, L.S., L.S., A. and E.	*Belling and Lee*	1	0	
Six plugs, H.T.—, H.T.1, H.T.2, H.T.3, G.B.+, G.B.—	*Belling and Lee*	1	0	
Two spades, L.T.—, L.T.+	*Belling and Lee*			6
One Plymax baseboard, 11in. by 7in.	*Peto-Scott*	4	9	
One 16 S.W.G. aluminium panel, drilled, polished, 11in. by 8in.	*Peto-Scott*	5	0	
Two panel brackets	*Peto-Scott*	1	0	
Quantity of 18-gauge tinned copper connecting wire, two lengths of insulated sleeving, and screws.				

ACCESSORIES

Three valves: two SG220SW, one Y220	*Hivac*
One pair headphones	*B.T.S.*
One 120-volt H.T. battery	*Drydex*
One 9-volt G.B. battery	*Drydex*
One 2-volt L.T. accumulator	*Exide*
One Stentorian Junior loudspeaker	*W.B.*
One L.S. control panel	*Clix*
One All-wave Aerial Kit	*B.T.S.*

More About Automatic Volume Control

A Simple Explanation of the Various Systems, When and How to Use Them, and the Snags to be Avoided

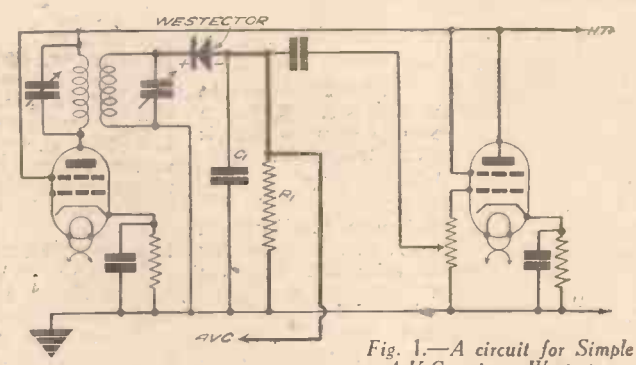


Fig. 1.—A circuit for Simple A.V.C. using a Westector.

WHEN "twiddling the knobs" of a sensitive receiver, such as a modern superhet, large variations in signal strength are encountered. Some stations are hardly audible, and others overload the set considerably, causing acute aural discomfort; while the reception of the long-distance stations is so marred by fading that they are of no programme value.

Automatic volume control is a system which has been designed to ensure that all stations above a certain minimum strength are received at approximately the same volume, so that operation of the set becomes a simple matter. A.V.C. also minimises the effect of fading.

The system used, whatever its form, controls the high-frequency gain of the receiver, according to the strength of the received signal. Part of the rectified output of the detector is fed back to the high-frequency stages and serves to alter the bias on the valves, which must have variable-mu characteristics, in accordance with the signal strength. It is just like altering the setting of the volume control on a set which is controlled by adjusting the bias applied to the H.F. valve, only with A.V.C. the action is carried out automatically by the set itself.

Varying the Bias Feed Back

Thus, for a strong signal the bias will be increased and the sensitivity of the set reduced. For a weak signal there will be but little variation in the applied bias and the set will continue to work at its maximum sensitivity. Constancy of detector output, therefore, is maintained whatever the strength of the incoming signal and, since the whole action is entirely dependent on the strength of the incoming signal, it follows that, providing the time constants of the A.V.C. decoupling circuits are properly designed, the bias fed back will vary in proportion to the signal strength, and will follow it accurately and constantly. The effect of fading will thus be minimised.

It should be noted that it is the variations in signal strength of the carrier wave of the received station which are used to control the gain of the set. Were we to use the audio-frequency currents carried by the carrier waves, we should only succeed in levelling up the loud and weak passages, and the average volume would still be prone to fading.

There are various methods of obtaining A.V.C. and various ways of using it. A.V.C. may be obtained by the use of:

(1) A Westector.
(2) A diode.
(3) A double-diode-triode.
(4) A double-diode-pentode.

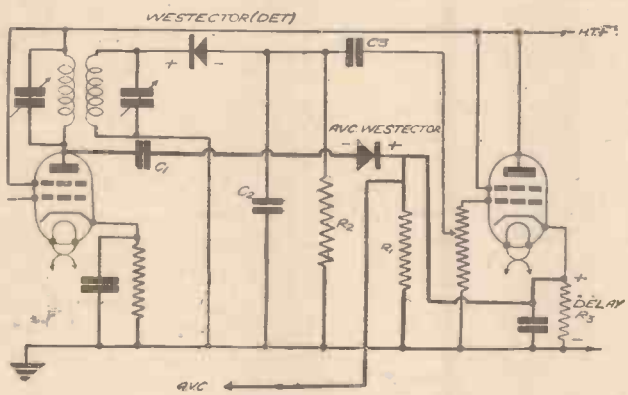


Fig. 2.—(Left) A circuit for Delayed A.V.C. using Westectors.

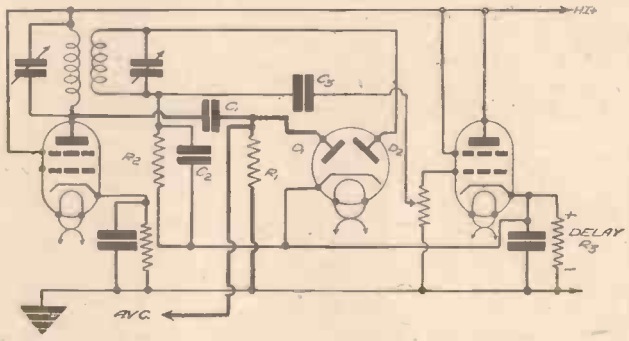


Fig. 3.—(Right) Delayed A.V.C. using double-diode valve.

It may be employed in any one of the following combinations:

(1) Simple A.V.C.
(2) Delayed A.V.C.
(3) Amplified Delayed A.V.C.
(4) Quiet A.V.C.
(5) Quiet Delayed Amplified A.V.C.

Simple A.V.C.

The simplest form of A.V.C., that known as Simple A.V.C., and using a Westector, is shown in Fig. 1.

The signal received by the Westector is rectified, and A.C. and D.C. components are contained in the output. The A.C. component is fed to the L.F. stages in the ordinary way and produces the sound in the loudspeaker. The D.C. voltage produced across the load resistance R.1 is normally not made use of, but, in order to use it for A.V.C. purposes, it is only necessary to feed it back to the H.F. and/or I.F. valves for the purpose of controlling their gain. The condenser C1 is necessary to filter out any H.F. voltages that may be present in the rectified output of the detector.

This circuit has the disadvantage that even very weak signals are controlled, so that the sensitivity of the set is lowered. By introducing a fixed voltage, it is possible to prevent the operation of the A.V.C. system until a signal of predetermined strength is received, when the A.V.C. becomes fully operative. This enables the receiver to work at full sensitivity on all weak signals and renders the A.V.C. more effective on strong signals. The system is known as Delayed A.V.C., and the use of a Westector is shown in Fig. 2, where part of the H.F. voltage is taken direct from the anode of the last I.F. amplifier valve, through a feed condenser C1, and rectified by a second Westector. A D.C. voltage is developed across R1 and fed back to the previous stages in the normal manner. The delay voltage is obtained by connecting the Westector to the cathode of the following valve, which, due to the presence of the biasing resistance R3, is positive in respect to earth. Until the HF. voltage applied to the Westector exceeds the value of the bias developed across R3, no rectification can

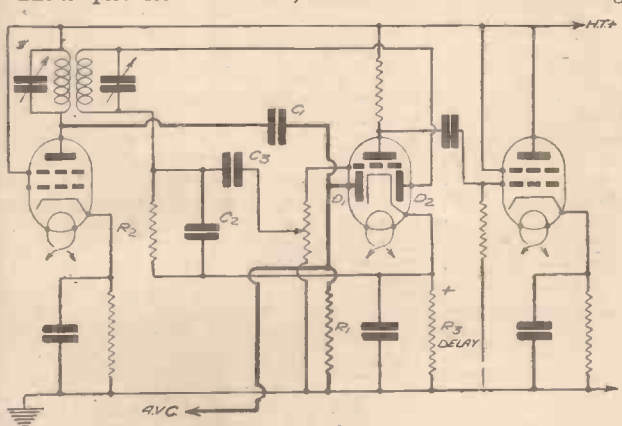


Fig. 4.—A circuit for Delayed A.V.C. using a double-diode-triode valve.

MORE ABOUT AUTOMATIC VOLUME CONTROL

(*Continued from previous page*)

take place, and no A.V.C. voltages can be fed back for control purposes. R2 is the usual load resistance across which is developed the audio frequency.

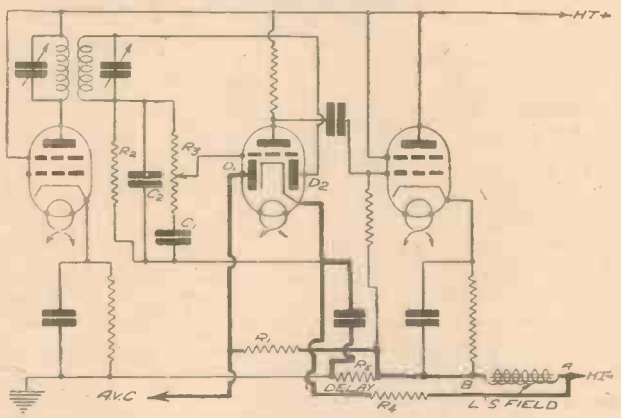
Delayed A.V.C.

Compare this circuit with Fig. 3, which shows how delayed A.V.C. is obtained by the use of a double-diode, and Fig. 4, a double-diode-triode.

In Fig. 3 the diode D2 rectifies the incoming signal, and the A.F. voltage developed across the load resistance R2 is passed on to the L.F. amplifier *via* the condenser C3. The incoming signal is also applied to the diode D1, by means of the coupling condenser C1. Diode D1 is biased negatively by means of the bias resistance R3 in the cathode of the following valve. When the H.F. voltage exceeds the value of this bias (the delay voltage), the diode D1 will become positive and current will flow through resistance R1. The voltage thus appearing across R1 is then fed back to the preceding valves, and serves to control their gain.

The double-diode-triode circuit shown in Fig. 4 operates in a similar manner. In fact, it is a double-diode with a triode amplifier in the same glass envelope, and the delay voltages are developed across the cathode of the valve by means of the current flowing through the triode portion.

A comparison of Figs. 2, 3 and 4 will show that all three circuits work in the same manner and the measure of control exerted by each is identical.



The application of Amplified A.V.C. is, however, rather more complicated and Fig. 5 shows a typical circuit using a double-diode-triode. It should be borne in mind that the A.V.C. voltages are not themselves amplified, but rather that the circuit is so arranged that the A.V.C. volts fed back for control purposes are much more than could normally be obtained simply by rectifying the incoming signal.

The diode D2 is used for rectification for L.F. purposes in the normal way and is identical with the previous circuits. When a signal is received, the grid of the double-diode-triode valve receives both the A.C. and D.C. components of the rectified output, and by reason of the latter, is biased in proportion to the strength of the received signal.

The A.V.C. voltages are obtained from the diode D1. As long as this diode is negative with respect to the cathode, no current can flow, but when the diode becomes positive, current will flow through the resistances R1 and R4, and the L.S. field connecting the diode and cathode.

In Fig. 5, the speaker field is in the negative H.T. line of the receiver. Thus the point A, to which the cathode is connected, is more negative than the point B, to which the diode is connected. Thus a very large bias, depending on the resistance of the L.S. field, is applied to the A.V.C. line, and its value is constant. As such it is of no use for control purposes, but, by connecting the cathode to H.T. negative through a fairly large resistance R4, we can make the bias dependent on the signal.

When no signal is received, there is no bias on the grid of the valve and thus a large current flows through R4, the value of which is so arranged that the voltage drop across it under this condition is slightly more than that across the speaker field. Both the A.V.C. anode and the cathode of the valve are now positive in respect to H.T. negative, the cathode more so by reason of the greater voltage across R4. Thus the diode is now negative with respect to the cathode.

As a signal is received, the grid is biased and the current flowing through R4 decreases. Less volts are developed and consequently the diode becomes positive in respect to the cathode and current flows along R1, across which volts are developed. This voltage is considerably greater than the initial bias applied to the grid of the valve, or of any that could be produced by the direct rectification of the incoming signal, and the measure of control exerted is considerably larger. The small resistance R5 serves to apply a small fixed delay voltage to the previous valves.

Fig. 6. — (Right) This circuit diagram shows Delayed Amplified A.V.C. using Westectors.

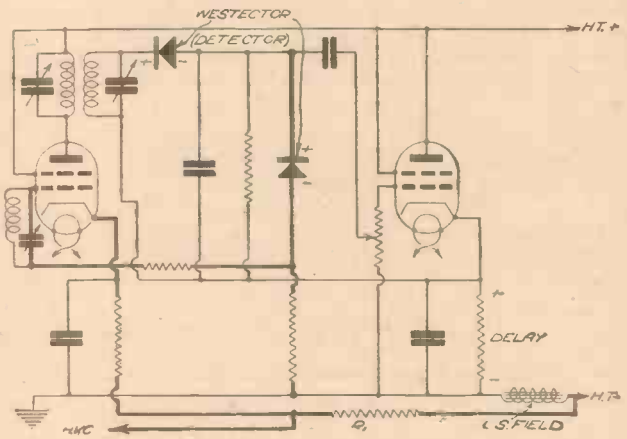


Fig. 5.—(Left) Circuit diagram of Amplified Delayed A.V.C. using a double-diode-triode valve.

The same system using Westectors is shown in Fig. 6, the I.F. valve is controlled by normal delayed A.V.C., and this control is such as to reduce the current flowing through the resistance R1 as well as to control the gain of the valve. The voltages appearing across R1 are thus dependent on the strength of the signal and are considerably more than could be obtained by direct rectification.

Quiet A.V.C.

A disadvantage of all these systems is that, as soon as the set is in a condition where it is not tuned to a station, no A.V.C. action takes place, and the set works at its maximum sensitivity. Thus, in between stations considerable atmospheric interference is picked up, and the set becomes noisy to tune. To counteract this, Quiet A.V.C. has been devised.

This circuit uses a triple-diode valve, in which the diodes are completely screened from the triode, and in operation the two circuits are independent of one another, except for the common cathode. By using such a multiple diode valve, we are able to get not only Quiet A.V.C., but also Amplified A.V.C. The rectified output of the detector diode is fed to the grid of the valve is the normal manner, but the D.C. component is applied to a third diode.

The A.V.C. diode is heavily biased and Amplified A.V.C. is obtained as explained above. At the same time, a heavy delay voltage appears at the detector diode, and this is used to obtain Quiet A.V.C. in between stations.

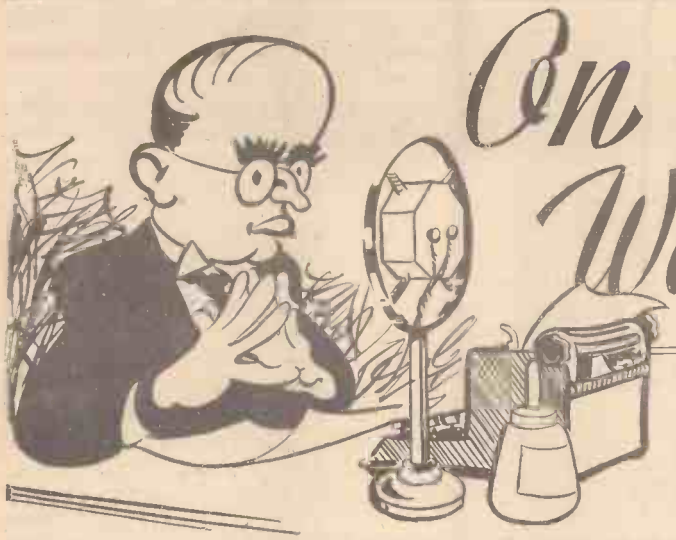
Quiet A.V.C. can also be obtained by the use of a separate valve, but both the systems referred to hardly appear to be worth while. In the first case, a very special valve (the only one of its kind on the market) has to be used, and, in the second, an extra valve is needed. On top of this, a further objection is raised in that distortion is often introduced by the use of these circuits. In fact, Quiet A.V.C. has been found to have so many more snags than advantages that it is not nowadays included in the specification of any manufacturers' receiver, and we do not recommend any constructor to incorporate it in his set.

An Alternative Method

By far the better way is to introduce a "sensitivity switch" in the form of an extra bias resistance in the cathode lead of one of the H.F. or I.F. valves. This has the effect of biasing back the valve so that its amplification is reduced, and the resistance is put in, or taken out of, circuit by means of the switch. In this way, manual inter-station noise suppression is obtained, and is very satisfactory.

This brings us to the end of the various methods. We can reject Simple A.V.C. on the ground that it greatly reduces the sensitivity of the station. Amplified A.V.C. would perhaps, at first sight, appear to be the best circuit, but this has rather a big disadvantage. It is well known that as stations fade, distortion is introduced. Take the case of a station that has faded very badly, with a lot of distortion present. Amplified A.V.C. would tend to bring this station right up to its normal level, with the result that very severe distortion would be introduced and, while the period of severe fading lasted, the station would not be worth listening to.

(*To be continued*)



On Your Wavelength

By THERMION

My Life is Threatened

I HAVE received a letter from a Scot. Fact! At last I believe that one of the hardy race remains in his own country. I picture this forlorn individual, dour of mien, with glassy, lack-lustre eyes, and short goatee beard, patrolling the Caledonian Hills, minding the sheep, mayhap sneaking away to some secret still at night. Perhaps to his local library where he read my recent note about the Welsh, Irish, and Scots in the B.B.C. He is in high dudgeon about it, which once again proves that the Scottish race cannot see a joke, not even an English joke, without the necessary surgical operation. It is true that the population of London is denser than that of Scotland, but at least they are not so dense that they do not perceive when their leg is being pulled. This bombastic Scot is so annoyed with my jocular remarks that he invites the Editor to inflict bodily punishment upon me. He also regrets that he cannot be in London to demonstrate what a 6ft. length of 14½-stone Scot can do to me. It would not be half so funny as what a 14½-stone Thermion with brains as well as beef might do to him. What you might call just a little friendly playfulness!

A land from my right is reputed to cost the recipient 2d. in bus fares to return to his starting point. By the way, did not one-way streets originate from the road from Scotland to London? Few Scots seem to return that way. Another reader, *apropos* bagpipes, asks me if I have ever heard a piper play a lament. He says that he can walk to hell and back (why back?) to the tune of the pipes. He does not expect Londoners to understand the bagpipes as well as the Scots. Why inflict them on us then? I invite a census of my readers on the question of whether bagpipes should be abolished. Just for fun!

Transmitting

S. L., of India, writes: "I write and ask you to have nothing to do with 'Transmitting.' I can see it coming. The budding young operator is madly working on your new page, and before long you will be worse than our brothers across the pond. 'When,' 'how' and 'why' a transmitting licence must be obtained. I read that for the past four years in books from U.S.A. They have made a real game of it, and I only hope I will not see such tripe on 'our favourite page.' I think our, or rather most of our, constructors have a little more idea of 'skill' at their apparatus other than wanting to use a 'small 'phone xmitter for portable use.' By some of the papers from U.S.A. it appears that before long there will be no need to pass a morse test as laid down. Think of the number of *sets* there would be in use. Every two people fumbling around all day trying to find what frequency they were on. Receivers constructed at home in the hands of a beginner were bad enough years ago. Before I finish I would like to thank you for a pleasant Christmas. I've read every page of the past year's books."

How difficult it is for a reader residing in India to gauge demands of the English public. If he could see our postbags he would find that it is the grown-ups who are turning to transmitting.

Crooners and Jazz

I SHALL soon have to start a library in which to store all the jazz literature which is being showered upon me by lovers and haters of that form of torture known as jazz. Ever since I mentioned my dislike of the crooner and modern dance music I have been receiving cuttings, books, pictures, and other matter relative to the subject, and whilst one reader will send me a photograph to illustrate the low mentality of the purveyor of jazz, another will send me a picture of a member of another band to show the high degree of intellect which is attracted to the profession. But I am at present greatly puzzled at the modern form of music now generally known as "swing," and although I recently quoted a definition of this noise, I have before me a cutting from a recent musical paper, in which it is stated by the Editor that no definition can be applied to it. I can supply the lacking term, but not in print. In a few weeks I shall be able to give you my list of names, and I only wish I could reproduce some of the photographs which I have received. I am sure they would prove very enlightening to those who accuse me of adopting a wrong point of view on the matter.

Good Components

I WAS delighted the other week to receive two interesting components from members of the trade, which show that at long last some measure of efficiency is being aimed at, in order to improve the many failings about which not only I but others have had to speak. In the first case, a well-known component had been sent to the Editor for test purposes, and I happened to notice it lying on his table. I am very familiar with this item, and was instantly surprised to notice that there was a small addition to it. Nothing very much in itself, but something which means quite a lot to the home-constructor—or even the commercial set builder, although he is in a position to overcome the shortcomings of individual parts in his own way. The component was a volume control, and the addition was simply a large shake-proof washer—you know, the type of washer which has teeth round it turned at an angle. I have often found, and have heard home-constructors complain of the fact, that when a control has been mounted it sometimes happens that owing to undue force at each end of the travel, the component eventually works loose, and even if no damage arises due to

wires being shorted when it turns, it is necessary to remove the control knob and tighten up the nut, and if a component has been calibrated, or some particular settings have been marked, these may be rendered useless owing to the control not being mounted in exactly its old position. This little addition is very welcome and I congratulate the makers.

In the other component, which, incidentally, was also a volume control, a better idea from some points of view was incorporated. This consisted of a small, ⅛in. projection moulded in the bakelite case, a short distance from the centre fixing bush. Consequently, when the component is mounted, and a hole has been drilled in the appropriate position, the projection acts as a key and the component cannot turn, even if the lock-nut comes loose. The electrical features of the component also are very sound and it should prove a very good item. The first item was by Bulgin, and the second by Dubilier.

A Handy Tip

I READ in a Trade paper the other day about the difficulties which arise in connection with switches. It is funny the way these small parts can cause trouble in a receiver, not only from noisy working but from the very erratic behaviour which often arises when a switch is making faulty contact. I know you can clean a switch, and we have had dozens of suggestions for carrying out this operation, from placing a piece of old emery between the contacts to a complete dismantling and polishing. But the little tip which I think is worth passing on is to take a piece of thin card and smear both sides with lead, rubbing a soft pencil over it. This is then placed between the contacts and the switch operated several times, during which it will wipe itself clear of grease, etc., and the lead or graphite on the paper will transfer itself to the contact surfaces, giving a clear contact. You must, of course, watch for a high-resistance contact in certain circuits, but otherwise the idea is quite good.

A Good Idea?

L. J. S., of Gidea Park, writes, apropos my recent paragraph: "Regarding your complaint, in a recent issue, about volume controls, I must remind you that a popular component manufacturer once produced a volume control which I personally found perfectly free from mechanical friction.

The advantage it had over the usual type of volume control was that the variable connection was made by a thin pliable metal disc fixed about one eighth of an inch from the resistance coil, and pressed down on to same by a revolving rod, thus eliminating the friction caused in the usual way. I fail to understand why this principle is not adopted generally."

Notes from the Test Bench

S.W. Converters for Mains Sets

WE receive numerous queries weekly concerning the addition of short-wave converters to commercial mains receivers. In most cases we are unable to give definite advice owing to insufficient information being supplied concerning the converter and broadcast set. The addition of a converter is a very simple matter, provided that it is self-contained. When the required H.T. and L.T. voltages have to be supplied from the broadcast receiver, difficulties arise, however. If the set and converter are battery operated the extra current taken by the converter valve can conveniently be supplied from the battery supplying the receiver. When the receiver is of the all-mains type, however, the extra 1 amp. required by the converter valve heater may cause overloading of the mains transformer in the receiver. It is therefore advisable to consult the receiver manufacturers before adding a converter in this manner.

Methods of Connection

IT is permissible, of course, to use a battery type valve in the converter, and supply this from a 60-volt H.T. battery and a 2-volt accumulator. This type of converter can then be used in conjunction with mains and battery operated sets—this is probably the most useful type of converter. Another method of separate supply when the mains are available is to use a mains valve in the converter, supplying L.T. from a small L.T. mains transformer and H.T. from a 60-volt battery.

Limit Four Troubles

IT is surprising how many readers tackle the construction of a receiver without first of all learning how to solder. It does not matter how carefully the components have been laid out, if the soldering is poor good results cannot be expected. In the Limit Four there are several soldered joints required on the multi-contact switch, and of the receivers which have been sent to us for servicing the majority of them have failed to function satisfactorily owing to bad contacts at this switch. Another point which we have continually to stress is the meaning of the abbreviation M.B. M.B. indicates the upper metallised surface of the chassis. In the Limit there is an M.B. contact underneath the switch. In some cases we have found that readers have used a wood screw in this position. A bolt is required, and should be passed through the baseboard to make contact with the metallised surface.

Coils

J. M., of Gorton, Manchester, writes: "All the sets I have made from your designs have been the goods, but they very nearly all use different parts, especially the coils, and these are practically different for every set described. Now a coil is usually the most expensive part of any set, excluding valves; it or they usually cost anything from 15s. to 30s., and I for one do not feel inclined to scrap a good bank of coils every time I build a new set. I am acquainted with quite a few readers who share my attitude. A short while ago I had a clearing out of my junk box; a second-hand dealer offered me 2s. 6d. for about £3 worth of modern coils, yet look what they cost me, and no coil was above two years old. I eventually sent them to my church jumble sale. I hope they got more than 2s. 6d."

This reader has evidently overlooked the fact that this journal has published more articles on making coils, transformers, chokes, etc., than any other wireless journal. If he wishes to make coils, he can consult the lengthy series of articles which we have published from time to time on these various subjects.

The Record Three

HERE is a tip for this receiver, which was described some time ago. There may be a possibility that some stations will prove too powerful to permit the 'phones to be worn comfortably whilst searching. An L.F. volume control may be fitted in such a case, a value of 500,000 ohms being selected. The Bulgin component, Type VC. 63, may be used, and should be mounted on a bracket situated at the rear edge of the baseboard between valveholders V2 and V3. The lead from terminal G on the L.F. transformer should be removed, and the two outside terminals on the volume control should then be joined to the G and G.B. terminals on the L.F. transformer. From the centre terminal on the volume control a short wire is then taken to the grid socket on holder V3. This control will enable the L.F. output to be kept at a suitable level for headphone listening, but it should be set to its maximum volume position when ordinary loudspeaker results are required.

NEW SERIES

Amateur Transmitting

Preliminary Considerations and Constructional Details of a 10-watt Transmitter are given in this Eleventh Article of the Series

By L. ORMOND SPARKS

I MENTIONED in my last article an A.C. operated transmitter, so I propose giving sufficient details of a 10-watt outfit to enable those who are in the position to operate such an installation to construct it or, on the other hand, use my suggestions as a basis for experimental work. To commence with, there are several limiting factors. For instance, the question of cost has to be considered; the types and number of valves; operating voltages—to avoid the necessity of costly and high-voltage mains equipment—and, lastly, the type of circuit, bearing in mind modulation requirements. All the above items are, more or less, dependent on each other, the whole being governed by the length of one's pocket.

I would suggest that a happy medium is the following. A crystal-controlled oscillator followed by a radio-frequency amplifier, i.e., P.A., which is modulated by a two-valve microphone amplifier, the whole receiving its operating voltages from one mains unit.

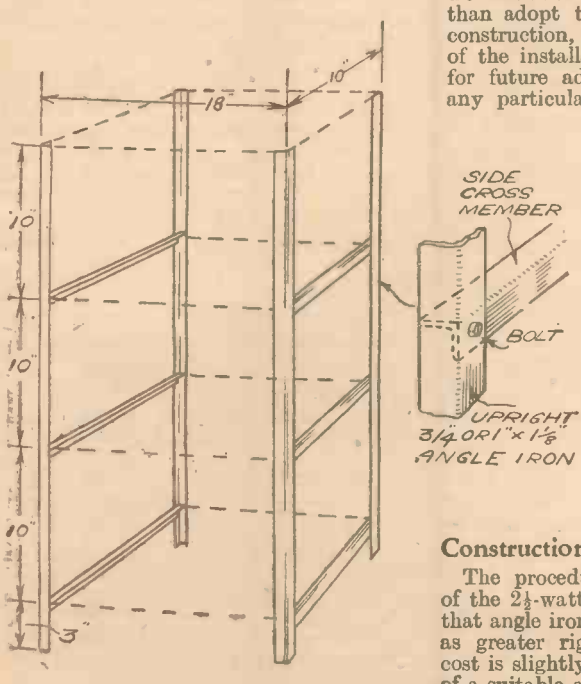


Fig. 1.—Method of building up the rack framework for the 10-watt transmitter.

With such an arrangement, it is possible to get a very satisfactory input to the aerial with a maximum voltage of 350 volts, so excessive cost is eliminated, while many constructors, quite possibly, have a suitable mains unit and rectifier to hand. The circuit, which will be discussed later, is such that a "freqency doubler" stage can be added in the future, if so desired, thus allowing other wavebands to be covered.

The C.O. (crystal oscillator) and P.A. (power amplifier), microphone amplifier, and mains power unit are made in separate sections, so one cannot do better than adopt the usual "rack" method of construction, and in constructing this part of the installation the amateur can allow for future additions, or make it to suit any particular space.

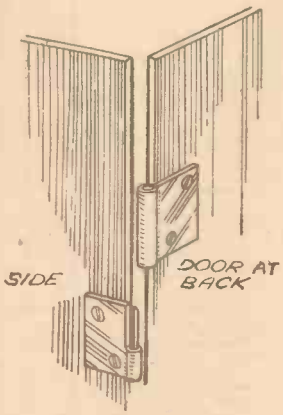


Fig. 2.—Detail showing method of fitting the back of the cabinet.

"mains" power unit in the bottom, the microphone amplifier next, and the C.O. and P.A. in the top, an arrangement which is both ideal and compact.

The question of covering the front is a matter for individual taste. Separate panels can be fixed to each baseboard, as in the case of the 2½-watt transmitter, or the components can be mounted on brackets, as in chassis construction, and one panel used to cover the whole of the front. The latter is certainly neater, but the other method allows each section to be quickly and easily withdrawn for alterations or tests.

Regarding the sides, they can be covered or left open, but beneficial screening can be obtained if they are covered with perforated zinc, which, by the way, if given a hard rubbing with metal polish will come up like silver, and add considerably to the appearance of the outfit, especially if black front panels are used. It must be remembered that if the apparatus is so situated that children or domestic pets are likely to have access to it, the sides and back *must* be covered or protected in some way, for the safety of all concerned.

For the back, a piece of thin ply-wood is sufficient, and I have found it very handy to fit the lift-off hinges which allow the whole back covering to be locked and/or lifted off and away from the job when so desired. The idea is clearly shown in Fig. 2. If a one-piece front panel is used, it is best to fit it before fastening the cross members, the length of which must be adjusted accordingly. Similarly, the perforated zinc is also fitted into the vertical angle-pieces before the cross members are bolted down.

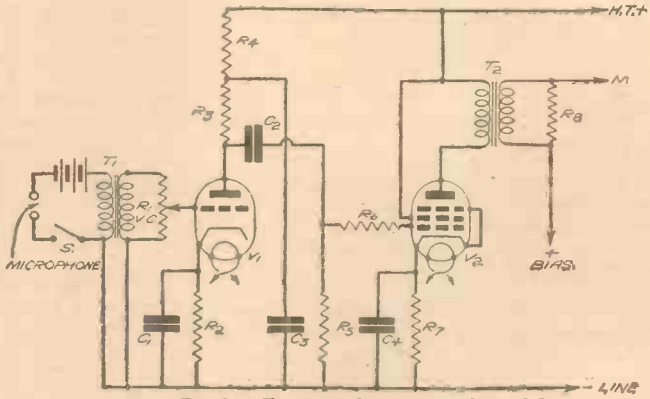


Fig. 3.—The microphone or speech amplifier circuit.

Constructional Details

The procedure is very similar to that of the 2½-watt outfit, but I would suggest that angle iron and not aluminium is used, as greater rigidity is obtained, and the cost is slightly less. The main dimensions of a suitable assembly are shown in Fig. 1, where it will be seen that three floors are provided, the idea being to house the

The Speech or Microphone Amplifier

Fig. 3 shows the theoretical circuit. It is quite straightforward and follows normal L.F. amplifier design.

(Continued overleaf)

AMATEUR TRANSMITTING.

(*Continued from previous page*)

Two transformers are necessary, one (T.1) for the microphone input, the ratio of which depends on the microphone requirements, and T.2, a good make of output transformer having a ratio of, say, 1 : 1, which is connected in the anode circuit of the valve V.1.

The volume control V.C. is essential, and it is best inserted early on in the circuit, as a more satisfactory control can be maintained. A simple switch is connected in series with the primary of T.1, and the energising battery E.B., and in view of the fact that such batteries are often left switched on, it is advisable to provide some form of signal light, which can be operated off the same battery or off the heater circuit. A word of warning about the latter. See that you keep all A.C. leads away from microphone leads and T.1, otherwise bad hum might be introduced.

Mention of hum brings in another very important item, namely, the screening of the amplifier against mains interference and H.F. from the transmitting section.

It is not a difficult matter to make a screening box to suit the layout of the components or, better still, well-made metal boxes can be purchased for a few shillings.

It may be that a constructor already has a good one-, two- or three-valve A.C. operated amplifier, complete with its own mains equipment. In such a case, there is no reason why it should not be used, providing, of course, that it is capable of giving distortionless amplification.

The Transmitter

As previously decided, two valves are used in this section, and their circuits are shown in Fig. 3, V.1 being a Tungsram APP4C, and V.2 an APP4G, both being in the triple-grid output valve class; in fact, their characteristics are very similar, but the APP4G. has its control or No. 1 grid brought out to a top cap connection, thus reducing grid to anode and grid to other electrodes capacities.

It will be noticed that "suppressor-grid" modulation is employed, for the reasons given in the last article, but, if so desired, other methods can, of course, be tried, though the beginner is well advised to stick to the above, as highly satisfactory results can be obtained with the minimum of trouble.

To avoid the use of several meters, jacks are fitted in the essential leads, thus allowing one meter to serve all circuits. The meter being mounted in a convenient central position on the front panel, while the jacks should be so placed that their connecting leads are kept as short as possible.

It is advisable to note at this point, although the matter will be dealt with in detail later, that it is very important for the crystal oscillator to be thoroughly screened from the P.A.; in fact, the crystal oscillator should be assembled in one of the screening boxes previously mentioned, or adequate screening built round the whole section.

For the biasing of the P.A., batteries are used, suitable H.F. chokes being included in the leadsin the same manner as inthesupplies to the screens, to prevent any trace of H.F. getting into the respective circuits.

Next week details will be given of the mains unit, component values, and makes.

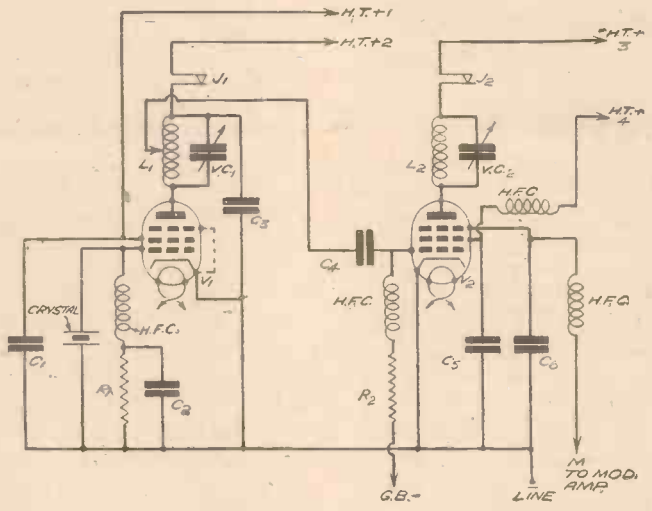


Fig. 4.—The oscillator and power amplifier circuit.

The "Zepp" Aerial

THIS is a very popular type of aerial which comes within the Hertz group. It obtained its name by the fact that it was widely used, in the early days, with the transmitting installations fitted to the Zeppelin airships.

The general arrangement is shown in Fig. 1, where it will be seen that twin feeders are used, only one of which is connected to the aerial wire, the other terminating at the insulator and left, so to speak, "floating."

The lines or wires, *d* and *e*, are known as "feeders," their circuit including the coupling coil, which is inductively coupled to the transmitter. The arrangement is tuned, as shown in Fig. 2, series tuning being usual if the "feeders" are a quarter-wavelength long, and parallel tuning if they are less than a quarter or between three-eighths and half-wavelength in length.

The feeders are spaced by means of rods of insulating material, the wires being kept 6in. apart and parallel to each other. It is important to see that *d* and *e* are the same length, and that they are not an even number of half-wave long. It is better to make them an odd multiple of a quarter-wave, according to the frequency of the transmitter.

When considering aerial length, the same formula as that given for the "end-on" Hertz aerial can be applied but it should be noted that the length is now only the distance between the extreme ends of the *horizontal* portion, as the feeders, if correctly designed, will not form part of the radiating system.

For 7 mc/s and 14 mc/s transmissions, a horizontal length of 66ft., with 33ft. feeders, will be found quite satisfactory.

It is not proposed to discuss here the many other types of aerial systems which are used by amateur transmitters, as the beginner is likely to be more confused than assisted, and, as previously mentioned, one cannot do better than commence operations, that is, if a Full Licence is owned, by employing one of the types mentioned in a previous article on the subject.

Whichever system is used, it is necessary to carry out tests over a reasonable period before condemning or praising the arrangement, as it is not possible to obtain an accurate idea of its performance immediately. If space permits the testing of aerials in various directions, the trouble is well worth taking, as one site will be found which will give better all-round results, although it must be expected that radiations will be weaker in certain directions, due to aerial characteristics and local conditions. A north and south arrangement is usually quite good, providing the feed-end is at the southern point.

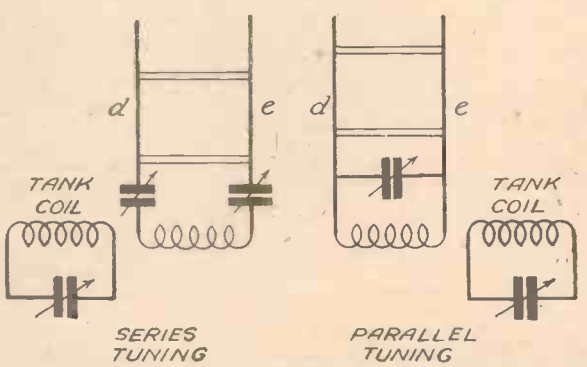


Fig. 2.—Two methods of coupling parallel feeders to the transmitter.

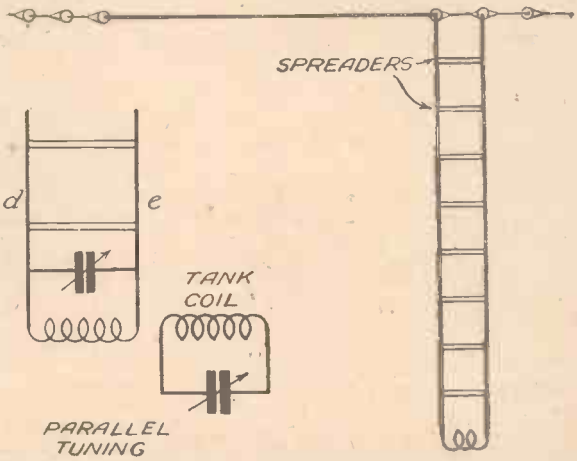


Fig. 1.—The method of connecting the feeders.

A PAGE OF PRACTICAL HINTS

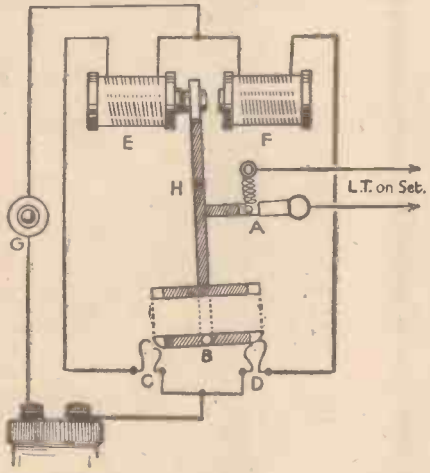
SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

A Single-push Remote Control

THE parts required to make this single-push control are two electromagnets—such as are used on electric bells—and



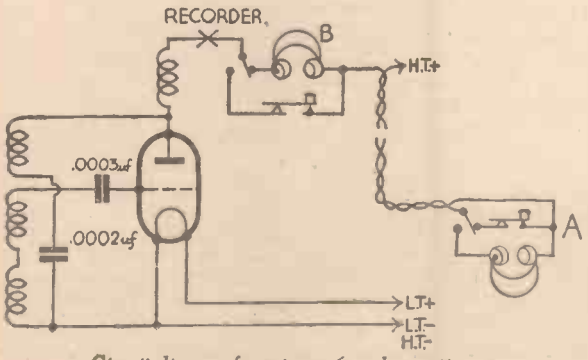
General arrangement and connections for a single-push remote control.

a T-shaped piece of wood, pivoted in the centre, to act as an armature. Strips of copper form the contacts at A, and at C and D. A nut and bolt was fastened through the end of armature so as to operate between the coils.

The operation of the relay is as follows: When at rest, contacts at A are open or closed (as in the sketch). The contacts at D are also closed. When push G is depressed current flows through coil F, thus attracting armature H, opening contacts A and closing contacts C. When the button is pressed again, current flows through coil E, thus closing contacts A which are connected to L.T. on set.—E. READ (Altrincham).

A Two-way Code Practice Set

WISHING to learn the morse code and desiring to transmit and receive signals with only one length of twin flex connecting the "stations," I designed the circuit shown in the sketch. A simple oscillating valve is used with a standard broadcast coil. When the switches are in



Circuit diagram for a two-way code practice set.

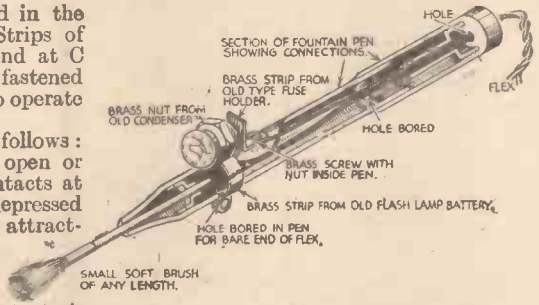
THAT DODGE OF YOURS!

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 positions shown, communication is from A to B. At the end of the message the switches are switched over and communication is reversed. A recorder inserted at the point marked x will record both communications and thus save arguments. The layout can be arranged to suit the constructor, so long as A is on one baseboard and B and the oscillator on another.—R. J. STEPHENSON (Lincoln).

A Handy Dusting Tool

THE accompanying sketch shows a handy device I use for dusting



Sectional view of a handy dusting tool.

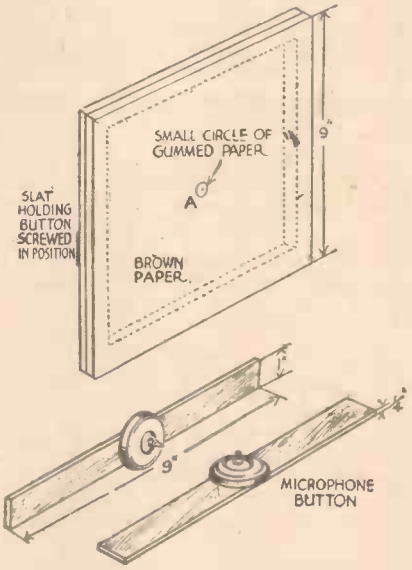
chokes and awkward corners in my receiver and other apparatus. For its construction I obtained the following parts: An old fountain pen holder, a locking nut from an old condenser, a long brass strip from an old flashlamp battery, a contact piece from an old fuseholder, two small screws with nuts, a flashlamp bulb, and two lengths of flex.

One wire is fastened to the screw as shown, and the other wire is pushed through a hole bored in the pen and right through holder, as shown. The long brass strip is formed in the shape of a clip. The end of the wire is bared and wound halfway round the outside of holder, the clip being fastened over the wire with a small screw which makes a contact.

The brushes, which I bought for a few pence, are of the round quill type.—A. DYKE (Biston).

A Sensitive Microphone

THIS simple microphone consists of a light frame-work of 1in. by ½in. wood, made to the size given in the sketch. A



A view of the finished microphone, and details of construction.

sheet of brown paper is wetted and gummed to the frame. When the paper drys, it becomes tight, like a drum skin, and by fixing a microphone button in the centre, so that there is a slight tension on the paper, it will be found on trial to be a super-sensitive microphone. The small disc of gummed paper at A, is optional.—F. DAVIDSON (Wick, Caithness-shire).

AMPLIFYING THE 193

Building a Simple Low-frequ to the Crystal Receiv

By W. J. L

A LARGE number of readers have found that the neat little crystal set described last month provides them with two alternative programmes at good headphone strength, and in certain other cases the local station is so far away that signals are very weak, even with a good aerial system. In the former case, a small loudspeaker may provide quite good volume if a suitable low-frequency amplifying stage is added, whilst in the second case, the addition of such a stage will give the user comfortable signals in the headphones. It is, of course, not a very difficult matter to convert the crystal receiver into a one-valve set, but then the crystal detector has to be dispensed with, and if you are a beginner, and wish to go through all the stages of set construction, it is better to leave this stage until a later period. The second stage in developing this receiver is, therefore, to add a simple L.F. (or low-frequency) amplifier. It is presumed that you have already read the various theoretical articles which have appeared in these pages, and understand that after detection (or more correctly rectification) the signals are of the type known as low-frequency. The theoretical circuit above shows the arrangement of our low-frequency stage, and the list of parts gives you all the necessary extras which you will have to buy.

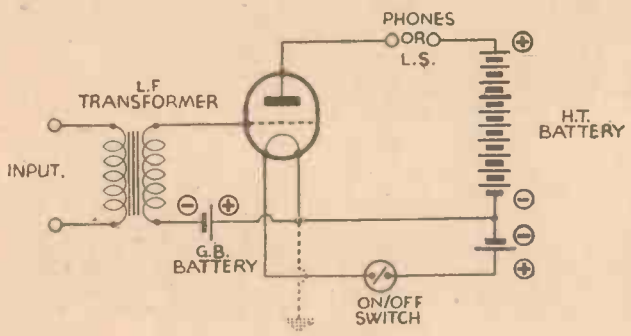


Fig. 1.—Theoretical circuit of the amplifier, with the various components clearly identified.

The Circuit

An L.F. transformer is now used to feed the signals to a valve instead of taking them to the headphones, and the valve has to be supplied with L.T., H.T., and G.B. These terms, of course, stand for low-tension, high-tension and grid bias. The transformer may be of any make, and will cost anything from 4s. 6d. up to a pound or more. Obviously, with a simple receiver the quality is not of prime importance and quite a low-priced transformer can be used. The ratio should be as high as possible, say 5 to 1. The low-tension supply will be obtained from an accumulator and a 2-volt type should be obtained, with a capacity according to your facilities for getting it re-charged, and the initial expense to which you are prepared to go. The H.T. may be of the 99-volt type, or if you wish to operate a loudspeaker at comfortable volume (and provided that the signals from the crystal are already fairly strong) a 120-volt battery may be used. A 9-volt G.B. battery will be suitable, but the negative plug will have to be inserted into the tapping which suits the valve you buy, and this point will be dealt with later. To cut off the L.T. supply when the receiver is not in use (or when headphones are being used with the crystal section) an ordinary on/off switch must be used, and if you are going to make up this receiver in the form of units, you will need a small baseboard, panel, and two more socket strips similar to those used on the crystal set.

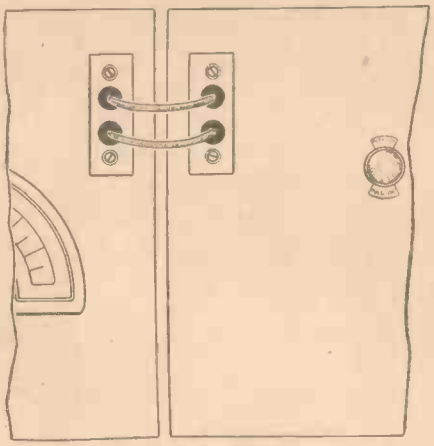


Fig. 4.—How the crystal set and the amplifier are connected together.

Construction

The baseboard and panel may be of the same size as were used in the crystal set, and the two additional socket strips will be mounted on the panel in the same positions as given in the crystal set, whilst the switch may be placed in the centre of the panel. The wiring diagram is drawn to scale and will help you to do this. A wiring diagram is also given showing the connections to the various parts, and it will be noted that the grid bias battery is left inside the unit, whilst the accumulator and H.T. battery will have to be kept outside. Ordinary flexible wire is used for the battery leads, and the type known as 5-amp. flex should be used—not the cheap thin flex which may sometimes be obtained from the popular stores. Two spade terminals should be fitted to the end of two of these leads, and these terminals should be of the type with red and black insulating sleeves, the black being the negative (—) lead and the red the positive (+) lead. Most modern accumulators are fitted with corresponding black and red terminals, or the terminals are marked — and +. The two high-tension leads should be fitted at the end with plugs, again using a red (positive) and black (negative). As an alternative to buying the separate flex and plugs you can obtain a 4-way battery cord from your local dealer. These are manufactured by Messrs. Belling and Lee, Bulgin, and other firms. For the G.B. leads two short lengths of flex are used with red and black wander plugs, as in the case of the H.T. leads, or alternatively the plugs which are engraved G.B. — and G.B. + may be fitted.

Screw the transformer and valveholder down in the positions approximately shown in the wiring diagram and wire up with ordinary tinned copper wire, or the special connecting wire sold in coils. In this case,

the coloured insulating covering must be scraped away with a penknife or similar instrument where it is twisted beneath the terminals.

Using the Amplifier

When the wiring is completed the unit should be placed alongside the crystal set and the two 'phone sockets on this should be connected across to the two input sockets on the amplifier, whilst the 'phones (or loudspeaker) should be plugged into the other socket strip on the amplifier panel.

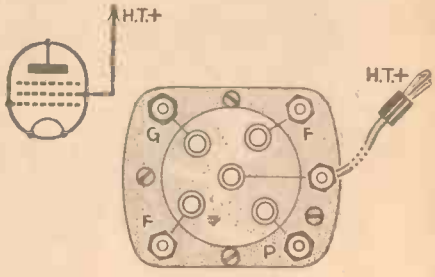


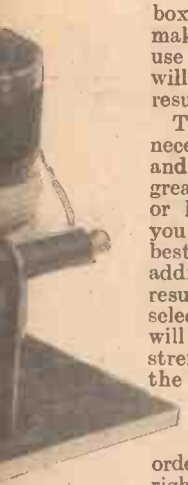
Fig. 3.—This illustration shows the theoretical representation of a pentode valve and how the additional connection is made to the 5-pin valveholder.

7 CRYSTAL RECEIVER

ency Amplifier for Addition Described Last Month

DELANEY

A valve of the L.F. type should be inserted into the holder, the L.T. leads should be fitted to the accumulator and the H.T. plugs inserted into the H.T. battery. Make certain that you get the positive sockets into the positive end of the battery and the negative socket into the negative end. Plug the positive G.B. plug into the socket on the G.B. battery marked with the plus sign, and insert the other plug into the appropriate voltage, as given either on the box containing the valve or on the leaflet inside the box. Make sure you get a good make of valve—don't try to use a cheap foreign one as you will only get disappointing results.



THE 1937 RECEIVER

To use the amplifier, all that is necessary is to pull out the switch and the signals will then be heard greatly amplified in the 'phones or loudspeaker, but, of course, you will still have to find the best spot on the crystal. The additional amplification may result in an apparent loss of selectivity, as the weak signals will be greatly increased in strength, and if you did not fit the pre-set condenser or anti-breakthrough choke, you may now find that one or both of these are desirable in order to keep the stations in their right place.

Using a Pentode

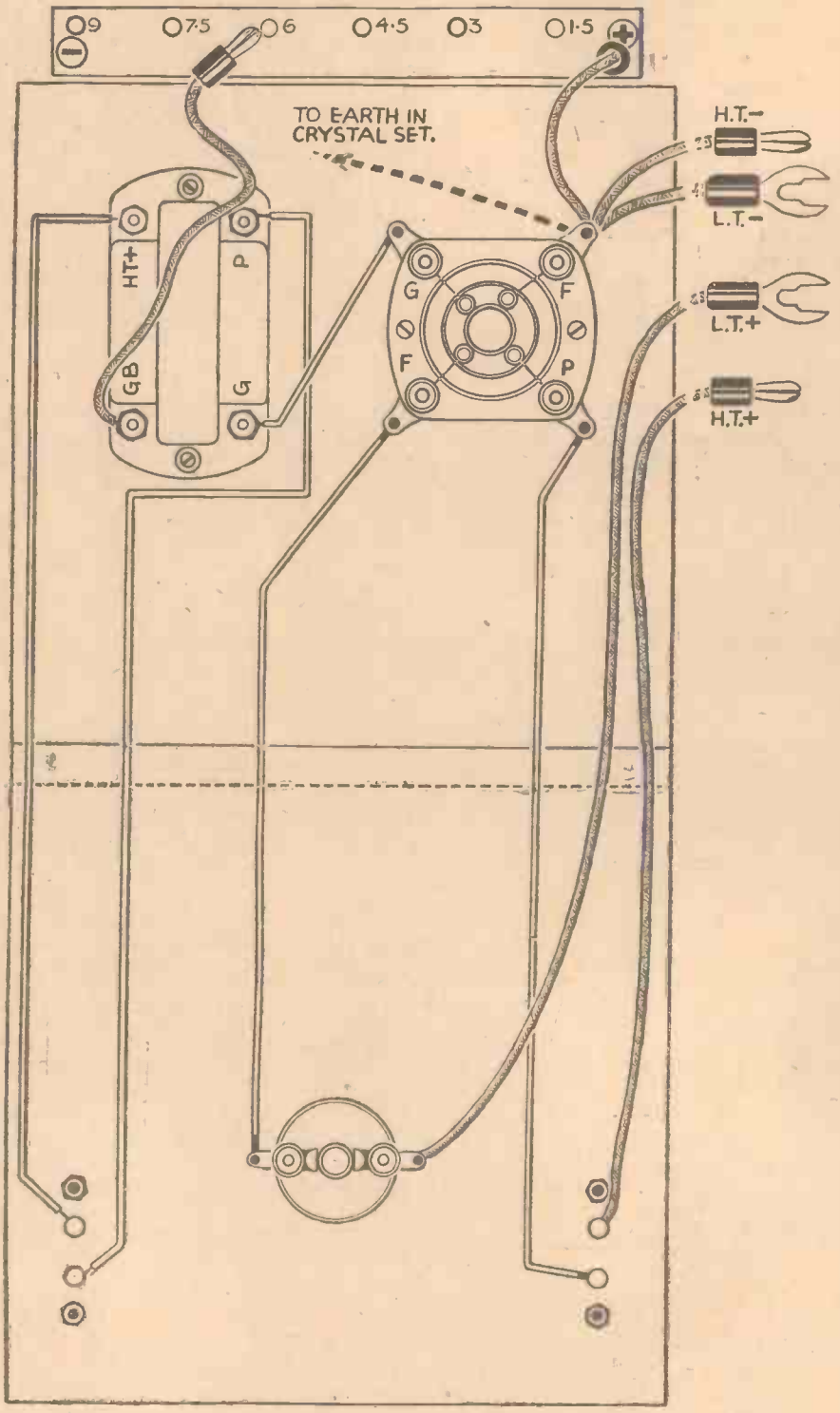
In some cases even greater amplification may be desirable, and in that case you can use a pentode valve instead of the L.F. type just mentioned. In this case, you will use a 5-pin valveholder instead of a 4-pin one, and the extra point will be fitted with another battery lead. To the end of this a red plug marked H.T.1 should preferably be fitted, or alternatively a lead of a totally different colour may be used (this will be the case if a 5-way battery cord is purchased). This lead should be inserted into a socket just below the maximum used for the other positive lead, but later it may be joined direct to the maximum lead with a decoupling scheme. However, this will be dealt with in its place. Again, the G.B. will have to be adjusted according to the makers' instructions for the particular valve in use. It will be noted that a dotted connection is shown in the theoretical diagram from the combined L.T. and H.T. negative line to earth, and in the wiring diagram the same connection is shown in dotted lines also. This may not be necessary, although sometimes it will be found that the set will give distortion or be unstable unless this connection is made. The lead may be joined to any part of the crystal set which is joined to earth.

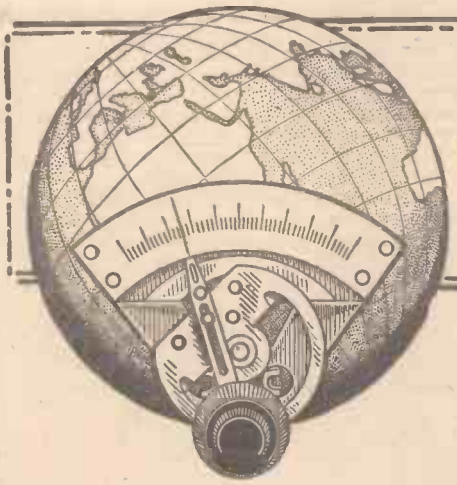
Next month we will see how to replace the crystal with a valve detector and thus change the receiver into a two-valver.

LIST OF COMPONENTS.

One wooden baseboard 6in. by 6in. (Peto-Scott).
One paxolin panel 6in. by 6in. (Peto-Scott).
One L.F. transformer (ratio 5 to 1).
One valveholder (4-pin or 5-pin according to valve used—see text) (Benjamin).
One multiple battery cord, or supply of flex and plugs.
One push-pull on-off switch (Bulgin).
Two terminal socket strips (Belling-Lee).
One coil of connecting wire (Peto-Scott).
One 2-volt L.T. accumulator (Exide).
One H.T. battery (see text) (Drydex).
One 9-volt G.B. battery (Drydex).

WIRING DIAGRAM OF THE AMPLIFIER





SHORT WAVE SECTION

Practical Pointers for Experimenters

Panel Layouts, Controls, Power Packs, and Battery *versus* Mains Operation are Dealt with in this Article

By A. W. MANN

SHORT-WAVE experimenters as a rule are more or less satisfied if on test a new receiver proves to be reasonably sensitive and selective. Whilst success depends largely upon these qualities, ease of operation is another and most desirable feature, and one which should not be overlooked.

Ease of operation is not simply a matter of ganging tuned circuits or reducing the number of tuning controls to the minimum.

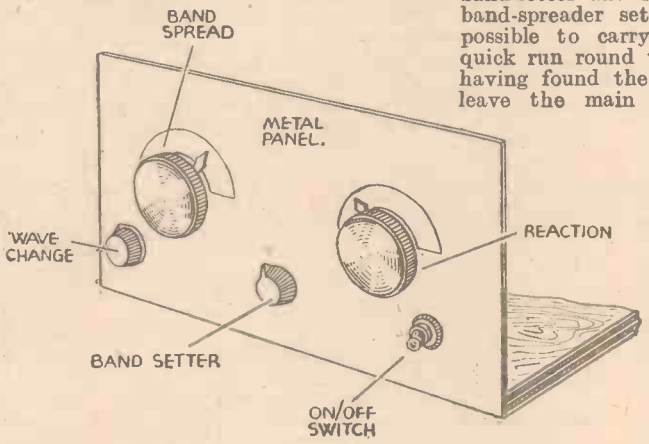


Fig. 1.—A suggested panel and baseboard scheme of construction showing an effective panel layout of controls.

For example, a simple two-valve receiver may be easy or difficult to operate. It may be a station getter, yet its tuning may be more of a task than a pleasure.

Such a state of affairs can, and should be, avoided, and a little careful study given to the arrangement of panel mounted components will prove in the long run to be worth while.

A Suitable Panel Layout

In Fig. 1, is shown a panel and chassis arrangement suitable for the construction of a two-valve receiver. On the panel are three tuning controls and two switches. It should be noted that all are mounted above the chassis, although there is nothing against arranging the switches underneath the chassis or base.

This arrangement of controls is a good one, because the operator has not to adopt a cramped position when tuning.

Even in such a simple receiver as a straight two, it is advisable to fit well made slow-motion dials to all tuning condensers. Tuning will then be comparatively easy and calibration with reasonable accuracy is made possible.

Fig. 2 shows a somewhat different arrangement, and one which is most satisfactory from the ease of tuning point of view when 'phone reception, and occasional loudspeaker reception, is desired.

It will be noted that the band-spreading and reaction condensers, respectively, together with two-valve headphone output sockets and the on-off switch, are mounted on the front panel, whilst the band-setting or tank condenser is mounted on the end of the metal box or cabinet. The writer favours this arrangement, especially in straight three-valver construction, because it provides a most comfortable operating position.

Tuning may be carried out using the band-setter and reaction only, with the band-spreader set at zero. Thus it is possible to carry out a comparatively quick run round the various bands, and having found the most promising band, leave the main condenser, i.e., band-setter, set and tune around with the band-spreader.

With reference to the two-valve output sockets, as shown mounted on the front panel, such an arrangement is very handy when searching for DX signals. An improvement would be to use a standard type jack, which would thus enable quick changes from headphone to loudspeaker to be carried out.

As in the case of Fig. 1, the connecting leads between the tank condenser and band-spreading condenser should be kept as short as possible. Care should, however, be exercised in order to avoid mounting the band-setter on the end of the cabinet in a position which will make tuning difficult, due to the fact that the operator must adopt a cramped position. Where it is possible to set the receiver well away from the front of the table, this arrangement will prove to be ideal, especially when long sessions of tuning is the usual procedure.

Multi-stage Receiver Controls

In Fig. 3 is shown a panel layout, suitable to multi-stage T.R.F. requirements, in which gang controlled tuning, reaction, and pre-detector volume control are used, respectively. This arrangement will be found to be highly satisfactory, especially where a heavy gauge metal chassis is used together with a metal panel. A well made mechanically sound slow-motion dial should be used in conjunction with the ganged tuning condenser, and, if possible, the reaction condenser should be fitted with a slow-motion head of the Bulgin or Eddystone type.

The experimenter sometimes wishes to control the aerial series capacity condenser when one is used, from the front panel. To mount this condenser directly on the panel is bad practice and will introduce body capacity effects. It is, therefore, advisable to use an extension rod and bracket arrangement, and thus avoid instability due to body capacity.

Battery *versus* Mains Operation

When battery and mains-operated short-wave receivers are being discussed, opinions are divided. The battery-operated receiver is favoured, and rightly in many instances, because of the low ratio of background noise accompanying signals. It does not follow, and neither should it be taken for granted, that irrespective as to type a mains-operated receiver cannot be otherwise than noisy.

(*Continued on opposite page*)

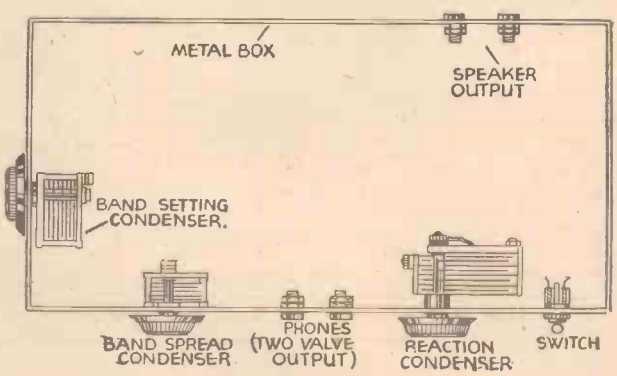


Fig. 2.—A different scheme in which 'phone connections may be easily made, and the tuning circuit is more efficiently wired.

Taking the broad view, a short-wave receiver, either mains or battery operated, is as good or bad as you make it. In order to obtain the utmost satisfaction, good material in the way of component parts, and sound workmanship must be put into it, otherwise the end will not justify the means. For example, experimenters sometimes build a battery-operated receiver, use it for some considerable time, and finally decide to use an H.T. eliminator in conjunction with it, in order to reduce running costs.

There is nothing against the idea in itself. The trouble is that sufficient consideration is not given to the matter and the special purpose for which it is intended. The deciding factor usually is, that a good make of eliminator is available at an attractive price; in other words, cheap, and herein lies the danger. The most expensive piece of radio apparatus as a gift, will prove disappointing if on test it will not meet the demands made upon it.

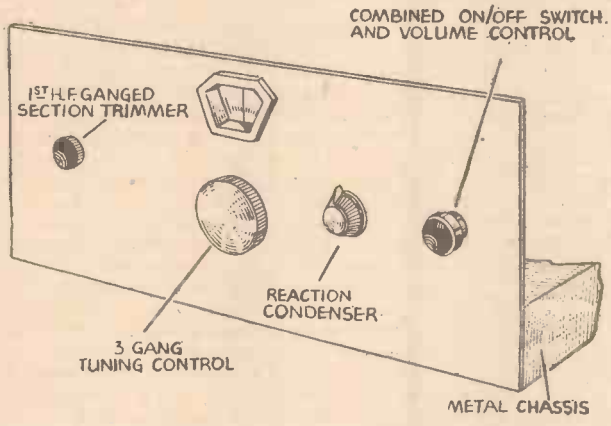


Fig. 3.—When ganged tuning is employed a panel layout on the above lines is recommended.

Eliminator Pointers

The usual trouble experienced when standard model eliminators designed for use in conjunction with broadcast receivers are used with short-wave receiving apparatus, is A.C. mains hum.

It is possible to go to considerable expense, incorporate elaborate decoupling arrangements in a receiver, and yet derive no benefit so far as hum elimination is concerned. The correct procedure is to confine one's attention to the eliminator and build up a suitable smoothing unit for use in conjunction with it. In this way ripple and hum troubles can be overcome.

Whilst dealing with the subject of power supply, we must not overlook the fact that in some instances experimenters may wish to go in for all A.C. operation, using indirectly-heated A.C. mains valves.

Just a word of warning. A mains-operated receiver requires comparatively high voltages in order to function in a satisfactory manner, and no matter how experienced one may be, care should be exercised. I mention these facts because, so far as the beginner is concerned, experiments with A.C. operated short-wave or broadcast receivers are inadvisable. When the fundamental principles, trouble-tracking procedure, the use of test equipment, and the most suitable equipment to use are thoroughly understood, is the time to undertake experimental work of the aforementioned nature, and not before.

The above remarks apply to A.C. mains-operated experimental apparatus. On the other hand, however, there is nothing to prevent anyone constructing an A.C. mains-operated short-wave or all-wave receiver of sponsored design with safety, because such a receiver is designed as a complete unit which will function satisfactorily if the specified components are used and the designer's instructions adhered to.

Power Packs

Reverting to experimental A.C. mains short-wave receivers, the problem of power packs or units arises. Should the power supply be built-in or constructed as a separate unit?

The majority of experimenters, it may be taken for granted, work from blueprints and theoretical diagrams, and a great deal depends upon the particular type of receiver it is desired to build in experimental form. The built-in power supply type of set is compact, but taking into account the fact that the components to be used for experimental purposes are individual units which may or may not function efficiently as a whole, and in any case do not conform to any particular specification, troubles may be expected. By successfully overcoming them, the experimenter will improve his knowledge, and gain additional practical experience, and on this account it is worth while experimenting with the built-in power pack type of receiver.

Experimental Receivers

There is, however, another side to the question. The experimenter may wish to build various types of A.C. operated receivers. The essential thing so far as he is concerned is that the receivers should function from the start, and whilst it is appreciated that minor alterations and adjustments might be necessary, comparative trouble-free running is desired.

The purpose of the experiments may be to find out by practical tests which is the most suitable type of receiver to use under a given set of circumstances, and to meet individual requirements. Undoubtedly, a problem of many experienced experimenters with lots of equipment, and A.C. mains to hand.

In such instances, the claims of the separate power pack are worthy of consideration. It can be made adaptable, compact, silent working and trouble free, and reliable and safe in operation.

It is, however, essential under these circumstances to formulate one's constructional plans ahead, relative to types of receivers, valves, and design, and then build a power pack which will meet all requirements, and one in which provision is made for H.T. output voltage variations. A careful study of power-pack designs, circuits, and requirements is advised.

One point well worth remembering is that for short-wave use additional smoothing is necessary. Skimping in this respect will not pay, and it is therefore advisable to build a power pack for use in conjunction with short-wave equipment from a published design, and exactly to specification.

The "Experimenters" on Volume and Purity

This Week Our Irrepressible Contributors Tell You All About a Very Interesting Quality Circuit for Battery Operation

by The Experimenters

THE experiments we are going to describe were carried out as the result of a chance remark by one of the younger members of our party that he was building a 10-watt amplifier. The reason, he alleged, was that he "liked plenty of volume, and was keen on obtaining perfect reproduction." Another of our number pooh-poohed the idea of using anything like 10 watts in the home. But this did not deter our youthful friend, who had obviously been reading several text books on the subject of quality amplification. He pointed out that, theoretically at least, perfect reproduction could not be hoped for unless the input to the loud-speaker was something rather more than 6 watts maximum. Following up his theorising, he explained that although the output stage might provide a maximum undistorted output of, say, 10 watts, this did not mean that the speaker constantly received an input such as this. In fact, he explained, the average volume level was probably considerably less than one-half of the possible maximum. Furthermore, he pointed out that if a full range of volume from *forte* to *pianissimo* (at least we think that those were the expressions he used) were to be obtained in the same proportions as in the original music the softest passages would be no more than just comfortably audible when the amplifier gave a maximum undistorted output of 5 watts.

Volume Range

None of us was prepared to disagree more than feebly, because it was evident that there was a good deal of wisdom in this. You have only to think of—or better still, listen to—a full symphony orchestra to appreciate the vast difference in sound level between the loudest and softest passages. And yet, one of our more practical members pointed out, even the best of amplifiers does not do justice to such a wide range of volume variation, although certain forms of volume-expansion circuits do help in this direction.

And then it transpired that our youthful friend who was building the amplifier had overlooked this important consideration. The circuit which he was employing was a fairly straightforward paraphase arrangement, similar to a circuit which has been given in PRACTICAL AND AMATEUR WIRELESS. He did not propose to add any complicated system of volume-expansion, since he had heard the results of the paraphase circuit in the technical laboratories, and was perfectly satisfied that this could not be improved on to any appreciable extent.

Interesting Comparisons

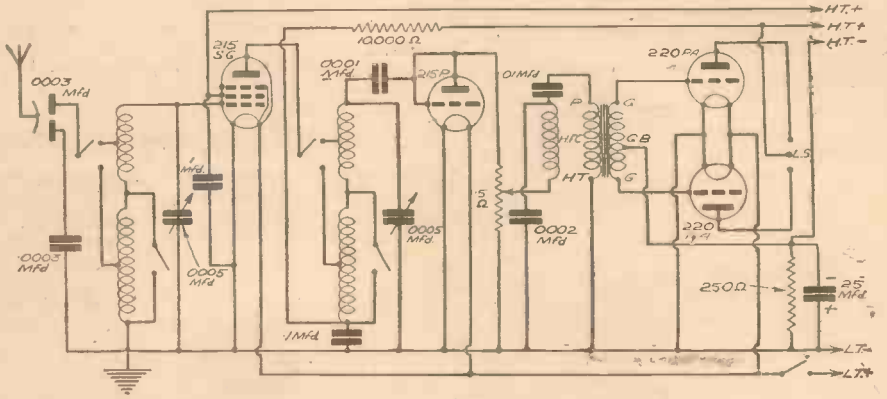
The "old man" among us explained that he did not like a lot of volume, although he did like to ensure good reproduction. This started the argument all over again: can you have quality without volume? It was decided that we should visit each other's homes in turn and compare the results of the various receivers which were in regular use. We waited until the "10-watter" was finished, though. Results were illuminating. It was found that none of us could really tell the difference between 3 and 5 watts, whilst it was extremely hard to distinguish between the volume levels of a battery set with an undistorted output of slightly less than one-half watt and of a mains receiver with an output stage which provides a maximum of 2½ watts undistorted! This was an eye-opener, especially since it was agreed that the reproduction provided by every one of the sets was well above the average; we knew, of course, that reproduction always sounds louder when there is a trace of distortion (argument as to whether or not distorted speech and music can be referred to as "reproduction").

