CIRCUITS READERS ASK FOR—See Page 450


# Practical and Amateur Wireless

AND AMATEUR TELEVISION

3d. EVERY WEDNESDAY

Edited by F. J. CAMM

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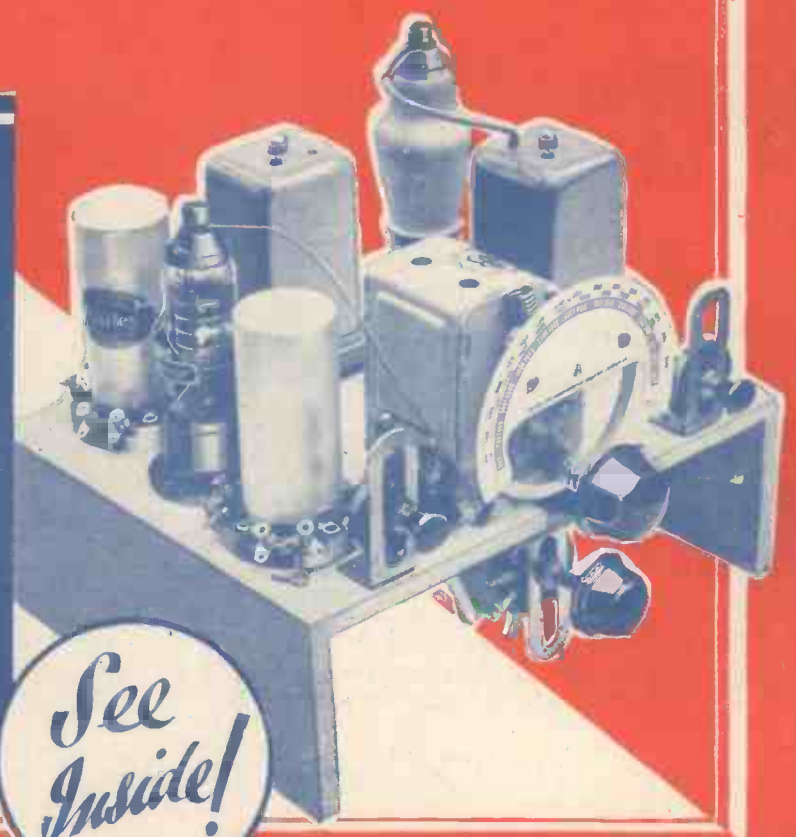
Vol. 6. No. 146. July 6th, 1935.


## At Last! A 2-Valve Superhet



See Inside!

# CIRCUITS READERS ASK FOR!

See Page 450

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. VI. No. 146. July 6th, 1935.

# ROUND *the* WORLD *of* WIRELESS

### Interesting Statistics

IF you were asked which European radio station broadcasts the most classical music you might find some difficulty in giving the answer. It is Bucarest, which devotes 36.3 per cent. of its time to this kind of entertainment. Stockholm holds the record for religious services; operas top the list of transmissions at Italian studios, followed closely by Lille, Toulouse, and Strasbourg. Paris PTT provides more dance rhythm for its listeners than any other European station; Hilversum is the best friend of the kiddies, followed by Brussels and London Regional. Japan gives most talks and Algiers fewer than any other world transmitter in the course of the year.

### "Bouquets" Concert Party

LIGHT entertainment comes from Scarborough on July 4th, when Northern listeners will hear the "Bouquets" concert party broadcasting from the Spa Theatre and Hal Swain's Dance Band from the Spa Ballroom. The "Bouquets" are directed by Murray Ashford, who acts as "entertainer" for the party, and the cast also includes Gladdy Sewell (comedienne), Laurel Mather (soprano), Walter Amner (comedian), Jack Howard (baritone), Mary Erne (soubrette), Lionel King (entertainer), Ralph Johnson (piano), Carlo (accordionist), and Marie Colores and Jean Pierre (speciality dancers).

### New Air Ministry Transmitter

THE Heston station, which has been regularly broadcasting weather reports and forecasts issued by the Air Ministry, will shortly be closed down. It will be replaced by a new 2-kilowatt transmitter which has been erected at Borough Hill, Northamptonshire, where for the broadcasts a vertical aerial 500ft. high has been installed. Listeners to ordinary programmes are able to tune in this service of weather forecasts as they are made on 1,186 metres (253 kilocycles).

### Leipzig High-power Station Closes Down

IN order to carry out a reconstruction of the plant and aerial system, the Leipzig 120 kilowatter will go off the air from July 3rd for a period of about three months; programmes will be broadcast during this time by the old transmitter.

### Short Waves on the French Railways

EXPERIMENTS are being carried out in France, according to a Paris report, with short-wave transmissions, in order to permit radio telephonic communication between engine drivers and certain stations on the line. A number of locomotives have already been equipped with transmitting and receiving apparatus.

### Tramp and Radio Pirate

AT Iglau, in Austria, the authorities recently arrested a beggar, who, on being searched, was found to possess a portable crystal set. When camped off the highway, he spent his time listening to the local wireless concerts, using as an aerial the overhead telegraph wires. The police authorities prosecuted him not only as a "rogue and vagabond," but also as a radio pirate.

### The New Deutschlandsender

FOR the new long-wave 150-kilowatt German National transmitter, the engineering staff is planning an anti-fading aerial system, which in their opinion will be the first to be used for transmission on long waves. By the method used it is claimed that the range covered by the station will be equal at least to one of a power of 200 kilowatts.

## ON OTHER PAGES



### Enlivening the German Programme

TO brighten up its wireless entertainments, the Berlin studio has decided that in addition to the humorous broadcasts carried out daily from B.S.T. 06.20-08.30, similar transmissions are also to be given daily between midday and B.S.T. 15.00. In addition, during the summer months, the programmes are to include more popular brass band concerts and dance music.

### Moscow Moves Up

IN order to avoid interference with Radio-Paris, the 500-kilowatt Moscow (1) transmitter has slightly raised its wavelength. Although the difference is only 2 kilocycles, on your condenser the broadcasts will tune in on 1,744 metres instead of 1,724 metres, as previously shown. The move results in an almost complete swamping of the Lahti (Finland) transmissions.

### Civil Airport Stations

ON 862 metres (348 kc/s) listeners now pick up a considerable number of transmissions with aeroplanes effecting the commercial services. The transmitters dealing with this traffic in telephony are: GEB2, Hedon (Hull); GED, Croydon; GEG, Lympne; GEL, Aldergrove (County Antrim); GEM, Manchester; GEN, Portsmouth; GEP, Fulham; GET, Newtownards (Belfast), and a new one at Jersey (C.I.)

### Broadcasts from Manchukuo

MTAY is the call sign allotted to the 100-kilowatt transmitter installed at Kuangchengtzu, near Hsinking, the capital of Manchukuo. Transmissions in the Chinese and Japanese languages, with an English news bulletin at B.S.T. 14.40, are broadcast daily from B.S.T. 23.00.

### Proposed 50-kilowatt Uruguayan Station

MONTEVIDEO, for some time past, has possessed a number of small stations ranging from 250 watts to 3 kilowatts. CX6 and CX16 alone, during the past year, raised their power to 5 kilowatts. The former of these stations, however, owned by the Servicio Oficial de Difusion Radio Electrica, has bigger plans for 1936; it has decided to build a 50 kilowatter in the neighbourhood of the capital. The wavelength allotted to this station is 461.4 metres (650 kc/s).

# ROUND the WORLD of WIRELESS (Continued)

### "Pleasure on Parade"

DURING the winter months Frank A. Terry's concert party. "Pleasure on Parade," gave regular broadcasts from the Manchester studios. Northern listeners who enjoyed these indoor performances will be glad to hear that "Pleasure on Parade" has now moved to the seaside, and its programme will be relayed from the Floral Pavilion, New Brighton, on July 13th. The composition of the concert party is slightly different, but the character of the show and many of its members remain the same.

**INTERESTING and TOPICAL PARAGRAPHS**

### "Opéra Bouffe"

REGINALD BURSTON, who conducts light music by the B.B.C. Midland Orchestra, will give a programme called "Opéra Bouffe," on July 8th. Jan Van der Gucht, the London tenor, and the orchestra will be heard in a potpourri from "La Poupée" and "Les Cloches de Corneville." The soprano singer for numbers from "The Tales of Hoffman" and "The Pearl Fishers" will be Marjorie Westbury, of Birmingham. "La Cigale" and "The Barber of Seville" are other works which will be recalled to the memories of listeners.

### Dance Music from Blackpool

DANCE music by Bertini and his Band will be broadcast to Northern listeners from the Tower Ballroom, Blackpool, on July 12th.

### Cardiff Repertory Company

A RADIO play will be presented by Isobel Elsom and the Cardiff Repertory Company, and produced by Cyril Wood, on July 9th.

### Orchestral Music from Madeira Cove

A SUMMER relay for Western listeners which has become an annual event is that of H. C. Burgess and Orchestra from the Rozel Bandstand, Madeira Cove, Weston-super-Mare. One of the newcomers this year is A. H. Trotman, who was for many years principal trumpet in the orchestra of the West Regional; he was principal trumpet in the National Orchestra of Wales during its existence. H. C. Burgess and Orchestra will be heard from Madeira Cove on July 11th.

MUSIC FOR LEISURE TIME

*Hildegarde, the charming continental cabaret and broadcasting star, listening to her new Cossor receiver.*

### Garde Republicaine Band

ON July 19th the Band of the Garde Republicaine will give a special programme, which will be relayed from Paris. The programme will probably include such works as their brilliant transcription of Strauss's tone poem, "Till Eulenspiegel," and a work composed for Military Band by Schmitt, "Dionysiaques."

### Gustav Holst Works

THE Northern programme on July 8th includes a concert of works by the late Gustav Holst, contributed by the Huddersfield Glee and Madrigal Society in conjunction with the B.B.C. Northern Orchestra. The society came into existence as the result of a musical competition held in Manchester in 1875, when a "scratch" Huddersfield choir won the first prize so easily that they determined to form themselves into a permanent body. The present conductor is Roy Henderson; the B.B.C. Northern Orchestra will be directed by T. H. Morrison.

### Opening of Leicester Airport

MR. LINDSAY EVERARD, M.P. for the Melton division, who helped to organise the "Looking to the Air" series of Midland broadcasts, will be one of the speakers at the opening of the Leicester Airport, which is to be relayed on July 13th. The ceremony will be performed by the Marquess of Londonderry, K.G., and the Lord Mayor of Leicester will speak on behalf of the city. The air display which follows will be described in a running commentary by E. C. Brown. For the benefit of those who are unable to listen on Saturday afternoon, a résumé of the events will be included in the evening programme.

### Scottish Military Band

THIS popular band, conducted by John A. McIvor, and Matthew Nisbet (baritone), will provide an hour's programme on July 13th. The band will play the march, "London Scottish," by H. E. Haines, arr. Winterbottom; phantasy, "The Three Bears," by Eric Coates, arr. D. Godfrey; and "Drink to me Only," by Roger Quilter. Matthew Nisbet will sing "Ethopia saluting the colours," by Chas. Wood; "The Asra," by Rubinstein; and "When the King went forth to War," by Koeneman. There will also be two cornet solos, "A Perfect Day," by Jacobs Bond, and "Killarney," by Balfe, played by W. Maddock.

### "Cable Ship" Broadcast

CABLE laying is a rare process nowadays as most of the work has already been done. The main function of the cable fleet is repair work. The cable ship must always be ready to grapple for a broken cable-end which has been fouled by a steamer or damaged in some other way. Broken cables mean delay and loss of revenue to their owners, so a cable ship must hurry. Laurence Gilliam's "Cable Ship" programme, to be broadcast on July 10th, largely concerns the cable ship *Mirror*, which is one of the biggest of a fleet owned by a British cable company. It will depict a panorama of cable routes, including the despatch of a message to London which is interrupted. Listeners will hear how the fault is traced, and go with the ship to the scene of the interruption, thus getting an outline of the delicate navigation needed to locate the exact spot. The whole operation will be illustrated in detail by actual recordings made in the ship.

## SOLVE THIS!

**PROBLEM No. 146.**

The output stage of Black's three-valve A.C. receiver employed an indirectly-heated pentode valve, and he noticed that there was a distinct blue glow in this. After a week or so, signal strength had fallen off and he decided that the valve was probably defective. Looking round his spare parts he found a directly-heated pentode with similar characteristics and decided to try this to ascertain whether or not the other valve was defective. He accordingly changed the valves, but although the characteristics were practically identical, the new valve only gave very distorted signals and no amount of adjustment of the controls would produce clear signals. Why was this? Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 146 in the lower left-hand corner and must be posted to reach here not later than the first post Monday, July 8th, 1935.

**Solution to Problem No. 145.**

The H.F. transformer in Jackson's receiver would naturally have a larger secondary winding than would be found on a coil designed for connection direct to an aerial, and therefore when he placed the aerial on to the grid of the detector valve he was cutting out the primary winding and naturally he obtained a higher maximum tuning range. A fixed condenser in the aerial lead would have enabled him to tune lower and he should not have removed the turns as the coil was quite in order.

The following three readers successfully solved Problem No. 144 and books are accordingly being forwarded to them: A. J. Marshall, "Hill View," Meigle Street, Galashiels; A. G. Arthurs, 1, Emlyn Gardens, May Hill, Swansea, Glam.; J. W. Winckworth, Sussex Place, S.W.7.

FIRST AGAIN!

# Mr. F. J. Camm's Two-valve Superhet!

**Improving Still Further Upon His Series of Superhet Receivers, He Has Now Perfected a Set of this Type with Only Two Valves. Preliminary Constructional Details are Contained in this Article.**

*The partly-finished receiver which is assembled on a chassis measuring only 10in. by 8in.*

READERS who studied my recent series of articles explaining the principles of the superheterodyne were greatly interested when I announced that I had succeeded in building a set of this type with only three valves. Hitherto it had been the custom to think of the superhet circuit in association with 7 and 8 valves, and indeed it is not so long ago when it was absolutely essential to use that number of valves in order to obtain an efficient set of the superhet type. With the introduction of the pentagrid or heptode valve, however, a reduction became possible, and this reduction was not merely a case of cutting out one valve, but carried with it the advantage that performance was improved in many important directions. The modern high-efficiency S.G. and pentode valves also enabled a reduction to be effected in the number of I.F. and L.F. stages, and thus to still further reduce the total number of valves. Those readers who read about or constructed my three-valve super will remember how I adopted the Westector or, as it is more often called, the cold valve for a second detector with a further reduction in valves, and now by a further device I have eliminated one of these, thus bringing us down to the very minimum number of valves for the superhet principle, namely two.

## The Circuit

A study of the theoretical circuit reproduced in Fig. 1 will show that, in spite of this reduction, there is no falling off of efficiency, and this is not merely a stunt circuit devised simply so that I could say "Here is a two-valve superhet." Every part of the circuit is theoretically sound, and it will be seen that the aerial is coupled to the pentagrid valve without the use of band-pass coupling, but that a separate aerial coupling coil is employed on the tuning unit. The usual frequency-changing circuits are employed and the output from this stage is taken to an I.F. transformer in the usual way and thence fed to a pentode valve which performs a dual function. A grid condenser is fitted in the lead to this valve and a resistance is joined between the grid and the secondary of an L.F. transformer, the latter being fed from the Westector which follows this valve. Thus, in the anode circuit of this pentode we have the original signal at its new high-frequency as well as a rectified or audio signal, but, owing to the extreme differences in frequency, the two are maintained distinct, and there is no interaction or instability of any kind experienced. The H.F. signal is taken through the usual I.F. transformer to the Westector, and thus the circuit arrangement follows more or less the principles of the £5 Superhet, except that the I.F. valve is employed in a dual capacity. The performance is almost as good as the £5 Superhet, and in fact the circuit is practically the same, although the use of the single valve for the dual function results in a very slight loss and does not quite equal the performance which is obtained when a separate output pentode is employed.

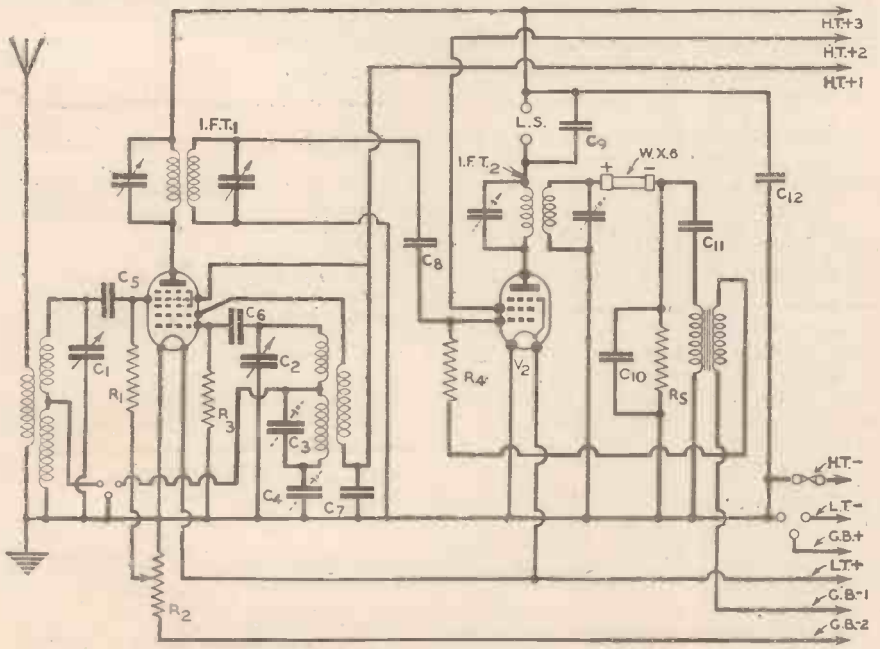



*Fig. 1.—Theoretical circuit of the 2-valve Superhet.*

## Construction

For the benefit of those who wish to commence construction at once the layout of the principal controls is shown in Fig. 2, and the layout should be carried out as nearly as possible in the same order as in the theoretical diagram. A wiring diagram will be given next week, but in the meantime it may be stated that the usual precautions are necessary—that is, earth returns when taken from the metallised surface of the baseboard must be thoroughly clean and a large washer should be included under the head of the bolt to ensure that a large area of contact is provided. The chassis is quite small, measuring actually 10in. by 8in. wide, with the usual 3in. runners. The tuning dial is attached to a two-gang condenser and this is one of the new baby components with a single section of ordinary shape for tuning the aerial circuit, and the remaining section cut to a special shape to enable it to be used with the

(Continued overleaf)

### A TWO-VALVE SUPERHET

(*Continued from previous page*)

coils which are specified in this receiver, and which employ an intermediate frequency of 465 kc/s. There are various reasons for the choice of this frequency, as distinct from the more usual 110 kc/s, and one of the principal reasons is the avoidance of second-channel whistles.

#### Precautions

In wiring a receiver of this nature it is necessary to take special precautions on the H.F. side to avoid losses, but these are more or less standard precautions which every home-constructor takes to-day. There are one or two points which need stressing, however, to avoid not only inferior results, but actual damage to components, etc. The bracket which holds the volume control, for instance, is attached to the under side of the chassis, and this is of plain unmetallised wood. Consequently, should the centre or control spindle come into contact with the bracket, there would be no danger or harm done. If, however, the screws which are used to attach the bracket to the chassis are sufficiently long, they will project and will come into contact with the metal coating on the upper surface of the chassis, and thus a short-circuit of the grid of the first valve would be produced. Similarly, the on/off switch is in contact with the chassis, *via* the mounting bracket, and if wired as shown in our diagram, the switch will function in the normal manner. If a different switch is used, or the contacts are differently wired, however, there will be a danger of the grid bias being left in circuit, and it will discharge through the volume control potentiometer. There are one or two other details of similar importance, and thus the constructional work must be carried out with care, and the arrangements and components adopted by us should be adhered to, when the receiver may be relied upon to give a good account of itself. Further constructional details will be given next week, together with a wiring diagram and illustrations of the completed receiver.

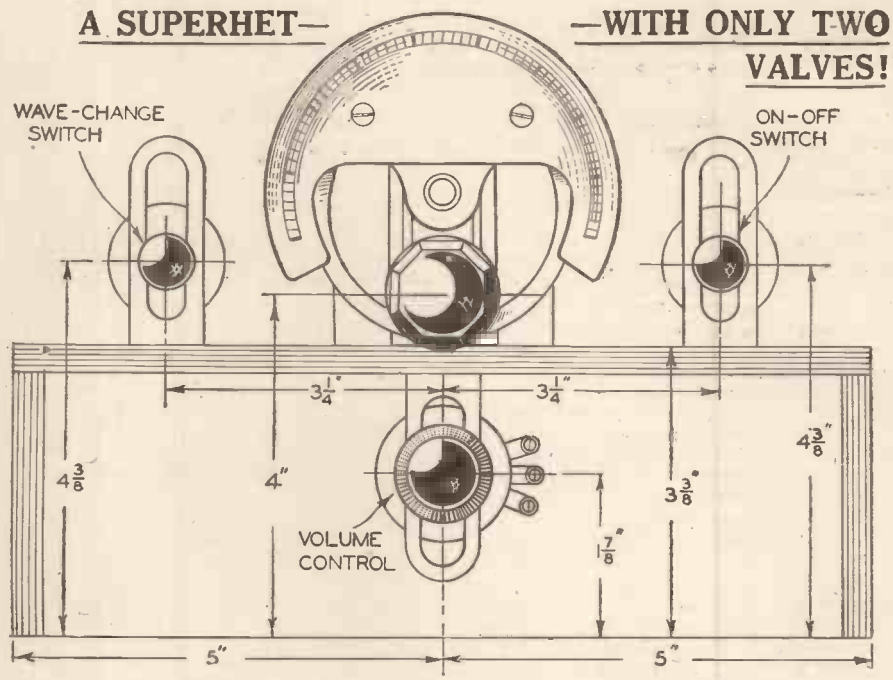



*Fig. 2.—Control layout which will assist in drilling the cabinet front.*

## LIST OF COMPONENTS

Two coils, Type BP80 and BP87 (Varley).
Two-gang superhet condenser, 465 kc., C1, C2 (J.B.).
Two I.F. transformers, Type 465 kc. (Wearite).
L.F. transformer (B.T.S.).
Eight fixed condensers: three. 0001 mfd., C6, C8, C10, Type M; one. 0005 mfd., C5, Type M; one. 005 mfd., C9, Type 300; one. 5 mfd., C11, Type 250; two 1 mfd., C7, C12, Type 65 (T.C.C.).
Two pre-set condensers: .0003 mfd., C4, and .0001 mfd., C3 (B.T.S.).
Four fixed resistances: one 100,000 ohms, R3; three 250,000 ohms, R1, R4, R5 (Dubilier).
One 50,000 ohms R2 potentiometer, VC36 (Bulgin).
One WX6 Westector (Westinghouse).
Two valveholders, one 7-pin, one 5-pin (Clix).
Two terminal strips, L.S. and A.E. (Belling Lee).
Two three-point switches, S36 (Bulgin).
Seven wander plugs: HT1, HT2, HT3, HT—, GB+ GB—1, GB—2 (Belling Lee).
Two spades, LT—, LT+. (Belling Lee).
Three component brackets (B.T.S.).
One fuse, 60 m.a. (Microfuse).
Two valves, 210 P.G., 220 H.P.T. (Cossor).
Metaplex chassis, 10in. by 8in. by 3in. (Peto-Scott).
One 120-volt H.T. battery (Drydex).
One 9-volt G.B. battery (Drydex).
One 2-volt L.T. accumulator (Exide).
One Stentorian loud-speaker (W.B.).

## TELEVISION TERMINOLOGY

THE problems associated with television terminology are beginning to make their presence felt, and while it is realised that a committee appointed by the Television Society are applying themselves to the recommended use of terms in a number of cases, the rapid development of the science merits the attention of an official body for the periodic issuing of reports and acceptances for words which must come into use. If this is not done a measure of confusion will arise as it did with radio, and terms will have become commonplace in an entirely wrong sense.

This point was emphasised during the course of a recent discussion among television engineers on the question of picture analysis. The more general term used for this is scanning, but there were others who favoured exploring. A recourse was made to a handy dictionary, but this did little to help matters. In everyday conversation the word "scan" is applied quite frequently to infer a hurried glance, but the dictionary defined the word as "to examine thoroughly, to scrutinise," and in the case of explore "to examine closely with a view to discovering the truth, to scrutinise."

Modern high-definition television, even with present-day standards (which, of course, will be improved later), demands that the scene or object which is to be televised shall be done in such a way that its subsequent reproduction in the receiving set bears the closest resemblance to the original from the point of view of the detail shown in the picture. Scan, that is, to examine thoroughly, should therefore meet this case, but the protagonists of the term explore point to the inclusion of the expression "with a view to discovering the truth" in their definition, and hold that television's ultimate aim is pictures of this calibre.

Although not attempting in any way to offer a solution to the interesting points raised, it is felt that no effort should be spared to settle these outstanding items before the new high-definition service proposed by the Postmaster-General's committee becomes an accomplished fact.

# Smoothing the High-tension Supply

A Simple Explanation of the Different Systems of Smoothing, with a Description of the Methods of Using the Field Winding of a Moving-coil Speaker as a Smoothing Choke, and of Obtaining "Free" Bias

By FRANK PRESTON

THERE is no need to explain that when the high-tension current supply is taken from the electric-supply mains a certain amount of smoothing is necessary, but several of the methods of smoothing do call for explanation, since they are by no means well known. The simplest and most commonly known system of smoothing is that in which use is made of a low-frequency choke in series with the positive (D.C.) lead, and two fixed condensers connected between the positive and negative leads, as shown in Fig. 1. In this case the choke "irons out" the fluctuations of current, due to the fact that it opposes rapid changes, the increases in current above the average value being used to create a magnetic field round the core, whilst this field serves to augment the current when it falls below the average value. This explanation is, necessarily, incomplete, but suffices for present needs.

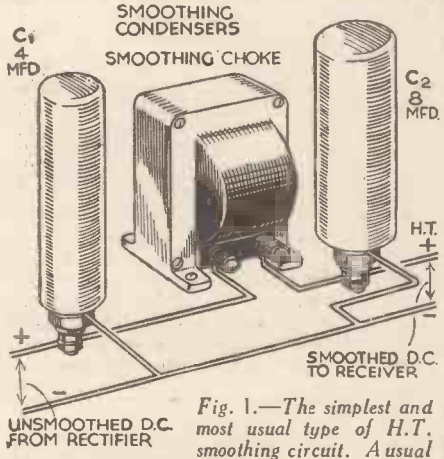



*Fig. 1.—The simplest and most usual type of H.T. smoothing circuit. A usual value for the choke is 20-30 henries (at the full H.T. current), while C1 and C2 generally have values of 4 mfd. and 8 mfd. respectively.*

The effect of the condensers is to "store" current when the value rises above the average, and to discharge it when the current falls off; the ability of the condensers to do this is largely dependent upon their capacities. The condenser marked C.1 in Fig. 1 also governs the output of the rectifier in many cases, and the value has been practically standardised at 4 mfd. Thus, if a condenser of, say, 8 mfd. were used in this position, the rectified output would probably be slightly higher than the figures at which the rectifier was rated.

## The Speaker as a Choke

The simple form of smoothing circuit just described is widely used in home-constructed receivers when the speaker is of the permanent-magnet type, but in the majority of commercial receivers expense is saved by replacing the smoothing choke by the field winding of an energized moving-coil speaker, as shown in Fig. 2. As, however, the field winding is placed on a ferrous core—the electro-magnets of the speaker—it can be considered in nearly every respect as an L.F. smoothing choke. The main difference is in connection with the D.C. resistance of the winding, for this is nearly always higher than the resistance of the equivalent choke. This means that the voltage-drop across the winding must be greater than that entailed by the use of a choke, so that, unless the rectified output voltage is appreciably greater than that required by the valves in the receiver, volume must suffer by the use of the energized speaker.

On the other hand, if there is a sufficiently high voltage available, and if the H.T. current consumption of the receiver is high enough, the sensitivity of the average energized speaker is greater than that of the average speaker of the moving-coil type. This leads us to a consideration of the power required to energize the speaker magnets; this varies considerably for different makes and types of speaker, but for the average unit for use with a "home" receiver the figure is about 6 watts. In most cases, however, the power can be increased up to 10 watts or so with a slight corresponding increase in sensitivity, whilst it can be reduced to 3 to 5 watts without losing a great deal.

## The Energizing Wattage

But how can we determine the wattage available for energization? The method is perfectly simple if the total anode-current consumption of the valves and the resistance of the field winding are known, and is found by multiplying the square of the current in amps. by the resistance in ohms. Thus, if the valves take 50 milliamps (a good average figure for most three- or four-valve mains sets) and the speaker has the usual resistance of 2,500, the energizing wattage is 50/1,000 multiplied by 50/1,000 multiplied by 2,500, which works out at 6¼ watts. A simpler calculation when the resistance of the speaker is 2,500 ohms can be made by squaring the current in *tens of milliamps.* and dividing by 4. Thus, if the current consumption were 60 milliamps, the energizing wattage would be equal to 6 times 6, divided by 4, or 9 watts.

In order to find whether the available

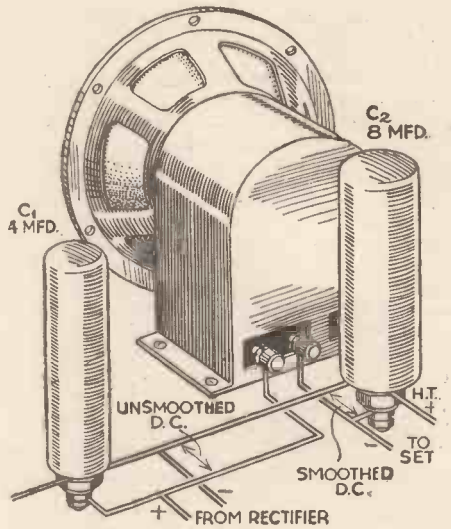



*Fig. 2.—This circuit is similar in principle to that shown in Fig. 1, but the smoothing choke is replaced by the field windings of an energized moving-coil speaker.*

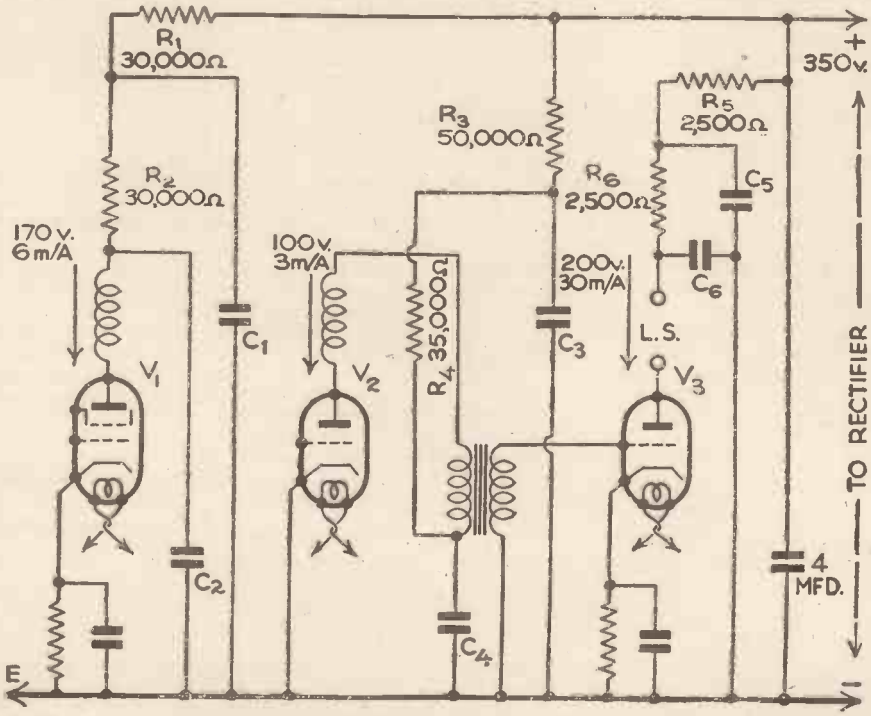



*Fig. 3.—This skeleton circuit shows the method of smoothing the H.T. supply without the use of an L.F. choke. Resistances and condensers only are employed, and these serve also for decoupling. Condensers C1 to C6 may each have a capacity of 2 mfd.*

(Continued on next page.)

## SMOOTHING THE H.T. SUPPLY

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D.C. voltage is high enough to allow for the voltage drop, it is necessary to determine the latter factor by multiplying the current in amps. by the resistance of the winding. For example, if the current were

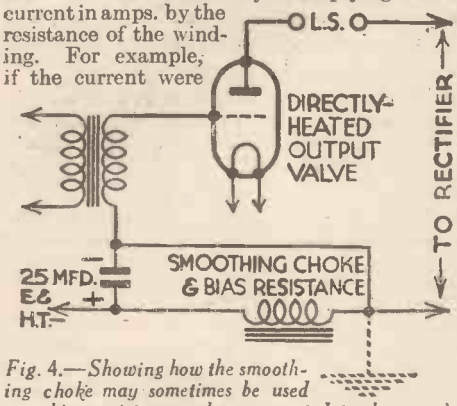


*Fig. 4.—Showing how the smoothing choke may sometimes be used as a bias resistance when connected in the negative H.T. lead.*

50 milliamps and the resistance 2,500, the voltage-drop would be 50/1,000 multiplied by 2,500, which equals 125 volts. It will be evident that this calculation also can be simplified by multiplying the current in milliamps. by the resistance in *thousands of ohms*. Assuming the application of the above figures, the rectifier would have to deliver an output of 325 volts, 50 milliamps. if the valves required 200 volts anode current.

### Smoothing by Means of Resistances

Quite apart from the two methods of smoothing described above, there is another which is used very successfully by certain designers and receiver manufacturers, and which depends upon the use of fixed resistances and fixed condensers only ; a circuit of the type in question is shown in Fig. 3. Here a separate smoothing system is used for each of the three valves in the skeleton circuit shown. The two resistances marked R.1 and R.2 smooth the supply to V.1, R.3 and R.4 apply to V.2, and R.5 and R.6 apply to V.3.

One of the great advantages of this system is that the resistances also serve very adequately to decouple the valves; another is that the resistances are cheap, and a third is that exactly the desired amount of smoothing for each individual valve can be chosen. The one disadvantage is that the resistances generally have to be of fairly high value, so that a very appreciable voltage-drop is introduced. The voltage-drop is, however, reduced to a minimum by feeding each valve separately, so that the current flowing through the various resistances is comparatively small. Approximate values for the various resistances are shown in Fig. 3, whilst the currents and voltages at various points are also indicated.