When we listened to the various receivers only the owner knew the exact circuit around which the set was built, but when it was discovered that that used by the eldest member of our group was a battery set with an output stage capable of giving only 450 milliwatts undistorted output, interest grew, because the reception seemed to be as good and almost as loud as that provided by some of the others. There were clamourings for the circuit, and expressions of surprise when its simple nature was discovered. It is reproduced on this page for the benefit of our readers. Let the "old man," who had evolved it tell you about it.

The Circuit Requirements

The object in mind when the circuit was first prepared was to make a simple battery set which would give really good reception of the local stations, although being sufficiently selective to separate them from each other, and from powerful foreigners on nearby wavelengths. Additionally, the set must be made mainly from parts which were available from sets already in operation, and which were to be dismantled. There must be no "frills," because simplicity nearly always pays when good reproduction is the first requirement. It was decided that an H.F. stage would be necessary to ensure sufficient selectivity if reaction were not to be used. Also, it was considered that diode rectification would be better in order to handle the output from the H.F. stage on local stations, particularly since a good outdoor aerial was available.

A diode valve did not happen to be on hand, and so a small-power triode was used, the grid and anode being strapped together to act as the diode anode. As a



This is the theoretical circuit diagram of the simple quality set described by the Experimenters.

gang condenser was to be preferred, because the set was for general "domestic" use, the diode had to be connected in a manner rather different from the usual one—which is used after an intermediate-frequency transformer. A fair amount of low-frequency amplification would be necessary to give a reasonably high volume level, and yet it was not thought wise to use a pentode valve. It was also thought that there would be more possibility of distortion if two L.F. stages were employed. Eventually, and after a few experiments with alternative arrangements, the push-pull system was adopted, using a couple of

high-amplification triodes. A difficulty arose concerning the best method of feeding push-pull valves from a diode, but this was overcome by using a resistance-fed L.F. transformer, the primary being fed from a volume control which also acted as load resistance for the diode.

As H.T. batteries would have to be employed—since there were no mains to operate an eliminator—it was decided to use automatic grid-bias. The reason for this is that, for quality, the G.B. voltage must be finely graded as the battery begins to run down. Incidentally, it was obvious that it would be necessary to use a really good super-capacity battery or else H.T. accumulators, because the H.T. load would amount to something like 20 mA.

Further Details

Those were the requirements. What about the practical details? Two standard coils would be suitable, and these should preferably be of the type having transfer tappings, although this should not be essential. It would be better to do without variable-mu control, and to vary the input to the first valve by means of a differential condenser, with a fixed condenser between one set of fixed vanes and earth to compensate for the change in effective-aerial capacity as the input was varied. A Cossor 215 S.G. was chosen for the input stage, and a separate H.T.+ lead was used for the screening grid, for simplicity. Tuned-anode coupling was used between the H.F. valve and the diode, and a 10,000-ohm decoupling resistance was inserted in the H.T. lead. The "diode" was a Cossor 215 P., and the output from this was developed across a .5-megohm potentiometer of the composition type. The slider of the potentiometer was connected to one end of the primary of the 1 : 5 push-pull transformer through an H.F. choke. A choke was desirable, although not essential here, to prevent the passage of any H.F. into the low-frequency circuit. Also to assist in this direction, a .0002-mfd. fixed condenser was connected from the "L.F." end of this to earth.

The Push-pull Stage

A pair of Cossor 220 P.A. valves served for push-pull, and these fed into a standard type of permanent-magnet moving-coil speaker, the transformer of which had a centre tapping. As to the automatic G.B. arrangement, it was found from the makers' lists that, at the maximum anode voltage of 150, the anode and screen of the first valve together passed about 1 mA; the diode did not require any anode current, of course; and the two output valves required 20 mA between them. Thus, the total anode current worked out at about 21 mA. The G.B. voltage required for the 220 P.A. valves proved to be 4.5, and so the correct bias resistance would be 4.5 times 1,000 divided by 21, or 4,500/21. This works out at about 215 ohms, and so a 500-ohm variable resistance was first tried, and adjusted to its best position. It was afterwards found that a fixed 150-ohm resistance gave equally good results, although the output valves were slightly over-biased. That being a standard resistance value, it was used.

We have all tried this circuit arrangement now, and we are convinced that it is extremely good, despite its simplicity. Generally speaking, the components do not appear to be critical, and so we can recommend the circuit to our readers who are inclined to experiment. It is not proposed to publish a complete constructional article, and, therefore, pictorial wiring plans will not be available. Try out this circuit, and let us know how you like it—we know that you will like it!

Cheerio.

Practical Television

February 6th, 1937. Vol. 3. No. 36.

Television and Invention

THE total number of patents applied for during the past year is only a few hundred less than 1935. There was a marked increase in the technical applications of modern discoveries in physics, while television itself was responsible for a very large increase in the patents. The bulk of these referred to receiving equipment, particularly with reference to cathode-ray tubes and their associated circuits, while on the subject of scanning, schemes were propounded for both sequential and interlaced methods for reducing flicker. With television on the threshold of commercial and industrial development it is only natural that considerable thought should be directed towards it, and many of the ideas are taking on a more practical nature as distinct from circuital theory.

The R.C.A. President

THE remarks of anyone closely associated with television always form the subject of articles in the lay press, and divorced from the context of the whole dissertation often give an entirely wrong impression of the speaker's true theme. This is the case of the president of the R.C.A. who has been conducting a European tour. He is stated to have said that general public television has reached a stage equivalent to viewing a boxing match from the top seat of the gallery. This, of course, is far from being a true fact, at least as far as this country is concerned, and the same applies to the phrase "obsolescence may become rapid and costly." It is, of course, well known that the American problems are of a big nature with the three million square miles of American continent on the one hand, and the limited ultra-short-wave range, coupled with a wide spread on the other. It is already being stated quite freely that the Empire State Building equipment installed about the middle of last year at a cost of nearly a quarter of a million pounds may have to be scrapped, but this again is no doubt the result of a misunderstanding. It is certain, however, that one of the very big problems which the television engineer all over the world has to face is to devise ways and means to amplify light with the same degree of ease that we now amplify sound.

After Mature Reflection

A WELL-KNOWN film critic made some very illuminating remarks the other day. They were inspired by the public performances of Baird super-screen television at the Dominion Theatre. While fully appreciating that the whole art of television is as yet immature, and has in many cases glaring deficiencies, the critic inclined to the view that in the not too distant future people will find television entertainment particularly economical. While not as satisfying or as perfect as the real thing, or its celluloid counterpart, it may be capable of doing the same to the cinema as the growth of the cinema has done to provincial theatres. This does not necessarily mean unemployment, but rather a slow but complete readjustment to a new order of things.

Television's Loss

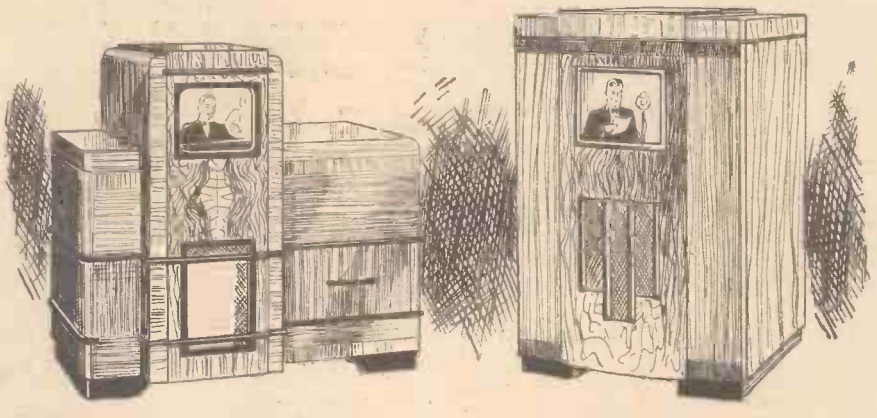
THE producer of the B.B.C. special programmes at Alexandra Palace, Mr. Cecil Lewis, very soon demonstrated his outstanding ability as far as television programmes were concerned. No doubt he saw in the early development of this new science an outlet for his pioneering instincts which were so apparent in the early days of the old B.B.C., but unfortunately Hollywood is now to gain what London will lose. His personality will not be seen on television screens for some time to come, now that he is to write the story and script for a great flying epic. His work will now be shared between Miss Mary Adams and Leslie Mitchell.

Foreign Visitors

FOREIGN visitors to these shores are always anxious to pay a visit to the home of B.B.C. television with the result that almost every week important parties are being conducted round the Alexandra Palace. For example, quite recently the Netherlands Television Commission made a very thorough investigation, special transmissions outside normal broadcast times being given by both television companies. Then, again, the deputy director of the German television service was agreeably surprised not only at the quality of the pictures radiated but at the nature of some of the special programmes. In Germany, which has had an experimental high-definition service for such a long period, they are still working on the propaganda idea of educating the mass of the people to what the service is capable of doing both now and in the future. Viewing-rooms are dotted all over Berlin, while there are two hours of programmes in the evening instead of the one in this country. Whereas in Germany a preference seems to be shown towards the film either similar to that shown in the cinema or derived from the intermediate-film apparatus, in England programmes of direct television seem to be more popular. There is no doubt that programme records are of great value and in this connection it was interesting to have a short review of the year on New Year's Eve as a result of selecting short items which had been televised by the Baird intermediate-film equipment since the commencement of the service. It was a peep into the past—shall we ever be able to gaze into the future? These were carefully edited and run through the scanning equipment so that a picture could be seen in the control room exactly as it would be received in the home. Instead of using the recorded sound on the film itself, however, a running commentary was substituted, the announcer who watched the control room picture being responsible for this effort through the medium of the ordinary microphone. This "rivalry" between direct and intermediate-film methods in Germany will be an interesting factor to watch, especially as in that country they have mobile van units with the two methods installed for any form of O.B. work.

A Pioneering Effort

NOW that high-definition television services are being talked about in many parts of the world, it is interesting to recall some of the pioneering stations who provided television signals several years ago. One of these is the Don Lee station at Los Angeles, which commenced activities in 1931, using a wavelength of 6.66 metres. The power employed is quite low and in consequence the range over which pictures can be received is never expected to exceed ten miles. Gravitating from the low-definition pictures the station now radiates a 300-line picture with a frame frequency of 24. Anyone within the service range can apply to the station for constructional drawings showing how to build a cathode-ray tube receiver, capable of giving a picture size of approximately 7in. by 6in., and costing about 175 dollars to build. Daily transmissions are now being scheduled, newsreels forming the bulk of the programme material.



The Pye television receiver on the left incorporates an automatic radiogram. The other Pye model receives the sound and vision programmes only.

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.

The Croydon Radio Society

THE non-appearance of a lecturer seemed a bad start for the Croydon Radio Society's second half of the session on Tuesday, January 5th, in St. Peter's Hut, Ledbury Road, South Croydon. Happily, no such disaster occurred, for members soon found problems to discuss, which entertained and even] instructed themselves to very good purpose. For instance, a new member, Mr. T. A. Bartlett sought a suitable scratch filter for his gramophone pick-up, after which the Chairman, Mr. W. J. Bird, described experiments he had made on how much frequency response was affected by alteration of volume control. Later on, too, a very interesting talk on car radio was given by Mr. Delves-Broughton, an ex-technical adviser of the Society. Particularly fascinating was his account of methods employed to overcome electrical interference from the engine, as well as what was the best position for the aerial. To conclude, Mr. L. F. Marshall described a system of switching off a heating supply in a district by means of wired wireless. On Tuesday, January 26th, A. F. Bulgin & Co., Ltd., lectured and demonstrated various components useful for the home constructor.

Hon. Publicity Secretary, E. L. Cumbers, Maycourt, Campden Road, South Croydon.

The Southall Radio Society

THE first meeting of the winter session of the above society was held on January 9th, when the speakers were Mr. Graham, Mr. Fox (Ve3DG), and Mr. Gordon Pipe (Ve3JX), who contrasted conditions in radio in Great Britain with those across the Atlantic. A large and appreciative attendance was presided over by Mr. C. Rapsey. Meetings are held each Tuesday at 8.15 p.m. at the society's headquarters, Southall Library, Osterley Park Road, Southall, which is near the G.W.R. station. Visitors are welcome, and those interested are invited to write to the Hon. Secretary, Mr. H. F. Reeve, 26, Green Drive, Southall, for details of the attractive programme which has been arranged.

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.

S. D. (Catcliffe, Yorks.). As the receivers are commercial models, the faults may be peculiar to them, owing to layout and other details. We regret, therefore, that we cannot treat these as general problems, and we are not familiar with the servicing difficulties of individual commercial receivers.

G. W. H. (Rotherham). The mike should be suitable, but we have not tried it and cannot, therefore, give you any definite opinion. For what purpose do you wish to fit a second meter?

D. R. H. (Gillingham). We cannot trace the valve in question and suggest you communicate direct with the makers. The mica diaphragm may be obtained from Electradix Radios.

A. H. (Beckenham). We will bear your request in mind. There are many reasons why a baseboard method of construction is not always possible, and you will notice that we now vary the construction according to the type of receiver.

J. C. (Wigan). Find out first whether your receiver is suitable for use with a converter. If so, P.W.48A will meet your requirements. This does not require a separate supply, but takes its H.T. and L.T. from the receiver with which it is employed.

G. A. R. (Bridgend.) We cannot give the constructional details in the form of a letter, but may give a constructional article in a future issue, dealing with this subject.

P. S.] (Fleet). Some fault may have developed in the receiver, and as this is a commercial model, with which we are not familiar, we suggest that you take it to a good local service man.

A. B. (Sandy, Beds.). A table of the type mentioned is given in our Encyclopædia and in "Everyman's Wireless Book." It will be repeated again in our pages in due course.

C. R. (Upton Park). You could certainly use the circuit to cover the entire wave-band mentioned by you, and coils are obtainable for the purpose. As only one valve is to be used, a good outdoor aerial is desirable, but quite good results will be obtained with an indoor aerial, and you may have to experiment to find the most satisfactory size and elevation for your individual situation.

W. G. (Magherafelt, N. Ireland). All of the parts mentioned in your letter could be used, but we remind you that we can never guarantee apparatus unless the parts used by us are also used by the constructor.

A. P. (Simla). We regret that we have no books which would be of use to you in the direction mentioned. You are, presumably, chiefly interested in receivers of American origin, and therefore should obtain the various service manuals issued in America.

E. W. K. (Shadwell). The trouble may arise in the detector stage, where a carrier causes the noise. A faulty transformer primary or anode-coupling resistance may be found. As, however, no trouble is experienced on medium waves, there may be some form of local interference which comes in on a carrier, and this may be of a type which is of a very low frequency (long wavelength). Some further tests would have to be made, preferably with a good meter connected in the anode circuits, to identify fluctuating currents caused by faulty components.

A. J. (Willesden Green). Although the filter shown in your letter may prove of use, it may be found necessary to include a special mains-type H.F. choke in the mains leads as well. If the light switches are faulty, they should be cleaned and the contacts adjusted so that they do not arc, but this must not be done until the power is switched off at the main fuse-box.

P. H. B. (Grange Park). The circuit would be unsatisfactory as a short-wave set and no H.F. transformer would be required. We suggest you make a simple short-wave one- or two-valver and use the present set for broadcast reception only.

K. G. (Hurst Green). The arrangement is quite in order and the ratio of the transformer is immaterial. If there is adequate amplification in the mains receiver, a 3 to 1 transformer should be used, but if only one stage of L.F. is fitted, use a 5 to 1. We regret that we have no complete details of the transmitters mentioned. Watch our Short-wave Log weekly, and no doubt details will appear as they become available.

G. H. T. (Ashford). The receiver does not appear to be one of our designs, and in any case the coils are no longer on the market. We regret, therefore, that we cannot supply a blueprint or other details to enable you to re-wire it.

H. J. M. (Cardiff). It is impossible to give you the capacity as this is not dependent entirely upon the number of plates. The area of overlap and the space separating them must be used in calculating the capacity. Perhaps a local radio dealer would be able to identify the make and give you the value.

K. P. (Stroud). Push-pull input transformers are generally of low ratio, either 2.5 or 3.5 to 1. There is no critical value for the circuit in question and you can obtain any make you desire. The output transformer must, of course, match the valves used to the speaker, and in most cases the transformer is fitted to the speaker, although shown in the circuit diagram as part of the circuit.

D. H. (Bracknell). The points marked M. B. are connections to the metallised chassis. Do not solder these, as you may burn the wood underneath and thereby fracture the surface, giving rise to a poor joint. Drill a hole and pass a bolt through, with a large washer above and below. A soldering tag may then be attached on either side for soldering purposes. It is desirable to connect together all bolts used in this way with a length of connecting wire.

Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

Bulgin Five-way Switches

THE complicated switching in modern receivers may be carried out in various ways. There are several types of switch available which may be ganged together, or a constructor may make his own arrangements for operating two or more switches with one control. The five-way switches supplied by Messrs. Bulgin possess several advantages over other schemes, not the least of which is that any number of these switches may be operated by one control, and thus the most comprehensive switching scheme may be carried out. The switches are made in the form of single units consisting of two fixed discs with a rotating central disc. Contacts are disposed round the edges of the two fixed discs and a wiper or contact arm is fitted to the central section. This carries a square drift, through which a square spindle may be passed and a special locator plate or unit is provided for panel mounting, or panel control. This has five definite positions and ensures that all of the switch units mounted on the shaft will be turned to a given position and the contact arm brought correctly to the appropriate contact point.

Three separate types of contact are provided, and these are shown in the accompanying illustrations. The first, type S.153, has only a single contact arm and this obviously opens the circuit when it leaves one contact, and before it comes into position on the next contact. This is necessary where a difference in potential exists between adjacent contact points. Where this trouble does not arise, and it is necessary not to have an open circuit (such as in a grid connection, or in other H.F. switching), the second type, No. S.158, would be used. This has a double contact arm, and thus before one arm leaves a contact, the other makes contact with the next point. The third type has an arcate feed to either pole, and is used when the circuit in which the switch unit is to be employed calls for the conventional double-pole five-way switching scheme. The contact points are provided with a barrier to prevent solder from running down on to the contact face and interfering with the smooth working, whilst the units may be obtained with additional spacing carried out by means of a separate bracket. The units are 2s. 3d. each, and the locator unit, with 6in. shaft, costs 2s. 9d. Additional lengths of shaft are available at slightly increased prices. The switch units, with mounting brackets, cost 2s. 6d. each.

New Siemens Batteries

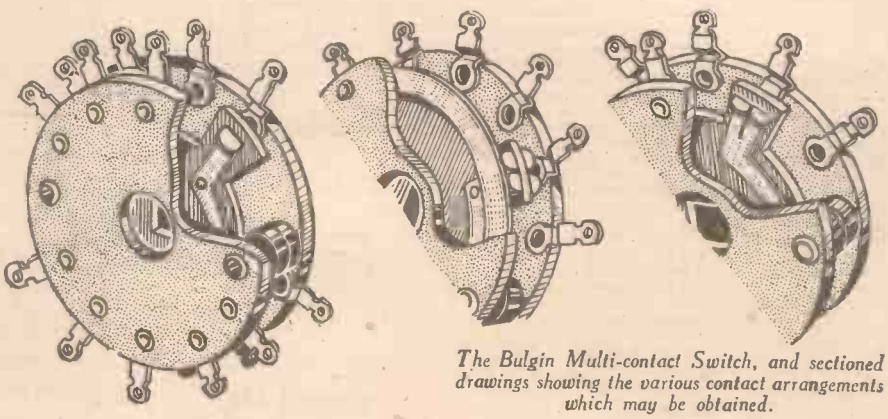
SOME new small batteries are announced by Messrs. Siemens, and although these are designed primarily as replacements in commercial receivers, they will be found of use to the home-constructor in certain circumstances, in view of their size. The first model is a 126-volt unit costing 9s. 3d. and measures 11⅛in. by 5⅛in. by 3in. The second is a 166-volt plus 9-volt G.B. costing 15s. 6d. This battery measures 10¼in. by 7⅝in. by 3⅛in.

Super P.A. Outfit

THE latest addition to the B.T.H. public address amplifiers consists of a special model utilising a Class A/B output stage delivering the enormous volume of 120 watts with 5 per cent. harmonic distortion. The consumption from the mains is 500 watts and a special separate rectifier unit is employed. Novel additions to the amplifier are a volume expansion circuit, and a speaker unit with a metal diaphragm, which it is claimed is far more efficient than the usual M.C. speaker when used in a circuit of this type. The input is designed to accommodate 10 to 15 watts.

Norman Set Analyser

A NEW set analyser and a range of fixed condensers is now available from Norman Rose (Electrical), Ltd. The meter employed in the analyser is of the moving-coil type with a 4in. scale, and provides five voltage ranges for both A.C. and D.C., six D.C. milliamp. ranges and three resistance ranges. A cable fitted with an adapter is plugged into the valve-holder in the set being tested and special adapters are supplied for use with the various types of valveholder met with in a modern receiver. The price is £9 17s. 6d. The condensers are available in aluminium cans or waxed cardboard containers and include all of the more usual types at prices from 1s. 6d.



The Bulgin Multi-contact Switch, and sectioned drawings showing the various contact arrangements which may be obtained.

LETTERS FROM READERS

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

DX Television Transmissions

SIR,—With reference to your note in PRACTICAL AND AMATEUR WIRELESS for January 16th, concerning U.S.A. television on the ultra-short waves. Having received a high-definition television signal on a wavelength of approximately 8½ metres, I inquired of the Don Lee Television System, Los Angeles, as to whether it was their station or not. Their reply, dated December 29th, 1936, does not confirm this. However, for the benefit of listeners who are on the "ultra-shorts," I give their schedule:

Frequency, 45,000 kc/s (the same as Alexandra Palace).

Times: Mondays, 5 to 6 p.m.; Tuesday, 6 to 7 p.m.; Wednesday, 7 to 8 p.m.; Thursday, 8 to 9 p.m.; Friday, 9 to 10 p.m.; Saturday, 10 to 11 p.m.

Also every day except Sunday at 2.30 to 3.15 a.m.

There are no transmissions on Sundays or holidays.

The identifying signal is a tone of 1,000 cycle frequency, which is always transmitted for five minutes or more before and after each transmission.

The sound is transmitted on KHJ, 900 kc/s.

No voice announcements are given on the ultra-short waves. Reports of reception will be acknowledged by Harry R. Lubeke, Director of Television, 7th At Bixel Street, Los Angeles, California.

These transmissions being on the same frequency as Alexandra Palace, may, conditions being good, interfere with the transmission from Alexandra Palace.

Trusting this information will assist readers in hunting for DX television.—RICHARD J. LEE (Heathfield, Sussex).

QSL's: Correspondent Wanted

SIR,—May I say how much I agree with the letter by Mr. F. A. Beane in the issue of January 23rd on the QSL-ing of S.W.L.s' reports. I do not boast of 300 cards, but I have 30, and on all the cards I have the operator has written an appreciative message. I have just received a card from W9PCG with the following message: "Thank you very much for F.B. report; very much appreciated here; hope to be able some day to talk to you over the air." I think amateur stations would reply more readily if the S.W.L.'s will send them good detailed reports. I should also like to mention I have never sent a reply coupon with any report yet. I should like to correspond with any fellow reader on the subject of S.W. listening.—EDWARD H. PERCY, 36, Cheltenham Road, Upper Parkstone, Dorset.

An Appreciation

SIR,—I should like to express my appreciation of your new articles, "Amateur Transmitting," they are filling a long felt requirement.

Some of your readers might be interested in the small photo of part of my "shack." On the right is a transmitter very similar in design to the one you are describing in your series, using a Class B valve, and on the left is my receiver, a B.T.S. "Oceanic" Bandspread-3, built up at home.

With this set I have been able to log many distant stations, such as VPD, VPD2, VK3MR, VK2BQ, W6BIN, OAX4D, JV's, JZ's, and just recently Canadian VE5CV. I have also managed to verify all Continentals and up to date I have logged about 700 stations.

About the QSL-collecting arguments, I still think that anyone who sends a detailed report plus reply coupon to any station over 4,000 miles away can usually expect

A corner of Mr. D. D. Chamberlain's wireless den.

a card in return, but there are so many people who send out reports that are useless to many stations and then are indignant when they receive no reply, that radio amateurs are getting tired of supplying "Wallpaper" and getting nothing in return but a report that is of no use to them.

Here's to the future success of PRACTICAL AND AMATEUR WIRELESS, may it be greater in 1937 than ever.—D. C. CHAMBERLAIN (2CHD) (Thornton Heath).

Back Numbers Wanted

WE have a request from a reader who requires copies of PRACTICAL AND AMATEUR WIRELESS for February 23rd, 1935, and April 13th, 1935. If any reader who has these issues to spare will kindly send them on to this office we will dispatch them to the reader concerned.

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., Tower House, 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.

Practical and Amateur Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS.

CRYSTAL SETS.

	Date of Issue.	No. of Blueprint
Blueprint, 6d.		
1937 Crystal Receiver	9.1.37	PW71
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
All-wave Unipen (Pentode) ..	—	PW31A
Two-valve : Blueprint, 1s.		
Four-range Super Mag Two (D, Pen)	11.8.34	PW36B
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow) ..	—	PW35
Summit Three (HF Pen, D, Pen)	8.8.34	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	22.9.34	PW39
Hall-Mark Three (SG, D, Pow) ..	—	PW41
Hall-Mark Cadet (D, LF, Pen, (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Genet Midget (D, 2 LF (Trans)) ..	*June* '35	PM2
Cameo Midget Three (D, 2 LF (Trans))	8.6.35	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	17.8.35	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen) ..	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P) ..	—	PW64
The Gladiator All-Wave Three (HF Pen, D (Pen), Pen) ..	29.8.36	PW66
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen) ..	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	5.12.36	PW72
Four-valve : Blueprints, 1s. each.		
Fury Four (2 SG, D, Pen) ..	—	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG) LF, Cl. B)	6.1.34	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF, Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P) ..	26.9.36	PW67
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen) ..	—	PW18
A.C.-D.C. Two (SG, Pow) ..	7.10.33	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	10.6.33	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow) ..	7.4.34	PW35C
D.C. Premier (HF Pen, D, Pen)	31.3.34	PW35B
Ubique (HF Pen, D (Pen), Pen) ..	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	18.8.34	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (R.C.))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen) ..	—	PW56
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	9.2.35	PW47
SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-Valve) ..	—	PW40
F. J. Camm's 2-valve Superhet (Two-Valve)	13.7.35	PW52
F. J. Camm's £4 Superhet ..	—	PW58
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve) ..	1.12.34	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. £4 Superhet 4	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
SHORT-WAVE SETS.		
Two-valve : Blueprint, 1s.		
Midget Short-Wave Two (D, Pen)	15.9.34	PW38A
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-Wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Bandspread S.W. Three (HF Pen, D (Pen), Pen)	29.8.36	PW68

PORTABLES.

Three-valve : Blueprint, 1s.		
F. J. Camm's "Elf" Three-valve Portable (HF Pen, D, Pen) ..	16.5.36	PW65
Four-valve : Blueprint, 1s.		
Featherweight Portable Four (SG, D, LF, Cl. B)	—	PW12

MISCELLANEOUS.

S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE CRYSTAL SETS.

Blueprints, 6d. each.		
Four-station Crystal Set	12.12.36	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450

STRAIGHT SETS. Battery Operated.

One-valve : Blueprints, 1s. each.		
B.B.C. Special One-valver	—	AW387
Twenty-station Loudspeaker One-valver (Class B)	—	AW449
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans) ..	—	AW388
Full-volume Two (SG det. Pen) ..	—	AW392
B.B.C. National Two with Lucerne Coil (D, Trans)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans)	—	AW338A
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	*July* '36	WM109
Three-valve : Blueprints, 1s. each.		
Class B Three (D, Trans, Class B)	—	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	—	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans) ..	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	—	AW417
1934 Ether Searcher: Chassis Model (SG, D, Pen)	—	AW419
Lucerne Ranger (SG, D, Trans) ..	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
Mullard Master Three with Lucerne Coils	—	AW424
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All-Britain Three (HF Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.11.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
£6 6s. Radiogram (D, RC, Trans)	—	WM318
Simple-tune Three (SG, D, Pen) ..	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans) ..	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP 21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen) ..	*June* '35	WM389
Certainty Three (SG, D, Pen) ..	*Sept.* '35	WM393
Minitube Three (SG, D, Trans) ..	*Oct.* '35	WM396
All-wave Winning Three (SG, D, Pen)	*Dec.* '35	WM400
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	*May* '33	WM329
Class B Quadradyne (2 SG, D, LF, Class B)	*Dec.* '33	WM344
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C. ..	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C./D.C. Two (D, Pen) ..	*Sept.* '35	WM394
Three-valve : Blueprints, 1s. each.		
Home-Lover's New All-electric Three (SG, D, Trans) A.C. ..	—	AW383

These blueprints are drawn full size.

Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following *prices, which are additional to the cost of the blueprint.* A dash before the Blueprint Number indicates that the issue is out of print.

Issues of Practical Wireless .. .. 4d. Post paid
" " Amateur Wireless .. .. 4d. " "
" " Practical Mechanics .. .. 7½d. " "
" " Wireless Magazine .. .. 1/3 " "

The index letters which precede the Blueprint Number indicate the periodical in which the description appears; thus, PW refers to PRACTICAL WIRELESS, AW to *Amateur Wireless*, PM to *Practical Mechanics*, WM to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the blueprint and the issue (stamps over 6d. unacceptable), to PRACTICAL AND AMATEUR WIRELESS Blueprint Dept., Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

QUERIES and ENQUIRIES

Voltage Drop in Leads

"I have experienced some difficulty with regard to a mains set I have built up. This is an A.C. model with a separate mains unit feeding all voltages to the set. For this purpose I have made a 9-way cable with a 9-pin plug and valve-holder for connecting, and on test I find that this cable gets quite warm. Volume is not what it should be, and I have tested practically every component in the receiver and have cut out one stage after another. Is there any possibility of losses in a multi-cable of this type which might be the cause of my trouble?"—L. S. (Birmingham 18).

IT is quite possible that the cable is responsible for the trouble, as this is a frequent source of difficulty. It is not often realised that the heater supply can rise to quite a high value, and unless special flex is employed there will be a serious voltage drop as well as overheating of the flex, and perhaps consequent burning through of the covering will take place. Special multi-cables are supplied by Messrs. Ward and Goldstone in which the heater leads are of very heavy gauge, capable of carrying up to 8 amps. at 4 volts, and we suggest that you use this type of cable. A good meter will, of course, enable you to check the voltages at each end of the connecting cables.

Superhet and Straight Condensers

"I am a beginner and am puzzled at several of the terms used in your book. For instance, you speak of a three-gang superhet type condenser, and a three-gang straight type condenser. Is there any difference in these types, and if I use a straight type in a super. receiver will it function correctly on short waves as well?"—L. E. T. (Holborn, E.C.1).

THERE is certainly a difference between the two types of condenser. In a straight gang condenser each section of the unit has an identical maximum and minimum capacity, and to enable it to "track" correctly, each section has to be made so that at any setting of the dial the two capacities are equal. Then, with matched coils the separate circuits will all keep in tune. Sometimes, the interconnecting wires will upset the matched coils, and a trimmer attached to the separate sections enables the balance to be restored. In a superhet gang condenser, however, one section (that tuning the oscillator) is cut with plates of a different shape so that there is always a difference between the tuning of the oscillator coil and the other coils, and this difference is the intermediate frequency. Superhet condensers are made for 110 kc/s and 465 kc/s intermediate frequency and must be purchased according to the type of oscillator coil in use. It is possible to use a straight condenser in a superhet, but additional small condensers have to be wired so that the correct difference is obtained, and in some cases this is a very complicated arrangement.

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., Tower House, Southampton Street, Strand, London, W.C.2.

The Coupon must be enclosed with every query.

Using A.V.C.

"Will you please tell me how I can fit automatic volume control to my present set and also where to fix a tuning indicator? The set is a straight 3, using a Colvern F5 coil, Detector, L.F. and Power, with transformer coupling. I wish to use some type of meter which is not too expensive yet accurate."—H. F. G. (Boscombe).

AS your set utilises no H.F. amplification, there is no valve to which the automatic volume control could be applied. This feature consists of a rectifier, which rectifies the H.F. currents, and the resultant voltage is applied, in the form of grid bias, to variable-mu H.F. valves. You cannot use a variable bias control on a detector. Added to these factors is the point that there would be no advantage in having A.V.C. in such a simple set. The main use of this feature is in a superhet where the high gain which results from the H.F. and intermediate-frequency stages results in the local station overloading the second detector or L.F. stages, and consequently this signal has to be restricted. Alternatively you can consider that the amplification of the receiver is modified according to the strength of the signal being received. A tuning indicator is also useless on your set, and is only of real value in a superhet fitted with A.V.C., as the gain will increase when the receiver is just off tune and distortion thereby result. We suggest that you study the article on A.V.C. which appears on page 617 of this issue.

A Good Short-wave Set

"Have you any blueprints of a good short-wave set that will give good 'phone signals on 120 volts H.T., with S.G., D. Power, or D. L.F., and with interchangeable coils?"—K. B. (Earlsdon, Coventry).

THE Prefect S.W. Three would appear to meet your requirements, and an H.F. unit was described which could be added to this to provide the H.F. stage, if you require to add to the set. The original circuit is a detector and two L.F. stages, and standard short-wave coils are used. The Tele-Cent described last week avoids the necessity for changing the coils and covers a much wider range, being designed to go down to the 5-metre band, whereas other short-wave receivers cannot be expected to give full efficiency on wavelengths below 10 metres or so, unless they have been especially designed for this.

Output Characteristics

"I have a Mazda P650 valve, but I find that I have mislaid the original data sheet. Would you kindly give me its main characteristics? I am desirous of using it as an output valve in a small amplifier. What power output should the preceding valve have?"—J. H. (Stalybridge).

THE valve is an output triode of the 6-volt .5 amp. type, designed for a maximum H.T. voltage of 250. The anode current is 22 mA with maximum H.T. and 40 volts grid bias. The impedance is 1,300 ohms and the maximum undistorted output 1.1 watts. For automatic biasing a resistor of 2,000 ohms is required. The grid swing is thus from 60 to 80 volts, and you can use a small power valve to feed it, with R.C. coupling, or a high-efficiency L.F. valve with transformer coupling. Without details of the H.T. supplies and remainder of the circuit the most suitable valve cannot be given, but from the above characteristics you can work out the design of the preceding stage.

The coupon on Cover iii must be attached to every query.

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," Tower House, Southampton Street, Strand, London, W.C.2.

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 amplifications, 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, switched, 2/11 each. Pair 5/3. 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., 1F transformers, 2/11. Telsen Ace, 1/11. RG4 Radiogrand, 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 8 mf., 1/6; 4 mf., 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/-.

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, microdisc 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.

ALL lines advertised last week still available.

RADIO CLEARANCE, 63, HIGH HOLBORN, W.C.1. Tel.: Holborn 4631.

BANKRUPT Bargains. List free. 1937 British mains superhets., £6/10/-; all-wave type, £7/10/-. Few only, in sealed makers' cartons. Battery all-wave 3v. with valves and MC, 79/6. Ormond A.C. 5v. superhets., £6. Ferguson and Pilot, trade supplied. Large stock valves all types, components, speakers, eliminators, etc. Get my price for anything radio first.—Butlin, 6, Stanford Avenue, Brighton. Preston 4030.

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.

EXPERIMENTERS' OPPORTUNITY. Parcels containing Wireless Components, 40/- value for 5/6. Carriage 1/-.—Taylors, Radio House, Macaulay Street, Huddersfield.

HEADPHONES.—5,000 guaranteed pairs to be cleared. Brown, G.E.C., B.T.H., Ericsson, Nesper, Western Electric, Siemens, Brandes, Sterling, etc., 2,000 ohms, 2/6. 4,000 ohms, 5/-. Postage 6d. **SPECIAL.** Telefunken, adjustable, lightweight, 2,000, 4,000 ohms, 7/6.

CRYSTAL SETS. Burne-Jones. Complete. Guaranteed. 5/6. Ditto, double circuit, 8/-. With permanent detector, 1/- extra. Sensitive permanent detectors, 1/6. Crystal detectors, complete parts, 1/-. Crystals 6d.—Post Radio, 183, Caledonian Road, London, N.1.

PREMIER SUPPLY STORES

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. 'Phone: Amherst 4723.**

CALLERS, AS USUAL, TO 20-22, HIGH ST., CLAPHAM, S.W.4 (Macaulay 2382). And 165 & 165a, FLEET ST., E.C.4 (Next door to Anderton's Hotel). Central 2833. New Branch: 50, HIGH ST. CLAPHAM, S.W.4 (Macaulay 2381).

Have you had our GIANT ILLUSTRATED CATALOGUE AND VALVE LIST? Send 4d. IN STAMPS FOR THIS BARGAIN LIST.

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 and Pen. 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, Octodes, Frequency Changers.

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-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, 1½in. 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.

H.F. CHOKES, S.W. 10–200 metres, 9d.; S.W. screened, 1/6; standard screened 180–2,000 metres, 1/6.
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 16 mfd. 530 v. peak, 1/9 each. Dubilier, 4 or 8 mfd. 500 v., 3/-; 50 mfd. 50 v., 1/9; 10 mfd. 50 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/-.

COSMOCORD PICK-UPS, with tonearm and volume control, 10/6 each. PICK-UP HEADS only, 4/6 each.

PREMIER MAINS TRANSFORMERS, 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. 3-4 a., all C.T., 17/6. Super Model 19/6. AUTO TRANSFORMERS, step up or down, 60 watts, 7/6; 100 watts, 10/-. 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, 0 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. Ammeters, 0-1, 3, 5, 10 or 20 a., 5/9. TELSEN Multi-meters, 3 and 30 m.a., 8, 16 and 240 v., 8/6 each. Reads A.C. and D.C.

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 or Pentode, 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. 8 volts at ½ amp., 14/6; 8 volts 1 a., 17/6; 15 volts 1 a., 19/-; 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.

NEW 1937 1-VALVE SHORT-WAVE RECEIVER OR ADAPTOR KIT 13 to 86 Metres without coil changing. Complete Kit and Circuit 12/6. VALVE GIVEN FREE! DE LUXE MODEL 14 to 150 Metres, complete Kit with Chassis, 4 Coils and all parts, 17/6.

SUPERHET CONVERTER KIT, 13/6.
S.W. SUPERHET CONVERTER, for A.C. Mains Receivers, 20/-. A.C. Valve given FREE!

NEW 1937 2-VALVE S.W. KIT, 13 to 86 Metres without coil changing. Complete Kit and Circuit, 19/6. VALVES GIVEN FREE. DE LUXE MODEL, 14 to 150 Metres, complete Kit and Chassis, 4 Coils and all parts, 25/-. VALVES GIVEN FREE.
3-VALVE S.W. KIT, S.G. Det. and Pen., 42/-. VALVES GIVEN FREE!

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!

SPECIAL OFFER. LISSEN TWO GANG SCREENED ALL-WAVE COILS, 12 to 2,000 Metres, complete with switching and wiring diagram, 6/11 per set.

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/-.

MAGNAVOX, Mains energised M.C. Speakers. '154,' 7in. cone, 2,500 ohms, 12/6; '152,' 9in. cone, 2,500 ohms, 17/6; '152 Magna,' 9in. cone, 2,500 ohms, 37/6. Magnavox P.M.s—'254,' 7in. cone, 16/6; '252,' 9in. cone, 22/6. Reliable P.M.s, 10/6.

ROLA latest type P.M.s, 18/6. GOODMANS' 8in. mains energised, 1,000 ohms field. 10/6 each. Jensen P.M.s, 10/6. 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.

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.

LOUDSPEAKER REPAIRS

REPAIRS to Moving Coil Speakers, Cones and Coils fitted or rewound. Fields altered. Prices Quoted including Eliminators. Loudspeakers Repaired, 4/-. L.F. and Speech Transformers, 4/- post free. Trade invited. Guaranteed. Satisfaction. Prompt Service. Estimates Free. L.S. Repair Service, 5, Balham Grove, London, S.W.12. Battersea 1321.

SHORT WAVES

SHORT WAVE on a crystal set. Full building instruction and crystal 1/2 post paid.—Radiomail, Tanworth-in-Arden, Warwickshire.

AMERICAN RECEPTION on your own receiver with the **RIDCO** S.W. Unit, from 9/6 complete; send for illustrated catalogue.—Radio Industries, Birch Street, Hanley, Staffs.

NEW RECEIVERS, COMPONENTS, AND ACCESSORIES

YOU WANT SOMETHING COMPLETELY DIFFERENT. If you have a nicely furnished home and the stereotyped models you see on every street corner do not appeal to you, you will delight in our superb range of exclusive quality models. We have Radiograms with and without Auto Record Changers, A.C. and A.C./D.C., which are a complete breakaway from the usual types in the local shops. If you prefer good furniture to boxes, if you want outstanding shortwave performance, and above all if you appreciate true quality of reproduction when you hear it, we have what you are looking for. Come and see. Come and listen. You will be agreeably surprised, not only to find that such splendid models exist, but that they can be sold at such very reasonable prices.—WIRELESS SUPPLIES UNLIMITED, 278-280-282, High Street, Stratford, E.15. Maryland 3191.

RADIO BARGAINS

ALCO ELIMINATORS AND CHARGERS. 4 H.T. taps. 120v./150v. 20/30 m.a., 18s., with charger, 25s. Charger alone, 7s. 6d. ½ amp., 11s. Year's guarantee. Details free.—P. & D. Radio, 1, Goodinge Road, N.7.

RECEIVERS, COMPONENTS AND ACCESSORIES

Surplus, Clearance or Secondhand, etc.

SOUTHERN RADIO'S WIRELESS BARGAINS. All Goods Guaranteed and sent Post Paid.

RECEIVERS.—Vidor 3-Valve Battery Sets. Model C.N. 212. Complete in attractive Walnut Cabinet with three Mullard Valves, Moving Coil Speaker, Batteries and Accumulator. New in sealed cartons, £3/17/6 (List 6½ gns.).

LUCILLE.—5-Valve American Midget Sets. Complete with 5 Valves, Moving Coil Speaker. Ready for use on any mains 100/250 volts A.C./D.C. Long and Medium Waves, £3/15/0. New, in sealed cartons.

RECORD CHANGERS.—GARRARD Model R.C.4, plays automatically and changes eight 10in. or 12in. records of any kind. New, in sealed cartons, £6.

GRAMOPHONE MOTORS.—COLLARO ELECTRIC Radiogram Units. For A.C. or D.C. mains 100/250 volts. Fully Auto Stop, complete with Pick-ups. Can be used on any mains. Brand new in sealed cartons, 57/6 each. COLLARO ELECTRIC Radiogram Units, complete with Pick-up and fully Auto Stop, for A.C. mains only, 37/6 each. COLLARO Single Spring Gramophone Motors with 10in. turntables, complete with all accessories, 11/-. Double Spring Motors with 12in. turntable, 15/-. COLLARO BATTERY RADIOGRAM UNITS, comprising Double Spring Motor and Pick-up mounted on plate, with all accessories, 35/- each. ALL COLLARO MOTORS ARE BRAND NEW IN SEALED CARTONS.

SPEAKERS.—CELESTION Soundex, permanent magnet, 10/-. TELSEN permanent magnet with 10-Ratio Transformers to suit any Receiver, 12/6. Telsen Loudspeaker Units, 2/6. ALL BRAND NEW AND BOXED.

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SOUTHERN RADIO.—Branches at 271-275, High Road, Willesden Green, N.W.10; 46, Lisle Street, London, W.C.2. All mail orders to 323, Euston Road, London, N.W.1.

SOUTHERN RADIO, 323, Euston Road, London, N.W.1 (near Warren St. Tube). 'Phone: Euston 3775.

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AMAZING prices. Lead, others follow. All-wave A.C./D.C. Table models, £6/15/0; Halcyon A.C.7, £7/7/0; Halcyon, A.C./D.C., Listed 14 gns., £7/7/0; Austin twin Rola speakers, Listed 15 gns., £7/7/0; A.C./D.C. Compacts, 65/-. Other Mains receivers, £5. Stamp for list. Speakers, Components, English, American Valve replacements. Full stock the amazing All-wave Ferguson models. Trade supplied. State requirements.—Littler, The Midland Dealer, 2, Barras Lane, Coventry

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OURS is now the only store in London handling a complete and comprehensive range of high grade Components and Accessories as distinct from clearance and surplus stuff. Everything from the smallest plug to the complete Auto Changer Unit; finest makes, really keen prices, and efficient personal service unobtainable from chain stores, clearance houses, department stores or by mail. Come and see.—WIRELESS SUPPLIES UNLIMITED, 278-280-282, High Street, Stratford, E.15. Maryland 3191.

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This coupon is available until February 13th, 1937, and must be attached to all letters containing queries.

PRACTICAL AND AMATEUR WIRELESS, 6/2/37.

ADVERTISEMENT INDEX

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A THREE-STAGE S.W. RECEIVER—See Page 653.

Practical and Amateur Wireless

AND PRACTICAL TELEVISION

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

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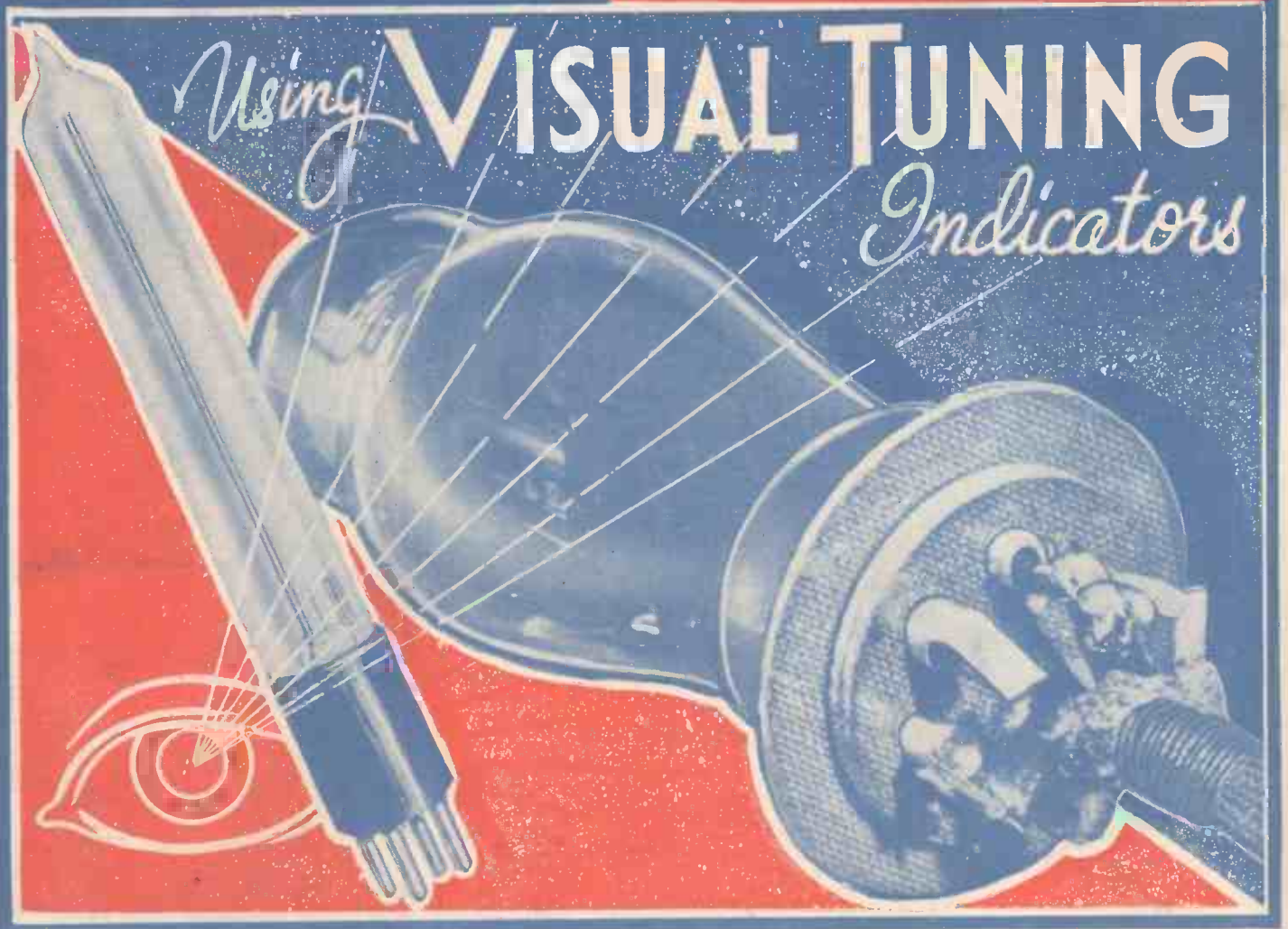


Using VISUAL TUNING Indicators

CAR RADIO PROBLEMS—See page 639

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. 230. February 13th, 1937.

ROUND *the* WORLD *of* WIRELESS

Tune by Sight

THE simple receiver is always tuned by ear, the tuning control being set according to the sound as heard from the loudspeaker. Where great volume is obtained the volume-control is usually turned down during the tuning process so that the exact point may more easily be determined. It is well known that with a wireless signal it is necessary to tune to the exact resonant position, or frequency, in order to obtain balanced reproduction, any deviation on either side resulting in a loss of quality. When A.V.C. is fitted, as was explained last week, there is a risk that the exact tuning point cannot be determined, as the increase in volume automatically decreases the H.F. sensitivity, and thus the exact resonant point is hard to determine. The only certain way of obtaining correct tuning, and consequently best quality, is to fit some device which will show, irrespective of the action of the A.V.C. circuit, when the circuits are correctly tuned, and this is the function of the Visual Tuning Indicator. Turn to page 648 and read how the device works, and how to use this useful adjunct to the modern receiver. The details are clearly explained, and circuits are given showing its application.

Four New Indian Stations

THE Indian Government has just placed a contract with Philips Radio for the supply of four 10-kilowatt short-wave transmitting stations for the All-India Radio organisation. All the stations will work on a wavelength between 30 and 90 metres.

The contract was given to Philips after Indian broadcasting engineers had inspected a number of other broadcasting transmitters in the Far East which were supplied by the same company. There are already in India five medium-wave stations and four short-wave ones, in addition to a number of local relay transmitters.

P.O. Trunk Radio

ULTRA-SHORT-WAVE wireless telephony is to be experimented with by the Post Office authorities with a view to providing trunk telephone services between the Orkney and Shetland Isles and the mainland. The experiments, it is understood, are to be commenced almost immediately and they wish to establish the suitability at all times of the year of this method of communication.

A New Insulation Tester

THE usual type of insulation tester is operated by turning a handle, this producing a high voltage in a test circuit. This means that two people must be employed, or the apparatus has to be connected so that the handle may be operated. A new idea is to be shown at the Leipzig Spring Fair, where a test instrument is to be introduced in which the pressure of a button sets the apparatus into action. A dry battery is employed, and the measuring voltage is of the order of 500 volts. A discharge lamp keeps the operator constantly informed as to the working of the apparatus, on which the readings are shown on a large dial. The instrument weighs only 4½lb. complete with straps and batteries.

ON OTHER PAGES

No Coronation Television

AS we go to press we are notified that the arrangements for televising the Coronation ceremony in Westminster Abbey have fallen through. It is announced, however, that the outside broadcasts will still be held, and the pageantry of the procession, to and from the Abbey, with the general crowd scenes, will give ample scope to demonstrate the efficiency of the modern television systems.

This Year's Radiolympia

IT was anticipated that from this year onwards the Annual Radio Exhibition would be held in the new exhibition buildings at Earl's Court. After considering the matter, however, it has been decided by the R.M.A. that Olympia will again be the scene of the exhibition. A contract has been entered into for three years, with the option of renewal for a further two years. This year's exhibition must fall between August 16th and September 5th.

Kerbside Kabaret

AS a result of an argument concerning the talent displayed by street performers, B. Martin Marks has arranged to present a programme bearing the above title. Freak performers, such as one-string fiddlers, bottle players and one-man bands are not included. The items will consist of articles of a legitimate type chosen from the city streets, and in introducing them the producer will describe them and tell where they were found. The rehearsals for the programme have been arranged so that all taking part will not be away from their pitches during the "peak" hours. The programme is to be given on February 19th from the London Regional transmitter.

Test Your Frequency Response

ON February 12th a recital on the double-bass is to be given in the programme "Intermission." This item will give listeners an ideal opportunity of testing the frequency response in the lower register. The nickname of the instrument in America is the "bull fiddle," and the item has been named "The Bull Steps Out." The composer and performer is Norman Hester, who has been double-bass player of the B.B.C. Variety Orchestra since it was formed.

Has Anybody Logged Tunis?

FRENCH wireless journals report the arrival on the ether of a new short-wave station at Tunis (North Africa). This transmitter is said to be operating daily from G.M.T. 12.00-14.00, and again from 18.30-20.00 or 21.00 on 49.12 m. (6.107 mc/s). No further details are given.

ROUND the WORLD of WIRELESS (Continued)

Radio Station to Aid Pilots

WITH the assistance of three pilots of the Chukhotsk aviation squadron, a radio station has been built on the high plateau of the Anadyr mountain range. Hitherto, the work of pilots flying from Cape Schmidt to Cross Bay on the Chukhotsk Peninsula suffered from the absence of a meteorological station in the region of the Anadyr range which could inform the pilots of changes in the weather on the route. All the material required for the radio station, as well as coal, kerosene and foodstuffs, were transported by air.

Variety in Miniature

MARTYN WEBSTER compères a half-hour programme on February 12th, which will include a short sketch by Francis Durbridge in which the action is supposed to take place just after a Paul Jones dance. Edith Athey, who first broadcast in 1923, will sing; Warwick Vaughan will give impersonations; Dickie Pounds and Ronnie Brandon are to give one of their "Out of the Blue" turns; and Jane Minton and Robert Austin will play duets on two pianos.

Concert from Torquay

FRANK PHILLIPS (baritone) will be the artist in a concert by the Torquay Municipal Orchestra, conducted by Ernest W. Goss, at the Pavilion, Torquay, on February 16th. This broadcast will be given in the Western Regional programme.

Three "Music Hall" Dates for Vic Oliver

WE are informed that Vic Oliver, husband of Miss Sarah Churchill, daughter of Mr. Winston Churchill, will be heard during three broadcast programmes in the near future.

As "England's Favourite American Comedian"—he has broadcast over here on four previous occasions—he will take part in "Music Hall" in the National programme on February 13th, March 6th, and April 3rd.

Vic Oliver, the popular American comedian, who is to give three broadcasts in "Music Hall," in the National programme.

INTERESTING and TOPICAL NEWS and NOTES

Radio Progress in Russia

ACCORDING to Mr. Proskuryakov, chief of the Radio Development Department of the All-Union Radio Committee, it is proposed to install nearly two million new radio sets and receivers, 50 per cent. of them in collective and state farms. The total number of radio sets and receivers in the Soviet Union by the end of 1937 will be six million.

A great deal of work is to be carried out on the reconstruction of district relay stations. Old equipment will be replaced by modern radio receivers, of which 600,000 will be produced. New relay stations are being built in Kiev, Baku, Tbilisi, Gorki, Minsk, and other cities, and existing radio stations are being enlarged.

Mr. Meredith, of Liverpool, has built a radio set out of old tins, a bottle, a clothes peg, a cigarette and some razor blades—and it works.

Film Stars in Glasgow!

TWENTY-FIVE minutes of revue will be broadcast on February 12th, consisting first of "Solo Flight" a one-man revuette devised and written by Peter Solman, and presented by Ian Sadler; and secondly, William H. D. Joss, in "Six Star Special," or "From Hollywood to Hope Street." The radio reporter will interview several film stars whom the public would never think were in Glasgow. The productions are by Robin Russell.

Midland Orchestral Concert

ON February 20th, Reginald Redman is to be the guest conductor of the B.B.C. Midland Orchestra in a concert which opens with Dvorak's "Carnival" overture and includes "The Enchanted Lake," by Liadov.

Variety from Derby

LESLIE HUTCHINSON, better known as "Hutch," tops the variety bill which will be heard from the Grand Theatre, Derby, on February 18th.

Organ Recital from Aberdeen

ON February 17th, Harold Coombs will play on the organ of the Capitol Cinema, Aberdeen, Spanish Valse, "Santiago," by Corbin; Foxtrot, "When the Sun says Good-night to the Mountains," by Vincent; and the second New Sullivan Selection, arranged by Higgs.

Light Fare from Crewe

VARIETY will be broadcast for the first time on February 18th from the New Theatre, Crewe. The bill from which excerpts will be taken includes the Four Hillbillies, Jack Warman (comedian), Lillian McEvoy (violinist), the Hurdles (comedy, singing and dancing duo), and Horace Waynes (radio talent spotting competition).

William Rees Concert

ELSIE SUDDABY, the well-known Yorkshire soprano, will be the soloist in the William Rees Concert that is to be broadcast from the Milton Hall, Manchester, on February 20th. She is to sing Mozart's "Dove sono," from "The Marriage of Figaro." The orchestra, conducted by William Rees, will play a programme including a selection from Rossini's "La Boutique Fantasque" and "Two Pieces" by Cowen.

League of Nations Broadcasts

DETAILS of the work done during the preceding week by the League of Nations are transmitted every Saturday between G.M.T. 10.30-11.15 through HBL, Prangins, on 31.27 m. (9.59 mc/s), and through HBP, between G.M.T. 22.30-23.15 on 38.18 m. (7.78 mc/s). Several new channels have been adopted by the Prangins stations for relays of Swiss and Austrian programmes for rebroadcast over the N.B.C. and Columbia networks in the United States of America. Those most used are: HBF, 15.83 m. (18.95 mc/s); HBJ, 20.64 m. (14.535 mc/s), and HBO, 26.31 m. (11.402 mc/s).

SOLVE THIS!

PROBLEM No. 230.

Cook constructed a short-wave three-valver using a home-made coil. He expected a tuning range of 18 to 40 metres, but when the set was tested out it would only tune down to 20 metres. How could the minimum be reduced to 18 metres and what was the cause of the high minimum? 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., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 230 in the top left-hand corner, and must be posted to reach this office not later than the first post on Monday, February 15th, 1937.

Solution to Problem No. 229.

There was an internal short-circuit in the condenser connected between the cathode of the H.F. valve and earth.

The following three readers successfully solved Problem No. 228 and books are accordingly being forwarded to them: E. G. Sears, 44, Graham Rd., Mitcham, Surrey; J. D. Morris, 17, Lynton Rd., Heaton Moor, Stockport; H. Lloyd, 23, Park View Terrace, Morton Rd., Middlesbrough, Yorks.

Car Radio Problems

Our Contributors Decided to Unite Forces in Making a Receiver for Motor-car Use, and Tell You about the Problems which Arose

by The Experimenters

YOU might think that this is not the best time of the year to experiment with car radio. In that case, we do not agree. The person who has to use his car all the year round, probably for business, is entitled to a bit of relaxation during the bad weather—and what better method of obtaining it than from radio? Many a tedious and otherwise tiring journey can be made more enjoyable by switching on "the wireless," and the foolish idea that the music detracts from the safety of driving has, we hope, been completely dispelled by now.

Power Supply

All of us have been keen on car-radio for a number of years, but until this season we have never been quite satisfied with home-made car sets. The main reason was that we had either to employ expensive H.T.-converter units or otherwise be content with batteries. Now that the Bulgin vibrator-rectifier unit is available there is no reason why a home-made car-radio should be either expensive or less satisfactory than a factory-produced job.

It was after the above points had been discussed that we recently decided to carry out a few experiments in order to see to what extent a reasonably good car-radio outfit could be produced without going to any great expense. One of our number had for some time been using a straightforward type of four-valve battery superhet with A.C.-type indirectly-heated valves, the filaments being fed from the car battery by making connection to the negative terminal and to the bus-bar inter-cell connector between the second and third cells—in order to obtain the correct voltage of 4. For H.T. he employed a double-capacity H.T. battery and results were commendably good.

Another of our members had consistently used an ordinary four-valve (H.F., Det., L.F., Class B) portable, not differing greatly from the well-known PRACTICAL WIRELESS "Featherweight" receiver. He explained that he had found that the self-contained frame aerial was not very successful in itself, due to the directional effects, and also because of the screening provided by the metal bodywork. However, he had overcome this trouble by fitting a 12ft. length of rubber-covered flex to the underside of the roof, this being arranged in zig-zag formation. The car battery had again been used for L.T. by taking a tapping at 2 volts, so the earth connection was automatically made to the chassis.

Interference Suppression

In neither case had it been found necessary to screen the receiver, provided that interference suppressors were fitted in the ignition circuit. A set of Belling-Lee suppressors was used, although other makes such as Dubilier were found equally effective. Incidentally, the total cost of these for a four-cylinder car is 15s. 6d., which is very reasonable. The set includes four resistances, with easy-fitting terminal clips for including between the plugs and their connecting leads, a similar resistance for including between the centre terminal of the ignition distributor (coil ignition) and its connecting lead, a metal-cased fixed condenser for connecting between the positive dynamo terminal and the frame of the car (negative terminal on those cars with positive earth), and a condenser for connecting between the H.T. terminal of the coil and the chassis. The general arrangement of these is shown in Fig. 2.

It was found after a considerable amount of careful experiment that the inclusion of the resistances had little or no effect on the running of the engine—in spite of arguments which have at different times been raised to the contrary—although it *was* found worth while to advance the ignition timing very slightly. This, no doubt, is due to the minute time lag which the resistances introduce. It is also worth mentioning, for the benefit of those who have not seen these suppressors, that they can be fitted in a few minutes, and that the earth or chassis connections from the condensers are made automatically through the metal cases and mounting brackets with which they are fitted.

"Parasitic" Interference

We did find in the course of our recent tests that a certain amount of interference was sometimes experienced in spite of the suppressors, but this was due to dirty contacts in the make-and-break, to the dynamo brushes not bedding-down properly on the commutator segments, or to bad connections in the electrical circuit as a whole. Additionally, it was noticed that the electric windscreen wiper was inclined to cause a little trouble, and that, occasionally, friction between different parts of the bodywork resulted in a few "scratching" noises.

The windscreen wiper could be silenced if this were considered necessary by connecting a 25-mfd. electrolytic condenser between the terminal of the wiper motor and the windscreen frame; connecting the positive condenser terminal to the motor terminal for a negative-earth system, or *vice versa* for positive earth. Noise caused by bodywork friction could always be overcome either by tightening the parts which were rubbing or by lightly smearing them with graphite grease. A certain amount of noise is inevitable when the direction indicators are operated unless one takes the trouble to fit condensers between the contacts, but this is never an important matter. The point is, of course, that any contacts which are "made" and "broken" cause a small amount of radiation unless a condenser is connected between them to "absorb" the current surge, whilst rubbing parts tend to generate a small amount of current due to electrolytic action.

The Aerial

Before tackling the new set itself we decided to "pool" our experiences of aerial and earth systems and allied matters. One had found, for example, that the best form of aerial was one consisting of a strip of "Pix" aerial tape fixed round the outside of the roof with the lead-in taken between

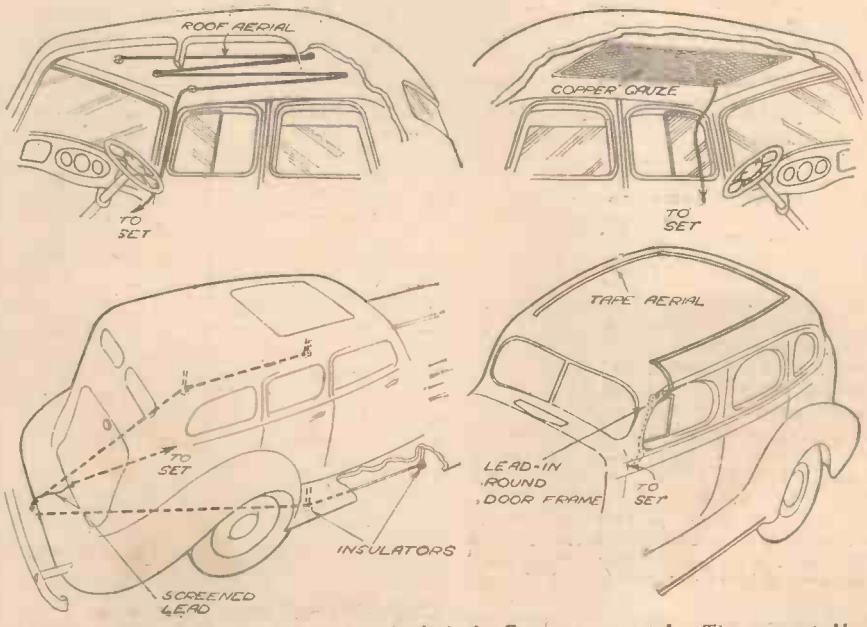


Fig. 1.—Some of the types of car aerial which the Experimenters tried. The most suitable should be found by experiment.

the top of the door and the door frame; another preferred the zig-zag arrangement of insulated wire inside the roof, as mentioned above; another had obtained good reception from a sheet of perforated zinc mounted underneath the wooden running-board on small insulators; another preferred a sheet of copper gauze (he had rather expensive tastes) fixed on the underside of the roof; yet another excellent arrangement was said to be obtained by means of a 12ft. length of insulated wire arranged as a V between the underside of the running-boards and the tail of the body, the lead-in being taken from the point of the V near the tail. For the last-mentioned arrangement it was claimed that interference was reduced due to the "dipole" system. Our "highly-technical" member who preferred this arrangement explained something about the fundamental wavelength of the interference being just above 7 metres, and said that the use of a half-wavelength aerial caused the interference to be cancelled out. We others looked very knowledgeable, even if we were not quite clear on the technicalities, although somebody did say that it was improbable that the fundamental wavelength would be the same for all cars. In the end, we came to the conclusion that it was best to try different aerial systems on each particular car, and this seemed to put a stop to further argument. Fig. 1 shows some of the suggested aerials.

What Circuit?

When we came to discuss the most suitable type of receiver it looked as though trouble would start again, for although one "went for" a six-valve superhet with delayed and amplified A.V.C., another preferred a simple four-valve "straight" circuit without any of these "new-fangled" refinements. In the end a compromise was struck by our agreement to try out a modification of the famous PRACTICAL AND AMATEUR WIRELESS "£5 Superhet"—A.C. version, with the addition of a simple form of A.V.C. Nobody could give any good reason why this should not prove satisfactory for reception of the local stations and Droitwich, so that point was settled. The reason for deciding on the A.C. version, by the way, was that it was agreed that indirectly-heated valves were more robust than battery valves, and that they provide a greater degree of amplification. In addition to this, it was considered that the A.C. circuit was more readily adaptable for use with the vibrator unit, which it had been decided to employ.

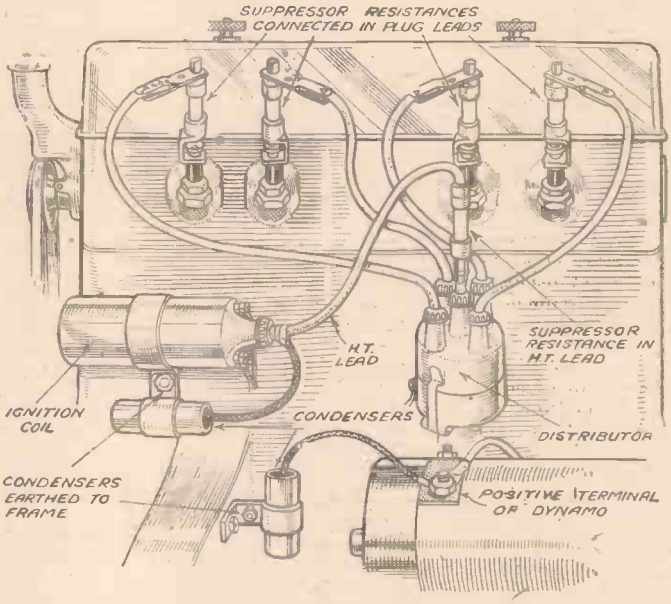


Fig. 2 — This illustration shows the principal points at which suppressors should be fitted to the engine. Connection of the two condensers varies slightly according to the electrical and ignition equipment of the car, but the general arrangement shown is usually effective. Better dynamo suppression can sometimes be obtained by connecting the condenser to the positive brush.

Self-contained or Separate Speaker?

The next "spot of bother" arose when the question of whether or not the speaker should be built into the set or mounted separately, and also whether a remote tuning control should be employed. If the receiver and set were all in one unit, that unit would be fairly big, so that difficulty would arise in accommodating it in the "baby" Austin, which one of us was running—and it was a foregone conclusion that the set should be "joint property." That settled that point, and it was agreed that, in the first place, set and speaker should be separate.

Then remote control? If the object were to receive several stations the tuning knob must be either on the steering-wheel, or somewhere near it, but if we should be content with two or three programmes, it would be good enough to have the condenser knob beneath the dashboard, where it could be reached quite easily when the car were stopped. Temporarily, the matter was dropped, it being agreed that, if necessary, remote control could be added later.

Well—we had intended to tell you something about the set, but as we have exhausted the space placed at our disposal by the Editor, we must leave that until next week.

Until next week!

MORE ABOUT A.V.C.

(Concluded from last week's issue)

ORDINARY A.V.C., whether of the simple or delayed type, cannot counteract the fading to a great extent. Fading and distortion would be noticeable, but it is surely better to put up with reduced volume for a little while than to have the original volume restored, but with severe distortion.

Delayed A.V.C. seems to have all the advantages and none of the snags. By its use, the sensitivity of the receiver is not impaired, and the control will be more level the greater the delay. Care must be taken, however, to see that the last I.F. valve can deliver the voltage required without overloading, and it is, therefore, often necessary to apply only one fraction of the A.V.C. to this valve or even to operate it with fixed bias only. With this exception, it is best to control as many valves as possible, and in general at least two valves must be controlled.

So far we have not considered the uses and values of the decoupling condensers and resistances used in A.V.C. circuits. A glance at any of the circuits will show that, developed across the A.V.C. load resistance, there is not only a D.C. voltage but, superimposed on this, there is also an H.F. voltage. These H.F. voltages must not be allowed to reach the grids of the controlled valves and are, therefore, smoothed out by a condenser-resistance combination, in just the same way as we use a decoupling resistance and condenser in the anodes of amplifying valves to remove hum, and prevent interaction and instability.

The Main Object of Decoupling

The primary object of the decoupling arrangement, however, is to introduce a time lag in the A.V.C. in order to reduce the effect of the modulation on the bias of the controlled valves. The time constant obtained (which is a product of the values of the condenser and resistance) varies between one tenth and one fifth of a second, that is to say, the time taken to charge up and discharge the condenser can be made to vary. In this way, the A.V.C. can be made very sluggish, or very fast. With a large time constant, and therefore slow A.V.C., interstation noise is greatly reduced because the set has been tuned from one station to another before the A.V.C. volts have been discharged. A disadvantage that will be immediately apparent, however, is that quick fading will not be counteracted. On the other hand, with a low time constant, even very quick fading (of the sort encountered on short waves) is easily controlled, but the set becomes very sensitive immediately it is slightly off tune, and atmospheric noises are greatly amplified.

It will be noticed that all the circuits given are for use in a superheterodyne receiver. This is because, in a straight set, at least two, and preferably three H.F. stages, are necessary in order to be able to effect any control worth while. Certainly the voltage at the detector is much greater in a superhet than in a straight set. Another disadvantage is that the tuning condenser preceding the detector may not be earthed except by the use of a special circuit which, in the case of a mains receiver at any rate, seems to introduce a good deal of hum, and extra screening is necessary. Also due to the fact that the full H.F. voltage is applied across the detector grid leak in a straight receiver, a much more efficient H.F. filter is required than in a superhet, and the circuit again becomes very complicated.

Supplying the Grid Voltages

The Principles and Use of Grid Bias; Making the Grid Negative or the Cathode Positive; "Automatic" Bias for Battery Sets

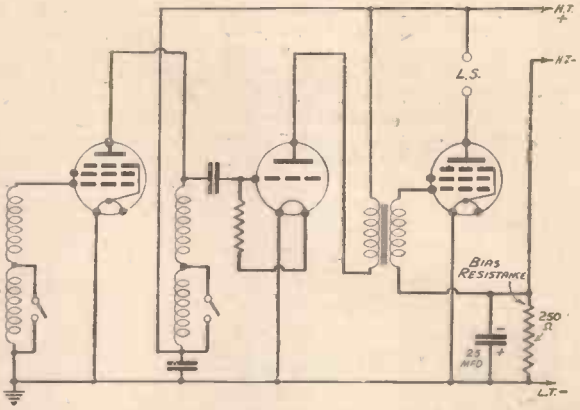


Fig. 3.—This circuit shows how "automatic" bias can be provided for the output valve in a simple three-valve battery circuit.

ALMOST every valve in a modern receiver requires grid bias, and problems sometimes arise concerning the best method of providing the necessary negative potentials. In the case of low-frequency and power valves the negative bias is required in order to cause the valves to operate on the straight portion of the characteristic curve. For the benefit of those to whom these curves are still something of a mystery, it might be explained that the latter statement simply means that the valves must be operated in such a manner that they give proportional amplification to signals of different voltage levels. In other words, if the signal voltage is doubled, the output from the valve should be doubled, and so on.

The Power Valve

In nearly every instance the grid-bias voltage required by low-frequency valves is fixed, according to the H.T. voltage and the particular valve. The supply of this (tapping G.B.2 in Fig. 1) does not often present any difficulty. When the set is battery operated, and "automatic" G.B. is not provided, it is merely necessary to take a lead to a tapping point on the grid-bias battery, the positive terminal of which is connected to H.T.—, L.T.— and the valve filament. The result is that the grid of the valve, which is joined to the G.B. battery through the secondary of the L.F. transformer, or through a grid leak when using R.C. coupling, is made negative in respect of the filament. A bias voltage of between 4½ and 9 is generally required by battery-operated valves, and the appropriate figure for different high-tension voltages is given on the makers' instruction sheet. It is worth remembering, however, that it is always wise to use the highest possible G.B. voltage consistent with good quality. This is because an increase in grid voltage results in a reduction in high-tension current, and so in a saving in upkeep costs. As an example, a typical high-efficiency small power valve passes 6mA when the H.T. voltage is 120 and the bias voltage 4½; by increasing the bias to 6 volts the current is reduced to less than 3 mA. And in many cases, when the valve is not called upon to deliver its maximum output, results are quite satisfactory when using the higher G.B. voltage.

Positive Cathode

The circuit shown in Fig. 2 is similar to that in Fig. 1, except that it is designed for mains operation, indirectly-heated-cathode valves being used. An entirely different method of biasing the valves is used, a resistance being included between the cathode of the valve (which corresponds to the filament in a battery valve) and the H.T.— and earth line. As will be understood, high-tension current flows through the resistance and from that to the cathode, and so on to the anode of the valve. In passing through the resistance a voltage-drop occurs, the extent of this being dependent upon the amount of current passing and the ohmic value of the resistance. As a result of the voltage-drop, the end of the resistance connected to the cathode becomes positive in respect of the earth line, to which the grid is "returned." In other words, the cathode is made positive; this is just the same as making the grid negative, because it means that the grid is made negative in respect of the cathode. This is a little point which is often misunderstood.

The correct value of the bias resistance is generally given in the makers' instructions, but it can be calculated by dividing the voltage required by the anode current of the valve, and multiplying the result by 1,000 (to change the current in mA to amps.).

Detector Bias

We can now turn to the other valves in the circuit. Normally, the detector valve does not require a negative bias, but when a pick-up is used, and the valve is made to act as an amplifier, bias is necessary. That is the reason for the tapping marked G.B.1 in Fig. 1, and the resistance marked R.4 in Fig. 2. The bias generally needed is about 1½ volts, and for nearly all indirectly-heated detector valves this can be obtained by using a 1,000-ohm bias resistance, as indicated in Fig. 2. It will be seen that, although bias is required only on "gram.," the resistance is permanently in circuit. The point to observe, however, is that the grid leak is connected to the cathode and the pick-up to earth; in consequence, the grid is negative in respect of the cathode only when it is joined to the earth line through the pick-up. A parallel case is found in Fig. 1, where the grid is connected to the bias battery only when the radio-gram. switch is turned to the "gram." position.

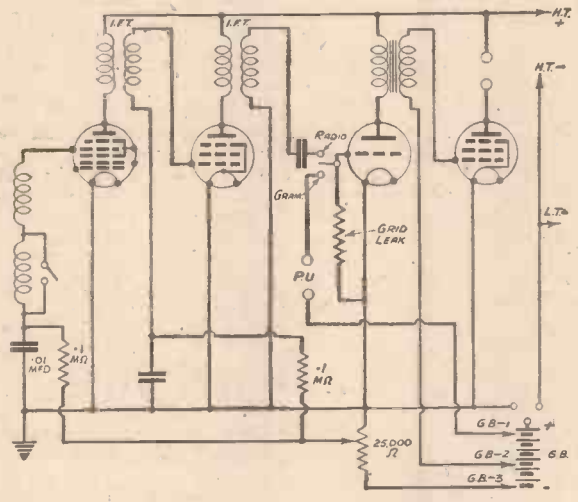


Fig. 1 (left).—The bias circuits of a typical four-valve superhet.

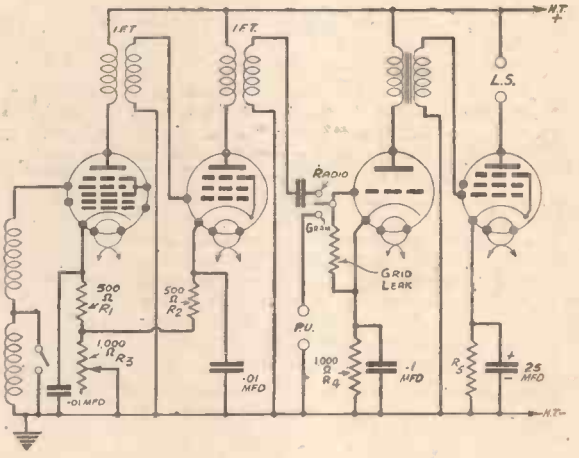


Fig. 2 (right).—Bias arrangements in a mains circuit corresponding to that shown in Fig. 1.

Variable-mu Bias

With regard to the intermediate-frequency and pentagrid valves shown in Fig. 2, a variable bias voltage is generally

(Continued overleaf)

SUPPLYING THE GRID VOLTAGES

(*Continued from previous page*)

required so that the variable-mu properties of these valves can be employed. In both Fig. 1 and Fig. 2 it is assumed that the same bias voltage is to be applied to these two valves—and that is satisfactory in most cases. Because of this, both grid circuits are joined together, although decoupled one from the other—by means of two .1-mfd. megohm resistances in Fig. 1, and by means of two 500-ohm resistances (R.1 and R.2) in Fig. 2.

In the battery circuit, the variable bias voltage is obtained through the potentiometer connected between tapping G.B.3 and earth in Fig. 1; and by means of the varable resistance marked R.3 in Fig. 2. As the various resistances must not impede the free flow of high-frequency currents, they are by-passed by means of .01-mfd. non-inductive condensers in both circuits. Incidentally, it should be explained that the bias connections shown in Fig. 2 are not necessarily complete, because they are sometimes coupled with the potentiometer circuit employed to feed the screening grids of the valves. This does not affect the basic circuit, however.

"Automatic" Voltage

It is frequently considered desirable to use "automatic" grid bias in a battery receiver, the bias being obtained by the voltage-drop across a resistance, as it is in the mains circuit. This is easy enough where the low-frequency valve is concerned, but there are many difficulties which arise when variable voltages are required for variable-mu control. In fact, when there is more than one valve which requires a variable G.B. voltage, the problem is well-nigh impossible of satisfactory solution. But when there are no variable-mu valves, or even when there is a single one which passes a small current by comparison with the other valves in the receiver, the matter is not generally unduly complicated.

Fig. 3 shows the skeleton circuit of a "non-variable-mu" H.F.-Det.-Pen. receiver in which "automatic" grid bias is obtained by means of the fixed resistance included between the H.T.— and L.T.— terminals. The object of this resistance is to provide a voltage-drop in exactly the same manner as do the bias resistances in Fig. 2. An important difference is that the H.T. current for all of the valves passes through it, instead of the current for one valve only. Thus, the value of the resistance must be calculated by dividing the required G.B. voltage by the total H.T. current and multiplying the result by 1,000. As an example, it can be assumed that the H.T. currents quoted by the makers as being required for the valves are: 5 mA, 2mA and 10mA respectively, or 17 mA in all; also that the bias voltage required for the output valve is 4½. This means that the correct value for the resistance is approximately 260 ohms. In practice, a 250-ohm component would be used, as being the nearest standard rating; this would be perfectly satisfactory because a small amount of tolerance is permissible due to the fact that the resistance is partly self-compensating.

Bias Resistance

It should be noted in passing that the bias resistance is shown as being by-passed by a 25-mfd. electrolytic condenser. This is not absolutely essential, but it allows free passage of low-frequency currents, so preventing low-frequency instability. Another point is that when considering the current passed by the various valves and the bias voltage required, these are taken at the maxiumm H.T. voltage, since the makers do not normally quote the H.T. current at other voltages. A slightly higher degree of accuracy would be obtained by taking the figures which apply at the particular H.T. voltage used, but the beginner might have some difficulty in finding this, since it would involve either the taking of measurements—by means of a milliammeter—or finding the actual figures from the characteristic curves of the valves.

When the bias resistance required does not approximate in value to that of a standard component, or when it is desired to over-bias the valve on weak signals, it is generally satisfactory to employ a variable resistance and regulate this to the highest value possible without introducing distortion.

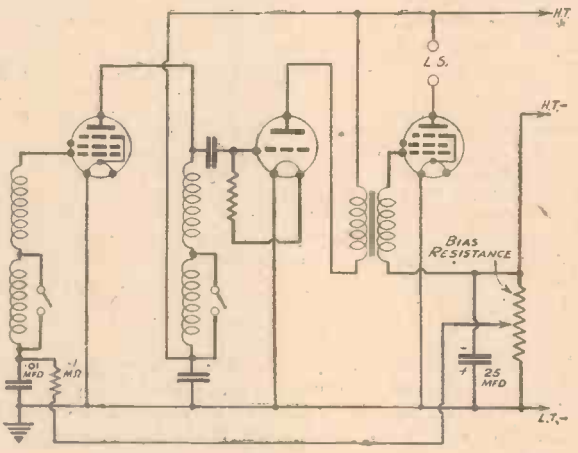


Fig. 4.—A method of obtaining fixed and variable bias "automatically." There are disadvantages in this arrangement and these are described in the text.

"Automatic" Variable-mu Control

If it were required to use variable-mu control in the circuit shown in Fig. 3, fairly satisfactory results could be obtained by following the connections given in Fig. 4. A potentiometer is used in place of the fixed resistance, the slider being connected to the grid circuit of the first valve, in a similar manner to that shown in Fig. 1. There are a few difficulties here, however; first, because 250-ohm potentiometers are not generally available. This objection could be met by using a 500-ohm potentiometer in parallel with a 500-ohm fixed resistance, or, better still, by using a 50,000-ohm potentiometer in parallel with a 250-ohm resistance. In both cases the tapping of the potentiometer would be used to feed the variable-mu valve.

The second objection is that as the bias applied to the first valve is varied the anode current of that valve is also varied. The means that the current passing through the resistance, and hence the voltage-drop across it, is caused to change as the volume control is operated. In turn, this results in a variation of the bias applied to the low-frequency valve. Provided that the change in current is confined to 2 or 3 mA—and it usually is—this need not be considered as a serious disadvantage, because the change in bias to the output valve would not vary more than a small fraction of a volt.

ITEMS OF INTEREST

New Photographic Services for the U.S.S.R.

WE understand that the Soviet Union intend to put into operation, during the present year, seven new telephotographic transmission lines. It will then be possible to transmit to Moscow over the radio and telegraph any diagrams, portraits, drawings and other documents from Alma-Ata, Tashkent, Sverdlovsk, Baku, Tbilisi (Tiflis), Irkutsk and Khabarovsk. By the end of the year new powerful television centres will be opened in Moscow and Leningrad. In both these cities apparatus will be installed for general demonstrations of television programmes on a screen the size of a postcard. The television centre in Moscow will be equipped with powerful ultra-short-wave transmitters intended for the demonstration of entire performances and sound films. At the same time, the output of high quality television receivers will be commenced.

Interference by Medical Apparatus

ONE of the worst forms of interference which is troubling manufacturers of television receivers is that caused by medical diathermic apparatus. This apparatus is actually a small transmitter working on a wavelength similar to that used for television, which radiates energy for curative purposes. A stray radiation from a powerful apparatus can be picked up by a television receiver a hundred yards away, and manifests itself in the form of a wide band with black serated bars or edges, which occupies about two-thirds of the total screen. At the present time nothing can be done at the receiver end to minimise this interference, other than to move the acrial to a more favourable position.

Extending Ultra-short-wave Sound Transmissions

A PROJECT is afoot whereby the ultra-short-wave sound transmissions which have proved of such excellent quality may be extended. Tests are to be undertaken to see whether one or more of the normal B.B.C. sound transmissions can be radiated from an ultra-short-wave transmitter at Broadcasting House, or, alternatively, use the equipment installed at Alexandra Palace. This will give those people with ultra-short-wave sound sets an opportunity of listening to first-class quality reproduction. If this experiment proves successful, it is possible that other ultra-short-wave radio transmitters will be established in the provinces, and these can then eventually be used in the various regions where television stations are to be erected.

On Your Wavelength

By THERMION

Good Out of Scotland!

I WAS wrong when I said that few good things came out of Scotland. I must withdraw that. I have learned better and must apologise to my Scottish friends for straying in my technical juvenescence from the paths of rectitude and veracity. I am caused so to retract my remarks because I read in the paper that at a meeting of schoolboys they unanimously decided to ask the B.B.C. to ban crooning. There's perspicuity and perspicacity for you! An Englishman (note, my dear Scots, the subtle distinction between Englishman and Britisher) is well past the age of maturity before he realises that crooning is a bum art, as our Yanks would say. My thanks also to many Scots who have sought to complete my education by telling me how little I know about history. But, then, what do they know of Scotland who only Scotland know? I have not had one letter from a Scot resident in England; they evidently when in Rome do as Rome does, and forget their hatred of the English which is manifest from so many of their letters.

The Coronation Not to Be Televised

AFTER all the fuss and bother about televising the Coronation, I learn that it has been decided not to do so. Why? Are there technical difficulties in the way? Are not the television engineers equal to this simple task? Are there political reasons against it? I am all against national flummery, and am fixed in my belief that this country has had far too much of it in the past five years, but a Coronation only happens once or twice in a lifetime, and therefore does not come within that classification.

One critic ingenuously remarks in supporting the B.B.C.'s policy in not televising it, that it would only appeal to those lookers living in London, and they are within a twopenny bus ride of the ceremony itself. This critic does not deserve a hat through which to talk. Old people are wiser to-day than to wish to be herded about like cattle in a field to watch a ceremony which may not last many minutes from their point of observation.

They would prefer to watch the ceremony from the comfort of their own homes, and with the additional advantage that they would see flashes from various points of the Coronation course. Is it, therefore, part of a plan to drive the public to see the Coronation in order to attract the largest crowd possible? That is, indeed, a very laudable object, for His Majesty's subjects are anxious to demonstrate their loyalty and fealty. I am considering elderly folk who would love to be present, but do not feel equal to the crush; or perhaps it is that the authorities feel that there are not sufficient television sets in operation to make the broadcast worth while. Here again, the actual number of sets in use would not be a true index of the number who would actually see the programme. If there are only 500 television sets in use in London, at least 25,000 people would see the programmes. I hope it is not too late for the authorities to change their mind.

Longevity of Volume Controls

A.B., of Parkstone, referring to my grouse about volume controls, mentions one for which he paid 9s. 6d., and which he fitted five years ago to the A.C. Super Sixty. It has never been removed from the set, he says, and it has never given any trouble. It does not crackle and works as smoothly and silently as when it was new.

Tempo Rubato

FROM a daily paper: "Tempo Rubato I may perhaps be permitted to remind you is robbed or stolen time, meaning a slight deviation to give more expression by retarding one note and quickening another, but so that the time of each bar is not altered in the whole. . . . In a book on symphony published in 1916 I discovered this definition of rhythm: 'The swing or lilt of the music; certain movements, as, for example, the first allegro in Beethoven's Seventh Symphony, are much more rhythmic than others.'" I am glad to know this, as a journalistic friend of mine with a few stock clichés would have said. The correspondent who sent me the above cutting says that jazz bands give him the impression of a blacksmith's shop in the middle of the Zoo. What an insult to a blacksmith's shop in the middle of the Zoo.

Television Inventions

NOW is the time for the enthusiast to try his hand at television. I am very intrigued with the experiments which apparently may be undertaken in the field of mechanical reception, and I have had one or two shots at it myself. I must admit I have not been very successful, but it would be interesting to know whether any readers have tried experiments in this direction, and if so, with what results. The cathode-ray apparatus is expensive, and no doubt this prevents many from trying their hand at building a receiver. The original disc receiver, such as we used for 30-line pictures, is definitely out of the question. But what about combinations of discs, or lenses and discs, or even the mirror-drum plus disc? The fact that one of the television systems has a definition of 240 lines leads one to suppose that some form of multiplier (eight times the original 30 lines) should give some results, although admittedly, when trying to get the interlaced type of picture with a definition of 405 lines there may be complications. I should like, however, to hear from amateurs who have tried to do something about this.

New Gramophone Records

NO doubt hundreds of experimenters are interested at the announcement that the sound-on-film method of recording for home use has now been perfected, and that before very long the apparatus will be on the market. I understand that a complete all-wave radiogram will be sold at about 30 gns., and that the records will cost about 10s. 6d. and 21s., the former playing for about half an hour, and the latter for an hour. The material is not standard cinema film, but a special material which is much cheaper to produce, but the ordinary method of reproduction (via a photo-electric cell, etc.) is employed. If the amateur can do his own home-recording on this arrangement (direct from the radio programmes) I can see some interesting possibilities. I can also see some drawbacks, but perhaps I had better not mention these. We shall, at least, be able to record the whole of the Saturday Music Hall programme (when all of it is worth recording) and listen to it on Sunday and on the other days when uplift programmes are in force. And how fine to be able to listen to a complete opera, without surface or background noises.

Interesting History

MR. E. J. CRAKER, of South Norwood, wonders if any reader can dig up anything prior to the following extract from Addison's Spectator No. 241, Dec. 6th, 1711: "Electric Telegraph Anticipated. Strada, in one of his effusions, gives an account of a chimerical correspondence between two friends by help of a certain lodestone, which had such virtue in it that if it touched several needles, when one of the needles so touched began to move, the other, though at never so great a distance, moved at the same time and in the same manner. He tells us that the two friends, being each of them possessed of one of these needles, made a kind of dial plate, inscribing it with the four-and-twenty letters in the same manner as the hours of the day are marked. They then fixed one of the needles on each of the plates in such a manner that it could move round without impediment, so as to touch any of the twenty-four letters. Upon separating from one another into distant countries, they agreed to withdraw themselves punctually into their closets at a certain hour of the day, and to converse with one another by means of their invention. Accordingly, when they were some hundred miles asunder, each of them shut himself up in his closet at the same time appointed and immediately cast his eye upon his dial plate. If he had a mind to write anything to his friend, he directed his needle to every letter that formed words which he had occasion for, making a little pause at the end of each word or sentence to avoid confusion. The friend, in the meanwhile, saw his own sympathetic needle move itself to every letter which that of his correspondent pointed at. By this means they talked together across a whole continent, and conveyed their thoughts to one another in an instant over cities or mountains, seas or deserts."

Speaker Connection

WHEN a constructor converts his battery receiver for all mains operation he often wishes to retain the speaker that was used in conjunction with the battery valves. Although it is possible that the speaker would give satisfactory results when connected in the anode circuit of the mains output valve, it is unsafe to make this connection in all cases. Small permanent magnet speakers designed for use in conjunction with battery type valves usually have a small output transformer attached, and the primary of this is designed to carry an approximate maximum current of 30 mA. Mains pentodes and power valves have a higher consumption than 30 mA, however, and therefore the transformer primary winding is liable to burn out if connected direct to the speaker sockets.

Parallel Connection

IF a small speaker of this type is to be used, the safest procedure is to connect an L.F. choke having an inductance of 20 to 30 henries and a current carrying capacity in excess of the mains valve consumption in place of the speaker. The valve anode end of this may then be connected via. a 2-mfd. condenser to one of the speaker leads, with the other speaker lead connected to H.T.—. Apart from the damage which direct connection is likely to make to the speaker transformer, the output valve can also be damaged due to the application of screen voltage after the anode circuit has been broken.

Pentagrid or Triode-Hexode?

THE triode-hexode valve is very commonly used as a frequency changer nowadays, but it does not seem to have ousted the pentagrid. It is claimed that the triode-hexode is more efficient than the pentagrid and that it is also more suitable for use in short-wave receivers. In short-wave sets it is advisable to use the triode-hexode if it is desired to tune below approximately 16 metres, but above this wavelength the pentagrid is quite as effective in practice. Although it is customary to tune the oscillator grid circuit of the pentagrid and the oscillator anode circuit of the triode-hexode, both valve types will work with either the grid or anode circuit tuned, and they may be interchanged without altering the wiring of the valve-holder. Experimental work is therefore very easily conducted. When substituting a pentagrid for a triode-hexode permanently, however, the anode and screen voltages should be carefully checked.

All Waves

WHY is it that several of those listeners who have recently bought all-wave receivers say that short-wave reception is unsatisfactory? We amateurs who have been using short-wave sets for many years merely chuckle, but I am afraid that we often miss the B.C.L.'s point of view. First and foremost is the fact that we know how to operate a short-waver; how to turn the knob very slowly; how to recognise a telephony transmission as it is tuned in; and when to turn the tuning knob backward again after a transmission has been "passed."

Another point is that we have learned that certain wavelengths are more productive of good signals at certain times of day. For example, the 19-metre band is generally best during daylight. Near dusk the 25- and 31-metre bands are better, whilst late at night, signals generally "come over" better on wavelengths from 30 metres upward.

The listener who is accustomed to medium- and long-wave reception only is inclined to expect too much. He thinks that because signals from all over the world can frequently be received at excellent strength, reception should be as reliable as that from the local station. He also overlooks the fact that interference is more noticeable—especially if a suitable aerial system is not employed—without appreciating that if "wanted" short-wave signals travel better than those on the higher wavelength, the "unwanted" signals must behave somewhat similarly. A little patience and practice in tuning, combined with the use of one of the many anti-interference aerials, would do much in showing many of those who are inclined to decry short-wave reception that they are blaming the set instead of themselves.

Practical Television

February 13th, 1937. Vol. 3. No. 37.

THE TIME BASE

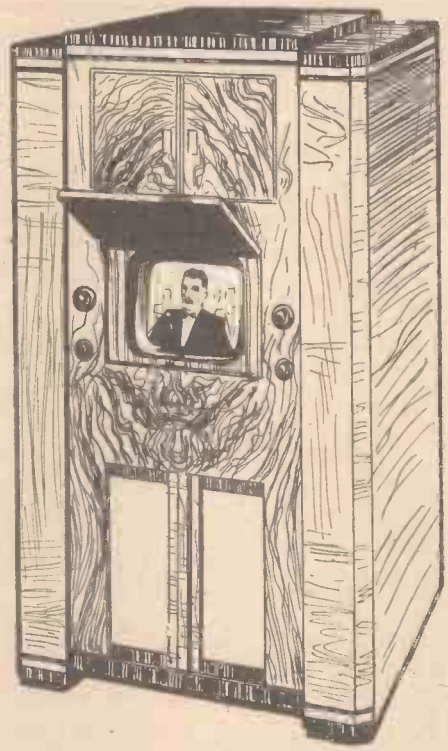
The Theoretical Considerations and Practical Methods of Assembling this Section of the Television Receiver. By W. J. DELANEY

THE most fascinating section of the complete television receiver is undoubtedly the time base, as it is this which gives to the spot on the screen of the cathode-ray tube the correct movement to trace out the complete picture area, generally referred to as the "format" or "raster." Under the present system two different types of movement are required. For the Baird system the spot must travel from the top left-hand corner of the screen across to the right, return to the left-hand side at a point slightly lower and travel across beneath the preceding course. This process must be repeated so that a complete picture format is built up consisting of 240 lines, one below the other (Fig. 1), and 25 of these complete picture areas must be completed each second. The distance traversed by the spot (and which forms a line owing to persistence of vision and slight time lag in the fluorescent material from which the screen is made up) must be adjusted by means of the time base so that the complete area possesses a ratio of four horizontal to three vertical, and there must be 25 picture traversals per second.

With the E.M.I. system, however, two separate frames are built up, each of 202.5 lines, and these are interlaced. This means that the spot first travels along as in the Baird picture, but when it returns to the left-hand edge of the picture it drops lower than in that system. If the lines were numbered we should find that the first traversal would be on line number 1, but the next would be on number 3, and the next on 5, and so on. When the format is completed, the spot returns to the beginning of the space where line number 2 should be, and when this is completed the next line is in position number 4. Thus the complete picture is built up of 405 lines and the frequency of the complete picture is also 25 complete frames per second.

Trigger Circuits

The movement of the spot is caused by potentials applied to two sets of plates, arranged in pairs at right angles to each other inside the cathode-ray tube, and the electron stream passes between these. The function of the time base is to apply the necessary varying potentials to the deflecting plates, as they are called, and thus there must be four separate outputs in the time base, each working correctly in order



The G.E.C. Television Receiver. Note that the panel controls are reduced to a minimum, and a protecting cover is provided for the end of the C.R. tube.

to give the spot its correct movement. This is carried out, in its simplest form, by the discharge of a condenser, and there are in use at the present time two separate systems for effecting the movement. The more usual system employs a gas-discharge tube, or gas-filled relay, between the anode and cathode of which is connected a fixed condenser. When a voltage is applied across the condenser it commences to charge up, and at a certain value, it discharges across the relay or discharge tube. The gradually rising voltage is applied to the deflecting plates, and naturally the capacity of the condenser is critical, as it is this which governs the time taken to reach a certain value, as well as the maximum voltage which is obtained.

Hard Valves

The above description is necessarily brief and non-technical, but it describes the function sufficiently well to understand the complete time-base circuit. An alternative system is the subject of a patent taken out by the Cossor Company, and in place of the gas-discharge tube an ordinary wireless valve is employed. This consists of an ordinary H.F. pentode which is used in conjunction with an ordinary triode. The condenser is connected between anode and cathode of the triode valve, and the grid of this valve is joined to the anode of the pentode. The anode of the triode is also connected to the grid of the pentode. When the condenser is totally discharged the cathode of the triode (which is connected to the anode of a further valve in the time-base circuit) receives the same voltage as its anode. As the condenser commences to charge the voltage on the cathode of the triode drops with the changing difference in potential across the condenser, and as soon as it reaches a value slightly positive compared with the grid anode current will commence to flow. This in turn causes the anode voltage to fall and the pentode receives a corresponding negative potential. The effect of this is to speed up the rate of discharge, and consequently this circuit works very rapidly, and is slightly cheaper to construct than the gas-discharge type. It is true that certain additional valves are needed in the hard-valve time base in order to obtain maximum results, but these compare with the push-pull valves generally employed to obtain a balanced output in the gas-discharge circuit, and it will be found that the general cost of construction is lower, and the efficiency is higher, when the correct values of the various components and the correct working voltages are obtained.

Constructional Details

The circuits briefly described above have to be duplicated for the two sets of plates, and naturally it is imperative to avoid interaction between the two sections. They may be built end-to-end, or side by side with a fair separation to avoid interference between leads and components. It is also necessary to use separate voltage supplies for certain of the valves to avoid interaction and other defects. The section

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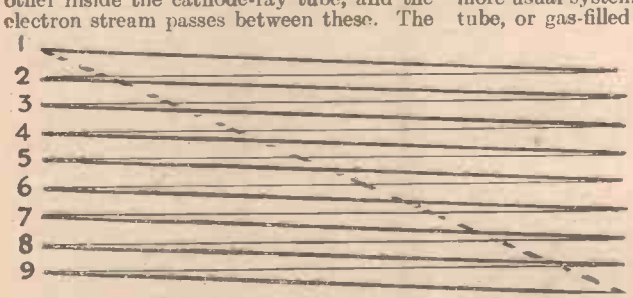


Fig. 1.—The above diagram shows how the picture area of the Baird System is built up in a regular manner. Each line is formed immediately below the preceding one, and it is claimed that the alternative system shown in Fig. 2 avoids flicker. The dotted line shows the course of the spot in its return to the commencement of the picture area.

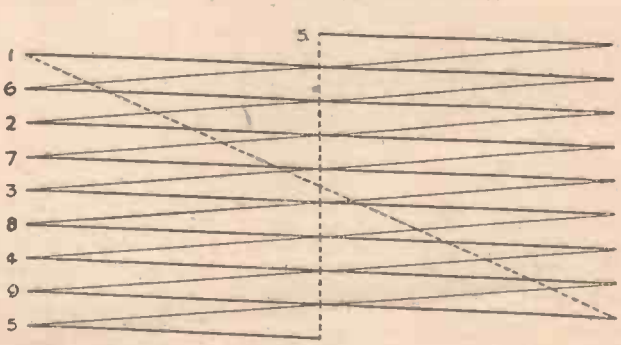


Fig. 2.—How the lines are interlaced to build up the screen in the case of the Marconi-E.M.I. transmissions.

PRACTICAL TELEVISION

(Continued from previous page)

which controls the line movement must be built with a very low capacity to earth, and therefore if a metal chassis is employed some care is necessary to ensure that condensers and leads are kept well clear of the surface. Failure to do so will shorten the length of the line traverse. A number of adjustable controls will have to be fitted, although certain of these may be arranged so that they are convenient to adjust when the circuit is first put into operation, when they may be left alone until some change in valves or other components renders it necessary to readjust them. Of these there will be the line amplitude and line frequency, as well as corresponding controls on the picture side. There may be an additional control to regulate the input from the radio receiver, unless a gain control is fitted in the I.F. circuits to regulate the signal strength. A switch will have to be fitted to make the necessary change in condensers for use on the two systems of transmitting, although when the B.B.C. adopt a single system this adjustment will be avoided. The leads from the time base to the cathode-ray tube should be kept as short as possible, and if a horizontal tube is desired the mounting for it should be on the time base so that the holder for the tube is in a convenient position for the connecting leads. A better scheme is to mount the tube holder in the centre of the chassis, between the two time-base circuits, when all leads will be rendered much shorter, and the tube will be easier to mount. This will mean, however, that a mirror or similar reflector will have to be fitted inside the lid of the cabinet in order to view the picture on the end of the tube, and if you are working to a published circuit, the connections to the deflecting plates will have to be reversed as the mirror reverses the picture. A final point, which may eventually be avoided, is that a shelf or screen should be placed above the time base so that the valves are not rendered visible through the glass of the cathode-ray tube. The silvered surface of the valves may catch outside lights and cause brilliant patches of light in the picture. For this purpose certain modern tubes are blackened or enclosed in a metal screen.

Television Notes

This Standard Question

WITHIN the last few weeks all sorts of rumours have been heard concerning the possibility of the Television Advisory Committee coming to a decision with reference to the choice of a single standard for television transmissions from Alexandra Palace, Unfortunately, confusion has arisen because some writers have used the word "system" for "standard." Either of the two systems now employed by the B.B.C. is capable of working on any given single standard, so that the companies concerned do not enter into the problem in the strict sense of the word. That a standardised form of signal would be a material benefit no one will gainsay, but any hasty or premature choice may cause difficulties. For example, Germany has been radiating signals for three years now with their experimental service, and the standard employed is 180 lines, scanned progressively with a picture speed of 25 per second. The authorities responsible for television development in that country are still uncertain as to the wisdom of making a final choice for any nation-wide service. Again, in France, the same situation exists, while in America where continuous experiments are being undertaken, most of the demonstrations have been staged on a 343 line definition basis, the scanning being interlaced. The latest news from that continent, however, suggests that the R.M.A. are keen on choosing 441 lines, this figure being recommended to the Federal Radio Commission.

A certain measure of economy in production costs will be effected when the time-base generator is only called upon to provide a single type of potential variation at the given line and frame speeds, but apart from that the present-day television receiver will need no alteration. In addition, the Television Advisory Committee have stated publicly that no question of receiver obsolescence will become evident for a period of at least two years. One of the main ideas behind the choice of a single standard is to provide the B.B.C. with more studio accommodation. In any case, it seems certain now that no public announcement will be forthcoming until after the Coronation. The televising of this pageantry is expected to give the B.B.C. service an enormous fillip, and receiver sales should reach unprecedented figures, while the home construction of sets will be a material factor which is sure to increase the number of viewers at that time.

Useful Suggestions

IN an effort to maintain and, if possible, increase public interest in television, several reasonable suggestions have been made. One of these is that there should be a "floating" daily period which would enable events (outdoor or studio) to be televised when the time of occurrence does not coincide with the normal hours of transmission. This would be most valuable, for the producer could plan some extremely interesting items either of local or widespread application. Yet another scheme proposed is the radiation of a simple still picture, say, a geometric figure, at certain stated daily periods so as to allow experimenters and manufacturers to carry out important tests. A signal of known constant modulation levels is most useful for this class of work, for very frequently adjustments are made to sections of the apparatus because of picture changes which are attributed to the receiver, when all the time this is happening at the transmitting end. This is particularly noticeable in film transmissions where changes in the density of the pictures necessitate careful adjustments in control levels in order to give the required degree of modulation.

In this Marconiphone television receiver a vertical tube is used, and the image on the end of the tube is viewed in a mirror.

Installation Problems

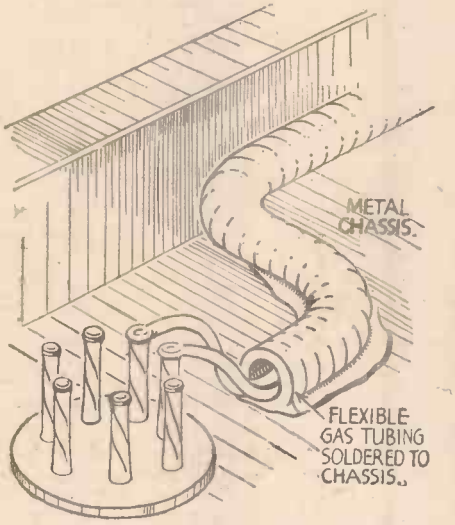
EACH company now marketing television receivers has built up an efficient department of service and installation engineers to deal with any problems likely to arise in connection with equipping homes with television receivers. While a certain number of difficulties were anticipated, they have not been so numerous as at first expected. This is largely the result of careful research into aerial design, coupled with the development of various types of efficient feeder cables. In some cases a dipole aerial is used with a form of Zepp connection made up as an efficient signal frequency transformer to give the necessary impedance matching between the aerial and the feeder line to the receiver. In other cases a simple dipole, with a flexible twin wire from a split centre point, has been all that is required in order to ensure maximum signal pick-up from the Alexandra Palace transmitter, coupled with the highest signal-to-noise ratio. This simple type of installation is sufficient in those residential areas on fairly high ground well away from any main road traffic. In other cases a single strand metal-screened feeder has to be employed, the centre air-spaced copper conductor constituting the signal feed, while the screening is earthed and acts as the second connection. Inside aerials provide adequate pick-up in some cases, and so simplify installations very materially, but in others sufficient height has to be achieved by using a mast fixed to the main chimney breast or alternatively, positioned in the garden. With the aerial attached to the top of the mast no difficulty is experienced. In every case, however, it is advisable to link both aerial and set by the transmission cable taken over the shortest possible route, with very sharp bends or untoward kinks carefully avoided. Damage to the feeder cable will reduce very materially the signal-to-noise ratio.

A PAGE OF PRACTICAL HINTS

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

Screening Heater Leads

I HAVE found flexible gas tubing excellent for screening heater leads and H.T. leads in A.C. mains receivers. Its great advantage is that one can get twin flex or several H.T. leads through it at the same time; also, it is very strong and can be fixed down by straps of metal or even soldered to a metal chassis. Care must be taken in cutting to have the ends quite smooth. I have found that tinning them with a liberal coating of solder finishes off the ends nicely. Another use is as a protector for accumulator leads from acid spray while charging is in progress.—JAMES CHRYSTAL (Edinburgh).



Using flexible metallic tubing for screening heater leads.

Making Cheap and Efficient Stand-off Insulators

GLASS, being one of the best of insulating materials, was chosen to form the supporting pillars for the home-made stand-off insulators shown in accompanying sketches. A length of ordinary test tube (stocked by most chemists) was procured for the purpose, and cut up into short lengths.

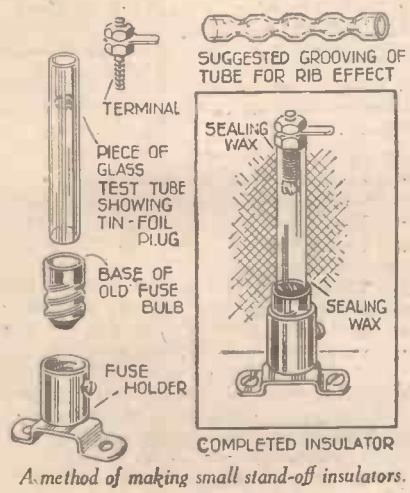
The main difficulty was to find a suitable method of fixing the tube to the baseboard, and also securing the terminal at the top. This was accomplished by means of ordinary sealing wax, a few burnt out fuse-bulbs, and the bracket type of holders shown in the sketch.

First of all, the glass bulbs of the fuses were broken, and the remnants of glass and cement cleaned out with a small file, thus leaving small hollow screw caps.

To make an insulator, take one of these caps, place into it a small quantity of sealing wax and heat until melted. The glass pillar is then inserted and held vertical until the wax has set. The terminal at the top is fixed in a similar manner, but in this case a small plug of tinfoil is first pushed in to prevent the wax running down the glass tube. The insulator is then complete, except for screwing it into its holder, which in turn is screwed to the required position on the baseboard.

Stand-off insulators made in this fashion will be found quite efficient, and, provided the glass pillars are not too short, there should be no unwanted capacity effect between the terminal and metal fixing holder. It may, however, be found preferable to use bakelite-type holders in place of the metal ones shown, and, of course, the glass pillar could be cemented directly into them if desired. When soldering connecting wires or small components to the tag of the insulator, a piece of damp cloth should be held against the terminal and glass tube to prevent the wax melting. In any case, the latter will soon re-set hard as soon as the connection is made.

A suggested rib effect may be obtained by heating the glass test tube (before constructing the component, of course) in a blow-pipe flame, and slightly stretching the tube when at melting point, the different points being treated in turn, a shape on the lines of that shown in the sketch being thus obtained.—R. L. GRAPER (Gillingham).



A method of making small stand-off insulators.

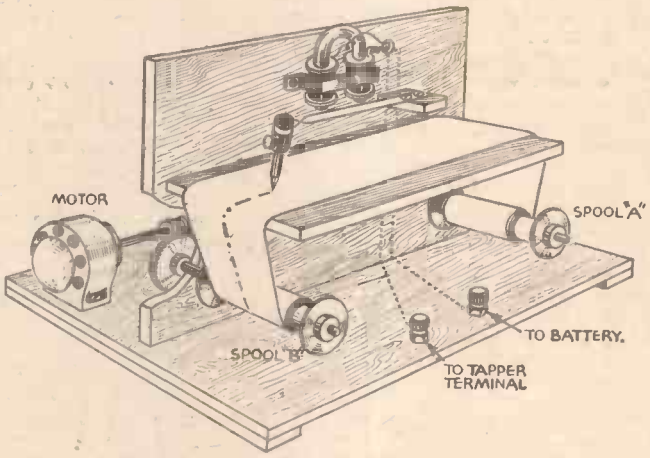
THAT DODGE OF YOURS!

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., Tower House, 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.

A Simple Morse Recorder

AN easy way to learn the Morse code is to listen to one of the slow-sending amateur Morse transmitters and then to tap out a fictitious reply (having the tapper joined in series with a Morse recorder and a battery), afterwards comparing the record on the paper with the reply.

A simple Morse recorder is shown in the accompanying diagram, and the sizes can be arranged to meet personal requirements. The parts required for making the recorder are: a thin piece of springy steel to which is attached a pencil-holder removed from an old pair of compasses; a spool of paper; a strong electro-magnet; two terminals; a pencil; some wire and a slow-running electric motor, which can be mounted on the baseboard, as shown.



A simple Morse recorder for practice purposes.

The paper is made to travel from spool A, over a shelf, on to spool B by means of the electric motor. The Morse is recorded, by having the pencil pressing gently against the paper (the pressure being applied through the springy steel arm). The electric motor is then allowed to run, the pencil traces a continuous line along the moving surface of the paper. Any current flowing through the electro-magnet attracts the steel arm, lifting the pencil off the paper and discontinuing the line until the current ceases to flow in the electro-magnet. Thus a short blank will represent a dot, and a long blank a dash.—JOHN MCLEOD (Edinburgh).

USING VISUAL TU

In this Article the Auth
Essential in Superhets, and

IF a receiver *not* fitted with automatic volume control is detuned, the volume of sound increases. It is by listening for maximum volume that the set is correctly tuned to the wanted station. Due to the fact that the selectivity of the H.F. and detector stages of a straight receiver is not so great as that of the I.F. stages of a superhet, slight detuning, providing it does not introduce interference from a station of nearby wavelength to the wanted station, will not cause audible distortion.

Where A.V.C. is fitted, however, the action of the circuit tends to keep the volume in the loudspeaker at its original level on detuning. Aural tuning is, therefore, very difficult, and often quite impossible.

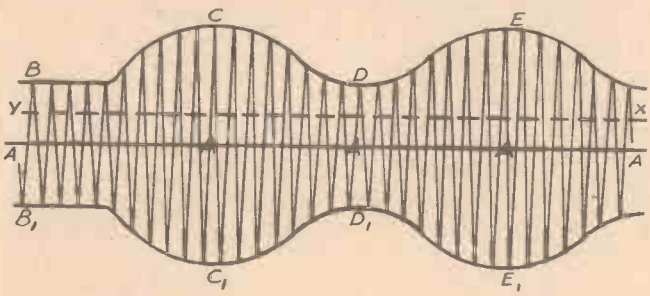


Fig. 1.—Diagram of carrier wave and audio-frequencies, showing correct (A), and incorrect (X) tuning points.

Carrier Wave and Sidebands

It is well known that the received signal consists of a carrier wave on which are superimposed the audio frequencies constituting the transmission. The frequency of the carrier wave, of course, determines the wavelength of the station, and, as such, does not vary in frequency, and is, furthermore, inaudible. The audio frequencies, which are known as sidebands, are spaced equally on each side of the carrier wave by an amount equal to the transmitted note concerned. For instance, the frequency of a particular note may be 5,000 cycles per second, and this frequency, because it is an alternating current, must appear on either side of the carrier.

The carrier wave is thus the centre of the group of frequencies comprising the transmission, and it is this which is tuned. This is depicted pictorially in Fig. 1, where the carrier wave is shown for simplicity as a straight line A.

When the microphone receives a sound pressure wave or a musical note, the equivalent electrical current is generated in the microphone and amplified, and is used to change the amplitude of the signal with changes in the sound wave. As the pressure increases, the signal increases to a value indicated by the wave A.C. As it decreases, so the signal falls to a value indicated by A.D. Then it increases and decreases again, and so on. The line joining the tips of the successive variations in waveform, B, C, D and E, represents the musical notes.

It will readily be apparent that for true amplification of the musical notes comprising the transmission, the receiver must be tuned to the centre of the group of frequencies transmitted, when the side bands on both sides of the carrier will be faithfully reproduced, that is, of course, if the selectivity has not been made too high, and the L.F. stages are capable of dealing faithfully with all frequencies.

Result of Detuning

Now suppose that the receiver is not quite correctly tuned, but to a point slightly removed from the true centre of the transmission, and indicated by the line X. Due to the A.V.C. action of the receiver, the signal in the loudspeaker will tend to remain at constant strength, but it will be apparent that quality will be very poor, due to the fact that part of the sidebands are now being cut. The effect is generally to make reproduction harsh with over-emphasis of the sibilants.

It is due to the action of the A.V.C. in tending to keep the volume output constant that an apparent flattening of tuning (as indicated by the dotted line in Fig. 2, where A is the exact resonant point of the wanted transmission) is produced.

During this levelling-up process, however, the carrier wave still has a definite resonant point. When the receiver is tuned to this point, the A.V.C. fed back to the controlled valves will be at its greatest, and the characteristics of the variable-mu valves will be altered accordingly. As the A.V.C. increases, more bias is applied to the valves, and the anode current of each falls.

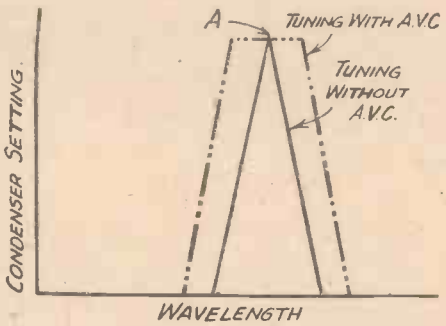


Fig. 2.—A.V.C. tends to give an apparent flattening of the tuning, thereby losing the exact resonant point A.

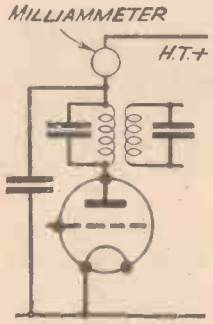
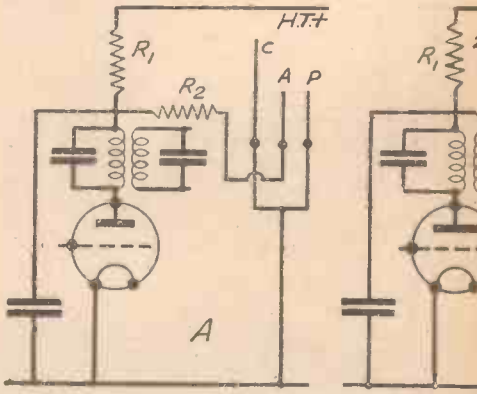


Fig 3.—Showing the use of a milliammeter as a tuning indicator.

If we connect a suitable milliammeter in the anode of a valve which is controlled by A.V.C., as shown in Fig. 3, the meter reading will vary in accordance with the strength of the signal and we shall, by tuning to the lowest reading, be able to tune in the wanted station accurately.



Figs. 4 and 5.—Circuits for using the Cossor neon tu voltage on the anode under conditions of no signal and this will rise by 30-40 volts as the receiver is

CALIBRATIO

This Table of Transmissions is for Use described in PRACTICAL AND AMATE

W9XAN, Elgin Observatory, Ill. U.S.A.

Date.	*G.M.T.*	*Freq.*	*(kc/s.)*	
Jan. 20th	22.00	7,000	40 *m.*	
	22.08	7,100		
	22.16	7,200		
	22.24	7,300		
Jan. 23rd	02.00	3,500	80 *m.*	*Signalling Procedure on each Frequency:* 2 mins. "QST QST QST de W9XAN."
	02.08	3,600		
	02.16	3,700		
	02.24	3,800		
Feb. 6th	02.00	7,000	40 *m.*	3 mins. Letter "O" repeated, followed by call W9XAN and statement of freq. being transmitted.
	02.08	7,100		
	02.16	7,200		
	02.24	7,300		
Feb. 10th	22.00	14,000	20 *m.*	1 min. Repetition of call W9XAN, statement of frequency and announcement of next freq.
	22.08	14,100		
	22.16	14,200		
	22.24	14,300		
Feb. 13th	02.00	7,000	40 *m.*	2 mins. Change to next frequency.
	02.08	7,100		
	02.16	7,200		
	02.24	7,300		
Feb. 17th	22.00	7,000	40 *m.*	*N.B.*—Only those frequencies usually to be heard in this country are given here. Accurate time-keeping is essential—G.M.T.
	22.08	7,100		
	22.16	7,200		
	22.24	7,300		
Feb. 20th	02.00	3,500	80 *m.*	
	02.08	3,600		
	02.16	3,700		
	02.24	3,800		

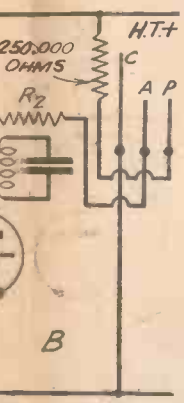
...NING INDICATORS

...or Explains why they are ... Discusses Suitable Circuits

The price of a typical meter specially designed for this purpose is about 8s., and no further components in the shape of resistances and condensers are necessary.

Neon Tuning Indicators

The Cossor Neon Tuning Indicator (price 4s.) has been found very successful. It is easy to connect, and two circuits which have been successfully used by the author are shown in Figs. 4 and 5, and are simpler than that suggested by the makers. The circuit in Fig. 4, however, is the simplest which can be used, but has the disadvantage that the current taken by the tube itself is now greater, while it is not so sensitive in its action. By suitable adjustment of the resistance R.1, the tube may be made just to glow when no station is received, and to give a large rise of the glow when even a weak station is tuned in. Care must be taken to see that the glow does not reach maximum on local stations before they are accurately tuned in, but even then it is still possible to tune accurately by the actual intensity of the glow after it has reached its maximum level. The resistance R.2 shown may only be necessary if maximum glow takes place too soon, or if the tube does not extinguish properly.



...ning indicator. The ... should be 140-160, ... correctly tuned.

The device operates on the following principle: as a station is tuned in, the valve becomes more biased due to the A.V.C. voltages fed back, less anode current flows, and thus, by Ohm's Law, the voltage drop across R.1 decreases (in practice, by about 30-40 volts). The voltage applied to the tube, therefore, increases and the glow spreads. It is as well to make R.1 as large as possible in order to get a large variation in voltage across it as the signal is received. For example, suppose the current flowing through R.1 with no signal is 4 mA, and that it decreases to 2 mA as the station is received. If R.1 is 5,000 ohms, the variation in the voltage drop across R.1 will be only 10 volts, and this will cause little variation in the glow in the neon tube. If, however, we can make R.1 20,000 ohms, we shall have a change in voltage of no less than 40 volts, which will give rise to a large indication in the tube. Therefore, providing the valve will work efficiently, and that the volts applied to the tube are sufficient to cause it to glow slightly under conditions of no signal, R.1 should be made as large as possible.

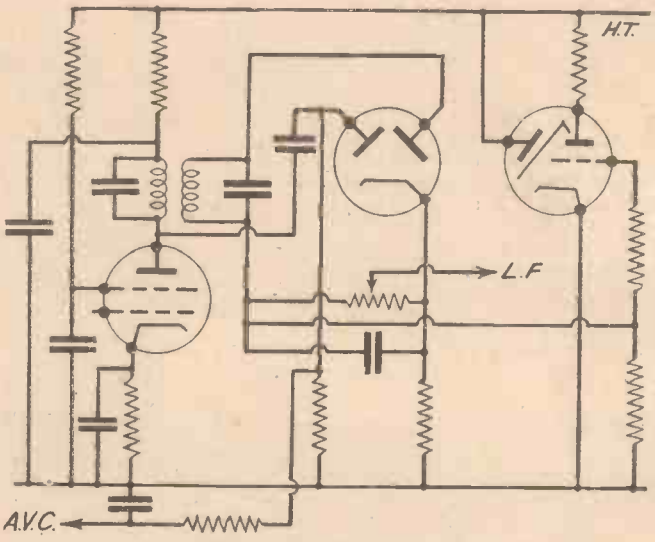


Fig 6.—Connections for the Mullard electron beam tuning indicator (type TV4).

Other types of neon tuning indicator, such as the Micromesh Tunograph, and the G.E.C. Tuneon, use the same type of circuit and work in the same manner.

The "Magic Eye"

The latest type of indicator is sometimes known as the "magic eye," and consists of a miniature cathode-ray tube combined with a small triode amplifier in the same bulb. The device costs 17s. 6d., and is at present for use on A.C. mains only. This type of indicator varies from the others we have discussed in that it is dependent for its operation not on the variations in anode current of the controlled valves, but on the rectified output of the detector.

As the rectified output increases due to a signal being tuned in, the grid of the tube becomes more negatively biased, and this grid voltage is amplified by the triode portion of the indicator and applied electronically to the ray control electrode, thus increasing the intensity of the electron stream from the cathode to the target. This target is the phosphorescent end of the tube, and the construction is such that the luminous image appearing on it under conditions of no signal is as shown in Fig. 7 (A). As the signal is received, the arms of the cross gradually widen and assume the position shown in Fig. 7 (B), when the station is tuned in accurately. Full details of this system were given in our issue of September 19th last, and it has the advantage that it is extremely sensitive.

A little-known system of visual indication is shown in Fig. 8. Two L.F. chokes are wound on a common core, and choke L.1 is connected in the anode circuit of

(Concluded on page 657)

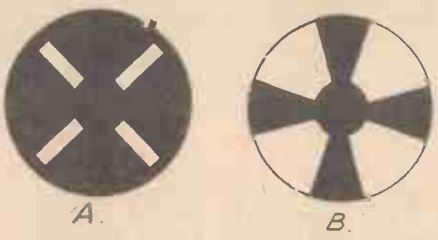


Fig. 7.—The image appearing on the screen of the Mullard electron beam tuning indicator, under conditions of (A) no signal, and (B) maximum signal.

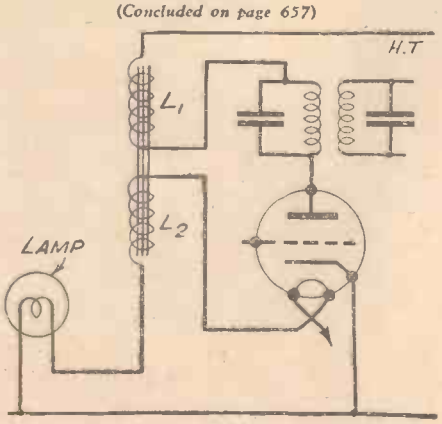


Fig. 8.—A little-known method of visual tuning indication.

...ON SIGNALS

... with the Heterodyne Frequency Meter ...UR WIRELESS, dated January 16th.

W6XK, Don Lee Broadcast, Los Angeles, Cal., U.S.A.

Date.	G.M.T.	Freq. (kc/s.)		
Jan. 23rd	00.00	7,000	40 *m.*	
	00.08	7,100		
	00.16	7,200		
	00.24	7,300		
Jan. 25th	00.00	14,000	20 *m.*	*Signalling Procedure on each Frequency:*
	00.08	14,100		
	00.16	14,200		2 mins. "QST QST QST de W6XK."
	00.24	14,300		
...6th	04.00	7,000	40 *m.*	3 mins. Letter "M"
	04.08	7,100		repeated, followed
	04.16	7,200		by call W6XK and
	04.24	7,300		statement of frequency being transmitted.
Feb. 20th	00.00	7,000	40 *m.*	1 min. Repetition
	00.08	7,100		of call W6XK,
	00.16	7,200		statement of frequency and announcement of next frequency.
	00.24	7,300		
Feb. 22nd	00.00	14,000	20 *m.*	2 mins. Change to
	00.08	14,100		next frequency.
	00.16	14,200		
	00.24	14,300		

N.B.—As W6XK is a West-coast station, it is rather more difficult to receive, especially on the 40-metre band.

It will be noted that these two stations W9XAN and W6XK work the schedule "in and out," so that there is a standard frequency transmission regularly available.

Both stations welcome reports to the addresses given.

RECEIVER DESIGN IN 1937

In This Article the Author Discusses Possible Improvements in Receivers

IN 1936, roughly two million people bought wireless sets. Of these, a relatively small percentage had never owned a set before, whereas the majority discarded their old love for a new one; doubtless a proportion were *forced* to buy a new set because they were no longer able to hold together some ten years' old contraption.

Many bought a new set because it offered some advantage over their existing one by virtue of the improvements incorporated in it. It may be that their need was greater selectivity, longer range, better tone, or perhaps they desired an all-wave set with which to recapture the thrill of really long distance reception.

With the exception of a few real enthusiasts, the two million referred to will not buy new sets next year, but as there are approximately seven and three-quarter million licences, there are well over five million people, some of whom will purchase a set in 1937, but many of them will only do so if improvements in design will give them sufficiently tempting advantages to warrant scrapping a serviceable instrument.

Manufacturers, trade, and public alike are looking to 1937, all equally anxious to know what advance will be made.

There is, of course, always the chance that somebody will invent something really new. This is a factor which cannot be taken into account, but at the moment of writing nothing of this nature has appeared on the horizon, and in forecasting the 1937 Radio Exhibition attention can only be directed to the possibility of improvement on existing themes. Our investigation along the lines of possible improvements will be greatly facilitated by dealing separately with each of the many desirable characteristics of a radio receiver.

Sensitivity

Commencing with sensitivity, a moment's thought will serve to show that an increase in this direction, while easily obtainable by the obvious means of an additional stage, or stages, will definitely add nothing to the usefulness of a receiver, as any good five-valve superhet to-day will bring in every station that is not so weak that the ratio of receiver signal to local interference is bearable. Greater sensitivity will only bring in those very weak stations which are so weak compared to local interference and static that reception becomes a mere farce, sounding like the all too familiar racket suggestive of a giant frying sausages, completely drowning the programme, snatches of which are only heard occasionally. It is suggested, therefore, that although sensitivity can be achieved either by detailed improvements to coils or valves, or by the obvious method of additional stages, nothing will be accomplished from the ordinary listener's point of view.

A 1933 receiver noteworthy for its ornate fretworked front and large tuning scale. This may be compared with the illustration of the modern receiver above.

Background Noise Suppression

Sensitivity, as already shown, is largely tied up with the question of background noise suppression. It has always been understood that the bulk of static and man-made interference is inseparable from deliberate broadcasting from the transmitter, as owing to the general similarity of characteristics of both forms of ether waves it would be impossible to separate them, in the same way that it would be impossible to separate two glasses of water once they had been mixed together. This problem has received very considerable attention in England by the Radio Research Board and other interested bodies, and also in America. Up to the present, as far as ordinary broadcast receivers are concerned, nothing has been done beyond taking steps to ensure that the background noise on distance reception is not rendered worse than it need be. The very fact that bad design can increase background noise without increasing the desired programme, shows that there is definitely some fundamental difference between the two, and to the writer's way of thinking holds out considerable hope that a new technique may be developed capable of suppressing such interference. If this can be done completely, a Utopian ideal will be reached where practically any station in the world may be received at real entertainment value, the range of a receiver being limited only by its sensitivity (which in turn can be almost unlimited) and atmospheric conditions, which, of course, can sometimes so divert the propagated wave that a specified area is completely blind either always, or at certain times of the day. As far as is known the Americans have made considerably more headway in this direction than anybody else, and it may confidently be expected that vitally important developments will be made public within a few months.

Quality Reception

The quality of reproduction is of utmost importance, as good quality reception is prized by both long-distance enthusiasts and local-station listeners. Excellent as the quality of reproduction is in modern receivers, it cannot be denied that there is considerable room for improvement both in the radio set itself, and in the loudspeaker. Improvement in the latter must necessarily come about in gradual stages as the result of devious and painstaking research, but improvements in the quality of reproduction in the receiver are already well in advance of general practice, as consideration of price makes it impossible for manufacturers of the relatively cheap sets to incorporate the desirable features that are standard in expensive instruments, costing £50 and upwards. Unfortunately the necessity for producing all-wave sets at an economical price has tended to bring about a slight decrease in quality in order that extra sensitivity may be gained. This is frankly a pity, but it is a thing that will sort itself out in the course of time.

An ultra-modern radio cabinet design, in which all controls and other outward signs of a radio receiver have been avoided.

Many readers who have well designed, up-to-date receivers, may condemn the writer in what is to them the certain knowledge that the reproduction on their own set is perfect. To this the writer would reply: "Wait until a pianoforte solo is being played, and then strike a few chords on grand piano in the same room, and note the contrast."

Selectivity

Next let us turn our attention to selectivity. Can any improvements be made in this direction? The modern superhet with band-pass tuning can be adjusted to almost any degree of selectivity, the limitations being the effect on quality. Broadcasting stations to-day cut their frequency range at about 9 kilocycles, as this is the allotted span between stations. To increase the selectivity of a superhet to, say, 6 kilocycles would mean the loss in a musical scale of that section between 6,000 and 9,000 cycles, which would result in everything sounding rather

lifeless. Curiously enough cymbals and big drums would be surprisingly affected; half a dozen instruments could be thrown out of a string band without the listener detecting any difference; sopranos and lady speakers would sound as if they had bad colds, and so on. There are, of course, ways of artificially accentuating the higher end of the register by correction in the L.F. section, but such arrangements are not very satisfactory, tend to increase background noise, and render reproduction unconvincing. To sum up, selectivity can be increased without the necessity for any further development, but only at the expense of quality; therefore it would seem that no development can be expected in this direction unless the crystal gate technique can be radically cheapened.

It is necessary to state clearly that by "selectivity," ease of adjacent station separation is intended, and it is not intended to convey interference due to double images breaking through, and kindred troubles, all of which are rapidly disappearing in modern receiver design.

A.V.C. Systems

The last twelve months have seen remarkable improvements in the efficiency of A.V.C. systems, and 1937 will definitely bring still further improvements. There is no question that A.V.C. systems should control both the L.F. amplifier (where one is used) and the output stage. Admittedly all sorts of arguments can be put up against controlling the output stage, but the writer is definitely of the opinion that such a course would be advantageous, taking into account all the circumstances. It is obvious that automatic volume control working on the second detector stage can never bring about perfect volume level, as it is the change of volume on the detector that controls the system. This will be more readily understood when it is realised that if the system were perfect, it would mean that the input to the detector remained constant, and if the input to the detector is constant, it cannot control the stages before it, as it is the change in the detector that exercises the control. This may sound rather complicated, but a little thought should make the explanation readily understandable.

If, then, the input to the detector cannot be completely controlled, it is obviously necessary to control the gain after the detector if apparently level volume is to be maintained from a fading station. In fairness, however, it must be said that automatic volume control as it exists in practice to-day gives volume sufficiently level to appear completely level to the average ear.

Touching on ease of control, the modern superhet is so simple that any further advance in this direction must of necessity be unimportant. The same remarks apply about the individual controls themselves. The smoothness of the volume control is perfectly adequate, and with compensated volume control, as fitted to many 1936 receivers, loss of quality and reduced volume is obviated. There is one factor—reliability—which is unquestionably of paramount importance, but it hardly comes within the scope of development. The same remark is true of price, but it may be mentioned in passing that while it is reasonable to think that 1937 sets will be found more reliable than their predecessors, it is unlikely that there will be any important reduction in cost for a given standard in value. It is hinted in certain usually well informed circles that there may be actually a tendency for prices to rise.

Items of Furniture!

In conclusion the writer would like to put forward a belief of his own for manufacturers to realise that nobody wants a wireless set, but merely the sound that comes from it, and it is high time that radio sets ceased to look like the dashboard of a motor-car, and become pleasing additions in the average house. Please do not let it be inferred that the suggestion is to try to make a wireless set look like a clock; by all means let a wireless set retain its individuality, but spare us the sight of knobs, scales, switches and gadgets! The average person does not operate the controls for more than one minute in two hours, and there is no justification for not hiding them. The writer likes to have warmth, light and music in his lounge; to do this, however, he is spared the presence of a gas meter and an electric light meter in the same room. Why, therefore, the works of the wireless set? Some manufacturers have unquestionably already produced cabinets which discreetly hide the knobs, but generally speaking no advance has been made in this direction since the days when the "cat's whisker" had to be easily available for constant adjustment.

CINEMA *v.* TELEVISION BATTLE

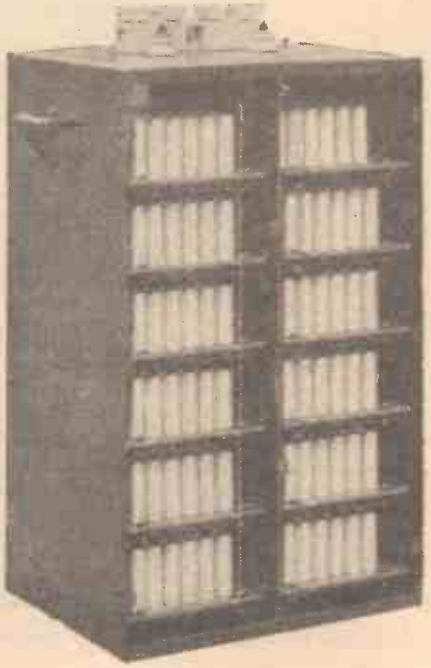
IN one or two quarters the old question of an inevitable clash between the cinema interests and television broadcasting is coming to the front again. On one side it is being stated that television's progress may be slow at the moment, but this is no excuse for inaction. There is a change of front, however, in the assertion that rigid opposition to television will lead nowhere, and vested cinema interests are making every effort to see how they can work in closer association with the new science. After all, the public becomes the final judge, and if they find that some cinemas are willing to show them the latest developments in television they will soon ignore those that do not. A striking example of this is furnished by the Dominion Theatre, London. Each Friday night the Baird Super Screen is included in the programme with the result that large crowds, interested in the innovation, are drawn to the theatre. It has been reduced to a one-night show simply because there is not room in the programme to make it a daily feature. Besides showing outstanding stage, screen, and broadcast personalities, the audience join in by asking questions and receiving answers from the person being televised. The extension of this idea to other cinemas is, of course, a matter of conjecture at the moment, but it seems certain that 1937 will be a big screen year for television, quite apart from any aspect of home viewing on standard forms of receivers.

Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

T.C.C. Electrolytics

ELECTROLYTIC condensers are always clearly marked as to the correct working and peak voltages with which they should be employed, but many constructors overlook the fact that when switching on (and sometimes when switching off) surges take place. The peak surge voltage can often rise to a value considerably greater than would appear on a rough examination of a circuit, and therefore some care is necessary if damage is to be avoided. The aqueous type of electrolytic is to be preferred when surge voltages are not known, and there is a wide limit permissible in the T.C.C. special surge-proof condensers. For instance, in the type 801 condenser, designed for a maximum continuous working voltage of 460 volts D.C., it is permissible to apply a potential of 500 volts or so. Obviously, however, such a high value must not be applied continuously, but the characteristics of the condenser prevent the value rising above a certain value, and the condenser behaves quite normally when the voltage falls to the correct value as it does not puncture.



An interesting assembly of T.C.C. surge-proof electrolytic condensers.

The condenser is available in various values from 4 mfd. up to 32 mfds. at prices from 5s. to 7s. As a matter of interest we give on this page an illustration of a bank of these condensers mounted on removable racks and assembled into a steel tank. The total capacity of the unit amounts to 2,500 mfds., and is suitable for working at 600 volts D.C. plus a super-imposed ripple. The particular bank was made for use in an electric tramway station, and similar units are used in film studios.

High Vacuum Valve Company

WE are asked to point out that the telephone number of the High Vacuum Valve Company, of 113-117, Farringdon Road, E.C.1, has been changed to TERminus 2587 and 2588. This company, of course, manufactures the well-known Hivac valves.

New Lissen Receiver

A NEW A.C. mains transportable has been added to the Lissen range of receivers, and is known as Model 8303. The most important feature of this receiver is the special loudspeaker mounting and arrangement for giving improved reproduction, as a result of which the receiver is to be known as the "Set with the Balanced Sound Chamber." The new cabinet design enables reproduction to reach a high level without blind-spots or distorting angles. No aerial or earth are required for the receiver, which incorporates four valves (including rectifier) and is designed for use with a pick-up. Sockets for an external aerial and earth are fitted when it is desired to make use of these outside aids. The price is 10 guineas.

New Bulgin Valveholders

A NEW range of chassis-mounting valveholders for English standard valves is being introduced by Messrs. Bulgin. These are to be made in accordance with recent British Standards dimensions, and are assembled from bakelite plates. A special feature is the inclusion of a special interleaved plate to provide a long leakage path, and this feature has been patented. The holders are of the resilient type, and perfect contact is obtained when the valve is pushed home. Special soldering contacts are fitted, and these are so designed that solder cannot run into unwanted places. The assembly is carried out in such a way that the upper plate forms a guard and prevents the valve from being damaged due to contact between the wrong pins and sockets, and no electrical contact can be made until the valve is correctly arranged. At the moment there are three types, No. V.H. 34 for 4-5-pin valves, No. V.H. 35 for 7-pin valves, and V.H. 36 for 9-pin valves. The prices are respectively 6d., 9d. and 1s.

New Mazda Tuning Indicators

THE Edison Swan Company announced the forthcoming release of two new visual-tuning indicators of the cathode-ray type, one designed for use in A.C. mains receivers, and one for use in the universal A.C./D.C. type of receiver. The design of this type of indicator, and method of using it, is explained on pages 148 and 149 of this issue, but circuit details of the Mazda component, and technical details have not yet been released.

Rothermel Microphone

AS from February 1st, the price of the model D.104 Piezo electric microphone, supplied by Messrs. Rothermel, has been reduced to £4 10s.

SHORT WAVE SECTION

A Three-stage Amateur Band SW Receiver

In this Article the Construction and Operation of a Three-valve Receiver for the Amateur Waveband is Described

THE intending amateur transmitter and the short-wave listener who finds his main interest in the amateur wavebands both require a receiver which, while it may be suitable for short-wave broadcast reception, is primarily designed for listening on the amateur bands.

One very often finds, however, that in the first case the amateur is so taken up with the transmitting side that he more or less overlooks the importance of receiver efficiency and as time goes on pays less and less attention to it, with the result that his over-all station efficiency suffers. The SWL, on the other hand, usually finds his way into the amateur wavebands after having either bought or built a short-wave receiver originally designed for general short-wave reception, and which may or may not be fitted with band-spread tuning; the manufactured set is usually not so fitted, and his results are accordingly not nearly as good as they should be.

In this article, therefore, it is proposed to outline the requirements of a straight receiver for operation on the amateur bands, and then to describe a suitable design for the purpose.

Essential Requirements

The essentials in such a receiver are band-spread, ease of handling, absolute stability even at the highest frequencies, sensitivity, selectivity, an output stage which can be switched to a speaker when signal strength permits, and a wave-range covering the amateur bands of 10 to 160 metres. There are probably few straight receivers which satisfy all these requirements, and superhets designed to cover them are usually somewhat expensive and deficient in other respects, such as having a low signal-noise ratio, the commonest failing in this type of receiver, particularly on the short waves. An amateur short-wave superhet having all the latest refinements and control circuits, such as crystal-gate, noise suppression, A.V.C., band-spread, "single signal" characteristics and so on, is undoubtedly a remarkable performer, but the additional elaboration involves considerable expense which the average amateur would rather devote to the transmitting side.