It will be evident that the method of calculating the resistance values is the same as that described above in connection with the field winding. It is also evident that the greatest degree of smoothing is applied to the anode current of the detector, since this is the valve which is generally most susceptible to current "roughness," and is the most likely to be the cause of mains hum in the speaker. In fact, it is often possible to dispense with the two resistances R.5 and R.6 in the anode circuit of the power-valve (provided that the rectified H.T. voltage is not in excess of requirements), since hum which is introduced in this circuit does not receive any amplification. All of the six by-pass and smoothing condensers, C.1 to C.6, may be of the electrolytic type, although ordinary "paper" condensers of sufficiently high working voltage will serve nearly as well.

### "Negative-lead" Smoothing

In each of the smoothing systems which we have so far considered the principal smoothing components have been included in the positive supply lead. This is not an essential, however, and there are frequently important advantages to be obtained by inserting the choke or speaker field winding in the negative lead, as shown in Fig. 4. Here the smoothing choke is used also as the bias resistance for the directly-heated power output valve, its resistance being of such a value that the voltage-drop incurred is equal to the bias voltage required. In determining the correct D.C. resistance for a choke used in a circuit such as this it is necessary to take into consideration the total anode current consumed by all of the valves, the calculation being the same as in the case of a battery-operated receiver in which automatic bias is employed; the calculation was described in the article on this subject in the series entitled "The Experimenters Explain" and published in the issue of PRACTICAL AND AMATEUR WIRELESS dated June 1st, 1935. The objection to using the choke for biasing purposes is that the system is not very satisfactory in a receiver having more than one variable-mu valve, since the alteration in anode current as the variable-mu volume control is adjusted causes the bias voltage to vary to a certain extent.

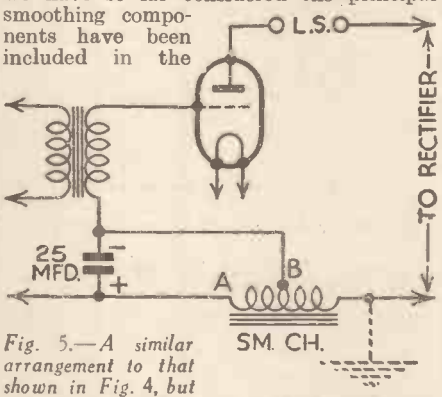


*Fig. 5.—A similar arrangement to that shown in Fig. 4, but where the bias voltage is developed across only a portion of a tapped smoothing choke, between points A and B.*

### "Free" Grid Bias

When it is not practicable to employ a choke of the correct value for providing the grid-bias voltage required, the connections shown in Fig. 5 or in Fig. 6 may be used instead. Fig. 5 shows a tapped smoothing choke of which the portion between the points marked A and B is of the required resistance. In the arrangement shown in Fig. 6 a 25,000-ohm potentiometer is connected in parallel with the smoothing choke (which might well be the field winding of an energized speaker), and the grid-bias tapping is taken from the slider. It will be clear that the bias voltage may thus be varied between zero and the full voltage which is dropped by the choke. As an example, if the choke were of such a value that it dropped 60 volts, and 20 volts were required for bias, the correct position of the slider would be one-third of the distance from the end of the element marked A.

It will be evident that the principal advantage gained by having the choke in the negative lead is that at least a portion of the voltage normally "lost" across the choke is usefully employed. There is just one more point which should be explained in connection with the negative-lead smoothing system, which is that it is sometimes found that a certain amount of mains hum is introduced when the earth lead is connected in its usual position. The remedy is to transfer the lead to the position shown by broken lines in Figs. 4, 5 and 6; in other words, to earth the negative H.T. lead.

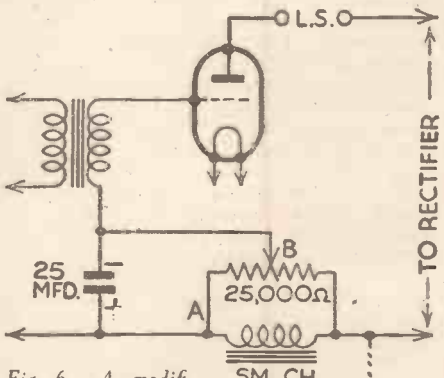


*Fig. 6.—A modification of the circuit shown in Fig. 5. In this case the bias voltage is obtained from a potentiometer in parallel with the smoothing choke.*

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### "Kenilworth"

ON July 9th Midland listeners will hear a dramatisation of Scott's novel, "Kenilworth." Phillis Bowman, who has made the adaptation, is not new to writing for radio; she was the author of a strikingly original sketch called "How Very Bemusing," which Martyn Webster produced last year. There will be about a score of episodes in this version of "Kenilworth," and the cast includes Stuart Vinden, as the Earl of Leicester ; Doris Nichols, as Queen Elizabeth; and Valeri Larg, as Amy Robsart. Mr. Vinden played Charles II in "The Royal Miracle," which was broadcast on Royal Oak Day. The production of "Kenilworth" is by Martyn Webster.

## Programme Notes

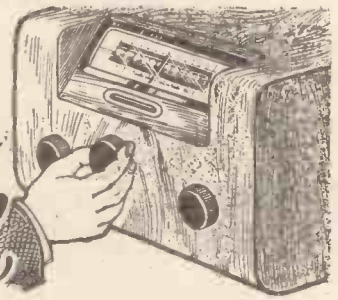
### Concerts from Midland Regional

THE Eroica Symphony of Beethoven is the work to be given at the Friday afternoon Symphony Concert by the B.B.C. Midland Orchestra on July 12th. H. Foster Clark will conduct. A concert party entertainment by the Radio Follies, presented by Richard Spencer, will also be heard by Midland listeners on July 13th.

### "Round the Bandstand"

MAX KESTER has devised a summer musical entertainment which he calls "Round the Bandstand," to be broadcast in the National programme on July 5th. As the name implies, it has a seaside scena.

# On Your Wavelength



By Thermion

## Kilowatts the Time

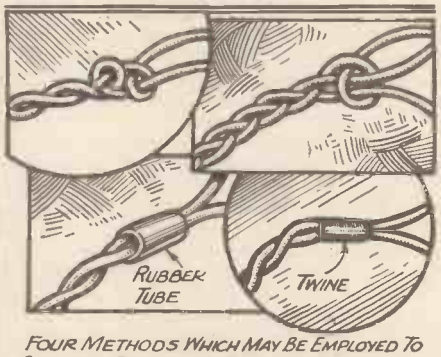
ACCORDING to a daily paper a clock which requires no winding has been patented at Prague. The works consist of a small receiving set which guides the progress of the hands. Time impulses are transmitted by an exact chronometer in the Prague Observatory, which has a transmitting station for announcing the time during wireless programmes. The clock can be operated from a distance of 500 miles; no winding or regulating is necessary. The exact time is recorded on the basis of astronomical data. The new clock is unaffected by the weather, it is simple and cheap to construct, and uses at most *five kilowatts of electric current in an hour.*

The above paragraph, a portion of which I have italicised, is not of my composition, but exactly as it appears in the daily newspaper. Only 5,000 watts, eh! with juice at the rate of anything between 4d. and 6d. per unit. Think I would rather install a Ferranti electric clock consuming practically no current. Like the Prague clock these synchronous mains clocks go for ever. In any case what is there novel about the Prague clock? Hasn't Greenwich been doing the same thing for years? With only 5,000 kilowatts on your mantelshelf there will, of course, be no interference with your radio and you have the added advantage of being able to run your own transmitter from the same source. On the whole a perfectly priceless daily paper paragraph.

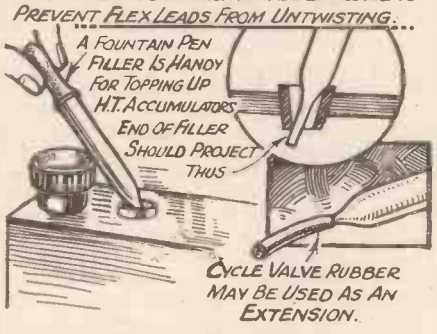
## Religious Broadcasts

G. B., of West Didsbury, thinks the controversy about jazz music is childish and would prefer me to air my views on what he considers the foolish waste of time and money given to religious matters and the various broadcasts sponsored by the religious bodies. He viciously demands to know the authority for extending the worn-out superstitions of religion without the consent of the public. He thinks the atheist should be allowed to have his say. 'Tis indeed hard to kick against the pricks, but whilst the great body of public opinion follows orthodox religions I trow not that programmes will be altered to suit a minority. I have no particular religious bent and have long been of the opinion that a lot of so-called religious teaching is unadulterated bilge water. You may believe what you like about religion, for the time has passed when any particular religious denomination has anything but the mildest influence on life or current affairs. Whilst a number of people enjoy this aspect of the Sunday broadcast they are entitled to their mead of enjoyment.

The go-to-church-on-Sunday brigade have happily fallen from favour, and children now have their religious belief moulded at school in a fairer way than in the Sunday school. There is more intense hatred and animadversion and anti-religious attitudes between religious bodies than between any other sections of the community; but my correspondent must remember that there are many aged, infirm, and sick people to whom a friendly talk by a parson acts as a solace and effects a far better cure than noxious potions or doctor's prescriptions. None the less, a great deal of religion is pure bunk. Fortunately, the modern parson realises this and there is a pleasant change taking place in ecclesiastical matters.


FOUR METHODS WHICH MAY BE EMPLOYED TO PREVENT FLEX LEADS FROM UNTWISTING...




## No Danger in High Voltage Television.

A FEW weeks ago in these notes I made reference to the high voltages required by cathode-ray tubes of the type which will be widely used for the reception of high-definition television. I pointed out that although the voltage was high it did not mean that it was dangerous, nor that the user would be in danger of his life if he happened to come into contact with the two supply leads. Apparently one or two readers have not been quite able to understand the reasoning of this for, as they point out, more than one person has been killed due to electrocution by coming into contact with ordinary electric-lighting supply leads which normally have a potential difference of a little over 200 volts.

The point is that the high voltage demanded by cathode-ray tubes need not be, and is not, accompanied by an appreciable amount of current, whilst the lighting mains supply at least 15 amps. The "cathode-ray" voltage might well be compared with the voltage supplied by the ignition system of a motor car—the only important difference is that the voltage in the latter case is generally a good deal higher. And most people are aware that the consequences of the shock received by touching the terminals of the sparking plugs of an engine which is in motion are not serious. In fact, I have met people who could stop the engine of a "baby" car by short-circuiting the ignition system by means of the fingers. I do not, however, recommend you to try this, because you may have a surprise—but you will certainly not suffer any serious injury, provided that your heart is reasonably sound.

## Will Crystal Sets Again Become Popular?

I NOTICE that attempts have been made in certain quarters to revive the crystal set, which was so popular in the early days of broadcasting. Although the crystal receiver has the advantage of being inexpensive initially, and costing nothing to run, I do not think that it can ever be used again in appreciable numbers. After all, there are very few of us who would again endure the agonies of wearing 'phones for hours on end—at least, not as a form of enjoyment. You may reply that hundreds of short-wave enthusiasts to-day use 'phones almost invariably, but the position is then entirely different. In the first place, by wearing 'phones it is possible to obtain good reception with a simple receiver over distances which would otherwise be impossible. With regard to broadcast reception, however, distance is of lesser importance, and in any case D.X. reception cannot be indulged in by crystal-set users. Besides, a decent two-valve set to-day costs so little in either initial or running costs that there are very few indeed who cannot afford to pay the small amount for the entertainment which it provides.

## The "Junk" Shops

A FEW days ago I took a stroll round one or two of those back streets in London where "cut-price" and second-hand wireless stores abound, and I was amazed at the prices of many of the components and sets which were offered for sale. After seeing what was offered I can understand why so many constructors are tempted by the prices at which apparently perfect goods

(*Continued overleaf*)

(*Continued from previous page*)

are offered. The "snag" is that the components are almost invariably of obsolete types which are practically useless for incorporation in a modern set. If an attempt is made to use them, disappointment is an almost certain result. My advice, therefore, is to leave them well alone unless you are prepared to take a risk and merely wish to experiment. But if your desire is to save money the best method is to buy modern materials of reputable make from our advertisers.

## A Field for Experiment

THE present television transmissions bring home to one the necessity for invention, for, as the majority of listeners no doubt appreciate, two separate transmissions are necessary for sound and vision, and, consequently, a double receiver is necessary so that each may be tuned to the respective transmission. Surely, in these days of invention, it should be possible to mix the two and pick them up on one set, separating them in the L.F. stages, or at least at the second detector of a superhet. I am not a television engineer and, therefore, probably not competent to pass opinions, but it seems to me that the vision (or the sound) signal could be converted by suitable apparatus to a particular frequency, and the other signal converted into a totally different frequency (much after the manner of the frequency-changing process of a superhet), and the two of them combined to form a modulation signal for the carrier of the transmitter. At the receiver end the two sets of frequencies could be separated out by similarly arranged apparatus, although I must confess I cannot at the moment see how the complete range of frequencies necessary for vision and sound could be kept distinct. However, perhaps this will awaken the germ of an idea in the mind of a reader and some good will come of it. Personally, I shall keep on looking at the television transmissions and dispense with the sound as I generally do, preferring the interest of the picture to the trouble of rigging up another set and dividing my attentions between the tuning of the two.

## A Useful Gadget

PROBABLY many of my readers have old wireless junk lying idle, and the following idea will prove useful. It is not original, but is a stunt which I saw at the house of a friend I visited recently. He had built a small wooden box, about 4in. square, and at the top had fitted what looked like the lid of a blacking tin (I had not the temerity to ask what it was !). In the centre of this was a hole about half an inch in diameter, and projecting from one side was a curved piece of gas-pipe (or at least that is what it appeared to be), and plugged into the top of this was an old-fashioned loud-speaker horn. The device was standing on his study table, and I thought it was a new invention for wireless until the 'phone rang. He then picked up the ear-piece and stood it in the blacking tin, and from the loud-speaker came the voice of the caller and my friend was saved from the fatigue of holding the ear-piece, could manipulate a pencil, look at a book of reference, or otherwise content himself whilst he carried on a conversation. I pass on the device for what it is worth.

## The Radio Exhibition

ALTHOUGH we are only in June, the various manufacturers are seriously considering their exhibits for the radio exhibition which takes place in August. From several sources I have heard that there will be some interesting things on show, and let us hope that a television section will be the centre of attraction this year. I hope all those readers who have to make early application for their holidays in order to come to London to see this show have already taken the necessary steps to ensure that they will be able to pay a visit to Olympia. I foresee a big time for constructors this winter, and no doubt the use of the ultra-short waves will give many constructors a new interest in wireless and this winter should see a real revival of the home construction of wireless sets, with a greatly improved standard in every direction.

# Notes from the Test Bench

## Speaker Field-winding Connections

IN last week's notes it was mentioned that when an output valve requiring 400 to 500 volts on its anode is used, the speaker field-winding can be satisfactorily employed in place of a dropping resistance in series with the common H.T. supply lead of the valves preceding the output valve. For example, in receivers having two L.F. valves and one or two H.F. valves, the total consumption will be approximately 30 to 35 m.a. This is the current necessary to energise the average 6,500-ohm speaker, and the voltage drop across the speaker winding will be approximately 200 volts, as required. If automatic volume control is incorporated, however, this method of connection is not recommended owing to the fluctuating nature of the anode currents of the H.F. valves. When A.V.C. is used, it is advisable to employ a speaker having a field-winding resistance suitable for connection in place of the usual bias resistance of the output valve.

## Increasing the Intermediate Frequency

SUPERHETS employing an intermediate frequency of approximately 465 kilocycles are gradually becoming more popular than those using a frequency of 110 kc/s. The main reason for this is the absence of second-channel whistles in receivers of the 465 kc/s type. The use of a high intermediate frequency enables second-channel interference to be avoided without using ultra-selective pre-selector tuned circuits, since the frequency of the station which might cause the interference differs so greatly from that of the required station; the actual difference in frequency when 465 kc/s components are used is, of course, 930 kilocycles. Given the same number of tuned stages, the 110 kc/s superhet provides a higher adjacent channel selectivity than the 465 kc/s type, but this disadvantage is more than compensated for by the absence of whistles.

## Adding an Extra H.F. Stage

THE sensitivity of a receiver can be increased to a marked extent by the addition of an efficient H.F. stage. This addition does not present many difficulties when the first valve of the receiver is the detector, but in cases where one or more H.F. stages are already incorporated, great care must be taken in the design of the extra stage. Even if the receiver has no H.F. stage it is necessary to place the extra coil a good distance from the existing coil, otherwise H.F. instability will be experienced; this instability takes the form of a whistle when the two tuned circuits are in step and tuned to the wavelength of the transmitting station. When one H.F. stage is already fitted, however, it is necessary to place the coils and tuning condensers in screening cans, and in some cases screening of the various H.F. leads is also necessary. Most of the British H.F. type valves are provided with a metallised coating, but if an old valve of the unscreened type is used, metal cans can be obtained for screening purposes.

## Harmonics

EXCESSIVE reaction and most devices for obtaining razor-edge tuning create a form of distortion by cutting or severely attenuating the top notes. This means that most of the valuable harmonics present in the original programme are lost or reduced considerably, and an unnaturally low-pitched reproduction with serious lack of "character" occurs. If hyper-selectivity is insisted upon, matters can only be improved by some form of tone correction circuit which will make a corresponding cut in the bass response and thus restore balance. Many modern super-hets employ sharply-tuned I.F. stages and tone control for this purpose.

## "The Keys"

IN the early years of broadcasting, an officer of the Grenadier Guards, then on the staff of the B.B.C., suggested that the Ceremony of the Keys would make an impressive outside broadcast. This was in the days before outside broadcasts had advanced, by experiment and experience, to their present state of perfection. Later, when the Ceremony of the Keys was first introduced into the programmes, it captured the imagination of listeners as few other outside broadcasts had then done. Nowadays this Ceremony is an annual broadcast event and it has even got as far as the film screen.

On July 23rd you will again hear this historic ceremony, which will be carried out by the Chief Warder of the Tower in conjunction with the 3rd Battalion Coldstream Guards. The relay is by kind permission of the Governor of the Tower of London. The Ceremony opens with the Chief Warder meeting his escort at the Bloody Tower. The Chief Warder and escort then proceed to the Visitors' Entrance gate on Tower Hill, the sentries *en route* presenting arms. The Visitors' Entrance gate is locked, and the sentries then return through the Middle and Byward Towers, locking each in turn. On reaching the Bloody Tower, they are challenged with the historic words, "Halt! Who goes there?" "The Keys." "Whose keys?" "King George's Keys." They then proceed to the Main Guard. The Main Guard salutes the Keys by presenting arms and the Chief Warder, raising his hat, calls out "God Preserve King George." The Guard answers "Amen." Ten o'clock booms from the Tower clock and the relay finishes with that heart-stirring call, the Last Post.

## Short Wave Tuning

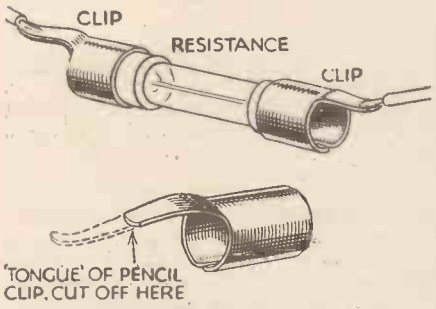
A GOOD slow-motion dial must be fitted to the short-wave tuning condenser, and it must be turned very slowly, with the set just on the point of oscillation. It will take some little time for a new-comer to get the hang of the tuning, but it is extremely easy, as will soon be discovered by practice, to tune in almost the whole world on the speaker with even a simple 3-valve set.

# A PAGE OF PRACTICAL HINTS

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

## Handy Resistance Holders

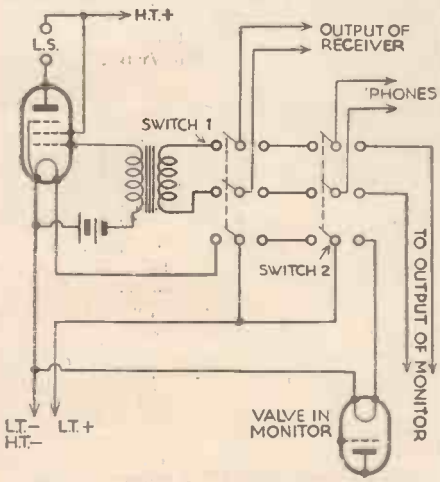
WHEN a baseboard clip resistance holder is not available, the changing of soldered resistances, when experimenting, is often a nuisance. A useful dodge for overcoming the trouble is shown in the accompanying sketch. The tongues of two metal pencil clips are cut off, as indicated, to form soldering tags to which the connecting wires can be soldered in the ordinary way. The ends of a grid leak or resistance are easily inserted in the improvised clips.—F. BARKER (Worthing).




*Neat improvised holders for grid leaks or resistances.*

## Switching for Amplifier and Monitor Valve

THE circuit shown in the accompanying diagram is of an amplifier to be used in conjunction with a short-wave receiver and monitor. With switch No. 1 turned to the left the amplifier is switched on, and the loud-speaker is in circuit. With the switch in the opposite direction, the amplifier is switched off, and the headphones are in circuit. The other switch puts the monitor's valve in circuit, and also connects the headphones to the monitor's output. Both switches are of the 3-pole 2-way type.—R. CRABTREE (Nelson).




*Circuit diagram of a switching arrangement for an amplifier and monitor valve.*

### *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.**

## Cost of Running Mains Sets

WHEN the electricity account arrives at the end of a quarter the shock sometimes received causes one to ask, "I wonder what my wireless set uses?"

The following "wrinkle" is for the benefit of those who know very little about electricity and who, of course, would have no electrical instruments for ascertaining the consumption. The only instrument required is a watch with a "second" hand, or, if available, a stop-watch.

Firstly, examine the electric supply company's meter, where you will find a metal disc inside the little glass window which revolves when a light is switched on.

Secondly, switch on one of the lights in the house, making sure that no other lights are in use, and note the wattage of the lamp switched on. Now go to the electric meter with your watch or stop-watch and ascertain the number of seconds the disc takes to make a complete revolution. It will be observed that there is a red line or a notch on the disc which, as it passes a point noted along the window, will give the starting and ending of the revolution.

Thirdly, switch off all lights and turn on the wireless set, making sure that it is connected to the lighting circuit and not to the power meter. Now time the revolution of the meter disc as for the lamp and the consumption of the set can then be worked out as follows:—

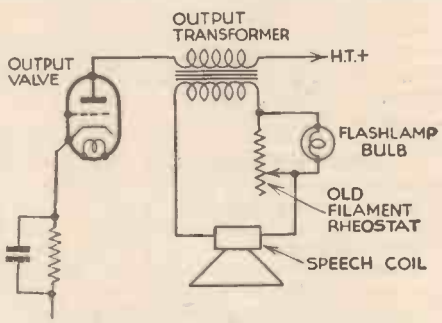
A lamp of 100 watts causes the meter disc to revolve in (say) 30 seconds. The wireless set causes the disc to revolve in (say) 60 seconds.

The consumption of the set is, therefore, 30/60 of 100 watts, which is 50 watts.

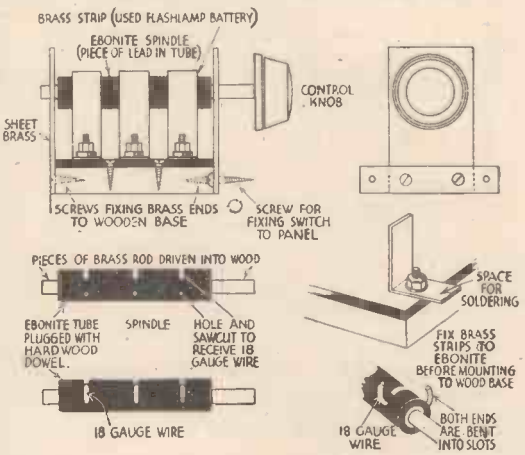
It is advisable to use a lamp of well-known and good manufacture and as new as possible, in order to minimise any difference between the actual current consumed and the wattage marked on the lamp.—F. WILLIE (Farnham).

## Visual Tuner

ALTHOUGH it is possible to use a meter for visual tuning indications, there is an alternative scheme which I have used very successfully, and which appeals more to the eye than the meter scheme. It also has the advantage that it may be made up to have the appearance of the more orthodox lamp tuning indicators, and is simple to arrange. As may be seen from the illustration the only requirements are a flash-lamp bulb and an old filament rheostat. These are wired in series with the speech coil and the secondary winding of the output transformer, the lamp and rheostat being in parallel. The arm of the rheostat is adjusted to furnish the required degree of control and obviously the value of the rheostat will depend upon the available signal strength and the type of bulb. The diagram should make the arrangement quite clear.—B. RIDER (Birmingham).




*A method of providing visual tuning.*




*Details of construction of a compact three-way switch.*

## A Compact Three-way Switch

I WAS recently in need of a three-way switch for experimental purposes, and not having one at hand I devised the switch shown in the accompanying sketches. The materials used were all requisitioned from the "junk box" excepting the pieces of brass used for the contacts, which were taken from used flash-lamp cells. The end pieces of brass were cut from the blades of an old type tuning condenser. The ebonite strip is simply drilled to receive screws, and is then fixed to the wooden base, after which the end plates can easily be fixed in place.—F. W. RITCHIE (Macduff).

# Circuits Readers Ask For

A Description of a Simple Four-valve Battery Circuit which is Suitable for Baseboard or Chassis Construction

By Norman Glauder

AN examination of the circuit diagram reproduced on this page will not reveal anything startlingly novel, nor will any new-fangled technical features become evident. Instead, the arrangement is that of a very straightforward circuit which can be adopted by any constructor of moderate experience without there being any likelihood of difficulties, without the need for experimental adjustments, and without the necessity for critical choice of components. Added to this is the fact that equally satisfactory results may be obtained whether the parts are assembled on a metal or metallised chassis, or on a plain baseboard.

### V.-M.-Det.-L.F.-Super Power Circuit

The circuit was prepared at the request of a fair number of readers, some of whose letters have been published on the "Letters From Readers" pages. There are four valves, the first of which is a variable-mu H.F. pentode, the second a triode detector, the third a small power valve and the fourth a 2-volt super-power valve. Two tuned circuits are included, these comprising a pair of highly efficient iron-core coils tuned by means of a two-gang condenser. Both coils are of the H.F.-transformer type, the first comprising aerial and grid windings and the secondary primary and secondary windings with reaction. The use of a tuned transformer for coupling together the high-frequency and detector valves obviates the need for an S.G., H.F. choke, and at the same time provides the maximum degree of amplification.

The primary windings of both coils are tapped so that varying degrees of selectivity can be obtained according to the situation of the receiver with respect to the "local" transmitter and the type of aerial employed. Wave-change switches are not shown since these are included in the bases of the coils specified, and are, of course, connected to the appropriate terminals by the makers; also, both switches are operated by means of a single spindle with its knob.

A radio-gram switch is included in the grid circuit of the detector valve so that a pick-up can be used and, if desired, the receiver may form the basis of a good radio-gramophone outfit. Coupling between the detector and first L.F. valve is on the R.C.C. principle, whilst a 1 : 3 transformer is used between the two L.F. stages.

### The H.T. Supply

The only objection to a circuit of this nature is that the H.T. current consumption is rather high—about 20 milliamps. at 120 volts H.T.—but we cannot expect to have our "bread buttered on both sides." In other words, we cannot have an output of 400 milliwatts, combined with high-quality reproduction, simplicity of construction, and cheapness of components without paying something for these undoubted advantages. But most good super-capacity H.T. batteries will give the necessary output, whilst the receiver can be fed from any eliminator with a 20-milliwatt output, or from high-tension accumulators. Besides, if economy of H.T. consumption is a very important consideration it is possible to use a small-power valve in the output stage, preceding this with an L.F.-type valve, although in that case the output will be reduced to about 200 milliwatts, and the H.T. current to between 12 and 15 milliamps. Another method of reducing the average H.T. consumption is to fit a "booster" unit to the output valve, as shown in broken lines; in this case a separate G.B. battery is required for the output valve.

### Choosing the Components

Although it was mentioned above that the exact components are not critical, it should be made quite clear that the values must be very nearly the same as those indicated on the theoretical circuit, and shown in the accompanying list of parts. But special consideration has been given to those who wish to modernise an existing receiver, using as much of the available material as possible. In fact, the following sentence occurs in a reader's letter published as long ago as May 4th of this year: "Such a design would be useful not only for building as a new set, but also for modernising old sets, especially if it included iron-core coils and ganged condensers." Most constructors will have on hand practically the whole of the components with the exception of the coils, and even if the available valves are of slightly different types it is probable that they can be used with fair success; one or

(Continued on page 452)

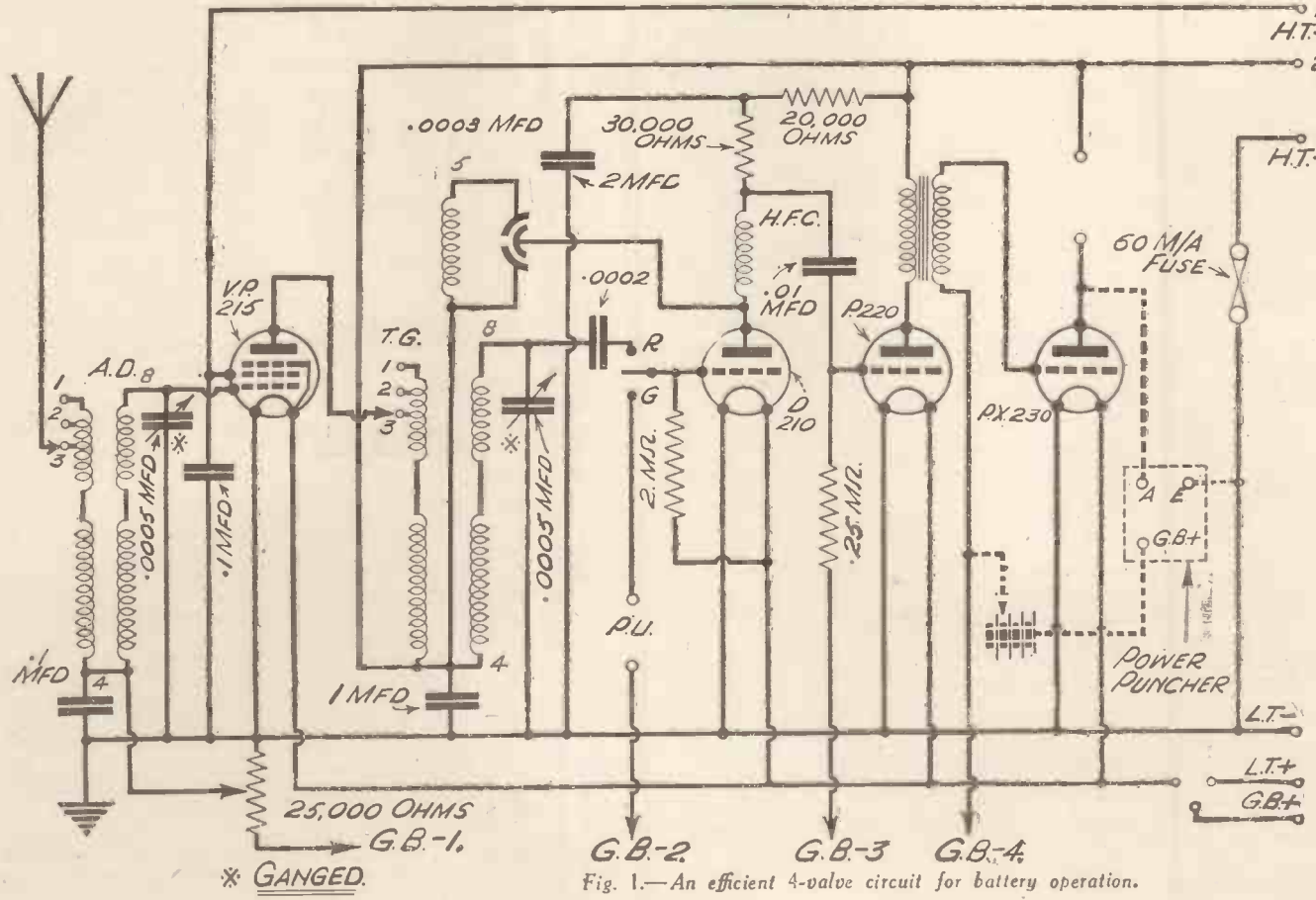



*Fig. 1.—An efficient 4-valve circuit for battery operation.*

## CIRCUITS READERS ASK FOR

(*Continued from page 450*)

two, at any rate, of the valves are almost sure to be suitable.

The disposition of the components is not critical, but for the benefit of those flat-baseboard enthusiasts, who consider that

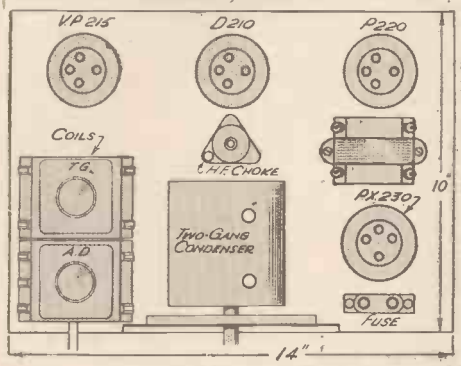



*Fig. 2.—Suggested layout for the components of the 4-valve set.*

they have been rather neglected, Fig. 2 is given to indicate suitable positions for the principal components. It is recommended that the baseboard employed be of the metallised type, or that it be covered with a sheet of foil to which all "earth-return" leads can be taken. Those who prefer chassis-form construction can follow a rather similar layout, using a smaller chassis, and mounting most of the components with the exception of the coils, tuning condenser and valve-holders on the under side.

As there are four knobs in addition to that for the two-gang condenser it will probably be found better to use a wooden or ebonite panel instead of components brackets, but much will depend upon the type of cabinet into which it is proposed to fit the finished instrument. In any case the controls should be placed in similar positions to those indicated in Fig. 3, so that a symmetrical appearance is obtained, and in order to keep the connecting leads reasonably short.

**PRINCIPAL COMPONENTS REQUIRED.**

One Baseboard or Chassis (see text).
One Pair Wearite coils: one Type A.D. and one Type T.G.
One J.B. "Baby" Two-gang Condenser, with Drive.
One Polar .0003-mfd. Differential Reaction Condenser.
One Varley 25,000-ohm Volume-control Potentiometer.
One Goltone "Super" H.F. Choke.
One Ferranti Type A.F.10 Low-frequency Transformer.
Four T.M.C. Tubular Condensers; two .1 mfd., one .01 mfd., one .0002 mfd.
Two T.M.C. Fixed Condensers, Type 25; 1 mfd. and 2 mfd.
One Goltone Three-point On-off Switch.
One Bulgin Snap-action Radio-gram Switch.
One Micofuse 60 m.a. Fuse and Holder.
Four Dubilier 1-watt Fixed Resistances: 2 meg., .25 meg, 30,000 ohms, and 20,000 ohms.
Four Hivac Valves; VP215, D210, P220 and PX230.
One W.B. Stentorian Standard Speaker and, if required (see text),
One Varley "Power Puncher."

### Preliminary Adjustments

When using the valves specified, tapping H.T+1 should receive approximately 66 volts, HT+2 120 volts, GB−1 9 volts, GB−2 1½ volts, GB−3 4½ volts, and G.B−4 12 volts; when using alternative valves the G.B. voltages will have to be modified accordingly.

After first connecting the receiver to the aerial, earth, batteries and speaker, the reaction condenser should be set to zero, and a fairly weak signal tuned in on about

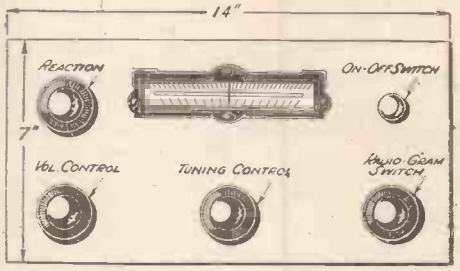



*Fig. 3.—The panel dimensions and layout. Note the neat and orderly appearance of the controls.*

230 metres, when the trimmer on the second section of the two-gang condenser may be adjusted until maximum signal strength is obtained on that station. This setting can next be checked by tuning to another transmission higher up the wavelength scale, after which all tuning can be done on the main tuning scale, since the trimming will "hold" over both wavelength ranges.

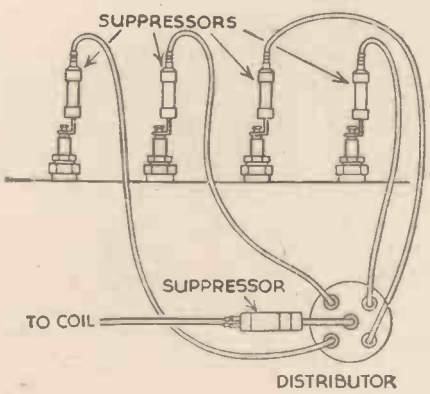
# WIRELESS IN THE CAR

**Some Precautions to be Taken when Fitting Radio to the Car**

WHEN a complete car-radio equipment is installed in the car by the makers' agents, suitable interference suppressors are fitted at the same time, and as a matter of course. This point should be considered by those who propose to use an ordinary portable set whilst travelling by car, and suppressors must be fitted. These consist of resistances made to fit between the high-tension leads and the sparking-plug terminals, and also in the lead between the ignition coil and the centre terminal of the distributor, as shown in the accompanying illustration.

### Fitting Interference Suppressors

Sets of interference suppressors are available from a number of firms, but those who wish to observe the effects of fitting them can, temporarily, use a set of non-inductive fixed resistances of the ordinary type. These should each have a value of, approximately, 20,000 ohms, and may be connected in the same manner as the special suppressors above referred to. Care must be taken to insulate the metal ends, since any short-circuit would lead to misfiring of the engine or might prevent the engine from starting. In most cases it will be found




*The method of fitting noise suppressors.*

that the fitting of suppressors does not affect the normal running of the engine in any way; if it does, resistances of lower value should be tried and the insulation should be carefully checked.

After the resistances have been fitted there should be no more than a trace of interference with normal reception, although in some cases it is necessary to fit a fixed condenser to the dynamo. Here, again, special condensers are available, but an ordinary high-quality tubular condenser of about .5 mfd. can be connected between the positive terminal of the dynamo and the engine casting (earth).

### Arranging the Aerial

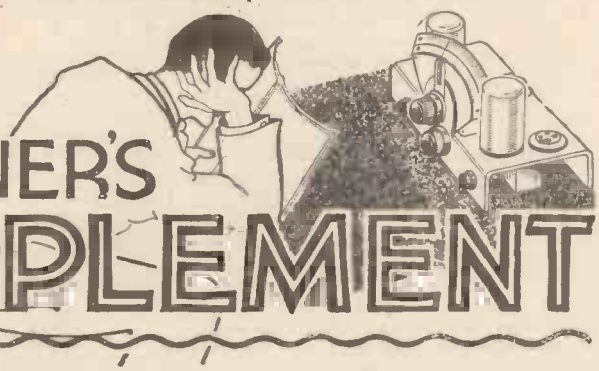
The aerial for a portable receiver used in the car often presents a difficulty, since if it is within the body it will probably be screened by the metal panelling, and will, therefore, be practically ineffective. A simple method of arranging it is to run an insulated wire in zig-zag fashion backward and forward along the underside of the running board. Another method is to fit a similar wire on the luggage grid. In every case the chassis of the car can be used as a fairly efficient earth connection.

When the receiver is to be installed as a fixture in the car it is well to make provision for a "permanent" source of H.T. supply; dry batteries are satisfactory, of course, but it is more convenient and economical to employ a converter of some kind. There are several suitable units on the market, and these are fed from the 6- or 12-volt car battery, supplying a D.C. output of, say, 200 volts at 50 milliamps. Various models are available, however, according to the actual voltage and current required by the receiver. In all cases the L.T. supply can be taken from the car battery, as explained in an article last week.

It is worthy of note that it is not necessary to obtain a separate licence to use an ordinary portable set in the car, but such a licence is required if the receiver is made a permanent fixture. The licence is obtained, like any other receiving licence, from the post office, and, in filling in the form provided, the registered number of the car must be stated in place of the address of the house in which the normal set is used.

There is just one other point which should receive attention in connection with the car-radio when the car battery is used as a source of power; the connections must be well made so that there is no chance of sparks occurring between loose wires, for these might easily result in fire.

DETECTION, OR RECTIFICATION—II.



# BEGINNER'S SUPPLEMENT

**The Difference between Grid Leak Rectification and the Method Described Last Week is here set out, and the Advantages of the System Explained by W. J. DELANEY.**

IF you refer to Fig. 2 last week, you will see that the audio or signal shape has been retained in the anode-current variation, and it is obvious from what has already been said that "quality" will only be retained when this shape agrees exactly with the shape of the transmitted signal. For anode-bend rectification, therefore, it is first of all essential to ensure that the part of the curve upon which you work is capable of giving an equal variation over the entire range of the incoming grid volts variation. It is at the same time necessary to choose for the purpose a valve with a suitable curve, as there are certain types of valve which are not really efficient as anode-bend rectifiers.

## The H.F. Component

It will be seen in Fig. 2 that the anode current is fluctuating rapidly all the time, and these fluctuations must be smoothed out as depicted by the heavy broken line. To do this with an anode-bend rectifier all that is necessary is to place a fixed condenser in the anode circuit of the valve, and this smooths out the fluctuations, leaving the audio signal which can operate any low-frequency component. In practice this audio component is less than the maximum value (as shown in Fig. 2) and strikes a value somewhat half-way between the zero line and the maximum change which is shown in the diagram.

## Grid Leak Rectification

When the grid of a valve is made positive, there is a flow of current from the grid to filament, in exactly the same manner as in a normal circuit there is a flow of current from the positive anode to the filament. Obviously, however, this grid current flow is very much smaller than the anode current flow, but in just the same way as the anode-current curve has a kink in it which enables us to use it for demodulation, so does the grid-current curve have a non-linear shape which enables it to be used for rectification purposes. Those readers who followed last week's article will appreciate how the suppression of one half of the A.C. fluctuations corresponding to the incoming carrier and signal constitutes rectification, and, therefore, an understanding of the grid-leak method of rectification will not be difficult to obtain.

## Making the Grid Positive

In our detector stage we must join the grid to one end of the tuned circuit and the other end of this circuit must be joined to the filament (or cathode). One side of the latter is negative and one side is positive in a battery receiver, and in an A.C. mains receiver the cathode is joined to H.T. negative. Therefore, in the battery circuit we can make the grid positive either by joining the lower end of the tuned circuit to the L.T. positive filament leg, or by inserting a small cell between the filament and the grid. But this would not be sufficient, as we must utilise the varying signal to produce a variation in the grid current, and the only way by which this can be carried out is to cause the varying current to pass through a resistance. It is well known that when a current passes through a resistance there is a voltage drop across it, and if the current varies whilst the

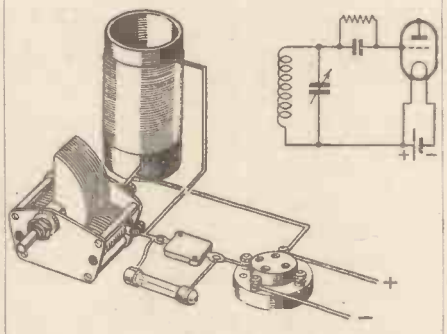


*Fig. 1.—One method of giving the grid a positive bias.*

resistance remains constant, then the voltage drop through the resistance will vary. If, then, we join a resistance from the grid of the detector valve to L.T. positive, we shall apply the necessary positive bias to the grid and the grid current flowing through this resistance will cause a voltage to be applied at the grid. The amount of positive bias applied to the grid must be so chosen that the incoming positive half-cycles cause an increase in grid current which is greater than the decrease caused by the negative half-cycles. The curve and the effects of the applied signal are, in effect, very similar to the diagram (Fig. 1), shown last week, so that no further diagram will be supplied.

## How Rectification Takes Place

Now the incoming oscillations, as they are of radio- or high-frequency, are constantly changing polarity at a very rapid rate, and the curve in Fig. 3 last week shows that, in addition to the regular rise and fall, there is a further change corresponding to the signal impulses. It is the latter which are required in our L.F. stages and, therefore, we have not only to select this curve, but must also smooth out the rapid changes which are known as the high-frequency pulses. A condenser will have the effect of smoothing these, as explained for anode-bend rectification, and all that is necessary is to fit a suitable capacity in the circuit. The most obvious place is between the tuned circuit and the grid, and the value of the condenser must be so chosen that it does not affect the signal impulses, but just smooths the high-frequency impulses and thus a very small capacity is indicated. In practice a value between .0001 mfd. and .0003 mfd. is chosen. There is now a more or less smooth rise and fall of voltage left to be applied to the grid and, as was explained just now, the positive rise will cause an increased flow of grid current which must pass through the resistance. Consequently, the voltage on the grid will be varying with the applied signal, and thus we shall have a rectified signal in the grid-filament circuit.

## Choice of Grid Leak

As the signal will have a frequency variation dependent upon the type of item being transmitted, it is obvious that the impedance of the grid circuit must be so chosen that there is a more or less constant effect at all frequencies. If this is not done the variation in impedance at different frequencies will result in some musical notes affecting the grid in a different manner from others, and consequently distortion will be present in our final signal. Actually, if a 2 megohm grid leak and a .0003 mfd. condenser combination is employed, the impedance at 5,000 cycles is much lower than at 500 cycles, and thus high notes are likely to be by-passed by the combination and will not be passed on through the valve. When, however, the resistance of the grid leak is made much lower, and the size of the condenser is reduced to about .0001 mfd. the effect is not so noticeable, and better high-note reproduction is obtained. However, these facts will be dealt with when considering distortion, as there is still the anode circuit of our grid-leak detector to consider.

## Amplification

We have already seen that the anode current which flows will vary with the applied grid bias, and there will be a stronger signal passed on to our next stage, and thus the valve carries out the dual function of grid-leak rectification and amplification, and consequently there are certain advantages to be gained from this form of rectification as compared with anode-bend rectification.

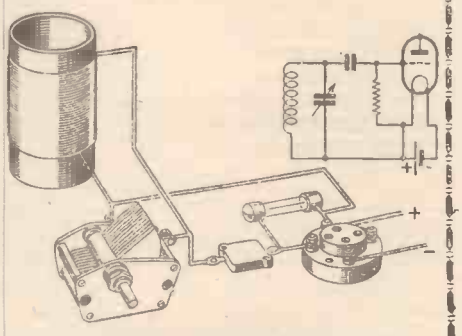


*Fig. 2.—An alternative method of making the grid positive.*

# CONSTRUCTOR CRUSADERS' CORNER

RECENT correspondence from Crusader rather points to the fact that the interest in television is falling off. Why should this be so, when in the near future we are to see great things in this branch of radio? I think the coming winter season will see many listeners taking up the television side of the hobby with greatly increased enthusiasm and some interesting developments are expected in this direction. I think the following letter will interest other Crusaders, as well as ordinary readers and I am therefore printing it in full:

"As a 'Crusader,' may I be allowed to air my views? I recently visited the Radio Section of the South Kensington Museum; this section is completely out of date, and P. and A. W. would surely be rendering a public service by taking up this matter with the authorities; the Radio Section should be brought into line with other sections of the Museum, so that the history of wireless can be traced from its inception up to the present time.

"It has been suggested that, in deciding what type of construction should be put forward for use by amateurs, price should be the first consideration. Your readers who hold this view would be well advised to go into a wireless shop and place an order for one of the up-to-date machines to suit their purse and so obtain marvellous value and service.

"When my friends ask me what my home assembled wireless has cost I think of the three valves I burnt out and go hot under the collar. I am reminded of the time when out East, after a small game shoot, I brought in triumphantly a huge bag, to be met with the remark: 'How many cartridges have you used?'

"With regard to the question of design your readers would surely be well advised to specify the results they require and leave the details, such as the number of valves, to your experts, as far as practicable the refinements to be found on an average manufactured set should be included, such as A.V.C. and visual tuning.

"It should not be necessary to get out of a comfortable chair to manipulate the wireless controls, and a consolette model on a dwarf stand is indicated.

"A point which requires ventilating is the question of A.V.C. Some of your readers seem to think that A.V.C. is overrated and unnecessary. When a wireless set is in the vicinity of a transmitter station, and its use practically confined to the programme issued therefrom, it would appear that fading is not troublesome; but where the wireless set is situated some distance from the transmitter, then some form of A.V.C. is necessary.

"Your 'Crusader' design AC/DC.5 seemed to me to be the ideal machine for construction by an amateur, and in order to make myself familiar with the details I drew out the machine to full size, using coloured pencils to show the various circuits.

"I first tried two types of indoor aerials without success, then three kinds of outside aerials; mains interference had already been dealt with but still crackles were terrible; however, a metallised down lead connected to earth finally solved this problem; the efficiency of aerials seems to vary in inverse proportion to the cost."

# TELEVISION FOR ALL

## A FILM SCANNER RECEIVER

By H. J. BARTON CHAPPLE, B.Sc., A.M.I.E.E.

JUDGING from the number of letters received from readers asking for further details, it would appear that the short note which appeared on page 616 of our issue dated Jan. 19th, 1935, describing a simple television receiver of rather a novel character, appealed to the constructional instincts of those who desired yet another method for reproducing low-definition television pictures. It will be recalled that instead of the more usual disc, mirror drum, cathode-ray or mirror screw methods of scanning, the writer showed briefly how a continuous length of black celluloid film strip would be employed to scan the modulated glow of a simple neon lamp connected to the output of a television set receiving the radiated signals from the London National station.

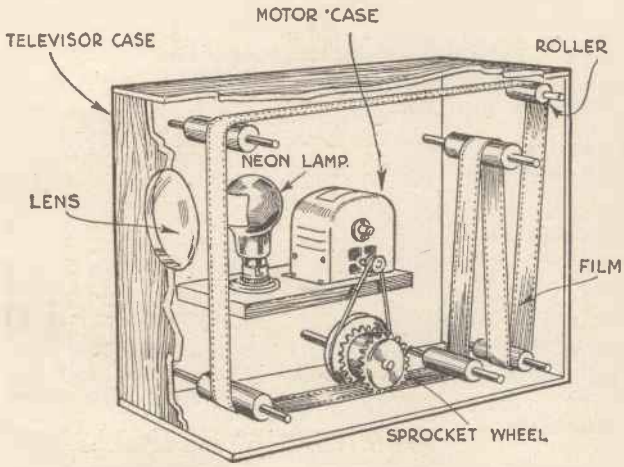



*Fig. 1.—Constructional details of a film scanner receiver.*

The idea is really not a new one, having been proposed on several occasions, but in the majority of cases difficulty is experienced in knowing exactly how to employ the film efficiently, coupled with the details of scanning aperture size and positioning.

The design proposed originally is reproduced in Fig. 1, and it is suggested that the best film for the purpose is the standard black 35 millimetre such as is used in the modern talking films of to-day, being known generally as "black spacing." It can be obtained from any large photographic stores. It is essential that the film be entirely free from any flaws, cracks, or scratches, otherwise this will cause extraneous light to pass through from the neon lamp at points other than the scanning holes, and thus mar the picture.

### Preparing the Film

The first task is to prepare the film for the scanning holes. With an ordinary scanning disc the resultant picture is slightly wedge-shaped with concentric circular inner and outer boundaries, but by using this film scanner the shape is quite rectangular, and the slight mechanical distortion thus avoided. With the standard 35 millimetre film there is a central blank section, while running down both sides are the sprocket holes which engage in the teeth of a sprocket wheel in order to drive the film at its correct speed. The clear space between the inner edges of these sprocket holes is almost 1in., so that, as it is necessary to have thirty strips in the picture, the size of each hole can very conveniently be made 1/32in. This is a trifle larger than the .028in. hole employed for a 20in. diameter scanning disc. The picture width thus becomes 15/16in., and since the picture ratio is seven vertical to three horizontal the total picture height is 2 3/16in.

### A Marking-out Template

Various methods will suggest themselves to the reader for marking out the scanning hole positions, but one of the best from the point of view of accuracy is to proceed on the following lines. Obtain a piece of flat, thin sheet aluminium whose width is cut to *exactly* 35 millimetres, that is the film width. A 3in. length of this will suffice for our purpose. Cut out from the centre of this a rectangular hole *exactly* 15/16in. wide and 2 3/16in. long, as shown in Fig. 2. This aperture now represents the true picture size, and along the bottom edge can be marked off with a steel rule the thirty 1/32in. divisions to represent the picture strip positions as indicated in Fig. 2.

Since there are thirty strip lengths in one complete picture scan the total length of film involved for this purpose is 30 x 2 3/16in., that is 65⅝in. It is advisable, therefore, to obtain a length of about 7ft.—the spare will be used for other purposes to be mentioned later. Since the film length used has to be joined together to form a continuous loop it is essential that at the lapped joint the sprocket holes should register. Now the exact distance between the sprocket hole centres for a standard 35-millimetre film is 0.187in., and the film length required takes in an exact number of sprocket holes to within a hundredth of an inch, which is quite satisfactory for all practical purposes.

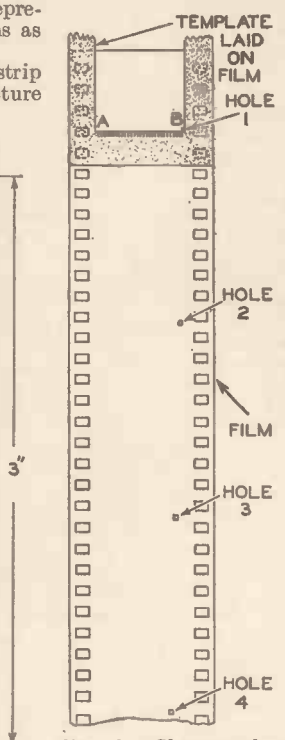



*Fig. 2.—Details of the metal template.*

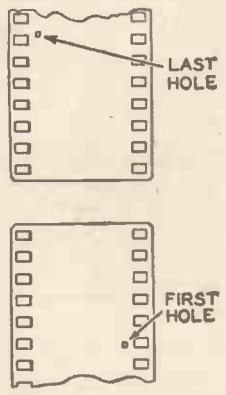



*Fig. 4.—The two film ends showing the first and last scanning holes and the trimmed edges.*

### Marking Out

It is now necessary to obtain a square silver steel hole perforator having a 1/32in. side. This can, with care, be ground down from a steel knitting needle or, alternatively, purchased from an instrument-maker's shop. It should taper at the end to a point, but apart from the short length of taper be parallel sided to ensure a square hole.

Reverting for the moment to the film itself it will be noticed that one surface is bright while the other is of dull, black character, and it is the latter which is the emulsified surface, and for scanning purposes (see Fig. 1) should face the observer, leaving the bright side towards the lamp. Hole perforations are made preferably with this emulsified surface uppermost.




*Fig. 3.—Showing how the separate scanning holes are marked off on the film.*

Trim up the end of the film with a pair of scissors so that the trim line (which should be at right angles to the film edge) just bisects the space between the sprocket holes, as shown in Fig. 3. Place the bottom edge of the template aperture three or four sprocket holes down from this top trimmed edge, and mark off the position of the first scanning aperture, using a needle point to make the punch positioning lines (see Fig. 3). The needle can be inserted eye end first into a piece of wood to act as a holder for this purpose. Extreme care must be taken not to scratch wrong lines on the emulsion side of the film. Since the template has been made exactly the film width it will register quite well with the sides, and give an accurate hole positioning, the first hole being on the extreme right of the divisioned edge AB of the template.

Slide the template *down* the film so that the top edge of the aperture coincides with

the bottom line of the first scanning hole, and mark hole 2, which is the next division in to the left on line AB. Repeat this process for each of the other holes in turn until the positions of the thirty have been located. If care has been taken and the metal template back is smooth, no defacing marks will have been made on the emulsion.

### Looping the Film

It is now necessary to loop the film and make the joint, it being borne in mind that the length of film between the first and last holes where the join is to be made is exactly equal to that between any other two holes, namely, 2 3/16in. This can be measured with the aid of the template and, as was stated earlier, this will enable the lapped sprocket holes to coincide, an essential feature for proper running.

The film must be cut so that there is an additional length equal to the distance between lines which bisect the space between sprocket-hole edges. Trim the film edge in a straight line as before—see Fig. 4—and just nick off the corners of the film as shown so that there is no chance of the film buckling at the corners when joined.

### Making a Join

Film jointing is a very specialised process, and it is suggested that the novice tries his hand by making one or two lapped joints with some of the film which is left over. First of all make up the cement, obtaining for this purpose a small bottle of amyl acetate. Into this should be dissolved some celluloid. With hot water clean the emulsion off about 6in. of the spare film, and cutting this up into small pieces dissolve it, a few pieces at a time, in the amyl acetate until the liquid is about the consistency of thick engine oil.

Wet the emulsion at one end of the film length to be joined to a depth shown as XY in Fig. 5, and using a blunt-edged metal instrument, such as a nail file (this is to avoid scratching the film surface) scrape away the emulsion carefully so that the film is quite clean. Dry this, and then with a small camel-hair brush paint on a very thin layer of the film cement. Now lap over the other end of the film loop so that the sprocket holes exactly register, and apply pressure with a flat surface, such as a book, until the joint is securely made. If carried out properly the joint will be a strong one, and the opacity of the film in no way damaged. The loop should now be examined carefully for any scratches or removal of emulsion, and if present they can be made good by painting them over with indian ink.

### Punching the Holes

In order to make the scanning holes in the film it should be laid on a piece of

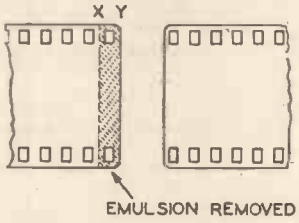



*Fig. 5.—Preparing the film for jointing.*

smooth wood and the punch placed accurately on the markings measured with the template. Now perforate the film and, removing it from the wood block, gently push the punch through so that the hole is a clear one with sides parallel to the film

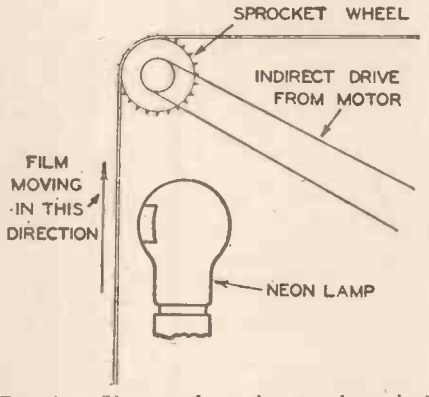



*Fig. 6.—Showing how the sprocket wheel should act as a drive on the film.*

edge. It is advisable to practise this operation on a spare piece of film to ensure that the film is in no way torn or damaged, otherwise the whole process must be repeated right from the beginning. When the thirty holes are made the only task that remains is one of assembly.

The home constructor can now give full rein to his own ingenuity, taking the suggestion shown in Fig. 1 as a basis. The sprocket wheel which acts as the drive on the film is an expensive item if bought new—their price is in the neighbourhood of £2, depending on the diameter of the wheel. A good second-hand one should therefore be obtained and cleaned thoroughly. The double set of teeth of this wheel engage in the perforations down each side of the film and it is strongly recommended that the wheel be placed in such a position that it is wrapped round by the film at least for a quarter of its circumference. In the position indicated in Fig. 1 the film is very apt to tear at the perforations, and the drive will be better if arranged as in Fig. 6.

### Assembly Details

The number and positions of the rollers will depend on the final size it is intended to make the cabinet, but where possible keep these auxiliary rollers down to the barest minimum. Also allow for the tension on the film to be adjusted to a nicety. If too taut it is liable to break, and if too slack it may jump the teeth in the driving sprocket wheel.

The drive between the sprocket wheel and the motor should be an indirect one, using a leather or rubber belt. The speed with which the motor must run is dependent on the diameters of both the sprocket wheel and its own pulley, as well as the pulley on the motor shaft. The calculations for this are quite easy, however, if it is borne in mind that the whole length of the film has to travel past the neon lamp 12½ times per second.

Reduce the strain on the film when starting up by ensuring that the motor begins its motion very slowly and maintains a slow and steady acceleration until the correct running speed is attained. It will be necessary to make a mask to position between the film and the magnifying lens in order to prevent light from the neon lamp passing through the sprocket holes when looking in. This is quite a simple matter, however, and readers who take the trouble to build up a receiver of this nature will be pleased with the results that are obtained. One final point, do not forget that it is the emulsion side of the film which faces towards the observer while the film travels upwards in order that the scanning holes have their vertical motion and so create the light strips in a right to left direction.

## Interesting Scanning Systems

TELEVISION undoubtedly has been well seasoned if only from the point of view of the numerous suggestions which have been made for carrying out the process of scanning. Paul Nipkow, whom the Germans regard as the "Father of Television," has recently been honoured in his own country for the simple apertured disc device which he patented as a scanning device as long ago as 1885. To celebrate his seventy-fourth birthday he was presented with a modern high-definition cathode-ray tube television set for vision and sound reception on the ultra short-waves. The principles established by Nipkow's original device have been applied in television systems all over the world, but as substitutes for this there are many forms.

### The Iconoscope

For example, it will no doubt come as a surprise to readers to know that Zworykin, who has come to the fore recently as a result of his ingenious Iconoscope, once pinned his faith in a method of spiral scanning which employed two prisms rotating at slightly different speeds to bring about the desired exploring sequence. A mathematically inspired inventor named Mohr used a scanning disc, but realising that the action of an aperture of finite size introduced distortion, he incorporated in both his transmitting and receiving equipment properly designed filter circuits to compensate for the error. It is interesting to note that the B.B.C., with their low-definition apparatus, embody aperture correctors in a predetermined position in one of the vision-signal amplifiers.

### Piezo-electric Crystal

The vibration of a piezo-electric crystal under the electrical stress of an alternating or pulsating current was brought to bear by Whittier for his scanning device. He "harnessed" the vibrations from a pair of these to a small mirror, but encountered considerable difficulty from the lack of constancy of action due to changes in temperature and pressure, while the minute amount of crystal movement produced trouble when steps were taken to "amplify" it.

A compound spring, at the end of which was a photo-electric point, was the transmitting scanner proposed by Rtcheouloff, while his receiver duplicated the apparatus, except that a fluorescent point replaced the photo-electric one. The required two dimensional scan, however, was very difficult to regularise, while to synchronise the action between transmitter and receiver added a complication which served ultimately to relegate the idea to one of historic interest. Many other ideas could be quoted, indeed, some of them have already been described in the pages of PRACTICAL AND AMATEUR WIRELESS, but the few mentioned show that inventors have not been wanting in this intriguing science of television.

# SHORT WAVE SECTION

## At the Short-waver's Bench—10

Reaction Effects and Mains-fed Output Stages are Among the Subjects Dealt With in this Article

### Dirty Contacts in the Short-wave Set

THE need for clean contacts in the short-waver cannot be emphasised too strongly, particularly in regard to the H.F. side of the circuit. This fact was recently brought home to me rather forcibly when my own short-waver refused to oscillate. It is of triple-range design, wave-changing being effected by means of two push-pull switches. It was not until one of these switches was rotated, and the contacts thus cleaned, that the set would work again. No trouble has ever arisen when the switch in question has been used in a broadcast-band set, nor in fact was any vestige of a dirty contact discernable. Nevertheless, it serves as a reminder of the desirability of seeing that all such contacts are electrically clean.

### A Curious Aerial Coupling Effect

Incidentally, it was whilst using the set referred to above that an interesting method of increasing the volume was discovered. The circuit of the set shown in Fig. 1 is the conventional form of three-valve short-waver, incorporating an H.F. pentode across the grid circuit, of which the aerial is coupled by means of an H.F. choke. It was found that if the aerial was wound once round the intervalve short-wave coil and then led to the aerial terminal, a tremendous increase in sensitivity and volume resulted. This was definitely not due to the inefficiency of the H.F. stage, as with the aerial removed from the aerial terminal and merely wound around the coil, working the set as a two-valver, signals were very weak indeed. The increased efficiency was no doubt due to the aerial causing a certain amount of feed-back between the anode and grid of the H.F. valve. In other words, a minor form of reaction effect obtained which leads to the suggestion that the experiment of adding reaction to this valve might be tried. It should be possible to react into the H.F. choke, or a tuned circuit with reaction might be tried. In the latter case some careful screening would no doubt be required.

### Variable Control of the Screening-grid

It will be noticed, by reference to Fig. 1. that the screening-grid voltage of the H.F. valve is obtained *via* a variable potentiometer. I have found that this assists to a great extent in obtaining the maximum sensitivity of the valve. In one of my sets the optimum position is quite critical, and enormously improved results are obtained by setting the potentiometer correctly. As readers doubtless are aware, variation of the screening-grid voltage can prove quite a useful reaction control, and such an arrangement may assist those who desire to carry out the suggestion outlined in the previous paragraph.

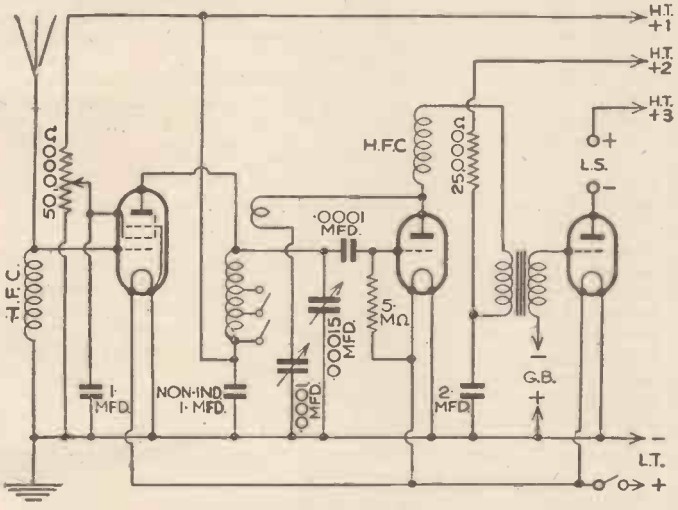



*Fig. 1. (left)—To obtain maximum sensitivity in an H.F. stage, the S.G. potentiometer proves very valuable.*

### The Position of the Reaction Coil

Continuing to discuss reaction, here is a hint which may prove useful to those readers who prefer to use a short-waver without a pre-detector H.F. stage. It is in regard to the reaction coil which should be placed between the grid coil and the aerial coupling coil. The idea is shown in Fig. 2, and its advantages are, firstly, that, reaction being introduced into the aerial circuit, its damping effect is reduced and its losses are minimised; secondly, the aerial has a much less effect upon the tuning of the grid circuit, and dead spots, "wobble" due to the aerial swinging, and similar aerial troubles are very much lessened. An extension of this idea, but which has not all its advantages, is to combine the reaction and aerial coupling coil into one, as shown in Fig. 3. This is particularly useful where the advantages of a special aerial coupling coil are desired,

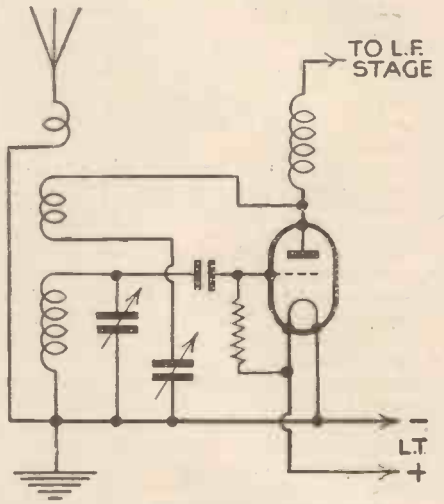



*Fig. 2.—Improved reaction effects may be obtained by placing the reaction winding between the aerial and grid coils.*

but the coil in use has not such a winding incorporated.

### Mains-fed Output Stages

There is at present on the market an extremely useful pentode. It has an extraordinarily high value of mutual conductance providing a large output

(*Continued overleaf*)

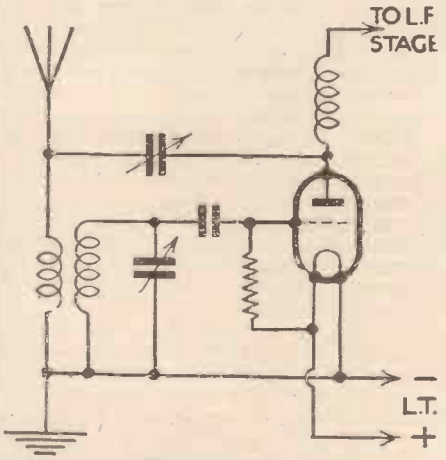



*Fig. 3.—A modification of Fig. 2 which has some of its advantages.*

## AT THE SHORT-WAVER'S BENCH

(*Continued from previous page*)

from a small input. This means that one L.F. stage only is required, with a consequent minimising of background noises, valve noise, and hum, etc. The one snag for those who prefer battery short-wavers is that this valve is for use with A.C. mains. Many cannot bear the thought of an all-A.C. short-waver, due to the trouble in eradicating hum. Most of this trouble originates in the detector stage, and in Fig. 4 is shown a useful battery-cum-mains "two" in which the background should be as dead as an all-battery set, with the consequent advantage due to the use of the special mains pentode with a very large output. This particular circuit is suggested as a basis for experiment, but if it is built up as shown some loading will be required on the filament winding in order that the rise in voltage as a result of using only one valve may not overrun that valve's heater.