A Three-stage Amateur Band Receiver

Coming now to a straight receiver which represents an up-to-date design and which will give good service, consider Fig. 1. This shows a battery-operated three-stage arrangement in which the first point to notice is that all feed circuits are decoupled. This may seem a little unnecessary in a battery set, but it results in a marked gain in stability, particularly on ten metres. The first valve, V1, is a screen-grid or H.F. pentode, the input circuit using the arrangement first described by the writer in PRACTICAL AND AMATEUR WIRELESS for February 16th, 1935. The value of an H.F. stage, whether tuned or untuned, preceding the detector valve, has often been pointed out in these columns, and it is now standard practice in a modern straight short-wave receiver. In the present instance, the input circuit C1-L1-R.F.C., is designed to operate tuned on the 160 m. band and untuned on the others. On closing the DPST panel switch S1-S2, C1-L1 becomes the input tuning circuit for 160 m., while on the other bands, with S1-S2 open, C1 is cut out and L1 and R.F.C. put in series to obtain the required impedance across grid-filament of V1. The necessary data is given in the table of values.

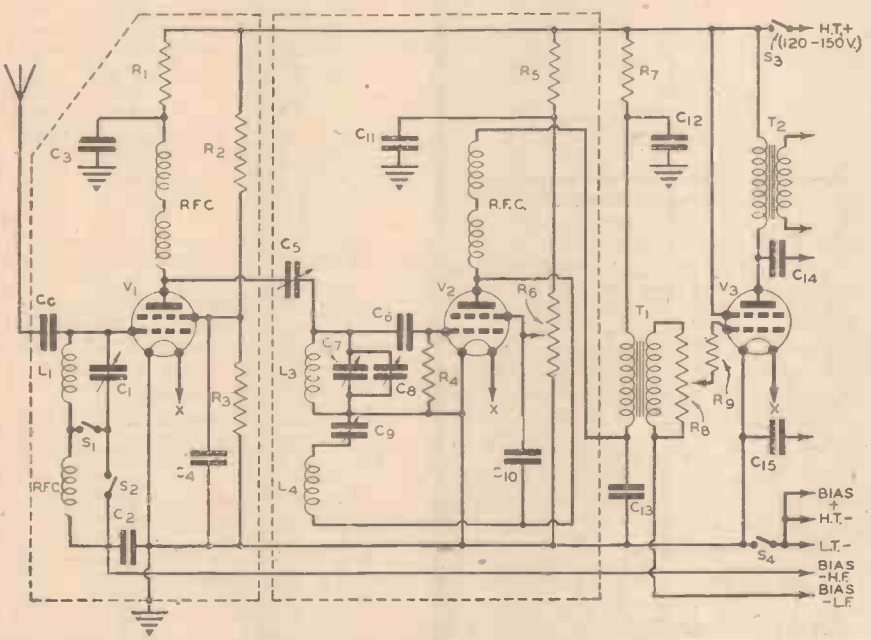


Fig. 1.—Suggested circuit arrangement of Three-stage Amateur Band SW Receiver. Dotted lines indicate separate screening boxes for H.F. and detector stages. For modification of H.F. stage, giving input tuning on 80 and 160 metres, see Fig. 2. All necessary data is given in table of values.

H.F. Input

While on this point, it is worth arranging matters so that H.F. tuning can be used on 80 m. as well, and an alternative input circuit is shown in Fig. 2. L1 is the 80 m. coil, L2 a second coil of similar value, since they

(Continued overleaf)

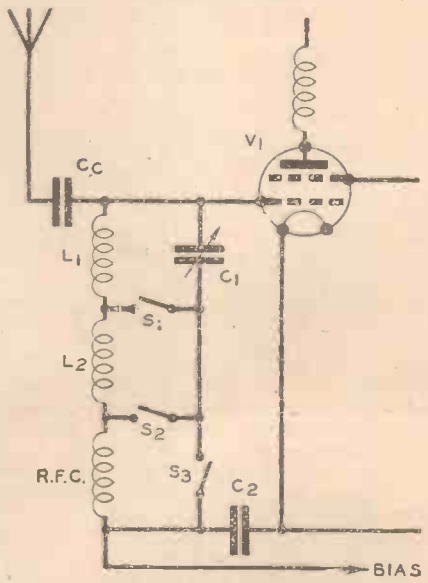


Fig. 2.—Suggested arrangement for H.F. stage tuning on 80 and 160 metres. Coil data is given in the table of values. Switches S1, S2, S3 should be SPST, R.F. type, and mounted on panel.

SHORT-WAVE SECTION

(*Continued from previous page*)

are put in series for 160 m., and R.F.C. is the H.F. choke. In practice, L1 and L2 comprise a centre-tapped winding, which itself tunes the 160 m. band. With the switches S1, S2 and S3 closed, L1-C1 tunes the 80 m. band. With S1 open, and S2 and S3 closed, tuning over 160 metres is obtained. With all three switches open, L1-L2-R.F.C. are in series, making the input circuit aperiodic for 40, 20 and 10 metres. A further point to notice is that by closing S3 and leaving S1 and S2 open, the condenser C1 is placed across this aperiodic circuit and can be used as an input volume control, H.F. energy being by-passed as its capacity is increased from minimum towards maximum. If it has a very low minimum capacity, as all good condensers should have, placing it in parallel with L1-L2-R.F.C. at the minimum capacity setting should not involve any noticeable reduction in signal strength on any band from 20 metres up.

H.F. Output

The output from the H.F. stage is coupled into the grid circuit of the detector through the condenser C5, which is a low-capacity, air-dielectric variable. C5 plays a big part in the performance of the receiver, in that both the input to and the selectivity of the detector grid circuit is controllable. A setting of this condenser can be found to give the best compromise over a wide range of reception conditions. For instance, if the receiver has to be operated through bad local-station interference, the input can be cut down and the selectivity of the circuit L3-C7 increased by adjusting C5 towards its minimum. Similarly, with bad interference on the 40m. band, on which, when conditions are good, large numbers of European stations come in on top of one another, a setting of C5 can be found which will help in sorting them out while still keeping signals at comfortable strength.

Band-spread Arrangement

The circuit L3-C7-C8 is the usual band-spread arrangement, to which reaction is applied by means of C9-L4. The detector valve is a screen-grid, thus improving the sensitivity and ease of control of the receiver owing to the fact that the screen-grid potential can be closely adjusted by means of the potentiometer R6. This makes it possible to get the smoothest reaction effect.

The output from the detector is coupled, through the high-ratio transformer T1 to a pentode V3 as the final stage, with a grid-blocking resistor at R9. The plate circuit of V3 is arranged for either 'phones or speaker operation by using an output transformer T2 for the speaker—assuming some form of M/C instrument—the phones being put across C14-C15. Low resistance headphones should be connected to appropriate tappings on the output transformer.

The H.F. chokes R.F.C., with the exception of that in the grid circuit of V1 which is described in the table of values, should consist of short-wave and broadcast chokes in series. This is particularly important in the plate circuit of V1, where it is possible to get resonance effects with its grid circuit such that "break-through" of broadcast and long-wave commercial stations is experienced as a background to the short-wave signals to which V2 is tuned. The recommended values should, however, obviate this, unless the receiver is used in the vicinity of a powerful station with the input circuit untuned on 80 and 160 metres. Short-wave chokes can be home-made by putting three sections of 50, 75 and 100 turns each of No. 32 enamelled wire on a 1in. diameter former, with about ¼in. between sections.

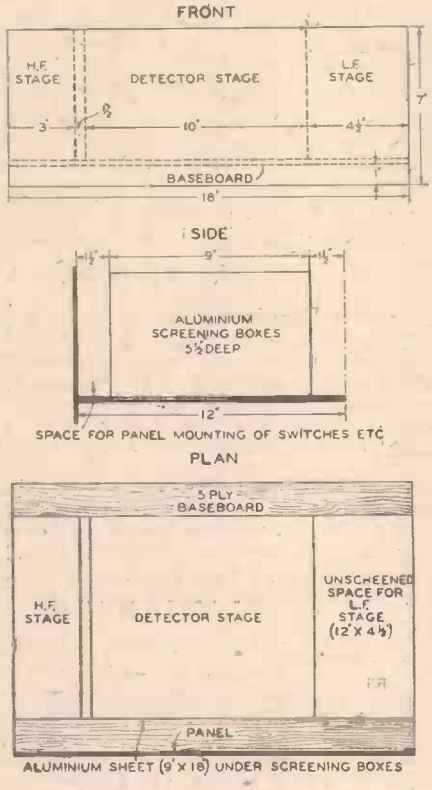


Fig. 3.—Details of construction of baseboard, panel, and screening compartments.

Main Tuning Control

Condenser C8, the band-spreader, is the main tuning control, and for this is recommended a split-stator type such as the "J. B." midget twin, or the Cyldon "Bebe" series-gap. The grid coil L3 is connected across the two stators only, the rotor being left free. This arrangement also tends to improve stability, and removes any possibility of trouble due to noisy or disconnected pig-tails.

With regard to the coils L3 and L4, for which the data is given for home-construction, it will be found that though the standard manufactured type of plug-in coil can be used instead, their turns values are arranged from the point of view of maximum frequency coverage in a set intended for general S/W reception. This means that in some cases the 20- and 40-metre amateur bands will be found on the same coil, at minimum and maximum capacity of the band-setter C7. Owing to the low L/C ratio thus resulting on 40 metres, this is most undesirable. Another point is that the manufactured type will take up a good deal more room than the home-made variety.

Coil Construction

The suggested construction of these coils is quite simple and they will be found to be extremely efficient. The former in each case consists of a piece of ribbed ebonite rod 1in. in diameter by 1¼in. long. The wire used is No. 32 enamelled, and the turns are close-wound on all except the 10 m. coil, on which they are slightly spaced. These small formers are tapped 4BA at one end—the ribbed rod will be found to have a hole running through its entire length—and are mounted on a small piece of ebonite about 1¼in. square. This carries four valve-pins to which the coil connections are made, the former then plugging into a low-loss valveholder mounted on a small stand-off insulator. The circuit connections are taken to the valveholder terminals, and the net result is a coil assembly about half the usual size, having a very small field, and a high turns-ratio.

General Layout

Trouble taken in the layout and construction of the receiver will be well repaid by results. The diagrams in Fig. 3 show a recommended form of construction. The panel is ebonite, though the two first stages VI and V2 are totally enclosed in aluminium screening boxes, as indicated. These boxes are bolted to a wooden baseboard over which is laid a sheet of aluminium, there being a space of 1in. beneath the baseboard for the by-pass condensers and resistors. The condensers C1, C7, C8 and C9 are mounted on brackets with extension rods brought out to the controls on the front panel. Note that this involves drilling both the front of the screening box—plain holes, clearing the rods—and the ebonite panel. This method of construction improves screening and shortens considerably the important grid and plate leads in the detector circuit. The condenser C5 should be mounted in the run of the wiring in the detector stage screening box—it is not necessary to bring it out to the panel—and the connection between it and the plate of V1 should be screened.

If the preliminary adjustments are carefully made, the receiver will be found to be exceptionally "smooth" and easy to handle, and tuning, except on 160 and 80 metres where the H.F. stage is tuned—if the circuit of Fig. 2 is used—resolves itself into "one-knob control," that of C8. Correct adjustment is largely a question of getting R6 at the proper setting to give smooth reaction. This setting will probably be found to vary from band to band, but with the coil values given the *reaction* adjustment of C9 should hold over a large frequency spread.

(*To be continued*)

TABLE OF VALUES.

R1, R5, R7, 10,000 ohms, 1-watt; R2, 40,000 ohms, 1-watt; R3, 50,000 ohms, 1-watt; R4, 4-megohm grid-leak; R6, 50,000 ohm, 2-watt potentiometer; R8, ½-megohm volume control; R9, 25,000 ohms, 1-watt. RFC, See text. T1, High-ratio coupling transformer; T2, Output transformer. S1, S2, DPST switch, R.F.; S3, S4, DPST switch, on-off; Cc, see text; C1, .00025 mfd; C2, .01 mfd; C3, C4, C10, C11, C12, 1 mfd; C5, 50 mmfd. midget; C6, .0001 mfd; C7, .0002 mfd, band-set; C8, split-stator band-spread, 50 mmfd each section, see text; C9, .0002 mfd, reaction; C13, .001 mfd; C14, C15, 2 mfd.

COIL DATA

Band.	L1.	RFCg.	L3.	L4.
1.7 Mc.	25	60	46	30
3.5 Mc.	L1 and RFC in		25	16
7 Mc.	series below		13	9
14 Mc.	160 metres		5	5
28 Mc.			3	4

All coils wound on 1in. diam. formers of ribbed ebonite rod, in 1¼in. lengths, using No. 32 enamelled wire, close-wound, except for 28 Mc, where the turns of L3 should be slightly spaced. The two windings L3/L4 of each coil are spaced about ¼in.

The various bands will be found with C7 about half to two-thirds in mesh. If the circuit of Fig. 2 is used, coil L1/L2 can be 26 turns centre-tapped.

VALVES SUGGESTED

	V1.	V2.	V3.
Mazda	VP.215	SG.215	Pen.220A
Hivac	SG.220SW	SG.220SW	Y.220

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.

S. G. (Narborough). It would appear that the trouble is due to some inductive effect in the pick-up leads, and that at a certain setting of the control the input impedance is brought to such a value that the trouble is introduced. We have never met this peculiarity and think it must be due to your control or the circuit you are using.

E. B. (Maidenhead). We are sorry that we cannot give the connections, as the coils differ, and the manufacturers in question have made several different types.

W. W. (Burton-on-Trent). You cannot use the alternative coil suggested. There should be no delay in obtaining the coils, and if you let us have details of the dealer, etc., we will take up the matter with the manufacturers.

A. H. (Rochdale). C1 may be .01 mfd. and C2 a similar value. R2 should be chosen between .25 and 1 megohm, and R4 between 10,000 and 30,000 ohms. We cannot see how the arrangement is intended to function with the remaining two resistances R1 and R3 and these appear to be unnecessary.

T. N. (Wanley Castle, Worcs.). An H.F. pentode may be substituted, but you could not use the variable bias on the detector stage. You may have to modify the anode load in order to obtain an improvement in the total volume given.

F. F. (Southampton). The volume control may have an incorrect value, and you should communicate with the makers of the receiver or their nearest local service agent regarding the correct method of using the pick-up on this set.

G. E. (Farndon). We cannot give full constructional details in the form of a reply. You should obtain the back number, where full constructional and operating details are given. You did not enclose a stamp or addressed envelope with your letter.

R. B. (Sanguhar) and Others. You are quite correct in stating that the accumulator is in opposition to the mains voltage. The current passed will not, therefore, rise to .5 amps. The battery resistance changes whilst it is under charge.

F. J. U. (Singapore). You may send your queries in the usual way. We make due allowances for the date of the query coupon in cases such as yours, and you are entitled to the same service as English readers.

H. F. S. (Harringay). You could not feed the valve heaters from the eliminator as they take too much current. You need a barretter or series resistance so as to feed the heaters direct from the D.C. mains and a transformer cannot be used on D.C.

C. P. (N.15).—It is not possible to give the data without the thickness of the core and the material from which it is made.

A. V. (Sheerness). It would be preferable to obtain a new receiver, as you have been informed. To try and convert the set so as to use Universal valves might lead to a tremendous amount of trouble and some difficulties might be found insurmountable. We advise you to get a Universal (A.C./D.C.) receiver, so that any future changes which you might have to make would not render the set obsolete.

B. G. H. (Bromley). The reception is certainly very good, but you must not overlook the possibility of freak conditions, and the trouble which sometimes arises on an unselective set, of one station being brought in on the carrier wave of another. The stations mentioned do not share their wavelength, but are separated by quite a considerable amount. Your set is not selective enough to separate them.

P. W. S. W. (Eastbourne). A suitable circuit will be found in the first article on transmitting, in our issue dated November 28th last.

K. C. S (Hertford). A fixed condenser (as in the usual output filter circuit) is all that is necessary.

A. J. W. (Sparkhill). The trouble may be due to a faulty grid condenser or grid leak. We presume that the frame aerial has not been kept near the accumulator, as the acid fumes may have eaten into the wire.

G. B. (Leytonstone). A temporary surge to the value mentioned is usual, but the current should not remain at that value. It may be due to the switch not breaking instantly, or to the valve characteristics. A scratch filter is the only cure for the excessive noise mentioned.

L. C. (Nottingham). The other side of the reaction condenser should be joined to the earth line. If it is mounted on a metal panel (which is earthed) no connection is needed, as the spindle will be in contact with the panel and the earth connection will be obtained in that manner. The choke is to keep the H.F. currents from the L.F. stage and therefore the connection is in order. The low value of resistance is a stabiliser.

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Club Wanted: S.W. Activities in Australia

SIR,—I should be very glad to get in touch with a few short-wave clubs near New Southgate. I have in mind a little morse practice, and later on I hope to build your 2½-watt transmitter.

The following paragraph which appears in the "Listener In," an Australian publication, might interest other readers.

"A very interesting state of short-wave affairs is developing in Australia, where the Commonwealth Government, through the P.M.G. Department, is planning to install a number of short-wave broadcasters throughout the Commonwealth. One, of course, will be the new VK3LR, which is to have its power increased to 5 kW. An eventual increase to 20 kW. is projected.

"A.W.A. has planned a new S.W. station which will carry the call sign VK6ME for Perth (W.A.). Little is known of the progress being made with this transmitter, but listeners may rest assured that it will not be long before it is in commission."—S. W. GREIG, 30, Park View Crescent, New Southgate, N.11.

[*Local club secretaries are invited to get in touch with Mr. Greig.*—ED.]

Loan of Oscillator Required

SIR,—I would like to get into touch with someone who lives in my neighbourhood, and who possesses a test oscillator which I could borrow for the purpose of ganging a superhet I have constructed. Although particulars of the set were published in your pages, I cannot claim free servicing, as the circuit was gathered mainly from the series "Designing your own Wireless Set." I remain, a great admirer of your paper.—M. C. MATTHEWS, 9, Well Road, Hampstead, N.W.3.

"Acoustic" Output

SIR,—Readers at times get a bit confused with the word "output" of a receiver, and perhaps the small experiments which I carried out may explain matters.

I used two commercial all-mains receivers, one delivering 2 watts undistorted output, the other 3.5 watts. The first receiver's volume control was turned full on, the same with the other, resulting in this case in the 2 watts output being much louder than the 3.5 watts output. I then continued to experiment, taking a battery set, with a pentode delivering approximately 1 watt output. A P.M. speaker was then fixed to a baffle a foot square, with excellent results. I then increased the baffle to 2ft. square. Output was greater than with first baffle used. I next placed the 2ft. baffle in a chamber—cube shape—and the volume was up to all-mains standard. Coming back to my two all-mains receivers with which I commenced the experiment, I removed the backs of each, and both sets fed their outputs to P.M. speakers. The 2-watt receiver's speaker was mounted in a larger chamber, the cabinet being much larger than that of the 3.5-watt receiver. The experiment thus shows that it was "volume of sound" I heard in the first set, and not actually the output.

So if a reader has a set giving 8 watts, it doesn't always mean that it is better than another giving 5 watts: it all depends on its "acoustic" output. I mention that this experiment is on "output" and must not be confused with the "range" of the sets, as my trials were carried out on the local station, but what I am aiming at proving is that it is *not* necessarily the loudest or "boomy" set that is best.—JOHN W. LEECH (Llandudno).

The Band-spread S.W. Three

SIR,—I thank you for your test report on my Bandspread S.W. Three. You recommended the inclusion of a 20,000 ohms resistor, which I have now fitted, and the set now works well. I give below a list of stations received during the past week: W1XAL, JZI, W2XAO, G5XN, W2XAF, G8IX, G5NY, G8BK, G5VX, G5PH, G8CP, G8FY, G2IW, G8GM, GSD, 2RO, G5UI, G8IH, G6JW, G2AI, W3EOC, and W2AU. Wishing PRACTICAL AND AMATEUR WIRELESS continued success.—W. B. WENDON (Brandis Corner, Devon).

CUT THIS OUT EACH WEEK.

Do you know

—THAT special coupling units are available so that any type of valve may be tested in a single valve-tester.
—THAT when adjusting a television time base, the spot should not be allowed to come to rest on the fluorescent screen.
—THAT the above difficulty may be avoided by connecting some source of continuous oscillation to one pair of deflecting plates.
—THAT when using a chassis-built set and experiencing difficulty from interference, it is often worth while to enclose the bottom of the chassis with a sheet of metal.
—THAT in a similar case, a metal screened component mounted on a wooden baseboard or chassis, may often advantageously be improved by covering the lower side with an earthed metal screen.
—THAT vibration of connecting leads can cause erratic tuning effects in a powerful multi-valve superhet.

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., Tower House, 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.

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.

The Croydon Radio Society

LECTURES by members of the Croydon Radio Society are always welcomed, but none more so than that by Mr. W. J. Bird, the Society's Chairman, who spoke on "Modern Sound Film Technique" at the meeting in St. Peter's Hall, on Tuesday, January 19th. After members had seen an actual specimen of sound film, lantern slides followed which were very helpful in making the lecturer's points clear. A vital part of sound film reproduction was the exciter lamp shining on to a narrow slit *en route* to the sound track, and thence to the photo-electric cell. The slit must be narrow, as the beam from it must pick out each individual cycle, with a space on the track of only .0018ins. Mr. Bird's account of the photo-electric cell and its circuit was distinctly useful. Typical amplifiers were discussed, and, naturally, much was said about such accessories as field current supply for loudspeakers, converting mains supply to 110 volts A.C., as well as features of the projection room. One loudspeaker did duty from 30 to 2,000 cycles, and another from 150 to 10,000 cycles. On Tuesday, January 26th, in St. Peter's Hall, S. Croydon, the topic was "Radio Interference," by Mr. F. W. Newson, of the G.P.O., and besides describing cures for electrical interference, he demonstrated them on the Society's quality receiver.

In the demonstration, he placed a small Neon sign generator next to the Society's quality receiver, thereby causing a loud crackle. Immediately, the suppression apparatus was switched on, and complete silence, as regards the interference, was at once noticeable. Hon. Pub. Sec.: E. L. Cumbers, Maycourt, Campden Road, South Croydon.

Portsmouth and District Wireless and Television Society

AT the meeting of the above Society Mr. Pegler demonstrated a two-valve set which covered all wavebands from 9 metres. After giving blackboard diagrams of the circuit and aerial used, he tuned in several stations on the loudspeaker. Lieut. Jackson also demonstrated a 3-valve miniature broadcast set which he had built, using an earphone for a loudspeaker.

Meetings will now be held every Wednesday and Morse practice takes place every Monday. We shall be pleased to hear from manufacturers, and others, who would give demonstrations and lectures.—Harold Leigh, 20, King Street, Southsea.

Halifax Experimental Radio Society

THIS Society carried out some interesting experiments on 40 metres recently, in conjunction with Mr. H. Crewe (G8CB). The receiver was situated at the Society's club rooms in the Friendly and Trades Club, and the transmitter approximately three miles to the north. Both the receiver and transmitter were made by members of the Society. Demonstrations were given of the ability of the amateur transmitter to deal with a large variety of broadcasts, among which were included speech, music from gramophone records, and morse; also a relay of some birds singing was done by taking a microphone near to a local aviary. The results at the club rooms on the receiver were exceedingly good, and particularly the bird singing.

The receiver was a 2-valve (Det. and Power) operated from batteries, and reproduction was by a moving-coil loudspeaker.

The transmitter was crystal controlled, with an input of 10 watts. The microphone was amateur made, being cut from a solid block of slate 6in. by 4in. by 2in. thick, and of the transverse current type.

Hon. Sec.: J. B. Bedford, Oak House, Triangle, Nr. Halifax, Yorkshire.

USING VISUAL TUNING INDICATORS

(Continued from page 649)

the controlled valves. Under conditions of no signal, the current passing though L.1 is at its highest, and the core becomes magnetised. The inductance, and therefore the impedance, of the other choke L.2, is thus at its lowest. A small flash-lamp bulb is connected in series with L.2, one side of the heater circuit, and earth. Were L.2 a simple resistance, the lamp would thus glow, the intensity of illumination being determined by the resistance. When the impedance of the choke L.2 is at its lowest, the lamp glows brightly as the resistance is now fairly low. As a station is tuned in, however, the A.V.C. action reduces the current flowing through L.1, the magnetisation of the core becomes less and the impedance (resistance) of L.2 rises, with the result that the lamp glows less brightly. Accurate tuning is obtained when the glow is at its minimum, or even extinguished.

Practical and Amateur Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS.

CRYSTAL SETS.	Date of Issue.	No. of Blueprint.
Blueprint, 6d.		
1937 Crystal Receiver	9.1.37	PW71
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprint, 1s.		
All-wave Unipen (Pentode)	—	PW31A
Two-valve: Blueprint, 1s.		
Four-range Super Mag Two (D, Pen)	11.8.34	PW36B
Three-valve: Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	—	PW35
Summit Three (HF Pen, D, Pen)	8.8.34	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	22.9.34	PW39
Hall-Mark Three (SG, D, Pow)	—	PW41
Hall-Mark Cadet (D, LF, Pen, (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Genet Midget (D, 2 LF (Trans))	*June* '35	PM2
Cameo Midget Three (D, 2 LF (Trans))	8.6.35	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	17.8.35	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	—	PW64
The Gladiator All-Wave Three (HF Pen, D (Pen), Pen)	29.8.36	PW66
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	5.12.36	PW72
Four-valve: Blueprints, 1s. each.		
Fury Four (2 SG, D, Pen)	—	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG) LF, Cl. B)	6.1.34	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF, Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	7.10.33	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve: Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	10.6.33	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.4.34	PW35C
D.C. Premier (HF Pen, D, Pen)	31.3.34	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	18.8.34	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (R.C.))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Four-valve: Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW29
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF, Pen, D, Push-Pull)	9.2.35	PW47
SUPERHETS.		
Battery Sets: Blueprints, 1s. each.		
£5 Superhet (Three-Valve)	—	PW40
F. J. Camm's 2-valve Superhet (Two-Valve)	13.7.35	PW52
F. J. Camm's £4 Superhet	—	PW58
Mains Sets: Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	1.12.34	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. £4 Superhet 4	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
SHORT-WAVE SETS.		
Two-valve: Blueprint, 1s.		
Midget Short-Wave Two (D, Pen)	15.9.34	PW38A
Three-valve: Blueprints, 1s. each.		
Experimenter's Short-Wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2LF (RC and Trans))	—	PW63
The Bandspread S.W. Three (HF Pen, D (Pen), Pen)	20.8.36	PW68

PORTABLES.

Three-valve: Blueprint, 1s.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	16.5.36	PW65
Four-valve: Blueprint, 1s.		
Featherweight Portable Four (SG, D, LF, Cl. B)	—	PW12

MISCELLANEOUS.

S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE CRYSTAL SETS.

Blueprints, 6d. each.		
Four-station Crystal Set	12.12.36	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450

PORTABLES.

Four-valve: Blueprints, 1s. 6d. each.		
Midget Class B Portable (SG, D, LF, Class B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367

SHORT-WAVE SETS.—Battery Operated.

One-valve: Blueprints, 1s. each.		
S.W. One-valve converter (Price 6d.)	—	AW329
S.W. One-valve for America	23.1.37	AW429
Rome Short-Waver	—	AW452
Two-valve: Blueprints, 1s. each.		
Ultra-short Battery Two (SG det., Pen)	*Feb.* '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve: Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-wave (SG, D, Pen)	*Jan.* 19, '35	AW463
The Carrier Short-waver (SG, D, P)	*July* '35	WM390
Four-valve: Blueprints, 1s. 6d. each.		
A. W. Short-wave World-Beater (HF Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valver Short-waver (SG, D, LF, P)	*Mar.* '35	WM383
Superhet: Blueprint, 1s. 6d.		
Simplified Short-wave Super	*Nov.* '35	WM 397

Mains Operated.

Two-valve: Blueprints, 1s. each.		
Two-valve Mains short-waver (D, Pen) A.C.	—	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	—	WM368
"W.M." Long-wave Converter	—	WM380
Three-valve: Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve: Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	*Aug.* '35	WM391

MISCELLANEOUS.

Enthusiast's Power Amplifier (1/6)	*June* '35	WM387
Listener's 5-watt A.C. Amplifier (1/6)	*Sept.* '35	WM392
Radio Unit (2v.) for WM392 (1/-)	*Nov.* '35	WM398
Harris Electrogram (battery amplifier) (1/-)	*Dec.* '35	WM399
De-Luxe Concert A.C. Electrogram	*Mar.* '36	WM403
New Style Short-waver Adapter (1/-)	*June* '35	WM388
Trickle Charger (6d.)	*Jan.* 5, '35	AW462
Short-wave Adapter (1/-)	*Dec.* 1, '34	AW456
Superhet Converter (1/-)	*Dec.* 1, '35	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May* '36	WM405
Wilson Tone Master (1/-)	*June* '36	WM406
The W.M. A.C. Short-wave Converter (1/-)	*July* '36	WM408

These blueprints are drawn full size.

Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following *prices, which are additional to the cost of the blueprint.* A dash before the Blueprint Number indicates that the issue is out of print.

Issues of Practical Wireless .. .. 4d. Post paid
" " Amateur Wireless .. .. 4d. " "
" " Practical Mechanics .. .. 7½d. " "
" " Wireless Magazine .. .. 1/3 " "

The index letters which precede the Blueprint Number indicate the periodical in which the description appears: thus, PW refers to PRACTICAL WIRELESS, AW to *Amateur Wireless*, PM to *Practical Mechanics*, WM to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the blueprint and the issue (stamps over 6d. unacceptable), to PRACTICAL AND AMATEUR WIRELESS Blueprint Dept., Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

QUERIES and ENQUIRIES

Using A Diode

"Is it possible to use a diode or double-diode for A.V.C. on a 'straight' set whilst retaining reaction on the usual triode detector, or could a D.D.T. be used for amplified A.V.C.? If so, could you give me a diagram? I have tried a Westector on my set (a 5-valve straight, 2 var. mu, Det. and Class B), but owing to the tendency to favour the L.F.'s I find there is very little control on medium-waves."—T. M. (Dublin).

THERE should be no difficulty, with a correctly-designed A.V.C. circuit, in using the Westector. This is, in fact, the only way you can obtain the results you desire, and the article on A.V.C. in last week's issue should enable you to arrange the circuit satisfactorily. We do not favour the incorporation of a double-diode or double-diode-triode valve as a separate A.V.C. valve with the ordinary triode as a reacting detector, for several reasons. If you must dispense with the Westector, one circuit which might be tried experimentally, and which might satisfy your requirements, is to use one variable-mu H.F. stage, followed by a triode H.F. amplifier with a separate triode reactor valve, adopting the Carpenter circuit, but there would not be the same gain in this stage, and following the H.F. pentode, you might find difficulty in arranging for satisfactory tuning arrangements, especially if you use a ganged condenser unit.

An Extension Speaker Problem

"I am contemplating running an extension loudspeaker from the living-room to the sitting-room. From measurements made, the twin flex would be 100ft. long. My receiver is a three-valve, with one S.G. and Pentode output, and I obtain ample volume with the existing speaker. For my extension, I would, of course, use a modern moving coil. Do you think I would obtain comfortable volume from my extension speaker from the above particulars?"—H. B. (Salford, 6).

IF your intention is to include the flex in the anode circuit of the output valve, you would not, of course, obtain satisfactory results. If, however, an output filter is fitted, such as was described in our Christmas number, then the length of the flex does not matter very much. Your mention of twin flex leads us to suppose, however, that you intend to use one lead for each speaker terminal, and thus you may be under the impression that two leads *must* be used. This is not the case. If an output filter circuit is used, only one lead is required, this lead running from the condenser in the filter circuit to the distant speaker, the other side of the speaker being joined to the nearest convenient earth point, such as a water pipe, radiator, etc. If you have obtained twin flex, we suggest that you connect the two ends together so that you will be using a single extension lead of double the effective area, and thus will avoid any possibility of losses of certain frequencies due to a high resistance lead.

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., Tower House, Southampton Street, Strand, London, W.C.2.

The Coupon must be enclosed with every query.

A Metal Screening Box

"Will you please send me the name of the manufacturer of the Three Compartment Screening Box, which was specified in your article, page 760, February 29th, 1936? It was used in the Beat Frequency L.F. Oscillator."—S. H. (Stockport).

THE screening box is not a standard component, but you may obtain a duplicate from E. Paroussi, 10, Featherstone Buildings, London, W.C.1.

One-valver for America

"Could you let me know if there is a blueprint available for the 'One-valver for America' described in your issue dated 23.1.37; if not, can you recommend a one- or two-valve set to get America. I want something which is cheap to make and does not require complicated aerial systems. I would like a blueprint which has got a copy of the paper to help in the constructional details."—M. B. (Parkhurst, I.O.W.).

THE blueprint for the One-valver for America is number AW429, price 1s. With regard to the reception of America, it is, of course, impossible to guarantee that this will be obtained every time you listen. Conditions on the short waves are so variable that you might find on some nights that even a five- or six-valve set will only just get the American stations, and then atmospherics or fading will be so bad that the signals will not offer entertainment value. Under favourable conditions, however, the receiver in question may be relied upon to give you quite good signals, and the logs submitted by readers who have built the receiver confirm this.

Standard Abbreviations

"I am an interested reader of your short-wave paragraphs, but to my dismay I am not able to understand what such terms as 14-20 G.M.T., QSO, QSA, QSL, etc., mean. Please state what they are, as I am sure many other readers are as puzzled as I am."—F. Y. (Yardley Wood, Birmingham).

THE first reference in the list of abbreviations you give is simply the time, G.M.T. standing for Greenwich Mean Time. The 24-hour system is referred to in the quotation you give, and this particular reference means from 2 p.m. to 8 p.m. The "Q" code, together with some other abbreviations used in wireless transmission, will be given shortly in the Short-Wave Section.

Television by Disc

"I have a lot of 30-line television apparatus, and I wondered if I changed the disc to 240 lines to scan horizontal at 25 pictures a second, would I obtain a picture using the Duplex neon lamp?"—A. R. (Brixton).

USING a 20in. disc (which was the most popular size) the diameter of the holes for 30 lines was .02in. To increase the definition to 240 lines, you would need 240 holes (using a single disc), and to accommodate these so that no overlapping takes place and to obtain the correct picture ratio, they would have to be so small that you would not only find difficulty in making the holes, but even when made, they would prove ineffective owing to the small amount of light which would pass through them, and the picture would hardly be visible. If you wish to experiment, we would suggest that you use two or more discs, and try the effect of a combination of slots and holes, somewhat on the lines of the high-definition disc transmitter, but we cannot give you any detailed instructions, and have not ourselves yet found any satisfactory way of using a mechanical receiver.

The 1937 Crystal Set

"Would you please let me know the address of the firm which supplies the crystal detector which is specified for the 1937 crystal set, and the price of the complete crystal, so that I can send direct and save any delay."—D. W. (Inverness).

THE crystal is supplied by the Jewel Pen Co., Ltd., of 21, Gt. Sutton Street, London, E.C.1, price 2s. 6d.

The Coupon on Cover iii must be attached to every query.

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," Tower House, Southampton Street, Strand, London, W.C.2.

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 amplifications, 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, switched, 2/11 each. Pair 5/3. Millammeters, 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, 1/11. RG4 Radiogrand, 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 8 mf., 1/6; 4 mf., 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/-.

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, microdisc 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.

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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.

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

NEW 1937 1-VALVE SHORT-WAVE RECEIVER OR ADAPTOR KIT 13 to 86 Metres without coil changing. Complete Kit and Circuit 12/6. VALVE GIVEN FREE! DE LUXE MODEL 14 to 150 Metres, complete Kit with Chassis, 4 Coils and all parts, 17/6.

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NEW 1937 2-VALVE S.W. KIT, 13 to 86 Metres without coil changing. Complete Kit and Circuit, 19/6. VALVES GIVEN FREE. DE LUXE MODEL, 14 to 150 Metres, complete Kit and Chassis, 4 Coils and all parts, 25/-. VALVES GIVEN FREE. 3-VALVE S.W. KIT, S.G. Det. and Pen., 42/-. VALVES GIVEN FREE!

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!

SPECIAL OFFER. LISSEN TWO GANG SCREENED ALL-WAVE COILS, 12 to 2,000 Metres, complete with switching and wiring diagram, 6/11 per set.

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/-.

MAGNAVOX. Mains energised M.C. Speakers. '154,' 7in. cone, 2,500 ohms, 12/6; '152,' 9in. cone, 2,500 ohms, 17/6; '152 Magna,' 9in. cone, 2,500 ohms, 37/6. Magnavox P.M.s—'254,' 7in. cone, 16/6; '252,' 9in. cone, 22/6. Reliable P.M.s, 10/6.

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GRAMOPHONE attachments for Radio, electric motors, 25/-; pick-ups, 9/6; portable gramophones, 12/-; spring motors, 4/6, dozen 36/-, 100 £12/10/0, 1,000 £100; walnut pedestal Anexagram, £5; soundboxes, tone-arms, horns, cabinets, needles, gears, springs, accessories, cheapest. Quantity buyers obtain lower prices. Catalogue free.—Regentam, 120, Old Street, London, E.C.1.

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HOLBORN 4631.

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LISSEN 4 VALVE UNIVERSAL AC/DC RECEIVER, fitted in handsome dark finish Walnut Cabinet of upright design, clock face tuning, Volume Control, Reaction Control, etc., a really fine receiver, £4 15s.

EXCLUSIVE BRITISH RIGHTS HELD BY US FOR CONSTRUCTRAD KITS (AMERICAN) During the sale, these Kits are offered as follows:—

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2 Valve Battery Kit complete with valves, 25/-
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These are complete sets, not converters, covering a wave band of 15-600 metres by means of 5 Interchangeable Plug-in Coils.

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REGENTONE 5-VALVE A.C. SUPERHET, Fitted in Cabinet as above, with similar salient details, A.V.C., etc., £4 2s. 6d.

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REGENTONE 5-VALVE A.C. SUPERHET CHASSIS, fitted with built-in Speaker. Complete with Valves, 53/6d.

FEW ONLY HANDSOME ELECTRIC CLOCKS, suitable for 200 to 250 A.C. Mains. British Made, to clear, 16/6d. each.

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SPECIAL, SPECIAL, SPECIAL.

JENSEN 7½in., 2,500 FIELD PENTODE TYPE MOVING COIL SPEAKER. 5/9 each. Few Only.

HANDSOME STRAIGHT SLOW MOTION DIAL, complete with Escutcheon, 2/3.

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8 Mfd., 550 surge, 500 working, Metal Can, 1 Hole Fixing, 2/11.
8 Mfd., 500 surge, 450 working, Metal Can, 1 Hole Fixing, 2/6.

TUBULAR CONDENSERS, paper type, all sizes up to .1 6d. each.

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50 Mfd., 25 volt working, condensers, well known manufacture, 1/3.
25 Mfd., 50 volt working, condensers, well known manufacture, 1/-.
50 Mfd., 12 volt working, condensers, well-known manufacture, 1/-.

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250-0-250, 80 m.a., 2-0-2 volts, 2.5 amp., 2-0-2 volts, 4 amp, 8/6.
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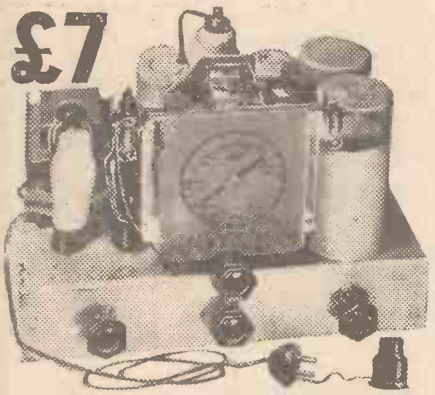
350-0-350, 150 m.a., 2-0-2 volts, 2.5 amp., 2-0-2 volts, 4 amp., 2-0-2 volts, 2 amp., 11/6.
500-0-500, 150 m.a., 2-0-2 volts, 2.5 amp., 2-0-2 volts, 6 amp., 2-0-2 volts, 2 amp., 2-0-2 volts, 2 amp., 16/6.

H.T.8 TRANSFORMER, 250 volts, 60 m.a., 2-0-2 volts, 4 amp., 8/6.

(Continued at top of column three)



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6 VALVE ALL-WAVE SUPERHET

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Improved all-wave superheterodyne for A.C. or D.C. mains. High sensitivity on all three wave-bands (16.5-50 metres, 200-550 metres, 800-2,000 metres). Many interesting features, including:—Illuminated "Airplane" dial with station names. Special "squelch" valve for inter-station noise suppression, with manual muting control. Octode frequency changer. 8 stages, 7 tuned circuits. Iron Cored I.F. Coils. Delayed A.V.C. 3.5 watts output, Extra heavy Cadmium-plated steel chassis.

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(Continued from foot of column one)

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MISCELLANEOUS BARGAINS. ALL BRAND NEW IN ORIGINAL SEALED CARTONS: TELSEN A.C./D.C. Multimeters test anything radio or electrical, 8/6. Telsen 2-Range Voltmeters, 3/-. 3-Range meters, including milliamps, 4/-. ACE (P.O.), Microphones, with transformer ready for use with any receiver, 4/6; 36 Assorted Tru-ohm Resistances, 1 watt, colour coded and marked, 36 on card, 6/- per card. BELL TRANSFORMERS, 200/250 volts input, 3, 5, and 8 volts output, 3/6. MORSE SIGNAL UNITS incorporating buzzer, tapper and flash with international code, complete with batteries and bulb, 3/9 each. Varley Square Peak Coils, BP5, 2/-. MARCONI V24 and Q Type valves (useful for short-wave experiments), 1/6; Glass insulators, 4d.; Light-weight headphones, double-pole, 4,000 ohms each ear-piece, 3/- pair. A.C. Trickle Chargers, for 2, 4, and 6 volts, 17/6.

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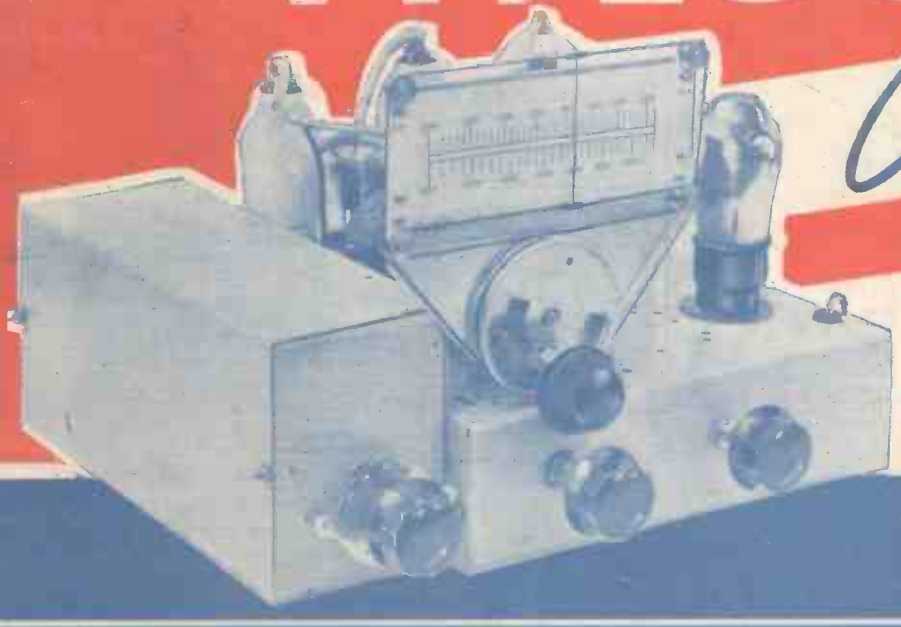

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By Stephen King-Hall

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MORE UNUSUAL FAULTS—See page 664

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. 231. February 20th, 1937.

ROUND *the* WORLD *of* WIRELESS

IMPORTANT NOTICE

A Super All-waver

THE tremendous popularity of the recent all-wave receivers which we have published has shown that the amateur is now keen to make full use of the various broadcasts which are available on the lower wave ranges. The user of an all-mains receiver has, of course, greater scope in the very high efficiency of the mains type of valve, and there are many listeners who have no mains facilities, but who wish to obtain a very high performance irrespective of the expense of supplying high- and low-tension voltages. These listeners are not satisfied with a simple three-valve set and require something much more ambitious. It is not economical to go beyond five valves for a battery receiver, and with this number of valves a really good type of receiver can be built up. In this issue you will find the preliminary notes on Mr. F. J. Camm's latest battery receiver which he has named the "Vitesse." It is one of the speediest receivers to build, owing to the fact that the entire tuning unit, with all switches, is assembled as a complete chassis. The constructional work is only a matter of a few hours, and the results compare favourably with many mains receivers. A Free Blueprint and full constructional details will be given in our next issue.

Flat Radio

THE P.M.G. won his appeal in the Licence Test Case recently, and this means that a licence must be taken out by everyone who makes use of the radio programme, even although he uses only a loud-speaker connected by leads to a receiver used in another part of the building. This decision is of the greatest importance to residents of flats where a central receiver is installed by the owner for the benefit of the residents.

Water-pipe Earths

THE Newquay and District Water Bill embodies a clause seeking to prohibit the earthing of electrical apparatus to the water mains. The Radio Manufacturers' Association and Newquay listeners have entered a petition against this Bill and a motion of amendment is to be heard when the Bill comes up for its second reading.

London Technical Standard

THE decision of the Television Advisory Committee to adopt a single standard bearing the above name for the television broadcasts has led to much confusion. It was, of course, anticipated that a decision would eventually be made, but after the announcement that nothing would be done until after the Coronation the sudden decision came as a bombshell. However, design is simplified slightly, and all of the existing receivers are, of course, capable of receiving the pictures without any alteration being required. The system-change switch will be turned to the Marconi-E.M.I. position and thereafter ignored. It is stated definitely that no further change will be made before the end of 1938.

NEXT WEEK

FREE BLUEPRINT

OF

Mr. F. J. CAMM'S "VITESSE" ALL-WAVER

Parsifal on Good Friday

ON Good Friday the B.B.C. announce that a concert consisting of excerpts from Parsifal will be given in the Queen's Hall under the direction of Sir Henry Wood.

Car Radio

CAR manufacturers are showing an intense interest in car radio, according to the officials of Philco Radio and Television Corporation. Practically every week inquiries come to Philco from some of the leading British car makers. Already four British car manufacturers are equipping part of their output with wireless sets as optional equipment, and eighteen others recommend Philco as their preference for installation in their cars.

The Traffic Goes Round and Around

INSPIRED by the theme "The Music goes Round and Around," Ernest Longstaffe has arranged a revue which he has called "The Traffic Goes Round and Around."

Chronologically it will start with the earliest form of traffic and present the story through the medium of popular songs dedicated to various forms of vehicles. The music begins with the cartwheel. This is an early form of wheel so "The wheel of the wagon is broken" is a little too modern—although it does deal with the early covered wagon.

The revue then skips to the bicycle, where "A bicycle made for two" seems to fit the bill. Trains will not be overlooked and the story finishes in the motoring era, during which many songs on motoring have become popular. The revue is produced and the orchestra conducted by Ernest Longstaffe, and will be heard on London Regional on March 4th.

Aquatic Monsters

E. G. BOULENGER, well-known authority on deep-sea inhabitants and curator of the Aquarium at the Regent's Park Zoo, will in a talk from the Regional on February 28 confine himself in general to the Sea Serpent and in particular to the famous Loch Ness Monster. He is firmly of the opinion that these monsters do not exist except in the imaginations of simple souls who justify the Apostle's accusation that we are always anticipating something new. Perhaps it is because so many different objects seen on the surface of the sea may convincingly suggest a huge snake that from 1520 down to modern times there are over 250 recorded appearances of giant sea serpents. As regards the Loch Ness Monster, E. G. Boulenger comes, after a close and entertaining scrutiny of the evidence, to the same conclusion as Sir Arthur Keith, who wrote: "I have come to the conclusion that the existence or non-existence of the Loch Ness Monster is not a problem for zoologists, but for psychologists."

ROUND the WORLD of WIRELESS (Continued)

Caught by Radio

A RADIO net was recently spread across hundreds of square miles of Nottinghamshire countryside in an attempt to trace a traveller's motor-car with jewellery worth about £6,000, which had disappeared from outside a shop. From Nottingham, which has a newly installed radio equipment, messages were wirelessed to stations throughout the East Midlands, as well as to scores of police cars. An hour after the alarm had been raised the car was found abandoned near a railway station in Nottingham, and later the same evening a man was detained at Sheffield.

An Exhibition Band

FROM the Brighter Homes Exhibition in Bingley Hall, Birmingham, Midland Regional listeners will hear Younkman and his Czardas Band on February 23rd. These exhibitions are promoted by a Birmingham newspaper; the first was held eleven years ago.

"Pantomime Variety"

THIS is the title of a variety programme to be given by some of the principals in the pantomime "Aladdin" from the Prince's Theatre, Bristol. On February 26th, listeners to the Western Regional programme will hear Jean Colin in some of her song successes, Connie Graham (comedienne), and Victor King (comedian).

Outside Broadcast from the British Industries Fair

ANNUALLY a parade takes place of fashions made from British fabrics at the British Industries Fair held at the White City. This year the Outside Broadcast Director is obtaining the services of an expert on women's fashions who will describe the wonderful fabrics used in the fashion parade at this great exhibition. Almost all the new fabrics which are used in women's dresses (and this includes those made in Paris) are manufactured in England. Broadcasting should prove a great help to the expansion of trade in British fabrics. This broadcast will be given in the Regional programme on February 22nd.

Mantovani, the famous Tipica Orchestra leader, plays a number to be sister, Stella Roberta, who sings with his orchestra.

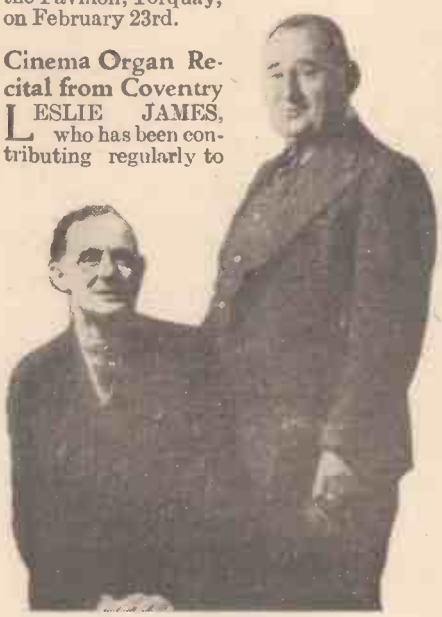
INTERESTING and TOPICAL NEWS and NOTES

Concert from Torquay

MAY BARTLETT (soprano) will be the vocalist in the concert by the Torquay Municipal Orchestra, to be broadcast from the Pavilion, Torquay, on February 23rd.

Cinema Organ Recital from Coventry

LESLIE JAMES, who has been contributing regularly to the morning organ recitals on the National wavelength, will give an evening recital on February 22nd in the Midland Regional programme. His own arrangement of Songs from the Cotton Fields will be one of the items.



Clapham and Dwyer, the well-known broadcasters, "off duty."

Dance Music for the West

ON February 24th, Western Regional listeners will hear dance music by Harry Evans and his Band, from the Grand Hotel, Torquay.

Pianoforte Recital

JOHN PALMER will broadcast a pianoforte recital on February 17th, when he will play works by Goedicke, Scriabin, Blumenfeld, and Rachmaninoff.

Old-time Concert

THE Revue Orchestra and the B.B.C. Midland Chorus are to join forces on February 24th for a real old-time concert, compèred by Percy Edgar, Midland Director, with Reginald Burston conducting. The soloists will be Marjorie Westbury, Cuthbert Ford, and, it is hoped, Webster Booth.

Star Ballad Concert

THE soloists at this concert on February 21st will be Olive Groves (soprano); Alec John (tenor); Foster Richardson (bass), who is a native of Nottingham; and Lilian Niblette, the pianist, who belongs to Wednesbury. The programme will close with duets by Olive Groves and Foster Richardson.

Midland Orchestral Concert

ON February 22nd, Leslie Heward will conduct the B.B.C. Midland Orchestra in Wagner's "King Enzio" Overture, Balakirev's Overture on Three Russian Themes, and Wolf Ferrari's English Dance Suite for Strings.

Liverpool Philharmonic Orchestra

ALBERT COATES is to conduct the Liverpool Philharmonic Orchestra on February 16th, and the second part of the concert will be broadcast from the Central Hall, Liverpool. The programme will include Tchaikovsky's Symphony No. 6 ("Pathétique").

Jean Salder and his Serenaders

THIS combination of six players has had 26 broadcasts in its first year on the air. In the concert from the Midland Regional on February 21st, the programme will take the form of a review of the tunes they have played in that time. Many special arrangements by Arthur Garner, who is one of the Serenaders, have been included.

Medtner at Liverpool

THE Rodewald Society's concert which is to be broadcast from the India Buildings, Liverpool, on February 23rd, will take the form of a recital by Nicolai Medtner, the famous Russian composer. He is to play some of his own works for the piano—six of the "Fairy Tales." Tatiana Makushina (soprano) will sing a group of his songs.

Variety from Scunthorpe

VARIETY will be broadcast on February 25th for the first time from the Palace Theatre, Scunthorpe.

SOLVE THIS!

PROBLEM No. 231.

The PT41 five-pin power pentode in Oliver's receiver burnt out so he went to his local dealer for a replacement. He was persuaded to buy a five-pin A.C./Pen, it being explained that this was also a power pentode having the same H.T. and L.T. consumption as the PT41. Why was he unable to obtain satisfactory results when the A.C./Pen was inserted in place of the PT41? 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., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 231 in the top left-hand corner, and must be posted to reach this office not later than the first post on Monday, February 22nd, 1937.

Solution to Problem No. 230.

The high minimum wavelength was due to the use of a tuning condenser having a higher minimum capacity than the specified tuning condenser. The minimum could be reduced to 18 metres by removing a turn of wire from the grid winding of the coil.

The following three readers successfully solved Problem No. 229, and books are accordingly being forwarded to them. S. A. Kilminster, 27, Warstock Lane, King's Heath, Birmingham; J. A. Lee, 52, East Avenue, Hayes; K. Aylward, 3, Warwick Ave., Quorn, Leicester.

Introducing F. J. CAMM'S "VITESSE" All-Waver

A New Five-valve High-quality Battery Receiver, Covering the Long, Medium and Short Wave-bands

FOR a long time it has been apparent that the discerning amateur needs something more than a simple two or three-valve receiver to provide him with his radio entertainment. The mains user is in the fortunate position of having placed at his disposal multi valves which enable him to build up a powerful receiver with very low running costs. The battery user is limited in his selection of valves and must at the same time consider the cost of maintenance. The accumulator alone is an important item, as it must be convenient in size to facilitate transport to and from the charging shop, whilst the cost of replacement of the H.T. battery is a very important factor. Furthermore, as the number of valves in the circuit is increased, the user feels that an increase in volume must also follow in order to justify the additional expense, and this makes it a difficult matter to design a receiver which will have a universal appeal.

Low Consumption

In the "Vitesse" I am sure I have produced a circuit which will give to the battery user all of the advantages enumerated above, and which will enable him to build a receiver which will provide him with entertainment value from the remotest stations. The total number of valves employed is five, giving a low-tension load of .7 amps. This is not too high for the mass type of battery and will give a fair service from one of the larger capacity batteries, without introducing the difficulty of transport. The H.T. consumption is not abnormal and it will be found that the large type of H.T. battery will give good service over a long period.

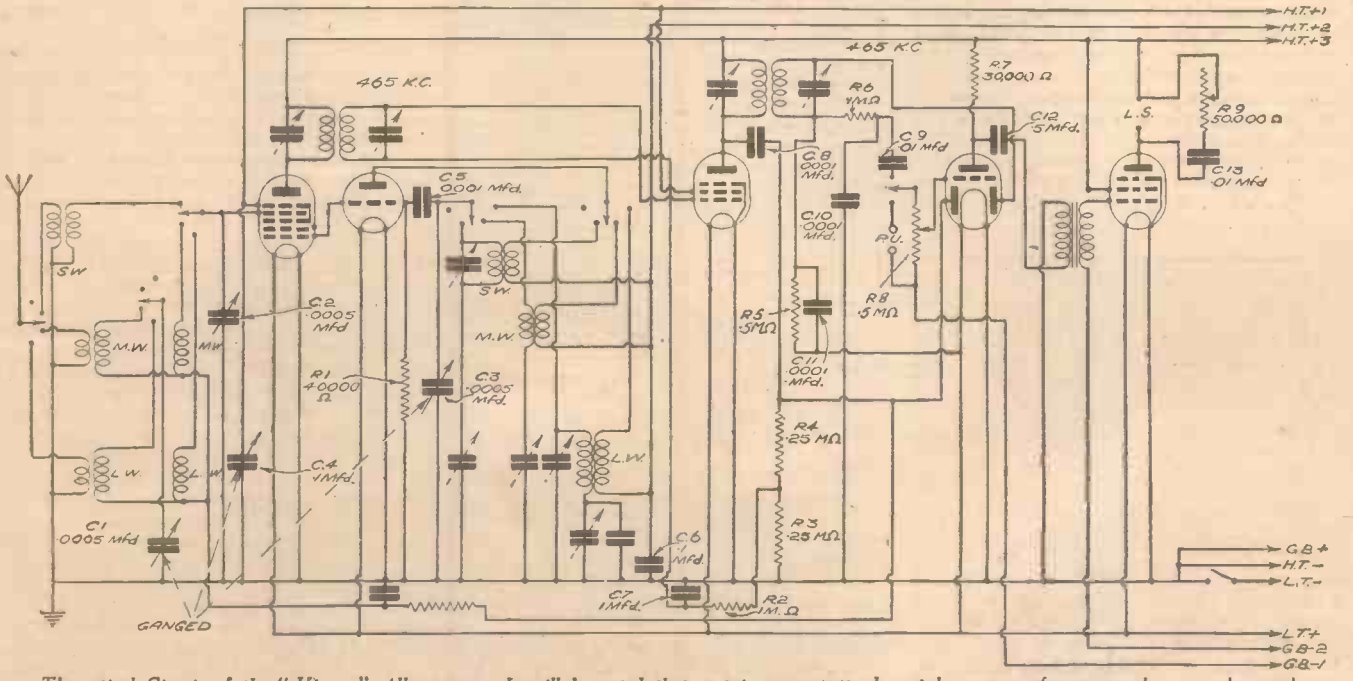
The main advantages of the circuit are to be found in its long range of reception, its good output volume and its ease of handling. In these respects it compares very favourably with the small mains superhet. The circuit embodied is of the superhet type with a special frequency-changing circuit which ensures that the same high efficiency is obtained on the short wavebands as is obtained on the other bands. This low band extends from approximately 18 to 53 metres, and in the ordinary type of frequency-changing stage it is generally found that towards the lower wavelengths the efficiency begins to fall off. The inclusion of the triode valve in this circuit enables the efficiency to be maintained, and those who have not before tried out this type of circuit will be surprised at the high standard which is attained.

High Quality

A double-diode-triode is employed after the I.F. stage and this provides a high quality signal as well as A.V.C., and the output from the triode portion is fed to the output pentode through a resistance-fed L.F. transformer, providing a high step-up and good quality. Thus the circuit follows on the lines of the simpler type of mains superhet and the results which have been obtained show that the receiver will fill a long-felt want in the ranks of the battery user.

The usual trouble in building a multi-valve set of this type is the large amount of wiring which has to be carried out, and the unbalancing of the tuning circuits which often arises due to stray capacities in the wiring. This has been overcome in the "Vitesse" by utilising a special tuning unit incorporating all of the coils and switching in a metal chassis, and each section is individually screened thus producing maximum efficiency on all bands.

Next week's issue of PRACTICAL AND AMATEUR WIRELESS will contain a Free Blueprint of this receiver, together with the full constructional details. Order your Copy now to avoid disappointment.



Theoretical Circuit of the "Vitesse" All-waver. It will be noted that certain components do not bear any reference number or value, and these parts are already included in the special coil unit.

More Unusual Faults

Measuring Instruments Sometimes Fail to Identify a Fault, and the Following Details Give Some of the Peculiar Troubles which have been Experienced in This Connection

By W. J. DELANEY

WHEN a receiver goes wrong the first thing the user does is to try to find the cause of the trouble. There are many ways of setting about this task, and the first and most obvious thing to do is to measure the voltage at various points. Sometimes the way in which a fault arises will itself give a clue to the trouble, but a sudden fault is not always so easily identified. It is, however, very often found that ordinary testing means will fail to reveal a fault, or the trouble will be of such a nature that the indication given by the test instruments does not in itself enable the trouble to be traced to its source. The result is that perhaps many hours of tiresome work are devoted to replacing components and getting the set in working order again. The following details give some of the faults of this nature which have actually been experienced in various receivers which have broken down, and they will no doubt be of assistance to others who may from time to time experience difficulty in locating a fault.

Faulty Condensers

A condenser is used primarily in such a position that no direct current passes, and should certain condensers in a receiver break down they can introduce some very peculiar faults which are very hard to trace. Fortunately, the breakdown is generally complete, which means that by testing the condenser in series with a meter and voltage source a direct reading would be obtained. Therefore, in a receiver circuit, such a fault would easily be located when the usual series of tests is made. Similarly, if the condenser breaks down and forms an open circuit, such a fault may be located by the voltage and meter test or headphones in series, a kick on the meter or click in the 'phones denoting the charging and discharging of the condenser. An A.C. receiver recently broke down, however, and although a condenser was responsible for the trouble, it was not possible in the ordinary way to trace this. The receiver was made up on two chassis, one carrying the H.F. and detector sections, and the second the mains and L.F. sections. The H.T. supply was of the order of 500 volts, and three separate smoothing circuits were fitted, one to feed the high-voltage output valve, the second for the L.F. stages, and the third for the H.F. and detector stages. To convey the H.T. and heater supplies to the latter section a multi-cable was employed, with plug and valve-holder connection between the chassis. The trouble arose rather suddenly, volume dropping to a very small percentage of the previous signal, and loud cracklings arising intermittently. A resistor or condenser was immediately suspected. When switched on the following day no signals could be obtained, but a very loud hum indicated overloading of the rectifying valve. The two chassis were accordingly placed on the bench and the meter was run over the set, without revealing anything wrong. The H.T. was correct and the current consumption was correct, but even when the pick-up was placed in circuit no signals were obtainable. After some considerable trouble it was found that one resistor was exceedingly hot, and this naturally led to suspicion being cast upon the by-pass condenser joined from this resistor to earth, but when tested it was neither shorted nor open-circuited. Later in the day, whilst the chassis was being checked in a rather dark position it was noticed that flashes were occurring inside the condenser, the cardboard casing being sufficiently thin to allow the red glow to penetrate. It so happened that this particular condenser only failed at certain times, and one moment it produced a dead short, and the next moment worked correctly.

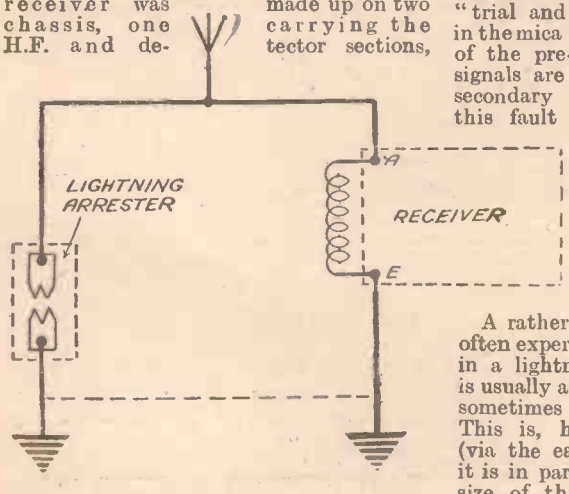


Fig. 2.—How the lightning arrester is included across the aerial coil.

Pre-set Condensers

Several cases have come to our notice where the mica insets in pre-set condensers have broken through abuse, and have caused troubles which have been very difficult to locate. The most common is in the case of the trimmers on I.F. transformers, where the continued adjustment due to the component being adjusted by "trial and error" methods has resulted in the mica being broken and the two plates of the pre-set being short-circuited. No signals are heard due to the primary or secondary winding being shorted, but this fault may sometimes be identified owing to the fact that when the pre-set is "unscrewed" a weak signal will be heard and a faint click is noticed when the pre-set is screwed up.

Lightning Arrester

A rather peculiar difficulty which is not often experienced is that due to rectification in a lightning arrester. This component is usually across the aerial circuit, although sometimes a separate earth lead is used. This is, however, eventually connected (via the earth) to the receiver and thus it is in parallel with the aerial coil. The size of this may be such that, should rectification take place in the arrester, a signal of a definite wavelength will be heard at all parts of the dial. At least two cases of this nature have come to hand, in each case a local station being heard at all settings of a superhet, and no amount of trimming or the use of wave-trap circuits cutting it out. The lightning arrester in each case was of the same make and acted as a rectifier, as was afterwards confirmed by including in a simple crystal receiver, where it gave almost as good results as a permanent-type crystal detector.

The leakage of moisture into this component can, however, give trouble due to the leakage provided from aerial to earth, and therefore should it be found that signals are very weak on wet days, the earth lead to the lightning arrester should be removed as a check.

Shorted Turns

Another type of fault which is difficult to locate by ordinary means, and which should not arise when ordinary care is used in handling components, is that caused by short-circuited turns on tuning coils and similar components. If the screening cans are removed from these and replaced in a clumsy manner it is possible for the edge of the can to scrape away the insulation of the windings and provide a short circuit between two turns. These may be at a wide difference in potential, due to the coil being wave-wound, and the result of this short will be seriously to modify its resonant point. Where ganged coils are used, or in the case of an I.F. transformer, this will result in it being found impossible to accomplish satisfactory ganging. One superhet which was serviced refused to tune to the long-wave stations, although Droitwich could be heard faintly in the background. It was found impossible to obtain satisfactory ganging, and until an oscillator was employed and the output carefully measured, it was not possible to identify that the fault arose in the I.F. transformer. An inspection of this revealed the bared wires which were almost invisible until a very close inspection was made. Such a fault would not have arisen had the screening can not been removed, and there was, in fact, no need for it to be moved as the trimmers were available on the top.

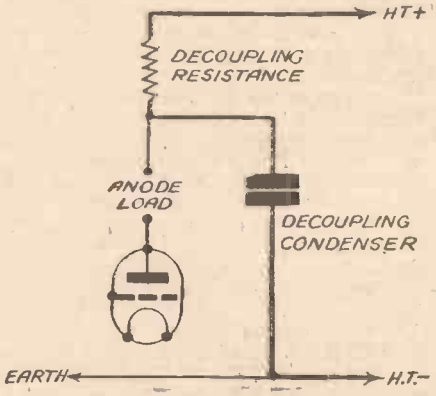


Fig. 1.—This diagram shows how a shorted decoupling condenser will short-circuit the H.T., and probably damage the decoupling resistance.

The NEW PENMON TRANSMITTER

Details of the Equipment of the New B.B.C. Transmitting Station in North Wales

THE opening of the new transmitting station at Penmon in Anglesey, on Monday, February 1st, marked another step in the development of broadcasting in Great Britain. More particularly it is a step towards the carrying into effect of the B.B.C.'s intention to provide a Welsh programme to as many listeners in Wales as possible. The power of the station, although only 5 kW., will enable it to serve the north of Wales which, next to the extreme south, is the most densely populated area. Recent progress in the operation of two or more transmitters on a single wavelength makes it possible to synchronise the new transmitter with the West Regional transmitter at Washford on the latter's wavelength of 373.1 metres (804 kc/s). This is a fortunate circumstance in view of the extremely limited number of wavelength channels available for broadcasting in Great Britain. The two transmitters will at all times radiate the same programme. From July, 1937, when arrangements for providing a separate service to the West of England come into force, this programme will become one catering exclusively for the interests of Welsh listeners, and will be known as the Welsh Regional programme.

The Penmon station is the first of the 5 kW. type to be built by the B.B.C. Although in some respects it is a miniature of the transmitters recently erected at Lisnagarvey, Northern Ireland, and at Burghead, North Scotland, there are many points of difference in detail.

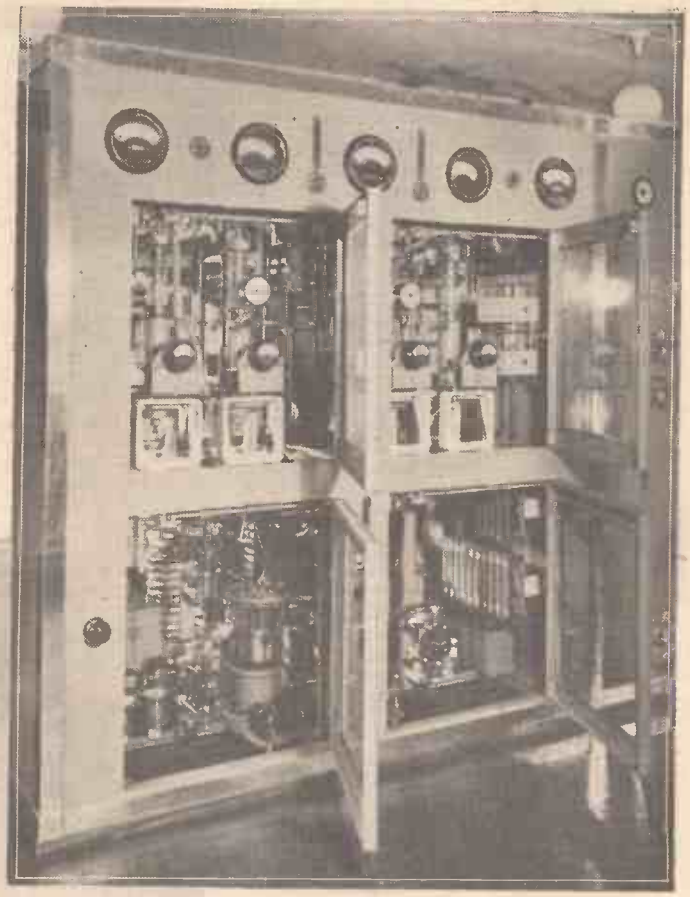
The Site

The site chosen, which is two miles N.N.E. of Beaumaris, was only decided upon after a number of tests had been made from various possible sites in the district, a mobile transmitter being used to obtain the necessary data.

High-frequency Input to the Transmitter

The high-frequency input to the transmitter originates from a valve oscillator, the oscillatory frequency of which is stabilised by a tuning fork. The frequency of this fork is itself controlled by a crystal at the West Regional station at Washford, the two being linked by land-line. Accurate synchronisation of the Penmon and West Regional transmitters on the same frequency is thus ensured. If an interruption were to occur in the line linking the two stations, the Penmon transmitter would continue to be driven by its own fork and the accuracy of synchronisation would depend upon the individual frequency stability of this fork and of the crystal at Washford.

The tuning fork has a natural frequency which is an exact sub-multiple of the desired carrier frequency. The oscillations at fork frequency are therefore passed through an appropriate number of multiplying stages until the carrier frequency is arrived at.



A general view of the Penmon transmitting station and mast-aerial, and (above) the output stage of the transmitter.

The Transmitter

The programme is passed from the control room to the transmitter and is applied to the grid of a low-power low-frequency amplifying valve, which is followed by the modulator stage consisting of two 500-watt valves in parallel.

The carrier frequency input is applied to a screen-grid valve, which is followed by the modulated amplifier stage consisting of two 300-watt valves in push-pull. These are in series with the modulator valves and with the source of high-tension supply, the anode circuit of the modulator valves being connected to the filament circuit of the modulated amplifier valves. Consequently, variations in the impedance of the modulator anode circuit, due to low-frequency variations of grid voltage, cause the effective high-tension voltage applied to the modulated amplifier anodes to vary in sympathy, thus effecting the modulation process.

The next stage in the transmitter is the main amplifying stage which delivers an output of 5 kW. to the aerial. This stage utilises two water-cooled valves in push-pull. The main amplifier compartment contains four such valves, two of these being spares. The conditions of operation of the valves in this stage are such that the total harmonic content does not exceed 4 per cent. when the carrier is modulated to a depth of 90 per cent.

The output circuit of this stage consists of a radio-frequency transformer coupling the balanced anode-tuned circuit to a trans-

(Continued on page 675)

NEW SERIES

Amateur Transmitting

Constructional Details of the Mains Unit for a 10-watt Transmitter are given in this Concluding Article of the Series.

By L. ORMOND SPARKS

THE mains unit for the transmitter mentioned in the previous article is shown in Fig. 1, where it will be seen that it differs slightly from normal practice in the arrangement of the smoothing chokes.

It will be appreciated, after the diagram has been examined, that the output should be free of any trace of ripple or hum, as it is essential for the various feeds to be pure D.C., as far as possible, otherwise objectionable snags will be introduced into the transmission.

It is not necessary for the chokes to be all of the same type or make. The vital qualifications are sufficient inductance when carrying their current load, reasonable resistance and well-constructed cores.

The various outputs are arranged for the H.T. supply points, shown in the diagram of the speech amplifier, and the C.O. and R.F. amplifier stages.

In case any constructor has a 500-0-500 volt transformer, I would mention that it could be used, provided the output is reduced, by shunt or series resistances, to the equivalent of that indicated in Fig. 1.

The rectifier required for the unit is the Cossor 442 B.U., which has an output of 350-0-350 volts at 120 mA, the filament requiring 4 volts at 2.5 amps. As this is of the directly-heated type it is always advisable to include a reliable single-pole "snap" action switch in the centre tap of the H.T. secondary winding (X on the diagram), to allow the heater to reach its maximum temperature before throwing the load into circuit, thus avoiding violent voltage surges.

The various resistances are calculated for the valves suggested, therefore it will be necessary to modify them if other combinations are used. It is assumed that the smoothing chokes have an average resistance of, say, 500 to 600 ohms.

To avoid any misunderstanding the outputs should be connected thus. The supply from Ch.3—i.e., H.T.+, is intended for the speech amplifier. H.T.+1 is the supply for the screen of the C.O., while

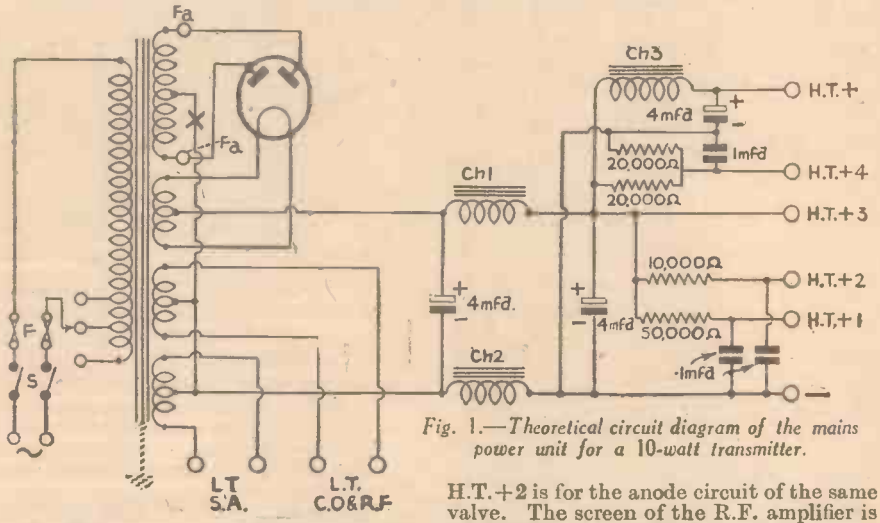


Fig. 1.—Theoretical circuit diagram of the mains power unit for a 10-watt transmitter.

H.T.+2 is for the anode circuit of the same valve. The screen of the R.F. amplifier is fed from the output H.T.4, and the anode from H.T.+3, i.e., direct from the choke Ch.1.

It will be noted that a double-pole Q.M.B. switch is included in the mains supply, and fuses (F) inserted between it and the primary of the mains transformer. For the slight extra cost it is well worth while including suitable fuses in the anodes of the rectifier, as they cost very much less than a new rectifier The points are marked Fa.

Constructional Details

Now as regards construction. If you are handy in working metal, I would suggest a cover made from perforated zinc, which can be given a coat of flat black. The cover, which is shown in Fig. 3, is quite easy to make, providing a little care is taken in marking and cutting it out (See Fig. 2).

The cover should, of course, be earthed, and so arranged that the main switch and fuses are outside. By the way, a pilot indication light should be provided to let you know when the circuit is alive.

There is one point to watch, and that is the position of the chokes in relation to each other. Arrange matters so that their cores are at right angles to each other, and so that no induction can take place between them.

If all the components are mounted on a stout piece of 5-ply, the whole assembly can be fitted into the bottom of the transmitter rack, the mains-supply lead being brought out at the back.

Component Values

Referring to the diagrams contained in the previous article, the following are the values for the components in the speech amplifier:

T.1, a reliable make of microphone transformer to suit the microphone in use. T.2, a good 1 : 1 output transformer.

(Continued on page 676)

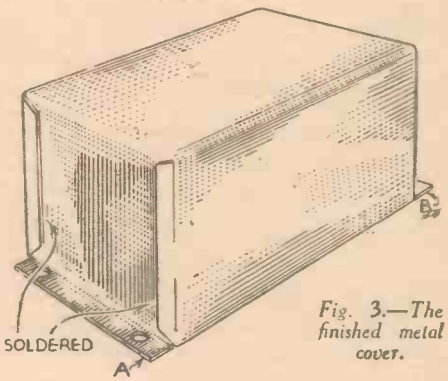


Fig. 3.—The finished metal cover.

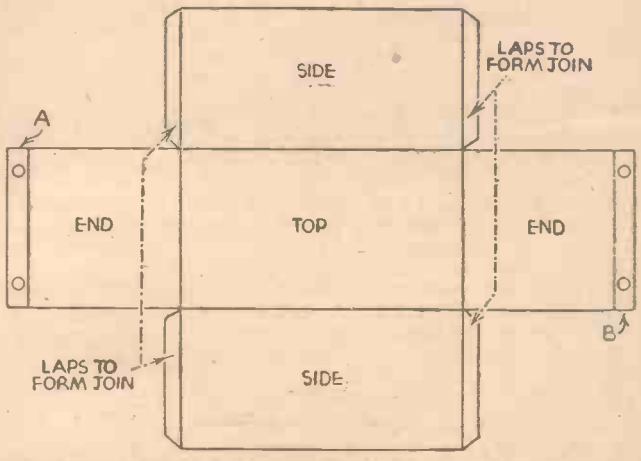


Fig. 2.—Developed blank for making the metal cover for the mains unit.

On Your Wavelength

By THERMION

Only One Standard

SO the B.B.C. or its advisers have made up its or their minds about the television transmissions, and have plumped in favour of Marconi-E.M.I. I am not surprised, and sympathise with the Baird Company that their pioneer work has met with this set-back. I take it, however, that there is still the possibility that they may obtain the provincial television transmissions when the television stations are erected in the provinces. The way of the pioneer is, indeed, hard. Those firms making television receivers will, I imagine, be pleased that they can now build receivers for one system instead of two, and thereby cheapen the production. I envisage that transmissions will take place from various stations, some on the E.M.I. system, and some on the Baird system, so that receiver manufacturers will be able to supply two different sets, each suitable for the particular system. This is a far better thing than endeavouring to design a television receiver to operate on both systems, for the technical difficulties in some cases are well-nigh insuperable. In fact, it is due to these difficulties that the present scrapping of one of them has come to pass. I do not think that it is any reflection on the Baird Company or its system ; certainly, it has not had a lot of time in which to perfect it.

Without the support of the B.B.C. transmissions, however, the Company will be compelled I take it to carry on its development work privately, and it may be that within a few months the system will be rid of present objections, if any. I must say that I thought the Baird transmissions particularly good, although it is difficult to make comparisons unless you can see the same transmission reproduced at once on the two systems. However, I am convinced that the Baird system is by no means out of the running.

Our Pleasures Sadly

FROM the dignified columns of *The Silk Journal and Rayon World* I pluck the following gems. I am, of course, a snapper up of unconsidered trifles. I gather the rosebuds while I may, and pluck my flagrant flowers and gems of wisdom to add to my conversational gadgets from omnifarious sources. However, herewith the quotation :—

"The English as a race are proverbial for taking their pleasures seriously, but not even the English have succeeded in putting the pleasures of modern dance music to quite such deadly serious effect as have the Japanese. Modern dance music has often enough been called deadly in this country, but it has been left to a Japanese investigator to prove that it is actually deadly—to the Kyochu maggot, a harmful parasite of the silkworm.

"The maker of this discovery is Dr. Yoshimasa Yagi, an authority on his subject who has found that jazz music played loudly on a gramophone proves so intolerable to the parasite that it tries to escape by burying itself deeply in the body of the silkworm, with the result that it is rapidly killed by asphyxiation.

"Any blatant variety of jazz is said to do the trick, and it is claimed that Dr. Yagi's discovery, by providing an effective weapon in the war against the parasite, will help to save the Japanese silk industry from serious loss."

SUCH IS FAME!

The letter sent in the envelope, shown above, reached Thermion safely.

Bagpipes Again

I MUST add to your mental pabulum the following, which appeared in a daily paper :—

"I am fond of bagpipe music, but are the pipes themselves as good as they might be? The suggestion that the pipes might be improved is worth the consideration of makers.

"It is now approaching 40 years since a North of England man described the bagpipes to me as 'an instrument of torture tolerated by the War Office because when played behind a regiment of Highland soldiers, it made them charge.'"

Am I right, sirs, am I right?

Here is another :—

"Mr. John Herries McCulloch is quite right. There is room for vast improvement in the bagpipes. It is torture for anyone with a musical ear to listen to the hideous, blaring discord produced when the performer plays a long-sustained note on the chanter that is out of harmony or unison with the drones.

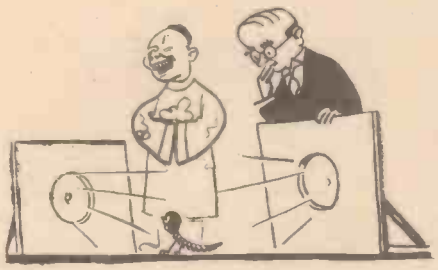
"The man who can convert the bagpipes into a musical instrument and save us from ridicule will be a national benefactor and will have done 'the best day's work since Bannockburn.'"

And in another paper which has been carrying readers' correspondence concerning the 'pipes, the question of their origin arose. One reader said that they had been introduced to Scotland by the Irish and the Scots have not yet seen the joke!

A Sensible Plan?

DURING one of Hitler's famous week-end speeches it was

ordered that all lifts should stop working in order to avoid interference with the wireless sets. On the face of it this seems a sensible plan, but a little thought will show that it is illogical. I believe that the suppression of interference is a responsibility of the set designer and the set user I do not believe that the old should have to set its house in order for the new. You have a parallel in the accident problem. Cyclists were using the roads years before the motor-car. Directly the motor-car arrives the accident problem starts, and it has been growing in intensity since. You cannot place the onus of responsibility upon cyclists but upon motorists. Electrical interference was unheard of until wireless started, and it is



The effect of dance music on the silkworm.

merely admitting that we have created an imperfect machine by asking other people to do something with their apparatus because our own is imperfect. You cannot argue against that. If I design a motor-car which has poor suspension I have no right to ask the authorities to make perfect roads in order to remedy it. That is an exact analogy. The argument seems to be that if your lawn mower annoys your neighbour get rid of your neighbour. If your wireless set picks up interference protest to the makers of vacuum cleaners, hair driers, and motor-car manufacturers. If you want to succeed with a device you must perfect it. You cannot alter the course of the world to suit your imperfect apparatus. I repeat that it is the problem of the set designer and set user to perfect his apparatus ; the means are available. A shoe manufacturer has to make shoes to suit my feet. I certainly am not going to have my toes amputated in order that my feet shall comply with his designs. Yet, wireless manufacturers through their associations would make it an offence to use electrical apparatus which in itself can cause interference with radio If I were the manufacturers of electric motors and other apparatus which gives rise to interference, I should tell the radio industry to go to blazes.

The Qualitone

SOME readers who have constructed the Qualitone Universal Four state that although reception on the medium waveband is excellent, the long waveband reception does not quite come up to expectations. Results should actually be very good on both bands, and constructors experiencing difficulty in obtaining satisfactory reception on long waves should test the pre-set padding condenser. It will probably be found that the maximum capacity of this is below .002 mfd., and although careful adjustment of this condenser is necessary in order to obtain optimum results a .002 mfd. fixed condenser will be found satisfactory in the majority of cases. For final adjustment when a fixed condenser is in use a small mica-dielectric pre-set condenser having a maximum capacity of .00004 or .00005 mfd. may be connected between terminals A and H of the rear coil on the BP111 unit. Another precaution to be taken in connection with this receiver, as in the case of all A.C./D.C. receivers, is that sufficient ventilation is allowed at the back of the cabinet. This is necessary owing to the heat generated by the dropping resistance or barretter. Unless the room in which the set is to be installed is very dusty it is advisable to leave the back of the cabinet off.

S.W. Frequency Changers

AS mentioned in last week's notes, the pentagrid valve can be relied upon to give as good results as a triode-hexode on the medium and long wavebands. In most cases this type of frequency changer will also function satisfactorily down to a wavelength of approximately 16 metres. It is generally found, however, that the performance below 30 metres can be materially improved by using a triode valve in conjunction with the pentagrid. It is customary to connect the grid of the triode to the oscillator grid of the pentagrid and the anode of the former to the oscillator anode of the latter. With this method of connection the stray capacity across the tuned circuit becomes excessive, however, and therefore it is advisable to leave the oscillator anode of the pentragrid disconnected.

Improved Components

MY recent comment upon improved products has led to one or two makers sending me items which they consider are worthy of note. Amongst these I must mention the new W/B Adiabatic volume control. This is made primarily for use with the novel Long Arm device and is fitted to the cabinet speakers. It is also sold separately, however, at 3s. This component is of the wire-wound type and 10 contact studs are employed in conjunction with a rotating arm. Fitted to this is a very thick stop arm which prevents over-turning the control and the wiper arm makes a very good contact with the studs. Such a component is noiseless, of course, and the bakelite moulding has the added

Stop the lift to hear the wireless.

advantage of raised "pips" for ensuring an immovable mounting when the lock nut is tightened up. A further novel feature is the fact that the contact arm is made of the new Monel metal, thereby guarding against oxidisation and chemical reaction between the contact arm and the studs.

Radio Components

MR. SPRATT, of West Hampstead, sends the following complaint : "For years now I have been interested in wireless construction and there is one thing that is annoying to the constructor : the time that he has to wait for components ; here is an example.

"About three weeks ago I ordered the coil-unit for F. J. Camm's 'Record,' ; as the dealer had not any idea as to when I would receive it, I telephoned direct to the makers, who informed me that it would be about another three weeks.

"I hope you will impress it upon firms that prompt delivery is one of the best means of advertising."

I hope this will help to remedy things.

Clubs

HERE is another Radio Club to add to those which I gave recently.

Heathfield Radio and Television Society.

More Car Radio Problems

Our Contributors Tell You About the Car-radio Receiver Which They Built, and Give a Number of Hints Which Were Discovered During their Experiments

by The Experimenters

WE told you last week about our preliminary discussions and experiments with car radio, so we had better tell you about the receiver itself now. As we told you before, it was decided that the receiver should be built round a circuit closely resembling that of the A.C. version of the very popular "£5 Superhet." Actually, we simplified the circuit to a certain extent by cutting out the band-pass filter in the aerial circuit, using a single coil tuned by one section of a two-gang condenser. We used the other two coils as in the original set, but as these are not now available it should be mentioned that any good pair of 110 kc/s superhet coils can be employed—one for normal aerial tuning, and the other for the oscillator circuit. When used in conjunction with the not-very-efficient car aerial, interference does not assume serious proportions.

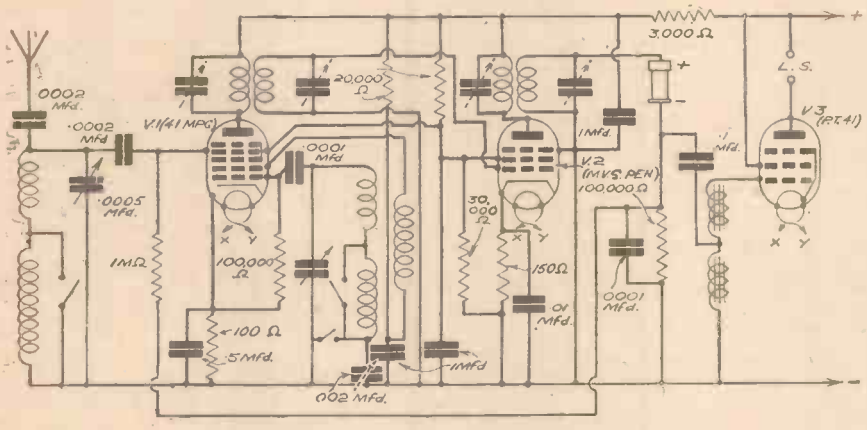


Fig. 1.—Circuit of the set described. It is a modification of the A.C. version of the "£5 Superhet."

A.V. Control

Additionally, the manual volume control was cut out, a fair measure of A.V.C. being fed back from the "Westector" to the grid of the frequency-changer. The modified circuit is shown in Fig. 1, and it will be seen that the method of applying the A.V.C. voltage is by breaking the grid lead to the first valve by means of a ·0002-mfd. fixed condenser, and connecting a 1-megohm grid-leak from the grid to the negative end of the H.F. metal rectifier. Incidentally, it is important that the leak be placed near to the first valve-holder, because it has to serve as a decoupler between the second-detector and frequency-changer circuits. Apart from these simple modifications, the circuit remained basically as in the original design, at least as far as the "receiver" portion is concerned.

A good deal of "juggling" was necessary in arranging the parts on the simple metallised wooden chassis in order to keep the complete unit as compact as possible, although it did not appear that the actual disposition of parts was critical, especially since the coils, I.F. transformers and gang condenser were screened by their own containing cases. Although we just mentioned that a chassis was used, this is not strictly correct, because we used a metallised baseboard with 1-in. side runners of ordinary wood. These were sufficient to allow clearance for the valve sockets, and to make possible the carrying of wiring underneath the baseboard. The layout of the principal parts was as shown in Fig. 2, but slight variations can be made, according to the shape and size, which will prove most convenient in individual cases.

Bias Resistances

Although it was known that the maximum H.T. voltage would be less than that provided for the valves in the original A.C. set, it was not found necessary to modify the values of the bias and feed resistances. In the experimental stages it was found possible to eliminate one or two decoupling condensers—because of the reduced sensitivity brought about by using less than the maximum high-tension voltage, but it is wise to err on the generous side in this respect.

You will gather from Fig. 1 that the set was first built without having any regard to the supply unit, because the main features of this had been decided on before. We had arranged, as you will remember, to employ the Bulgin vibratory unit, which combines the functions of a contact make-and-break and vibratory rectifier. The power-supply unit could have been built as part of the receiver, but it was decided that, for a start, at any rate, it should be made as a separate small unit so that it could be fitted in the receiver or in the speaker when the instrument was installed in the car.

Power Supply

The circuit for the power-supply unit is perfectly simple, as can be seen in Fig. 3. A special five-pin holder (different pin arrangement from that of a five-pin valve-holder) is required for the rectifier, and the connections to this only are shown in Fig. 3. The vibrator plugs into the holder in just the same manner as an ordinary valve. It is necessary to use a double-centre-tapped transformer in conjunction with the vibrator, and this, the Type M.T.2, is made by the makers of the rectifier unit. Enamelled connecting wires are fitted for the primary, whilst three coloured leads are attached to the secondary winding. Of the primary leads, the centre one is joined to L.T.+, the other two going to terminals on the five-pin holder. They must be connected right way round to obtain correct H.T. polarity, but as they are not marked, a trial must first be made, and the connections reversed if necessary.

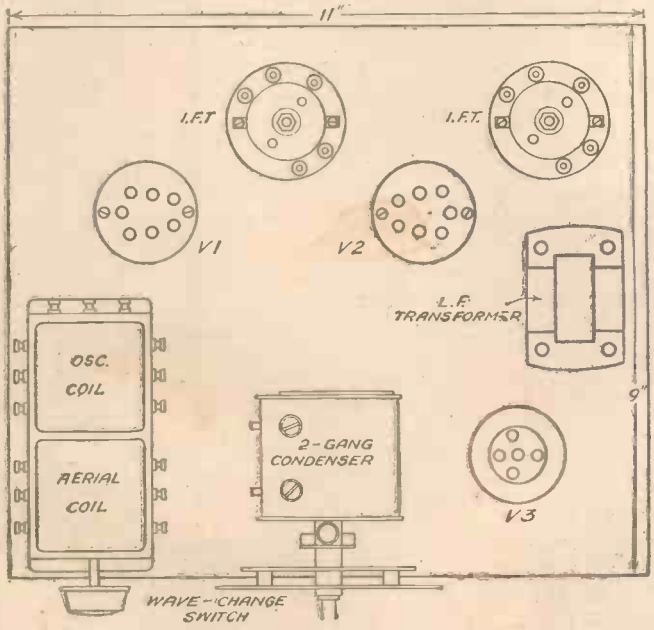


Fig. 2—Approximate positions of the principal components on the baseboard, which is mounted on 1-in. side runners.

Connections to the coloured secondary leads are indicated in Fig. 3, so no difficulty need arise concerning their correct points of attachment. It will be seen that four small fixed condensers are used, and these can be ordinary tubular components. Additionally, there are two 8-mfd., 500-volts working, electrolytic condensers used for smoothing purposes. If preferred, it is possible to obtain a double 8+8-mfd. condenser

(Continued overleaf)

MORE CAR RADIO PROBLEMS

(*Continued from previous page*)

for this purpose, and this effects a saving in space.

Smoothing

The smoothing choke, by the way, is an ordinary power choke rated at about 20 henries, 500 ohms. It is best to use a choke whose resistance is not higher than this, in order to conserve the available H.T. voltage as much as possible. Another item in the H.T. circuit which might appear rather unusual is the H.F. choke in series with the output from the rectifier circuit. The purpose of this is to filter out any H.F., and the choke should have a low D.C. resistance and be capable of carrying up to about 50 mA. If desired, one can be made by winding about 600 turns of 32-gauge wire on a ¾in. diameter bobbin. It is not wise to employ any old choke that happens to be handy, because it might have a high resistance, as well as being incapable of carrying a sufficiently high current.

The vibrator-rectifier is fed from the 6-volt car battery (or from a tapping giving 6 volts when the battery has a maximum voltage of 12), but only 4 volts is required for the heaters of the valves. This could be obtained by using a separate tapping on the car battery for the heaters, but a simpler and neater idea is to includo a small fixed resistance in series with the twin-flex heater leads, as shown. As the current passed is 3 amp., and the voltage to be dropped is 2, a resistance of 2/3 ohm is needed, and can be made by winding 1yd. of 20-gauge Eureka resistance wire on a strip of fibre.

Shielding

When the complete outfit was first tried on the bench, it was found that a certain amount of hum could be heard in the speaker unless the H.T. section was placed a few feet away from the set and speaker. To overcome this difficulty, the power-supply section, which was mounted on a strip of five-ply wood, was placed inside a tin box, insulated leads being brought through holes in the sides. The box was connected to the L.T. lead which was earthed to the car chassis—negative in most cases, although sometimes positive in certain of the newer models.

Eventually, the power-unit was screwed to the side of the box which had been improvised to carry the receiver, and this

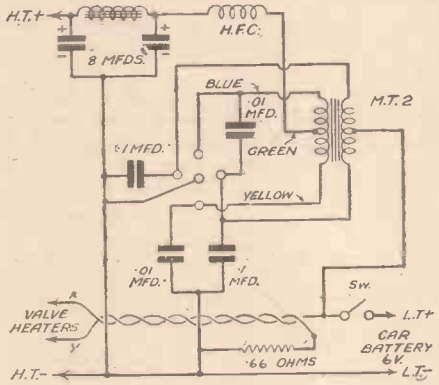


Fig. 3.—Circuit of the H.T. and L.T. unit, using the Bulgin vibratory rectifier and special transformer.

proved quite convenient. The speaker was not given a permanent "home" during our tests, although it was found convenient to place it on the rear seat of the car, connecting it to the set by means of a length of twin screened wire, of which the outside metal braiding was joined to L.T. negative at the set end, and to a chassis bolt near the end connected to the speaker. When permanently mounting the speaker, it would be a good plan to take the screened lead along a chassis member, to which it could be attached by means of metal clips.

The final set worked very nicely, although it could not be described as a really "pukka" job, mainly due to the fact that the A.V.C. action was not sufficiently "keen" to cope with the variation of signal strength which occurs when the car is travelling past various kinds of buildings, which cause all kinds of shielding effects. Nevertheless, considering the simplicity of the lay-out, results were commendably good. We propose at a later stage to experiment with a similar set having two I.F. valves, and with A.V.C. applied to both of them, in addition to the frequency-changer; that should reduce fading and signal-strength fluctuations to negligible proportions.

Positive Earth

We did come across one point which will be of interest to those whose cars have the positive-earth system. This is that the positive L.T. lead to the set should be joined to the positive terminal of the battery, the negative lead being taken to a tapping from the third cell. If this is not done, there is the resistance of one-half of the battery in series between the set and earth, and this can have an adverse effect, especially when the battery is not in very good condition.

Another point which applies to all those readers who care to carry out experiments similar to our own is that the connecting leads between the car battery and the power unit should be of heavy-gauge wire. If thin wire or ordinary twin flex were used, the resistance might be sufficiently high to cut down the voltage to such an extent that the set could not operate efficiently. The best wire is stout vulcanised cable, such as is used for the sparking-plug leads. Even when this is used, its length should be no more than is essential.

Good luck to those who propose to try out the experiments described. You will find it good fun, and full of interest. Let us know how you get along, and also if you find any items of interest which we have not mentioned.

ITEMS OF INTEREST

Music Broadcasts

THE special recitals for the week beginning February 21st will be devoted to Variations for Pianoforte, of which both old and modern examples will be heard. The pianists engaged for this series of broadcasts are Clifford Curzon and Kendal Taylor.

Eda Kersey will give a violin recital on February 21st (National) and will play, among other things, a "Rhapsody" by the Bulgarian composer, Wladigeroff, entitled "Vardar." On the following day Beatrice Harrison, the well-known 'cellist, will play Delius' Violoncello Sonata.

Folk songs of various nations—England, Iceland, Sweden, Norway and Denmark—will be a feature of a joint recital given by Engel Lund (soprano) and Harold Fairhurst (baritone) on February 26th (National). Engel Lund will sing these songs in the original language.

Mass Production

ROBIN WHITWORTH'S feature programme entitled "The Making of a Motor Car—A Study in Mass Production," will be repeated on February 25th at a better listening hour than that at which it was first given in November last. The entire programme was recorded by the B.B.C. Mobile Unit at a large motor works in the Midlands. Nearly a hundred of the employees had speaking parts, while many others helped to provide the noises illustrating the various processes. Several humorous incidents are related, some dealing with queer finds by testers.

Portadown Variety

ON February 26th a Variety programme is to be broadcast from the Town Hall, Portadown. Charles Lawson, who is promoting it, is already known to Northern Ireland listeners for his "Harmonica Rascals." Amongst the other artists will be Billy Brown (accordeon), Eddie Ferree (banjo and musical saw), Tom Richardson, who will give monologues, and Vincent Fox, who recently won a crooning competition in Belfast. The "Harmonica Rascals" will of course take part, and the programme will be presented by Raymond Glendenning.

Songs from the Films

WE understand that Gracie Fields will broadcast in the first of a new series of "Songs from the Films" which begins on February 19th and 20th. "Songs from the Films," with John Watt as producer, has over a period proved a very popular programme formula. The new edition will present melodies from "Follow the Fleet," "Strike me Pink," "Sanders of the River," "Roman Scandals," "Gay Divorce" and "Flying Down to Rio." Miss Fields will be supported by a strong cast which includes Eda Peel, Reginald Purdell, Foster Richardson, Sam Browne, The Three Ginx and the Revue Chorus.

Organ Recital from Glasgow

FRANK OLSEN at the organ of the New Cinerama, Glasgow, will provide half an hour's tuneful music for those who can listen on February 25th in the morning. The items will be: Selection, "Rose Marie" (Friml); Intermezzo, "Sizilette" (von Blon); "Humoreske" (Dvorak); "This'll Make You Whistle" (Sigler, Goodhart and Hoffman); Waltz, "You Will Remember Vienna" (Romberg); "Parade of the Sunbeams" (Maclean); New Sullivan Selection (arranged Godfrey).

Catalogues Required: Manufacturers Please Note

THE Commercial and Technical Department of the Leicester City Libraries is engaged in building-up a collection of Manufacturers' Catalogues. Such a collection will undoubtedly prove of definite value to the business community and to those firms who have deposited in the Library catalogues providing information regarding their productions and specialities.

Firms are, therefore, invited to supply a complete set of their current publications which will be indexed in the card catalogue, both under the firm's name and the particular productions in which they specialise.

Practical Television

February 20th, 1937. Vol. 3. No. 38.

OPERATING A TELEVISION RECEIVER

Tuning Controls, Tone Values, and Strength and Focus are Among the Subjects Dealt With in this Article

BEFORE the various designs of high-definition television receivers appeared on the market, it was thought in many quarters that their operation would be difficult. No doubt this was based on early experiences with radio sets where the knobs were multitudinous. Each valve was provided with a filament rheostat, the tuned circuits had separate condensers to operate, variable aerial coupling and reaction control, and an adjustable grid leak presented considerable difficulties to the operator whose knowledge of radio was scanty. Knowing that a television receiver was in effect two sets in one—a sound set and a vision set—the idea got abroad that to tune in a picture was certain to be a complexity that only the expert could solve.

A few months' experience with manufacturers' sets has shown very clearly that these pre-conceived notions were quite erroneous. It is admitted that with the television demonstrations given by radio eighteen months ago, the experimental sets used gave the appearance of being difficult to operate. As many as fifteen knobs were used on the sloping panel beneath the picture screen of the cathode-ray tube. In use, however, only one or two of these controls had to be handled, the knobs attached to the time base generator which governed the scan on the screen being pre-set on installation.

Common Features

Nowadays, however, a considerable proportion of these controls are hidden from view, being incorporated only for the convenience of the engineer making the initial installation. After that the time base generator knobs have only rarely to be adjusted by the owner of the set. Naturally, each particular make of set has its own particular features, but there are many points common to all types, for at the moment every receiver now available, either home-constructed or the commercially produced product, uses a cathode-ray tube as its picture reconstituting device. As an example, the reader is referred to Fig. 1, which shows a pictorial diagram of a present-day Baird receiving set with the various controls, etc., carefully labelled.

The Effect of Tuning

Taking the operation of tuning first of all, with some sets both the sound and vision tuning condensers are ganged together. It is claimed that in this way the set user has only to tune in his sound correctly—an operation with which he should be quite familiar owing to his previous radio set experience—and it will be found that the vision chassis is then tuned correctly to give full effect to the picture. In practice, however, this is not always found to be the case and some makers, therefore, provide a trimmer tuning control, while others make the tuning of the sound set a preset operation, which is undertaken by the engineer on installation. After all, there is only one station radiating signals, and as the frequency of the sound wave is crystal controlled it is quite satisfactory to pre-tune the set on installation, so that the owner is relieved of any further responsibility in this connection. The vision tuning is still left as a variable quantity, however, for it is found in practice that a careful adjustment of this knob provides an excellent picture detail control. This arises from the wide frequency band encompassed by the video signal, and practice has proved quite conclusively that the vision tuning is a valuable asset, for it enables the user to adjust his picture detail to individual taste.

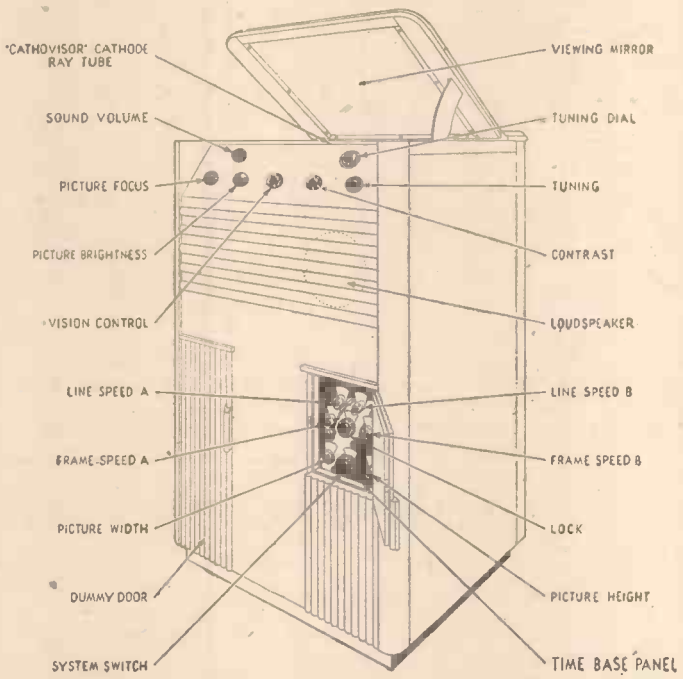


Fig. 1.—A pictorial representation of the controls on a present-day Baird television receiver.

Tone Values

Another important operation is associated with the knob marked "contrast." An adjustment of this knob has the effect of altering the relative tone values of the built-up picture. That is to say, the correct relationship between the light and shadow can be found according to individual requirements. Turning the knob varies the degree of picture detail or gain passed to the modulating electrode of the cathode-ray tube without in any way affecting the strength of the synchronising signals. Too much contrast results in a soot and whitewash effect (something akin to an overloaded loudspeaker), while insufficient contrast makes the resultant picture look dull and flat. The advisability of incorporating an adjustment of this nature is, therefore, apparent quite readily, being a feature common to nearly every make of set.

Closely associated with this control is the one termed "brightness," whereby the *mean* brightness level of the observed picture can be governed at will. Picture brightness is really a multiple function of several items in the cathode-ray tube itself, for there are several ways in which the degree of luminescence, under the stimulus of the electron beam at the point of impact on the screen, can be adjusted. A very bright picture may tend to become somewhat trying to the eyes, and the mean level can be set at the beginning of the programme in conjunction with the contrast, or at times it may be felt desirable for certain types of scenes to raise or lower the level to suit the nature of the transmission. For example, it is very often found that when news reels are being radiated the picture brightness can be increased to give better effect to the whole result.

Of course, it must not be overlooked that every vision signal transmitted from Alexandra Palace incorporates the D.C. lighting component, and this must not be confused with the screen brilliance control to which reference has just been made. The D.C. lighting concerns the relative degree of overall lighting used for interior or exterior scenes. In addition to the varying or alternating component of the picture, which is the amplitude modulation, the mean brightness of the scene is made implicit in the signal. That is to say, the viewer can differentiate between the portrayal of brilliant sunshine, a partially-lit room, twilight, and so on. There is no fixed level for the average carrier as this is made to vary automatically at the transmitting end according to the scene lighting present at the studio end.

Strength and Focus

Yet another important control is often termed the vision control. This resembles to some extent the volume control of the sound receiver, and the particular setting at any situation depends primarily on the distance separating the receiver from the transmitting station and the height of the aerial above any form of possible shielding. Its operation increases or decreases the total signal, that is, both synchronising and video modulation, and, as a general rule, is set in that position which gives a picture sufficiently pronounced and holding well in place.

Then we have the focus adjustment which must be turned one way or the other until the lines on the picture are sharp, in just the same way as you manipulate the lens on a home cinema or camera. In the case of electrostatically-controlled cathode-ray tubes with two or three anodes, it is the relative positive voltages between

these electrodes which the focus control adjusts. This corresponds to moving the position of lenses in any standard form of optical system. With an electromagnetically-operated tube, this control either increases or decreases the measure of direct current passing through a solenoidal coil surrounding the narrow glass neck. This change in the magnetic field alters the degree of constriction imparted to the beam of electrons passing through the centre of the coil inside the neck.

These constitute the main controls for operation with the usual type of home television receiver, and when it is desired to look in, these controls can be set initially and need not be handled day in and day out, except for very occasional slight movement. The usual procedure on first using a set is to switch on, and after waiting approximately a minute for the valves to warm up, the picture brightness is adjusted to an average level and the focus set. Contrast is then advanced to its maximum and the vision control adjusted very carefully until the picture is found to be sufficiently pronounced. Contrast and picture brightness can then be operated together to give the right balance of tone values for personal taste. The best compromise between these two will ensure that the picture is of a pleasing nature.

The Final Effects

As a general rule, all the time base generator controls will have been set on installation, but if the picture, by chance, does not remain quite steady, the line and frame speeds can be set at about their mid position and the "lock" turned very carefully until the picture is steady within the mask frame limits of the screen. The picture height and picture width—quite self explanatory to the reader—may then be set if required so that the proportions of the picture are correct; that is, 6 to 5.

From the foregoing it will be appreciated quite readily that operating a television set is a process easily assimilated by the normally-intelligent person. In some of the sets featured at the last Radio Exhibition further simplification was aimed at by placing the most important controls at the top of the set and the remainder at the bottom. This is illustrated in Fig. 2, where the two knobs on the sloping panel are for picture brightness and focus. In addition to the television adjustments the remaining controls which can be seen include tuning, wavechange switch, and volume control for an ordinary medium- and long-wave radio receiver, so that the set is extremely simple to handle. No doubt further research will bring about other "economies" in operational controls, but it can be said with every degree of sincerity, that modern television receivers are quite simple to use after the set has been handled on a few occasions to learn the true function of each knob provided.

Fig. 2.—One of the television receivers, with very simplified vision controls, featured at the last Radio Exhibition.

E.M.I. TELEVISION PRICE ANNOUNCEMENT

THE news that the B.B.C. was to adopt one high-definition television system only was followed by an important announcement from E.M.I. to the effect that this organisation will now make television a practical proposition for countless homes in the London area by reducing the price of Marconiphone and H.M.V. television receivers from 120 and 95 guineas to 80 guineas and 60 guineas, respectively. This reduction became operative on February 9th, 1937.

This amazing gesture is accompanied by the statement that those who have already purchased these instruments at the original prices will be fully compensated by the company. This remarkable price adjustment does not affect in any way the free aerial equipment and year's maintenance guarantee which accompanies these sets.

The models are also to be sold from now onwards on hire-purchase terms which amount to only a small deposit and payments at the rate of £1 per week.

Television Notes

At the B.I.F.

FOR the first time in the history of the British Industries Fair television is to be featured in the Radio and Piano section on the first floor, Empire Hall, Olympia. Baird Television, Ltd., have an attractive stand, and one of their standard T.5 receivers will be shown working during those times that programmes are being transmitted from the Alexandra Palace. This should undoubtedly prove a great attraction to the overseas buyers who flock to this fair in their thousands each year. In addition, a new departure is being taken by showing educational television equipment on the same stand. Using two cathode-ray tubes—one as a transmitter scanner, and the other as a picture-receiving device—it will be possible to show how a television picture is built up from a stationary spot, then as a horizontal line trace, a vertical line trace, a complete scan, and finally, as an intensity modulated electron beam. Film frame stills will be shown, as well as the shadowgraphs of common objects which may be handed to the demonstrator. The effects of variations in the line definition of pictures can be undertaken at will by the simple expedient of turning a single knob. This equipment is invaluable for all types of teaching and lecture work, and represents a new phase in the commercial activities of Baird Television, Ltd. Relatively compact and quite complete in itself, the apparatus, apart from its interest value, makes it possible for anyone to explain with clarity every phase of transmission and reception apart from the actual radio link. Readers of PRACTICAL AND AMATEUR WIRELESS will be welcomed to the stand (No. G934) during those periods that the Fair is thrown open to the public.

Television Terms

IT is very satisfactory to learn that the British Standards Institution have now issued a book in which is incorporated a glossary of television terms and definitions. So much confusion has arisen by different words being applied to the same operation, function, or part in television equipment that it is a wise move to include a subsection amongst the electrical engineering terms to clarify matters on this important subject. At the beginning, television itself is defined quite clearly as the art of instantaneously producing at a distance a visible image of an actual or recorded scene by means of an electrical system of communication. The careful wording has made provision for all types of equipment whether direct, intermediate film, or telecine, and should therefore dispose once and for all of the "hair-splitting" which takes place concerning which is and which is not real television. Again, high-definition and low-definition television have been segregated by taking the dissection of a complete picture at 100 lines. Above this figure is high definition, and below comes low definition. Scanning is preferred to the word exploring, while progressive (sequential) and interlaced scanning are both very carefully defined. It is gratifying to find that picture frequency and frame frequency have been properly segregated into their correct places. Too often are these confused but picture frequency is now set down as the number of *complete* images transmitted per second. On the other hand, frame frequency is defined as the number of scannings of the frame by the scanning beam per second. Thus, in interlaced scanning the frame frequency is always an integral multiple of the picture frequency.

The Coaxial Cable

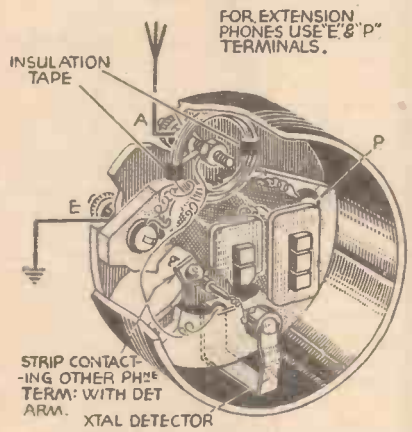
NOW that the installation of the coaxial cable between London and Birmingham is complete, the repeater stations at the various points along the line are receiving attention. These should be finished in a few weeks, and in the meantime tests that have been conducted between Watford and London have given very satisfactory results.

A PAGE OF PRACTICAL HINTS

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

A Midget Crystal Set

THIS vest-pocket set should prove useful where space is limited, and a reasonably efficient aerial and earth are available.



A midget crystal set in an old earphone.

An old carpiece is needed (preferably with a bakelite case). The only other materials required are: one terminal, a detector arm and crystal, a strip of $\frac{1}{16}$in. brass., and a few feet of 36 gauge enamelled copper wire. A piece of tin is shaped as shown to hold the crystal. The detector arm can easily be detached for carrying the set in the pocket, but a permanent detector may be fitted in place of this. The coil is wound on a 1in. former for about 20 turns—the exact number being determined by experiment—and then slipped off and tied with cotton. The receiver is automatic, and provision for extra 'phones is made by terminals on the back.—C. W. OLIVER (Sidcup).

A Five-Range S.W. Coil

THE accompanying diagram shows the connections for a five-range S.W. coil which I have found to be very efficient.

Four grid and four reaction coils were wound in pairs on a 6in. by 1½in. ribbed ebonite former, while the largest pair (70-170 m.) were wound on a similar former 3in. long. The windings, of course, may vary to suit individual requirements.

One end of each grid coil was taken to a common terminal and the same with the reaction windings. The other ends are taken to sockets in the panel. The terminals, the two plugs and flex are connected as shown in the diagram. The method of coil switching is obvious. It is a simple, cheap but efficient coil assembly obtained without the trouble of plug-in coils, or the expense of switching apparatus.—C. N. R. Ross (Fife).

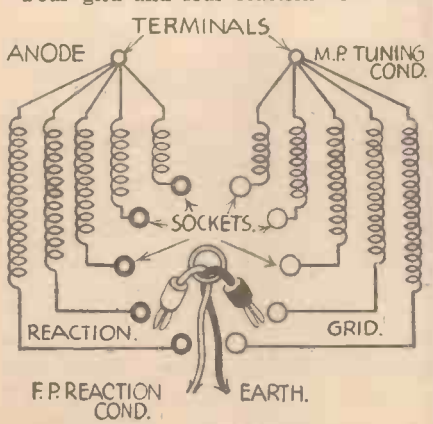


Diagram of connections for a five-range short-wave coil.

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., Tower House, 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.

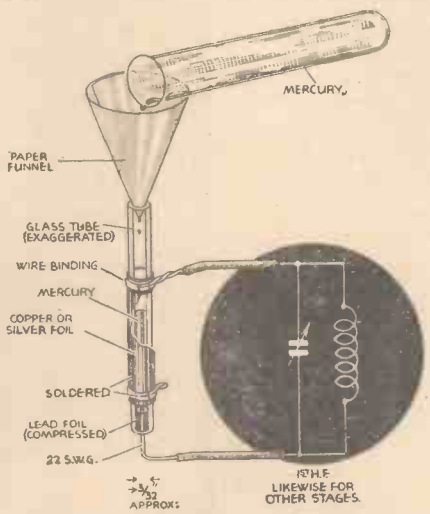
A Novel Trimmer

IT is common knowledge that the matching, at home, of coils is a difficult process, and particularly so on the short-wave bands. With the aid of some mercury I found that it is possible to arrive at a "critical capacity" by pouring—very carefully indeed—a quantity of the mercury into a prepared container, as shown in the sketch.

If the oscillator is adjusted to give a frequency which is tuned in on the lower part of the waveband of the coils to be matched, it only remains—providing the coils are wound accurately—for the coupling and parallel padding capacities to be finely adjusted, and here is the origin of this idea.

It is not suggested that this trimmer be used in place of the standard condenser trimmers, but rather as an additional "balancing" device for the purpose of removing the peculiar effects due to inter-circuit wiring.

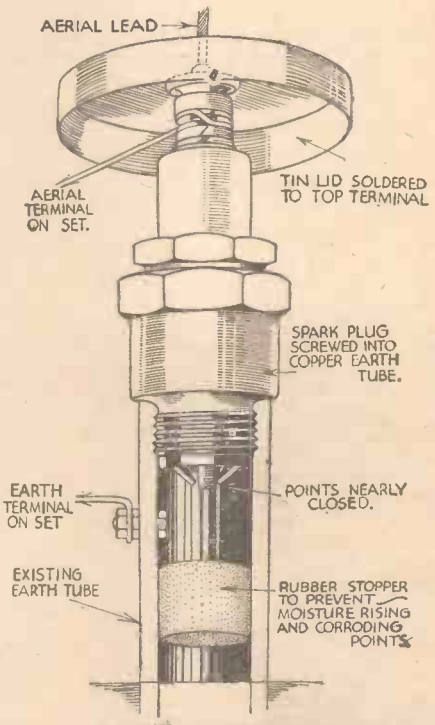
The "condenser" may be constructed out of glass or bakelite, but I find glass definitely preferable owing to its low loss characteristics.—L. G. FRANKS (Ilford).



A novel trimming device in which mercury is used for varying the capacity.

An Efficient Lightning Arrester

A VERY neat and efficient lightning arrester can be made from an old sparking plug in the manner shown in the accompanying sketch. There is no need for any dismantling; I just screwed the threaded end of the sparking plug into the open end of the earth tube, connected the aerial lead on to the terminal, and after thoroughly cleaning and closing the points a little, placed a rubber stopper in the tube to stop moisture rising and corroding same. A tin lid soldered to top terminal completes the job.—A. WARD (Edgware).



A novel lightning arrester, incorporating an old sparking plug.

SHORT WAVE SECTION

CHOOSING COMPONENTS

In This Article the Choice of Components for Experimental Purposes is Dealt With. By A. W. MANN

MODERN short-wave and all-wave receivers of commercial manufacture are undoubtedly products of high efficiency. Price, however, is a sure indication as to the overall performance to be expected.

On the other hand, sponsored receivers invariably exceed expectations, and price cannot be regarded as a true indication as to what may be reasonably expected in the way of selectivity, quality, sensitivity, volume, and ease of operation. Nevertheless, there are enthusiasts who prefer to build, and in some measure design, their own receiving equipment.

To the experimenter, design, construction and listening are subjects of equal interest and an education in themselves. An experimental short-wave receiver can be improved or modified when and as funds permit, and the effects of such modifications, when put into practice, duly noted.

Causes of Failure

Successful short-wave reception is commonplace to-day, and the variations due to phenomena generally understood, yet there are instances where satisfaction appears to be unobtainable.

The beginner often makes the mistake, when the idea of constructing a receiver is under consideration, of viewing the matter from the wrong angle, and taking too much for granted.

An experimental receiver, whether it be a simple straight affair, superheterodyne, T.R.F., or, for that matter, an ultra-short-wave super regenerator, can be built and made to function in a satisfactory manner providing the experimenter knows what to do and what to avoid, and realises at the start that there is no easy way.

A common mistake is to attempt to design one's own circuit. That is, to choose a detector circuit, sketch out one or more H.F. stages ahead of it and low-frequency stages behind it, the whole being based on the spare components to hand. Such procedure simply will not do, especially if the receiver is one's first attempt at short-wave construction.

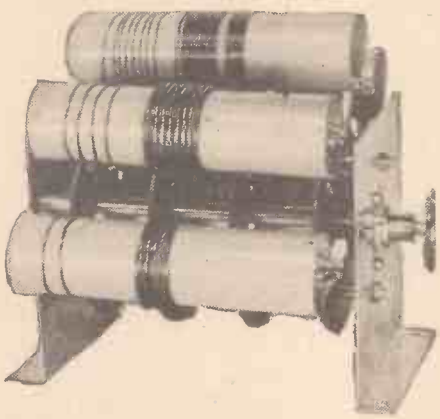
Incidentally, the total cost, even though a number of spare components are to hand, will in most instances prove to be in excess of the price of a sponsored kit of components.

Sponsored Designs

The writer strongly advises everyone who is attracted by the possibilities of short-wave listening, to build first any of the excellent designs which have from time to time appeared in this journal, and to build them exactly to specification. By so doing they are assured of a set which will function in a most satisfactory manner.

Having followed the procedure outlined, the beginner will, within a short period, obtain a thorough grasp and understanding of construction, tuning and phenomena, and may then undertake experimental work with confidence.

How to make a start is the first problem. First select the circuits you wish to try out,



A novel all-wave coil unit from the Bulgin range, in which low-loss design is a prominent feature for the short-wave ranges.

and study them thoroughly, making a note of component values which are common to the majority, and then be prepared to spend a little on the purchase of suitable components which have been specially designed for short-wave work, keeping in mind that to spend wisely means that you only spend once.

Valveholders and Coil Bases

Let us first consider valveholders and coil bases. The latter being intended for use in conjunction with four- and six-pin plug-in type S.W. coils.

At first sight there would appear to be little to choose from so far as valve holders are concerned. So far as broadcast receiver construction is concerned, one may use any particular make or type. We must, however, consider short-wave requirements.

The choice of suitable valveholders and coil bases for use in short-wave receivers makes all the difference, and the purchase of ceramic types, preferably those which may be used in baseboard or chassis construction as required, is to be commended. The same applies to coil bases. As in the case of valveholders, it is a matter of low loss, the reduction of self capacity and the elimination of leakage paths, together with the provision of sure and constant electrical contact. These factors govern performance and assure that the set will tune down to the expected minimum, other things being equal, with reliability.

Tuning Condensers

The next components to which consideration should be given, are the tuning condenser and drive. The beginner generally has one or more spare tuning condensers to hand which are of the assembled rotor and stator types. The usual values are generally .0003 mfd., and .0005 mfd., both of which are much too high in capacity for short-wave purposes.

The idea of dismantling and reassembling them in reduced capacity form is attractive. The variable condenser which functions satisfactorily on the broadcast band is, however, apt to prove disappointing when adapted to short-wave requirements. The cost of a special short-wave tuning condenser is invariably a sound investment.

A cheap condenser with unsuitable pig-tail contact, etc., will always be a source of annoyance. This also applies to reaction condensers, and in both instances soundness in mechanical and electrical design will

(Continued on facing page)

Two components from the Lissen range of special short-wave items. On the left a slow-motion drive with many novel features, and on the right a special low-resistance choke.

SHORT-WAVE SECTION

(*Continued from facing page*)

result in smooth working and trouble-free operation.

Tuning Coils

A census of beginners' equipment, if possible, would no doubt prove that such equipment included various types of comparatively large diameter and obsolete tuning coils, or dual-range coil units. It is not realised in many instance that, due to the increased efficiency of modern receivers, valves, etc., such coils are unsuitable, and productive of capacity troubles due to interaction. Modern tuning coils, also tuner units, are comparatively cheap nowadays, and will justify their inclusion in any receiver.

The writer does not, however, suggest that home-constructed coils should not be used. Coil construction provides an interesting field of experiment, but the experimenter is advised to move with the times and purchase the popular types of small diameter low loss four- and six-pin formers, and wind his coils, using published winding data as a guide, unless it is desired to try out various original ideas.

High Frequency Chokes

The modern H.F. choke is a compact, soundly-designed and highly-efficient component. Screened and unscreened types are available. The experimenter whose equipment will be limited, is advised to consider the screened all-wave type, providing that the minimum wavelength at which efficient choking is obtainable suits his purpose.

L.F. Transformers

L.F. transformers of well-known makes, if on hand, can be used. If such must be purchased, it is advisable to consider the Parafeed types, which are highly satisfactory for S.W. work.

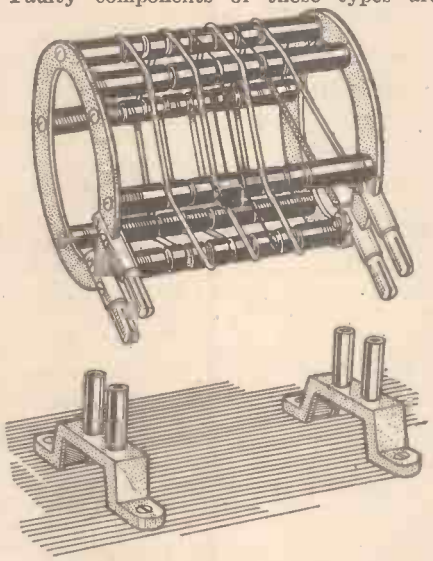
By all means avoid obsolete types, usually to be found on radio junk stalls, otherwise threshold howl and other troubles will undoubtedly be experienced.

The claims of R.C.C. should not be forgotten, resistance coupling is not only a comparatively cheap form, but is highly satisfactory. At least one R.C.C. stage is advisable on the L.F. side.

Slow-motion Dials and Volume Controls

If you purchase a special S.W. tuning condenser, go the whole way and use the dial specially designed for use in conjunction with it. Don't use any old dial to hand. It is false economy.

Care in the selection of volume controls, and other variable resistances, switches, etc., is advised. These are more or less simple components and available in cheap forms. Faulty components of these types are



An efficient short-wave coil of the low-loss type from the Bulgin range.

frequently responsible for poor and unsatisfactory reception.

Valves

Old valves, valves upon which there is nothing to indicate the particular type, should not be used. Valves are key components. Success or failure depends on them. For example: The detector valve oscillates or does not oscillate, and junk valves usually do not.

Spare components of good make should be used, providing they are suitable, and not just because they are to hand.

If the procedure outlined in this article is followed, the beginner will find in the long run, that he has spent wisely, avoided unnecessary expense, and that he is in a position to undertake serious experimental work with confidence, and with entire freedom from worrying delays, due to faulty equipment.

LEAVES FROM A SHORT-WAVE LOG

San José (Costa Rica)

TIPG, which is now broadcasting regularly on 31.41 m. (9,550 kc/s), has adopted an unfortunate position in the band, inasmuch as these transmissions are sandwiched between DJN, Zeesen (31.45 m., 9.54 mc/s), and its colleague DJA (31.38 m., 9.56 mc/s). Some little time ago a report was received to the effect that TIPG would be using 31.31 m. (9.583 mc/s), the channel used by HJ1ABG, Barranquilla (Colombia). This is not much better in view of the proximity of GSC, Daventry, and PCJ, Eindhoven (Holland), but as the latter does not work nightly there would still be a chance of hearing the Costa Rican studio. The move may have been a temporary one, and it may return to its former wavelength of 46.8 m. (6.41 mc/s), on which it was so frequently captured by European listeners.

The Bangkok Broadcasts

If you wish to hear Siamese programmes you should choose your day and wavelength as the broadcasts from Bangkok are not yet carried out daily. On Mondays, between G.M.T. 13.00-15.00, you must tune in on 15.78 m. (19.016 mc/s), and on Thursdays, at the same time, on 32.09 m. (9.35 mc/s). Announcements are made in Siamese, French and English. Interval signal: three chimes (ascending scale) thus, *soh-do-mi-do-mi-soh-mi.*

Spain Again Invades Amateur Band

On 42.8 m. (7.008 mc/s), between G.M.T. 20.50-21.15 daily, a Barcelona station is heard broadcasting war news in the English language. The call-letters have not been clearly received, but would appear to be PSUI. On other evenings another broadcast has been picked up on 42.88 m. (6,996 mc/s), between G.M.T. 22.00-23.30; in this instance the call was logged both as ECNI and CNT.

A Three-stage Amateur Band S.W. Receiver

(Concluded from last week's issue)

IT should now be found that, having got the detector just oscillating at the bottom of the 40 m. band, it is possible to tune right round almost as far as the L.F. end before reaction needs taking up. R6 is not used for reaction control except in so far as it is set for each band.

Tuning Adjustments

Under these conditions, tuning for CW stations on 40, 20 and 10 metres is simply a matter of using C8, with an occasional touch of C9. Telephony stations are, of course, tuned in the usual way, for the reception of which the use of the screen-grid detector will be found particularly suitable. Actually, the 40 m. band is covered by one complete 180-degree movement of C8, 20 metres by about 100 degrees, and 10 metres by 120 degrees. The frequency ranges involved in connection with all the amateur bands can be found by reference to Fig. 1, on p. 547, PRACTICAL AND AMATEUR WIRELESS, January 16th, 1937. For 80 and 160 metres, on which the set can be operated with the H.F. stage aperiodic by leaving all three switches S1, S2 and S3 open, as previously described, it will be necessary to use the band-set condenser C7 in two and three positions respectively, since C8 will not completely cover these two ranges. If C7 is fitted with a slow-motion driving head, it can be used for tuning on 80 and 160 metres, with C8 as vernier.

Peak Values

On tuning the H.F. stage on 160 metres, a sharp peak should be obtained when the grid circuit of V1 (C1-L1/L2) is brought into resonance with the grid circuit of V2 (C7-L3), and this peak should occur with C1 nearly all in when the receiver is tuned to top end of 160-metre band. Here a little adjustment of L1/L2 may be necessary, as the value will be somewhat affected by the aerial characteristics. If the peak is found to come below the required setting on C1—say, at 100 degrees instead of about 150—the aerial coupling condenser Cc should be reduced in value till its capacity is not less than .0003 mfd. If the peak still comes too low on C1, a few turns should be taken off L1/L2 and the centre-tap moved accordingly. On the other hand, if it is found on the first test that the H.F. stage is peaking with the condenser C1 at nearly 180 degrees, the value of Cc should be increased till the peak is brought down to about 150 degrees. If it is found that even with direct coupling of the aerial the resonant point is still too high on C1, a few turns will have to be added to L1/L2 till, with a value for Cc of not less than .0003 mfd., the dial reading for resonance at the top of the 160-metre band is about 150 degrees. Remember that any adjustment of the turns value of L1/L2 will have to be accompanied by a corresponding alteration of the centre-tap and that it is worth while carrying out the whole adjustment carefully, since once set for 160 metres in the manner described, the H.F. tuning will automatically be correct for 80 m. The sharpness of tuning in the H.F. stage—the peak—largely depends upon the degree of damping introduced by the aerial; hence the suggestion that the value of Cc should not be less than .0003 mfd., as with the average aerial, this will be found to give the best relation between sharpness of tuning and coupling on both bands.

The receiver as described can, of course, be used for listening anywhere within the frequency range of the various coils, and it will be found that all the usual S.W. broadcasting stations can be received. For this, the band-spread feature will be found very helpful.

One final point in connection with the set, which can be operated from an eliminator if desired, is that it is advisable to have the control knob of C7 working against a scale of some kind. This enables the amateur bands, and the S.W. broadcasting bands, to be quickly found on the different coils once the initial calibration of C7 has been carried out. In this connection, the heterodyne frequency meter described in the January 16th issue of PRACTICAL AND AMATEUR WIRELESS will be found most useful.

THE NEW PENMON TRANSMITTER

(Continued from page 665)

mission line. This takes the form of a concentric tubular feeder and conveys the high-frequency energy to the aerial transformer house near the base of the mast, some distance from the main building.

The water which cools the anodes of the valves in the main amplifying stage forms a closed system and is itself cooled by an outdoor radiator through which air is drawn by a fan.

The Aerial

The type of aerial used is that in which the mast itself radiates the high-frequency energy. It is 250 feet high and has a capacity ring 40 feet in diameter at the top. It is of lattice steel construction supported by three sets of stays and is tuned by circuits in the aerial transformer house adjacent to its base. These circuits are coupled to the feeder referred to above. Duplicates of both feeder and aerial tuning apparatus are provided.

Power Supply

The power supply is taken from the 11,000 volt A.C. mains of the North Wales Power Company, Ltd., through a small sub-station adjacent to the transmitter building. In this the supply is stepped down to 400 volts, at which pressure it is used in the transmitter building.

The high-tension supply apparatus is located in the transmitter enclosure and consists of main and auxiliary power transformers feeding high-voltage valve rectifiers, duplicate transformers being provided. The main rectifier consists of six valves and delivers approximately 2 amps. at 12,000 volts, whilst the auxiliary rectifier consists of three valves and delivers approximately 0.3 amps. at 5,800 volts.

The filament-heating and grid-bias supplies are obtained from motor generators, duplicate machines being provided in each case. The main filament-heating motor-generator sets have an output of 225 amps. at 25 volts D.C. and the grid-bias sets, each of which consists of a motor driving two generators, have outputs of 1 amp. at 150 to 300 volts and 0.4 amps. at 350 to 500 volts D.C. The filaments of the modulated amplifier valves, which are at a high potential with respect to earth, are heated by an insulated motor generator which, together with a spare machine, is located within the transmitter enclosure.

AMATEUR TRANSMITTING

(Continued from page 666)

The volume control (R1) is an Erie .5 mehogm, while R3 is 50,000 ohms; R4 20,000 ohms and R2, the bias resistance, 750 ohms for a Cossor 41 MHL, or according to valve specification.

The grid H.F. stopper, R6, is 50,000 ohms, while the grid leak, R5, is 0.2 megohms. The bias resistance, for a Tungsram A.P.P.4c is 150 ohms, its by-pass condenser C4 being 50 mfds. (12-volt rating) of the electrolytic type.

The by-pass condenser C1 (for R2) should have the same value for preference, though a smaller capacity can be used if one is to hand.

The intervalve coupling condenser C2 is 0.05 mfds., mica dielectric; the anode decoupling component C3 is 2 mfds. or 4 mfds., and the resistance R8, across the secondary of the output transformer T2, is 10,000 ohms.

It is advisable to use a separate battery for the energising of the microphone, and screen all leads on the primary side of the transformer.

The C.O. Stage

The condensers C1, C2 and C3 are 0.006 mfds., while R1 is, say, 40,000 ohms, the best value being determined, as previously explained, by experiment.

The tank circuit L1, V.C.1, must be designed according to the waveband to be covered, but a value of 100 micro-micro-farads for V.C.1 is a satisfactory capacity for the 20 to 160-metre range.

It will be remembered that it is essential for the C.O. stage to be fully screened from the remainder of the circuit, particularly the R.F. amplifier.

The R.F. Amplifier

The coupling condenser C4 is 0.0001 mfds., mica dielectric, and the resistance R2 in the G.B. circuit, 10,000 ohms. The decoupling condensers C5 and C6 are .01 mfds. and .001 mfds. respectively.

There is one point to note about the tank circuit L2, V.C.2, and that is, it is advisable to use double-spaced vanes for V.C.2, and a heavy gauge copper-wire coil, air spaced, for L2, it being supported by the stand-off insulators obtainable for such purposes.

All H.F. chokes must be of good make, and it is desirable to see that they do not resonate at any frequency within the band under consideration.

The actual rating of the complete transmitter, using the valves suggested, is in the neighbourhood of 7.5 watts, thus bringing it within the scope of a 10-watt licence, that being the power permissible for a beginner. It is, of course, assumed that a full licence has been obtained before the transmitter is put "on the air."

As this is the last article of this series, I would like the opportunity of saying that it has been impossible to cover all phases of this very interesting and instructive branch of wireless. In fact, it was not the purpose of these articles to do that, as such a task would fill a volume. If, however, I have conveyed sufficient information, and aroused sufficient interest to enable the enthusiast to make a start and enter the realms of amateur transmitters, then I shall feel that the series have achieved their object.

THE BRITISH LONG DISTANCE LISTENERS' CLUB

The Language of the Amateur

ALTHOUGH we have given before the various abbreviations used by the wireless amateur, there are many newcomers to the ranks of the B.L.D.L.C. who are unfamiliar with the many terms used both on the air and in correspondence. The following details are necessarily incomplete, but the majority of the more usual terms are given. First, in describing a receiver the abbreviation RCVR is often used, whilst for a transmitter the abbreviation XMTR is employed. The letter X is often applied for "trans" and thus transmission is often written Xmission and so on. But it is also employed in the abbreviation Xstal, standing for crystal. In describing the type of receiver, a group of symbols is generally employed, and these describe the manner in which the set is divided up. The detector is identified by the letter V or C, dependent upon whether a valve or crystal is used, and on either side of this letter the number of H.F. and L.F. stages is placed. Thus, a receiver employing 1 H.F. stage followed by a valve detector, followed by 1 L.F. stage would be referred to as a 1—v—1 receiver, and a 2—v—1 would be a set employing 2 H.F.'s, detector and L.F.

Signal Strength

So much for the references to equipment. When reporting upon a transmission it is necessary to give the strength at which it is received, and this is done by means of the "R" code, in which the letter R followed by a number is used to denote the reception which is obtained. This code is usually applied to telephony signals, and for Morse signals a T code is often used. The "R" code is as follows, but it must be remembered that the individual idea of "Good reception" may vary, and thus, the code is not so good as a measured output, although this is not always easy to obtain:—

R1—Very faint signals, unintelligible.
R2—Weak reception, unintelligible.
R3—Weak reception, but partly intelligible.
R4—Fair signals, just intelligible.
R5—Moderately strong signals.
R6—Good reception.
R7—Good, clear reception that comes through interference.
R8—Very strong signals heard several feet from the 'phones.
R9—Extremely strong signals.

The "T" code is as follows:—

T1—Very bad A.C. ripple.
T2—Rough, A.C. ripple.
T3—Bad ripple on note.
T4—Small ripple on note.
T5—Nearly D.C., but bad key thumps.
T6—Good note, but not quite pure.
T7—Pure D.C. note, but key clicks noticeable.
T8—Pure D.C. note, but not as good as T9.
T9—Fine, steady, crystal-controlled D.C. note.

The "Q" Code

To avoid sending long messages, or writing out a whole sentence, a series of abbreviations known as the "Q" code is used, and these are employed commercially to operate as both question and answer. Thus, QRA is the abbreviation standing for the question, "What is the address of your station?" and also for the reply, "The address of my station is ——." The following are the main Q abbreviations:

QRA—The address of the station is
QRB—The approximate distance between our stations is . . .
QRG—Your frequency is . . . kilocycles.
QRH—Your frequency varies.
QRJ—I cannot receive you.
QRK—Your signals are good.
QRM—Interference.
QRN—Atmospherics.
QRO—Increase power.
QRP—Decrease power.
QRT—Stop transmitting.
QRU—I have nothing more for you.
QSA—Signal Strength (see QSA code below).
QSL—An acknowledgment of reception (i.e., QSL card).
QSO—A communication or contact.

The QSA code, which is sometimes used in place of the R code, divides the signal strength into five degrees as follows:—

QSA1—Hardly perceptible.
QSA2—Weak signals, readable only now and then.
QSA3—Fairly good reception, readable with difficulty.
QSA4—Good, readable signals.
QSA5—Very good signals, perfectly readable.

Fading and Atmospherics

The old hand is well aware that atmospherics, or statics, as they are sometimes called, are referred to as X's. Therefore, to refer to interference from this source there are four references:

X—Slight static.
XX—Strong static.
XXX—Very strong static.
N—No static.

To identify the degree of fading we use the letter F.

F—Slight fading.
FF—Fairly strong fading, but the transmission still intelligible.
FFF—Very strong fading, with complete loss of transmission at times.

When making reports on a transmission the above abbreviations will not only save time and space, but in many cases will enable you to give a clearer account of your reception, and you may complete your report by adopting some of the "personal" abbreviations, such as O.M. (old man), Y.L. (young lady), or 73's (best wishes).

Local Clubs

MR. J. N. BEATON, of 8, Richmond Park Road, Clifton, Mr. B. Symonds, of 10, Audley Park Road, Hele, Torquay, and Mr. S. M. Withers, of 1, Discons Row, Grove, Nr. Wantage, Berks, would like to get into touch with other members in their respective districts.

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.

Exeter and District Wireless Society

FUTURE events in the spring programme of this Society are as follow: Feb. 22nd: A visit to the Exeter Radio Exchange, Belmont Road. March 1st: "Modern developments in small Electrical Apparatus," by Mr. F. S. Rumball. March 8th: "The very high frequencies and how they are utilised by the Medical Profession." Lecture by Dr. C. Wroth, Exeter. March 15th: "My Home Set fully remote-controlled." 9-valve Superhet; A visit to Mr. E. H. Ware's home at Woodbury. March 22nd: "Electricity in Agriculture." A lecture by Mr. L. W. Cornish, City of Exeter Electricity Dept. March 29th: Easter Monday—No Meeting. April 5th: "A Telephone Talk," by Mr. G. D. Bateman. Illustrated by lantern slides. April 12th: "A Talk on Short and Ultra-short waves," by Mr. R. C. Lawes. April 19th: "How and what we see," by Mr. D. R. Barber, B.Sc., of the Norman Lockyer Observatory, Sidmouth. April 26th: Annual Meeting.

All meetings are held at the Y.W.C.A., Dix's Field, Southernhay, at 8 p.m., except that for April 19th, which will be at 7.30 p.m.

Hon. Sec.: W. J. Ching, 9, Sivell Place, Heavitree, Exeter.

The West London Radio Society

REGULAR meetings of the above Society are held at the "Anchor," Uxbridge Road, West Ealing, W.13. The Annual General Meeting will be held at this address on February 17th, at 8.15 p.m., and all interested are welcome to attend. Particulars may be obtained from Mr. D. Reid, 15, Tring Avenue, Ealing Common, W.5.

The Southall Radio Society

AT the meeting of this Society, held on January 26th, the lecturer was Mr. H. V. Wilkins, G6WN, who gave a talk on "Ten Metres." The Society's President, Mr. Ancrum, was in the chair. The large attendance was obviously keenly interested in Mr. Wilkins' subject, and he had to face a barrage of questions for more than 40 minutes at the conclusion of his address.

At the meeting of this society held on February 2nd, the speaker was Mr. Graham Fox, VE3DG, who gave a talk, which was amusing as well as instructive, on the subject of mast construction. He was followed by Mr. Leslie Wilkins, G6WN, who discussed various aspects of long-distance working. Mr. W. A. Ancrum, the Society's President, was in the chair.