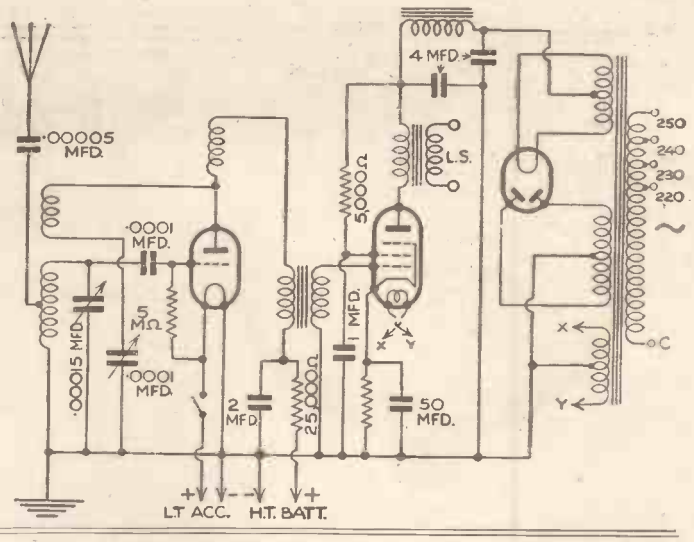



*Fig. 4.—A suggested scheme for using a battery L.T. supply as well as a mains supply for a short-wave set. The use of the battery supply for the detector valve removes the risk of hum.*

# Leaves from a Short-wave Log

### "Veri" Cards

IF you happen to possess, amongst your friends or acquaintances, some enthusiastic short-wave listeners, you will notice when they get together how frequently in the course of conversation they refer to "veris," conditions of reception, types of receivers used, and so on. You may boast of the transmissions you have received as much as you like, but although many may be willing to believe in all the captures you have made, your case is considerably strengthened if you can show a batch of official confirmations from the stations logged. This confirmatory evidence, or "veri," can be obtained from most experimental transmitters under certain conditions, as most of them welcome reports of reception from distant listeners. But bear in mind that before a station will grant this request it requires details proving that the broadcast was heard by you.

### The Required Particulars

The particulars you should report must include date, wavelength or frequency, details of items heard, with time, if possible, against each, audibility and readability of signals, to which you might add weather conditions, and so on; in fact, any information which may prove of interest to the transmitting station. In every instance do not fail to enclose an International postal reply coupon, which can be obtained at most post offices and which, exchanged by the addressee, will cover the cost of his reply to you. (It is useless to send a man dwelling in a foreign country an envelope addressed to you and bearing a British stamp!). Bear in mind also that commercial stations as a rule do not acknowledge reception reports inasmuch as their transmissions, being mostly of a private nature, are not intended for the general public.

A collection of "veri's" is an interesting one, as in many instances the stations send cards with full particulars of their transmitters, and in the case, say, of South American studios, even go to the length of giving photographic views and pictures of their cities or towns. If you take up short-wave listening in a serious way, it is well worth your while to secure confirmations to add to your log.

### Distinctive Names for S. Waves

Another matter which was impressed upon me recently when talking with some beginners is the necessity to give distinctive names to short waves. The term short wave is too vague, and is so loosely used by general listeners for the broadcasting band of 200-600 metres; these are, of course, medium waves, and must remain so if we wish to avoid confusion. By short waves we cover from, say, 10-200 metres; below this we must refer to metre-waves, and in scientific quarters one talks glibly of decimeters and so on. The best method, in my opinion, for what the average listener calls "short wave" is to classify stations in the 20, 30, 40 or other metre bands.

Sometimes when I have done so, I have been asked for a more accurate wavelength, but this precise information is not always necessary, as if you are told that a station works in a particular band, in practice this covers roughly 10 metres, so that although you may not, at the time, know the exact frequency, your search has been considerably narrowed down. If you are told the band in which it works, namely, 20, 30, 40, 50 metres and so on, you can pick out a station from even the longest wavelength list in a few seconds.

### Broadcasts from French Liner *Normandie*

Although it had been stated that the new French liner *Normandie* on her first trip would relay broadcasts of her orchestral concerts to the PTT network, for the benefit of listeners, apparently this was not done, as against this tests were carried out with W2XBJ, one of the Rocky Point (New York) experimental stations, as well as with WQO and WEL, also Rocky Point, with which the liner was in communication. The wavelength used by FNSK, s.s. *Normandie*, was roughly 22.70 metres, but as the modulator was not working properly the National Broadcasting Company, who had hoped to take a concert, did not do so. The ship is entitled to use channels comprised in the following bands: 16.85-18.27; 22.50-24.30; 33.93-36.58 metres, and so on. For your guidance, WQO and WEL, Rocky Point (New York) operate respectively on 44.61 metres (6,725 kc/s) and 33.52 metres (8,950 kc/s). However, there is no doubt that on her next trips further attempts will be made to transmit radio entertainments, and it would be worth while instituting a search for the liner's channels in the near future.

### Bowmanville (Ontario)

VE9GW, Bowmanville, on 49.26 metres (6,090 kc/s), the short-wave relay of CRCT, at Toronto, has made some alterations in its time schedule. The station is now on the air on Mondays, Tuesdays, and Wednesdays from B.S.T. 21.00-03.00; on Thursdays, Fridays, and Saturdays from B.S.T. 13.00-05.00, and on Sundays from B.S.T. 18.00-02.00. The call is as follows: *This is VE9GW, the Canadian Radio Commission station operating on a frequency of* 6,090 *kilocycles, at Bowmanville, Ontario, in the Dominion of Canada.* It is given every fifteen minutes, as is customary with most North American studios.

### African Broadcasts

Another station in that neighbourhood of which one seldom sees reports is Johannesburg (ZTJ), on 49.2 metres (6,097 kc/s), the short-wave 5-kilowatt outlet of the African Broadcasting Company's radio programmes. The transmissions are made in both English and Afrikaans (Cape Dutch), and the times of broadcasts are now B.S.T. 10.00-13.00; 15.00-21.30 daily. It is still an experimental transmitter and has also been heard at other hours of the evening.

### Radio-Colonial Again

Finally, Radio-Colonial, Paris-Pontoise, on 25.23 metres (11,880 kc/s), is now working from B.S.T. 17.00-20.00, in order to link up the No. 2 and No. 3 broadcasts. On 19.68 metres (15,243 kc/s), in addition to the B.S.T. 13.00-17.00 transmissions, a special programme is broadcast daily between B.S.T. 09.00-10.00 for listeners in New Caledonia; it consists of a thirty minutes' record recital, followed by a news bulletin.

# 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.*

**A.-A.R. & T.S. DANCE ORCHESTRA**

MEMBERS in the London area will have a chance of hearing the newly-formed Anglo-American Radio and Television Socicty Dance Orchestra in the near future. Arrangements are being made whereby it is hoped to broadcast this orchestra during the monthly concerts broadcast from Radio-Normandie by courtesy of the International Broadcasting Company of London.

Several auxiliary orchestras are being organised, and readers who would like to join these should send particulars to Mr. Leslie W. Orton, at "Kingsthorpe," Willowbank, Uxbridge.

Lady readers in Ireland should note that Miss Mae Mack, of 110, Rock Road, Booterstown, Co. Dublin, I.F.S., has been appointed Irish Representative of the Ladies' Section of the Anglo-American Radio and Television Society.

The society is holding a picnic at Ruislip Reservoir on August 11th. There are no charges and readers are invited. Boat, running, and swimming races will be among the attractions, whilst it is hoped that a section of the Anglo-American Radio and Television Society Dance Band will entertain during the day.

**S.-W. RADIO AND TELEVISION SOCIETY (THORNTON HEATH)**

THIS branch of the society held a Field Day on Sunday, the 16th instant. A spot in the heart of Surrey was selected for the erection of a transmitter, working on 40 metres, by Mr. C. H. P. Nutter (G5DB), the other members of the society being divided into small parties, each with a directional receiving apparatus. Each party was equipped with compass and map and received instructions to proceed to a given point about four or five miles distant from the transmitter, which was to all intents and purposes enclosed in a circle.

The transmission was commenced at 11 o'clock with the microphone by Mr. Nutter calling in turn each of the parties at fifteen-minute intervals until 12.30 p.m., when the morse key was substituted.

The parties started off in brilliant sunshine, but later met with torrential rain and thunderstorm. In spite of this the members carried on and all but one party succeeded in locating the transmitter.

Mr. R. E. G. Copp, one of the members of the society and the owner of a ciné camera, took moving pictures showing the erection of the transmitter and of the various parties as they arrived.

At the weekly meeting of the society, held at St. Paul's Hall, Norfolk Road, on Tuesday, the 18th instant, the members concerned gave their experiences, describing the construction of the receiver used and the compass readings obtained which were confirmed by the fact that they located the transmitter.

Each party had received a sealed envelope containing directions for finding the transmitter if they had not already succeeded in doing so by 3 p.m., and the one party who failed to do so put this down to the fact that they had been given a spot which is notoriously bad for short-wave reception.

In spite of the bad weather encountered, all the members expressed the wish to hold another Field Day later on in the season.

The secretary of the society is Mr. Jas. T. Webber, of 368, Brigstock Road, Thornton Heath, from whom full particulars of forthcoming lectures and demonstrations can be obtained.

**SLADE RADIO**

A DEMONSTRATION of the latest McMichael No. 135 radio set was given on June 13th. Our member, Mr. Jefferies, demonstrated this and then gave the six main reasons governing its design. He then explained the technical points and told the members how the set had been tested directly under a local broadcast aerial. In this position there was sufficient selectivity to bring in foreign stations, yet when tuned to the local broadcast, there was no overloading of the output valve at full volume. The quality proved to be of a very high order indeed. Hon Sec., C. Game, 40, West Drive, Heathfield Park, Handsworth, Birmingham.

# LETTERS FROM READERS

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

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

## Signal Fade-outs

DEAR THERMION,—A short while ago I was interested to read in your columns an account of a "fade-out" which occurred on the amateur band some weeks ago. I also noticed this "fade-out" and heard the Coventry man to whom you referred. On June 2nd I had another similar experience on 7 metres. This fade-out occurred at about 11 a.m. and lasted for about ten minutes. The band, hitherto full of statics (I logged twenty that morning) suddenly went dead except for one or two C.W.s and 'phone stations. Shortly after the stations came back with increased strength. Nothing was wrong with the set as the stations came in later at good strength on the speaker without any alteration. The receiver was a Det. 2LF with band spreading on tuning and reaction. The aerial is an outside one of the inverted L type, with a top which is half wave for the 40-metre band.

With regard to crooners, more power to your elbow, and more studs to your boot!—R. A. TETT (Salisbury).

## Midget Sets

SIR,—What is wanted is a light, portable set built into an ordinary fibre attache case for reception of the Droitwich, Regional, and local station, with a frame aerial built inside the lid. Such a set would be for 'phones only, but if used in conjunction with an outdoor or good indoor aerial, it should work a small loud-speaker of the balanced armature type.—ROBERT T. SIMMS (Parkstone).

## Hall-Mark Battery Four

SIR,—I have built the Hall-Mark Battery Four receiver and am getting very good results with it, quality and volume being all that could be desired. The H.T. supply is through an H.T. eliminator giving 30 m.a. at 150 volts.—J. A. LEWIS (Wallasey).

## Interesting Amateur S.W. Logs

SIR,—I noticed a letter from a reader in your issue dated June 15th asking for reports of short-wave amateur transmissions. Here is a list of "Ham" stations I have heard during the past few weeks on the 20-metre band on 'phones:—

Between 8 p.m. and 2 a.m. B.S.T. VP6YB — Barbados, VP5IS — Jamaica, VP9R — Bermuda, HP1A — Panama, HC1FG—Ecuador, TI2FG—Costa Rica, HI7G—Santo Domingo, K4SA—Porto Rico, CO2HY, CO2WZ, CO2LL, CO2KC, CO6OM—Cuba, VO1I, VO1P—Newfoundland, VE1CR—Nova Scotia, VE3HC, VE3HE, VE2BG—Canada, SU1CH—Egypt, W9BPK—Minneapolis, W9BPM—Grand Forks, N.D., W9EEL—Elkhorn, Wis., W9BRX—Wheaton, Ill., W8IV, Argyle, N.Y., W8CDW—Mt. Sterling, Ohio, W4ZF—Leaksville, N.C., W5ZS—La., and many more W and VE stations.

Between 5 a.m. and 7 a.m. B.S.T. during the past week I have heard the following 20-metre stations on 'phones:—W6CZ, W6CLH—Los Angeles, W6BAY—San Francisco, W6ITH—Berkeley, W6DDA—North Hollywood, W6BYW—Santa Cruz (all California), and W7QC—Bonners Ferry, Idaho.

The United States amateurs use code only on the 40-metre band, but many Spanish-speaking stations can be heard throughout the night.

On the 75-metres amateur band several W and VE stations can be heard on 'phones, but static is rather bad on that band at present, and Dutch and English amateurs are the only ones that are heard consistently.

English 'phone stations can be heard well on all bands except 20 metres. The 40-metre band on a Sunday forenoon is alive with British 'phones.

My receiver is a two-valve, detector and pentode, battery driven with 140 volts. My aerial is 70 feet long, 25 feet high and runs east and west. Reception is on 'phones.

Trusting this information will be of use to other readers.—DUNCAN T. DONALDSON (Kelty, Scotland).

SIR,—The following list of British amateurs may be of interest to your readers. I logged them all on the 40 metres waveband with your "Beginner's Short-Waver," described in your March 16th issue. I am particularly proud of this log as I am only sixteen years of age, and have only just started short-wave work.

The following stations were logged on two Sunday forenoons.

G6SR (Edn.), R8; G6RL; G5KW; G5TB; G6KB (Bristol); G6PY; G5AW; G5AU; G6VK; G5UK; G5YG; G6VF (Bristol); G5LC; G5TP; G5TZ; G6XR; G5PP (Coventry); G5CY; G2XU; G6FS; G5BK; G5WW; G2NN; G6KV; G5PB; G5JW; G2IP; G6GB; G5ML (R7); G5TU; G2JD; G2PO; G2PL (Cambridge); G2MV (Surrey); G2PX; G2DD (Coventry); G2NS; G2TR (Oxford); G2PN; G2XO; G2LD; G2TM (Edinburgh) about R6; G2AO; EI6F (Dublin), very good transmission about R6 to 7); 6GO.—ERIC W. STEWART (Edinburgh).

## From the Falklands

SIR,—I feel I must write and express my gratitude to you for such a fine paper as PRACTICAL AND AMATEUR WIRELESS. I have been a reader of *Amateur Wireless* for the past four years, and prepared myself for a pleasant surprise when I saw the announcement that PRACTICAL WIRELESS and *Amateur Wireless* were to be amalgamated. I was not disappointed. May I suggest that we have more articles describing home-made components and sets. I built up a S.W. one-valver with home-made components, and I receive Daventry, W2XAF, DJC, Rome and many others. Daventry is over eight thousand miles distance from us. Wishing you every success. — EDWIN RUTTER (Falkland Islands).

## Suggestions for Midget Portable

SIR,—The article in June 8th issue dealing with midget portables is very interesting. I think that a suitable circuit for general purposes, hikers, cyclists, etc., would be a dual range 0—v—1 set for use with a flexible steel rule as aerial, and capable of receiving the Regionals and Daventry at a strength of R6 or R7 on a small speaker. For a light cabinet, an aluminium box chassis with carrying handle would prove quite strong enough for a set of such small dimensions.—J. CROSS (Reading).

## A Fine S.W. Log

SIR,—I have been a regular reader of PRACTICAL WIRELESS since it was recommended to me last June. Everything I have learned about wireless I have gleaned from its pages and also from your fine books which I got through your voucher scheme. I built the special one-valve short-waver (April 14th, '34) and the results are marvellous. On the 30-31 metre band some of the stations received are: W2XAF, EAQ, CT1AA, Daventry, Zeesen PRF5, Rio de Janeiro, VK3ME, and on the 25-metre band: KDKA, Pittsburg, YV3RC, Venezuela, FYA, Paris, PHI, Holland, and W1XAL. On 30.67 and 25.4 metres, Rome is a fine signal, as also is RNE, Moscow. On 19 metres, Zeesen, Vatican City, W2XAD, W8XK, PCJ, W1XAL, Boston, and W3XAL, Bound Brook are strong signals. Altogether, they constitute a wonderful log. Also, as an adaptor or convertor it is ideal. Might I suggest that you further extend the short-wave section and give us weekly problems that have more mathematics in them. Wishing your fine paper every success.—GERALD MCCAFFRIE (Killarney).

## A Battery Quality Set

SIR,—I would like to offer my sincere thanks and appreciation to PRACTICAL AND AMATEUR WIRELESS.

In respect of the quality set which readers ask for, I suggest a set having 2 V.M. H.F., Det. and three outputs—push-pull, pentode, and super-power, such as the Cossor 230X.P. In respect of the tuning, I suggest the aerial coil being tuned separately and having band-pass for the rest.—CLIFFORD CHAPPELL (Rochdale).

**CUT THIS OUT EACH WEEK.**

## Do you know

**—THAT a buried wire will often prove of value for distant reception during heavy atmospheric disturbances.**

**—THAT if a screened down-lead is employed with impedance-matching transformers, it is possible to run the wire for considerable distances without loss of signal strength.**

**—THAT phosphor-bronze has a resistance about four times as high as ordinary copper.**

**THAT silver has a lower resistance than copper.**

**THAT the metallised coating on a valve is of no use unless it is connected to earth.**

**—THAT practically all forms of screening must be joined to earth to be effective.**

**—THAT care should be exercised in arranging the switching for an H.F. and a Detector coil to avoid interaction in the leads.**

**—THAT special low-capacity switches are available for the above purpose.**

*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, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

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

# Facts & Figures

## COMPONENTS TESTED IN OUR LABORATORY

### Cossor Universal Receiver

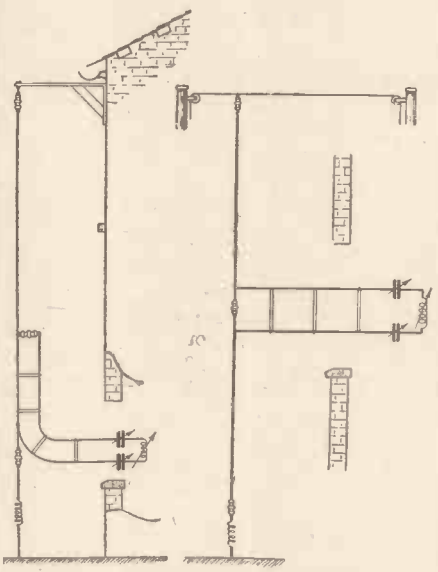
COSSOR'S are entering the "Universal" field with a receiver which caters, as do most of the sets in the Cossor range, for the man of moderate means. In spite of the exceptionally low price (£8 18s. 6d. complete), the specification includes every modern development applicable to a receiver of this description. It is designed to work equally well on either direct or alternating current and is obviously a boon to the listener, the nature of whose supply may change owing either to the advent of the grid scheme or to the possibility of a change of address.

The valve team is particularly strong, a variable-mu H.F. pentode being used in the first stage, followed by an H.F. pentode as detector, a super-power valve in the output, and an indirectly-heated valve rectifier. The super-power output valve works in conjunction with a specially designed moving-coil loud-speaker, which, like the pentode detector, is a feature scarcely ever found in receivers so moderately priced as this.

The particularly high degree of selectivity is obtained by the application of the Super-Ferrodyne principles which have been developed in the Cossor laboratories. This employs special iron-cored coils in conjunction with the pentode detector. The Cossor model 369 will log all worthwhile European stations on quite a small aerial, while the super-power output valve will easily deliver ample volume for domestic use, with perfect quality.

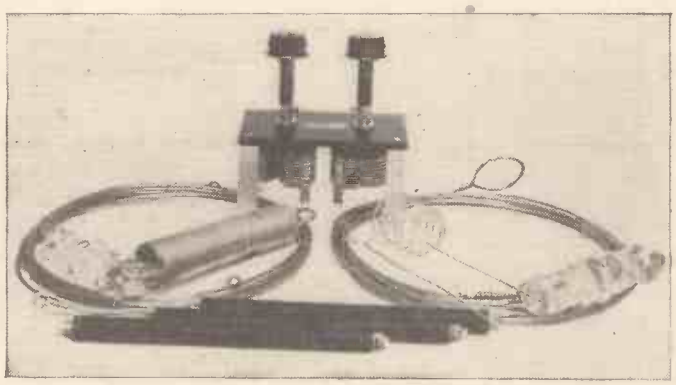
### B.T.S. Short-wave Aerial Kit

FOR maximum results on the short waves it is necessary to design the aerial system on certain lines. Amateur transmitters are well aware of the importance of this matter, and the range of a station can be increased enormously when the aerial design is right. For the amateur short-wave station the new B.T.S. aerial kit will prove especially valuable as it contains all the essentials of a good dipole system, although it may be adapted for use on any particular scheme favoured by the amateur. As will be seen from the illustration at the foot of this page, the kit consists of a length of 7/22 stranded aerial wire and a length of similar wire for lead-in purposes. In addition there are two highly efficient specially-designed glass short-wave insulators and a tensioning spring. To space the leading-in wires a number of ebonite spacers are provided and these are tapped and provided with a screw at each end. Lugs are soldered to the aerial and lead in to accommodate these screws, and for connection to the receiver there is a small coil and a pair of low-capacity condensers mounted on a small table. Two methods of using



*Two suggested methods of using the new B.T.S. short-wave aerial kit which is illustrated below.*

the arrangement are illustrated above, but other schemes may be adopted at the discretion of the user. The price of the complete equipment is 21s., and those readers who experience interference on short waves, or who are desirous of improving their short-wave reception, should try the equipment in one of the approved schemes.



*Short-wave aerial equipment made by the B.T.S. Co*

## 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.*

**R. E. B (Penywana).** Undoubtedly there is something wrong, but we cannot suggest where from the details which you give. It would appear that either the tuning circuit is defective, or the first stages in the set are not functioning, either because the valves are defective or from some wiring fault. We would advise very careful checking of voltages, etc.

**W. C. (South Tottenham).** As the receiver does not function satisfactorily with the pick-up it rather points to a faulty L.F. circuit, but we cannot state where without further details. We presume you have checked the wiring carefully and have made certain that all components are in order. Are the valves in good condition?

**G. M. (Blackburn).** The fitting of a super-power valve in the last stage, with appropriate H.T. and G.B., will improve the low-note response. The loud-speaker must, of course, be correctly matched and capable of reproducing the bass.

**C. C. 1597 (Kurseong).** As your wiring is identical with the blueprint it is obvious that one of the joints must be poor—probably a dry joint—and this is causing the trouble. Although you state you have re-wired, you probably left this bad connection in position. Alternatively, the resistance is internally disconnected or otherwise broken, and is thus preventing H.T. from being applied to the first valve.

**C. C. (Rochdale).** We regret that we cannot help you, as the coils as described are unknown to us. We cannot understand why the makers, whose name appears on the coil, cannot give you the information asked for.

**B. A. B. (Hove).** We have no blueprint of an amplifier on the lines you mention. Any standard L.F. section of a broadcast receiver should be suitable.

**J. W. H. (Luton).** We have not described an S.G. four with Class B and the coils you mention. The only Class B4 we can recommend (the Radiopax Class B Four) employs a commercial band-pass tuner.

**J. M. (Glasgow).** It is probable that as the mica is broken the two plates of the trimmer short-circuit. On the other hand, it may be that instability sets in when the circuits are in tune.

**L. H. (Wimbledon).** Without a circuit diagram it is difficult to diagnose the fault. It would appear, however, that owing to the ganged switching there is interaction between the two coils and this is causing the trouble.

**H. S. W. (Thornton Heath).** The pentode will give extra punch. Wire a 5-pin holder instead of a 4-pin in the output stage, and connect the four pins which are in the same positions as in the blueprint, as shown there. The extra pin should then be joined to H.T. positive at a point about 100 volts positive.

**J. W. N. (Kirkby).** The trouble is probably L.F. oscillation, and we would suggest that you fit further decoupling, or increase the values of the decoupling resistances and condensers. An output filter might also prove of value.

**W. J. D. (Goole).** The gauge of the Litz wire may be 27/42, although a value near this will prove equally suitable.

**T. D. M. (Mountain Ash).** We regret that we cannot diagnose your trouble, as we are not familiar with the internal wiring of the commercial receiver you are using. We would advise you to communicate with the makers, and they will no doubt be able to assist you.

**W. R. H. (Enfield).** The noise you refer to points to a faulty circuit, and we would advise you to communicate with the makers of the receiver or a local service-agent.

**R. A. (Timperley).** We regret that we have no details of a single-valve A.C. receiver of the type required.

**J. G. (Harefield).** We regret that we have no blueprint of a receiver using the parts you list. We would suggest that you take any standard 3-valve set and use your parts, but we cannot give you any guarantee of performance, and we cannot recognize your coil from the description.

**B. M. (S.E.).** As yours is a commercial receiver with which we are unfamiliar, we would recommend you to consult the makers or a local service-agent.

**J. A. S. (Kuala Lumpur).** We would suggest that you communicate with the Premier Supply Stores, 20-22, High Street, Clapham, S.W.4, or Electradix Radios, Upper Thames Street, London, E.C.4.

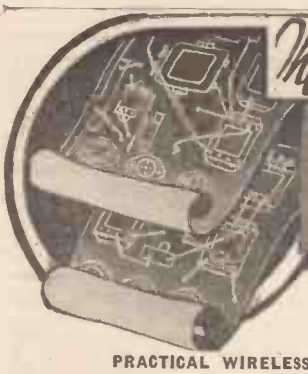
**F. M. C. (Belfast).** A suitable D.C. eliminator was described in our issue dated July 8th, 1933.

**G. R. C. (Peterboro).** We cannot give you the values of the resistances, as you have not given all the necessary data. The body of the resistance carries one colour, the tip another, and a spot or band is marked on the body of the resistance to designate the number of noughts. We have given the code on many occasions.

**E. S. (Harwich).** We cannot give you instructions for constructing a loud-speaker. Any good commercial component should prove quite suitable for your receiver.

**B. L. T. (Repton).** We cannot give you the wiring details in question. Probably the makers could supply the necessary information.

**F. B. (Newcastle).** No charge is made for verifications. Simply write to the station in question and give all information which will be of assistance to them but do not expect verifications from every station. Details were given in our issue dated May 11th, 1935



# The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

These blueprints are full-size. Copies of appropriate issues of "Practical Wireless," "Practical Mechanics," "Amateur Wireless" and of "Wireless Magazine" containing descriptions of these sets can in most cases be obtained at 4d., 7½d. and 1s. 3d. each, respectively, post paid. Index letters "P.W." refer to "Practical Wireless" sets, "P.M." to "Practical Mechanics" sets, "A.W." refer to "Amateur Wireless" sets, and "W.M." to "Wireless Magazine" sets. Send, preferably, a postal order (stamps over sixpence unacceptable) to "Practical and Amateur Wireless" Blueprint Dept., Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

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|---|---|---|
| **Blueprints, 1s. each.** | | |
| Long-Range Express Three | — | PW2 |
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| Argus Three | 12.11.32 | PW6 |
| Empire Short-Wave Three | 3.12.32 | PW7 |
| Solo Knob Three | 10.12.32 | PW8 |
| Midget Two | 17.12.32 | PW9 |
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| Three-Valve Push-Pull Detector Set | — | PW22 |
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| All-Wave Two | 19.8.33 | PW28 |
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| Premier Super | 23.9.33 | PW30 |
| Experimenter's Short-Wave Three | 23.9.33 | PW30A |
| A.C.-D.C. Two | 7.10.33 | PW31 |
| All-Wave Unipen | 14.10.33 | PW31A |
| F.J.C. 3-valve A.V.C. (Transfer Print) | — | PW32 |
| Luxus A.C. Superhet | 14.10.33 | PW33 |
| A.C. Quadpak | 2.12.33 | PW34 |
| Sixty-shilling Three | 2.12.33 | PW34A |
| Nucleon Class B. Four | 6.1.34 | PW34B |
| Fury Four Super | 27.1.34 | PW34C |
| A.C. Fury Four Super | 10.2.34 | PW34D |
| Leader Three | 10.3.34 | PW35 |
| D.C. Premier | 31.3.34 | PW35B |
| A.C. Leader | 7.4.34 | PW35C |
| Atom Lightweight Portable | 2.6.34 | PW36 |
| Ubique | 28.7.34 | PW36A |
| Four-Range Super-Mag. Two | 11.8.34 | PW36B |
| Summit Three | 18.8.34 | PW37 |
| Armada Mains Three | 18.8.34 | PW38 |
| Midget Short-Wave Two | 15.9.34 | PW38A |
| All-Pentode Three | 22.9.34 | PW39 |
| £5 Superhet Three | — | PW40 |
| A.C. £5 Superhet Three | 24.11.34 | PW43 |
| D.C. £5 Superhet Three | 1.12.34 | PW42 |
| Hall-Mark Three | 8.12.34 | PW41 |
| F. J. Camm's Universal £5 Superhet | 15.12.34 | PW44 |
| A.C. Hall-Mark | 26.1.35 | PW45 |
| Battery Hall-Mark 4 | 2.2.35 | PW46 |
| Universal Hall-Mark | 9.2.35 | PW47 |
| Hall-Mark Cadet | 23.3.35 | PW48 |
| Short-Wave Converter-Adapter | 23.2.35 | PW48A |
| F. J. Camm's Silver Souvenir (All-Wave Three) | 13.4.35 | PW49 |
| F. J. Camm's A.C. All-Wave Silver Souvenir Three | 11.5.35 | PW50 |
| Genet Midget Three | *June* '35 | PM1 |
| Cameo Midget Three | 8.6.35 | PW51 |

## AMATEUR WIRELESS AND WIRELESS MAGAZINE.

### CRYSTAL SETS.

| | | |
|---|---|---|
| **Blueprints, 6d. each.** | | |
| Four-station Crystal Set | — | AW427 |
| 1934 Crystal Set | 4.8.34 | AW444 |
| 150-mile Crystal Set | — | AW450 |

### STRAIGHT SETS. Battery Operated.

| | | |
|---|---|---|
| **One-valvers : Blueprints, 1s. each.** | | |
| B.B.C. One-valver | — | AW344 |
| B.B.C. Special One-valver | — | AW387 |
| Twenty-station Loud-speaker One-valver (Class B) | — | AW449 |
| **Two-valvers : Blueprints, 1s. each.** | | |
| Melody Ranger Two (D, Trans.) | — | AW388 |
| Full-volume Two (SG.-Det., Pen.) | 17.6.33 | AW392 |
| Iron-core Two (D, Trans.) | — | AW395 |
| Iron-core Two (D, QPP) | 12.8.33 | AW396 |
| 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 |
| Family Two (D, Trans.) | — | WM278 |
| **Three-valvers : Blueprints, 1s. each.** | | |
| £8 Radiogram (D, RC, Trans.) | — | AW343 |
| P.T.P. Three (Pentode-Triode-Pentode) | *June* '35 | WM389 |
| New Regional Three (D, RC, Trans) | 25.6.32 | AW349 |
| Class-B Three (D, Trans, Class B) | 22.4.33 | AW386 |
| New Britain's Favourite Three (D, Trans., Class B) | 15.7.33 | AW394 |
| Home-built Coil Three (SG, D, Trans) | 14.10.33 | 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) | 20.1.34 | AW417 |
| 1934 Ether Searcher, Chassis Model (SG, D, Pen) | 3.2.34 | AW419 |
| Lucerne Ranger (SG, D, Trans) | — | AW422 |
| Cossor Melody Maker with Lucerne Coils | — | AW423 |
| P.W.H. Mascot with Lucerne Coils (D, RC, Trans) | 17.3.34 | AW337A |
| Mullard Master Three with Lucerne Coils | — | AW424 |
| Pentaquester (HF Pen, D., Pen) | 14.4.34 | AW431 |
| £5 5s. Three: De-luxe Version (SG, D, Trans) | 19.5.34 | AW435 |
| Lucerne Straight Three (D, RC, Trans) | — | AW437 |
| All Britain Three (HFPen, D, Pen) | — | AW448 |
| "Wireless League" Three (HF Pen, D. Pen) | 3.1.34 | AW451 |
| Transportable Three (SG, D, Pen) | — | WM271 |
| Multi-Mag Three (D, 2 Trans) | — | WM288 |
| Percy Harris Radiogram (HF, D, Trans) | *Aug.* '32 | WM294 |
| £6 6s. Radiogram (D, RC, Trans) | *Apr.* '33 | WM318 |
| Simple-tune Three (SG, D, Pen) | *June* '33 | WM327 |
| Tyers Iron-core Three (SG, D, Pen) | *July* '33 | WM330 |
| C.-B Three (D, LF, Class B) | — | WM333 |
| Economy-pentode Three (SG, D, Pen) | *Oct.* '33 | WM337 |
| All-wave Three (D, 2LF) | *Jan.* '34 | WM348 |
| "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, QP21) | *June* '34 | WM362 |
| 1935 £6 6s. Battery Three (SG, D, Pen) | *Oct.* '34 | WM371 |
| Graduating to a Low-frequency Stage (D, 2LF) | *Jan.* '35 | WM378 |
| **Four-valvers : Blueprints, 1s. 6d. each.** | | |
| 65/- Four (SG, D, RC, Trans) | — | AW370 |
| "A.W." Ideal Four (2SG, D, Pen) | 16.9.33 | AW402 |
| 2 H.F.Four (2SG, D, Pen) | — | AW421 |
| Crusaders' A.V.C. 4 (2 H.F., D, QP21) | 18.8.34 | AW445 |
| (Pentode and Class-B Outputs for above: blueprints 6d. each) | 25.8.34 | AW445A |
| Quadradyne (2SG, D, Pen) | — | WM273 |
| Calibrator (SG, D, RC, Trans) | *Oct*, '32 | WM300 |
| Table Quad (SG, D, RC, Trans) | — | WM303 |
| Calibrator de Luxe (SG, D, RC, Trans) | *Apr.* '33 | WM316 |
| Self-contained Four (SG, D, LF, Class-B) | *Aug.* '33 | WM331 |
| Lucerne-Straight Four(SG, D, LF, Trans) | — | WM350 |
| £5 5s. Battery Four (H.F., D, 2LF) | *Feb.* '35 | WM381 |
| The H.K. Four | *Mar.* '35 | WM384 |
| **Five-valvers : Blueprints, 1s. 6d. each.** | | |
| Super-quality Five (2HF, D, RC, Trans) | *May* '33 | WM320 |
| New Class-B Five (2SG, D, LF, Class-B) | *Nov.* '33 | WM340 |
| Class-B Quadradyne (2 SG, D, LF, Class-B) | *Dec.* '33 | WM344 |
| 1935 Super Five (Battery Superhet) | *Jan.* '35 | WM379 |