Visitors are welcome to the Society's meetings, held each Tuesday, at 8.15 p.m., at their headquarters, Southall Library, Osterley Park Road, Southall. This is near Southall (G.W.R.), station. A programme can be obtained on request from the Hon. Secretary, Mr. H. F. Reeve, 26, Green Drive, Southall, Middlesex.

The Croydon Radio Society

TUESDAY, February 2nd, saw the Technical Adviser of the Croydon Radio Society ensconced behind an array of members' loudspeakers in St Peter's Hall, S. Croydon. Comparisons took place on radio and on the frequency oscillator. The latter was a special one brought by the chairman, Mr. W. J. Bird, giving frequencies from 32 to 10,000 cycles. After some preliminary judgments, four models emerged. Mr. S. F. Webster's 10in. Goodman found a worthy opponent in Mr. G. S. Taylor's 1937 Stentorian Senior, but more comparisons followed, which were equally difficult to adjudicate on. Summarising all tests, Mr. Barden's 12in. Goodman obtained the final verdict because of its so very even and wide frequency range.

On Tuesday, February 23rd, is a lecture demonstration by Mr. P. K. Turner, on the Hartley Turner loudspeaker. Hon. Pub. Sec. E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

Deptford Men's Institute Short-wave Radio Club

THE above club continues to hold meetings every Tuesday evening at 8 p.m., at the "Deptford Men's Institute," Clyde Street, S.E.8, and recently experiments on transmitting have been conducted. Several types of crystal oscillators, triode and pentode, have been made and tested, and the start has been made on a 40-metre transmitter consisting of a pentode crystal oscillator and RFP15 power amplifier.

It is hoped that a series of 5-metre experiments will soon be commenced on alternate Tuesdays from 8 p.m. onwards. The call sign used will probably be G2UX, and any reports of reception will be much appreciated, and answered. Any information regarding membership and subscriptions can be obtained by communicating with the Hon. Sec., Mr. A. S Wilson, 11, Bennett Street, S.E.13.

The Newbury and District Short-Wave Club

THE above club is still going strong and one of our members has now obtained his A.A. Transmitting Licence, so we might be on the air shortly. We had Messrs. Lissen's demonstrator at our last meeting, and several new members were introduced. L. Harden, Hon Secretary, 12, Highfield Avenue, Newbury, Berks.

Harco Radio Club

AT the meeting of this club, held on January 26th, 1937, we had a very interesting lecture and demonstration, given by Mr. E. Cholot, of Lissen, Ltd.

Several receivers manufactured by this firm were demonstrated, and new members were amazed at the number of American radio stations that were logged in a very short space of time. Also demonstrated were the new HI-Q components, also manufactured by Lissen, Ltd., which proved to be of great interest to members.

An interesting programme is being arranged for the future entertainment of our members. All readers are welcome to attend any of our meetings, which are held every Tuesday, at 8 o'clock, at the club room. The membership fee is 2s. 6d. per year. Hon. Sec., C. W. Kemp (Dept. HRC), 124, River Way, Greenwich, S.E.10.

BOOKS RECEIVED

THE PRACTICAL ELECTRICIAN'S POCKET BOOK, 1937, published by Odhams Press Technical Book Department, 85, Long Acre, W.C.2. Price 2/10, post free.

IN the new edition of this useful pocket-book further extension has been made to the reference tables of supply voltages. Covering eighty pages, these tables are in two sections. The first gives the main details of supply for each of the electricity undertakings in Great Britain; the second contains the voltages of some 7,000 cities, towns and villages on mains of these undertakings. Similar information is also given for Northern Ireland and the Irish Free State.

In revising the 1937 Pocket Book, the editor has consulted Professor C. L. Fortescue, O.B.E., M.A., M.Inst., C.E., M.I.E.E., principal of the electrical engineering department of the City and Guilds Institute. No new chapters are included, but substantial revision is made in many sections. Principal among these are the sections dealing with Power and Power Factor, Furnaces, A.C. Motors, the Theory of Dynamos, Rectifiers, Electricity Regulations, Transmission and Distribution, Photometry and Illumination and Domestic Electrical Appliances.

Mr. A. P. M. Fleming, C.B.E., M.Sc., M.I.E.E., F.Inst.P., director of research and education, Metropolitan Vickers Electrical Co., again contributes the introductory chapter in which the outstanding features of electrical progress in 1936 are discussed.

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.

F. R. (Catford). You do not say whether you require the amplifier for battery or mains use. We have two or three mains amplifiers which would suit your purpose, and these will be found in the blueprint list in this issue, at the foot of the third column. An article on making amplifiers of the type mentioned, both battery and mains versions, was given in our issue dated July 4th last.

H. R. F. (New Malden). We refer you to the various constructional articles on I.F. transformers. The intermediate frequency mentioned could be employed, but you would probably find it more suitable to use 465 kc/s.

G. L. (Buckland). R.9 may have any value from 2,000 to 20,000 ohms. Adhere to the connections shown in the theoretical diagram.

C. B. (Eastcote). The aerial is rather on the long side, and a shorter arrangement is to be desired. The connections to the coil-holder are standard, but your coil may be connected to the pins in a different manner. Try to trace out the windings and make certain that they are correct. The H.F. choke should be joined direct to the anode terminal of the valveholder, not to the reaction condenser.

W. N. (Rotherham). We regret that it is impossible to help you in your difficulty, as it would be necessary to measure the output from the various windings, in order to find out the voltage given at each point. A good service engineer or radio dealer should be able to measure these and you should then fit a terminal strip suitably marked to avoid further difficulties.

R. E. S. W. (Cheam). We hope to give the details before very long. There has not been a great deal of interest in this arrangement.

E. T. (Penang, S.S.). No blueprint is available for this particular set. It would be difficult to make one coil cover the wide range mentioned. Two coils should be wound, the first with four turns for the secondary and two turns for the primary, and the second with 25 turns and nine turns respectively. Ninety volts should be adequate, and you may find that 60 or 66 volts will give smoothest reaction. The L.T. must be chosen according to the valve type, and this should be one of the General Purpose or H.L. valves.

F. B. (Whaley Bridge). We regret that we do not know of any firm who can supply the spring. It would be necessary for the makers to replace this, as it is part of the actual winding, and we cannot trace the trade mark in our records.

W. S. (Stamford Hill). You will probably find that the valve you mention may be used in the circuit without alteration, but we cannot guarantee results unless you adhere to the specified valves.

J. H. (Forest Gate). We are sorry that we have no blueprint which would be of use to you. The circuit you mention should be quite sound, and you must have made some mistake in wiring or used a defective compouent. We suggest you check the wiring again.

FREE ADVICE BUREAU

COUPON

This coupon is available until February 27th, 1937, and must be attached to all letters containing queries.

PRACTICAL AND AMATEUR WIRELESS, 20/2/37.

IMPRESSIONS ON THE WAX

By T. Onearm

Decca and Brunswick

"ON your Toes" is a new musical play which we shall see in London shortly, and for the first time in his career Lew Stone will act as musical director of the show, and will conduct the production. Hear "On your Toes" selection played by his band on *Decca K* 855. As regards "Sing something in the morning" and "No More" on *Decca K* 6264, this is the first Decca record of two tunes from C. B. Cochran's show, "Home and Beauty," which we shall see in London in a week or two's time. I rather anticipate that "Sing something in the morning" may become a more popular habit than whistling in the bath.

"Pennies from Heaven"

THE above is the title of a new film which will be released some time in March, featuring Bing Crosby and Louis Armstrong. Records of numbers from this film have just been recorded by the Decca Company. I would draw your attention to *Brunswick* 02316, "Pennies from Heaven" and "Let's call a Heart a Heart," which is a 12in. solo record of Bing Crosby, and *Brunswick* 0134, "Pennies from Heaven" Selection, a celebrity record of Bing Crosby, Louis Armstrong, Frances Langford and Jimmy Dorsey and his Orchestra. Although these records are issued some time before the public have had an opportunity of seeing the film, I am convinced you will take to the music.

A Popular Song

THE STREET SINGER appears in the Decca list with "In the Chapel in the Moonlight" and "I dream of San Marino" on *Decca F* 6251. In my opinion, "In the Chapel in the Moonlight" is a 100 per cent. popular song, very reminiscent of the genuine sentimental songs of the pre-war English music-hall.

Duke Ellington and his Orchestra have made a new recording on *Brunswick* 02365 —"Rent Party Blues" and "Doing the Voom Voom." I like the titles of this record, and "Rent Party Blues" suggests the gathering together of a lot of people who cannot meet their landlord in a friendly spirit—we are not told who has the "blues," the landlord or the tenants. I have no idea what the Voom Voom is, and Harry Sartou, who is principally responsible for this record, is unable to enlighten us.

"This'll Make You Whistle."

JACK BUCHANAN and Elsie Randolph make three records between them, of the principal tunes from their successful musical play "This'll Make You Whistle." "There Isn't Any Limit to My Love" and "Without Rhythm" is sung by Jack Buchanan on *Brunswick* 02347. "This'll Make You Whistle" and "I'm in a Dancing Mood" is sung by Jack Buchanan and Elsie Randolph on *Brunswick* 02348, and the latter sings "My Red Letter Day" and "You've Got the Wrong Rumba" on *Brunswick* 02349.

Bing Crosby also makes a new record this month of "Dear Old Girl" and "Just One Word of Consolation" on *Brunswick* 02341. This time he appears in association with a female vocal trio called "The Three Cheers."

Parlophone—New Tauber Records

RICHARD TAUBER, who needs no introduction to readers, appears this month on Parlophone *RO* 20318, singing "Smile for Me" and "Simple Little Melody," and on Parlophone *RO* 20319, on which he has recorded "You must Have Music" and "Heaven in Song"—four songs from his new British film, "Land Without Music." It is Tauber at his best.

Leslie A. Hutchinson, better known to readers as "Hutch," has made two fine records this month for Parlophone. They are "There's a Small Hotel" and "In the Chapel in the Moonlight"—*Parlophone F* 655, and "Easy to Love" coupled with "I've Got you Under My Skin"—*Parlophone F* 670.

Of interest is the famous Parlophone laughing record — *Parlophone E* 5078 — which, originally issued at 2s. 6d., has now been revived at 1s. 6d.

H.M.V.—Gigli's New Triumph

IN the new H.M.V. list Beniamino Gigli is represented by two arias, César Franck's "Panis Angelicus" and "Romanyo di Federice" from the opera "L'Arlesiana" on *H.M.V. OB* 2914.

Richard Crooks has chosen two favourite songs, "Songs my Mother taught me" and "Mother o' Mine," on *H.M.V. DA*1538.

Max Miller, "the cheeky chappie," who made his first H.M.V. record last month, caps it with "Ophelia" and "Down in the Valley," on *H.M.V. BD* 396, both of which are in his best vein of quick-fire humour.

Dancing Time

MANY people have admired Fats Waller's dexterity on the piano in his many dance records. On *H.M.V. B* 8501 we have him translating hot rhythm music to the organ, on which he plays "St. Louis Blues" and "Lenox Avenue Blues."

There is a wealth of new dance music and swing music of which I give a summary: Jack Hylton and his Orchestra play "Did you mean it" and "Have you forgotten so soon" on *H.M.V. BO* 5142 and "Rose Room" and "Tiger Rag" on *H.M.V. BD* 5128. Roy Fox and his Orchestra contribute "Magnolias in the Moonlight" and "Crazy with Love" on *H.M.V. BD* 5148 and "I was saying to the Moon" and "To you, Sweetheart" on *H.M.V. BD* 5149. "Easy to Love" and "I've Got You Under My Skin" are played by Ray Noble and his Orchestra on *H.M.V.* 5147. The Ballyhooligans add Parts 3 and 4 to their "Ragging the Rag Medley" on *H.M.V. BD* 5131. Other dance records are played by Teddy Foster and his Kings of Swing, Ronnie Munro and his Dance Orchestra, and Eddie Duchin and Tommy Dorsey.

Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

Brimar Valves

STANDARD TELEPHONES & CABLES LTD., announce that they are introducing American types of valves in the series of Brimar valves, all to be sold at standard B.V.A. prices. They are manufactured in Great Britain at the Brimar factory at Foots Cray and are equivalent in all respects to the American products bearing the same type numbers. The range and prices are as follows:—

Type No.	List Price.
6A7	15/-
6B5	22/6
6B7	20/-
6C6	12/6
6D6	12/6
25Z5	10/6
42	13/6
43	13/6
75	12/6
78	12/6
80	10/6
89	13/6

Cathode-ray Tubes

A FURTHER range of cathode-ray tubes are now available for the home-constructor and for replacement purposes. These are Ferranti and H.M.V. (Emiscope) products and the main characteristics are given below.

Type.	Heater Volts.	Heater Amps.	Max. Anode Volts.	Screen diam.	System of Deflection.
			FERRANTI		
T.10	2	1.5	5,000	9in.	Magnetic focusing and deflection.
T.12	2	1.5	5,000	11in.	ditto.
T.15	2	1.5	5,000	14in.	ditto.
			H.M.V.		
9in.	4	1.3	6,000	9in.	Magnetic deflection and electrostatic focusing.
12in.	4	1.3	6,000	12in.	ditto.

All of the above tubes are of the black-and-white screen type and the prices of the two Emiscope tubes are 11 gns. and 15 gns. respectively. The Ferranti tubes are coated internally with Acheson's Colloidal Graphite, minimising reflection and reducing internal charges.

New Mullard Pentode

A NEW output pentode is announced by the Mullard Company, and this is to be known as the Pen 428. It is eminently suitable for use in Public Address amplifiers, used in Class A-B circuit. Using two of these valves in the above circuit, with 375 volts on the anode and 275 on the auxiliary grid, an output of 28 watts may be obtained, with the low total distortion of 2 per cent. A single valve, with an anode voltage of 250 will enable 8 watts output to be obtained. The heater is of the 4 volts 2.1 amp. type and the price is 25s.

Farrex S.W. Converter

THE accompanying illustration shows the novel form taken by the Farrex S.W. converter, which is in future to be known as the 1937 Pre-amplifier Short-wave Unit. The round cabinet is all metal, whilst the round feet are of tubular rubber, thus preventing difficulties from microphony or vibration, and at the same time providing a firm footing for the unit even on a polished surface. The coils and main parts of the unit are arranged on a small metal chassis which fits into the lower part of the cabinet and which is also suspended on rubber buffers and totally screened, the bottom of the chassis being closed with a sheet of bent aluminium. The unit shown is for mains operation and is designed to employ Universal type valves, those specified by the makers being the Mazda V.4020 and SP.1320. A mains adjusting resistance is mounted on the chassis, and smoothing is carried out by two 8 mfd. electrolytic condensers. A mains plug and length of flex is fitted for connection to the nearest mains socket, and a single lead for inclusion in the aerial socket of the broadcast receiver is the only additional external connection. The aerial and earth leads are, as usual, connected to an appropriate socket strip on the back of the cabinet. A separate on/off mains switch is fitted, but the main switch control on the panel front cuts out the converter when it is desired to use the receiver without the short-wave addition.

The wave ranges are from 11 to 28 metres, from 24 to 60 metres, and from 45 to 115 metres, but an additional position is provided for use with a special ultra-short-wave attachment which can be supplied by the makers. A single tuning control is fitted (with a concentric slow-motion drive) and the scale is illuminated from the rear, with a pointer in this position, thus enabling the scale to be fitted direct on the cabinet and render it dustproof. The unit works very well with practically any straight receiver employing H.F. amplifying stages, and a small trimmer is fitted at the rear of the chassis to remedy any slight tendency to squegger. The broadcast receiver must, of course, be adjusted to a long wavelength, the most effective position in the sets which we tried being about 1,850 metres. The price of the unit is 79s. 6d. without valves.

This is the Farrex 1937 pre-amplifier short-wave unit reviewed above.

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Reports Wanted

SIR,—Apropos the remarks concerning QSL's which have been appearing in your pages, I give below an extract from a letter I have just received from a U.S.A. transmitter :—

"WIJFG, on 3,943 kc/s, power 95 watts (phone), would appreciate reports QRK, QSL, with particulars of receiver, etc., to RFDI (ARRL), Woonsocket, R.I., U.S.A."—H. O. CRISP (Southampton).

Our One-valve Short-waver

SIR,—You may be interested in my experiences with the One-valve Short-waver recently described in your interesting journal. Frankly, I think it an exceedingly efficient circuit.

To name a few of the stations received at real entertainment value strength, I have logged : Daventry, GSB, GSC, GSD ; Rome, 2RO ; Moscow, RW59 ; Zeesen, DJD, DJN, DJC ; Paris, TPA3 ; Wayne, W2XE ; Schenectady, W2XAF ; Pittsburg, W8XK ; Prague (experimental transmissions) ; Tokio, JVP ; Bandoeng, PMN ; and many Spanish stations.

I have wound my own coil on a commercial 6-pin former, giving me from 20 to over 50 metres. I can certainly recommend the fitting of a coil holder as it facilitates so much the experimenting with various windings. The coil I use was arrived at in this way plus a little mathematics. The .0003 fixed condenser has been replaced by a .0005, and I consider the .0003 reaction condenser must be an air-spaced slow-motion one. Great care was taken with the wiring and all connections—except, of course, to terminal screws—soldered.

Outside aerial is about 40ft., and runs from a garden fence about 20ft. from the house up to the eaves and down through a ground floor window. I thought this would be very inefficient, but had no alternative as my family objected to my linking up the one-valver to the commercial receiver aerial and earth, thus depriving them of the broadcast programmes. Curiously enough, it has turned out to be eminently satisfactory, as you can judge from the results. The valve used is a Mullard PM1HL. Thanks for a very interesting circuit.—W. G. MONEY (Birmingham).

QSL's and Reports

SIR,—I have read with much amusement the letters written to PRACTICAL AND AMATEUR WIRELESS recently on the subject of QSL's, etc., and, dear me, you certainly seem to have an argumentative set of readers. What with Mr. Everard-cum-BSWL and Mr. Ismay-cum-G6IJ, it looks as if the letters page is rapidly developing into a "bureau for nasty remarks."

Personally, I think both the Everard clique and the Ismay group are right to a certain extent, but apparently, neither intends to be persuaded that they are in the wrong.

Finally, I would like to add a few words complimenting you on your excellent paper, and hope you will continue to satisfy your readers as you always have done to date.—SYD. A. CARTER (Coventry).

[*This subject is now closed.*—ED.]

Quality Reproduction !

SIR,—I have been reading PRACTICAL WIRELESS from No. 1 and have always found it very useful and interesting. I have been searching for real quality for years, and I have just built the amplifier described by Mr. Noel Bonavia-Hunt in the December 26th issue. I find it gives superb quality of reproduction. Many thanks for the article and your fine paper. —P. C. JONES (Clapham Common).

Back Numbers Wanted

WE have a request for copies of *Amateur Wireless* dated December 9th and 16th, 1933, March 4th, 1933, and for a copy of the W.M. blueprint of the "Signpost Four." If any reader having these to spare would kindly forward them to this office they will be sent on to the reader concerned.

We also have a request for a copy of the *Wireless Magazine* dated August, 1934.

The Experimenters

SIR,—I fully endorse the opinion expressed in your article, "The 'Experimenters' Discuss Old Times," that the energy radiated is at times fully absorbed. You in the London district can all but use a bit of string as an aerial to get all the energy you require, but we at a distance find it very different.

My set is Det. and 2 L.F. and with an indoor aerial. I have noticed again and again, when some very important event is being broadcast, that the reception is very much weaker, especially if the evening is wet and keeping more people indoors. Also, our reception has been clearer and stronger since the destruction of the Crystal Palace.

I remember reading an article some time back in one of the Wireless papers, I believe either *Amateur Wireless* or the *Wireless Magazine*, stating the screening effect of the metal framework over a large section of the south-east corner of the kingdom.—W. W. BRANSTON (Hawkinge).

A Good Log : Correspondent Wanted

SIR,—I have been a regular reader of your excellent paper for just over three years. I am aged 16 and would like to correspond with any other young reader. I would also like to become a member of any short-wave club in my district.

I give below my log for the last nine months :

W2XAF, W2XAD, 8XK, 3XAL, 1XK, 1XAL, 2XE, VK2ME, EAQ, 2RO, CSW, CT1AA, CT1CT, OLR, RNE, LRU, PCJ, W3XAU, SP1CC, HI7G, TI3AV, SV1MK, SM1SX, SM1CP, HB9A, EA1AZ, D4YMI, LA1G, XEIG, ON4ZA, ON4PA, ON4SS, SU1SG, SU1KG, VE2DC, VE1CR, VE1CI, VE1IN, VE1CN, VE1BI, PY8AD, F8MG, F8II, F3JB, F3LG and F3YZ. Also 80 Americans, including W1CCZ, W2XAU, W3DHG, W4FM, W4DY, W4CPG, W4AHH, W5BRM, W7MG, W8MPX, W8DWI, W8FEI, W8GLY, W9BBW, W9ITS, W9LLX, W9DXE. I have also logged 13 Dutch stations and GTN, GZBW, (Berengaria)—P. R. SMITH, 84, Orchard Avenue, Lancing, Sussex.

[*Will the local club secretary please note ?*—ED.]

A Reader's Helping Hand

SIR,—I would like to point out for the benefit of any of your readers who may reside in this district that I am open to assist, free of charge, in the construction of any PRACTICAL AND AMATEUR WIRELESS receiver, or location of any faults that may occur, being an experimenter of some years standing. I have an Avo Oscillator and Avometer, etc. I would also like to express my appreciation of your very valuable paper.—W. H. BECKETT. Hillcrest, Hamilton Road, Braintree, Essex.

Barcelona and Madrid S.W. Stations

SIR,—I have just received a very interesting QSL card from Station PSUI, Barcelona, which depicts, with a red flag as a background, a helmeted soldier, rifle in hand, and the information which it gives may be of interest to other readers of PRACTICAL AND AMATEUR WIRELESS.

Station PSUI broadcasts every night at 20.50 with news in English about the war in Spain, on a wavelength of 41.15 m. They have recently increased their power about three times.

Station UCT (Madrid) also broadcasts news in English every night from 21.00-21.15 G.M.T. on wavelengths of 30 m. and 40.6 m.—R. C. MARTIN (Exeter).

CUT THIS OUT EACH WEEK.

Do you know

—THAT it is sometimes advisable to use two or more resistors in series, rather than one single one, to avoid damage to the component.
—THAT a microphonic valve may be used for testing a receiver which is faulty, by including it in each stage in turn in order to determine which stage has broken down.
—THAT an ordinary power valve may often be used as a rectifier in a mains unit.
—THAT switches should not be cleaned with an abrasive in view of the risk of metallic dust causing noisy working.
—THAT coupling between coils for such purposes as band-pass etc., may be carried out with twisted wires.
—THAT a variable condenser in the H.F. coupling enables selectivity to be adjusted.
—THAT a solid dielectric reaction condenser acts as a safeguard against H.T. short-circuits.

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., Tower House, 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.

Practical and Amateur Wireless
BLUEPRINT SERVICE

These blueprints are drawn full size.
Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following *prices, which are additional to the cost of the blueprint.* A dash before the Blueprint Number indicates that the issue is out of print.

Issues of Practical Wireless — 4d. Post paid.
" " Amateur Wireless — 4d. " "
" " Practical Mechanics — 7½d. " "
" " Wireless Magazine — 1/3 " "

The index letters which precede the Blueprint Number indicate the periodical in which the description appears; thus, PW refers to PRACTICAL WIRELESS, AW to *Amateur Wireless*, PM to *Practical Mechanics*, WM to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the blueprint and the issue (stamps over 6d. unacceptable), to PRACTICAL AND AMATEUR WIRELESS Blueprint Dept., Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS.

	Date of Issue.	No. of Blueprint
CRYSTAL SETS.		
Blueprint, 6d.		
1937 Crystal Receiver	9.1.37	PW71
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
All-wave Unipen (Pentode)	—	PW31A
Two-valve : Blueprint, 1s.		
Four-range Super Mag Two (D, Pen)	11.8.34	PW36B
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	—	PW35
Summit Three (HF Pen, D, Pen)	8.8.34	PW37
All Peutode Three (HF Pen, D (Pen), Pen)	22.9.34	PW39
Hall-Mark Three (SG, D, Pow)	—	PW41
Hall-Mark Cadet (D, LF, Pen, (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Genet Midget (D, 2 LF (Trans))	*June* '35	PM2
Cameo Midget Three (D, 2 LF (Trans))	8.6.35	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	17.8.35	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	—	PW64
The Gladiator All-Wave Three (HF Pen, D (Pen), Pen)	29.8.36	PW66
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	5.12.36	PW72
"Tele-Cent" S.W.3 (SG, D (SG), Pen.	30.1.37	PW74
Four-valve : Blueprints, 1s. each.		
Fury Four (2 SG, D, Pen)	—	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG) LF, Cl. B)	6.1.34	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF, Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	7.10.33	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	10.6.33	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.4.34	PW35C
D.C. Premier (HF Pen, D, Pen)	31.3.34	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	18.8.34	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (R.C.))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF, Pen, D, Push-Pull)	9.2.35	PW47
SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-Valve)	—	PW40
F. J. Camm's 2-valve Superhet (Two-Valve)	13.7.35	PW52
F. J. Camm's £4 Superhet	—	PW58
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	1.12.34	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. £4 Superhet 4	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	16.1.37	PW73
SHORT-WAVE SETS.		
Two-valve : Blueprint, 1s.		
Midget Short-Wave Two (D, Pen)	15.9.34	PW38A
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-Wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Bandspread S.W. Three (HF Pen, D (Pen), Pen)	29.8.36	PW68
PORTABLES.		
Three-valve : Blueprint, 1s.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	16.5.36	PW65
Four-valve : Blueprint, 1s.		
Featherweight Portable Four (SG, D, LF, Cl. B)	—	PW12
MISCELLANEOUS.		
S.W. Converter-Adapter (1 valve)	—	PW48A
AMATEUR WIRELESS AND WIRELESS MAGAZINE CRYSTAL SETS.		
Blueprints, 6d. each.		
Four-station Crystal Set	12.12.36	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
B.B.C. Special One-valver	—	AW387
Twenty-station Loudspeaker One-valver (Class B)	—	AW449
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det, Pen)	—	AW392
B.B.C. National Two with Lucerne Coil (D, Trans)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans)	—	AW338A
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	*July* '36	WM409
Three-valve : Blueprints, 1s. each.		
Class B Three (D, Trans, Class B)	—	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	—	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	—	AW417
1934 Ether Searcher: Chassis Model (SG, D, Pen)	—	AW419
Lucerne Ranger (SG, D, Trans)	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
Mullard Master Three with Lucerne Coils	—	AW424
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All-Britain Three (HF Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.11.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
£6 6s. Radiogram (D, RC, Trans)	—	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP 21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	*June* '35	WM389
Certainty Three (SG, D, Pen)	*Sept.* '35	WM393
Minitube Three (SG, D, Trans)	*Oct.* '35	WM396
All-wave Winning Three (SG, D, Pen)	*Dec.* '35	WM400
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans)	—	AW370
"A.W." Ideal Four (2 SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2 SG, D, Pen)	—	AW421
Crusaders' A.V.C. 4 (2 HF, D, QP 21)	18.8.34	AW445
(Pentode and Class B Outputs for above: Blueprints, 6d. each)	25.8.34	AW445A
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2LF)	*Feb.* '35	WM381
The H.K. four (HF Pen, HF Pen, D, Pen)	*Mar.* '35	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	*April* '36	WM404
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	*May* '33	WM329
Class B Quadradyne (2 SG, D, LF, Class B)	*Dec.* '33	WM344
New Class-B Five (2SG, D, LF, Class B)	*Nov.* '33	WM340
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C./D.C. Two (D, Pen)	*Sept.* '35	WM394
Three-valve : Blueprints, 1s. each.		
Home-Lover's New All-electric Three (SG, D, Trans) A.C.	—	AW383
Three-valve: Blueprints, 1s. each (*contd.*)		
S.G. Three (SG, D, Pen) A.C.	—	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen) A.C.	23.6.34	AW439
Mantovani A.C. Three (HF, Pen, D, Pen) A.C.	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan.* '36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen)	*July* '33	WM326
Harris Jubilee Radiogram (HF Pen, D, LF, P)	*May* '35	WM386
SUPERHETS.		
Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
Varsity Four	*Oct.* '35	WM395
The Request All-Waver	*June* '36	WM407
1935 Super Five Battery (Superhet)	—	WM379
Mains Sets : Blueprints, 1s. 6d. each.		
1934 A.C. Century Super A.C.	—	AW425
Heptode Super Three A.C.	*May* '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
1935 A.C. Stenode	*Apl.* '34	WM385
PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Midget Class B Portable (SG, D, LF, Class B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
TWO H.F. Portable (2 SG, D, QP21)	*June* '34	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS.—Battery Operated.		
One-valve: Blueprints, 1s. each.		
S.W. One-valve converter (Price 6d.)	—	AW329
S.W. One-valve for America	23.1.37	AW429
Rome Short-Waver	—	AW452
Two-valve: Blueprints, 1s. each.		
Ultra-short Battery Two (SG det., Pen)	*Feb.* '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve: Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-wave (SG, D, Pen)	*Jan.* 19, '35	AW463
The Carrier Short-waver (SG, D, P)	*July* '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A. W. Short-wave World-Beater (HF, Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valver Short-waver (SG, D, LF, P)	*Mar* '35	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-wave Super	*Nov.* '35	WM397
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
Two-valve Mains short-waver (D, Pen) A.C.	—	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	—	WM368
"W.M." Long-wave Converter	—	WM380
Three-valve : Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	*Aug.* '35	WM391
MISCELLANEOUS.		
Enthusiast's Power Amplifier (1/6)	*June* '35	WM387
Listener's 5-watt A.C. Amplifier (1/6)	*Sept.* '35	WM392
Radio Unit (2v.) for WM392 (1/-)	*Nov.* '35	WM398
Harris Electrogram (battery amplifier) (1/-)	*Dec.* '35	WM399
De-Luxe Concert A.C. Electrogram	*Mar.* '36	WM403
New Style Short-waver Adapter (1/-)	*June* '35	WM388
Trickle Charger (6d.)	*Jan.* 5, '35	AW462
Short-wave Adapter (1/-)	*Dec.* 1, '34	AW456
Superhet Converter (1/-)	*Dec.* 1, '35	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May* '36	WM405
Wilson Tone Master (1/-)	*June* '36	WM406
The W.M. A.C. Short-wave Converter (1/-)	*July* '36	WM408

QUERIES and ENQUIRIES

A Pentode Detector

"I am using a battery two-valve set (detector and L.F.) and I am using an ordinary triode as detector. I want to use an H.F. pentode for this stage, but as I am using a short-wave adapter, how could I use the same with the pentode valve? I am using the plug-in adapter method. Could I use the converter method, as it will be before an H.F. valve, or does it only apply to sets with two tuned circuits?"—F. K. W. (Ponders End).

IT will be quite a simple matter to modify the wiring to the detector valveholder in order to use a pentode in place of a triode. Certain other modifications may, however, be necessary in order to obtain an improved performance from the pentode. For instance, a higher anode load (impedance) will have to be provided to get a greater gain from the valve, whilst you may also find that the values of the grid condenser and grid leak may be changed to effect an improvement. This you will have to find out by trial. To use your plug-in adapter, a triode is desirable, and therefore you should obtain one of the special reducing adapters which may be plugged into the 5 or 7-pin valveholder (according to the type of H.F. pentode valve which you obtain), and this adapter should have four sockets on top so that a normal triode may be plugged into it. You could, of course, make such an adapter from old valve bases and pins and sockets. The converter can only be used when there is H.F. amplification, as the H.F. stages then become I.F. stages. The combination then becomes frequency changer, I.F. amplifiers, then detector followed by L.F. stages.

The Short-wave Three

"I am building the S.W. Three described in the 'Television and S.W. Handbook,' and am unable to identify the short-wave chokes of the type shown, which appear to be of the permanently mounted type. Can you tell me where this type of choke can be bought? Also, what make of valves and speaker do you recommend for this receiver?"—A. C. S. (Derby).

THE H.F. chokes are of Ward and Goldstone make, list number R4/406, price 2s. 6d. each. The valves specified are Hivac types SG.210, L.210 and Y.220, and the speaker originally specified was the Amplion type M.C.22. You can, of course, use any good speaker for this receiver, provided that it has a transformer suitable for a pentode output valve.

Short-wave Station Addresses

"Please can you let me know where I I could get a list of short-wave station addresses to which I can send for QSL cards?"—N. K. (Lytham St. Annes).

THE *Radio Amateur Call Book Magazine*, published quarterly by an American firm, is the official call-book of the Radio Society of Great Britain, and is used by the U.S. Naval Reserve, U.S. Army, amateurs, etc. It gives a very complete list of call-signs and addresses of amateurs in all countries of the world compiled from the records of the Federal Radio Commission, Radio Amateur Clubs, and official Government sources. It does not include official broadcast stations. A copy of this book may be obtained in England from F. L. Postlethwaite, 41, Kinfauns Road, Goodmayes, Ilford, Essex, price 6s. post free.

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., Tower House, Southampton Street, Strand, London, W.C.2.

The Coupon must be enclosed with every query.

Extension Speaker

"I am desirous of fitting an extension speaker to an A.C. push-pull output stage. I wish to silence the existing speaker when the extension is in use. What is the correct way of carrying this out?"—R. B. (Prestwich).

IF the present speaker is fitted with a transformer, and this is connected in the output circuit, you will have to fit the silencing switch on the secondary side, that is, between the speech coil and the transformer winding. This should not be difficult. To feed the extension speaker a 2 mfd. fixed condenser should be joined to each anode of the output stage, and the extension leads taken from the other sides of these two condensers. The condensers should be mounted as close to the valveholders as possible.

Microphone Amplifier

"As a standby for my present quality receiver, I would like to amplify signals from a crystal set, but without a valve. Would you kindly give me the connections for fitting a microphone button, microphone transformer, battery, and loudspeaker?"—H. G. B. (Cricklewood).

THE most effective way of carrying out your idea is to mount the microphone so that it is influenced by the signals from the crystal set. To do this you must mount the microphone on a telephone earpiece, and you will probably find that best results will be obtained when an ordinary diaphragm is cut down, after the manner of the reed in an ordinary moving-iron type loudspeaker. The microphone button should then be mounted on the reed, but the best position and method of mounting will have to be found by trial, as insufficient movement will fail to give the necessary amplification. The battery should be connected in series with the primary winding, but the voltage may be found critical.

Short-wave H.F. Stage

"I have built the Prefect three-valve set, and I am getting very good results. But as I do not find it selective enough, I wonder if an H.F. stage could be added. In such case what components do I require? Is there a coil I could put in the H.F. stage without disturbing my present coils?"—J. M. M. L. (Rothesay).

YOU can build an H.F. stage quite easily, and a similar coil to that now in use would be required. We described the construction of such a stage in our issue dated June 27th last.

Combining Two Sets

"Is it possible to connect the output of a two-valve short-wave receiver to the pick-up terminals of a five-valve superhet so as to get the full use of the L.F. amplification?"—R. W. (Woolaston).

THIS query is often cropping up, and is generally capable of a simple solution. It must be remembered, however, that the output terminals of a normal simple set will be joined to the anode of the output valve and H.T. positive. The pick-up terminals, in general, are connected to the grid of a valve and earth (H.T.—) or G.B. negative, which is also connected, via the grid battery to H.T.+. Therefore, if the connection is made direct between the output and pick-up terminals, and a common H.T. supply is used, a short-circuit may result—depending upon the relationship between the terminals which are coupled. Therefore, the best plan is to use a 1:1 L.F. transformer in every case, as this will not only avoid short-circuiting the H.T. supply, but will also enable better results to be obtained owing to the shortening of the H.F. leads. If a filter-circuit is fitted to the short-wave set the transformer may, of course, be omitted. We do not now include station identification in our query service.

The Coupon on page 678 must be attached to every query.

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," Tower House, Southampton Street, Strand, London, W.C.2.

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 amplifications, 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, switched, 2/11 each. Pair 5/3. 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.

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(*Continued at top of column three*)

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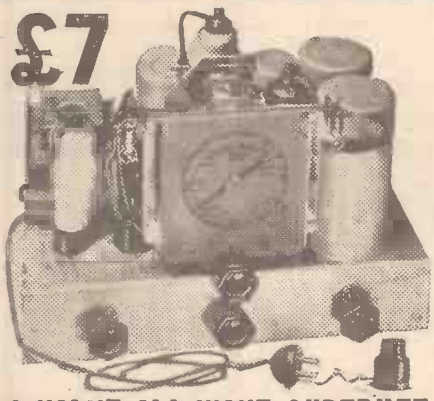

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(*Continued from foot of column one*)

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SOUTHERN RADIO.—Branches at 271-275, High Road, Willesden Green, N.W.10; 46, Lisle Street, London, W.C.2. All mail orders to 323, Euston Road, London, N.W.1.

SOUTHERN RADIO, 323, Euston Road, London, N.W.1 (near Warren St. Tube). 'Phone: Euston 3775.

ALCO ELIMINATORS AND CHARGERS. 5 H.T. taps, 120/150 v., 20/30 ma., 18/-. With ¼ amp. charger, 25/-. Charger, 7/6. ½ amp., 11/-. Year's guarantee. Details free.—P. & D. Radio, 1, Goodinge Road, N.7.

BANKRUPT BARGAINS.—List free. 3v. all-wave battery sets, 79/6. 1937 Superhet battery all-wavers, complete, £8/5/-. Telsen 6v. superhet A.C., £5/15/-. A.C./D.C., 5v. superhets., £6/5/-. Ditto all-wavers, £7/15/-. Ferguson, Pilot, all-wavers, trade supplied. Large stock valves, A.C., battery and American, from 3/-. Signal key, lamp and buzzer sets, 3/-. I will supply anything radio. Write for requirements. Secondhand-Cossor battery set, 3 v., with M.C. and valves, 37/6.—Butlin, 6, Stanford Avenue, Brighton.

EXPERIMENTERS' OPPORTUNITY.—Parcels containing Wireless Components, 40/- value for 5/6. Carriage 1/-.—Taylors, Radio House, Macaulay Street, Huddersfield.

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3D EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 9. No. 232. February 27th, 1937.

Build F. J. Camm's "VITESSE" ALL-WAVER

Full-size Blueprint Inside!

MAKING VISUAL TUNING INDICATORS

See Page 689

ROUND *the* WORLD *of* WIRELESS

Bombay Short-wave Station

IT is now stated that Bombay is to have at last a new short-wave transmitter. It was originally planned to install short-wave transmitters at Calcutta and Madras, with a twin short-wave transmitter at Delhi. It was then suggested that one of the existing 5-kW transmitters now at Delhi might be transferred to Bombay at a later date. The present programme to erect short-wave stations at the four principal towns is hailed as the most satisfactory.

More Radio Telephones

ANOTHER radio telephone service has been installed, this time to link up the Hull and Humber ports with ships operating off the coast. A ship-to-shore telephone service is thus available at all times for trawlers, coasting craft and other vessels within a range of 200 miles of the coast.

"Forsaken City"

ON March 21st this feature will be repeated in the London Regional programme. The theme is London in the Plague Year—"This was that yeare of wonder, when this Land was ploughed up into Graves, and graves did stand, From Morne till next Morne, gaping still for more." When first heard in 1932 it provoked considerable interest and discussion. Certainly the theme is macabre, but it is also inherently dramatic as well as being historically significant. The music chosen to accompany this programme is Stravinsky's "Sacre du Printemps," itself a brilliant essay in the macabre.

Coronation and Television

DESPITE the decision that only the processions, and not the actual ceremony itself may be televised, there are indications that the demand for sets will be maintained. The G.E.C. state that all the sets they have manufactured to date will be in use. "For some weeks before the official transmissions started," an official of the G.E.C. stated, "we began manufacturing sets on a regular production basis in the same way that we manufacture our wireless sets. We are now having to speed up further production."

"Ticket-of-Leave Man"

THIS truly terrific melodrama, packed full of scenes and situations of heart-rendering poignancy, will be produced by Peter Creswell on the National on March 16th and Regional on March 18th, with a full regard for the necessity of preserving the true atmosphere of the Victorian Theatre. The plot can certainly be described as "meaty," and the figures of the hero and his faithful beloved must cause a responsive throb in all but the stoniest of hearts.

Amateur Radio Help

A YOUNG amateur in South Wales recently picked up a message sent out by a South American amateur to the effect that an explorer had returned to civilisation after wandering in the wilds for eleven months. The message asked that the explorer's brother in London be informed of the fact as all hope had been given up concerning the safety of the explorer. The listener 'phoned the message and heard the brother express his gratitude.

Farewell to Swing

IN a series of seven broadcasts, Henry Reed and his Dance Orchestra have given listeners to the Northern programmes a comprehensive survey of that new and hitherto mysterious musical form, "Swing." The orchestra will come to the microphone for the last time on March 3rd, when they propose to abandon exposition and concentrate solely upon "swinging." After that, there will be no more "Swing" in the Northern programme for some time to come. Henry Reed is considering the formation of an entirely new combination, which will specialise in some new and unexpected aspects of dance music.

Honour for J. L. Baird

AT a recent meeting of the International Faculty of Sciences, Mr. John Logie Baird, the pioneer in television, was presented with the Faculty's Gold Medal for 1936 in recognition of his outstanding services to the science of television. In the course of a speech, Dr. Bridges, the President of the Institution of Electronics stated that those who had followed the development of the science from the early days would appreciate the importance of Mr. Baird's work which had culminated in large screen television.

L.C.C. New Fire Brigade Headquarters

THE L.C.C. have awarded the contract for the whole of the new battery charging equipment for the Fire Appliance batteries at the above, to Westinghouse Brake & Signal Co., Ltd. This equipment, which will, of course, be of the metal rectifier type, will be supplied through the electrical contractors, The Bower Engineering Works (Electrical & General), Ltd., of 14, Nicholas Lane, E.C.4.

Hebrides Radio Link

A HILL-TOP at Ganavan Sands, near Oban, has been proposed as a site for a wireless station to link up the Hebrides with the mainlands. During the recent stormy weather conditions have amply shown the need for this, and it is hoped locally that arrangements will be made at an early date.

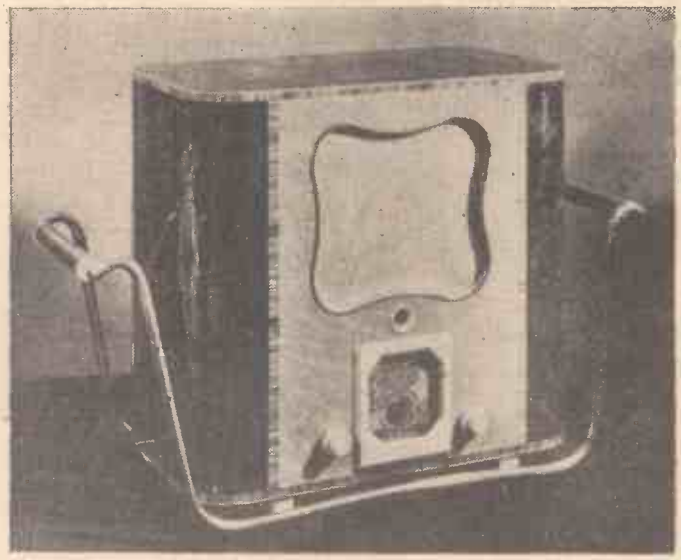
Unknown Radio Artists

ONE of the thousand aspirants who came to a cinema in Glasgow for auditions by Carol Levis recently was a young unemployed man from St. Andrews. He was unable to get together his railway fare, but rather than lose the chance he borrowed a cycle and came through to Glasgow.

ROUND the WORLD of WIRELESS (Continued)

Light Operatic Music

IN a programme entitled "From the Light Operas" on February 28th, some of the most popular numbers will be rendered by Hilda Blake (soprano), Frederick Harvey (baritone), and the Clifton Light Orchestra and Chorus, led by Joan Allen and conducted by Reginald Redman. The selection will include items from "Merrie England," "Tom Jones," "The Rebel Maid," and "Veronique." This broadcast will be given from the Western Regional.



One of the remarkable receivers made by Philips Radio for the Maharajah of Patiala.

The Scottish National Transmitter

NEXT July, the Scottish National programme transmitter, which at present works on a wavelength of 285.7 metres (1,050 kilocycles per second), will be synchronised with the London and North National programme transmitters on 261.1 metres (1,149 kc/s). The wavelength thus released will be used temporarily by the present National programme transmitter at Washford to provide a separate West Regional programme to those listeners in the West of England who now take their Regional programme from the Washford transmitter on 373 metres (804 kc/s). The latter will then become the separate Welsh Regional transmitter. Listeners who at present receive the National programme from the National programme transmitter at Washford will be asked to use Droitwich.

The World's Most Expensive Radio Set

THE Maharajah of Patiala has recently purchased what are believed to be the most expensive radio sets ever built. The cost of the sets is due not only to the fact that the Maharajah attached much value to technical perfection, but that he demanded extreme beauty in the outward appearance of these receivers. A number of unheard-of luxuries were asked for. The cabinets had to be made of the costliest kind of wood, whilst the dial holders and control knobs are of carved ivory.

In order to make the sets easily transportable in the halls of the Palace, they are placed on chromium sledges provided with small wheels. A costly kind of leather has been used for the handles on the sledges. The rear panel of the sets, with the exception of the control knobs, is identical with the front panel, so that the receivers have the same luxurious appearance when viewed from all sides.

The sets, which have been constructed by Philips Radio, are mounted on a low sledge to adapt them to the customs of the country, for in Patiala no chairs are used, and people sit down on a carpet or cushions.

INTERESTING and TOPICAL NEWS and NOTES

Entre Nous

GORDON MCCONNEL will produce another of his interesting Entre Nous programmes, on March 21st. The secret of the success of these lighthearted affairs is their basic idea. Famous artists are engaged with no indication of what type of programme they are to play. The artists naturally expect to do something in their own line—an opera singer to sing an aria or a comedian to provide light fare. When the artists arrive at the studio they find themselves pitchforked into an entirely strange environment, and as time is pressing have to make the best of their rôles. The result is very amusing and of a high order.

Stanelli's Bachelor Party

LISTENERS to the London Regional on March 25th will hear another broadcast by Stanelli's Bachelor Party. This clever artist can be described as a virtuoso, for he plays the violin extraordinarily well besides being a successful vaudeville artist. The difficulty of forming a broadcast concert party is that the better known the artist, the more certain it is that he or she will be engaged on the date they are required. So far, Stanelli has booked Russell and Marconi and Jack Wynn, his pianist. Stanelli hopes to have in the studio the majority of the original Bachelors.

Variety from Birmingham

ON March 3rd, Martyn Webster will present a programme of mid-week variety in which the artists will include Hermione Gingold; Aerbut and Gaertie in a Birmingham dialect sketch; Janet Joye in impersonations; Raymond Green, entertainer; the Four Rhythm Boys, from Derbyshire; and Vincent Ladbrooke and his Band.

Eight Million Wireless Licences

THE Post Office issued 1,406,143 wireless receiving licences during January. This figure represents a net increase of 110,891 in the number of licence holders during the month, after making allowance for expired licences and renewals.

The total number of licences in force at the end of January, 1937, was 8,071,464 as compared with 7,478,617 at the end of January, 1936, an increase during the year of 592,847. During the month there were 261 successful wireless prosecutions.

CONNIE RUSSELL, the new 16-year-old swing vocalist, who made her debut on "His Master's Voice" records recently, can be heard singing two new numbers, "Swinging the Jinx Away" and "One, two, button your shoe." (H.M.V. BD 403). Here she is seen recording the numbers before the "H.M.V." microphone.

Organ Recital

REGINALD PORTER-BROWN will broadcast an organ recital from the Regal Cinema, Torquay, on March 6th, and there will be vocal numbers by J. Ashfield Salter (tenor).

SOLVE THIS!

PROBLEM No. 232.

James built a four-valve superhet of modern design using a pentagrid I.F. amplifier, double-diode-triode, and output pentode, with delayed A.V.C. The sensitivity of the set was high, as was evidenced by the large number of stations received, but the maximum volume obtainable was low, even from the local stations. Give the probable reason for the lack of volume. 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., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 232 in the top left-hand corner, and must be posted to reach this office not later than the first post on Monday, March 1st, 1937.

Solution to Problem No. 231.

The P.T.41 is a directly-heated pentode, whereas the A.C./Pen is of the indirectly-heated type. The valveholder wiring should therefore have been changed to suit the new valve.

The following three readers successfully solved Problem No. 230, and books are accordingly being forwarded to them: N. Vernon, Main Rd., Grindleford, Nr. Sheffield; H. Tipton, 3, Brookway, Featherstone, Yorkshire; B. Walker, Bradley St., Wotton-under-Edge, Gloucestershire.

The Importance of the Detector Stage

When to Use Leaky-grid, Power-grid, Anode-bend or Diode Rectification

HAVING obtained the desired oscillations by tuning a set to the wavelength of the wanted station, and amplified them by the H.F. stages, the next problem is to rectify them; that is, to separate the complex audio-frequency currents from the higher frequencies composing the carrier wave. The audio frequencies are then amplified and used to operate the loudspeaker in the normal manner.

What is not perhaps fully realised is that a good deal of the distortion found in a radio receiver more often than not results directly from the detector stage. The detector may not be functioning properly; there may be excessive H.F. currents at its anode; it may overload; the grid leak and condenser (in leaky-grid and power-grid detection) may have wrong values and cause choking; the anode and grid bias voltages may be incorrect, and reaction may be fierce, ploppy, or not sufficient.

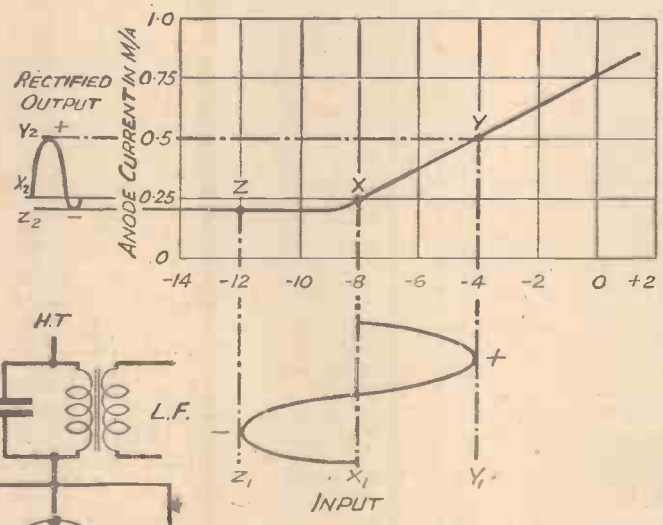
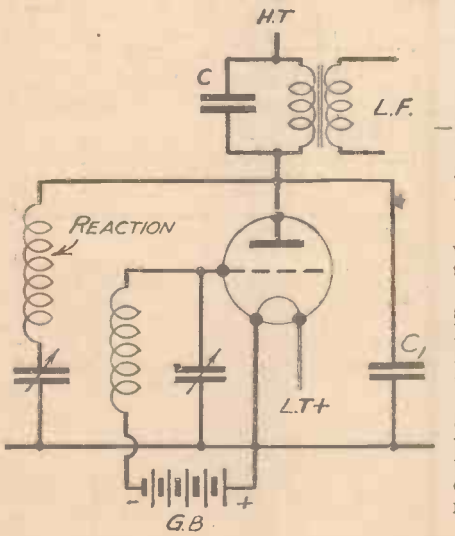


Fig. 1 (below).—Shows the arrangement of an anode-bend detector, and Fig. 2 (right).—Graphical representation of anode-bend rectification.



In fact, there are a thousand and one snags in the detector stage, which is a very vulnerable part of a radio receiver and must, therefore, be properly designed and understood.

Any conductor which is non-linear, i.e., when alternating current is applied it lets more current through when the current is, say, positive than when it is negative, or *vice versa*, will act as a detector. The simplest form of detector is the crystal, but in view of the fact that valve rectification gives such better results, we will not discuss it further here.

The valve is used as a detector in one of four ways, as outlined in the heading. Anode bend detection depends on the non-linearity of the anode current/grid volts curve, leaky-grid and power-grid detection on the grid current/grid volts curve, and diode detection (including Westectors) allows of the fact that current will only flow in one direction through the valve or Westector.

Anode-bend Detection

Fig. 1 shows a typical circuit for anode-bend detection. To obtain satisfactory operation the anode volts must be high and the characteristic curve of the valve must be known. The grid bias can then be made sufficiently negative to bring the working point on to the curved portion of the curve.

Fig. 2 shows the curve of a typical valve suitable for this form of detection, the horizontal distances representing negative grid bias, and the vertical distances the anode current.

We adjust the grid bias so that the voltage appearing on the grid before a signal is tuned in is, say, 8 volts; that is, the valve is working at a point X on the curved portion of the characteristic. The anode current is now 0.25 mA.

When the amplified radio signal reaches the grid, the impressed voltages rise and fall in accordance with the frequency of the carrier wave. Looking at Fig. 2 again, it will be seen that as the voltage rises above the value indicated by the point X, the grid becomes more positive so that the effective negative grid bias is reduced from X (8 volts) to the point Y (4 volts), and the anode current rises from 0.25 mA to 0.5 mA. When the voltage due to the other (negative) half-cycle falls below the point X to the point indicated by Z (12 volts), then the anode current falls, but only to about 0.20 mA; that is, by 0.05 mA only. We obtain, therefore, an effective increase in the anode current of the valve, which is made more positive, attracts electrons in one direction only, and rectification is therefore obtained.

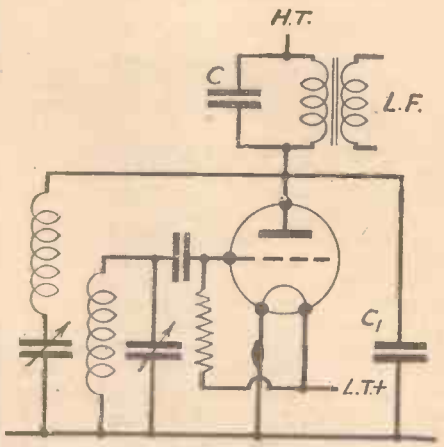


Fig. 3.—The standard leaky-grid detector circuit.

Anode-bend rectification of this kind imposes very little damping on the tuned circuit preceding it, and, consequently, the selectivity is very high. It will be noticed, however, that if the incoming signal is small, the rectifying action occurs wholly on the part of the valve characteristic which is curved, and hence severe distortion will be introduced. At the same time, the impedance of the valve corresponding to a point on the bend of the curve is high, and this affects the question of further amplification.

On the other hand, if the variation of the voltage on the grid of an anode-bend detector is large, i.e., if the detector is preceded by at least one good stage of H.F. amplification so as to ensure heavy signals on the grid, then the current corresponding to the point Y will be well within the straight portion of the curve and far less distortion will be introduced. Sensitivity will be good and the impedance of the valve will be at its lowest, so that the amplification of the rectified signal is easier.

It is obvious that, in order that the valve may handle the large signals necessary for good anode-bend detection, a high voltage must be applied to the anode.

When we come to the question of reaction with this form of detector, certain difficulties arise. In the first place, if we choose an operating point X (as in Fig. 2), which is a good position for detection, then the reaction current in the anode circuit is less, and good reaction will be impossible. If we adjust the valve so that its operating point is now Y, then reaction will be far better, but the detecting properties of the valve will be impaired. Working at a point Z still farther down on the curve will result in little or no reaction, with detector distortion, introduced by the valve working wholly on the bend of its curve. It is necessary, therefore, to adjust the operating conditions very carefully, altering both H.T. and G.B. step by step until a compromise giving reasonable detection and reaction is obtained.

The condenser C, shown in Fig. 1, smooths out the very rapid pulses of the anode current corresponding to the radio-frequency signal. It acts so that when the current in the anode is greater than the mean value, it receives the excess energy,

(Continued overleaf)

THE IMPORTANCE OF THE DETECTOR STAGE

(*Continued from previous page*)

and when the current is lower, it gives out the energy and maintains the current at its mean value.

A by-pass condenser C1 is necessary in order to remove the H.F. currents left in the rectified current. For obvious reasons these H.F. oscillations must not be allowed to get into the L.F. circuits, and hence they are by-passed to earth by the condenser.

Grid-leak Detection

It has been shown that the anode current curve of a valve can be used for anode-bend rectification. But a valve has a grid current curve which is also non-linear, and in some respects better suited for rectification. Using this curve, we obtain grid-leak rectification, which is very popular owing to its greater sensitiveness to weak signals, and to its simplicity.

The greater sensitiveness is due to the fact that the rectification takes place wholly in the grid circuit, leaving the audio-frequency voltage imposed on the grid. This is then amplified by the valve, which thus serves a double purpose.

Fig. 3 shows the connections for a leaky-grid detector of the battery type. If a mains valve were used, the leak would be taken to the cathode of the valve instead of to L.T. positive.

When a signal is applied to the grid of a valve, positive half cycles produce a greater increase in grid current than the decrease produced by the negative halves, leaving a mean increase. This increase in current flowing through the grid leak causes a drop of voltage at the grid, in addition to the drop already caused by the steady grid current flow through the leak when no signal is applied. This drop of voltage varies in accordance with the incoming signal. The blocking condenser is charged up by the grid current flowing when positive half cycles are applied, while the negative half-cycle has no effect. The successive positive half-cycles, therefore, gradually build a charge up on the condenser, which thus places a negative bias on the valve

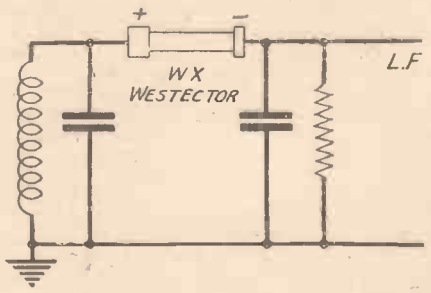


Fig. 5.—Circuit of a detector stage utilising a Westector.

equal to the peak value of the incoming signal. This causes a variation in the anode current of the valve and, provided the valve is working on a straight portion of its curve, the anode current variation is proportional to the signal, and distortionless rectification is obtained, the rectified signal being amplified within the valve itself.

This form of detection is more sensitive to weak signals, but is rather easily overloaded. This is denoted by an accentuation of the sibilants and upper frequencies generally, and severe distortion is often introduced. Overloading of a leaky-grid detector is usually shown up by two tuning points for the station being received. This is due to the fact that, above a certain limit, the output of the detector definitely falls off, so that, at exact resonance on a strong signal, the output is less than when the station is not quite in tune. This gives two peaks of greater volume, one on either side of the resonant point.

The remedy for overloading is, of course, to reduce the input, either by an aerial series condenser or by using valves of variable-mu characteristics in the H.F. stages, when the stage gain can be controlled by adjustment of the standing bias applied to the valves.

Leaky-grid detection imposes more damping on the tuned circuit than the anode-bend method, and hence selectivity is not quite so good. Further, the H.F. currents appearing at the grid are themselves amplified, so that rather elaborate filtering is necessary at the anode of the valve.

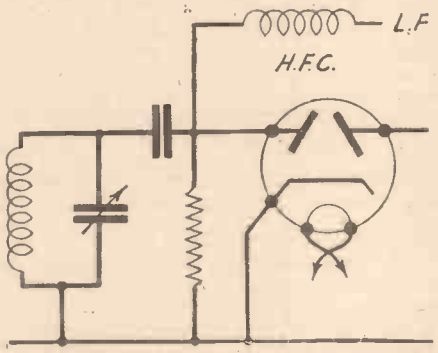


Fig. 4.—The diode detector stage in theoretical form.

Distortion in leaky-grid detectors is caused not only by over-loading, but by wrong values of grid leak and condenser. If the leak is too high, "grid choking" occurs, due to the fact that the charge on the condenser cannot leak away fast enough. On the other hand, if the leak is too low, then bass reproduction suffers, volume will be low and further distortion will be introduced.

The object of the condenser being to convey the alternating frequencies to the grid of the detector and the grid leak to discharge the electrons accumulated on the grid during alternate half-cycles, the values must be carefully chosen in order that the "time constant" of the circuit is small compared with the frequency of the incoming oscillations, so that at all times the grid is ready to accept the next half-cycle. If the resistance is large in relation to the condenser, there is a serious loss in the higher audio frequencies, the impedance of the combination being much lower at 6,000 cycles than at 500 cycles. This effect is very pronounced with the use of the 2 megohms grid leak and .0003 mfd. condenser popular a few years ago and account for the bad reputation which grid-leak rectification then had. This reputation was quite undeserved, for if moderately strong signals only are applied and suitable values given to the grid leak and condenser this form of detection is very reliable and gives quite good quality. Average values are .0001 mfd. and 1 or even 0.5 megohm, when the distortion introduced is far less serious.

Power-grid Detection

The inability of the leaky-grid system to handle large signals led experimenters to increase the anode volts, and they found that, provided the values of the condenser and leak were greatly reduced in order to obtain satisfactory reproduction of the higher audio frequencies, large inputs could be handled in this way without the introduction of serious distortion. The circuit arrangement is the same as for leaky-grid detection, but is less sensitive. Owing to the large standing current, it is desirable to use a fairly high impedance valve, and it is impracticable to use transformer coupling owing to saturation troubles. This means either resistance capacity coupling or a parallel-fed transformer, and it is obvious that the high current flowing through the large resistance in the anode necessary to match the impedance of the valve, will result in a very heavy voltage drop. The anode voltage will, therefore, be low and the whole object of the scheme defeated. Where a very high H.T. voltage, such as in A.C. mains receivers, is available, power-grid detection may be safely used, but in battery receivers, it is advisable to use the leaky-grid system, and keep the input always on the low side.

We find, therefore, that power-grid detection is not all that it has been made out to be, for it requires substantial inputs, is not very sensitive nor selective, and the high anode voltage required is hard to obtain by simple methods.

Diode Detection

Where large signals are available for detection, as in a straight set employing two H.F. stages, and particularly in superhets, diode detection is far better. This valve works on the principle that electrons leave the heated filament or cathode and are attracted to the diode (anode), provided this is at a positive potential with respect to the filament (or cathode). The space current flows only when the anode is positive; when negative no current will flow. Consequently, when a radio signal is applied to a diode detector as in Fig. 4, space current (i.e., a stream of electrons from filament to anode) flows only on the positive half cycles, and rectification is thus obtained.

Such a detector will handle very large inputs indeed, imposes little damping on the tuned circuit so that selectivity is high and is reasonably sensitive, more so of course as the signal strength increases. It also has the added advantage that it is extremely simple, but it does not amplify.

To smooth out the audio frequencies, a grid leak and condenser are used just as for

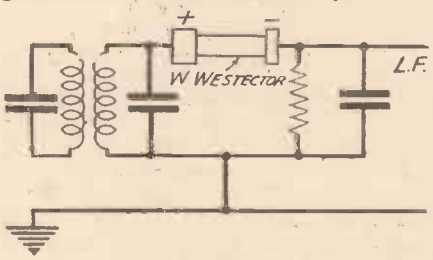


Fig. 6.—In a superhet the second detector may take this form if a Westector is employed.

leaky-grid and power-grid detection, the usual values being .0001 mfd. and 0.5 megohm.

The Westector

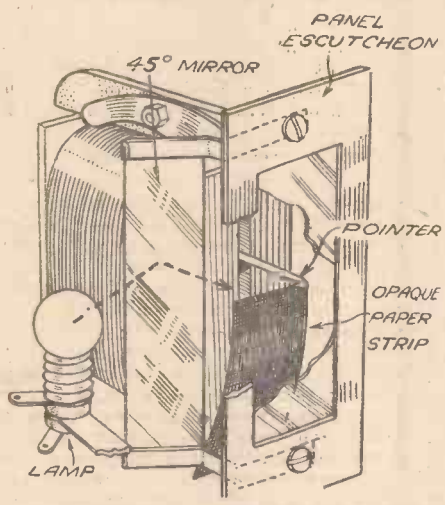
The Westector is fundamentally the same as the diode, except that it depends for its action on the fact that at the junction of a metal and its oxide current can only flow in one direction and rectification is, therefore, obtained. It has the added advantage that it will handle even larger inputs, is simpler, and detector distortion is entirely absent. A reservoir condenser and grid leak are used as before and less H.F. filtering is required. It has the disadvantage, however, that its capacity is high and that the damping introduced is also high.

(*To be continued*)

Making Visual Tuning Indicators

In This Article Suggestions are Given for Constructing Two or Three Simple Types of Visual Tuning Indicator on the Lines of those Fitted to Modern Receivers. By W. J. DELANEY

AS has recently been pointed out in these pages a good modern receiver fitted with A.V.C. requires some form of visual tuning indicator in order to ensure accurate tuning and best quality. The majority of modern receivers of this type are fitted with "Electric Eyes," "Tuning Beacons," "Climbing Lights"



and other devices, some of which employ cathode-ray indicators, whilst others utilise some form of mechanical device. The amateur can, of course, purchase a neon or cathode-ray indicator which may be fitted in the simplest possible manner, and which will work flawlessly if the maker's instructions are carefully adhered to. But the other types of indicator are in the form of novelties which add to the attraction of home-construction, and they will also operate in a very efficient manner provided that they are well made. As has already been explained, the milliammeter is the simplest form of indicator, and it is this instrument which may be modified by the amateur to form some type of indicator which will provide a suitable novelty to the panel whilst at the same time fulfilling a useful purpose.

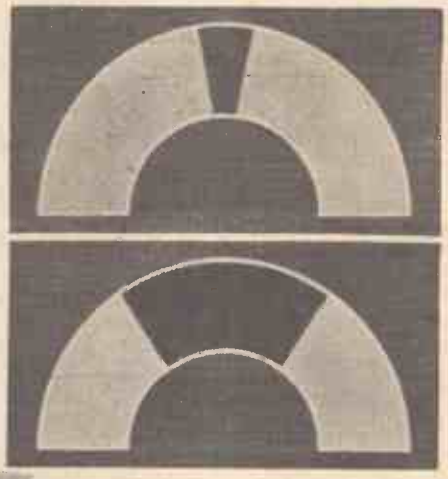
Suitable Meters

There are two types of meter available, that with a circular dial, and the pattern which has an end-type scale in the form of an arc over which the needle travels. Cheap meter movements are obtainable which will fulfil the purpose, a full-scale deflection of 5 mA being adequate in the majority of cases, but in any case a movement not greater than 10 mA should be obtained. The meter will have to be dismantled so that only the actual movement with pointer is left, and the method of mounting the complete indicator will vary according to the pattern of meter which is purchased. Obviously no exact details can be given in view of the wide differences in pattern which may be obtained, but the method of modification will apply in each case, and the user can contrive his own method of mounting.

"Climbing Lights"

The simplest indicator to make is that in which a column of light rises and falls with the signal strength. With the ordinary milliammeter the pointer will rise as signal strength fails, and fall with an increase in volume. Therefore, by fitting some form of flat shutter to the pointer and placing this between a narrow slot in the panel and a lighted panel, the shutter will vary the amount of light which may be seen. It is obviously possible by this means to arrange that one tunes for the largest shadow or the largest light area, according to the relative positions of the shutter and the lighted panel. An ordinary dial light may be used for illumination; in a battery receiver one of the special low-consumption bulbs (*not* a flash-lamp bulb) should be used, and in an A.C. receiver a 6-volt low-consumption bulb should be used. Again, do not make the mistake of using a 4-volt bulb, as the supply is A.C. and the bulb is rated at D.C., and will very soon burn out. In a Universal receiver a similar bulb may be used. A suitable holder may be obtained from the Bulgin range of components, and may be mounted behind a small frame made of wood on which is stuck a piece of thin paper of the greaseproof type, or a thin piece of frosted glass. This is only to diffuse the light, and prevent the source of illumination being localised.

Fig. 1.—(Left) how to modify an "end-type" meter to obtain a "climbing light" or "climbing shadow" effect. Fig. 2 (right) the effect given by the cathode-ray tube indicator, which is shown in a receiver in the illustration below.



Making the Shutter

To the pointer or needle of the meter movement a thin piece of paper should be stuck with good adhesive, and thin brown paper will be found best, as it will not permit the weak light from the bulb to shine through. Alternatively, a piece of the black paper in which photographic plates or paper are packed may be used. Again, the size of the paper and its shape will have to be chosen according to the meter movement, but it should be such that as the needle moves the paper strip will pass across the paper or glass *between* it and the lamp. In this way the light will be cut off as the needle rises, and will lengthen as it falls. The general assembly is shown in Fig. 3. This scheme may be modified to give the indication in either way, that is, cut off light as current increases, or give more light according to the relative position of the meter. The

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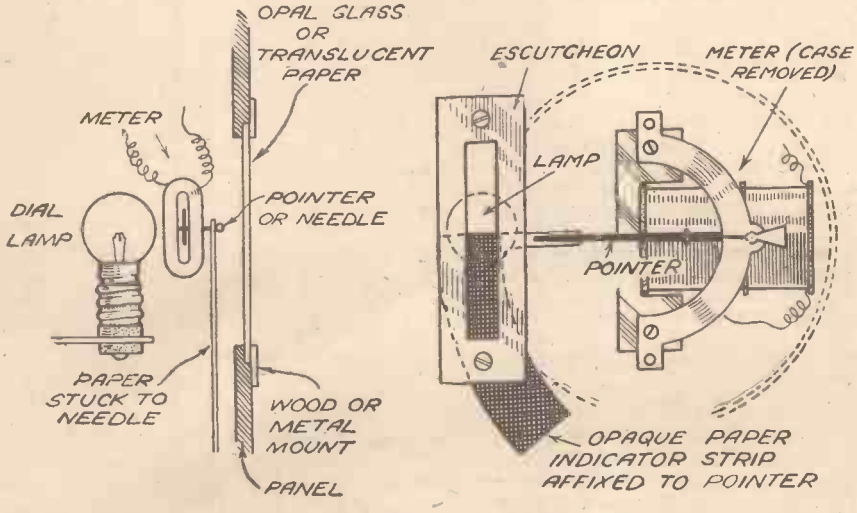


Fig. 3.—Elevation and side view of the method of converting an ordinary milliammeter to give an indication of tuning by light or shadow.

MAKING VISUAL TUNING INDICATORS.

(Continued from previous page)

paper will slightly affect the movement of the needle owing to its weight, but as it only has to give a relative indication this is of no importance.

An Alternative

The end-type meter is easier to convert, as the dial may be removed and a strip of coloured or greaseproof paper put on in its place. One side of the meter should then be cut out, and a square of silvered glass or highly-polished metal placed at an angle of 45° to reflect the light from a dial light arranged as before. Fig. 1 shows the Bulgin type of movement, but any ordinary end-type indicator may be similarly modified. If no convenient means of mounting the mirror or reflecting surface can be found, it may be sufficient to mount the indicating light close to the meter and

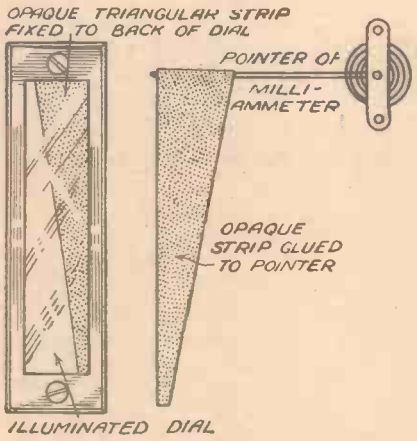


Fig. 4.—Method of arranging for an "eye" or varying angle indicator. If the escutcheon is round, an eye effect will be given.

simply cut away a portion of the meter casing to enable the new "dial" to be illuminated from the rear. In this type of movement the needle travels across the end of the scale, and therefore a small piece of paper will suffice to cut off the light from the dial and act in the same manner as the previous arrangements.

To provide an alternative form of lighting, a meter of this type may be mounted upside down so that the needle falls instead of rises with current, and the edge of the paper may be cut at an angle. The illuminated scale surface may then be obscured by a piece of dark paper stuck to form an angle in the opposite sense (Fig. 4), and thus when the paper slide travels up the two edges will give the effect of a gradually widening triangle of light as the signals increase. Obviously again in this case, the position of the strips may be reversed to provide a decreasing area of light with signal increase.

Radio Afloat

A Brief Description of a 4-valver Used on Board a Small Cabin-cruiser. By F. FRANKE

STRANGE as it may seem, there exists to-day a class of people little known outside their own sphere who very much stand in need of having special wireless receivers designed for them; they are the owners of small yachts. To be able to pick up weather forecasts and timely gale warnings is of great help to yachtsmen of all types, but the less wealthy ones cannot afford to buy

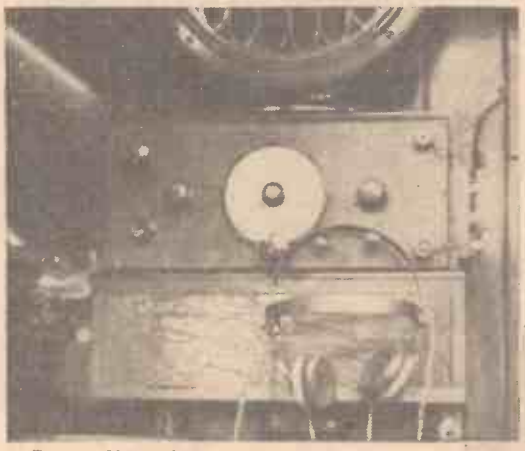


Fig. 1—View of the receiver in the cabin.

the one or two special makes that are on the market. What one usually finds on board some of the small cabin-cruisers is a second-hand set which, never having been intended for use at sea, soon gives up the ghost.

For three years now I have used aboard my own cabin-cruiser *Kimmy* a four-valve battery receiver which I built at home, and which has given excellent service. Perhaps the following short description of this outfit may be of service and of general wireless interest.

How the Set is Installed

The set in question is seen in the accompanying illustration, Fig. 1. Only a part of the loudspeaker is shown owing to the fact that cabin space was too limited to bring camera farther back. The receiver employs a straight circuit (1 S.G., det. and two L.F.), and the wave-range 100 to 2,200 metres, including the 600-metre band. The cabinet housing the set is made of mahogany. Standing on top and screwed firmly to the set is the loudspeaker. Immediately underneath the set's cabinet, and bolted to it, is situated a teak box, with door opening towards the front, which contains H.T. battery and jelly 2-volt cell. Fastened to the left side on the battery-case is a separate small teak box containing the grid-bias battery, just discernible in the illustration. Both speaker and headphone leads are provided with a jack, and either can be plugged into the output socket which is placed on the left side of the cabinet, but, unfortunately, not visible in the illustration. An output transformer to protect the windings of both speaker and 'phones is incorporated inside the cabinet of the receiver. The whole installation is supported by two strong brackets fixed under the teak battery case, while for extra stability the back of both the receiver cabinet and battery case are also bolted to the bulkhead separating the main cabin from the forecastle quarters.

The aerial is slung from the top of the ensign-staff aft to the top of the mast from which point the lead-down goes without a break through a stout glass lead-in tube fixed into the middle of the deck and protruding into the cabin below, right above the aerial terminal of the receiver. Bitumen filling has been used to prevent rain or spray getting down the tube.

The earth wire runs from the set straight down through the floorboards of the cabin, through the bilge and is bolted to the gun-metal keel of the boat.

Easily Disconnected for Replacements

Coming back to the set, nothing has yet been said as to what happens if it should become necessary to replace a valve or effect repairs. In such an eventuality aerial and earth wires are disconnected, two screws, one each side of the panel, taken out, and the whole chassis and panel slide out, this operation being facilitated by the battery leads and output leads having been kept long enough, and arranged in special fairways.

Satisfactory as the set has been, there is much room for improvement. I would like to fit a short-wave adapter.

This illustration shows the cabin-cruiser referred to above, with the aerial which is used.

Practical Television

February 27th, 1937. Vol. 3. No. 39.

C.R TUBE FOCUSING.

The Importance of Focusing in Television Receivers Cannot be Over-estimated, and this Article Explains Simply How the C.R. Tube is Operated for This Purpose.

By H. J. BARTON CHAPPLE, B.Sc.

IN every type of television receiver of the home constructed or commercial type, there are several controls made available for the user, and although under normal viewing conditions none of the knobs need be touched, the importance of each control should be appreciated. One whose function is so often misunderstood is the focusing control, for unless left set in its correct position it can mar completely what may otherwise be a perfectly satisfactory picture. Since there are two types of cathode-ray tube available, two distinct methods of focusing are employed, but although the "means" are different the "end" is the same; that is, a sharp, clear picture on the screen of the tube.

A Lens Combination

Anyone who has handled a camera or any form of optical system whether simple or complex, realises that one or more lenses in the equipment must take up relative positions with reference to the plane in which the image is being viewed, in order to secure a sharply defined optical replica of whatever is under observation—a scene, person or object. A coarse and fine mechanical adjustment of the lenses' positions ensures this happening, otherwise the image is fluffy and imperfect; detail is lost and narrow lines become widened, so that the combined effect is to destroy the identity of the subject under observation. Exactly the same sort of thing can happen with a cathode-ray tube picture reproducer, except that now we are dealing with a stream of swiftly moving electrons instead of light rays.

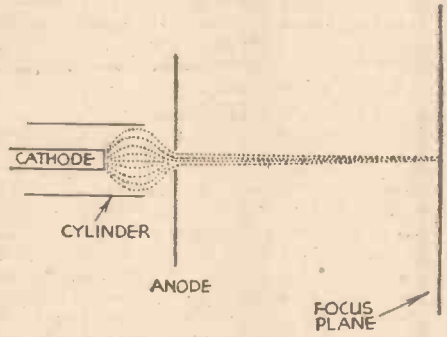


Fig. 1.—Showing the constricting effect produced on the electron stream by the negatively charged cylinder.

Taking the case of the electrostatically operated cathode-ray tube first, it must be remembered that the early tubes relied on the presence of gas inside the glass bulb in order to give the focusing action. This inert gas was ionised by the impact of the electrons moving at high velocity as a result of the combined action of the anode and cathode. This ionised gas then formed a kind of guiding path for the electrons, and by adjusting the cathode current it was possible to secure quite a good focused spot on the screen. The introduction of a negatively charged cylinder partially surrounding the cathode, as shown in Fig. 1, was the next step, forward. The electric field produced by the cylinder had a constricting effect on the electron stream, and concentrated them so that a larger number passed through the accelerating anode hole.

Maintaining Modulation and Focus

For television purposes, however, no trace of gas should be present inside the tube. Normally, with a gas-filled tube of the simple type the voltages applied to the anode and cylinder are interlinked with one another. As the incoming television signals are applied to the cylinder electrode, however, it is easy to see that the depth of modulation of the signal not only altered the intensity of the beam which is correct but also altered focus. Hard tubes are now employed, therefore the cylinder or modulator as it is called is given the sole function of intensity modulating the electron stream, and the task of maintaining correct spot focus, that is, a spot of constant size but of varying brightness irrespective of its position on the screen, is undertaken by a combination of anodes. These anodes, generally up to three in number, are fixed in predetermined positions inside the tube electrode assembly and are frequently termed electron lenses owing to their similarity of action to ordinary optical lenses. A typical commercial assembly of this type is illustrated in Fig. 2, which shows a Cossor high-vacuum tube for television receivers.

An Analogy

To better understand the action of these anodes reference can be made to Fig. 3. A beam of light from the point X is passed through a pair of lenses and whereas on entry into the lenses the beam was diverging, on exit it is converging, becoming a fine point of light in the plane AB at some definite setting of the distance between the lenses with reference to X. This action is, of course, a very familiar one and electron engineers have "borrowed" the principle for application to cathode-ray tubes. The glass lenses are replaced by discs having a centre perforation or cylinders with holes at each end.

Since it would be unpractical to move the

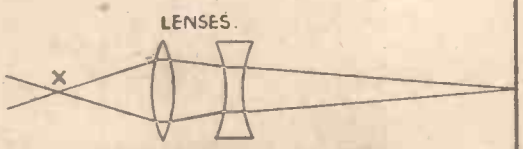


Fig. 3.—A simple lens arrangement for focusing a light beam.

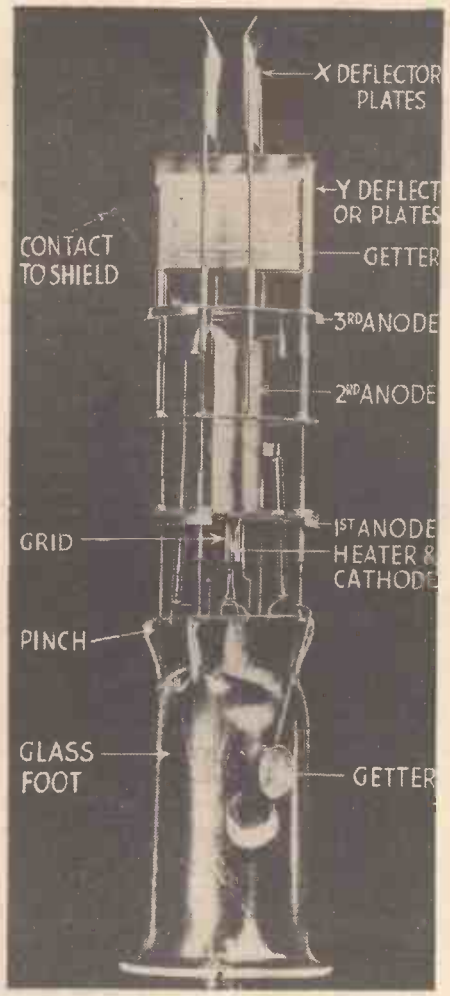


Fig. 2.—A typical electrode assembly for a commercial electrostatically operated C.R. tube for television.

positions of these anodes, as they are called, inside the tube neck, they are fixed in place and the positive voltages applied to them are graded. This produces a series of electrostatic fields which guide the electrons in the beam over a definite path. To take a practical case the first anode may have applied to it a positive voltage covering the range of 150 to 400 volts; the second anode a fixed potential of 1,200 volts; while the third anode is given the highest voltage of 6,000. By arranging a potentiometer to alter the first anode volts between the makers' specified limits, the spot seen on the screen is focused to a sharp, clear outline of very small dimensions—a condition very essential for high-definition television working where such a large number of lines must just fill the available picture height.

For example, with a picture 8ins. high and 400-line definition, the spot diameter must not exceed a fiftieth of an inch if overlap is to be avoided. With a multiple anode arrangement of this nature the cylinder or modulator electrode is left quite free to control the intensity of the beam of electrons which pass to the anodes. This it can now do without in any way upsetting focus and produce a full range of brilliancy from light to dark

(Continued overleaf

PRACTICAL TELEVISION.

(Continued from previous page)

with a relatively small range of signal volts—something between 15 to 30 volts, according to type. A simple rotation of the focus control knob incorporated in the television receiver will ensure that the picture is adjusted to suit individual tastes.

Magnetic Focusing

With those cathode-ray tubes which are operated electro-magnetically only a cathode, modulator and single anode constitute the whole electrode assembly. The scheme adopted for focusing, therefore, must be one which performs its function external to the neck of the tube. For this fasciculating action the rather complicated multiple anode assembly is replaced by a solenoidal coil of wire slipped over the neck of the tube between the anode position and the line scan coils This mode of assembly is seen very readily in Fig. 4 which indicates the focusing and scanning arrangement used by the Baird Company in their receivers and which was shown in this "baseboard" form at this year's British Industries Fair. When a direct current is passed through the coil it produces the familiar type of magnetic field. The electron beam which diverges as soon as it leaves the tube's orificed anode comes under the action of this field. The effect is to rotate the beam so that the electrons follow a spiral path towards the screen. This spiral traverse is brought about by the axial velocity of each electron (a negatively charged particle of electricity) combining with the lines of force of the magnetic field.

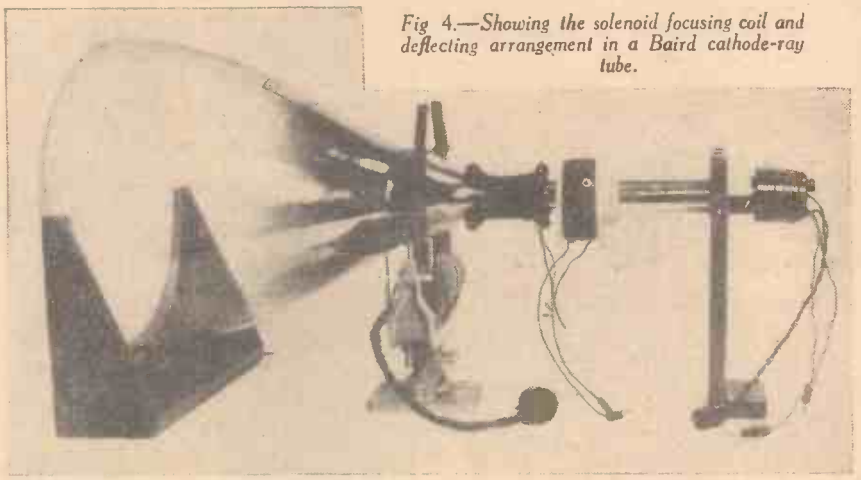


Fig 4.—Showing the solenoid focusing coil and deflecting arrangement in a Baird cathode-ray tube.

Readers will remember that a somewhat similar corkscrew or twisting action to the electron beam is brought about in the image dissector tube used in the Baird electron camera at the Alexandra Palace. The degree of twist is a function of the strength of the magnetic field which, of course, for a given coil dimension is dependent on the magnitude of the current fed round the coil turns. In effect, the coil becomes a very efficient type of lens system.

An Advantage

Another important advantage of magnetic focusing is that the tube can be "set up" very readily on site. The coil mounted over the tube neck so that it can have an angular movement within certain predetermined limits. If it is found that the spot is not circular but changes from a narrow horizontal eclipse to a narrow vertical one when the focus and current is altered, the angle of the coil can be manipulated to give the desired minute circular spot of light. This is done by a trunnion coil support or shaped wedges. Another factor associated with this form of tube, apart from the cheaper electrode assembly and lower manufacturing costs, is that defocusing of the spot does not occur when the brightness of the spot is altered for any particular reason in the television receiver. The merits and demerits of the two types of tubes with their respective focusing arrangements is a matter which cannot be discussed in this article. As far as the set user is concerned the control in both cases consists of the movement of a single knob attached to a potentiometer type resistance. From the points which have been enumerated, however, the reader will understand what happens during the operations.

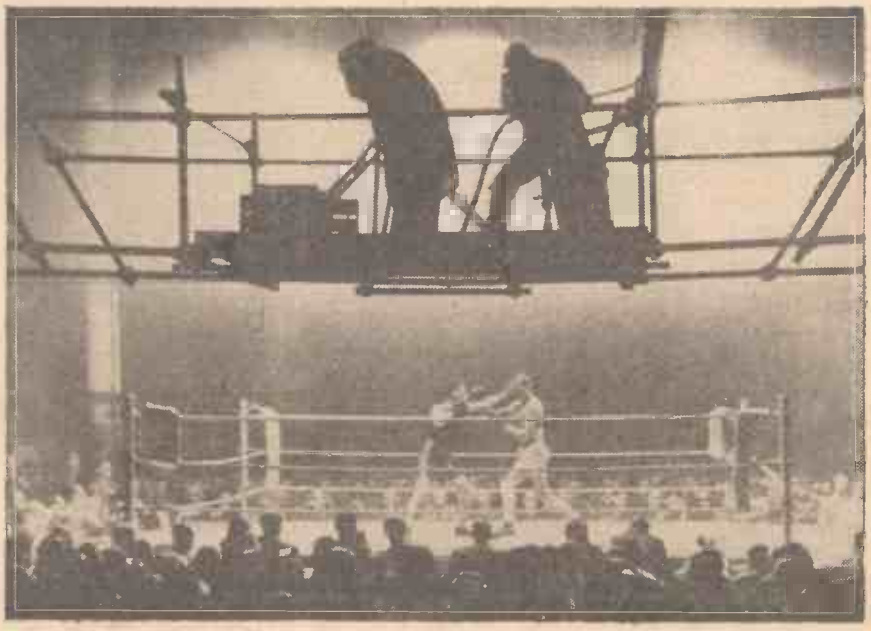
TELEVISION NOTES

Televising a Competitive Sporting Event

RECENTLY the B B.C. carried out its first public televising of a competitive sporting event, namely, part of an amateur boxing club tournament at Alexandra Palace. Special lighting was employed for this purpose and the camera itself was supported on a platform about ten to twelve feet from the ring. The accompanying illustration shows the arrangement. The experiment proved very successful, and may be the forerunner of other attempts at televising sporting events, which have a wide appeal to the British public. Readers will recall that the atmosphere and conditions appertaining to boxing matches were simulated at the Crystal Palace two years ago by the Baird Company. Owing to exigencies of space, spectators could not be accommodated, but a painted blackcloth was substituted for this. The intermediate-film camera was employed for the demonstrations, but the whole atmosphere of an event of this nature with boxers, timekeeper, seconds, and referee were shown quite clearly on the pictures seen on the television receivers which picked up the signals radiated from the South Tower aerials.

Is It Banned?

A RUMOUR is current in some quarters that the televising of the actual Coronation ceremony in Westminster Abbey is to be banned. No definite statement has yet been issued, as the Earl Marshal is away, but it would be a great blow to the hopes of the television authorities if the actual television broadcast was confined to scenes of the procession It is obvious that the results would not be perfect, but the service would not suffer if the pictures were not up to the standard associated with outside broadcasts in the vicinity of the Alexandra Palace itself. Many of those unable to watch anything of the Coronation itself would welcome an opportunity to see it by television, and it is certain that the industry would reap material benefit if judged from the point of view of set and component sales.



The illustration shows how a boxing match was televised recently at the Alexandra Palace.

A Simple Tone-control Unit

Constructional Details of a Neat and Simple Device Which can be Connected to the Loudspeaker to Effect Tone Control, as Well as to Eliminate Heterodyne Whistles and Gramophone-record Needle Scratch. By FRANK PRESTON

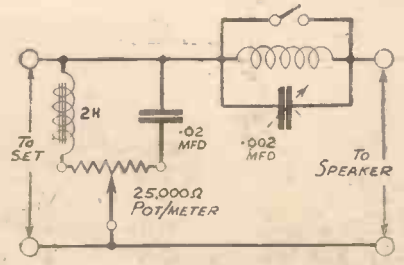


Fig. 1.—Circuit of the tone-control and whistle filter described.

MANY receivers are provided with a built-in tone control, which is very valuable in varying the pitch of reproduction to suit individual requirements. It is also useful, in a superheterodyne, for reducing interference caused by second-channel whistles, and in all types of receiver for minimising sideband-splash and similar forms of interference, which is due to two stations working on nearby wavelengths.

Those who have sets not fitted with a tone control, or fitted with the type which is merely intended to curtail the amplification given to the higher frequencies when using a pentode output valve, will be interested in the little device illustrated on this page. The parts are shown mounted on a small plywood panel, but this can best be fitted on top of a small wooden box to form a complete unit. As can be seen, there are four terminals; two of these are intended to be connected to the speaker terminals on the set, and the other two should be joined to the terminals of the speaker itself, in place of the leads which were previously connected to it.

The Circuit

The complete circuit of the simple device is given in Fig. 1, and this shows that there is an iron-cored choke, a fixed condenser, a potentiometer, an air-cored choke, a pre-set condenser, and an on-off switch, in addition to the four terminals. The iron-cored choke, fixed condenser and potentiometer form the normal tone control, whilst the air-cored choke and pre-set condenser together serve as a whistle filter, scratch filter, and top-note cut-off device.

Let us first deal with the tone-control portion. As most readers are aware, a choke offers very little impedance to low-frequency currents, but a much higher impedance to currents of higher frequency. On the other hand, a condenser offers very little impedance to high-frequency currents, but an almost infinite impedance to currents of very low frequency. This is the main principle of the tone-control circuit. The 25,000-ohm potentiometer serves to place either the choke or the condenser in parallel with the speaker in varying degrees. Thus, when the arm of the potentiometer is in the centre of the resistance element the effects of the choke and condenser are "balanced out." By moving the slider towards the end connected to the condenser, that component is brought to bear on the circuit to a greater extent; moving the slider to the other end causes the effect of the choke to be more pronounced. Thus, a steady and variable control of the tone of reproduction is made possible.

Component Values

The first practical difficulty is to choose values of inductance (choke) and capacity (condenser) which give the most desirable results. Experiment shows that the condenser should be about .02-mfd., whilst the choke can conveniently have an inductance in the neighbourhood of 2 henries. It is possible to buy a ready-made choke with suitable properties, but the reader will probably prefer to make his own. He can do so by winding about 2,000 turns of 36-gauge enamelled wire on a core made up from lengths of soft iron wire into a bundle about ½in. in diameter, and 3in. long.

The soft-iron wire might take the form of a number of hairpins straightened and bound together with thread, or iron wire of a similar gauge can be softened by heating to redness in a flame and allowed to cool slowly. Make two cardboard or fibre cheeks 1in. in diameter to fit tightly on the core, and bind between these with insulation tape. After that, it simply remains to wind on the wire, although it is a good plan to solder short lengths of flex to each end of the wire for the purpose of making connections. These can be anchored by threading them through a pair of holes in each cheek. For experimental purposes it might be preferred to take two or three tappings, so that different inductance values can be tried. Another practical refinement is to place a length of 4B.A. rod in the centre of the bundle of wires, allowing it to project at one end, so that it can be used for easily attaching the choke to the panel.

Those who have an old L.F. transformer or choke which is burnt out can use the former and core of this, after stripping the damaged wire, by winding on about 1,200 turns of 36-gauge enamelled wire. The smaller number of turns is sufficient, due to the higher inductance value provided by the "closed" core.

It will be understood that a choke made to the particulars given will not be of any accurate value, but that is rarely an important matter, and most readers will prefer to experiment to a certain extent in order to find the most suitable number of turns.

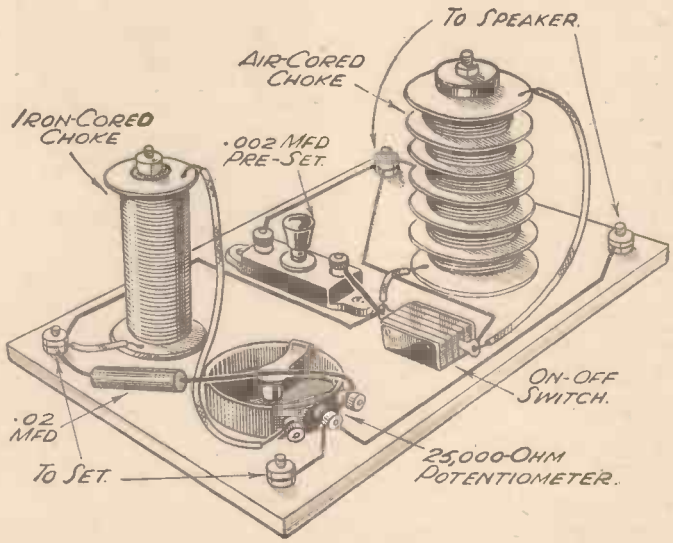


Fig. 2.—Pictorial diagram of the unit, showing how the components are mounted on a plywood panel.

Whistle Filter

The idea of the air-cored choke and pre-set condenser is to form a series-tuned circuit which will resonate at the frequency of heterodyne whistles, record needle scratch and the like. As will be remembered, a series tuning circuit such as this offers a maximum resistance to frequencies to which it is tuned. Thus, if the circuit tunes to, say, 9 kilocycles, whistles of that frequency will be prevented from passing through the filter to the speaker. In conjunction with the choke to be described the filter can be tuned from about 8 to 10 kilocycles. If desired, two chokes could be used in series in order to "tune" from about 4 to 5 kilocycles — which is the usual frequency of gramophone-record needle scratch. It will be seen from Figs. 1 and 2 that a switch is incorporated in the unit for cutting out this filter circuit when it is not required.

It might be wondered why the filter should be used at all when the tone-control portion of the unit makes possible the reduction in intensity of the higher frequencies at will. The point is that the tone control acts gradually, and does not have a sudden or pronounced effect at any particular frequency. In other words, if the high notes are subdued by its use, the reduction may be greatest at, say, 10,000 cycles, but there will be a progressively-smaller reduction in intensity of all frequencies down to, say, 1,000 cycles. The tuned filter circuit, however, operates at one frequency only; at least this is so in theory, although in practice the tuning is not sufficiently sharp to give a very pronounced "peak" effect, such as is obtained with the usual signal-frequency tuning circuits.

(Continued on page 710)

On Your Wavelength

By THERMION

Transmitting

I NEVER want to be an Editor. I am privileged to read some of the letters your Editor gets and if I received some of them I should suffer permanently from blood pressure, heat beneath the collar, and similar signs of aggravation. Bowing to popular demands of many readers, we published a series of articles dealing with the ABC of transmitting. These articles appeared regularly, and then a gap of one week occurred. This immediately brought forth a letter from a reader who said that if the transmitting series was going to be discontinued, "I and my friends will discontinue taking the paper." Really! In other words, unless these readers can have their own petulant and pig-headed way, they refuse to continue as subscribers. Once again, we must bow to the inevitable. No Editor is going to have his policy dictated by two or three readers. He must bear in mind the proportion of interest in a particular subject and mix the ingredients of his issues accordingly. Only a tithe of our readers are interested in transmitting, and only a very small proportion of those who are interested will eventually obtain the P.M.G.'s Licence. Looking back through past volumes I have discovered that this journal has published more about transmitting than any other wireless journal. How say you now?

The Scots Problem Again

MY gentle twitting of the fiery race who like to speak about the glories of Scotland from the safe distance of London has drawn more missives, screeds and epistolary efforts from Scots who live in the land of the free. Here is a fair sample :—

"Is it possible that the rivalry between the Scots and the English will ever die down? As a Scot in England I must emphatically say No! It does not get the opportunity, neither side is willing to make allowance for two different temperaments.

"I am being continually involved in racial arguments, none of which I have ever started myself. The English never lose an opportunity of a jibe at their neighbours in the north.

"I have been told time and time again that the Scots, suffering from an inferiority complex, must needs brag about themselves to attract attention. Admitted we are a boastful race, we talk of what we have done, but not of the other individual's efforts. The English on the other hand imagine themselves God's chosen people, and are offended at the least reflection upon their omnipotence. I should like, however, to differentiate between Londoners and the real English countryman, the latter is a really excellent individual, honest and straightforward, but this, the real Englishman, is not to be found within easy reach of a city. The Londoner on the other hand, combines all the faults that he complains of in others. He is supercilious, arrogant, and honest only if there is a possibility of being found out. He is meaner than any Scot I have yet met and his wit, which he so proudly boasts, is nothing more than a repetition of ancient jokes and inane back-answers. The standard of humour in *Humorist* is rarely appreciated by the average Londoner.

"Apropos your remark about the road to London, that was cracked by Sam Johnson in the eighteenth century. Why shouldn't Scots or Welsh and Irish for that matter take the road to London? That city is no longer the capital of England, but the capital of an empire. The world owes a great debt to those who have left their native country. Edison's parents left Scotland, so did Clerk-Maxwell, Bell and Baird, to name only a few connected with the one branch of science.

"In a book that I was reading a short while ago entitled 'Foreigners,' written by two English people, it was remarked of the proud, patriotic Englishman, that 'Given anything in the shape of a Scottish great-grandmother, would dress himself in a kilt, adopt all pretensions of being a Scot.' Other Englishmen, presumably, are in the position of the fox who was unable to reach the grapes.

"Perhaps the day will come when the two races will make allowances for each other's shortcomings, and give credit where it is due, but until then—"

This letter merely strengthens my argument that the Scots think a heck of a lot about their mild achievements.

Local "Practical and Amateur Wireless" Clubs

HEREWITH a letter from Mr. Norman Hearfield, of 1, Stanningley Road, Armley, Leeds :—

"I am very keen on forming a radio club in Leeds and would very much appreciate your help in this matter, and also I would very much like to meet any amateur transmitters in the locality; but the first point first.

"I remember reading once, in a back number of PRACTICAL WIRELESS, an article on the formation of a radio society, and I am busily wading through my small mountain of back issues to locate it, and, also, I believe I remember reading one week in your notes that you would be pleased, if necessary, to convene a preliminary meeting, and whilst I realise the impracticability of travelling some 400 miles to do this, I would greatly appreciate your help *via* the medium of your paper. If you have had any previous correspondence with anyone in this area or know of anyone interested, and would kindly let me have their address, I would try to arrange a first meeting (our house is fairly large and conveniently situated for this purpose) and see if there is sufficient interest displayed to warrant

the formation of a society. My idea (I may be wrong—if so, please correct me) is to welcome both amateurs proper and 'professional' radio service men (I am really both—I hope—myself) and so try to disseminate knowledge from each to both, if you understand what I mean—the amateur with his knowledge of 'first-hand' construction, and the service man—beg pardon, service engineer—with his specialised knowledge of 'trouble shooting,' each seeking further theoretical enlightenment and each equally interested in practical problems.

"Let me state here and now that I, although engaged daily in tracking the elusive electron (I am chief engineer to the main Leeds wireless retail dealers), am at heart a very keen amateur experimenter interested chiefly in set design and construction, amplifier and microphone construction, recording, short-wave work and transmitting, although I have not yet sat for the P.M.G. exam. to obtain my 'ticket,' as my morse speed is not quick enough—about three words per fortnight it has been timed at—and if we could secure the services of a local transmitter—the operator, I mean—we could probably hold morse classes, because all S.W.L.'s are interested in learning morse, even apart from transmitting.

"Anyhow, as this letter has rambled on over almost three pages, I will 'close down' here and give you a chance to decipher it all, since my calligraphy is not always intelligible even to myself.

"Seriously, though, if you can find time to help me get people together to form a society I will be most awfully obliged to you—as, incidentally, I feel sure will all the other members of the society-to-be, since I am confident that, once started, we can have some really good times and at the same time can each learn something new about this most fascinating—and expensive—of hobbies."

Perhaps local readers will get into touch with this reader.

Crooners

HEREWITH another quotation to add to your pile about crooners—those lowest forms of life :—

"I am a regular listener to short-wave transmissions from all parts of the world, and I can say with certainty that the only two countries that nightly inflict the crooning nuisance upon listeners are Britain and America.

"That I regard as a sign of the decadence of the Anglo-Saxon race.

A.C./D.C. Receiver Speaker

IN an A.C./D.C. receiver the smoothed voltage is lower than the mains voltage, and the field winding of an energised speaker cannot be connected in the common H.T.+ lead as is customary in A.C. receivers. The normal consumption is approximately 50 mA, and, therefore, in order to obtain the necessary 200 anode volts a rectified voltage of approximately 300 volts would be required if a series-connected energised speaker were used. For this reason most A.C./D.C. receivers use a permanent magnet speaker. A low resistance L.F. choke may then be connected in the common anode lead for smoothing purposes, and an anode voltage of 200 volts can be obtained if the mains voltage is over 225 volts.

Parallel Connection

CONSTRUCTORS who particularly wish to use an energised type of speaker can employ the parallel method of connection, employing a speaker having a field-winding resistance of approximately 6,500 ohms. This winding can be connected across the rectifier-output circuit instead of in series with the H.T.+ lead, thereby avoiding the heavy voltage drop which would take place with the series method of connection. One precaution must be taken when parallel connection is made, however; the rectifier must be capable of passing the extra current taken by the field winding. This current will be approximately 30 mA if the winding resistance is 6,500 ohms, and, therefore, if the valves take 50 mA the rectifier must be designed to passs 80 mA or over.

Extra Speaker for Push-Pull Set

MANY inquiries are received concerning the addition of an extra speaker to push-pull receivers, such as the Hall-mark Four series. The extra speaker leads may be connected via 2 mfd. condensers to the anodes of the push-pull valves or to the speaker terminals to which these leads are connected. The addition of the condensers is advised in order to prevent direct current passing through the extension leads. If headphones are used the value of the condensers should be reduced to approximately .1 mfd. Direct connection can be made to the valve anodes, of course, but even so it will be necessary to keep the set speaker in circuit, otherwise H.T. voltage will not reach the valves—the H.T. lead is connected to the centre tap of the set-speaker transformer. If it is found necessary to silence the set speaker a lead should be connected across the speech coil, leaving the speaker transformer in circuit.

"A people that can derive pleasure from the caterwauling of crooners is approaching that stage when it will accept anything.

"There is nothing to be said for crooning. It does not make dancing easier; it adds nothing to the appeal of dance rhythms.

"Why cannot the B.B.C. clear the crooners out of their studios? The vast majority of listeners would applaud the extermination of the pest."

And in my daily paper I see that at a recent court case a lady crooner was stated to be earning £50 a week at the job. Well, perhaps, after all, there is something in it, and I think I shall have to have my voice trained. I note, however, that the judge described this as a "startling figure," with which sentiment I am in entire agreement—but startling is hardly the word.

All-wave Fascinations

A FRIEND of mine with a statistical turn of mind has been making detailed comparisons of the various types of receiver on sale at shops and in use in the various homes which he visits from time to time. It is apparent that the all-wave set, or, at least, that type of set which now bears that name, has gained tremendously in popularity during the past twelve months. The figures are most fascinating, although by one of those peculiarities of mathematics it works out at so many and a half sets! However, there is little doubt that the ordinary type of medium- and long-wave receiver is fast losing favour, and I had only just received this information when I was invited to a demonstration of Mr. Camm's latest battery receiver. I must say that I was considerably impressed by the performance of this. I know what a mains set of similar design can do, and I also know the usual results of a battery set which is "hotted up" for long-distance work. But the range of stations which may be heard on a simple battery receiver is not appreciated until a really worth-while circuit is used on the short waves. The Americans came in particularly well on the night I heard the set, and although I am not a lover of the type of programme which they dispense to the great American public, there was adequate entertainment value for the majority of listeners so far as volume and constancy of reception were concerned. But, of course, the vagaries of short-wave reception are such that some weeks America comes in loud enough to blow your hat off on a one-valve set, whilst another week, not even the B.B.C. can get the signals.

A PAGE OF PRACTICAL HINTS

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

A Novel Fault-location Mirror

THE location of a fault in some modern receiver chassis is often made very difficult owing to the close proximity of the component parts, and, again, it is often necessary to ascertain the value of, say, a fixed condenser which is wired in such a way that its designation is obscure. To remedy this state of affairs I concocted a flexible fault-location mirror, and the accompanying illustrations clearly show the construction. The measurements are, of course, optional, and those indicated have proved suitable, in my case, for general requirements. To make the device, take a piece of mirror glass of suitable size, and a piece of tin with an $\frac{1}{8}$in. flange all round to allow for an overlap, as indicated in Fig. 1. Place the mirror in the centre of the tin back and bend the flanges over to secure same. Next, cut three or four lengths of 20-gauge copper wire and twist these together, as in Fig. 2. Having done this, leave the ends x, y and z for soldering to the edges of the mirror back, and cover the length of wire with sleeving, as shown. Fix a banana plug top to finish end off and the result will be a useful addition to the test kit.—T. W. HOLT (London, W.C.2).

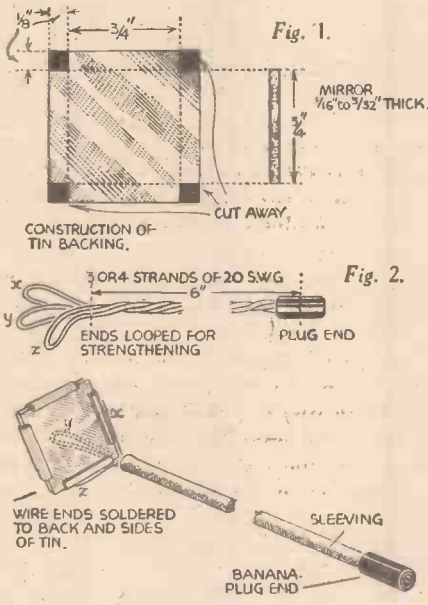


Fig. 1. Fig. 2.

Details of a handy fault-location mirror.

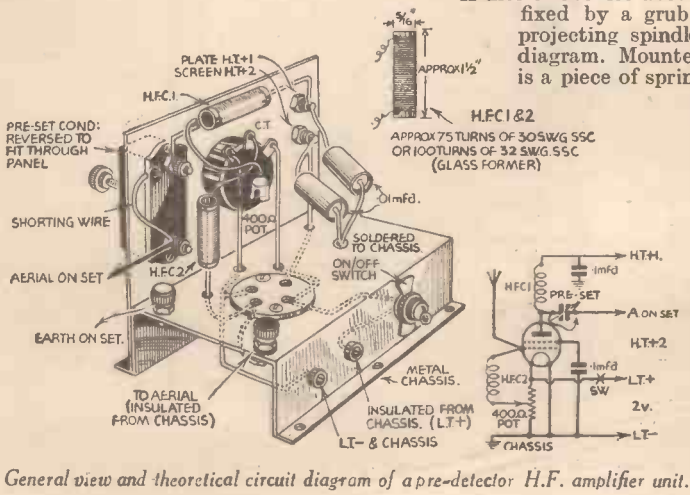
A Pre-detector H.F. Amplifier Unit for Short Waves

AN untuned H.F. stage in the form of an independent unit serves many useful purposes; for example, adjustment of aerial input may be made without appreciable loss of sensitivity, and this in itself permits the use of an ordinary broadcast aerial when normally forbidden.

A further advantage gained by the use of this R.F. amplifier is the smoothing of reaction, and here, again, tests on new receiver designs are facilitated where, for example, amplification figures are being calculated at intermediate stages in the receiver.

The accompanying sketches give details of an easily constructed unit of this nature, and illustrates one which I have employed for use with wavebands as low as 12 metres on an indoor aerial not employing even insulators, other than its own rubber covering, and wooden anchoring, owing to its temporary erection for test purposes. The chokes H.F.1 and H.F.2 should preferably be wound on pieces of $\frac{5}{16}$in. or $\frac{1}{4}$in. diameter glass tubing about 1in. long, as shown, and the ends should be terminated by the aid of either sealing-wax or insulation tape.

Measurements are not included, since variation in general design can be effected and the unit made to suit individual requirements. Just a word regarding the S.G. valve. The maker's characteristics will obviously apply and may necessitate the alteration of the value of the 400 ohm potentiometer or even its exclusion, and the supplementing of a suitable fixed centre-tapped resistance.—F. J. HALL (London, E.C.4).



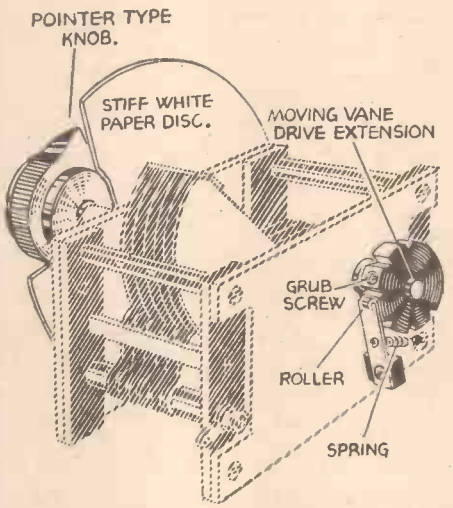
General view and theoretical circuit diagram of a pre-detector H.F. amplifier unit.

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., Tower House, 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.

A Band-spread Condenser Improvement

A FAVOURITE method of spreading out the short-wave bands is to use two condensers in parallel, the larger, or "band-set" condenser, being used for the required waveband, and the smaller, or "band-spread" condenser, being then used for tuning. Unfortunately, there is a serious disadvantage to this method in that it makes calibration of the receiver difficult. This can be overcome by arranging that the band-set condenser is variable in steps, the difference in capacity between two steps being equal in capacity to that of the band-spread condenser when in its maximum position. A condenser of the type used for ganging, having the spindle projecting through the rear end-plate, can easily be arranged so as to be variable in such steps. A disc of ebonite about 1in. in diameter is fixed by a grub screw to the rear projecting spindle, as shown in the diagram. Mounted on the end-plate is a piece of springy brass carrying a small roller, so that this roller presses against the edge of the ebonite disc. Notches can now be cut in the disc at intervals with a triangular file, the spacing between the notches corresponding to the tuning range of the band-spread condenser. Alternatively, the notches can be cut to correspond to particular wavebands.—D. TAYLOR (Stroud).



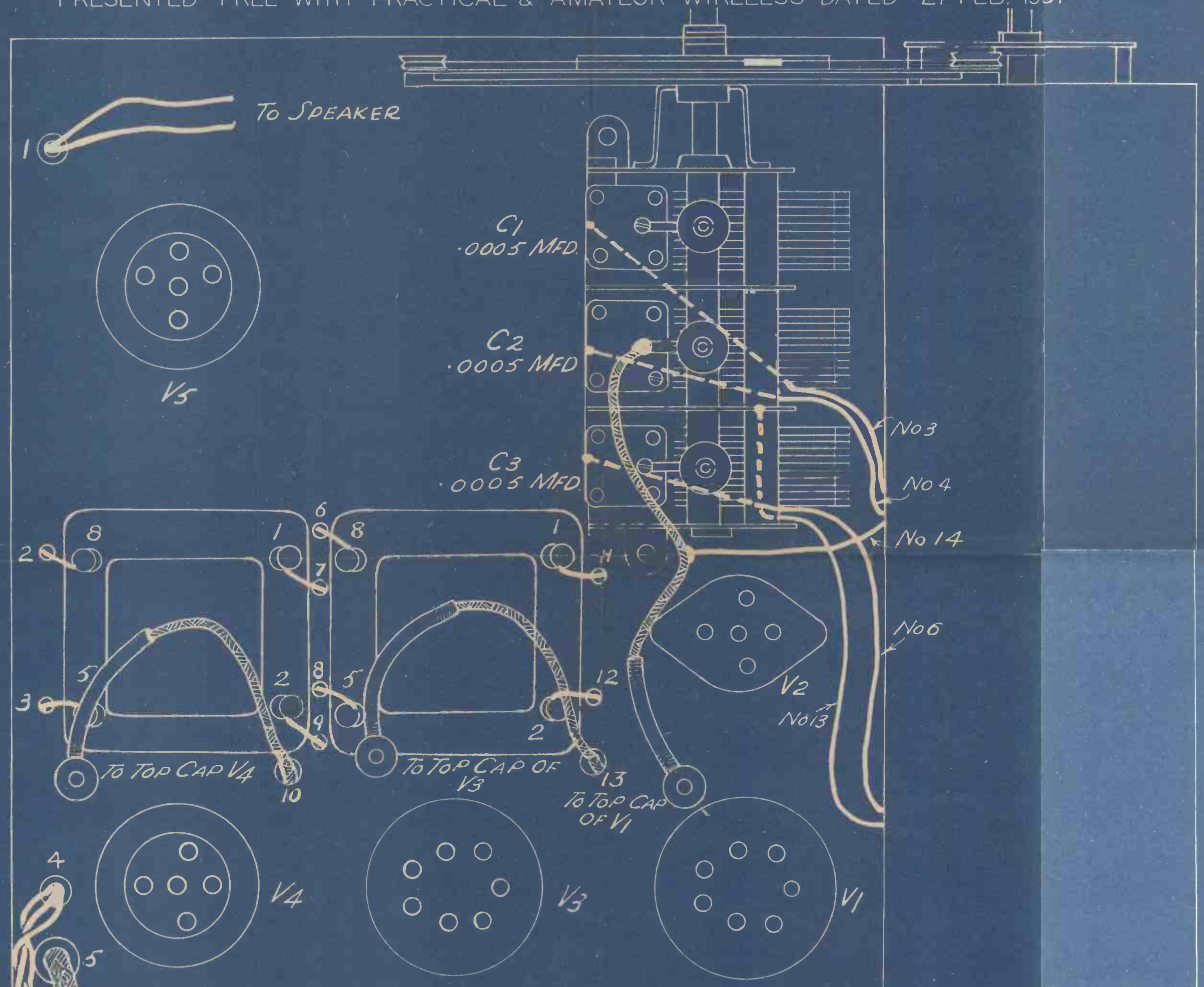
A method of setting a band-spread condenser.

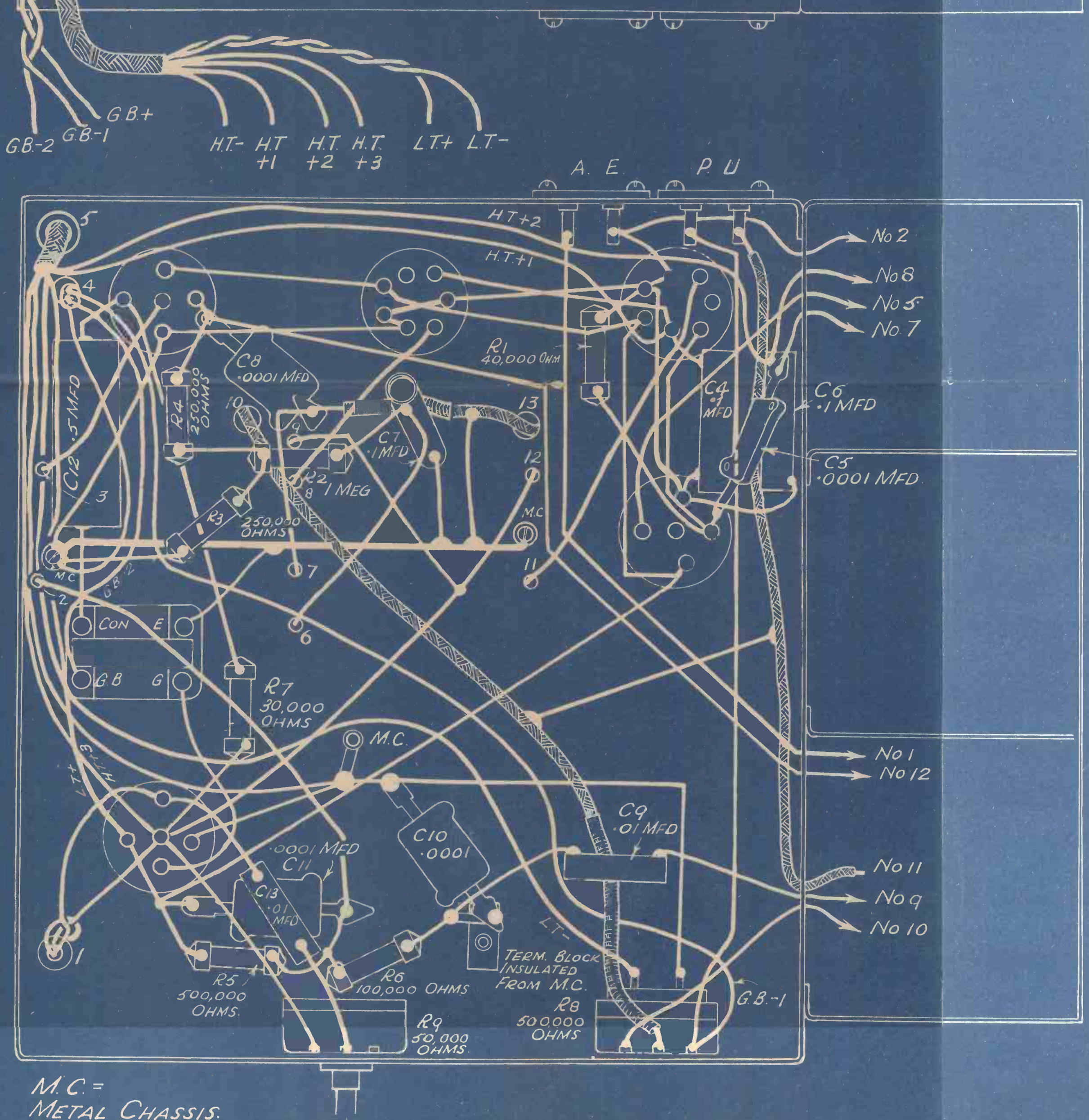
"PRACTICAL & AMATEUR WIRELESS" BLUEPRINT NO. 75 PRICE ONE-SHILLING

F.J. CAMM'S VITESSE ALL-WAVER

PUBLISHED BY GEORGE NEWNES LTD. 8-11 SOUTHAMPTON STREET STRAND W.C.2.

PRESENTED FREE WITH PRACTICAL & AMATEUR WIRELESS DATED 27 FEB. 1937





M.C. = METAL CHASSIS.

Constructing F. J. CAMM'S "VITESSE" All-Waver

How to make this Latest Highly-efficient Five-valve All-wave Battery Superhet

A Design which is Wanted

DESIGN of wireless receivers must either progress or retrogress—it cannot stagnate. We design sets for the needs of the moment, and with an eye to the future. It is one of our greatest problems to endeavour to capture the tendency of public taste as distinct from what its taste is at the moment, otherwise we should be producing sets which would rapidly go out of date. Because you like smoked salmon for lunch it is more than likely that you will soon be sated with it, and it is not until you have had that delectable dish consistently for a couple of years that you can say that your taste is not going to change. The very newness of the science of radio connotes change, although the periods between change will extend as our knowledge grows greater. In fact, radio has suffered less from scientific climacteric than most other sciences, and we can say that design has reached a certain degree of stability and a stage where changes in detail only are possible. We know that television is going to force design along short-wave and ultra-short-wave lines at least until the end of 1938, and now that television transmissions are taking place on one standard known as the London Standard (Marconi-E.M.I.), designers are less fettered and can produce receivers which will not be subject to violent change.

Making the Change

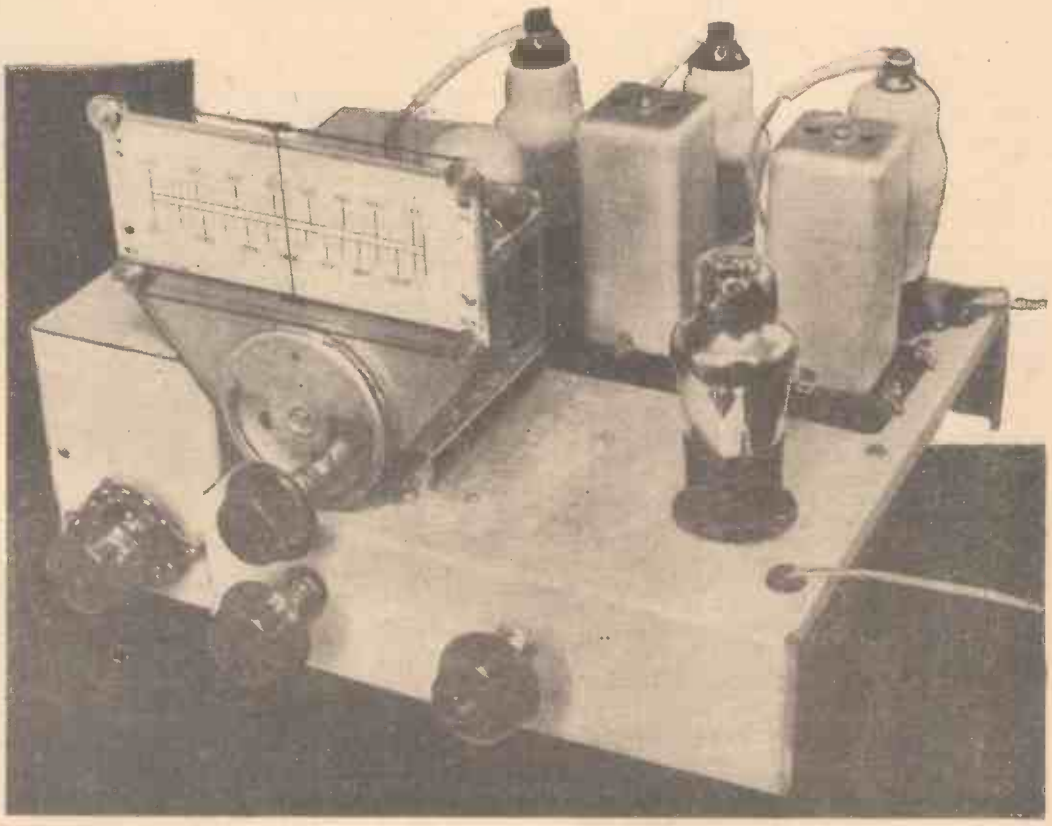
The first step, however, is to become acquainted with short-wave reception, and the home-constructor has not been slow to appreciate that he cannot jump straight away from the technique of medium- and long-wave reception to ultra-short-wave reception.

For the past two years, therefore, there has been a growing demand for short-wave receivers, and so fascinating have constructors found it that the original idea behind their experiments has become obscured, and they are now almost entirely interested in all-wave receivers, satisfying family requirements on the medium and broadcast side whilst accommodating in the same receiver a useful vehicle for short-wave experiments. At first a short-wave adapter, then a one-valve short-wave set, followed by a two-valver, and finally by a three-valver.

A Super Battery Set

This meant two receivers, and as a natural corollary you had the demand for all-wave receivers. Initially this was for a three-valve all-wave set, but because of the vagaries of short-wave reception on the more distant stations, it has been difficult with the popular three-valver to bring some of the stations up to loudspeaker strength.

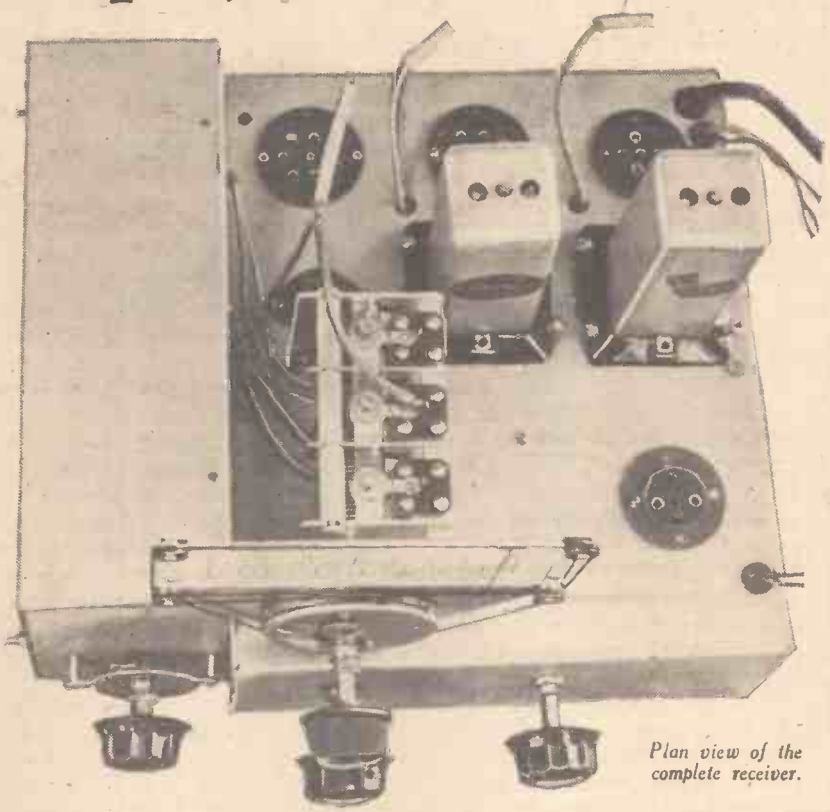
This must account for the insistent demand I have received during the past year for a powerful all-wave



This view of the "Vitesse" shows the neat and workmanlike layout which is adopted.

Simple and Speedy Construction

battery receiver of a type now epitomised in the Vitesse, constructional details of which are presented here together with a full size blueprint. It has a robustness of performance and a quality of reproduction which cannot be beaten. Its performance compared with a three-valver is like comparing the performance of a Rolls-Royce with a cheap 12-h.p. motor-car. Both are excellent in their respective fields, but for quality you must back the more expensive car. This analogy from that point begins to break down, for apart from the increased cost of two more valves, a few more milliamps of H.T., and a bit more L.T., the cost of the Vitesse is comparable to an ordinary three-valver. Certainly the construction is no more difficult and the operation is just as simple. You have the great advantage that practically every worthwhile station comes in at full loudspeaker strength without having to indulge in digital gymnastics with the knobs. The volume control enables you to control the L.F. output, and thus you are able to retain quality of reproduction.

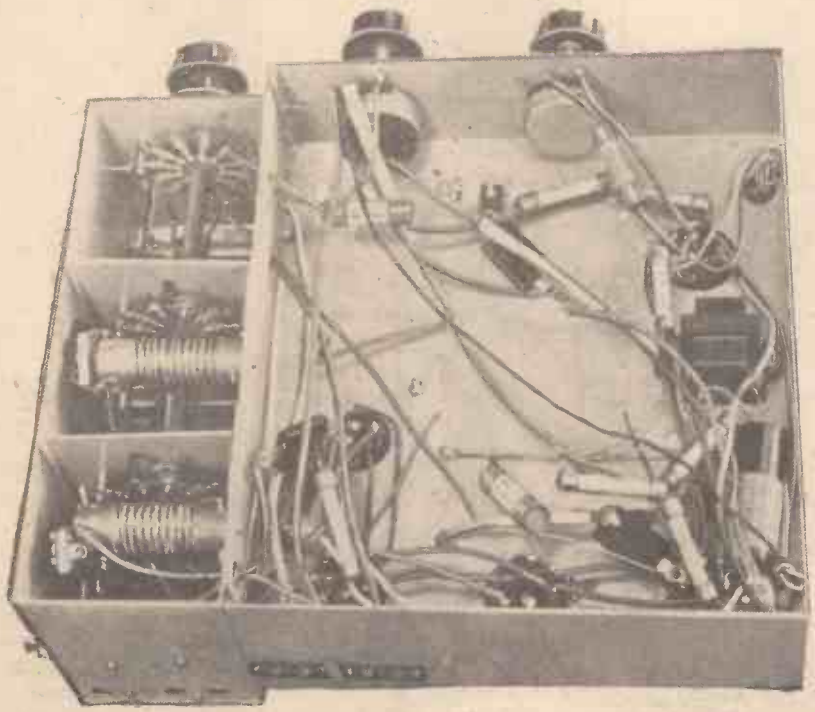


Plan view of the complete receiver.

All-metal Construction

I have endeavoured to simplify the work of construction by designing the receiver on a metal chassis, which for a small sum is available ready drilled, thus avoiding metal work. This chassis, as the photographs amply testify, gives the set quite a professional appearance, and I do not recommend you in this design to use a metallised wooden chassis. In order to stave off queries I should like to say at once that the design is totally unsuited for baseboard assembly. The lead lengths are critical, and have been carefully worked out. Do not attempt, therefore, by any re-arrangement of the design to spoliate what I have taken so much trouble to get right.

Follow the blueprint to achieve immediate results, backed by my usual guarantee. Once again, in connection with the latter I must stress that I cannot undertake to service receivers except for genuine readers of the paper. I cannot service sets sent to me by dealers; they take the profit, and must accept the servicing. Even though you are not a dealer you may be making receivers for profit, and here again, I must decline to service the set unless my service fee is paid. Every genuine reader of the paper who builds the set and fails to obtain results can claim free service.



View of the underside of the chassis showing the small amount of wiring which has to be carried out.

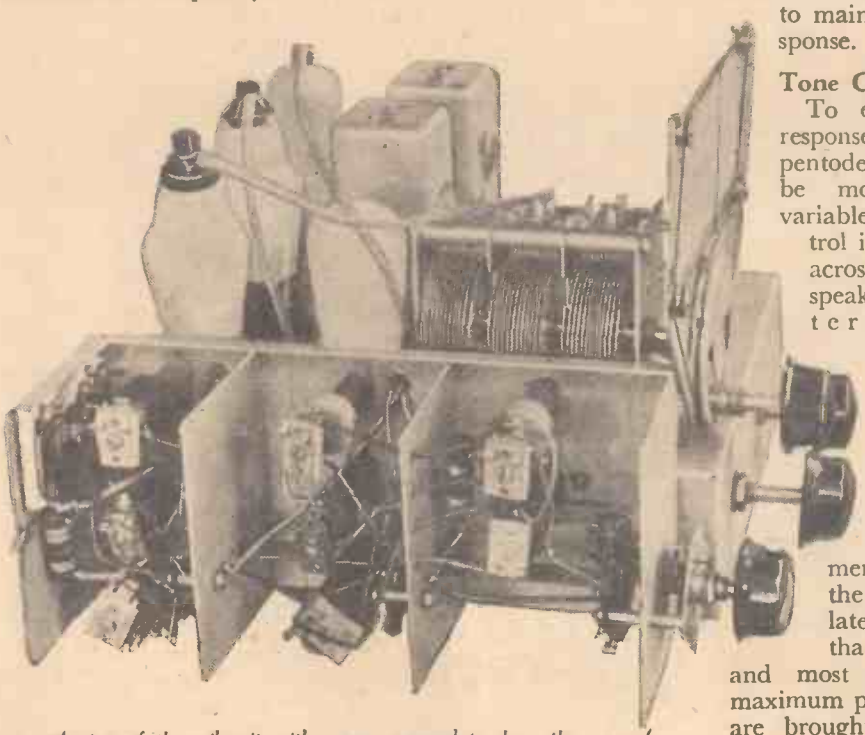
I have had to make this condition in the interests of the readers themselves because of flagrant cases of misrepresentation on the part of dealers. Perhaps one day the wireless industry will refuse to supply goods to dealers who know nothing about radio. Perhaps . . . !

But really there is little fear that the set will fail to give satisfaction even when built by a beginner. He merely needs to follow the blueprint faithfully, and to ensure that his components are not defective. Before writing to me it is always advisable to conduct a simple continuity test because it is more than likely that the trouble, if any, will be found in that direction. That is my almost invariable experience.

A Simple, Sensitive and Selective Sup

Principles of the Design

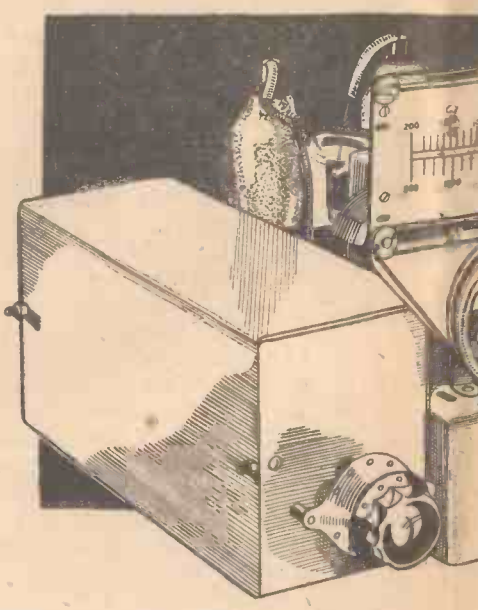
Last week I briefly covered the main details of the circuit, and this week before describing the actual constructional work I will go into the circuit in detail. The tuning circuits are self-contained, all the coils being enclosed in separate screening boxes, as may be seen from the illustration below. These coils are switched to cover the three wavebands by means of the multi-contact switches which are housed in each section. This complete coil unit is supplied by the makers ready wired, and leads are already attached and brought out through holes in the side of the chassis for connection in the circuit. The wavebands covered by these coils are from 18 to 53 metres, from 200 to 550, and from 900 to 2,250 metres. Thus all of the more important short-wave stations should be covered, in addition to the normal broadcast stations on medium and long waves. The input circuit is of the straight type, and is fed to a pentagrid frequency-changer in accordance with standard practice, but the oscillator section includes a separate triode in order to ensure maximum performance on the lowest wavelengths. When a simple pentagrid is employed it is generally found that as the frequency increases the action falls off, and a point is often reached where oscillation ceases. The triode-pentode type of frequency-changer overcomes this difficulty, but the circuit adopted in the "Vitesse" has certain advantages over this type of valve and gives maximum efficiency over the entire range of the receiver. The intermediate frequency which is adopted is 465 kc/s, as this is generally found better on the short waves than 110 kc/s, although conversely the latter is often preferable for the medium and long waves. As, however, the majority of users will require maximum efficiency on the shorter wavelengths, it is desirable to make use of the higher intermediate frequency.



A view of the coil unit with screen removed to show the general arrangement of coils, padding condensers, and switches.

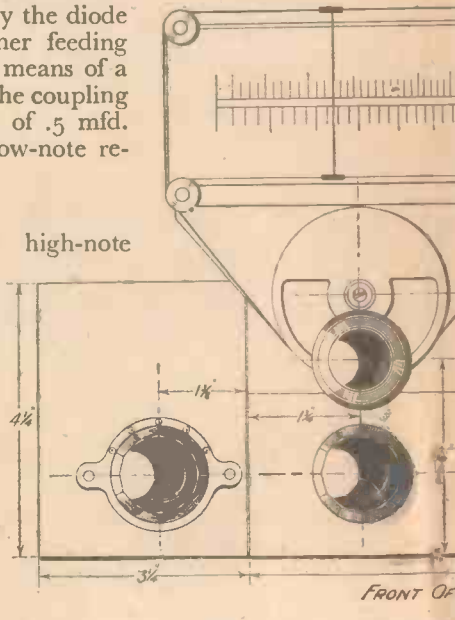
Quality Detection

The intermediate-frequency valve, as well as the pentagrid, possesses variable-mu characteristics, and thus volume may be controlled by varying the bias on these two valves. To ensure correct operation, and to maintain signals constant, this control is carried out automatically by the familiar A.V.C. circuit, which is taken from the fourth valve in the series, a double-diode triode. One diode acts as a rectifier, giving high quality of reproduction, whilst the other diode provides the necessary voltage for volume control purposes. The signal is fed to a volume control potentiometer which is wired in such a manner that it may be included either across the pick-up terminals or across the radio signal, and thus the input to the triode portion of the D.D.T. valve may be controlled on both radio and gramophone. To complete the L.F. amplification a pentode of the economy class is used, and to maintain the high quality delivered by the diode rectifier, the L.F. transformer feeding the pentode is coupled by means of a resistance-capacity circuit, the coupling condenser having a value of .5 mfd. to maintain the low-note response.



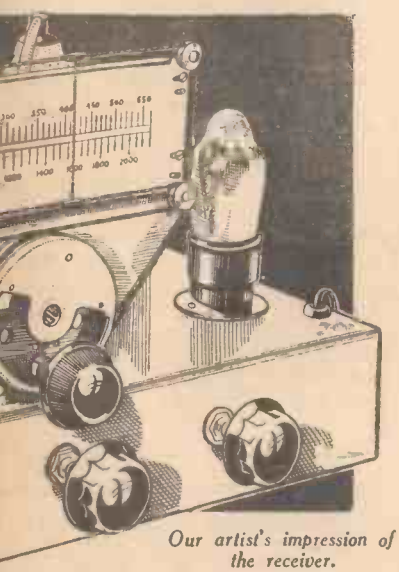
Tone Control

To enable the high-note response of the pentode valve to be modified a variable tone-control is included across the loud-speaker output terminals and more or less standard values are employed here. It might be mentioned in passing that the spindles of both the volume and tone controls must be insulated from the chassis. It will thus be seen that the circuit embodies all of the latest and most up-to-date features, and to ensure maximum performance in each stage the H.T. leads are brought out separately so that the user can experiment and find the best working voltages. I



Dimensions for marking out

erhet — The "Vitesse" is Guaranteed

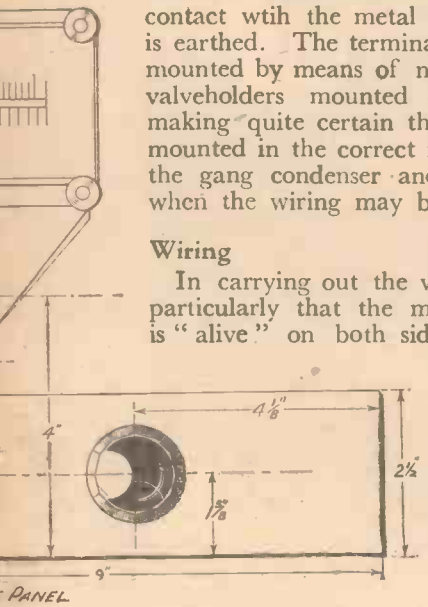


Our artist's impression of the receiver.

have found that the majority of listeners prefer this arrangement to a single H.T. lead with the various voltages obtained automatically by means of decoupling circuits, although this latter has the advantage of simplicity.

Construction

The construction is rendered extremely simple by the fact that an all-steel chassis is specified, and this will obviously be obtained with all holes ready drilled. The coil unit is also embodied in an all-steel chassis and the two are bolted together with the leads from the coil unit passing through the holes ready drilled in the side runner of the chassis. The unit may be bolted on first, as there is very little likelihood of damage to the coils arising as they are adequately protected. The two potentiometers should next be mounted on the front of the chassis, placing the insulating washers over the bushes to ensure that they do not come into contact wtih the metal chassis which, of course, is earthed. The terminal socket strips should be mounted by means of nuts and bolts, and the valveholders mounted in a similar manner, making quite certain that the 7-pin holders are mounted in the correct relation. Next bolt down the gang condenser and the I.F. transformers, when the wiring may be commenced.



a panel or cabinet front.

Wiring

In carrying out the wiring, note particularly that the metal chassis is "alive" on both sides; that is, do not permit any bare wire to touch the chassis unless it is to be earthed. When using a wooden chassis, of course, the underside is "dead," and may be used as an anchoring point, or may be allowed to come into contact with a bare lead without any difficulty. When long leads are employed, and there is a risk of sagging, with perhaps consequent short-circuiting, slip a length of the standard insulated sleeving over the wire first. Some of these leads will be seen in the illustrations. The fixed resistors and the condensers are suspended in the wiring. That is to say, the connections from one point to another are in some cases made by these components, and the ends of the wire attached to them are cut to facilitate this process. The L.F. transformer may be now bolted in its place and the wiring completed. Note that the battery and loudspeaker leads are brought out through large holes in the chassis, in which rubber grummets should be fitted to prevent the wires being damaged due to the sharp edges of the chassis. The leads to the anodes or top caps of the valves should be carried out through the screened sleeving supplied with the kit and the sleeving should be connected to earth. Note particularly that the wire inside the sleeving must *not* be earthed. In some of the receivers which have been sent in for servicing the readers had made the mistake of joining the ends of the wires and not only the screening to earth, with the result, of course, that the lead and the H.T. was short-circuited. Wrap a length of the bare connecting wire round the braid from which the sleeving is composed, and run some solder round it. Do not leave the iron too long on it, or you may damage the insulation on the inner lead (if insulated wire is employed). A further important point here is that the sleeving should not be cut off short and stretched out to accommodate the inner wire. A long piece of sleeving should be used, and it should be compressed; that is, the two ends should be pushed towards each other, so that the internal diameter is increased. In this way the capacity between the inner wire and earth will be reduced, with improved results. It will be found that 12ins. of screened sleeving may be used for each of the leads if this procedure is adopted.