### Mains Operated

| | | |
|---|---|---|
| **Two-valvers : Blueprints, 1s. each.** | | |
| Consoelectric Two (D, Pen) A.C. | 23.9.33 | AW403 |
| Economy A.C. Two (D, Trans) A.C. | — | WM286 |
| **Three-valvers : Blueprints, 1s. each.** | | |
| Home-lover's New All-electric Three (SG, D, Trans) A.C. | 25.3.33 | AW383 |
| S.G. Three (SG, D, Pen) A.C. | 3.6.33 | 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 |
| D.C. Calibrator (SG, D, Push-pull Pen) D.C. | *July* '33 | WM326 |
| Simplicity A.C. Radiogram (SG, D, Pen) A.C. | *Oct.* '33 | WM338 |
| Six-guinea A.C./D.C. Three (HF Pen, D, Trans) A.C./D.C. | *July* '34 | WM364 |
| Mantovani A.C. Three (HF Pen, D, Pen) A.C. | *Nov.* '34 | WM374 |
| **Four-valvers : Blueprints, 1s. 6d. each.** | | |
| A.C. Melody Ranger (SG, DC, RC, Trans) A.C. | — | AW380 |
| A.C./D.C. Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C. | 8.9.34 | AW446 |
| A.C. Quadradyne (2SG, D, Trans) A.C. | — | WM279 |
| All Metal Four (2SG, D, Pen) | *July* '33 | WM329 |
| "W.M." A.C./D.C. Super Four | *Feb.* '35 | WM382 |
| Harris Jubilee Radiogram | *May* '35 | WM386 |

### SUPERHETS.

| | | |
|---|---|---|
| **Battery Sets : Blueprints, 1s. 6d. each.** | | |
| 1934 Century Super | 9.12.33 | AW413 |
| Super Senior | — | WM256 |
| 1932 Super 60 | — | WM269 |
| Q.P.P. Super 60 | *Apr.* '33 | WM319 |
| "W.M." Stenode | *Oct.* '34 | WM373 |
| Modern Super Senior | *Nov.* '34 | WM375 |
| **Mains Sets : Blueprints, 1s. 6d. each.** | | |
| 1934 A.C. Century Super, A.C. | 10.3.34 | AW425 |
| 1932 A.C. Super 60, A.C. | — | WM272 |
| Seventy-seven Super, A.C. | — | WM305 |
| "W.M." D.C. Super, D.C. | *May* '33 | WM321 |
| Merrymaker Super, A.C. | *Dec.* '33 | WM345 |
| Heptode Super Three, A.C. | *May* '34 | WM359 |
| "W.M." Radiogram Super, A.C. | *July* '34 | WM366 |
| "W.M." Stenode, A.C. | *Sep.* '34 | WM370 |
| 1935 A.C. Stenode | *Apr.* '35 | WM385 |

### PORTABLES.

| | | |
|---|---|---|
| **Four-valvers : Blueprints, 1s. 6d. each.** | | |
| General-purpose Portable (SG, D, RC, Trans) | — | AW351 |
| 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 |
| Town and Country Four (SG, D, RC, Trans) | — | WM282 |
| Two H.F. Portable (2 SG, D, QP21) | *June* '34 | WM363 |
| Tyers Portable (SG, D, 2 Trans) | *Aug.* '34 | WM367 |

### SHORT-WAVERS. Battery Operated.

| | | |
|---|---|---|
| **One-valvers : Blueprints, 1s. each.** | | |
| S.W. One-valve | — | AW329 |
| S.W. One-valve for America | — | AW429 |
| Roma Short-waver | 10.11.34 | AW452 |
| **Two-valvers : Blueprints, 1s. each.** | | |
| Home-made Coil Two (D, Pen) | 14.7.34 | AW440 |
| **Three-valvers : 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-waver | *Jan.* 19, '35 | AW463 |
| Short-wave Adapter | *Dec.* 1, '34 | AW456 |
| Superhet, Converter | *Dec.* 1, '34 | AW457 |
| The Carrier Short-waver | *July* '35 | WM390 |
| **Four-valvers : Blueprints, 1s. 6d. each.** | | |
| "A.W." Short-wave World Beater (HF Pen, D, RC, Trans) | 2.6.34 | AW436 |
| Empire Short-waver (SG, D, RC, Trans) | *Mar.* '33 | WM318 |
| Standard Four-valve Short-waver | *Mar.* '35 | WM383 |

### Mains Operated.

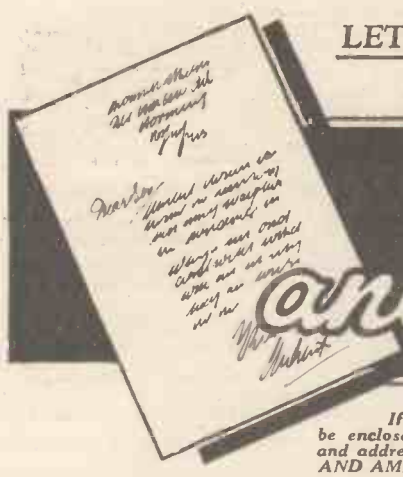
| | | |
|---|---|---|
| **Two-valvers : Blueprints, 1s. each.** | | |
| Two-valve Mains Short-waver (D, Pen) A.C. | 10.11.34 | AW453 |
| "W.M." Band-spread Short-waver (D, Pen) A.C./D.C. | *Aug.* '34 | WM368 |
| "W.M." Long-wave Converter | *Jan.* '35 | WM380 |
| **Three-valvers : Blueprints, 1s. each.** | | |
| Emigrator (SG, D, Pen), A.C. | — | WM352 |
| **Four-valvers : Blueprints, 1s. 6d. each.** | | |
| Gold Coaster (SG, D, RC, Trans) A.C. | *Aug.* '32 | WM292 |
| Trickle Charger | *Jan.* 5 '35 | AW462 |

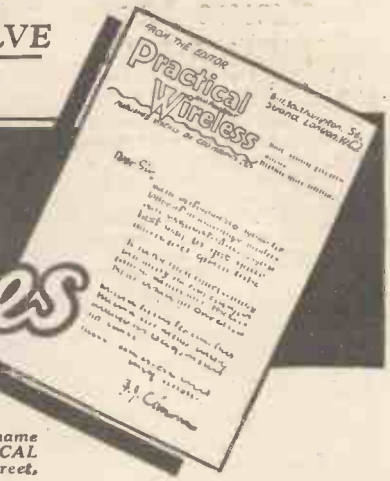
### MISCELLANEOUS.

| | | |
|---|---|---|
| Enthusiasts Power Amplifier (1/6) | *June* '35 | WM387 |
| Newstyle Short-wave Adapter (1/-) | *June* '35 | WM388 |

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

# Queries and Enquiries






*If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.*

**SPECIAL NOTE**

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.

## A D.C. Circuit

**"Have you published a D.C. circuit suitable for people like myself who desire high-quality signals, but who are unfortunately only able to obtain access to D.C. mains? I do not want a universal circuit, but one intended to offer good selectivity and good quality direct from D.C. mains. If you can give me any details regarding such a circuit, with a blueprint number if one is issued, I should be obliged."—T. H. (Wimbledon).**

WE think the D.C. Premier would most nearly meet your requirements. This employs an H.F. pentode, triode detector, and output pentode, and to provide ample selectivity band-pass tuning is employed. A complete commercial tuning unit is utilised—the J. B. Linacore, and an energised M.C. speaker is fitted in the interests of quality. The blueprint No. is PW35B, and the receiver was described in March of last year.

## Short-wave Circuit

**"I am sending a circuit of a 5-valve receiver employing a neutralised H.F. stage which I wish to adopt for short-wave working. Will this be all right, if I use a good set of short-wave coils? If not, can you offer any suggestions?"—R. M. (Hornchurch).**

IN general we would not advise H.F. stages for amateur short-wave reception. The superhet is, of course, in a different category and is quite good for short-wave work, but an ordinary tuned H.F. stage, especially of the neutralised type, would probably prove not only inefficient, but also a drawback owing to the difficulty of adjusting it. A detector and L.F. receiver would no doubt give better results, owing to the simplicity and ease of handling. An untuned or aperiodic H.F. stage may be included to smooth reaction and otherwise give stabilised working, but in the hands of a beginner especially, the detector L.F. reeeiver will give a greater range and be productive of better results.

## Resistance Connections

**"I wish to fit automatic bias to my A.C. mains receiver, and from the voltage which I have worked out I find that I need an odd value of resistance which is apparently not on the market. Is it permissible to use two or more in parallel and what is the wattage rating of each to be in this direction?"—G. T. (Yarmouth).**

YOU may use as many resistances in parallel as you desire to obtain the correct value, and as the current passed by each is less than it would be through a single resistance the wattage will accordingly be reduced. Thus if you use only two equal resistances in parallel the wattage of each one will be half that of the total circuit.



## Q.P.P. Transformer

**"I am building a Q.P.P. amplifier and have a number of parts on hand. Is it right that you cannot use Class B parts in a Q.P.P. amplifier and vice versa? I should like to know the reason if this is not possible."—G. W. R. E. (Brighton).**

AN output transformer or choke may be used in either the Class B or the Q.P.P. stage, and there is very little difference in the two types. With regard to the input transformer, however, the matter is vastly different and the two types are not interchangeable. For Q.P.P. a step-up ratio of about 1 to 8 or 1 to 9 is required, but for Class B a step-down ratio is required and the secondary winding has to be designed to deliver a certain wattage, as grid current flows through each half of it. The usual ratio is about 1.5 to 1.

## Ganging Coils

**"I have a three-gang coil unit made by a well-known firm. I also have a number of similar types of coil by the same firm, which includes an oscillator coil. I wish to build the Superhet Three, but anticipate using two band-pass coils from my collection, ganged with the oscillator. I have tried the arrangement temporarily without success. The switch rod passes through the entire assembly and seems quite in order. Can you let me know whether I should be doing right by assembling the coils in this way?"—J. E. (Cardiff).**

ALTHOUGH the coils may all be of the correct type there is a risk in pushing the switch rod through the coils that the switches may not all be in the correct position, so that as the switch is operated one coil may be put in the long-wave position whilst the others are in the medium-wave position. You must check this point carefully. It is also possible that the coils are not of similar characteristics, and will not function satisfactorily when assembled in this manner, and, therefore, you should approach the makers regarding the proposed procedure.

## Re-wiring Commercial Receivers

**"I have a well-known three-valver which has worked for a long time quite well. I now propose to bring this up to date and should like you to recommend a suitable blueprint from your list. Can you please let me know which print will suit the parts in my set which I have written out on the attached paper?"—B. R. Y. (Holloway).**

APART from the fact that we do not advise the construction of any of our receivers unless the specified parts are used, there is another point which must be borne in mind when converting an old set of this nature. Probably many of the parts are obsolete, and although similar in appearance to modern components they may be totally unsuited for modern circuits. Similarly, some of the parts in your commercial receiver may have been designed especially for that receiver and will not function in any other circuit. Therefore, in such a case, our advice would be to dispose of the receiver as it stands and to purchase the new parts necessary to construct a modern circuit from one of our blueprints, or from an article given in our pages.

## Mains Transformer Parts

**"I am building my own mains transformer from details recently published by you, and should like to know where I can get the stalloy stampings, bobbins, etc."—T. G. (Liverpool).**

THE stampings may be obtained from Lumen Electric Company, 9, Scarisbrick Avenue, Litherland, Liverpool, and from other advertisers in our pages.

**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. Unless otherwise stated, all items are clearance, second-hand, or surplus lines, and radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," 8, Southampton Street, Strand, London.**

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*(Continued at top of column three)*



*(Continued from foot of column one)*

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PREMIER 350-0-350 150 milliamps, 4 volts 1-2 amps., 4 volts 2-3 amps., 4 volts 3-4 amps., 12/6.

PREMIER Combined H.T.8 and H.T.9 Transformer, rectified output 250 or 300 volts 60 milliamps, 4 volts, 1-2 amps., 4 volts 3-5 amps., 10/-; or with Westinghouse rectifier, either type, 18/6.

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# PRACTICAL MECHANICS

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# A TWO-VALVE SUPERHET!


# Practical and Amateur Wireless

3D EVERY WEDNESDAY

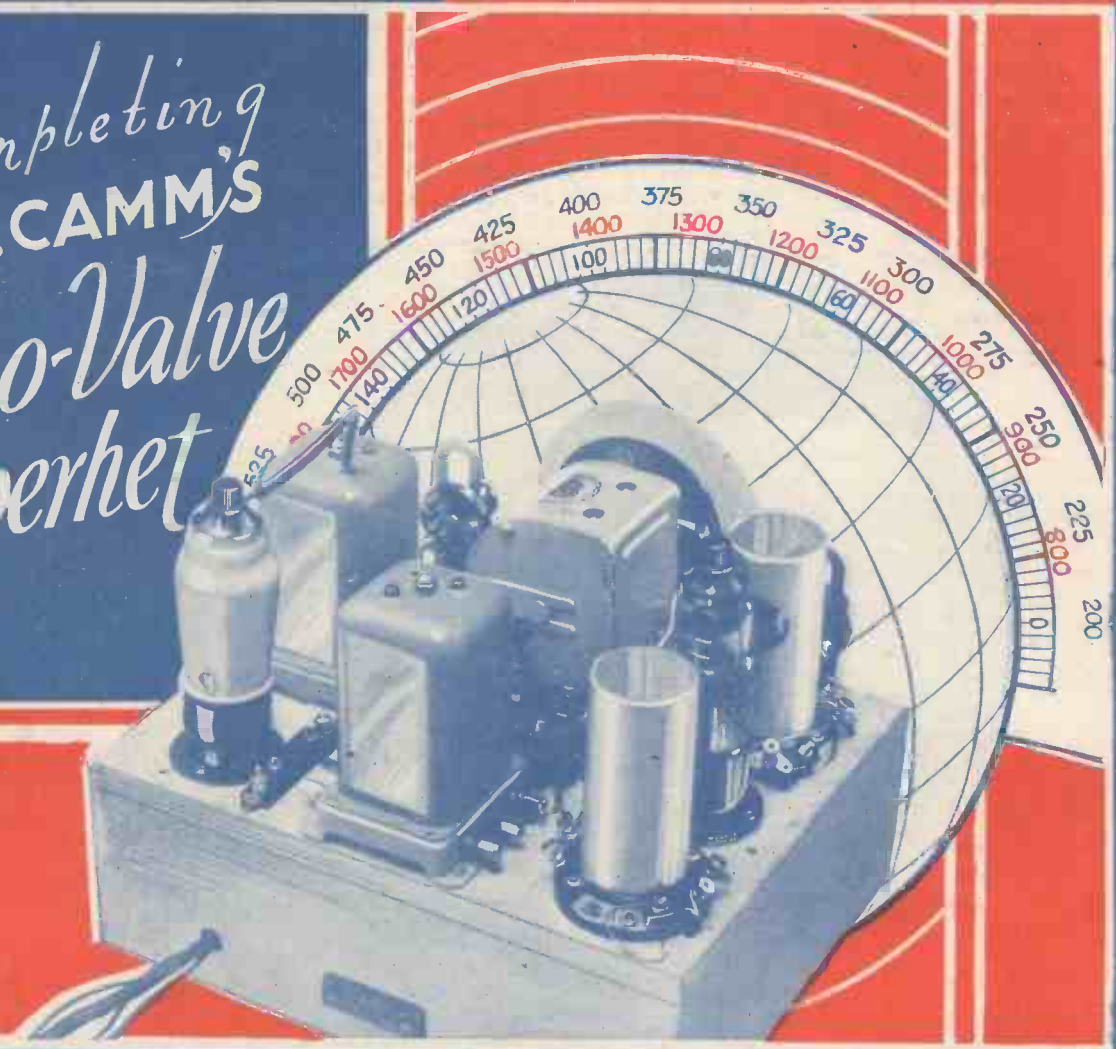
Edited by F. J. CAMM

a GEORGE NEWNES Publication

Vol. 6. No. 147
July 13th. 1935.

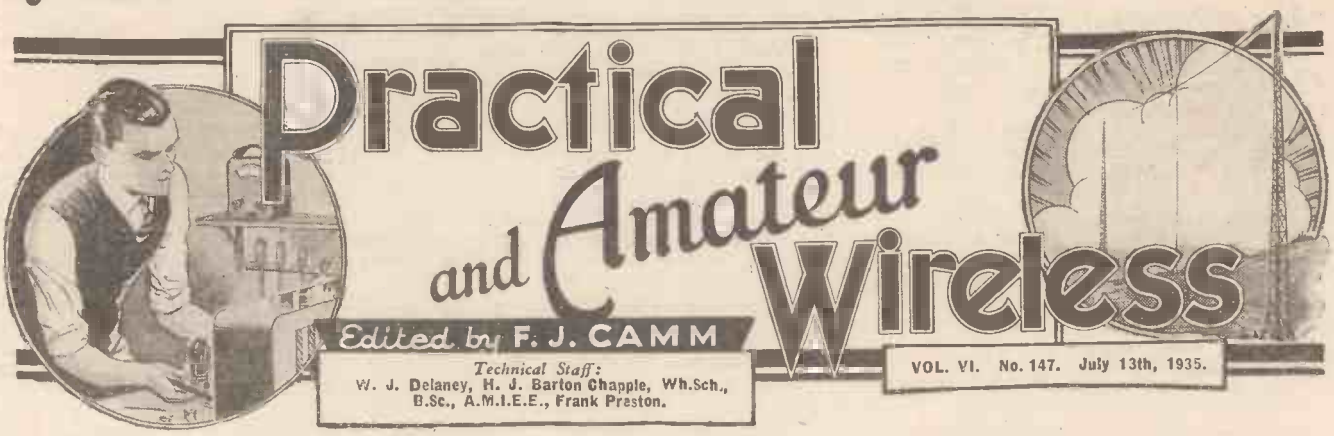
AND AMATEUR TELEVISION


## Completing F. J. CAMM'S Two-Valve Superhet



# QUIET AUTOMATIC VOLUME CONTROL

SEE PAGE 470




# ROUND *the* WORLD *of* WIRELESS

### Chinese Radio Funerals

UNTIL recently, in Shanghai, dance music and syncopated melodies were relayed from hearses at Chinese funerals. Recently, however, the authorities brought out an official order to veto the practice. Native music is not forbidden.

### Map Tuning!

AT the recent Paris Radio Exhibition a wireless receiver was shown which possessed, in lieu of a wavelength scale, a map with the principal European stations. It was claimed that by means of pre-set condensers, the listener need only insert a plug into the corresponding socket to get the desired transmission!

### Algiers and One Million Francs

THE studio officials running Radio Alger have protested against the latest PTT decree in which the station is no longer allowed to give publicity broadcasts. The revenue from this source has approximated one million francs per annum, a sum which has permitted an improvement in the programmes.

### More Sponsored European Broadcasts?

IT is rumoured that an International Syndicate is negotiating for a concession in the Balearic Islands—probably Majorca—for the installation of a high-power transmitter of the Radio Luxembourg type. The aim of the organisers is a publicity programme service for Southern Europe and Northern Africa.

### Heilsberg on 100 Kilowatts

THE Heilsberg 60-kilowatt station, which has been under reconstruction, is expected to take up its duties as a 100 kilowatter some time in July. In addition, it is expected that its signals will be heard at greater advantage as the opportunity was taken to equip the station with a new anti-fading aerial system.

### How Many European Languages?

ALTHOUGH all of them are not picked out in foreign radio programmes, it is interesting to learn that 120 different tongues exist in Europe. The German language heads the list, being used by about 80,000,000 people; Russia by 70,000,000; English, 47,000,000; Italian, 40,000,000; and French by about 250,000 less.

### Wireless Fog Beacons

IF you tune your set to the region of 1,000 metres, you will frequently hear long-drawn-out morse transmissions, finish-up with one long or a series of dashes. These signals emanate from wireless fog beacons off the British coasts—each station giving out a different combination of letters. Those more regularly picked up are GGB South Bishop Lighthouse (942 metres), GDM, Dungeness (979 metres), GGG, Round Island (1,019 metres), and so on.

### PTT Lille and Lyons to Start Testing

THE new 60-kilowatt transmitter which is to replace the present 4-kilowatt plant is now ready, and it has been officially stated that PTT Lille on 247.3 metres (1,213 kc/s) will start testing within the next week or so. Lyon-Tramoyes, the most powerful French station, has been heard giving experimental broadcasts on 463 metres (648 kc/s) at the end of the day's programmes.

**Build Our New TWO-VALVE SUPER**

*Full Constructional Details of this Amazing Receiver will be found on pages 467, 468 and 469.*

### What is Eiffel Tower Doing?

SINCE this station abandoned the 1,389-metre channel, its official programme has suffered a number of alterations. On 206 metres, in addition to radio entertainments and the usual market reports, a time signal is broadcast at 11.35 a.m. Similar signals are transmitted daily on 2,650 metres at 10.26 a.m. and 10.36 p.m. On 206 metres the Eiffel Tower gives weather forecasts at 07.45, 13.15 and 19.10.

### British Time Signals

ALTHOUGH most listeners pay attention to the time signals which precede the transmission of the news bulletins, it is interesting to know that the exact time may also be picked up at other periods of the day. The B.B.C. broadcasts the Greenwich "six pips" every weekday at 10.30 a.m., 14.00, 18.00, 21.30, and 23.30, and on Sundays at 10.30 a.m., 16.30 and 21.30. Big Ben, on the other hand, is usually heard at 10.15 a.m., noon, 17.15, 18.30 and midnight during the week, and at 12.30 and 10.30 p.m. on Sundays.

### Prague's Weekly Noble Acts

EVERY Sunday the Prague studio devotes a few minutes to a special broadcast, in which the announcer relates outstanding good or courageous acts performed by the citizens of the Czech capital during the preceding week. Although no medal is conferred upon the favoured ones, they consider it a signal honour to hear their names mentioned through the microphone.

### Radio Publicity Over the Ether

IN view of the revenue secured by Radio Luxembourg, Poste Parisien, Radio Toulouse, and other private broadcasting associations, it is reported from Paris that steps are to be taken to erect a station for the purpose of radio publicity in Morocco, if the Authorities cannot be induced to provide a more liberal subsidy for the maintenance of the existing transmitter.

### The Source of All Depressions

LISTENERS in North Britain frequently pick up the Reykjavik (Iceland) broadcasts on 1,442 metres (208 kc/s) during daylight hours. Although, as a rule, but few concerts are given before the evening, the station may be heard working in the morning and afternoon. Weather forecasts and storm warnings are transmitted five times daily in Icelandic and twice in German and English. Of all countries Iceland, perhaps, is the one which suffers relatively the greatest loss of lives at sea. The call of the station is: Utvarpsstod Reykjavik.

# ROUND the WORLD of WIRELESS (Continued)

## "Hassan"

THIS play, by James Elroy Flecker, will be broadcast for the fourth time on July 11th and 12th. Its first broadcast, in 1925, was a radio occasion. Cecil Lewis, who was in charge of programmes at that period, was quick to spot its suitability for broadcasting. It had just previously created a great impression at His Majesty's. In the coming broadcast, Henry Ainley will again play the part of Hassan, the bazaar confectioner, and the cast includes Carol Goodner, Gwendolen Evans, Malcolm Keen, Leon Quartermaine and Ion Swinley. Of considerable interest is the fact that W. H. Flecker, the father of the author, plays in his brilliant son's drama the part of the Master of the Caravan. This is not the first time that he has broadcast, but his appearance in this play is a notable occasion. Proof that "Hassan" has a permanent appeal can be found in its repeated appearances in the broadcast programmes and in its projected production as a film.

## Six Winners Now

ANONA WINN, the popular Australian star, will be heard again on July 22nd with her "Winners." This act has become so popular that "Four Winners" are now six, and if this growth continues steadily we shall eventually hear of Anona Winn with a complete band.

## Back to the U.S.A.

GRETA KELLER, who broadcast in Jubilee "Music Hall" on June 27th, will give a farewell programme on July 25th before sailing next day for New York. This little Viennese artist became exceedingly popular when she was resident in England some three years ago. But since her marriage to Ross, of the act, Ross and Sargent, she has lived in the U.S.A., and only pays fleeting visits to England. She has a vivid personality, and her technique is admirably suited to the demands of the microphone.

## To End July

SOME interesting broadcast programmes are to be heard during the last two weeks in July. On July 15th the next broadcast will take place of "The Red Sarafan," and on July 16th and 17th the long-awaited "Music of Men's Lives," by Mr. C. Mackenzie, will be presented. Listeners who like a hearty "road show" should listen on July 17th to Sandy Powell and his third "Album."

## Walsall's Home Week

"ONCE More in Walsall" is the title of a feature to be broadcast from the Birmingham studio on July 16th. It is part of the celebration of Walsall's Welcome Home Week, which is organised every few years so that natives of the town who have gone abroad may revisit their birthplace and receive its hospitality. The scheme originated in 1924 and was begun by Alderman J. A. Leckie, who is the present M.P. for the borough. The Town Council and the Chamber of Commerce co-operated. There have been as many as sixty overseas Walsall visitors at one time. Among those who are expected this year are the British Minister to Albania (Sir Robert Hodgson), a New York doctor, a Professor of English from Niigata University, the former superintendent of the Palestine railways, and people of Walsall birth or ancestry from Western Australia and New Zealand.

**INTERESTING and TOPICAL PARAGRAPHS**

## From Peterboro' Cathedral

A RECITAL by the Organist and Choir of Peterborough Cathedral will be relayed to Midland listeners on July 14th. The Choir last broadcast in Jubilee week, when they were the singers in a programme of work by Masters of the King's Musick. Three of the nine numbers which they will sing at this recital will be unaccompanied; one of these is "Grant us Grace, Lord," by Dr. Alfred Whitehead, the Organist of Montreal Cathedral, who dedicated it to Dr. Henry Coleman, the Peterborough Cathedral Organist, and the Cathedral Choir. Dr. Coleman has been Organist and Master of the Choristers at Peterborough for fourteen years.

## Married Bliss

A FLITCH Trial will be relayed from the Town Hall, Rugeley, Staffordshire, on July 16. It is held in aid of the local hospital. The "Judge," whose arrival will be heralded by a fanfare of trumpets, is Major J. Selby Gardner; local solicitors act as counsel for the Flitch and for the three genuine couples who are the claimants. The jury, as usual in Flitch trials, consists of six maids and six bachelors, and the qualification which the claimants have to make good is that they have not quarrelled for a year and a day.

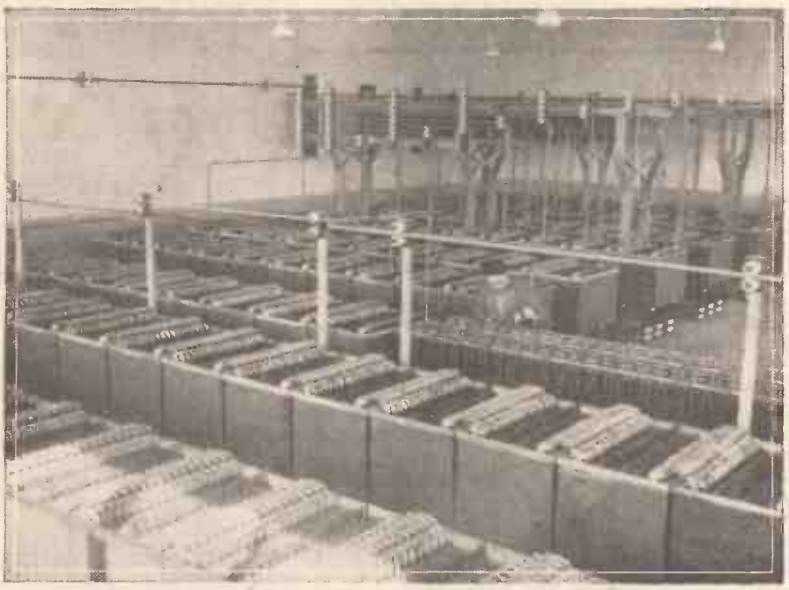
## Celebrity Cruise

THREE Midland writers have collaborated in "Celebrity Cruise," which Martyn Webster will produce on July 18th. The book is by Francis Durbridge, the lyrics by Charles Hatton, and the music by Michael North. Helmar Fernback takes the part of a publicity king, and Marjorie Westbury that of an out-of-work actress whom he has engaged to impersonate a millionaire's widow in order to ensure the success of the cruise. The Midland Revue Orchestra will be conducted by Reginald Burston. "Wealthy Widow Blues" is the title of one of the numbers.

## Yeoman's Humour

STORIES in dialect from Devon, Somerset and Gloucestershire will be given for Western listeners on July 17th, under the title "Yeoman's Humour." Listeners will hear F. W. Harvey telling stories of Gloucestershire, Major Garton telling stories of Somerset, and some further stories will be given by a speaker who prefers to remain anonymous. He has lived in West Somerset for eighty years, sixty of them close to the Quantock Hills. His first story will be "The Sale of a Donkey" which was told to him a good many years ago, and the second, "Cure of a Toothache," will be given exactly as it was told to him by the wife of the bailiff of a large farm in West Somerset.

## ENSURING A STEADY H.T. SUPPLY



*At the new radio station at Severac a large bank of accumulators is maintained, and a section of these may be seen in this picture.*

# SOLVE THIS!

### PROBLEM No. 147.

Some slight instability was occurring in the A.C. three-valver which Jerrold had built, and after some searching he came to the conclusion that it was due to interaction between the lead to the anode terminal on the S.G. H.F. valve and some of the remaining leads. He therefore decided to screen this lead, and as he had no ordinary metallic braiding available he took some wire from an old tuning coil and wound this round and round the anode lead in a neat manner, all turns contiguous and parallel, and connected the lower end to the metal chassis. When tested again, Jerrold found that his trouble was worse, in spite of this apparent screening. What had he done wrong? Three books will be awarded for the first three correct solutions opened. Envelopes must be marked Problem No. 147 in the bottom left-hand corner, and must be addressed to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received not later than the first post Monday, July 15th, 1935.

### Solution to Problem No. 146.

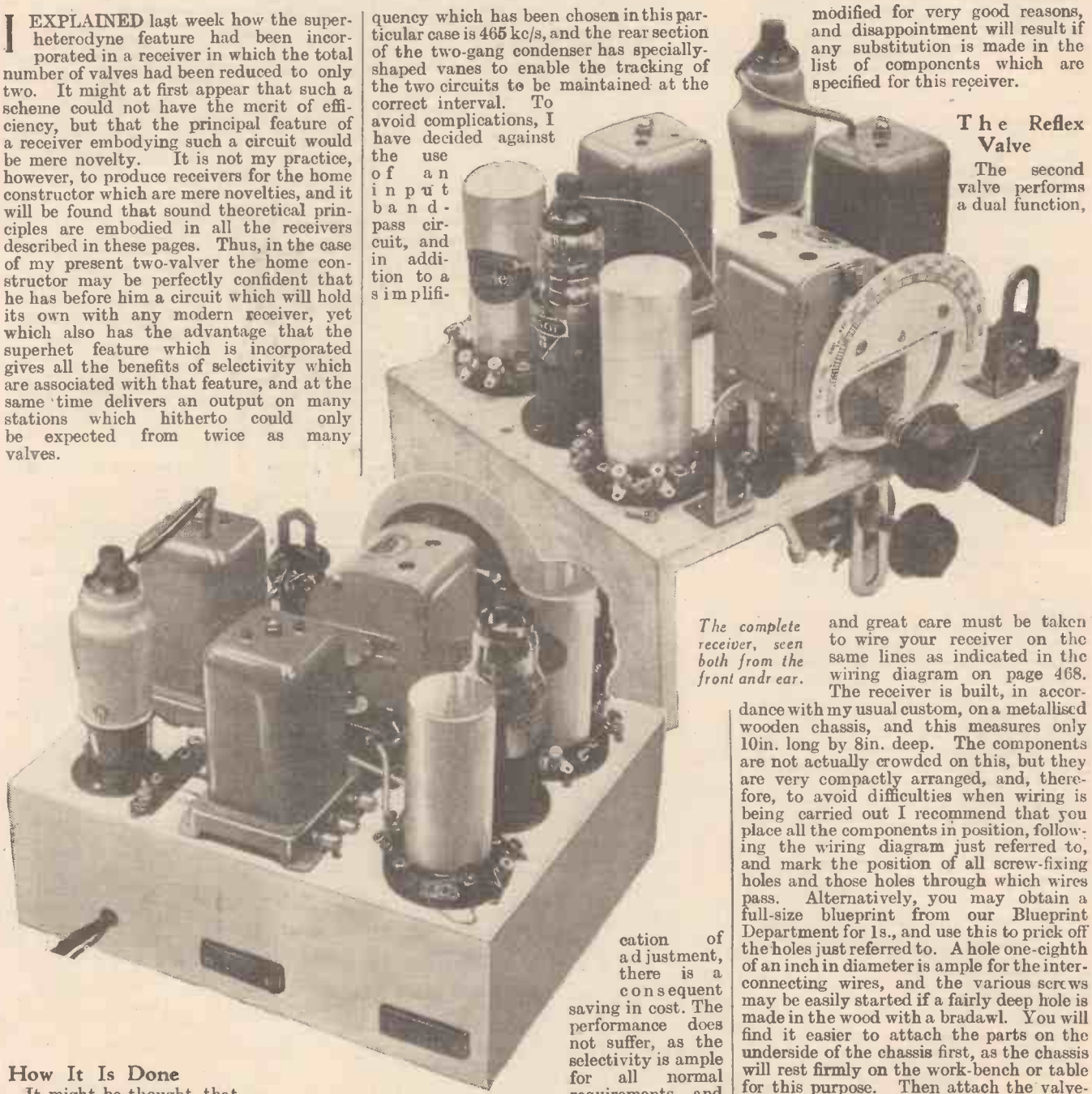
When Black changed his indirectly-heated pentode for a directly-heated one he overlooked the fact that the bias for the former was obtained by a cathode resistance, and as the D.H. valve does not employ a cathode it was unbiassed.

The following three readers successfully solved Problem No. 145, and books are accordingly being forwarded to them: R. F. Radcliff, Berridge, Sunningdale, Berks; J. G. Galt, Hillhurst, Saltwood, Hythe, Kent; G. N. Patchett, 71, Moorside Road, Eccleshill, Bradford.

# My Two-Valve Superhet

## *Full Constructional Details of the Most Novel and Ingenious Receiver Ever Placed Before Home Constructors. By F. J. Camm*

I EXPLAINED last week how the superheterodyne feature had been incorporated in a receiver in which the total number of valves had been reduced to only two. It might at first appear that such a scheme could not have the merit of efficiency, but that the principal feature of a receiver embodying such a circuit would be mere novelty. It is not my practice, however, to produce receivers for the home constructor which are mere novelties, and it will be found that sound theoretical principles are embodied in all the receivers described in these pages. Thus, in the case of my present two-valver the home constructor may be perfectly confident that he has before him a circuit which will hold its own with any modern receiver, yet which also has the advantage that the superhet feature which is incorporated gives all the benefits of selectivity which are associated with that feature, and at the same time delivers an output on many stations which hitherto could only be expected from twice as many valves.



*The complete receiver, seen both from the front and rear.*

### How It Is Done

It might be thought that some measure of efficiency must naturally be sacrificed to obtain these advantages, but the superhet principle is particularly adaptable to a circuit of the nature of that which I have employed in this two-valve set. Firstly, the main feature of the superhet is the frequency-changer, and the modern pentagrid type of valve carries out this function in a very efficient manner. Thus you will find a pentagrid filling the first position in this receiver. Associated with it are the input-tuning circuit and the oscillator circuit, the tuning of these two sections being carried out with a two-gang condenser of special design. The intermediate frequency which has been chosen in this particular case is 465 kc/s, and the rear section of the two-gang condenser has specially-shaped vanes to enable the tracking of the two circuits to be maintained at the correct interval. To avoid complications, I have decided against the use of an input band-pass circuit, and in addition to a simplification of adjustment, there is a consequent saving in cost. The performance does not suffer, as the selectivity is ample for all normal requirements, and except in certain parts of the country there will be no troubles from second-channel interference and similar effects which arise from a heavily-loaded input circuit.

The I.F. transformers are of the 465 kc/s type, and are provided with trimmers, but a fixed coupling. Again, the selection of components has been made with a view to delivering the most useful balance of selectivity and signal strength, and readers should not assume—because the components are not identical with those used in the £5 Superhet Three—that it is possible to use those parts. The intermediate-frequency in the two receivers is different and has been modified for very good reasons, and disappointment will result if any substitution is made in the list of components which are specified for this receiver.

### The Reflex Valve

The second valve performs a dual function, and great care must be taken to wire your receiver on the same lines as indicated in the wiring diagram on page 468. The receiver is built, in accordance with my usual custom, on a metallised wooden chassis, and this measures only 10in. long by 8in. deep. The components are not actually crowded on this, but they are very compactly arranged, and, therefore, to avoid difficulties when wiring is being carried out I recommend that you place all the components in position, following the wiring diagram just referred to, and mark the position of all screw-fixing holes and those holes through which wires pass. Alternatively, you may obtain a full-size blueprint from our Blueprint Department for 1s., and use this to prick off the holes just referred to. A hole one-eighth of an inch in diameter is ample for the interconnecting wires, and the various screws may be easily started if a fairly deep hole is made in the wood with a bradawl. You will find it easier to attach the parts on the underside of the chassis first, as the chassis will rest firmly on the work-bench or table for this purpose. Then attach the valve-holders, taking particular care with the 7-pin holder, as the arrangement of the pins is not very clear when first examined. Note that the two filament pins, which are situated close together at one end, must be toward the centre of the chassis. The holes for the valve-holders should be cut with an ordinary brace and bit, unless you obtain a chassis already drilled, and for V1 the hole should be 1 1/4in. in diameter, and for V2 a 1in. hole will suffice. When screwing the valve-holders to the chassis make quite certain that the upper part of the valve sockets is clear of the metallised surface on top of the chassis. Quite a number of receivers have been received here for examination in which

the only trouble was due to a short-circuit arising from this apparently small point.

### Wiring

The rear terminal strips should be mounted, either by drilling small holes to accommodate the individual sockets, or cutting a slot into which the two sockets on each strip will pass. A warning should here be given regarding the mounting of the bracket on the underside of the chassis. This must definitely not come into contact with the metallised coating and therefore short screws must be used when attaching it. If you have a meter and battery handy it will be as well to check this point before mounting the volume control. Carry out the wiring with fairly stiff wire, either of the insulated variety or bare wire. Ordinary tinned copper is very convenient and may be soldered from one point to another and then cut off, resulting in a very neat appearance. There is a risk, of course, of a short-circuit being introduced unless care is taken to arrange all wires in such a manner that none can touch. On the other hand, insulated sleeving may be slipped over the wires as they are put into position. It should be noted that the tubular condensers and fixed resistances are held in position by their own wire ends.

### The Battery Leads

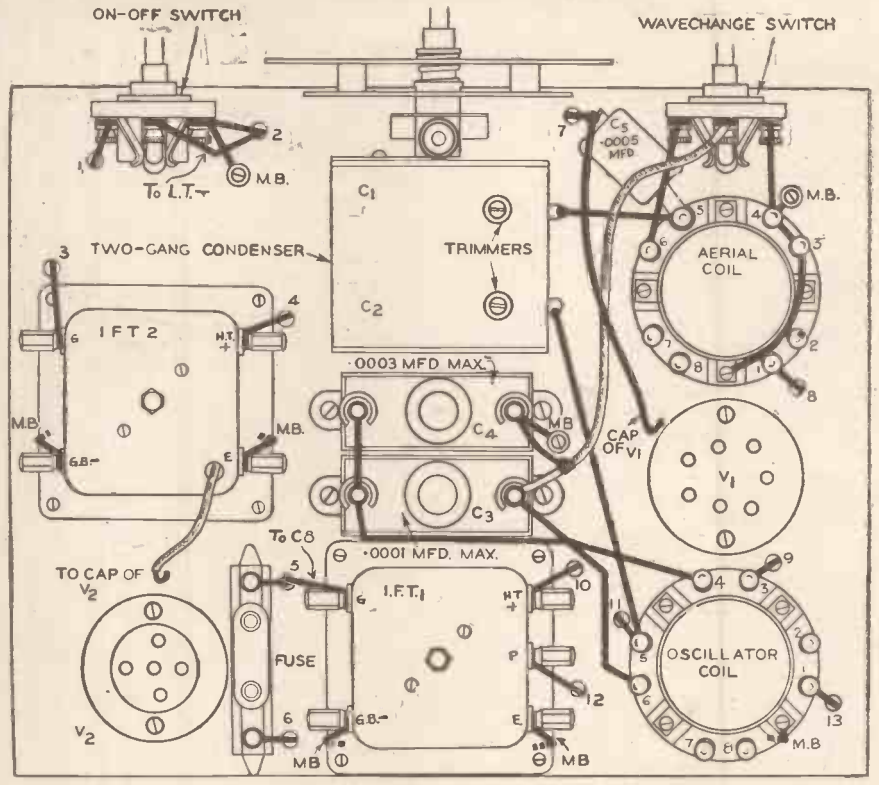
For the battery leads you may use either one of the commercial ready-made assemblies, or ordinary red and black flex with the wander plugs which are specified in the list of components below. A hole is drilled in the rear chassis strip and the leads are passed through this. They will naturally be a bit straggly inside the receiver, but they may be anchored, if desired, at various points by means of cotton. In general, there will be no ill-effects arising from the battery leads, although they may pass other wiring, but they should not be permitted to wander all over the set. To prevent them from being pulled adrift, a knot may be tied in the cords inside the chassis, or a small cleat may be attached to the wood where they pass out through the rear strip. In the latter case, take the precaution of inserting a piece of fibre or other insulating material between the wire and the cleat to avoid risk of damage due to the edges of

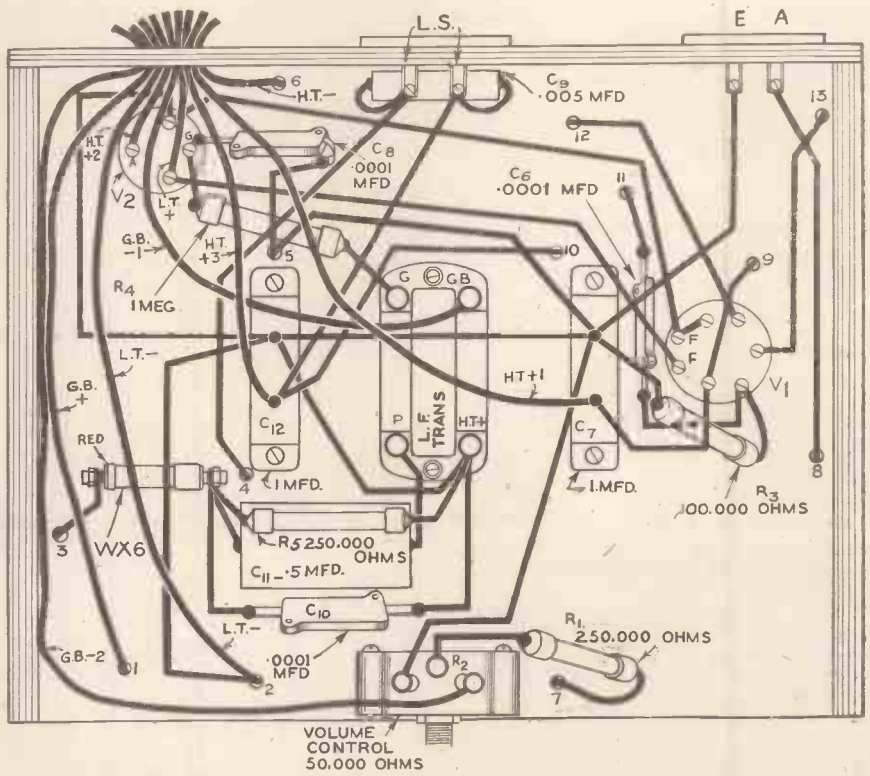
*(Continued on opposite page)*

### LIST OF COMPONENTS

Two Coils, Type BP80 and BP87 (Varley).
Two-gang superhet condenser, 465 kc., C1, C2 (J.B.).
Two I.F. transformers, Type 465 kc. (Wearite).
One L.F. transformer (B.T.S.).
Eight fixed condensers: three .0001 mfd., C6, C8, C10, Type M; one .0005 mfd., C5, Type M; one .005 mfd., C9, Type 300; one .5 mfd., C11, Type 250; two 1 mfd., C7, C12, Type 65 (T.C.C.).
Two pre-set condensers, .0003 mfd., C4, and .0001 mfd., C3 (Ward and Goldstone).
Four fixed resistances: one 100,000 ohms, R3; two 250,000 ohms, R1, R5; one 1 megohm, R4 (Dubilier).
One 50,000 ohms R2 potentiometer, VC36 (Bulgin).
One WX6 Westector (Westinghouse).
Two valveholders, one 7-pin, one 4-pin (Clix).
Two terminal strips, L.S. and A.E. (Belling Lee).
Two three-point switches, S36 (Bulgin).
Seven wander plugs: H.T.1, H.T.2, H.T.3, H.T.—, G.B.+, G.B.—1, G.B.—2. (Belling Lee).
Two spades, L.T.—, L.T.+. (Belling Lee).
Three component brackets (B.T.S.).
One fuse, 60 m.a. (Microfuse).
Two valves, 210 P.G., 210 S.P.T. (Cossor).
Metaplex chassis, 10in. by 8in. by 3in. (Peto-Scott).
One 120-volt H.T. battery (Drydex).
One 9-volt G.B. battery (Drydex).
One 2-volt L.T. accumulator (Exide).
One Stentorian loud-speaker (W.B.).

## Top and Sub-Chassis Wiring of Mr. F. J. Camm's 2-Valve Superhet




**A Full Size Blueprint may be obtained, price 1/-.**

**Ask for Blueprint No. P.W. 52.**

(Continued from previous page)

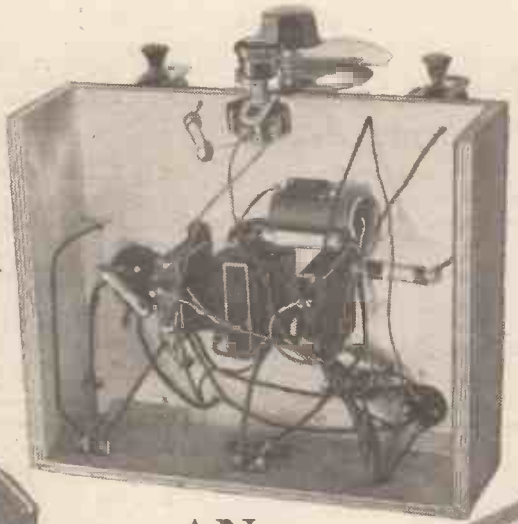
the cleat cutting through the insulation of the wires.

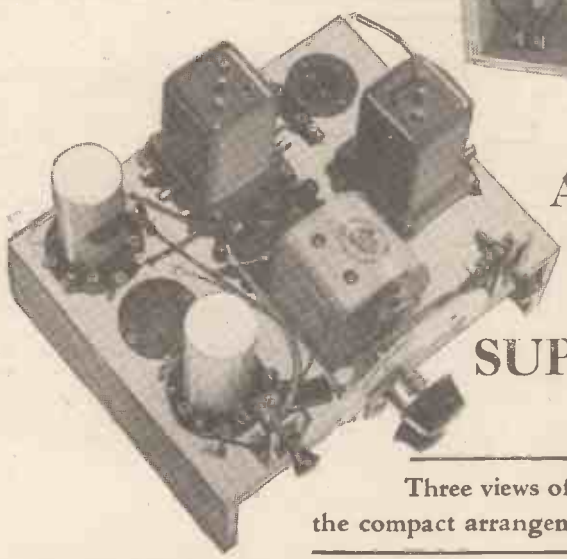
## Testing Out

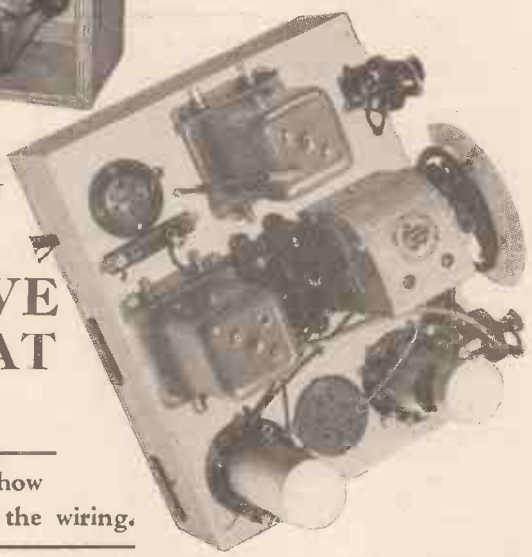
The operating details of the receiver are exactly similar to those of the £5 Superhet. There are only two trimmers to worry about on the gang condenser, and the correct positions for these may be obtained by tuning in any station and adjusting for the loudest results. As usual, take stations at opposite ends of the medium-wave tuning scale in order to make certain that the correct balance has been obtained. The I.F. transformers must be trimmed to give the same maximum response throughout the scale, and thus it should not be difficult to obtain a good performance within a very short space of time. Remember that any adjustment in one part of the scale should immediately be checked by turning to the opposite end of the scale in order to make certain that a balance is being maintained. If a loud signal is obtained, reduce volume by means of the volume control and work always throughout the trimming operations with the faintest signal which can be obtained. In this way you are much more certain of obtaining correct results. On the long waves the only additional adjustment is that of the pre-set condensers C3 and C4. These are adjusted to produce maximum volume on any long-wave station, and in general it will be found that C3 should be set to approximately a midway position, whilst C4 is adjusted for the best position. A slight re-adjustment of C3 may then be made. Do not be tempted to use any gang condenser other than that specified as you will probably find that in so doing it will be impossible to obtain a matching of the tuned circuits throughout the entire medium and long-wave band.

Some little experiment should be carried out with each individual receiver in order to find the optimum values of H.T. and grid bias. As a guide it will probably be found that 120 to 150 volts for H.T.3 and 60 to 80 volts for H.T.2 will give good results, but the latter voltage especially may be found quite critical in order to obtain maximum efficiency. Instability must be avoided in the I.F. valve, and if the voltage is not carefully chosen there will be a risk of this valve becoming unstable with a deterioration in quality and a lack of punch. H.T.1 should also receive careful attention in order that the oscillator section of V1 is maintained at a suitable degree of oscillation. G.B.—2 should be the maximum, namely 9 volts, whilst G.B.—1 must be adjusted for quality as it biases the output valve. When once the correct voltages have been ascertained they will not require modification unless the valves are changed or the batteries are replaced.

A fairly good aerial should be used with the receiver unless you are situated close to a powerful B.B.C. station. In the latter case, if you wish to obtain good reception of long-distance stations it will be worth while to experiment with a good aerial arranged in different schemes in order to avoid swamping by the local. Particular care should be taken not to make the aerial directional on the local, otherwise it will be found difficult to eliminate whistles on practically every station. If no alternative position can be found for the aerial, then an indoor arrangement should be adopted, and it may easily be found that just as good results are obtainable with a carefully-chosen layout, even although the volume on certain distant stations may not be quite so good.

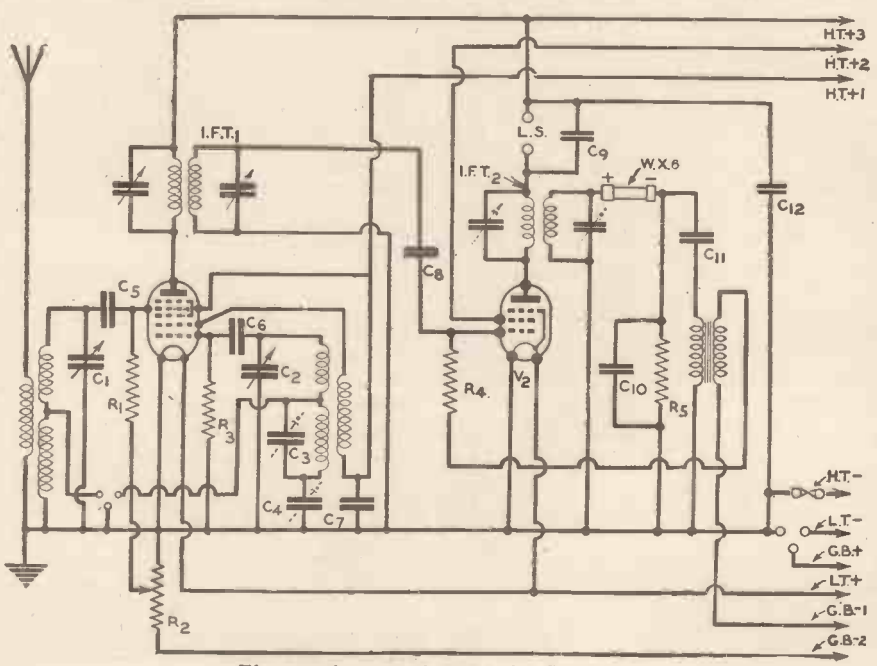






# AN AMAZING TWO-VALVE SUPERHET AT LAST!

Three views of the receiver which show the compact arrangement of the parts and the wiring.




*Theoretical circuit of the 2-valve Superhet.*

# Points About Quiet Automatic Volume Control

## Interesting Details Regarding Inter-station Noises and Their Suppression—by G. V. Colle

THE study of noise suppression has been the natural sequence to the evolution of modern multi-valve receivers. Investigations have shown that noise created in the loud-speaker may be due to a combination of any single one, or more, of the following causes: (1) natural static due to atmospheric disturbances, (2) man-made static created by electrical appliances or machines, (3) natural background noises in sets with A.V.C., where the sensitivity rises to maximum when the receiver is "off-tune," and (4) voltage surges due to the manipulation of switches.

Considering each of these points in the order enumerated, it is clear with reference to (1) that natural static cannot be overcome, except perhaps by employing wavelengths which are unaffected by it. In the tropics, for instance, short waves are used to the exclusion of practically all others. With regard to man-made static, it is now possible to employ devices which effectively suppress it, either at the source or at the receiving end. The majority of commercial receivers for 1935–36 will inevitably provide for the inclusion of static-free aerials, and for the exclusion of mains-borne interferences. For the purpose of this article we are concerned with the possibilities mentioned in (3) and (4) for the simple reason that the noises can be obviated by suitable design of the receiver. It is a simple matter to overcome (4) as the switch which normally governs the wave-changes, and perhaps the pick-up connections in the set, can be fitted with an extra pair of contacts, and a cam which is so arranged as to momentarily short circuit a vital part of the wiring when changing from one waveband to another. The cam can be adjusted so that it will close, say, the grid circuit of an L.F. valve when the switch is in any intermediate position during its rotation.

### The "Static Suppressor"

A variation of this arrangement, which is also proving popular, is known as a "static suppressor," and consists of a manually-controlled resistance, or switch, across a resistance, and which connects in series with one or more cathodes of the H.F. valves. When the resistance is in circuit equivalent to the "on" position it functions to increase the automatic grid bias applied to the H.F. stages, and thereby reduces their sensitivity. In effect, the arrangement brings the sensitivity of the whole receiver down to that which would exist, say, on the local station.

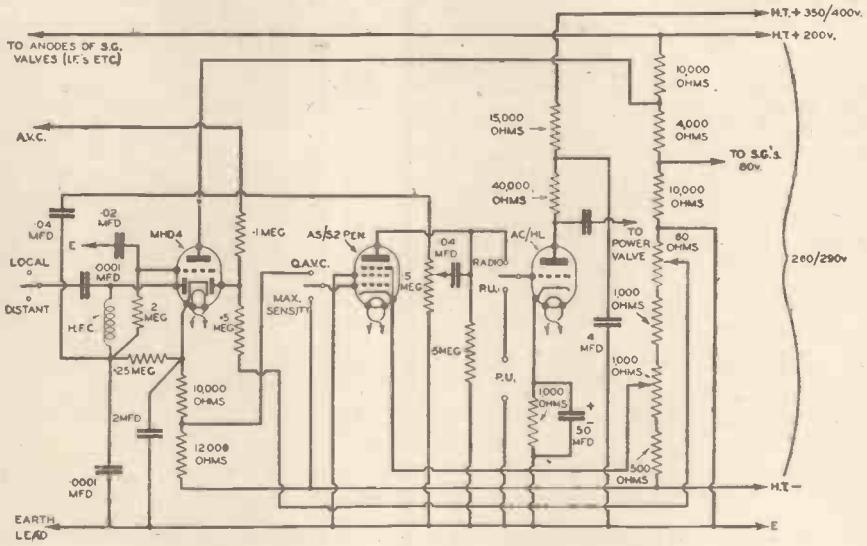
Thus, it is possible to tune in a weaker transmission at a low volume level with the volume control set to maximum, but without the attendant bangs and crackles. From the point of cost the "static suppressor" described has much to recommend it. In the writer's experience the owners of sets incorporating the suppressor rarely make use of it, as the natural tendency is to overlook the controlling switch, especially in "tuning away" from the local to which the majority of sets are normally tuned.

### Q.A.V.C. Systems

For this reason, and the fact that such a control is rendered unnecessary, particular interest attaches to the introduction of automatic inter-station noise suppressing system. Quite properly, the latter arrangements have been termed Q.A.V.C., or quiet automatic volume control. In their early stages Q.A.V.C. systems made use of mechanical relays, and these were connected in the receiver with the magnetising coil either in series with the anode circuits of the controlled H.F. valves or in the anode lead of a special Q.A.V.C. valve. The local contacts were joined across convenient L.F. grid circuits, and were adjusted to short-circuit the L.F. input when the receiver was off-tune (not tuned to a transmission).

It will be understood that the receiver when off-tune is at its maximum sensitivity corresponding to minimum grid bias on the H.F. valves and maximum anode current. The current through the magnet coil of the relay would then be at its highest, and thus would attract the armature which closed the local contacts. As soon as the receiver is tuned to a station providing an input on or above a pre-determined level the grid bias on the H.F. valves is automatically increased, the anode current decreases, and this releases the armature to open-circuit the L.F. input so as to pass the signal.

Special relays provided with minute adjustments and actuated by only a few milliamps. change of anode current were, of course, necessary. A feature of the system was that the relays only passed signals above a predetermined voltage level. The disadvantages were not inconsiderable, in that the armature or contacts were apt to stick, due to the armature becoming magnetised or slightly warped owing to temperature changes, and also owing to the minute clearance which was necessary between the contacts. Any slight threshold effect, due to the automatic volume controlling system which is "wrapped up" with the time constants of the grid decoupling system also tended to make the relay armature fluctuate and so "break up" the signal.




*A typical circuit which employs the Q.A.V.C. system referred to by the author.*

### A Q.A.V.C. Circuit

For these reasons, therefore, the relay came into disfavour, and the natural evolution of non-mechanical systems followed. The writer has experimented with practically all the known arrangements and has finally employed one which is due to R.G.D. There is not the slightest threshold effect with the circuit depicted in the accompanying diagram, and the action is both rapid and decisive. Readers will understand that the Q.A.V.C. valve is an integral part of the receiver design and the H.T. output of the rectifier must be so adjusted that allowance may be made for the voltage drop in the supply, which is necessary in order to allow the valve in question to function.

The values of resistances shown will be approximately correct for most superhets or straight circuits having three S.G., variable-mu, or pentode valves preceding the diode detector. This allows in a superhet. for an H.F. stage at the signal frequency, a first detector, and one I.F. valve.



### An Old-established Band

MOST Salford people will be familiar with the concerts which the Salford City Police Band give regularly during the summer months in the local parks and recreation grounds. They will have the opportunity of hearing this band—which was formed as long ago as 1878—when they broadcast to Northern listeners from the Manchester studios on July 16th under the direction of Thomas Wilson, an old Army bandmaster.

### The Test Match

CAPTAIN H. B. T. WAKELAM will broadcast a running commentary on the third test match between England and South Africa at Headingley Cricket Ground, Leeds, on July 15th.

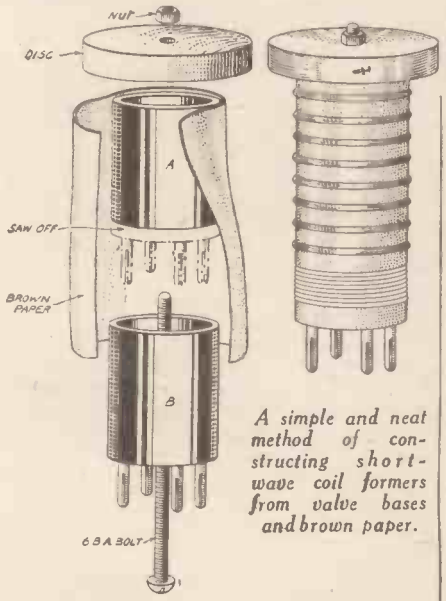
# A PAGE OF PRACTICAL HINTS

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

## Fashioning 4-pin Coil Formers

FOR most of the general short-wave work done to-day the "tube-base" type of coil is largely used. Low cost, high-band efficiency, small size (with narrow external field), and quick interchange are some of its advantages.

Complete coils of this type and blank 4-pin formers are available at reasonable prices, but to the enthusiast who prefers to make his own the following particulars will be helpful.




*A simple and neat method of constructing short-wave coil formers from valve bases and brown paper.*

A 4-pin coil, comprising reaction and grid windings, could certainly be wound on a single valve-base; but the single base has too many limitations for general work, and the coils are easily damaged. Here is a better way:—

Take two plain bases, A and B. Saw off part of A where shown; drill a centre-hole between the pins on B, and cut a hardwood disc 1½in. diameter, with centre-hole. Push a long round-head 6 B.A. bolt through B, attach part A and disc, and align carefully. Fix the nut tightly, and glue on three layers of thin brown paper and let the whole set. To wind the coils, remove nut and disc, afterwards tightly replacing. Cut off surplus part of bolt; finish off by painting disc red, blue, or green, as desired, to indicate wave-range of the finished coil in the modern "colour coded" style.—F. J. G. (Ellesmere).

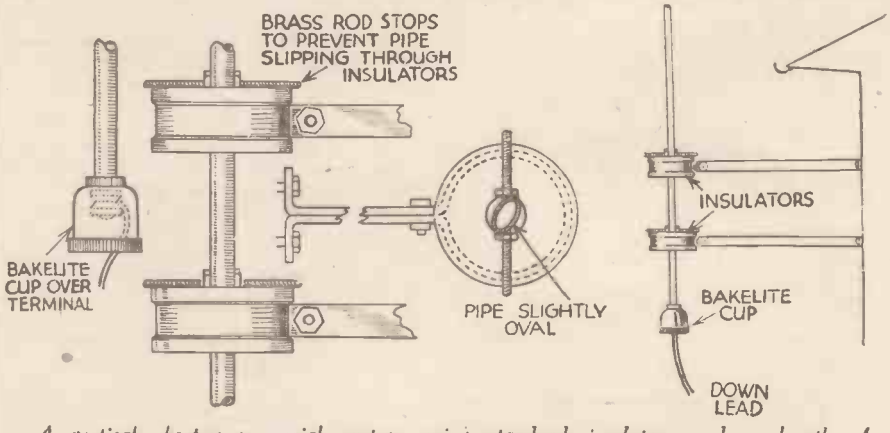
## A Vertical Short-wave Aerial

SEEING in the pages of "P & A. W." that a vertical aerial often gives good results on the short waves, I obtained an 8ft. length of copper pipe from a local plumber and a couple of stand-off insulating brackets, which have the reel type of insulator clamped in them. The brackets should be at least 2ft. long, and of a substantial nature, and also have a fairly large opening in the insulators themselves. The copper pipe is chosen of a thickness which is a near fit in this opening.

In my case the diameter of the pipe was slightly smaller and I made a proper fit by carefully hammering it to a slight oval shape until there was no play between it and the insulator. To prevent the pipe from falling through the insulators, a 3in. length of brass rod was put through a small hole drilled in the pipe just above each insulator and secured with a nut on each side, as shown in the illustration.

A small cap should be screwed on both ends and the one at the lower end drilled and fitted with a fair-sized terminal to take the down lead to set. A bakelite cup from the 6d. stores clamped under this terminal will serve to protect it from the weather.

The completed aerial should be mounted with the topmost bracket just under the eaves if possible.—D. G. ROBOTHAM (Leicester).




*A vertical short-wave aerial system, using standard insulators and a length of copper tubing.*

### THAT DODGE OF YOURS!

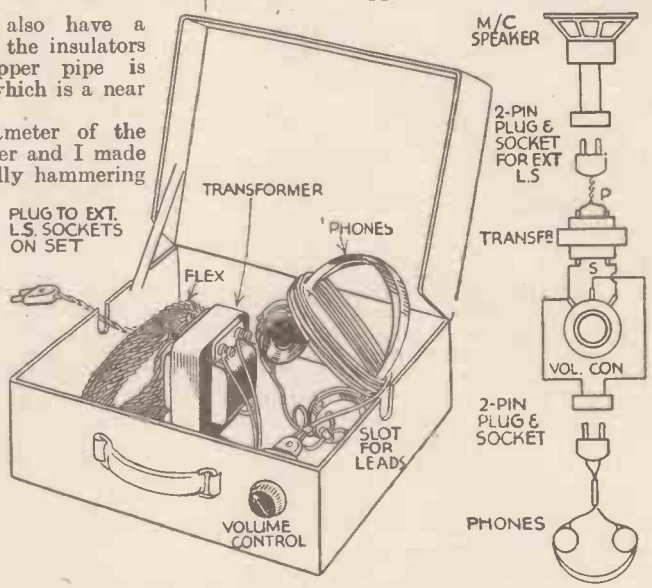
Every Reader of "PRACTICAL AND AMATEUR WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account 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.

## Headphones for Mains Sets

SOMETIMES it is necessary to discontinue listening in on account of sickness—the powerful speaker being too loud for the invalid. By using headphones you may continue your interest in the broadcast, particularly if the set speaker has no universal input transformer as is often the case.

Connect a short pair of leads from the terminals (for external speaker) to a 2-pin socket—at the back of the set; from thence a 2-pin plug to the primary of a 1 to 5 transformer (app. resistance 600: 3,000 ohms). The secondary to the headphones.

By putting the equipment in a cheap 6d. attache case it is made convenient to handle and very useful. The diagram will make the scheme clear. A volume control can be used with the headphones externally if desired.—G. M. DOUBLEDAY (Southampton).




*A good scheme to enable headphones or loud-speakers to be used at will. This arrangement is particularly valuable in the case of illness.*

# Designing Your Own Wireless Set

**This is the First of a New Series of Articles in Which the Practical Details of Receiver Design will be Simply Explained for the Benefit of Those Who Wish to Make a Set to Suit Particular Requirements. The Reader is Here Shown that Theoretical Circuits can Easily be Mastered**

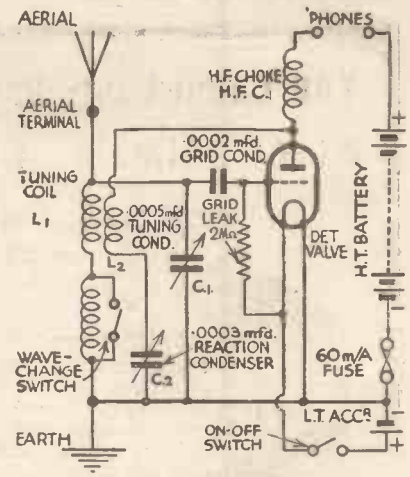


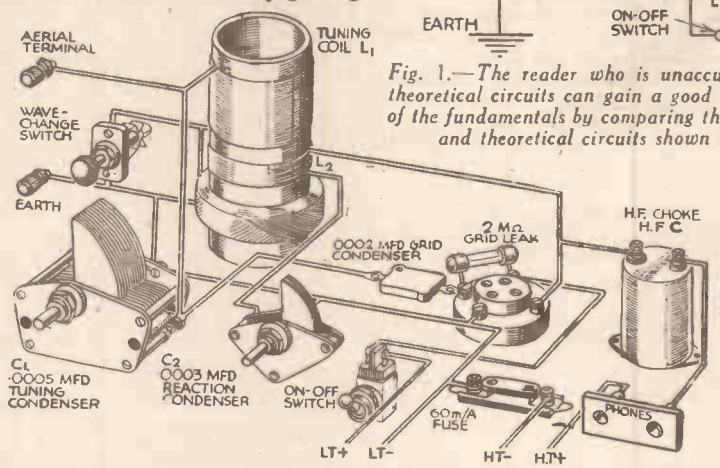

*Fig. 1.—The reader who is unaccustomed to theoretical circuits can gain a good knowledge of the fundamentals by comparing the pictorial and theoretical circuits shown here.*

NOT very many years ago it was quite a common thing for the amateur to design his own receiver, drawing up his own circuit and incorporating several of his own favourite devices and ideas. But conditions have changed, circuits have become more complicated and the average constructor has accustomed himself to following published designs rather than drawing on his own initiative and adding "individuality" to the finished product. In many respects this tendency is not to be wondered at, because every class of constructor has been well catered for by the wide variety of designs regularly published in this journal.