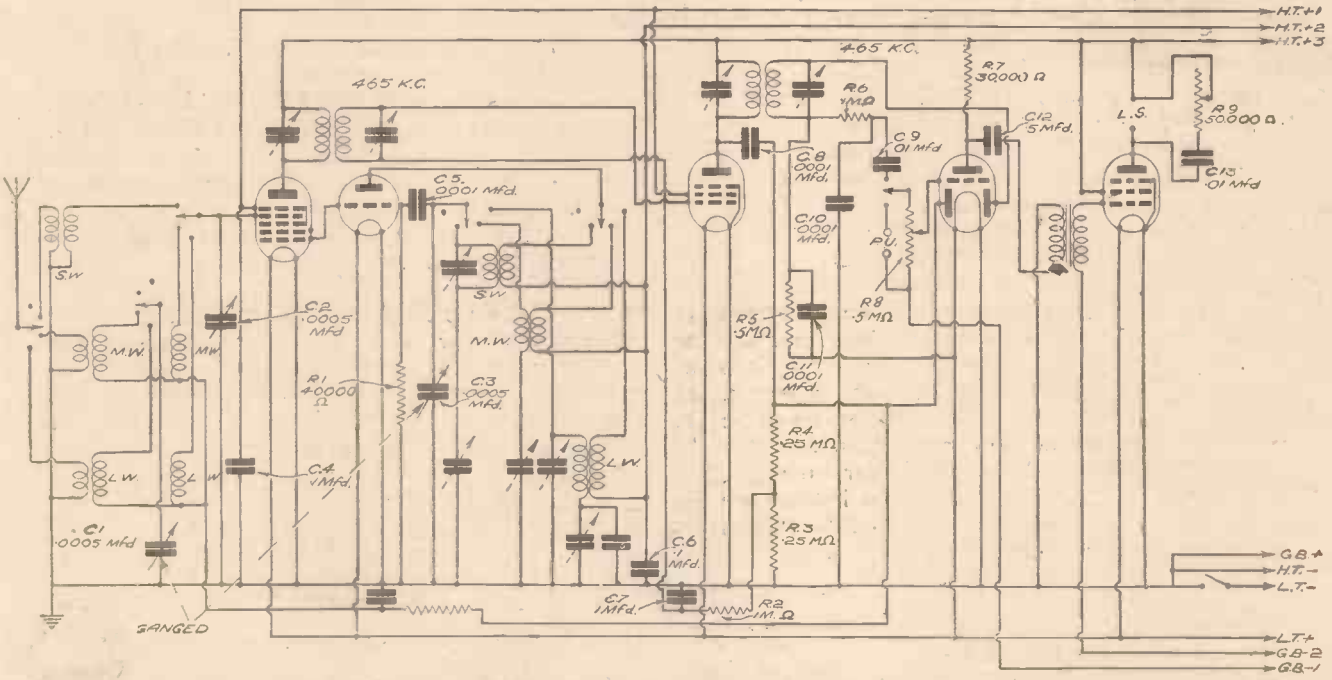
Rear view of the "Vitesse" showing the screened connecting leads and general clean appearance of the receiver.

The Coil Unit

It will be noted on the blueprint which is included in this issue that the leads from the coil unit have been given numbers, and the leads on the unit which is supplied by B.T.S. will be similarly numbered. This scheme has been adopted in preference to colouring the leads, as some confusion has arisen in the past when coloured leads have been used. The points on the blueprint marked M.C. indicate anchoring points for earth return leads, and a bolt should be passed through the chassis at this point and the leads soldered to small soldering tags anchored by means of these bolts. In the centre of the print a thick white lead is shown from two points each marked M.C. and to this lead four other leads are joined. This arrangement simplifies connection and also improves efficiency as it avoids bunching all leads in one point for earth connection. In the original model a 5½in. length of heavy gauge bare tinned copper wire was joined from one bolt to the other, and the leads were then soldered to this as shown on the print. We advise this method of connection rather than joining leads together such as that from the screening cable on the wire projecting through hole number 13 and the lead from condenser C7. Remember that the metal end caps on the resistors are "alive" and take care to wire these in such a position that they cannot come into contact with any other metal part. If you adopt the screw method of connecting the leads to the valveholders, do not tighten the screws provided with undue force, or you will probably find that the ends of the leads will be sheared off.

Testing the Set

Remember to keep all stations which are used for ganging at the weakest setting, as in this way the adjustments of the trimmers are more easily heard. It is desirable to trim at the top and bottom of the medium-wave band, and no further adjustments should be required on the long or short waves. The I.F. trimmers should be adjusted for maximum response in a similar manner.



Theoretical Circuit of the "Vitesse" All-waver. It will be noted that certain components do not bear any reference number or value, and these parts are already included in the special coil unit. The make and type numbers of the remaining components may be seen in the list given below.

PRICE LIST OF COMPONENTS

Coil unit, Type AWS/B ..... B.T.S. ..... £2 2s. 0d.
Three-gang condenser, Bar Construction Type, .0005 mfd. (C1, C2, C3) Polar ..... 17s. 6d.
Slow-motion drive, type V.P.Horizontal Polar ..... 6s. 6d.
Two I.F. transformers, type BP96 .. Varley ..... 17s. 0d.
Ten fixed condensers :—
Three .1 mfd. (C4, C6, C7)
Two .01 mfd. (C9, C13)
One .5 mfd. (C12)
(tubular) ..... T.C.C. 10s. 8d.
Four .0001 mfd., (C5, C8, C10, C11) type M
Seven fixed resistors (½ watt type)
One 30,000 ohms (R7)
One 40,000 ohms (R1)
One .1 meg. (R6)
Two .25 meg. (R3, R4)
One .5 meg. (R5)
One 1 meg. (R2)
..... Bulgin ..... 3s. 6d.
Two variable potentiometers ; 500,000 ohms (R8) (type VS.63) ; 50,000 ohms (R9) (type VC.60) ..... Bulgin ..... 8s. 9d.
One L.F. transformer, type LF12 .... Bulgin ..... 6s. 0d.
Five chassis type valveholders : two 7-pin, two 5-pin, one 4-pin. ..... Clix ..... 4s. 2d.
Two socket strips, A.E. and P.U. .... Belling-Lee ..... 1s. 6d.
Six-way battery cord 30in. ..... Belling-Lee ..... 2s. 6d.
One steel midget "Vitesse" chassis, ready drilled ..... Peto-Scott ..... 4s. 6d.
Three plugs : GB + GB − 1, GB − 2 .. Belling-Lee ..... 6d.
Five valves { 210PG ; 210 Det ; 210 VPT ; 220HPT ..... Cossor
HD22 ..... Osram }
Flex, connecting wire, 3ft. screened lead ..... Peto-Scott ..... 2s. 6d.

ACCESSORIES

One speaker, Stentorian Junior ..... W.B.
One 120-volt HT battery
One 9-volt G.B. battery
..... Drydex
One 2-volt accumulator ..... Exide

Cheaper Television

TELEVISION has been brought appreciably nearer to general home use by substantial reductions in the price of receivers. This is the direct result of the B.B.C.'s decision to transmit only 405-line pictures.

Against the original prices of 95 and 120 guineas the General Electric Company announce that their model BT 3701 high-definition receiver is now listed at 60 guineas, while Model BT 3702, which incorporates an eight-valve all-wave radio receiver, is now only 80 guineas.

To help popularise this latest means of entertainment and instruction, especially in view of the proposed Coronation transmissions, the G.E.C. are now offering hire-purchase facilities for a small deposit and £1 a week. The sets and aerial are installed without charge and a year's free maintenance is guaranteed.

Messrs. H.M.V. also announce a similar price reduction, Model 900 costing now 80 gns., and Model 901 costing 60 gns. In addition, H.M.V. announce that all enthusiasts who have already purchased an H.M.V. television set will receive a cheque representing the difference between the old and the new prices.

Messrs. Pye have made the following official announcement on the subject: "Naturally, we welcome the simplification of the television transmission, as in our opinion it was ill-advised to attempt to transmit on two different systems. Now that one arrangement has been definitely decided upon, it will, of course, make the cost of manufacture of Pye television receivers substantially less, although, perhaps, not so much lower as some people anticipate.

"At the same time, it will make their operation definitely simpler and the controls less complicated. We consider the chief advantage of the new policy to be that more time will be concentrated on programme production and more space will be available for it.

"With our experience to date, the chief difficulty in popularising television has been, not so much the price of the receiver, as the uncertainty in the mind of the public on matters of continuity, and the experimental nature of the programmes which have been transmitted. The Pye television policy and prices will be announced in the near future."

Mr. John Logie Baird also announces that the Baird Television Receiver has, with the simplification made possible by the B.B.C.'s adoption of one London Transmission Standard, been reduced in price to 55 guineas. This is the cheapest set now on the market and claims besides to have the largest screen.

SHORT WAVE SECTION

IMPROVING THE SHORT-WAVE RECEIVER

This Article Gives Several Useful Hints for the Constructor and Indicates How the Performance of the Existing Short-wave Receiver can be Improved. By IDRIS EVANS

CAREFUL attention to small details is very necessary when designing a short-wave receiver if optimum results are to be obtained. Low stray capacities and inductances which would not materially affect the performance of a medium-wave receiver have an increasing effect as the incoming signal frequency is increased. When constructing a receiver for short-wave reception, stray capacities and inductances should therefore be reduced to a minimum by using the shortest possible leads between the tuning condenser and tuning coil, and choosing valves having a low internal capacity. Excessive screening of the grid lead connected to the tuned circuit should also be avoided as this introduces a capacity between the lead and earth, thereby increasing the effective minimum tuning capacity. For the same reason the coil screening can, if used, should be kept well clear of the winding—a separation of at least ½in. should be allowed.

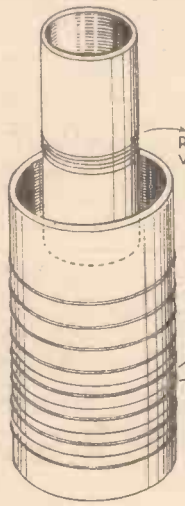


Fig. 1.—An efficient method of winding a short-wave coil.

The Straight Receiver

The straight receiver is still very popular amongst short-wave enthusiasts, and can be relied upon to give an excellent performance if correctly designed. In a receiver of this type good reception depends to a great extent on the smoothness of the reaction control, which in turn is mainly governed by the design of the coil. A suitable detector valve must be used, of course, but the choice of valve is fairly easy, as the manufacturers indicate the type most suitable for rectification. Many short-wave constructors make their own coils, however, and although a certain measure of success can be attained with a carelessly constructed coil, there are many precautions to be taken in connection with the construction of a short-wave coil if best results are to be obtained.

The Reaction Winding

If the detector is the first valve it is advisable to use a three-winding coil—grid, reaction, and primary—otherwise the aerial capacity will have too great an effect on the tuned circuit. The primary winding should consist of approximately half the number of turns used for the grid winding, and should be wound as shown in Fig. 1. The position of the primary winding is not as important as that of the reaction winding, however. The reaction winding must be kept sufficiently clear of the grid winding to avoid a capacity effect between the two windings, but they must also be sufficiently close to each other to ensure effective inductive coupling. If the capacity coupling between the two windings is excessive, rotation of the reaction condenser will affect tuning, and if the correct number of turns is not used, either insufficient or excessive reaction effect will be produced. Although it is customary to wind the reaction winding on the same former as the grid and primary windings, better results are generally obtained by using a separate former for the reaction winding, as shown in Fig. 1. There should be a clearance of at least ¼in. between the two formers, and the best position for the inside former can then be found by experiment. For wavelengths between 20 and 50 metres it is generally found that the reaction winding requires approximately half the number of turns used in the grid winding, and smoothest reaction is obtained when the reaction winding is approximately half-way between the top and bottom turns of the grid winding. By using a movable winding in this manner the exact position for best results can easily be found, and the inner former can then be simply wedged in position.

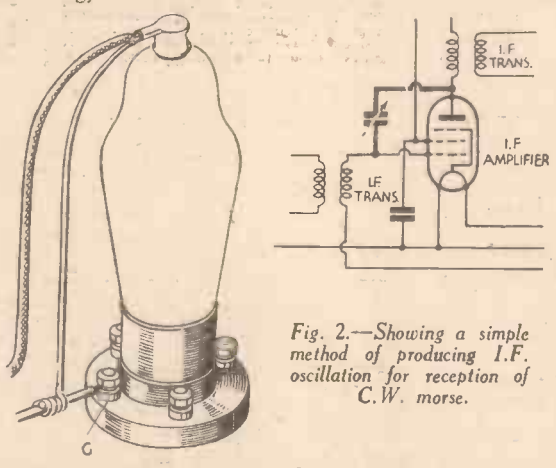


Fig. 2.—Showing a simple method of producing I.F. oscillation for reception of C.W. morse.

The Superhet

The multi-valve superhet is certainly more sensitive than the straight receiver, but it usually suffers from the disadvantage of not being able to receive continuous-wave morse transmissions. To the amateur who knows the code, this is, of course, a great drawback. There is, however, a simple method of converting the normal superhet for C.W. reception. If the intermediate-frequency amplifier is made to oscillate, C.W. signals will be picked up as on a straight set. There are several methods of producing oscillation, but the simplest is the one shown in Fig. 2. It will be seen that a wire is connected to the cap of the I.F. valve (the anode) and its free end placed near or wound round the lead connected to the grid terminal of the same valve. This provides a capacity between the anode and grid, and thereby produces instability. The proximity of the extra lead to the grid lead varies with different receivers, and although in most cases it will be found that they need only be brought within ¼in. of each other, in other cases it will be necessary to wind the extra lead over the grid lead. It is emphasised, of course, that the two wires must be effectively insulated from each other, and it is also advisable to insulate the free end of the extra wire in order to prevent it from touching a point at low potential and thereby cause a burn out of the I.F. transformer primary. A very low capacity

(Continued at foot of next page)

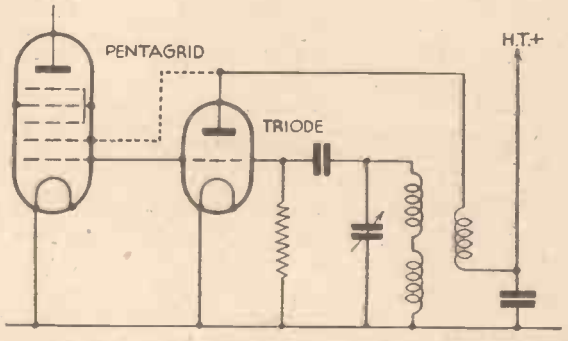


Fig. 3.—Showing the addition of a triode to a pentagrid for improved S.W. reception.

Coronation Souvenir

AN exquisite souvenir of the Coronation of Their Majesties the King and Queen. Size 14in. by 9¼in., 48 pages of pictures and text, finely printed in two colours, plus 16 beautiful colour plates by well-known artists, designers, and photographers. Price 2/6. Published February 26.

THIS is likely to be by far the most beautiful book issued in connection with the Coronation of Their Majesties King George VI and Queen Elizabeth, and has been specially written by Edward Shanks.

In the text attention has been paid in the first place to the lives of the King and Queen. In addition, however, much space has been devoted to the Coronation ceremony in history and to the same ceremony as it is to-day.

The admirably written text matter is adorned with many fine photographs, and the colour plates, by such artists as Gordon Nicholl, R.I., Ellis Silas, Reginald Knowles, and others, are perfect examples of colour reproduction.

The colour plates include:

Coloured title-page.

Their Gracious Majesties King George VI and Queen Elizabeth.

The Kings of England: A Genealogical Tree.

T.R.H. The Princesses Elizabeth and Margaret Rose.

The First Oblation, King Charles I.

The Coronation of Queen Elizabeth.

Proclamation of King George VI's Accession.

The King's Champion.

Westminster Abbey: The High Altar.

The Inauguration of Oliver Cromwell as Lord Protector.

Queen Mary.

The Coronation Banquet of King Henry VIII.

The Court of Claims: Period of Edward V.

The Coronation of William the Conqueror.

The Crown Jewels (I).

The Crown Jewels (II).

SHORT-WAVE SECTION

(Continued from facing page)

variable condenser could be used in place of the suggested lead if a variable effect is desired.

Using Separate Oscillator

The performance of a superhet using a pentagrid frequency-changer can generally be greatly improved by using a triode in conjunction with the frequency-changer. This additional valve improves the sensitivity, and also lowers the minimum wavelength to which the receiver can be tuned. It is customary to connect the anode and grid of the extra valve to the oscillator anode and oscillator grid of the pentagrid, but it may be found that this method of connection introduces too great a stray capacity across the tuned circuit. To overcome this the oscillator anode of the pentagrid should be left disconnected, with the oscillator grid connected to the triode grid. The circuit arrangement is shown in Fig. 3, the lead to be disconnected being shown in dotted lines.

Leaves from a Short-wave Log

When to Log a Chilian

BETWEEN G.M.T. 02.00-05.00 if you tune your receiver to 31.25 m. (9.6 mc/s) you may hear a call: *el Praco, Santiago.* This emanates from the station CB96O, Santiago (Chile). Announcements are made in both English and Spanish. The address is: Radioemisora Pilot (Sr. Henriquez Humeres), Casilla 1342, Santiago (Chile).

New Station at Port-au-Prince

French listeners report hearing broadcasts from a new Haitian transmitter giving out the call-letters HH3NW, at Port-au-Prince; the channel used is 47.24 m. (6.351 mc/s).

Still Searching for Good Channels

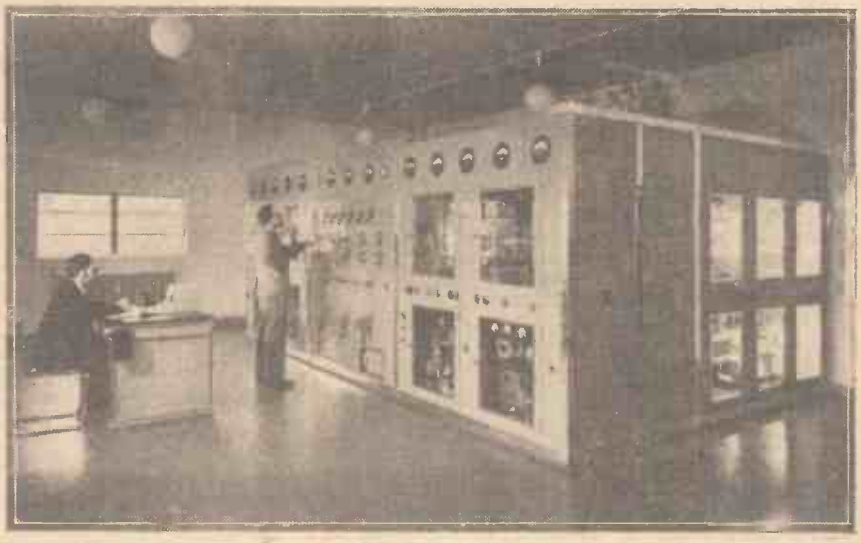
Apparently OLR, Podebrady (Czechoslovakia), has not yet definitely adopted the frequencies to be used for the relay of the Prague broadcasts. During the past month tests have been regularly carried out on 19.69 m. (15.24 mc/s); 25.34 m. (11.84 mc/s), and 49.75 m. (6.03 mc/s). The authorities will shortly announce the channels selected, and a regular service of programmes is to be instituted in the near future.

Lisbon Seeks a New Wavelength

CT1AA, from which broadcasts are made every Tuesday, Thursday, and Saturday, between G.M.T. 22.00-24.00 on 31.09 m. (9.65 mc/s), has been recently logged as testing on 25.31 m. (11.83 mc/s) but seems to have since reverted to its original frequency. An easy station to identify with its triple cuckoo call!

Re-allotment of Venezuelan Call-Signs

According to official lists many of the Venezuelan short-wavers have been given new call-signs and, in some instances, a change has been effected in the frequency. YV11RB, on 45.84 m. (6.545 mc/s), is now YV6RB, Ciudad Bolivar; YV6RV, Valencia, *La Voz de Carabobo*, is YV4RB (46.01 m.—6.52 mc/s); YV5RH, *Ondas Populares*, at Jardines del Valle, Caracas, in future, will be known as YV5RH on 46.88 m. (6.4 mc/s); YV1RH, Maracaibo, on 47.17 m. (6.36 mc/s), replaces YV1RV, and on 47.28 m. (6.345 mc/s) we find a new transmitter, YV1RG, Valera. Radio Maracay, also a newcomer, is registered as YV4RD, on 47.62 m. (6.3 mc/s), as is *Radio Coro* (YV1R1), on 48.31 m. (6.21 mc/s). YV5RF, on 48.62 m. (6.17 mc/s), is a 300-watter installed at Caracas-Catra, and on 48.78 m. (6.15 mc/s) will be found our old friend YV3RC, *Radiodifusora Venezolana*, with the call-letters YV5RD. YV8RB, Barquisimeto, formerly on 50.90 m., is now reported on 51.02 m. (5.88 mc/s) as YV3RA and YV1RE, Maracaibo, on 51.64 m. (5.81 mc/s), which was formerly YV7RMO (49.42 m.). On 51.72 m. (5.8 mc/s) you may log Radio Caracas, YV5RC, a slight alteration from YV2RC. Finally, YV10RC becomes YV2RA, San Cristobal, on 52.45 m. (5.72 mc/s). Where programmes are relayed to the U.S.A. or for the benefit of any other foreign country, the channel to be used is 46.55 m. (6.445 mc/s) through YVQ, Santa Rita, Maracay, a 10-kilowatt short-wave transmitter operated by the Venezuelan Government.



The transmitter and programme control desk in the new Penmon broadcasting station in North Wales.

Radio Tananarivo

In the French colony of Madagascar the authorities have increased the power of the existing transmitter at Tsaralana to 500 watts. FIQA, situated near Tananarivo, now works on 49.96 m. (6.005 mc/s) daily from G.M.T. 08.30-09.45 and again from 12.00-18.00. The call is: *Ici Station Française de radiodiffusion Coloniale et Equatoriale à Tananarive.* The programme opens with the playing of a gramophone record of that old and very popular favourite *Ramona*. Relays are given of concerts given at the local Hotel Fumaroli, from a native theatre, and also from Paris *via* the Poste Colonial stations.

Moscow's Present Wavelengths

Until further notice the Moscow broadcasts will be carried out on 50 m. (6 mc/s) daily from G.M.T. 21.00—and on Sundays on 39.89 m. (7.52 mc/s) between G.M.T. 16.00-19.00. These transmissions mainly consist of talks and war news bulletins in various foreign languages.

Broadcasting News and Notes

A New Variety Feature

ACCORDING to a recent announcement, a new variety feature, entitled "The B.B.C. presents the A.B.C.," will this season succeed "In Town To-night" as from Saturday, April 10th. It has been devised by Alan Keith, the promising young writer who, as an actor, is already well known to listeners for his performances in various radio plays and variety features. His West End appearances include "Late Night Final," "Dinner at Eight," and "Magnolia Street."

On twenty-six successive Saturdays, one for each letter of the alphabet, the feature will deal with people and things whose names begin with the appropriate letter.

Thus the first programme will be introduced by a celebrity whose surname initial is "A." He or she will choose at random between seven and ten subjects beginning with the same initial letter. It is then hoped to bring to the microphone well-known personalities who will be able to deal with each of the subjects so chosen. The programmes will not necessarily consist solely of talks. Outside broadcasts may be introduced, and telephone calls will enable well-known people in Europe generally to take part in the programmes. A short play may occasionally be introduced and recordings used to obtain the appropriate "atmosphere" for a subject. The feature will be produced by A. W. Hanson, who has been responsible for "In Town To-night" since its inception in October, 1933, and for "Café Colette," "The Table Under the Tree," and other musical presentations.

Henry Hall's Hour

NEW programme developments will take place in connection with Henry Hall's Hour, starting on Saturday, March 13th, on which date the B.B.C. Dance Orchestra completes five years of broadcasting.

It is intended that each of the Saturday night programmes shall include one or two examples of modern rhythmic compositions by British, American, and Continental composers, many of the British contributions to the series being new works specially written for the B.B.C. Dance Orchestra. In this way, Henry Hall hopes to stimulate the British composer in a field which has been exploited almost exclusively by the famous names of American rhythmic music, and the scheme will undoubtedly create a new interest for listeners.

In selecting works for this series, no departure will be made from the essential character of light entertainment which is the feature of the "Hour." Henry Hall believes that this demand need be no handicap to the rhythmic composer, and, indeed, it is possible that the series will produce a work which might become as popular as America's "Rhapsody In Blue."

Oliver Wakefield's contract expires on February 27th, when he will have completed six months' regular broadcasting. It is not intended to appoint another resident comedian with the start of the new series on March 13th.

B.B.C. Symphony Orchestra to Visit Southampton

WE are informed that the B.B.C. Symphony Orchestra will be the first of its kind to be heard at Southampton within living memory, when, on March 10th, Dr. Adrian Boult will direct, in the Guildhall at the famous port, the second of the orchestra's series of four provincial concerts during the 1936-7 season.

No other hall in the district would accommodate the full orchestra. The recently-completed Guildhall, however, with its large organ—which, by the way, will be used in two of the works to be performed—will seat nearly 2,000 people The Guildhall is a building symbolic of the town's progressive spirit.

Elgar's "Cockaigne" Overture and three excerpts from Wagner's "The Mastersingers" are, by special request, to be included in the programme, which also will include the César Franck Symphony, Mozart's "Masonic Funeral March," and three numbers from Holst's "The Planets" (Mercury, Saturn, Jupiter).

Remaining concerts of the series will take place at Edinburgh on March 31st, and at Leeds on April 4th. The first was given at Hanley in October last. Applications for tickets should be addressed to Messrs. Murdoch, Murdoch and Co., 180, Above Bar, Southampton.

English Music of the Theatre

THE B.B.C. Scottish Orchestra, conducted by Guy Warrack, will play a programme of English music of the theatre on March 1st. It will include Overture to a Pantomime, by Hely-Hutchinson; Suite, "Where the Rainbow ends," by Quilter; "Graceful Dance from the Incidental Music to Henry VIII," by Sullivan; and Four Dances from "The Blue Bird," by Norman O'Neill.

INTERFERENCE SUPPRESSORS

WE have several times received requests for details concerning the cost of maintenance of interference units which are connected direct to the mains. It appears that some doubt exists as to whether a condenser from mains to earth consumes current, and in this connection Messrs. Belling and Lee have apparently also been confronted with the same request from users of their units. The following details have been given by Messrs. Belling and Lee in their Interference Bulletin, and are reproduced for the benefit of those who are interested in the matter :—

On connecting a condenser across A.C. mains or between the live main and earth a current flows as can be demonstrated simply by removing the fuses from one of the suppressors, when a spark is usually set up at the tips of the fuse clips. To those who have made a study of alternating currents it is only necessary to point out that as long as there is little resistance in series with a condenser, the power factor is almost zero and as a result, the power consumed is infinitesimal.

When a condenser is charged up from, say, a battery, a current flows into it, and it is clear that all or almost all of the energy has been taken out of it and it is again dead. If a 50-cycle alternating voltage is applied across the condenser, much the same thing happens one hundred times a second ; the condenser is charged up to the maximum voltage of the mains, and when this has occurred the current flows out of the condenser back along the mains, and the essential fact is that all the energy that passes into the condenser comes out again, except for a very minute amount which is due (*a*) to the leakage across the mica or paper dielectric, together with (*b*) a minute loss due to the resistance of the connecting leads.

Tests have proved that of the energy entering into the type of condenser in use, only 1-300th is wasted. Another way of saying the same thing is that the power factor of the condenser is .003 and that only 0.3 per cent. of the current which is flowing through a condenser connected on A.C. mains tends to operate the meter.

Tests and calculations show the fitting of a Belling-Lee type L.1118 condenser suppressor across 250 volts A.C. mains results in a consumption of 0.51 units per year, which is, of course, negligible.

Car-radio Interference

WITH regard to the article on "Car Radio Problems," by The Experimenters, in the issue dated February 13th, Messrs. Belling and Lee point out that their ignition-suppressor condenser is not intended to be connected as shown in Fig. 2 on page 640. They recommend that the pigtail be connected to the L.T. terminal on the coil which is joined to the ignition switch. When connected to the H.T. terminal there is a danger of the condenser being ruptured by the high voltage of the high-tension circuit.

BRITISH LONG DISTANCE LISTENERS' CLUB

Local Members

THE following members would like to get into touch with other members in their neighbourhood, and perhaps those readers who are interested would get into touch with them direct :—

Mr. M. Ward, of Clevedown, Brighton Road, Lewes.

Mr. B. Symons, of 10, Audley Park Road, Hele (or Barton), Torquay.

Mr. G. E. Stroud, of 9, Shepherds Hill, Stoughton, Guildford, Surrey.

Mr. Stroud is anxious to gain proficiency in Morse sending and receiving and would like to contact with another member in the district who is prepared to carry out Morse practice.

Recent Conditions

HERE is an interesting letter from Mr. A. T. Anderson, Grays : "Here are a few experiences of mine of the past few weeks. My set is a Mullard AW5. Aerial is as follows : 100 feet of uncovered aerial wire, running N. and S., E. and W., from a 20ft. pole to a 40ft. one, then down to house at 30ft. and connected direct to set. This has turned out to be the best I can find after pretty extensive tests of about 30 different types.

"My set covers 16.7 to 51 metres on the short-wave band, but until recently I have been picking up telesound on a little over 21 metres, but something went wrong with the volume control; whenever I tried to increase the volume it shut the set off, now it has been fixed I no longer get my telesound. The B.B.C. engineers inform me that, 'it is no doubt accounted for by harmonics of the local oscillator in the receiver.' What do others think ?

"Next, I have found that conditions have been great for DX this past month, up to the 2nd of February, Hams coming in FB, including FA3LY, CN8MB, PY2EJ, all at R9.

"On the 3rd of February I tuned in on the 20 m. band and got nothing—the band was absolutely dead, so I thought something must be wrong with the set, but after hunting around everything was O.K. I then tried the other bands, but everything was terribly distorted. I then switched back to 20 metres and again drew a blank, until suddenly, like a blast, in roared SU1CH calling W2IXY; to designate his call as R9 plus is no indication of his volume. The power was so great the windows rattled. This went on for five minutes then, again, in the middle of a call he disappeared as though the set had been shut off. Search as I would I could not find him, or anybody else, after that. Conditions have been bad since, with fair periods early in the evening.

"Well, that is all for to-day, so hoping this letter will be of use to yourself and other members, two of whom have become firm friends of mine, one in India and another about 10 miles away. We were brought together by means of this club so, if other members would like to exchange views with me, I will be glad to hear from them, especially outside this country, but all are welcome."

His address is, A. T. Anderson, Radio 2CGW, 12, Goodyear Terrace, West Thurrock, Grays, Essex.

A SIMPLE TONE-CONTROL UNIT

(Continued from page 694)

The Air-cored Choke

The air-cored choke can be made by using a cardboard former 1in. in diameter and 3in. long and divided up into six sections by means of cardboard spacing washers 2in. in diameter. A total of about 2,400 turns of 36-gauge enamelled wire is required, and this should be wound 400 turns in each section of the complete former. The wire should be all in one length, and connections can be made to the ends of the winding, as explained above in respect of the iron-cored choke. It can be attached to the panel by means of a length of 4 B.A. screwed rod, as used for the choke previously described, fitted with a large cardboard washer.

Fig. 2 shows how the various components are assembled on the panel, and no further explanation is necessary. It can be mentioned, however, that the parts could, if preferred, be attached directly to the speaker cabinet or to the receiver.

Method of Use

The method of using this little unit does not call for very much explanation. When first trying it, the tuned filter should be switched out of circuit by turning the on-off Q.M.B. switch to the "on" position. Operation of the potentiometer will then be found to provide a fairly wide range of tone control. It will be noticed that a variation in the setting of the potentiometer will cause a change in volume level, as well as in the tone of reproduction. This is, admittedly, an undesirable feature, but it cannot be avoided in a simple unit such as this. In any case, the variation will not usually be very great over the comparatively small movement of the potentiometer which will normally be found necessary.

After it has been found that the tone control is behaving correctly, tune the set to a point at which a very high-pitched whistle is heard. Then switch the filter into circuit; this should cause the whistle to be very much reduced in intensity. By adjusting the pre-set condenser, a point should be reached at which the whistle is no longer heard or, at least, at which its volume level is so much reduced that it does not constitute an annoyance. Strictly speaking, the pre-set should be set for each individual whistle, but it will be found that once the best position has been found, further adjustment is seldom necessary.

Books Received

Broadcast Talks

THE B.B.C. Broadcast Talks pamphlet for the present spring quarter gives particulars of a number of interesting talks to be broadcast regularly up to the end of March. Among the most interesting serial talks yet to be given in the London Regional and National programmes are those on "This Way Out," "It's Happening Now," "In Your Garden," "I Was There," and "The World Goes By." Particulars of several other talks to be given from the other Regional stations are also included in the pamphlet, which is available free on personal application to any B.B.C. office, or post free on application to the B.B.C. Publications Department, 35, High Street, Marylebone, London, W.1. Applications by post should be marked "Pamphlet" in the top left-hand corner of the envelope.

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.

A. L. G. (Litherland). We regret that we cannot insert applications of the type mentioned in our pages. We suggest you insert a small advertisement. If you only require the blueprint, it would be cheaper to buy one as the cost is only 1s. and the registered post and other details mentioned in your letter will cost you nearly as much.

B. E. (Glamorgan). We advise you to attain proficiency at morse before building the transmitter. The small test circuit given in the first of the series will be quite suitable.

J. G. W. (Dublin). Normally the adapter could not be connected to the pick-up terminals. You would have to use some other arrangement, or arrange to effect a better earth connection to the adapter. Is the grid lead shown in the adapter circuit in parallel with any leak or transformer winding in the receiver ?

H. M. (Poplar). It should be a simple matter to make up an H.F. unit round the coil in question, but we have no suitable blueprint. You could take any standard three-valve circuit and build this, using your coils in place of those specified, but you may find it essential with the type of coil mentioned to use separate tuning condensers.

W. B. (Newcastle 2). We should certainly imagine that the trams are responsible, and the only cure will be to erect your aerial as far away from the tramway lines as possible, and connect it to the set through screened cable and impedance-matching transformers.

E. W. S. (Swindon). The best suggestion we can make is that you build the Prefect S.W. Three, omitting the second L.F. stage if you only need a 2-valver. The 'phones should be connected in place of the transformer primary.

A. P. N. (S.W.11). We are not familiar with the servicing difficulties of individual commercial receivers and advise you to have the set inspected by a good local radio dealer.

J. E. B. (Amesbury). We have already given some of the constructional details you require, and the remainder are given in last week's issue. We cannot supply a blueprint.

J. D. (Guernsey). The trouble must be due to local conditions as it does not occur on other stations. Perhaps you can inquire of friends in your neighbourhood and find whether they experience the same trouble.

K. W. (Croesyceiliog). The circuit is very incomplete, and you cannot fit a reaction condenser. You have no tuning circuit, and no grid leak or condenser. As shown you cannot tune to any station, and the valve cannot rectify.

M. H. (Hull). We cannot supply a blueprint for an amplifier on the lines you require, but in our issue dated July 4th last you will find a circuit with all values which may be of use to you. It was included in the article on Public Address Systems for the Amateur.

G. A. K. (New Cross). You need a more selective set to separate the stations in question. A superhet or a good wave-trap connected in the aerial circuit are the only practical suggestions we can offer.

D. T. F. (Clogher). We do not supply components or kits, but Messrs. Peto-Scott can supply a complete kit for any of the receivers described in our pages or publications.

N. A. (Paignton). The Tele-Cent Three recently described is a good short-wave set, but the Linut or the Record all-wave receivers will enable you to hear ordinary broadcasting in addition to the short waves. The issues describing construction give a full list of parts, and Messrs. Peto-Scott can supply the kits. Their advertisements appear in each issue and give the prices of the sets as we describe them.

G. M. (Alexandria). It is not as yet possible to pick up the television transmissions on disc apparatus. In any case, we think you would experience considerable difficulty in receiving the transmissions at your address.

E. V. C. (Armley, Leeds). We suggest you find out first from the makers of the set whether it will work satisfactorily with an S.W. converter. If so, P.W.48A will meet your requirements. Coil-winding data is given in our issue dated May 9th last.

A. J. (Tring). The eliminator may now require some replacement, or a condenser may have broken down. We suggest that you measure the voltage applied to the various stages with a good meter.

F. O. A. (Hull). The Prefect S.W. Three, blueprint P.W.63, would meet your requirements.

H. A. (Bordesley Green East). Your letter has been returned marked "Gone Away." If you will send your new address the reply will be sent on to you.

G. M. (Sheldon). We regret the issue is now out of print.

W. S. (Roker). We refer you to the article on coils in our issue dated May 9th last. Messrs. Brown's address is Victoria Road, London, W.3.

J. A. S. (Clydebank). The amplifier is suitable, but no back numbers of the issue giving constructional details are available. See our Christmas Number for suitable circuits and details.

R. D. G. (Kilburn). It is difficult to test the condensers by ordinary means, and we suggest that you have the unit tested at a good radio dealer's. You require very good instruments for the purpose.

B. P. D. (Hayward's Heath). If the earth is sound there should be none of the trouble you mention. The best remedy is to cover the back of the panel with metal foil, cutting clearance holes for the various components to avoid short circuits and connecting the foil to earth.

J. V. H. (Stretford). We cannot be certain of the coil but think the following connections will prove in order. Aerial to either 1 or 2; three-point wave-change switch to earth, 4 and 3. No 8 is joined to tuning condenser and grid condenser, and 7 and 6 are earthed. The reaction condenser is joined between anode and No. 5.

R. G. (Cheltenham). "The Wireless Constructor's Encyclopædia" or "Everyman's Wireless Book" should prove the most useful for your needs.

J. M. N. (Glencoe, Argyll). The harmonics are the same as in music. A station on 500 metres would have harmonics at 250, 125, 62.5 and 31.25 metres. There may also be harmonics lower as well as higher. The first number is the first harmonic, the next the second harmonic—and so on. We have no details of a cycle radio in blueprint form.

J. M. C. (Sogiealmond). The Prefect S.W. Three blueprint P.W.63, is suitable.

J. W. R. (Newbridge). We have no blueprints of a short-wave portable. Messrs. Hivac can supply midget valves.

J. J. G. (Chiswick). No value can be given for the resistance as the current of the Class B valve varies according to the volume of the received music. You should use a Neon stabiliser across the mains unit to overcome this difficulty.

W. T. (Rochester). The connections appear to be correct, and we can only suggest that you adopt a different intermediate frequency where no interference is experienced.

W. B. G. (Wood Green). You could not obtain satisfactory reception of the television programmes on the crystal set.

C. R. (Armagh). The trouble is probably due to instability on the I.F. stage or in the frequency-changer stage, and the voltage on anodes and screens should be modified to remove this difficulty.

S. M. (W. Hendon). We cannot recommend any blueprint to use up the old parts, but suggest that you replace the old coils by up-to-date ones. Modern valves might also effect an improvement, or, alternately, you should dispose of the set as it stands and obtain the new parts for an up-to-date receiver.

H. F. L. (Bilston). Blueprint P.W.48A will meet your requirements. The complete kit for the converter, or the converter ready assembled, may be obtained from Messrs. Peto-Scott.

G. H. (Leek). We have no circuit details of the eliminator and suggest you communicate direct with the makers, Messrs. E. K. Cole, at Southend-on-Sea.

H. S. W. (Croydon). We cannot solve your difficulty from the brief details which you give. Can you supply some further information.

J. J. (Nantwich). We regret that the issue in question is now out of print.

T. V. (Blackburn). It would be difficult to arrange for automatic bias in both cases, but the problem would no doubt be met by including a 150-ohm fixed resistance in series with a 500-ohm potentiometer, using the junction of the two for the one stage and the moving arm on the potentiometer to adjust the bias on the other.

D. S. (Dundee). As the receiver is a commercial model we cannot suggest the trouble and recommend that you have it inspected by the makers or their nearest local service agent.

C. J. R. (Wing). A faulty condenser in the R.C.C. stage might cause the trouble by allowing a positive potential to be applied to the grid.

J. N. P. (Lancing). We do not think you would hear the television signals at your address, but you should be able to hear some amateur transmitter. Probably you have been unlucky at the times you have listened, and the receiver may itself be functioning satisfactorily.

T. C. B. (Salisbury). All issues for the set in question are now out of print, and the receiver is rather out of date for modern conditions.

A. H. H. (Dagenham). The circuit given in our issue dated February 6th should give you all the details you require. See pages 617 and 618.

C. E. P. (Hoxton). A pentode valve would not improve matters but would aggravate them. You are probably using insufficient H.T. or G.B., and the speaker may not be matched to the valve. Try R.C. coupling or resistance-feed the L.F. transformer with a large-capacity fixed condenser for coupling purposes. We cannot give coil winding data in the form of a reply.

E. J. (Aylesbury). The Auto-B Three is the nearest to your requirements, but no further copies of the blueprint are obtainable.

J. P. W. (Ancoats). Details of the coil were given in the issue in question, namely, January 2nd. The volume control may have any value above 250,000 ohms, and 500,000 would probably prove most suitable.

J. M. (Glasgow). A blueprint for the battery version of the set in question may be obtained from this office. The number is P.W.52 and the price is 1s. The issue describing construction is dated August 13th, 1935, price 4d. No A.C. model is available.

H. S. T. (Worthing). The mains version of the set in question costs about the amount mentioned. You will see from the blueprint list that A.C. and universal mains versions are available (P.W.59 and P.W.60). An S.W. converter may be built for use with these sets for short-wave reception.

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

A Reader's Thanks

SIR,—I thank you very much for your helpful letter of the 27th of last month in which you gave me advice on a matter relating to suitable grid-bias circuit connections for a directly-heated output valve in my A.C. mains set.

I have followed your instructions with success and, apart from the slight drop in signal strength, the set seems to operate as well as it did before the change from pentode N41 to triode ACO44.—GEORGE W. BARLOW (London, N.W.).

An Improved Insulation!

SIR,—I have been a reader of your paper for some time now, and I have picked up much useful information from its pages.

I noticed recently in the columns of "Round the World of Wireless," a few words regarding improved insulation, by using rubber tube instead of insulating tape. I do not wish to run the idea down, because it looks a very neat job, but having used the system for about six months, I had to discard it owing to the fact that in a very short time, the rubber tubing perished and my joints were bare again. This was more than a year ago. I would be pleased to know if any progress had been made in the process of making the tubes.—A. C. H. JOHNSON (Eltham).

A One-valve Short Waver

SIR,—I have built a one-valve short-wave receiver from a standard kit advertised in your pages, and costing 19s. 6d. complete. I have had it in operation for about a fortnight now, and have listened to America, Japan, Moscow, Rome, Germany, etc., and have also heard the "Queen Mary" ('phone), and many amateurs on 40 metres. The antenna used is simply a ten-feet length of insulated wire running round the wall; no earth connection is used, nor is one required. I would very much like to see an 0-v-1 short-wave receiver detailed in your very fine paper. The set should be simple, and have band-spreading on ten, twenty, and forty metres.

I have read all the "Amateur Transmitting" articles since their commencement and think them excellent.

I have sent out many DX reports giving QRK, QSA, QRM/N, QSB, Modulation, WX, RX, ANT, etc., and in most cases have enclosed a coupon, yet I have received back but one card. I am anxious to know whether W4BYY, VE3CK, and W2UK QSL. Can any reader help?—R. L. PLUCK (Tunbridge Wells).

Correspondents Wanted

SIR,—I am a beginner, and would like to correspond with another reader of PRACTICAL AND AMATEUR WIRELESS who is also interested in radio.—R. A. WOOD, 5, Crescent Gardens, Birchwood, Swanley, Kent.

SIR,—I shall be very glad to correspond with readers in Great Britain or overseas who are interested in SWL cards and S.W. listening, with a view to exchanging radio magazines and photos.—PHILIP FITZSIMONS, 13, Upper Dorset Street, Dublin, I.F.S.

A Good Log from Essex

SIR,—As I have not seen any 10-metre logs from this district published in your paper I enclose my log, which I hope will be of interest to other readers.

List of stations received during the present month on 28 MC. ('phones):—
W2ACZ, W3AZG, W3FVO, W9CLH, W3PC, W2IXV, W2HVQ, W2EOA, W8MWL, W8MMH, W8MCY, W8OPO, W2HYJ, W1ADM, W1HQN, W3GPM, W2DKJ, W2KAP, W2CLD, W2TT, W2BJX, W1WB, W8BZO, W1DJE, W4CPG, W2BAA, W3ABG, W1DTJ, W2MB, W1WV, W1AAK, W1JPM, W1TTJ, W1TIL, W4DIZ, W8CHB, W4EDM, W3AKX, W1BEY, W8EBS, W3GIZ, YLBPP, and YLCDD.

Ultra-short waves provide—Broadcast, W9XHW and W9XAZ; Police, W2XEN, W2XFA, and W2XEM. While higher up Alexandra Palace sound and vision channels are well received. My receiver is an "Eddystone" super-regen 3 with an inverted "L" type aerial 15ft. long and 40ft. high.—L. C. STYLES (Ingatestone).

Absorption of Energy by Receivers

SIR,—With reference to "The Experimenters'" welcome reappearance, and their interesting argument regarding the absorption of energy by receivers, the following is an extract from Sir Oliver Lodge's "Talks on Wireless," pp. 71-72: After explaining the "electric" and "magnetic" components of a radio wave, he says:—

"A receiver acts by obliterating some of the electric component, and thereby stops a portion of the wave. This it does either directly as by a linear aerial, or inductively, as by a loop aerial. The energy of such portion of the wave as effectively encounters the aerial is abstracted and utilized for the signal, some fraction of it degenerating into heat. The rest of the wave goes on."

The above would seem to explain what "The Experimenters" (and others, including the writer) have noticed, viz., the worsening of reception conditions on the medium and long-wave broadcast bands since 1922-4 or so, as the number of radio receivers has, of course, enormously increased since then.

On the other hand, the sunspot cycle has some effect upon medium and long-wave reception, as well as its well-known effect upon short-wave reception, but it is precisely in the opposite direction, i.e., medium and long-wave conditions are best during a period of *minimum* sunspot activity, whereas short waves are then at their worst.

There was a period of minimum sunspots in 1923, which may account for the extraordinary reception achieved in those days with crude 1-valve receivers on the medium and long wavebands. On the other hand, another minimum year was 1935, when I do not recollect much bettering of medium-wave reception.

The whole problem of poorer reception to-day compared with twelve years or so ago is very puzzling, and yet another factor is that of selectivity. In 1923, the most unselective tuning was quite permissible, in view of the few transmitters "on the air." Now, selectivity has to be of a high order, and this particularly affects the sensitivity of simple sets (1 or 2 valves, without H.F. stages) since increased selectivity can only be obtained in such receivers by loosening aerial coupling, or reducing the size of the aerial, both of which reduce sensitivity enormously.

Other readers' views on the subject would be interesting.—F. W. T. ATKIN (Sheffield).

Our Single-valve S.W. Set

SIR,—I have been reading your journal for a long time, and it has interested me in short-wave work. I therefore decided to make the one-valve set described in your December 12th, 1936, issue, and it worked very well indeed. During the first three days of listening I received over eighteen amateurs, and also the following commercials: GCW, OLR, GSE, DJM, DGB, RV59, DJN, 2RO, and a Canadian station ON4VC. These stations were heard without an earth connection.—F. O. ATKINSON (Hull).

Suggestions for Articles

SIR,—Your transmitting articles are excellent. I would also like to see published in your pages constructional articles on:—

(1) Modulated oscillator, crystal controlled, on the lines of the 2½-watt class B, but using two separate triodes, about 4-watts battery and mains versions.

(2) CO, PA with speech amplifier modulator, battery-operated 5-watts 'phone output. Also CW arrangements, including filtering.—A. W. MANN (Middlesbrough).

CUT THIS OUT EACH WEEK.

Do you know

—THAT the technique of operation of the television camera is very similar to that of the standard cinema camera.
—THAT due to the above fact "mixing," fade-outs, rapid changes from close-ups to long-shots and similar effects are possible.
—THAT cathode-ray tubes for television may be obtained with screens of different colours.
—THAT a small by-pass condenser should always be joined from anode to earth in a grid-leak detector stage.
—THAT a series-aerial condenser should never be mounted direct on a metal chassis without ensuring that a low capacity to earth exists.
—THAT overlooking the above point often results in poor signal strength in a home-constructed receiver.
—THAT the capacity between an anode lead and earth in an H.F. stage should be kept low, and especial care is necessary when screening this particular type of lead.

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., Tower House, 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.

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.

Swindon and District Short-wave Society

AT a well-attended meeting held at the Swindon and District Short-wave Club's headquarters, Maxwell Street Schools, on Thursday, February 4th, an extremely interesting lecture on his 20-metre transmitter was given by Mr. R. A. Hiscocks (G6LM), of Chippenham.

On Sunday, February 7th, three members of the Society visited the Cheltenham Short-wave Society. A round of the various transmitting stations was made, and, with the help of G5BK, a short location test was carried out with direction-finding apparatus, and he was located in about three-quarters of an hour.

The Society now has its own three-valve short-wave receiver installed at its headquarters, and is expecting to receive the G.P.O. licence for its transmitter in the very near future.—W. C. Barnes, Hon. Sec. (2BWR), 7, Surrey Road, Swindon.

Southall Radio Society

THE speaker at the Southall Society's meeting on February 9th was Mr. J. T. Tyrrell (ex-VU2BM), from Rawalpindi, India. He called his talk "A Ham in the Himalayas," and his experiences of operating with the temperature at 120 deg., with occasional pauses to remove scorpions from the transmitter, created great interest. Mr. W. A. Ancrum, the President, was in the chair. Visitors are welcome at meetings held each Tuesday at 8.15 p.m. in the Southall Library, Osterley Park Road, Southall (near G.W.R. station). Hon. Secretary, Mr. H. F. Reeve, 26, Green Drive, Southall.

The West London Radio Society

THIS Society has now obtained the use of the premises of "Ross and Robinson," Ltd., 16, Bond Street, Ealing, every Tuesday evening, at 8.15 p.m. Here members have the free use of a television receiver. Regular meetings are also held at the "Anchor," Uxbridge Road, West Ealing, W.13. All inquiries should be addressed to D. Reid, Esq., 15, Tring Avenue, Ealing Common, W.5.

The Cardiff and District Short-wave Club

THE above club held its first Annual Dinner at the Barry's Hotel on February 4th, the attendance being 36, which included members from towns as far apart as Swansea, Port Talbot, Neath, Merthyr, Pontypridd, and the Newport area.

Mr. D. Low, G5WU, was in the Chair, and as the oldest licenced amateur transmitter in South Wales his reminiscences of the early days of wireless transmission were very interesting to all present.

After various toasts, that of "The Visitors," was proposed by Mr. Mathews, G8AM, the chairman of the club, and he stated how glad the club was to see such transmitters as G5PH (Swansea), G5VX (Port Talbot), G5FI, G6YJ, and others who also had travelled great distances to be present. G6YJ, replying, said that he was very glad to have had this opportunity of meeting several of his acquaintances over the air in person, and he was glad to see that there was such an active club in the area.

The ordinary meetings of the Society are still being held weekly, and all interested in membership are invited to write to the Secretary, H. H. Phillips, at 132, Clare Road, Cardiff, for information.

Radio Society for Bellingham

READERS residing in the Bellingham district who may be interested in the Radio Society now being formed, are invited to write for further particulars to C. J. Leek, 50, Farmstead Road, Bellingham, S.E.6.

British Short Wave League

THE first anniversary of the B.S.W.L. is being celebrated in March with a special birthday number of the *B.S.W.L. Review*. The League has made progress since its inception in March, 1936, under the leadership of Mr. F. A. Beane, Ridgewell, Essex, who is the Editor and one of the founders. Mr. Beane's intention in forming the League was to link together all the individual short-wave fans and form one big brotherhood to promote short-wave listening and experimenting in general. Full details of the League's activities and particulars may be obtained from Mr. F. A. Beane, Ridgewell, Halstead, Essex, or from the Yorkshire representative, Mr. G. Walker, 33, Napier Road, Thornbury, Bradford, Yorks.

Wellingborough and District Radio and Television Society

AT a meeting of the above society held at Wellingborough on Wednesday, February 10th, a lecture and demonstration of Lissen Hi-Q apparatus was given by Mr. E. Cholot.

Mr. Cholot prefaced his lecture by drawing attention to the growing public interest in short-wave reception which was being made possible by the advent and production of the all-wave receiver, but, he maintained, the heart of the short-wave movement was to be found inside the various Radio Clubs and Societies up and down the country.

A whole group of short-wave components came under review and discussion, and great interest was shown in the special rotary four-coil unit that would tune from below five to well over a hundred metres.

The meeting was excellently attended, and proved to be one of the best the Society has so far had, and several new members were enrolled. The President, Mr. A. E. Fletcher, occupied the chair, supported by the Hon. Sec., Mr. L. F. Parker (G5LP), with Mr. R. Bradshaw kindly helping with the lantern.

Bradford Short-wave Club

THIS club held its annual social and pie supper on Friday, January 29th, when the members had a very enjoyable evening.

An artificial aerial licence has been granted to the club, with the call 2BWC, and the members are busy with the transmitter. The Morse instruction class is being continued with success under the guidance of G8JD, who is only too pleased to welcome newcomers.

On Friday, March 12th, a lecture will be given by the Post Office Telephones (Interference Dept.) on "Interference in reception." G. Walker, Hon. Sec., 33, Napier Road, Thornbury, Bradford, Yorks.

Practical and Amateur Wireless
BLUEPRINT SERVICE

These blueprints are drawn full size.
Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following *prices, which are additional to the cost of the blueprint.* A dash before the Blueprint Number indicates that the issue is out of print.

Issues of Practical Wireless	--	4d. Post paid.
" " Amateur Wireless	--	4d. " "
" " Practical Mechanics	--	7½d. " "
" " Wireless Magazine	--	1/3 " "

The Index letters which precede the Blueprint Number indicate the periodical in which the description appears; thus, PW refers to PRACTICAL WIRELESS, AW to *Amateur Wireless*, PM to *Practical Mechanics*, WM to *Wireless Magazine*.
Send (preferably) a postal order to cover the cost of the blueprint and the issue (stamps over 6d. unacceptable), to PRACTICAL AND AMATEUR WIRELESS Blueprint Dept., Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS.

	Date of Issue.	No. of Blueprint
CRYSTAL SETS.		
Blueprint, 6d.		
1937 Crystal Receiver	9.1.37	PW71
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
All-wave Unipen (Pentode)	—	PW31A
Two-valve : Blueprint, 1s.		
Four-range Super Mag Two (D, Pen)	11.8.34	PW36B
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	—	PW35
Summit Three (HF Pen, D, Pen)	8.8.34	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	22.9.34	PW39
Hall-Mark Three (SG, D, Pow)	—	PW41
Hall-Mark Cadet (D, LF, Pen, (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Genet Midget (D, 2 LF (Trans))	*June* '35	PM2
Cameo Midget Three (D, 2 LF (Trans))	8.6.35	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	17.8.35	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	—	PW64
The Gladiator All-Wave Three (HF Pen, D (Pen), Pen)	29.8.36	PW66
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	5.12.36	PW72
"Tele-Cent" S.W.3 (SG, D (SG), Pen.	30.1.37	PW74
Four-valve : Blueprints, 1s. each.		
Fury Four (2 SG, D, Pen)	—	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG) LF, Cl. B)	6.1.34	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF, Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	7.10.33	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	10.6.33	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.4.34	PW35C
D.C. Premier (HF Pen, D, Pen)	31.3.34	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	18.8.34	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (R.C.))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF, Pen, D, Push-Pull)	9.2.35	PW47
SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-Valve)	—	PW40
F. J. Camm's 2-valve Superhet (Two-Valve)	13.7.35	PW52
F. J. Camm's £4 Superhet	—	PW58
F. J. Camm's "Vitesse" All-Waver (5-valver)	27.2.37	PW75
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	1.12.34	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. £4 Superhet 4	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	16.1.37	PW73
SHORT-WAVE SETS.		
Two-valve : Blueprint, 1s.		
Midget Short-Wave Two (D, Pen)	15.9.34	PW38A
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-Wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Bandspread S.W. Three (HF Pen, D (Pen), Pen)	29.8.36	PW68
PORTABLES.		
Three-valve : Blueprint, 1s.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	16.5.36	PW65
Four-valve : Blueprint, 1s.		
Featherweight Portable Four (SG, D, LF, Cl. B)	—	PW12
MISCELLANEOUS.		
S.W. Converter-Adapter (1 valve)	—	PW48A

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Blueprints, 6d. each.		
Four-station Crystal Set	12.12.36	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
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Lucerne Minor (D, Pen)	—	AW426
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Home-built Coil Three (SG, D, Trans)	—	AW404
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Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
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Five-valve : Blueprints, 1s. 6d. each.		
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S.G. Three (SG, D, Pen) A.C.	—	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
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Four-valve : Blueprints, 1s. 6d. each.		
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PORTABLES.		
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Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-wave (SG, D, Pen)	*Jan.* 19, '35	AW463
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Empire Short-waver (SG, D, RC, Trans)	—	WM313
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Four-valve : Blueprint, 1s. 6d.		
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The W.M. A.C. Short-wave Converter (1/-)	*July* '36	WM408

QUERIES and ENQUIRIES

Mains Interference Suppressors

"I am in trouble with H.F. interference *via* the mains, as proved by various tests outlined in your last reply to me. What is the best filter suppressor, and from whom can I get a ready-made apparatus? I have been told that when these devices are fitted across the mains they take current and that they are wasteful. Perhaps you will confirm this and give me an idea of the cost of running."—G. T. (Notts.).

THE best suppressor in your case is that consisting of special H.F. chokes and associated condensers. The latter should be four in number, two in series on each side of the two chokes which are arranged one in each mains lead. The junction of the two condensers should be connected to earth. It is imperative that the latter should be a sound electrical earth, and you may find that there is a suitable point close to the mains fuse box where the suppressor should be mounted. There is no running cost for this type of unit, and the problem is dealt with on another page in this issue.

Energised Speakers

"I wish to fix an extension speaker of the moving-coil type to my receiver, a commercial superhet. Sockets are provided in the back of the set. I am not quite clear about the merits of a mains-energised speaker, however, and would be much obliged if you could help me. The speaker is to be in a room not very far away, and I should like to know whether the mains current for the energising must be drawn from the set, which is all-mains, or from any other supply. Can I, for instance, take the current, after smoothing, from a mains supply in another room?"—K. K. B. (Didsbury).

THE supply for the field winding of the speaker is quite distinct from the remaining part of it. That is to say, it is quite immaterial what type of speaker you use, permanent magnet, or energised magnet. The two sockets on the set are for connection to the speaker transformer and thus you can use either type of speaker. The question as to whether or not an energised model should be used is bound up in the problem of expense and sensitivity. A good-class permanent magnet will provide the same sensitivity as a low-class energised model, although a good energised speaker will be much more sensitive than the best permanent magnet. To obtain the energising current, however, a voltage source must be used, and as the speaker is to be used at a distance the best way of obtaining this would be to use a mains transformer and rectifier, built into the speaker cabinet, and chosen according to the field winding. The mains energised speaker is cheaper, but the cost of the associated mains unit has to be added. You will therefore find that for an extension point the permanent magnet speaker will be quite satisfactory.

H.T. from L.T.

"Can you give me directions for making a step-up transformer to step up from 2 volts to 120 volts or 4 volts to 120 volts, or any manufacturer who can supply me? My set is a three-valve screened set, and I am anticipating to make an apparatus to obtain H.T. power from L.T."—J. H. R. (Smethwick).

WE are not sure that you have not overlooked the fact that D.C. cannot be stepped up. If you anticipate using an accumulator to step up to 120 volts you will have, first of all, to transform the D.C. supplied by the accumulator into A.C. This A.C. can then be transformed by means of a suitable transformer into any desired voltage, and this will again have to be rectified to supply the H.T. of a receiver. The initial change from 2 or 4 volts D.C. to A.C. can be carried out simply by means of one of the new vibratory rectifiers and the supply then transformed by means of a suitable transformer, from which the high voltage is fed back into the vibratory rectifier and a D.C. supply thus obtained at the higher voltage. Messrs. Bulgin can supply both transformer and rectifier.

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., Tower House, Southampton Street, Strand, London, W.C.2.

The Coupon must be enclosed with every query.

Pick-up and Mains Valves

"With reference to the A.C. Record 3, kindly advise *re* method of fixing pick-up sockets for pick-up leads. Also, I have a small 3-valve battery set, but with H.T.5 rectifier for H.T. Can this rectifier be used for this set with A.C. valves, with, of course, the necessary alterations of circuit and parts? I wish to convert the set, but at the minimum of cost."—S. J. P. (Enfield).

TO fit a pick-up you must break the cathode lead to the detector valve and insert a 1,000 ohm resistor (1 watt) type between cathode and earth. Across this a 25 mfd. 25 volt type electrolytic condenser should be joined. The grid leak (R6) should be joined direct from grid to cathode. Pick-up sockets may then be mounted on the rear chassis runner and one socket joined direct to the metallising and the other to the grid of the detector valve. You may find, however, that the additional wiring will lead to losses on the shorter waveranges. The H.T.5 could be used for mains valves, but as the total output is only 120 volts at 20 mA. the results would be very poor. The average mains valve operates at 200 or 250 volts and the efficacy is low with only 120 volts.

Modifying a Meter

"Is it possible to alter the range of a 0-6 volts voltmeter to 0-150 volts and higher ranges. If so, what is the best method?"—W. G. D. (Aberdeen).

IF it is considered that the meter actually registers the current flowing through it, it will at once be appreciated that it may be modified in the manner you suggest. If the meter is joined across a 6-volt cell a current dependent upon the total resistance of the meter will flow, and in your case this will be of such a value that the needle is driven over to the end of the scale (full scale deflection). If now you placed the meter across a 12-volt cell the winding would perhaps be burnt out owing to the greater current which would flow, and, accordingly, to prevent this it would only be necessary to include a further resistance in series with the meter. If this resistance has the same value as the meter resistance (and a 12-volt cell is still used) the current passing through the two resistances would be identical and would be such that 6 volts would be dropped across both meter and resistance, consequently the meter would still register 6 volts. This means that the scale would be doubled, when a resistance equivalent to the meter is included in series, and, therefore, on similar lines the scale could be trebled and so on. The value of the series resistance would have to be chosen according to the resistance of the meter, but by trial and error methods you may find suitable resistances to use to give any desired higher voltage range, when a known voltage source is used for calibration.

Simple L.F. Amplifier

"With reference to your neat little one-valve amplifier for use with the 1937 Crystal set, I wonder if it would be practicable to construct one on somewhat similar lines for use with the 'Simplest One-valve Short-wave set,' using, of course, H.F. components, or would an amplifier for the H.F. have to be entirely different. I think an article with perhaps a diagram on this subject would be very much appreciated by a large portion of your readers as this would improve the performance of almost any simple short-wave set such as the one mentioned."—R. E. (Southampton).

THE amplifier in question (described in our issue dated February 6th) is quite standard and may be used after any type of receiver. No special components have to be used with a short-wave receiver as the amplifier deals only with the low-frequencies, but it may be found desirable to include a small fixed condenser across the transformer primary, and another similar small condenser from the anode of the valve to earth. When used with a valve set in which the H.T. is of a low value, a second small H.T. battery may be joined in series with it to bring the total up to 120 volts, and the H.T. positive lead for the single valve set may then be inserted into the appropriate low value socket. Similarly, if used after a set in which grid bias is already provided, the wander plug attached to the transformer in the amplifier may be inserted into the existing G.B. battery if this has a sufficiently high value, and G.B. plus ignored. Alternatively, another small G.B. battery may be joined in series as with the present one.

Miscellaneous Advertisements

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Announce 1937

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

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MISCELLANEOUS

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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-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.

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

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.

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PREMIER MAINS TRANSFORMERS, 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. 60m.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. Super Model, 19/6. **AUTO TRANSFORMERS**, step up or down, 60 watts, 7/6; 100 watts, 10/-. **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.

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

NEW 1937 1-VALVE SHORT-WAVE RECEIVER OR ADAPTOR KIT 13 to 86 Metres without coil changing. Complete Kit and Circuit, 12/6. **VALVE GIVEN FREE! DE LUXE MODEL** 14 to 150 Metres, complete Kit with Chassis, 4 Coils and all parts, 17/6.

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NEW 1937 2-VALVE S.W. KIT, 13 to 86 Metres without coil changing. Complete Kit and Circuit, 19/6. **VALVES GIVEN FREE. DE LUXE MODEL**, 14 to 150 Metres, complete Kit and Chassis, 4 Coils and all parts, 25/-. **VALVES GIVEN FREE. 3-VALVE S.W. KIT**, S.G. Det. and Pen., 42/-. **VALVES GIVEN FREE!**

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!**

SPECIAL OFFER. LISSEN TWO-GANG SCREENED ALL-WAVE COILS, 12 to 2,000 Metres, complete with switching and wiring diagram, 6/11 per set.

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/-.

MAGNAVOX. Mains energised M.C. Speakers. '134,' 7in. cone, 2,500 ohms, 12/6; '152,' 9in. cone, 2,500 ohms, 17/6; '152 Magna,' 9in. cone, 2,500 ohms, 37/6. Magnavox P.M.s—'234,' 7in. cone, 16/6; '252,' 9in. cone, 22/6. Reliable P.M.s, 10/6.

ROLA latest type P.M.s, 15/-. **GOODMANS'** 8in. mains energised, 1,000 ohms field, 10/6 each; Jensen P.M.s, 10/6. **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.

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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. 18, 24A, 35, 42, 43, 45, 47, 56, 57, 58, 75, 77, 78, 80, 2A5, 2A6, 2A7, 6A7, 2B7, 6B7, 6C6, 6D6, 25Z5, 25Y5. Write for other prices to Dulci Electrical Co., Ltd., Devonshire Works, Duke's Avenue, Chiswick, W.4.

LOUDSPEAKER REPAIRS

REPAIRS to Moving Coil Speakers, Cones and Coils fitted or rewound. Fields altered. Prices Quoted including Eliminators. Loudspeakers Repaired, 4/-. L.F. and Speech Transformers, 4/- post free. Trade invited. Guaranteed. Satisfaction. Prompt Service. Estimates Free. L.S. Repair Service, 5, Balham Grove, London, S.W.12. Battersea 1321.

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SHORT WAVE on a crystal set. Full building instruction and crystal 1/2 post paid.—Radiomail, Tanworth-in-Arden, Warwickshire.

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BANKRUPT Bargains. List free. All brand new goods. Following all 1937 models. Decca A.C. Superhet radiograms listed 18gns., my price 12gns. Vidor and Burndept midget portables £5 18s. 6d. list, £3 17s. 6d. Vidor model 253 all-wave battery receivers, £7 19s. 6d. list, £4 17s. 6d. Lotus 4v. AC/DC table models £3 15s. 0d. Ditto 4v. AC/DC midgets £3. Following 1936 models. Ormond 3v. AC/DC, 59/6. Ormond 5v. A.C. superhets, £5 15s. 0d. Ormond 3v. Battery MC, 59/6. All-wave battery 3v. MC, 79/6. Pilot, Ferguson and Truphonic mains and battery all-wave superhets. Trade supplied. Large stock replacement valves, mains and American, from 3/-. Components, speakers, etc. State requirements. Butlin, 6, Stanford Avenue, Brighton.

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ALCO ELIMINATORS AND CHARGERS. 4 H.T. taps. 120v./150v. 20/30 m.a., 18s., with charger, 25s. Charger alone, 7s. 6d. ½ amp., 11s. Year's guarantee. Details free.—P. & D. Radio, 1, Goodinge Road, N.7.

RECEIVERS, COMPONENTS AND ACCESSORIES

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RADIO CLEARANCE

63, HIGH HOLBORN, W.C.1.

HOLBORN 4631.

Special Clearance Sale now taking place at our London Premises; the following bargains are offered to enable our Mail Order Customers to participate in this eagerly awaited annual event.

8-VALVE A.C. MAINS SUPERHET, BY WELL-KNOWN MANUFACTURER, fitted Visual Tuning, Volume Control, Tone Control, etc.; Handsome Bird's-eye Maple Cabinet, size 16ins. wide, 12ins. deep, 23ins. high; Valves as follows: AC/VP1, FC4, AC/VP1, AC/VP1, AC/HLDD, V914, AC2Pen, IW3, Pre H.F. Stage, 2 I.F. Stages, Full A.V.C., a super bargain, £6 19s. 6d.

LISSEN 4-VALVE UNIVERSAL AC/DC RECEIVER, fitted in handsome dark finish Walnut Cabinet of Upright Design, Clock Face Tuning, Volume Control, Reaction Control, etc. A really fine receiver, £4 15s.

LISSEN AC/DC UNIVERSAL SET, with 3 Wave Bands, Short, Medium, and Long. Splendid Cabinet, finished in dark walnut, Clock Face Tuning, Volume Control, Reaction Control, etc. A really fine receiver, £5 12s. 6d.

BUSH S.B.4 BATTERY RECEIVER. A modern 4-Valve Battery Superhet, incorporating A.V.C., by means of Westector, etc. Fitted in handsome dark Walnut Cabinet. A bargain at £3 17s. 6d.

EXCLUSIVE BRITISH RIGHTS HELD BY US FOR CONSTRUCTRAD AMERICAN KITS. DURING THE SALE THESE KITS ARE OFFERED AS FOLLOWS:

1 Valve Battery Kit, complete with valve, 21/-.
2 Valve Battery Kit, complete with valve, 25/-.
1 Valve AC/DC Kit, complete with valve, 29/6.
2 Valve AC/DC Kit, complete with valve, 32/6.
These are complete sets, not converters, covering a wave-band of 15-600 metres by means of 5 Interchangeable, Plug-in Coils.

8 VALVE A.C. SUPERHET CHASSIS, complete with valves, details as above, £6 7s. 6d.

REGENTONE 5 VALVE AC/DC BAND PASS RECEIVER, fitted in handsome dark finish Walnut Table Cabinet, Thermometer Tuning, Separate Dials for Long and Medium Waves, etc., complete with valves. To Clear, £4 4s.

REGENTONE 5 VALVE BAND PASS CHASSIS, fitted with built-in Speaker, complete with valves, 53/6.

LISSEN ALL-WAVE COILS, complete with circuit, switching, etc. In matched pairs, 8/- per pair.

DITTO SINGLE COILS, 4/6 each.

LISSEN 126 K/C I.F. TRANSFORMERS, fully screened, 1/3.

G.E.C. 110 K/C I.F. TRANSFORMERS, Midget Type complete with trimmers, 1/3.

SPECIAL SPECIAL SPECIAL
JENSEN 7½IN. 2,500 OHM FIELD PENTODE TYPE MOVING COIL SPEAKERS, 5/9 Few only.

HANDSOME STRAIGHT LINE SLOW MOTION DIAL, complete with escutcheon, 2/3.

THE FOLLOWING CONDENSERS BY WELL-KNOWN MANUFACTURER:

8 plus 8 plus 4 Electrolytics, Wire End type, Metal Cases, 3/-.
14 plus 8 plus 4 Electrolytics, Wire End type, Metal Cases, 2/-.
8 plus 8 plus 4 Electrolytics, Wire End type, Cardboard Cases, 3/-.
8 Mfd. 550 Surge 500 Working, Metal Can, 1 hole fixing, 2/11.
8 Mfd. 500 Surge 450 Working, Metal Can, 1 hole fixing, 2/6.

TUBULAR CONDENSERS, PAPER TYPE, ALL SIZES UP TO .1, 6d. EACH.

50 Mfd. 50 volt working condensers, by well known manufacture, 1/6.
50 Mfd. 25 volt working condensers, by well known manufacture, 1/3.
25 Mfd. 50 volt working condensers, by well known manufacture, 1/-.
50 Mfd. 12 volt working condensers, by well known manufacture, 1/-.

UTILITY 3-GANG CONDENSERS, Superhet type, two .0005 Sections, one 110 kc/s Section, fully screened, with top trimmers, 2/6.

LISSEN CLASS B DRIVER TRANSFORMERS, ratio 1-1, brand new, boxed, 1/9.

BRYCE MAINS TRANSFORMERS AND CHOKES, BRITISH AND GUARANTEED, STANDARD FOR THE SEASON.

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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., 11/6.
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., 16/6.

H.T.8 TRANSFORMER, 250 volts, 60 m.a. 2-0-2 volts, 4 amp., 8/6.

DITTO WITH H.T. 8 METAL RECTIFIER, 16/6.

ALL TRANSFORMERS ARE FULLY SHROUDED.

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