## Be Original or Copy Accurately

Despite this, however, there are still many good reasons why the constructor of moderate experience may wish to draw up his own circuit and work out his own design. A word of warning should be given here, lest the reader should imagine that an attempt is being made to persuade him to modify one of the PRACTICAL AND AMATEUR WIRELESS designs; that is a course which is to be deprecated. When the constructor is able to draw and read a circuit diagram, and is in a position to be able to "translate" the theoretical circuit in terms of a receiver, there is a strong case for the individual design, but a constructor whose experience is as yet too limited to permit of such a course being followed is very strongly advised to follow a published design and to adhere to it *implicitly*. In other words, the exact design should be duplicated or else an entirely new one should be prepared; to modify an existing design indiscriminately is to ask for trouble.

Having explained the position it can be stated that the object of this series of articles is to supply the budding experimenter and constructor with the information he requires in order to prepare an efficient design for his own receiver—a receiver which may be different from all others, which may be modified from time to time as new ideas occur, and which may suit exactly the requirements of the individual. It will be best to make a start by gaining a thorough working knowledge of theoretical circuit diagrams, and a good deal may be learned by comparing the theoretical and pictorial circuits shown in Fig. 1. The circuit represented is that for a single-valve receiver, which is a detector with capacity-controlled reaction.




## The Simplest Type of Circuit

There is no necessity to explain the meaning of the various theoretical symbols, since nearly every reader who is interested in this series of articles will understand them. Those who do not, however, can soon teach themselves to master them by comparing the two circuits referred to. If the circuit is analysed it becomes evident that there is a tuned circuit comprising a coil and variable condenser, L1 and C1 and this is connected between the grid and filament of the valve on the one hand, and between the aerial and earth on the other. The idea is that the aerial and earth provide the signal input to the tuned circuit, the output from which is applied to the input circuit of the valve. A grid condenser and grid leak are included between the tuning circuit and the valve, but these are purely incidental and enable the valve to detect or rectify. We are not going to enter into theoretical questions of rectification and similar matters here, because all such points were fully treated in the recent series of instructive articles under the heading of "Components." It is recommended, however, that any readers who overlooked those articles, and who wish to go rather more deeply into the matter now, should turn up their back numbers.

Going further through the circuit we come to the output of the valve, which is that circuit between the anode and filament. Thus it will be seen that the 'phones (a speaker would be connected similarly) are wired in series with the high-tension battery between the anode and the filament, or earth.

Should any reader wish to "try his hand" at a single-valve receiver he may do so by following the connections given in Fig. 1. Values of components are indicated, but these are not very critical, and the keen amateur can learn much by trying alternative values and so on. So that the valve cannot be damaged during the "probationary" period, a 60-m.a. fuse is included between the negative high-tension lead and earth, so that if the battery connections were inadvertently reversed the fuse would simply "blow" and so prevent the valve filament from

(Continued on page 474)

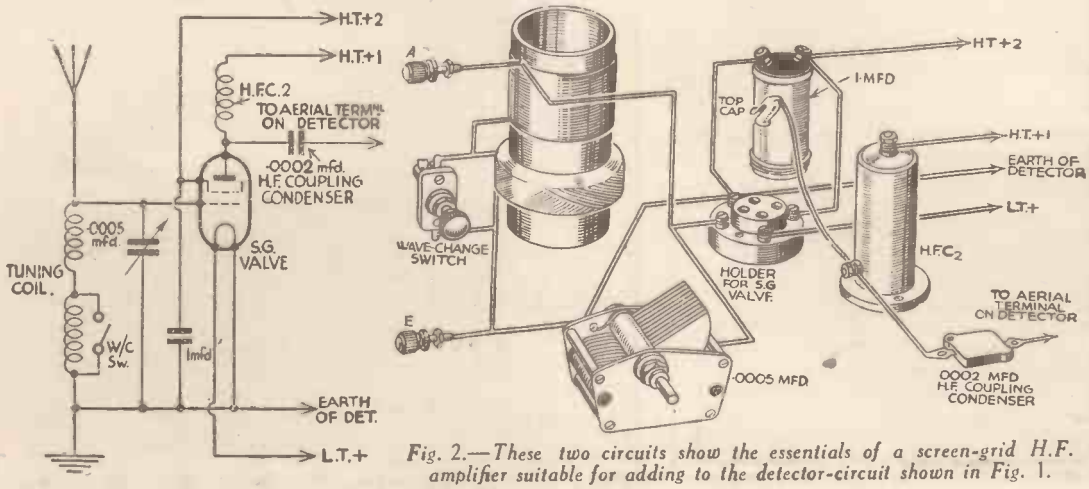



*Fig. 2.—These two circuits show the essentials of a screen-grid H.F. amplifier suitable for adding to the detector-circuit shown in Fig. 1.*

## DESIGNING YOUR OWN SET

(*Continued from page 472*)

being burned out or the battery from being damaged by short-circuiting.

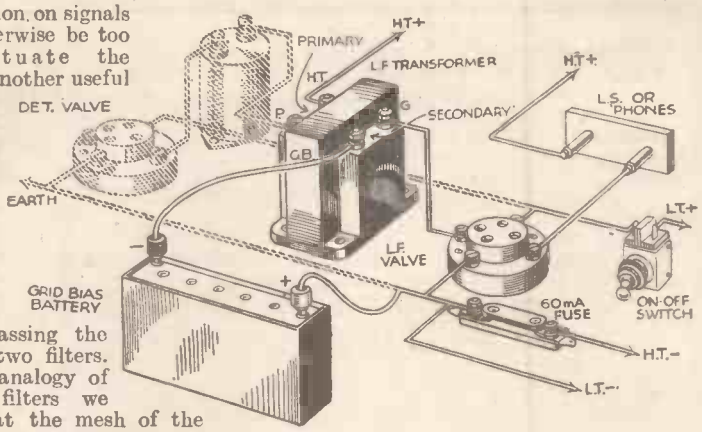
### The H.F. Amplifier

Let us now look at the circuit for an H.F. amplifying valve—a standard arrangement is shown in Fig. 2, where, again, both theoretical and pictorial designs are given. In this case also there is the tuned circuit (coil and condenser) connected between aerial and earth, and also between the grid and filament of the valve. There is no reaction circuit in this case and a high-frequency choke takes the place of the 'phones used in the detector circuit. In other words, the output from the valve is developed across the choke. This output must be transferred to the detector valve, by way of the detector tuning circuit, and this is carried out *via* the fixed condenser, the lead from which is marked "to aerial terminal on detector." It is not difficult to appreciate from this that the output developed across the H.F. choke H.F.C.2 is applied to the detector, and that this output is similar to the input previously supplied by the aerial. In fact, the only difference is that the signal currents picked up by the aerial have been increased in magnitude—amplified is the correct word—before being passed on to the detector.

The high-frequency amplifying valve shown is of the screen-grid type, in which there is a second grid placed between the input or control grid and the anode. The purpose of this has been described before, and it is only necessary at this stage to explain that the screening grid must be supplied with a voltage equal to about one-half that applied to the anode of the valve. The simplest method of obtaining this voltage is by connecting the lead marked H.T.+2 to a tapping on the H.T. battery. It is also a practical essential to connect a fixed condenser of about 1 mfd. between the screening grid and earth, this being to allow the free passage of H.F. (or signal currents) between the screening grid and earth.

### Increased Range and Sharper Tuning

It is appropriate at this stage to explain that the object of the H.F. valve is to amplify the signals at the same frequency as that at which they are received. By doing this, the H.F. stage increases the range of reception because it allows the detector to function on signals which would otherwise be too feeble to actuate the detector valve. Another useful purpose served by the high-frequency stage is that of increasing selectivity due to the fact that the signals have to pass through two tuning circuits before they are rectified. This is equivalent to passing the signals through two filters. If we take the analogy of two mechanical filters we must imagine that the mesh of the two is crossed, so that the effective mesh is made finer.




### Greater Volume

Although the H.F. amplifier amplifies the signal voltages it does not increase the volume provided by any other than weak signals, and therefore it is of little value when it is desired only to obtain greater volume from nearby transmitters. When that is the object we use a low-frequency amplifier which comes, not between the aerial and the detector valve, but between the detector and the 'phones or speaker. Fig. 3 shows the theoretical and practical circuits of the same L.F. amplifier connected to a portion of the detector circuit. From this is may be seen that the 'phones in Fig. 1 are replaced by the primary winding of a step-up transformer which generally has a ratio of between 1 : 3 and 1 : 7. This means that the voltage of the rectified signals from the detector are increased from three- to seven-fold before they are passed to the grid-filament circuit (or input) of the low-frequency valve. The latter valve increases the audio of low-frequency voltages still further before they are applied to the loud-speaker which is included in the anode circuit in the same relative position as that previously occupied by the 'phones in the detector circuit.

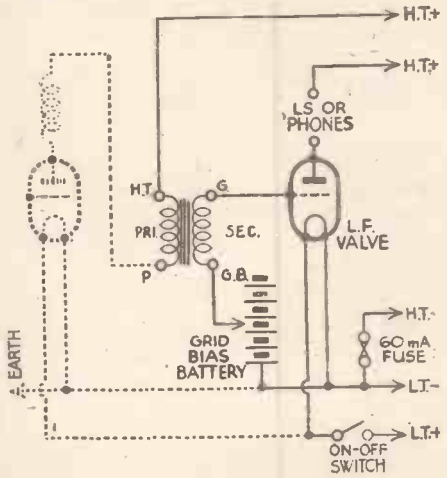



*Fig. 3.—Theoretical and pictorial circuits for a simple transformer-coupled L.F. amplifier suitable for use in conjunction with the H.F. and detector circuits shown in Figs. 1. and 2. Notice that the on-off switch is transferred from the position shown in Fig. 1. and is in series with the lead from the + terminal of the accumulator.*

### Understand the Theoretical Circuit

The explanations just given have been as brief as possible and have been presented principally with the idea of refreshing the memories of those readers who have not recently considered the matter from this particular angle, and also by way of assisting the less-experienced amateur to understand more clearly the matters which will be explained in later articles. In the meantime it is suggested that those who are as yet somewhat unfamiliar with theoretical diagrams should carefully compare the circuits illustrated, for once the first essentials are grasped circuit diagrams become just as easy to read as the written word, and they are certainly much easier to follow than are pictorial arrangements.

## "Good Evening, Mr. Ghost"

THE third of the series of interviews "arranged" by Froom Tyler with West Country worthies of the past will be given for Western listeners on July 15th, when his subject will be Thomas Coryate, known as "Tramping Tom of Odcombe." In this series which is entitled "Good Evening, Mr. Ghost," the opinions expressed by the "ghosts" are those held by them in their lifetime and they are only interviewed on matters in which they were particularly interested. Thomas Coryate, a Somerset man, may be said to have invented hiking, for he went on extraordinarily long journeys alone and mostly on foot. He walked with only one pair of shoes from Venice to Flushing and on his return to Odcombe hung up his shoes in the village church as a thankoffering for his safe return. He wrote an account of his travels called "Coryate's Crudities," and he is credited with having introduced the fork into England.

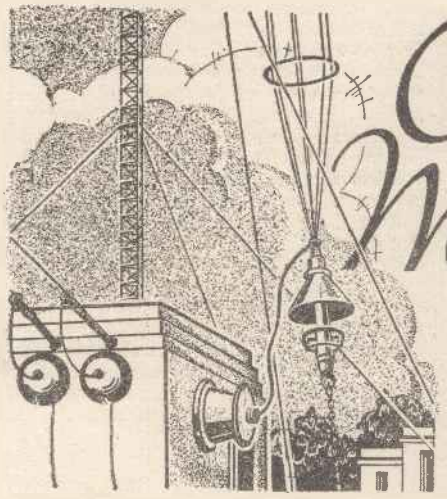
## Programme Notes

### Northern Know-Alls

A NEW series of talks features of a composite nature is to make its début in the Northern programme of July 19th. All prospective holiday-makers should find them of interest and also of service, whatever type of holiday they are planning. It is hoped that few people are so singularly ill-equipped as the Gubbins family—the central figures of these features—to set off for an expedition of any kind, but if they have the same readiness to learn and the same enthusiasm, they will be interested to hear the Gubbins consulting various experts and will be able to share the advice they receive. The first of these "Northern Know-Alls" talks will be on the subject of the ever-popular picnic, and even those listeners who rather pride themselves on their cutting of a sandwich, or their *nous* for a good "spot," should find their knowledge usefully supplemented.

### A Varied Career

JOHN COATES, the well-known Yorkshire tenor, has had a remarkably varied and interesting career. At the age of five he became a choirboy at Girlington Church, near Bradford, and subsequently went to London to study singing, as a result of which he appeared in comic opera for five years. In this capacity he toured America, but, returning to England in 1901, he turned his attention to the singing of "straight" opera and played several rôles at Covent Garden. In more recent years he has shown his preference for the choral works of Elgar. His recital for Northern listeners on July 14th will consist of old English songs by composers such as Dowland, Purcell, Boyce and Storace.



# On Your Wavelength

By Thermion

## At the Show

THE calendar creepeth on apace. Within a month Radiolympia will be on us. The technical hounds of PRACTICAL AND AMATEUR WIRELESS are in possession of most of the facts concerning the new season's programmes, but like all true journalists they have refused to spill the beans until they have the word from the Presence. They are also busily at work on some cunning designs for the new season—designs which with my half-technical eye have hair-raising possibilities. This journal has been responsible for many things during the three years of its life. For one thing, until its appearance most home-constructed receivers were designed on a flat baseboard reminiscent of the early days of wireless.

## Those "Designers"!

APPARENTLY a few youthful so-called "designers" who themselves could not solder and could not differentiate between a drill and a file, presumed that the rest of the public were of a similar low order of intelligence, and hence the "designs" which were presented to the intelligent constructor public were more suitable for a children's annual than for grown men. The same so-called youthful "designers" very badly misled the component industry by stating that set-constructors could not solder, and hence the trade were forced to produce components with terminals instead of the more secure soldering tags.

## This Journal Has Led and Shown the Way

EVERY terminal fitted to a wireless set is a source of trouble. If a long wire is attached to it mild vibration of the wire will loosen the terminal. Half of the crackling noises of which some constructors complain are due to terminals which they think are tight but which yet permit of intermittent contact.

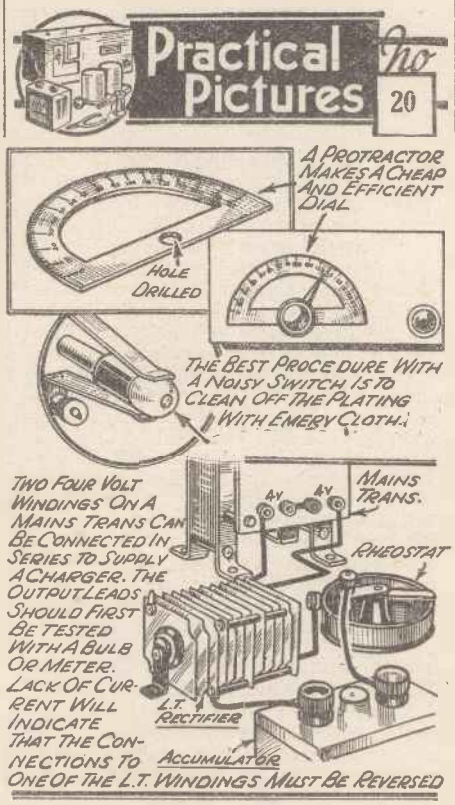
I am glad to see that PRACTICAL AND AMATEUR WIRELESS has cleaned up design very considerably and has led home-construction on many other important features of design. For this we must thank the Editor of this journal whose unbounding energy, enthusiasm, and indefatigability has been responsible for this state of affairs. His personal guarantee of receivers sponsored by this journal encouraged home construction. His policy of specifying only those parts used and found satisfactory after test saved the reader an enormous amount of work in finding out by trial and error which component best suited a certain receiver.

## Radio Knowledge For All

THE Editor's various volumes have brought the accumulated knowledge on radio within the reach of all, and I look forward during the coming season to some further startling developments as a result of his mental fertility. I am sincere in my expression of opinion when I say that he is unique in Fleet Street, and I welcome the opportunity afforded by the amalgamation of this paper in serving him.

## Interlaced Television

I WAS privileged to witness the other evening a cathode-ray television receiver designed by the Editor for low-definition reception. It was equal to any home cine and he had achieved this effect by the use of a tube with a large scanning spot. At the same time I was afforded an opportunity of witnessing high-definition television on 180 lines, 260 lines, and 405 lines, both with ordinary scanning and interlaced scanning. I notice that the latter system gives a remarkable stereoscopic effect to the pictures which are astonishingly steady. With a cathode-ray tube you focus and frame the picture and then sit back to enjoy the programme. There is no knob-twiddling as with a disc scanner, and the 30-line programme I witnessed was surprisingly excellent. It is a great pity that the Editor may not be permitted to exhibit this apparatus at the forthcoming Radio Exhibition.




## Police Messages

HOW many readers have picked up police messages? I shall be interested to hear from readers regarding the wavelength on which they have picked up these messages. I am given to understand that the wavelength of the police transmissions is kept a secret. Personally, I can see no reason for this, since with a little experiment with simple apparatus it would soon be possible to find it. Rather fun, I should think, listening in to Sergeant Smith giving instructions to P.C. Brown.

## Summer Conditions

I WONDER how you have found reception conditions in your part of the country during the recent hot spell? I have experienced some very peculiar effects in the north-west part of London, some of which cannot be attributed, I am afraid, to the weather. Apart from atmospherics, which, of course, are always troublesome in the hot weather, certain distant stations seem to have increased in strength, and this in contra-distinction to the expected decrease in strength. The well-known French station, for instance, which is on the air at breakfast-time, now seems to come in remarkably well, and I am sure that on several mornings he has been a better signal than during the past winter months. On the long waves, too, the Deutschlandsender has very good entertainment value, and I must confess that I cannot understand why he seems to be more steady than formerly. Of course, there is always the possibility that adjustments have been made to a transmitter, and thus the listener is unaware of the reason of improved or—for that matter—worse results, and this must be borne in mind. But I feel that conditions so far this summer have been very variable and warrant some keen experiment and investigation.

## Schoolboy Constructors

I VISITED a school exhibition the other day and saw some marvellous examples of set construction by juveniles. It is not many years ago that wireless was a mystery even to many adults, yet in this particular school it appears that youngsters of eleven and twelve had mastered the intricacies of the modern valve and had made up all kinds of sets from their own knowledge and definitely not copied from books. One boy of thirteen had built a six-valve super and it worked really splendidly. The soldering, too, was a credit to many a so-called electrician, and I should imagine that when the present young generation begin to take up their position in the world's affairs we shall see some remarkable improvements in

*(Continued overleaf)*

(Continued from previous page)

wireless technique. It is, after all, only as a result of experiment by one and all that improvements are effected, and when a nation becomes completely wireless-minded it is only natural that inventions will be forthcoming and improvements effected in all directions. Perhaps even before I pass on, the daily use of radio-conveyed power will be achieved, and vehicles will pass through our streets silently, without smell, and operated by electric power picked up from local radiating stations.

### Wireless in the Air

THOSE who visited the recent Air Pageant were no doubt very impressed by the improvement in wireless telephony for aircraft. We were able to hear a pilot leading a flight of aeroplanes talk to his co-pilots and instruct them in various manœuvres. What an improvement over the war-time use of radio, when the aerial had to be lowered through the floor and wound up before we could land! Now even the smallest aeroplane has a neat aerial fitted rigidly to the machine, interference from the engine is eliminated, and although it is true that the noise of the engine is rather prominent, it was certainly possible to hear the pilot's speech even after severe amplification by the ground engineers in order that it could be relayed to the many speakers all over the aerodrome and round about. This type of transmission must not be confused with the modern air liner's equipment as the conditions are so vastly different, but when this point is considered, in conjunction with the control of an aeroplane flying pilotless by means of wireless signals, it does really seem as though wireless is looking up these days.

### Wireless on the Fire Engine

FOR the first time in the history of this country two-way ultra-short-wave radio telephony has been carried out from a fire engine to the fire station, enabling the firemen on the moving engine to be instantly called, or to receive instructions from their headquarters, alternatively to speak to their station if they require further assistance, etc.

The foregoing has been made possible by the new British invention, the "Hermes Midget Transreceiver," which is a novel combined transmitter and receiver, the change from "send" to "receive" being carried out by means of a simple switch.

### Marconi-Stillè Recorder

THE provision of a high-class equipment for recording broadcast performances is necessarily of the greatest utility to broadcasting concerns. I understand that the Research Department of the Marconi Company have recently completed a lengthy investigation into the operation of the magnetic steel-tape recorder, and as a result of this research the company have now placed on the market a new recorder known as the Marconi-Stille Recorder, Type M.S.R.1, which surpasses any of the existing equipments for fidelity of reproduction, ease of operation, and general robustness under arduous working conditions. Several of these equipments are now under construction at the Marconi Works at Chelmsford for various broadcasting authorities. I wonder if this forecasts the end of the present-day gramophone?

### New Wireless Beacons

THE necessity, under modern conditions, for special wireless services operating on fixed wavelengths to adhere very closely to their allotted frequencies has led to an interesting new development in the design of wireless beacon-transmitters of the class installed in many lighthouses and lightships as an aid to maritime navigation. This is the addition of a crystal-controlled drive unit to the latest Marconi automatic beacons, enabling the wavelength of the transmitter to be stabilised with a very high degree of accuracy, and thus reducing the possibility of interference by beacon transmissions with other wireless services on neighbouring frequency channels.

Two of the new crystal-controlled beacon transmitters have already been ordered by coastal authorities. The first, of 250 watts aerial power, is to be installed at Cabo Vilano, north-eastern Spain, and the second, of 100 watts aerial power, at Cape Columbine, South Africa. The crystal-controlled drive unit is so arranged that it may be added to any existing beacon transmitter without undue complication.

## Notes from the Test Bench

### Band-Pass Tuning

WHEN reception of foreign stations is desired, it is generally found that two tuned circuits do not provide a sufficiently high degree of selectivity. In cases where a very long aerial is used, the connection of a preset condenser having a capacity of approximately .0003 mfd. between the aerial lead and the aerial terminal of the set usually provides a marked improvement in apparent selectivity, but this procedure also tends to reduce signal strength. The connection of an extra tuned stage between the aerial and the aerial-tuned circuit provides a marked improvement in selectivity, however, without materially affecting the signal strength of foreign stations. It is desirable to use a similar type of coil in the extra circuit to the one incorporated in the receiver, but this is not essential if a separate tuning condenser is employed. The extra tuned circuit must be coupled to the first circuit of the set by means of a capacity or an inductive coil common to both circuits.

### Capacity Coupling

IT is rather difficult to add a coupling coil, especially if the tuning coils are enclosed in screening cans, and, therefore, the use of capacity coupling is recommended. There are two types of capacity coupling, namely, top coupling and bottom coupling. In the case of top coupling, a very small condenser having a capacity of approximately 15 m.mfd. should be joined between the fixed plate terminal of the extra tuning condenser and the fixed plate terminal of the receiver aerial-tuning condenser. It is difficult to obtain a commercial component having this low capacity, and, therefore, it is suggested that a 3in. length of Glazite or similar type of insulated wire be connected to each of the fixed vane terminals, and then tightly twisted together to a length of approximately 1½in. The necessary length will depend to a great extent on the stray capacity in the circuit, and, therefore, this can best be found by trial. If the coupling capacity is too high, double-hump tuning will be experienced, and if it is too low signals will be weakened. Bottom-capacity coupling is obtained by joining the earth ends of the two tuning coils and then connecting the juncture *via* a fixed condenser of approximately .005 mfd. to the juncture of the moving-vane terminals of the two condensers.

### Visual Tuning Indicator

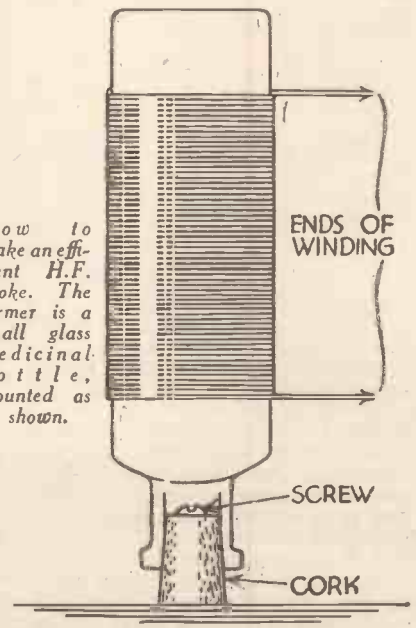
IN selective superhets incorporating automatic volume control, a visual tuning indicator is very desirable. There are several methods by means of which visual indication can be obtained, but the easiest for the home constructor is that employing a milliammeter. It is advisable, of course, to use a reliable instrument having a full scale deflection slightly in excess of the total current consumption of the controlled valves. The common H.T. supply lead of the controlled valves should be broken and the terminals of the meter connected to the free ends. The total anode current of these valves will then pass through the meter.

### Three Good Plays

A TRIPLE bill of Yorkshire plays, to be presented in the Northern programme on July 15th, should provide plenty of scope for Jan Bussell, when he produces them on his return from his three months' stay at Head Office. These plays are the work of Yorkshire authors, and are varied in theme and setting. "The Deaf Beggar Man," the action of which takes place in the eighteenth century, is by W. Hawdon; "No Such Luck" is by Norman Hillas; and the authors of "Calling the Tune" are Leonard G. Hines and Frank King. Felix Felton, who has filled Mr. Bussell's post as Northern Dramatic Producer during his absence, will no doubt return to Head Office the richer in experience for his sojourn in the provinces, and it will be interesting to note how Mr. Bussell has profited by his stay in London.

### Home-made H.F. Chokes

HERE is an idea for those readers who like to make as much as possible of their own short-wave gear. It concerns H.F. chokes which can very easily and efficiently be made with the aid of the small round




*How to make an efficient H.F. choke. The former is a small glass medicinal bottle, mounted as shown.*

medicine bottles which are usually used for children's medicine and are graduated in teaspoons. These make excellent formers and for a short-wave choke one hundred or so turns of 32 d.s.c. should be carefully wound on it. The completed choke may be pressed on to the cork, which has previously been screwed on to the baseboard in order to mount it.

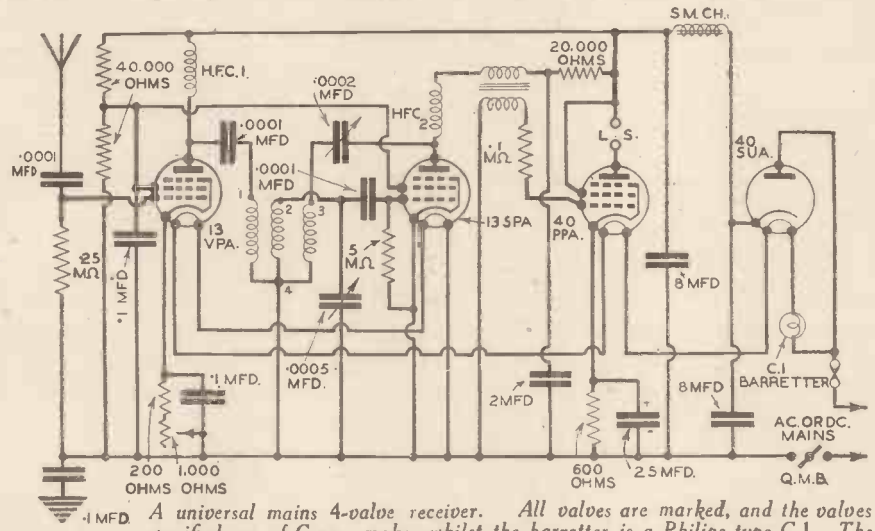
# Circuits Readers Ask For

The Interesting Three-valve Circuit Described this Week is for A.C. or D.C. Working, and Covers Long, Medium, and Short Waves

By FRANK PRESTON

A NUMBER of letters have been received from readers asking for a circuit of a simple all-wave receiver with a reasonably long range, that can be made easily and which does not call for any very great operating skill. That, briefly, is a description of the circuit shown on this page.

We have previously given details of battery-operated all-wave receivers, whilst full constructional details have been published in respect of a highly-efficient set of this type for A.C. operation—the "A.C. Silver Souvenir"—and so it was considered that the best interests of the majority would be served by describing a circuit for operation from either A.C. or D.C. mains at will. Thus, the arrangement can be described as universal in every sense of the word; it will tune to the wavelength of any broadcasting station in the world, and it can be operated from any mains rated at between 200 and 250 volts.




*A universal mains 4-valve receiver. All valves are marked, and the valves specified are of Cossor make, whilst the barretter is a Philips type C.1. The layout should approximate to that of the component shown in the theoretical diagram.*

## Three Pentodes

The first thing which becomes apparent on examining the circuit is that it includes three pentode valves, in addition to the half-wave rectifier and the barretter lamp. Of these three valves, the first is of the variable-mu type, the second is an ordinary screened H.F. pentode, and the third is a power pentode, this being a combination which proves extremely effective for the particular purpose for which this circuit is intended.

In order to simplify tuning to the greatest possible extent, and at the same time to avoid the necessity for preliminary trimming and balancing adjustments, the aerial circuit is untuned, but consists merely of a .25-megohm non-inductive resistance which provides a uniform impedance over the complete range of wavelengths covered. This is followed by the variable-mu pentode, which is choke-capacity coupled to an H.F. transformer feeding into the leaky-grid detector. This transformer is actually an all-wave coil, which is provided with an efficient built-in switching system, so that any one of five different ranges can be obtained. The ranges covered by the particular plug-in coils specified are 20-45, 40-90, 85-170, 200-500, and 1,000-2,000 metres, but other ranges are available merely by replacing one or other of the coils by others which are interchangeable with them, and which are obtainable at prices between 3s. 6d. and 4s. each, according to wavelength coverage. It should be mentioned in passing that the switches and multiple coils are not shown in the circuit, in order to keep it as simple as possible, and also that there are only four terminals on the complete assembly, these being marked with the figures 1 to 4 in the circuit.

Following the detector is an L.F. transformer which feeds into the output valve through a .1-megohm H.F.-stopper resistance, the latter serving to prevent H.F. breakthrough and instability when listenidg on short waves. The output valve is automatically and correctly biased by means of the 600-ohm resistance included in its cathode lead, whilst a variable bias voltage for the first valve is provided by adjustment of the 1,000-ohm variable resistance shown.

## Power Supply

The power-supply system is interesting because it functions equally well when fed from A.C. or D.C. A Cossor 40 SUA half-wave rectifying valve is included in the positive mains lead, and the positive H.T. lead is taken from the cathode of the valve through the usual smoothing choke to the anode circuits of the three valves. The rectifier functions as such when the set is operated from A.C. mains, but it acts merely as a small series resistance when the supply is D.C. Incidentally, the rectifier specified has a maximum output of 250 volts at 75 milliamps, which is quite adequate for the needs of the valves.

As is usual in D.C. and universal-mains receivers, the heaters of the three receiving valves and also of the rectifier are connected in series and also in series with a ballast resistor, the latter in the present case taking the form of a barretter. This is the Philips type C.1, which is rated to pass .2 amp. over a voltage range of 90 to 230, which means that the barretter will limit the current passing through it to .2 amp. when the voltage of the supply varies between 90 and 230 in excess of that required by the valve heaters. The latter voltage is 106—found by adding together 13, 13, 40 and 40, which are the heater-voltage requirements of the first, second, third, and rectifying valves respectively. The valves specified have been carefully chosen so that they all require the same heater current of .2 amp., since this obviates the need for resistances in parallel with the heaters of any particular valves.

### PRINCIPAL COMPONENTS REQUIRED

One Peto-Scott Metaplex Chassis, 14in. by 10in. by 3in.
One Ebonite or Plywood Panel, 14in. by 8in.
Four Clix 5-pin Chassis-mounting Valve-holders.
One W.B. Side-contact Chassis-mounting Valve-holder.
One Bulgin 5-range Coil Chassis with Switch.
Five Bulgin Coil Units for above chassis, types SW.24, SW.25, SW.26, SW.28 and SW. 29.
One J.B. .0005-mfd. Slow-motion Condenser, type D.
One J.B. .0002-mfd. Midget Condenser (for reaction).
One "Eddystone" All-wave H.F. choke, type No. 982 (screened).
One Wearite All-wave H.F. Choke, type H.F.O (unscreened).
One Varley 20-henry Smoothing Choke, type DP.10.
Eight Dubilier 1-watt Metallised Resistances; one each, 40,000 ohms, 40,000 ohms, 20,000 ohms, 600 ohms, 200 ohms, .1 megohm, .25 megohm, and 5 megohm.
Three T.M.C. .0001-mfd. Tubular Condensers.
Three T.M.C. Fixed Condensers, type 350; .1 mfd., 1 mfd., and 2 mfd.
One Dubilier 25-mfd. Electrolytic Condenser, type 3001.
Two Dubilier 8-mfd. Reversible Electrolytic Condensers, type 0281.
One Bulgin 1,000-ohm Volume Control Potentiometer, type V.C.24.
One Ferranti 1:3.5 L.F. Transformer, type A.F.5.
Four Cossor Valves, types 13 VPA, 13 SPA, 40 PPA, and 40 SUA.
One Philips Barretter, type C.1.

## The Components

Generally speaking, the components are not very critical, but it is desirable that only the specified valves should be employed because others might have different characteristics and different working voltages. Notice also that both H.F. chokes are of the all-wave type, although one—H.F.C.1—is unscreened and the other is screened. It might be considered that the condensers in series with the aerial and earth leads could be omitted, but this would be unwise, since in certain cases the positive D.C. mains lead is earthed, and in such an instance the mains would be short-circuited through the earth lead.

It will be seen that of the five valve-holders specified one is of the side-contact type, this being for the barretter; the others are of the usual type for chassis mounting. This type is specified because it will be found better to use a chassis in preference to a baseboard for this set. Three electrolytic condensers are specified, and two of these are of the reversible pattern, the reason for this being that when the receiver is first con-

(Continued at foot of next page)

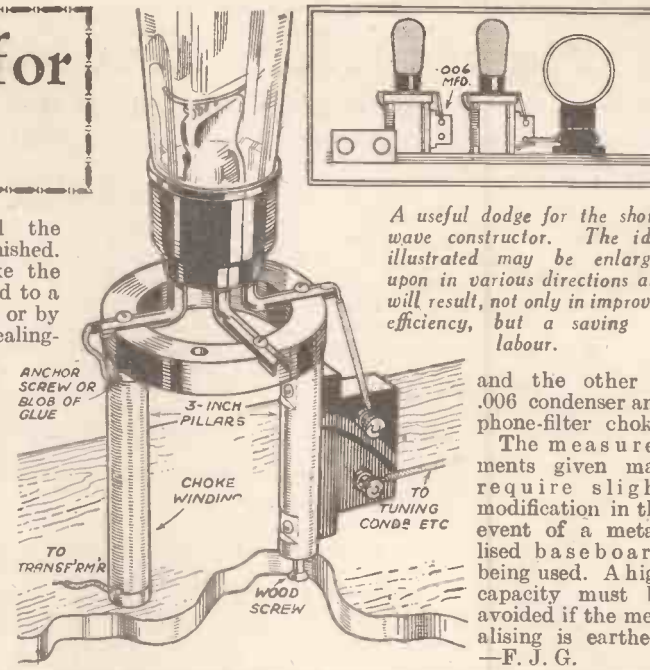
# A "Valve Elevator" for S.W. Work

SINCE the earliest days experimenters have had a fondness for elevating their short-wave detector valve above baseboard level. This is usually done with small ebonite pillars, and has the advantage of reducing capacity to earth and of improving the general layout. The "elevator" unit to be described goes a step farther.

This unusual-looking assembly not only contains and elevates the valve-holder to an extra high level, but also contains an efficient R.F. choke and its own coupling condenser. The layout and wiring advantages are obvious.

The pillars are two 3in. lengths of wooden dowel-rod, having a diameter of ½ to ¾in. These, and particularly the grid side pillar, may be square if desired, but a round rod looks better. Starting holes for the fixing screws are made with an awl in the centre of each end, and the pillars are then varnished.

To start the choke the wire may be anchored to a short tack or screw, or by a blob of glue or sealing-wax. Cover 2½in. with 34-40 G. wire and secure the end as before. Mount a suitable condenser on the other pillar, assemble the unit, and mount it on the baseboard as indicated. In a 2-valve R.C. coupled set use two similar units. One unit will have a .0001 condenser and reaction choke, and the other a .006 condenser and phone-filter choke.




*A useful dodge for the short-wave constructor. The idea illustrated may be enlarged upon in various directions and will result, not only in improved efficiency, but a saving in labour.*

The measurements given may require slight modification in the event of a metallised baseboard being used. A high capacity must be avoided if the metalising is earthed.

—F. J. G.

# Variable Selectivity

## An Interesting Suggestion for Enlarging the Scope of a Modern Receiver

ALTHOUGH variable volume controls, tone controls, and reaction controls are practically standard fittings on modern receivers, it is surprising to find that a selectivity control is generally conspicuous by its absence. In many respects this is to be regretted because, by making the selectivity of such a high order as that frequently demanded by present-day reception conditions the quality of reproduction is often seriously impaired. It is admitted that a sensitive receiver intended for long-distance reception must be highly selective, but it is also claimed that when the same set is used for reception of nearer stations much broader tuning could satisfactorily be employed.

When the tuning circuits are so adjusted that they admit a band-width of, say, 7 kilocycles, it is not possible to obtain anything like perfect reproduction, so that even if the set is provided with a perfect L.F. amplifier and a superlatively-good loud-speaker, really natural reproduction is impossible. It is fully appreciated that high-fidelity reproduction of programmes from a distant transmitter would be out of the question no matter how broadly the receiver was designed to tune, but a good receiver having a band-width response of about 10 kilocycles can perform extremely well.

It is generally assumed that a highly-selective receiver intended for distant reception cannot give good-quality reproduction from the "local" except by employing "unnatural" methods of tone compensation, but this need not be the case if the receiver be provided with a variable-selectivity control. The provision of this does not present insurmountable difficulties, and the practical application is perfectly straightforward when a band-pass filter is employed. All that is required is a simple method of varying the coupling between the two tuned circuits; when bottom-capacity coupling is employed it is only necessary to provide two or three coupling condensers which can be brought into circuit in turn by means of a switch; whilst if the coupling is inductive a means must be devised of rotating the coupling coil in respect of the tuned winding. In those instances where top-capacity coupling is employed a small-capacity variable condenser could be used to produce the same effect by using this in place of the usual fixed condenser.

With a superheterodyne circuit the coupling between the windings of the I.F. transformers must be varied, and this can be done by following the same system as that suggested above for top-capacity band-pass coupling. There may be some mechanical difficulty in ganging the various selectivity controls, but this could be overcome if the coils and/or I.F. transformers were mounted together on a metal chassis.

There is yet another method of providing a variable selectivity control which is by altering the position of the core in coils and I.F. transformers. Whatever method is adopted it is important that the control should be brought out to the front of the panel, and that operation of it should not alter the tuning or ganging of the tuned circuits.

It is appreciated that certain manufacturers have produced tuning components the band-width of which could be altered—but only by applying a screwdriver or spanner to the components themselves. This method is inconvenient and somewhat clumsy, and the writer looks for something better at Radiolympia.

## CIRCUITS READERS ASK FOR

*(Continued from previous page)*

nected to a D.C. supply the polarity might be reversed, so that ordinary electrolytics might easily be damaged. As it is, no harm can be done by connecting the mains plug wrongly, and as soon as it is found that the receiver does not function it is necessary only to reverse the plug in the holder.

### Component Layout

A convenient size for the chassis is 14in. by 10in. by about 3in. deep, and this allows ample spacing between the parts and, in consequence, low inter-component capacity and easy wiring. The three receiving valve-holders may be placed in line along the rear of the chassis, the other two (for the rectifier and barretter) being arranged side by side at the right-hand end.

The .0005-mfd. tuning condenser, with its slow-motion dial, can then be mounted in the centre of the panel, which may be of ebonite or plywood, with the coil slightly to the left and the reaction condenser on the right. The on-off switch and variable-mu volume control may then be mounted near the left- and right-hand ends of the panel, to make the arrangement of the five knobs symmetrical. The unscreened H.F. choke should be placed near to the first valve-holder and should be mounted vertically so that its axis is at right angles to the axes of the coils in the all-wave tuning unit. Most of the other components can be accommodated underneath the chassis in such positions that the leads from them are as short and direct as possible.

The method of operating the receiver does not call for any special mention, since it is the same as for a simple broadcast receiver of the detector-L.F. type. Consequently it is necessary only to set the pointer of the wave-change switch to the appropriate mark on the circular plate supplied with the coil unit, and to operate the tuning and reaction knobs in the usual manner. When receiving on short waves, however, it is especially important that both condenser knobs should be turned as slowly as possible, whilst it will probably be found that the reaction condenser has to be used almost simultaneously with the tuning condenser. After very little practice, however, it will be found that tuning on any waveband is perfectly straightforward.

# SHORT WAVE SECTION

## At the Short-waver's Bench—11

Some of the Commoner Troubles Met With in the New S.W. Set are Dealt With in this Article

THIS week I must ask the "fans" to forgive me if I devote a considerable amount of space to the short-wave beginner, and try to elucidate a few of the problems he is likely to find in his new hobby. I hope some of these beginners have built the two-valve set which was described in No. 7 of this series and which is a fairly typical example of a short waver, as it is to this set I intend to refer. The first trouble which may be discovered with modern high-efficiency valves (particularly if the H.T. battery is a little run down) is that the set is slightly unstable. Decoupling will easily cure this, however, and is cheaply and easily fitted by means of a 25,000-ohm resistance and 2-mfd. condenser, as shown in Fig. 1. If this addition causes the set to cease oscillating, the H.T. on this tapping should be increased.

A trouble which is peculiar to the short-waver is "threshold howl"—a hoot or howl which manifests itself just on the critical spot before the set commences oscillating. It was regarded almost as an incurable disease a few years ago, but is now considered as due to excessive inductance in the anode circuit of the detector. It may often be cured by the use of a cheap L.F. transformer, but the resulting quality is usually not too pleasing; a certain cure, therefore, is to parallel-feed the transformer as shown in Fig. 2. This is far better than all the other makeshift ideas which used to be popular at one time.

### Dead Spots

Another annoying short-wave trouble is the occurrence of "dead spots" on the tuning dial where the set will refuse to oscillate. These are due to harmonics of the aerial, and may be removed by connecting a small variable condenser, such as a "neutralising condenser," in series with the aerial lead-in. This is adjusted until the dead spots either disappear altogether or else are removed to parts of the dial where they do not matter.

To obtain the optimum results it is essential that reaction should be smooth and build up gradually into oscillation. This may be assisted by careful adjustment of the detector H.T. voltage, and is also considerably helped by adjustment of the bias to the grid of the detector valve by means of a potentiometer across the L.T., as shown in Fig. 3.

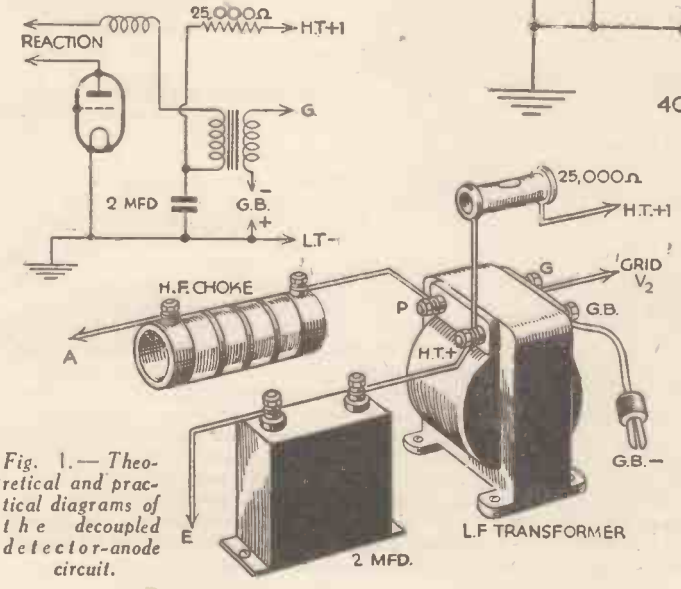



*Fig. 1.—Theoretical and practical diagrams of the decoupled detector-anode circuit.*

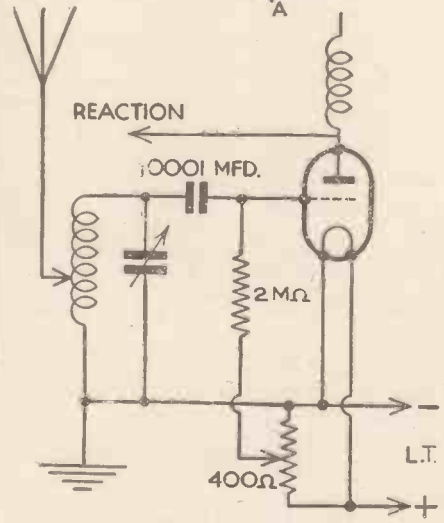



*Fig. 3.—Making reaction control smooth by adjusting the bias for the detector valve.*

The set should now be working at its best, but difficulty may be experienced with hand-capacity. I always think the extension-handle method of curing this is rather a makeshift one. Personally, I find that covering the baseboard with metal foil which is carried up behind the panel and connected to earth always cures the defect, even if the earth lead is somewhat long.

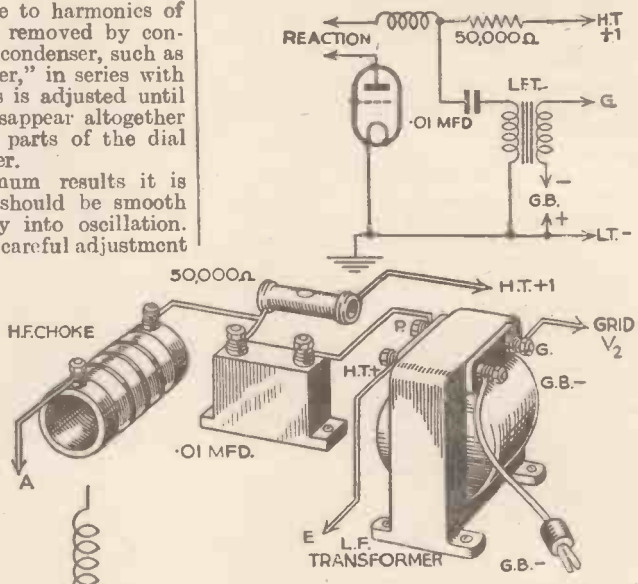



*Fig. 2.—Parallel-feeding the L.F. transformer will often cure threshold howl.*

Finally, a point which often puzzles the beginner is that frequently his set works just as well, or better, without an earth. This is quite in order as it often happens that quite an efficient counterpoise is formed by the foil, the plates of the L.T. accumulator, and the H.T. battery.

### Keeping a Short-wave Log

To beginners, and others who do not already do so, I would suggest that the keeping of a short-wave log is an extremely interesting aid to experimenting. An exercise book may be ruled up in table form, or, as in my own case, a diary of somewhat large size which gives one or two days to a page may be used. Facts which are necessary to include are: The date (if you do not use the diary); the time, in G.M.T., using the twenty-four-hours system; the station received; its signal strength and readability. Other points which might be included for interest are: the quality, or tone, of the signals; the distance of the station from the receiver, and the weather conditions at the time. With regard to the latter, details might be included as to the phase of the moon, whether it was fine or rainy and the strength of wind prevailing. Those readers who use different aerials and a variety of receivers should also leave spaces for brief details of these. Also, of course, in view of the number of different wavelengths on which the same station will work, a column should be provided in which to record the frequency upon which the station is working.

# Leaves from a Short-wave Log

WITH the approach of summer, conditions in certain portions of the short-wave band are becoming less favourable, and this will be found to be the case in particular with the longer channels—namely, from 40 to 55 metres. Reception of signals from both amateur commercial and broadcasting stations in the band comprised between 19 and 30 metres or so are still very good, and although the transmissions may be faint during daylight hours, as dusk sets in they rapidly increase in strength. From roughly B.S.T. 22.00 the listener experiences the feeling that the receiver is "alive," and it is difficult to move the condenser even slightly without picking up carrier waves which, in many instances, are easily resolved into speech or music.

## Vienna

By this time, I take it, many of you will have logged most of the European official short-wave broadcasters, as the greater number are on the air nightly with regular schedules. Some, however, may still have proved elusive; one, in particular, OER2, Vienna, which hitherto has been working on comparatively very low power. However, this station, on 49.4 metres is now operating on 1.5 kilowatts, and for some days as an experiment has been broadcasting until B.S.T. 04.00 for the benefit of North and South American listeners. As soon as reports have been received from various parts of the world, the authorities will establish a regular nightly schedule of transmissions.

Rome I2RO on 31.13 metres (9,637 kc/s.) now broadcasts every Monday, Wednesday, and Friday from B.S.T. 00.00 to 01.30 to listeners in North America, and from B.S.T. 01.45 to 02.30 or later on Tuesdays, Thursdays, and Saturdays for South and Central America. For the programmes destined to Canada and United States all announcements are made in the English language; for the other transmissions, in Italian, Spanish, and Portuguese. In every instance the station opens with the call, followed by the Fascist hymn (Giovinezza), and closes down with Puccini's *Hymn to Rome*. Tests are sometimes made between B.S.T. 22.30 and 00.00 to allow comparison of reception in U.S.A. with broadcasts carried out on 49.3 metres (6,085 kc/s), but transmissions on the latter wavelength as a regular feature are being suspended until next autumn, as the lower channels at this period of the year are found to be more favourable.

## Calgary (Alberta)

A new Canadian, advertised as a 10-kilowatter, which has made its appearance is VE9CA, Calgary (Alberta), on 49.75 metres (6,030 kc/s). As a rule it relays CFCN, the medium-wave station on 1,030 kilocycles. It has been heard after midnight. The call is: *This is CFCN, the Voice of the Prairies, in Calgary*. Regular transmissions are made on Thursdays from B.S.T. 15.00 to 08.00 (Friday), and on Sundays from 18.00 to 06.00 (Monday); other days from B.S.T. 15.00 to 06.00.

Another new station of which tests are reported is CMBH, San Spiritus, Cuba, on 29.41 metres (10,200 kc/s). It is on the air daily between B.S.T. 22.00 and 01.40, but has been picked up at a later hour. The call in both Spanish and English is given out every ten minutes or so; it would appear to relay a medium-wave Cuban station advertised under the same call letters and working on 241.9 metres (1,240 kc/s).

HJ4ABA, Medellin, now on 25.6 metres (11,720 kc/s), although not one of the most powerful of the Colombian stations, is well heard in Western Europe on favourable nights between B.S.T. 02.00 and 03.00. In addition to announcements in Spanish an English call is given every thirty minutes: *You are listening to short-wave station HJ4ABA, Medellin*, and reference is made to its slogan: *Echoes of the Mountains*.

HCJB, Quito (Ecuador), formerly on 56 metres, then later on 37 metres, has now reduced its wavelength to 36.59 metres (8,200 kc/s), on which it broadcasts its slogan: *La Voz de los Andes*, at every opportunity. It broadcasts daily (Tuesdays excepted) from B.S.T. 01.00 to 04.00. Here again calls are also given in the English language. Times given are B.S.T. 01.00-03.00 daily.

Another short-waver is reported from Mexico City—namely, XECR, on 40.60 metres (7,390 kc/s.), which appears to be operated by the authorities inasmuch as reports are to be sent to the Secretaria de Relaciones Exteriores, the equivalent of our Foreign Office in this country. I am informed that it only works on Sundays between B.S.T. 00.00 and 01.00, apparently for official broadcasts and government communications.

## Bogota (Colombia)

Also HKV, of Bogota (Colombia), on 34.09 metres (8,800 kc/s) is a new-comer. It is described as an experimental station belonging to the Radio Department of the Ministry of War. Although heard testing with gramophone records, there is a possibility that the station may be used only for a public telephony service—as most transmitters use canned music for their experimental transmissions as an alternative to speech.

The question of Summer Time in different parts of the world has caused some slight complications inasmuch as, unfortunately, the alterations are not made on the same dates. In Europe the differences are very great, as will be seen by the fact that Great Britain and Northern Ireland have chosen April 14th and October 5th; France, March 31st-October 5th; Holland, May 15th-October 6th. As against this the Argentine Republic changes over to Summer Time on October 1st, and back again on March 30th. In the United States the change has not been made throughout, but cities and towns which agreed to do so on April 28th and are now working to daylight time, alter their clocks again on the last Sunday in September. Finally, in Canada, barring a few exceptions, we may take it that the summer period is from the beginning of May to some date in September.



# A NEW FIELD FOR THE HOME CONSTRUCTOR

EVER since the earliest days of British Broadcasting there has been a vast army of enthusiastic amateurs who have built their own sets, and have derived a large amount of pleasure and instruction from their hobby. The mainspring of home construction has always been, I think, the thrill of pride which accompanies the creation of something which actually works. Other important factors in building up constructor interest have arisen and departed with the changing of the radio industry, but the urge to create remains.

For example, during the first few years of the broadcasting service, and even before, apparatus was scarce and very expensive; and a large proportion of pioneer amateurs had literally to make their receivers themselves or go without. Then, early commercial sets were far from efficient, and the well-made home-constructed receiver gave far better results. In fact, it is not too much to say that the radio industry of to-day owes its very existence to the amateur, for the ranks of the B.B.C., the manufacturing side, and the technical Press have largely been recruited from the experimenters and home constructors.

Moreover, there has always been a number of listeners who have felt that by the use of their ingenuity and skill they could produce satisfactory receivers at a cost substantially less than the factory-made article.

It must be admitted, too, that generally speaking, up to comparatively recently, the average home-made set has been as good as, and often better than, the commercial receiver. But, during the past two seasons, technical developments and the general conditions of broadcasting have proceeded at such a pace that it becomes necessary to pause and consider seriously the position of the home constructor.

## The Modern Superhet

The popular demand is for receivers having almost world-wide range and giving fairly large output. To achieve reasonable performance on these lines in the face of modern broadcasting conditions involves not only great sensitivity, but a high degree of selectivity, and the use of such devices as A.V.C. The manufacturer's solution in nine cases out of ten is a modern superhet.

But, although it may seem rank heresy to a large number of readers, I state frankly that it is quite beyond the powers of the average home constructor to design, build, and adjust a good superhet receiver, which can compete in all-round performance, in efficiency, in appearance, and in price with the better class factory-made sets of similar type.

In saying this I am in no way belittling the expert knowledge of those who design constructor sets, nor the intelligence and skill of those who build the receivers. I am merely stating that the inevitable has occurred—that modern commercial design and manufacturing facilities have been able to produce better general purpose sets, and at a cheaper price, than the average amateur.

The reasons are not far to seek. Set manufacturers, in addition to having at their command their own technical staffs and laboratories, receive prior information from valve manufacturers and others concerning new developments. Moreover,

(Continued on opposite page)

## A NEW FIELD FOR THE HOME CONSTRUCTOR

*(Continued from previous page)*

they are able, in most cases, to design most of the individual components especially for the particular set in which they are to be used, whereas the home constructor has to use what components happen to be put on the market. Then the manufacturer has the benefits of skilled labour, modern plant, and a full array of measuring instruments and other apparatus for the assembly and final adjustment and testing of his products, whereas the amateur must usually content himself with a modest kit of hand tools, and ganging and final adjustments must in most cases be done by ear.

Now does all this mean that the real amateur must pass out of existence, leaving the field of home construction to those who wish merely to build a workable set at the cheapest possible cost?

That would indeed be a tragedy, but, fortunately, it is not in the least likely to happen. As, in the past, the serious amateur has led the industry, so now, and in the future, I am convinced he will continue to lead.

But his activities must be diverted into new channels. He cannot hope to make much progress in the field of what may be termed "general purpose" receivers, for here the manufactured set will always beat him. How, then, can the amateur take the lead again? The answer is simply—in the direction which the industry as a whole has shown little inclination to explore; and by this I mean in the design of sets intended primarily for super-quality reproduction.

### "High-fidelity" Radio

This side of radio reception has been greatly neglected by most radio manufacturers, because hitherto there has not been a very general demand for quality receivers, or what is known in America as "high-fidelity" radio. What the majority of listeners have wanted has been stations and power—and then more stations and still more power. It is true that a few firms are offering sets which represent a very high standard of achievement in high fidelity—at prices up to a hundred guineas or more; and that others are willing to build sets of this type to special order—again at an almost prohibitive price.

The facts of the matter are that there are certain technical difficulties, chiefly due to broadcasting conditions, still to be overcome in the production of super-quality receivers, and that, although many of these difficulties are far from being insuperable, the demand for such sets is not sufficiently large at the present time to warrant production on a commercial scale, which alone would make possible a popular price.

Yet I am convinced that slowly and surely the public is learning to appreciate, and to demand, higher quality and natural reproduction. The time will come, and probably within the next few seasons, when manufacturers will not only be compelled, but will be anxious, to supply that demand.

Until that time comes, however, the listener who requires real high fidelity at a reasonable price will have to build his own receiver. Here, then, is the great chance for the ambitious and keen home constructor. He can build something which is practically unobtainable elsewhere; he can experiment and may even make original discoveries. In any case he will possess a better set than his neighbour—and he will even be leading the industry!

There is so much that is interesting and instructive and novel in developing this kind of set, and such a good opportunity of exercising a certain amount of originality (which undoubtedly is lacking in the repeated building of the more conventional kinds of receiver) that it is proposed to deal further with the question of realistic reproduction in future issues of PRACTICAL AND AMATEUR WIRELESS.



## 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. C. (Manchester).** We regret that we have not described a car radio of the type mentioned by you.

**H. M. (Manchester).** The usual cause of crackles is a faulty resistance or transformer winding, and we would therefore suggest that you test these points in your receiver. We note that you have checked switches.

**W. H. P. (Abertillery).** We regret that we have no blueprint of a set using exactly the parts which you mention.

**J. A. (Southall).** We have not used the coils in question in a 3-valve A.C. receiver and cannot give you instructions for making such a set.

**C. G. H. (Stockport).** We do not think it would be possible to make the conversion you refer to. We would advise you to dispose of the receiver as it is and construct a modern set of the type you require.

**C. C. 2,399 (Walthamstow).** The most likely cause of the trouble is a valve defect, and we would therefore advise you to have the valves tested.

**W. P. (Ealing).** The electrolytic condensers will be quite suitable, and Messrs. Dubilier make a condenser for the purpose. The circuit will be quite standard, simply substituting the electolytics for the ordinary type.

**J. W. H. (Pensarn).** The Telsen Unit could be used in place of the other component mentioned by you. The correct terminal for the anode lead is No. 3. The set is guaranteed.

**Diode (Cardiff).** Your point will be borne in mind. The principal use is in superhet circuits, where the advantages of diode detection are obtained, plus the use of A.V.C. from the other diode. In a straight set the two diodes may be joined together and treated as one for distortionless rectification.

**A. S. (Londonderry).** We can supply any of our books upon receipt of your remittance. The series by Ralph Stranger would no doubt prove valuable to you, in addition to that already mentioned.

**A. G. (Uttoxeter).** The 27/40 Litz will be preferable for the coils.

**L. A. (Fleetwood).** We would not recommend the modification you refer to. It would be preferable to re-design the receiver.

**L. J. L. (Tottenham).** Your trouble would appear to be due to the gang condenser, the rubbing noise being due to the plates touching. A careful inspection should enable you to verify this.

**W. C. (Nottingham).** We regret that we cannot explain the trouble, although it might be due to a faulty fixed condenser which is leaky and thus enable a wrong voltage to be applied at some point in the receiver. Careful examination with a meter is indicated.

**A. G. H. (Blandford).** Biassing the H.F. valves in the usual manner might improve matters. We would suggest an half amp. fuse in place of the one you are using.

**T. A. (Nottingham).** The wires in question are: No. 1 is 26 gauge enamel, and the other 28 gauge resistance wire. The exact type of wire is indeterminable, but it appears to be ordinary Eureka.

**J. W. G. (Dalston).** Ample volume should be obtained from the pick-up you name. The speaker in question should be quite satisfactory, although we have not tried it. A suitable replacement choke must be used, or a speaker obtained with a field of the same resistance as that specified, namely, 2,000 ohms. A 1 to 1 output transformer should be employed and the primary used as a choke for the extension speaker.

**L. P. (Bournemouth).** A list of blueprints is published each week, and the list gives also the dates of issue of the journal in which constructional details are given. Where a dash occurs it indicates that the issue is now out of print and unobtainable.

**M. C. P. (New Malden).** We have only published one all-wave one-valver—namely, the Unipen, blueprint No. PW31A.

**H. G. H. (Malvern).** The fault points to a resistance which is defective, or a break in the volume control connections. Alternatively the arrangement of the circuit causes the grid bias positive to be disconnected before L.T. and H.T., thus allowing the valves to work without bias, or the filaments operate more efficiently at a slightly lower voltage than is obtained from your battery. Thus when switching off they give greater volume just before the filaments are extinguished.

**J. (Greenford).** Any piece of ebonite rod will do for the coil supports. Your local dealer will be able to supply you.

**C. F. J. (Brixton).** A mains suppressor should be fitted to the fan leads. Write to Messrs. Belling and Lee for details of their devices for this purpose, and they will recommend the most suitable type.

# Facts & Figures

## COMPONENTS TESTED IN OUR LABORATORY

### Sator Resistances

AN interesting range of components has been submitted by Orion Lamps, Ltd., and a group of these is shown at the foot of this page. The trade-name of these components is Sator, and they include potentiometers, resistances, and condensers. Special potentiometers, having a value of 100 ohms to 2 megohms, may be obtained for 3s. 6d., and one of these may be seen in the group. Fitted with a switch, the price of these components is 5s., and Messrs. Orion Lamps have developed some novel uses for these controls, details of which may be obtained on application. A semi-variable potentiometer (type EB—20 ohms to 2 megohms) costs 2s. and will be found very useful in many types of circuit. The resistances, fitted with normal wire ends, may be obtained in ½ watt, 1 watt, 2 watt, and 3 watt types, the prices in each group being 5d., 8d., 1s., and 1s., respectively. The first three types may be obtained in various values from 100 ohms up to 10 megohms, and the 3 watt resistances are of the wire-wound variety, in ranges from 10 ohms to 20,000 ohms. A special tapped resistance of 1,000 ohms is obtainable at 4s., and will be found very useful for universal receivers.

The condensers are of the tubular type, also with wire ends, and are obtainable in all capacities from .0001 to .5 mfd. at prices ranging from 6d. to 2s. All of these components are of modern design and may be used with perfect confidence in any modern receiver.

### Exide at the Naval Review

A BROADCAST of the King's review of 150 vessels at Spithead on July 16th will be carried out by the B.B.C., and we understand that for this broadcast the Corporation will use Exide Batteries for the apparatus which is being employed.

### Sifam Change of Address

OWING to the increase in business the Sifam Electrical Instrument Co., Ltd., have found it necessary to move into larger premises. The new address of this company is Hollydale Road, Queens Road, S.E.15 (Opposite Queens Road Station), and it is pointed out that the usual lines of measuring instruments, mains transformers, amplifying equipment for relay and public address services, and meter repair work will be continued.

### New Type Wearite Coils

THE universal coil made by Messrs. Wearite has now appeared in a slightly modified form, the overall dimensions being slightly reduced. The actual dimensions are now 2½in. by 4in. by 3¾in. high, and, as before, the coils are obtainable in two types, Type A and the Universal. The windings are of the "transformer" type, a separate primary being employed, and in the Type A coil this carries a tapping between the medium and the long-wave section. In other respects the coils are identical and carry a tapped secondary and a reaction winding. The latter is joined to the secondary winding internally so that the reaction condenser must be joined to the anode of the valve, although this is not a very important matter in the majority of circuits. The screens are fastened in position, and must not be removed, as the coil is maintained in its correct central position by means of a projection on the cover, and the average listener would find it difficult to get the coil back into its correct position when once the cover is removed. There will also be the risk that the leading-out wires might be shorted if the coil is tampered with. The range covered by the coils is 180 to 550 metres and 750 to 1,950 metres, with a standard .0005 mfd. tuning condenser. The lower ranges will, of course, be modified according to the minimum capacity of the condenser. The price of these coils, in either type, is 5s.



### A Cabinet Accessory

SERVICE engineers or dealers will be very interested in a neat kit which has just been produced by E.M.I. for re-finishing a cabinet after servicing. It is well known how the modern cabinet gets scored and scratched in use, and when such a set is received for repair it is well worth while re-finishing the cabinet, so that the set is returned to the customer in a more or less new condition. This kit contains all the essentials in a neat black wallet, fitted with loops and pockets to hold the various items. These include glass paper, polishing materials, shellac, etc., in fact all the items which are necessary for the stripping down of the original polish and the replacing of the high glaze which is imparted to the cabinet when it first left the makers' hands. The price of the kit is 17s. 6d., and for an additional 1s. the service man's name and address may be added to the case in gold lettering.

### Erie Quarter-watt Resistors

IN many parts of a modern circuit the current passed is exceedingly small, and it becomes wasteful to fit a resistor of the 1-watt type. There is, of course, the fact that such a resistance has a safety factor, but when cost is being considered, a lower factor of safety can be taken and in many cases a wattage rating of only .25 watt is ample. Resistors of this type are now included in the Erie range and they have all the good qualities of the well-known Erie 1-watt resistance, from the material out of which they are constructed, to the neat firmly-attached wire ends. The resistances measure only .97in. in diameter and 7/16in. in length, and they may be obtained with tolerances of 5, 10, 15 or 20 per cent. For convenience in wiring, the ends are left approximately 2in. long. Standard colour-coding is adopted.

### New Philco Set Tester

TO meet the demand for a really comprehensive set tester which, while easily portable, is made sturdily enough to withstand hard usage, Philco have introduced Model 025.

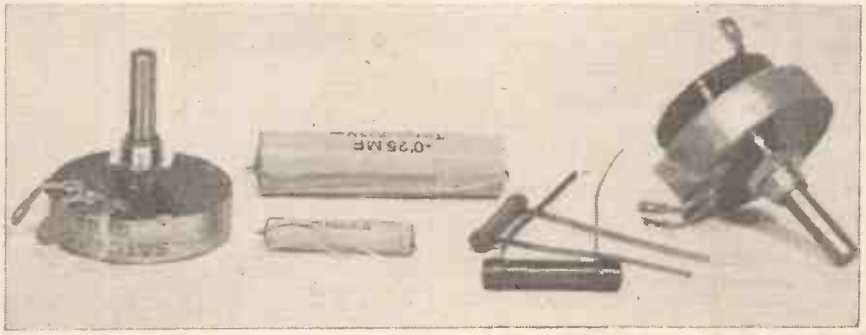
Entirely self-contained, this tester is designed for universal use on A.C., D.C., motor-car, and battery sets and can be applied to any frequency and voltage. The equipment includes two test prods for voltages, resistance, and continuity probing in receivers, and two output adapters and leads from output circuit to output meter.

Meter scale readings:—

D.C. volts 0-10, 0-30, 0-100, 0-300, 0-1000.
A.C. volts 0-10, 0-30, 0-100, 0-300, 0-1000.
D.C. amps. 0-10.
D.C. milliamperes 0-10, 0-100.
Ohms 0-150, 0-15,000, 0-1,500,000.
Output meter—5 degrees sensitivity.

Special chart readings: 0.01 to 2.0 microfarad capacity meter.

Complete with carrying case and batteries, Philco Model 025 is priced at £9 9s.



*Some items from the range of Sator components. These include potentiometers (with and without switch), condensers and resistances.*

RECTIFICATION AND DISTORTION

# BEGINNER'S SUPPLEMENT

**The Meaning of the Term, and How the Detector Circuit May be Responsible for the Majority of the Distortion Which Occurs in a Wireless Receiver.**

**By W. J. DELANEY.**

THE word distortion, as applied to wireless signals, simply means that the signal reproduced from the loud-speaker is not identical with the original signal. Although the signal does not appear in a receiver as an audio-frequency impulse until after the detector stage, and thus might lead the beginner to imagine that distortion could only take place in the audio, or low-frequency, stages, the detector stage is, in the majority of cases, responsible for the greatest amount of distortion. It is quite true that a poor or badly-designed transformer, or wrongly chosen resistance-capacity components may lead to L.F. distortion, but even if the L.F. stages are perfect, it is possible to have very poor signals simply through detector distortion. Firstly, then, we must find a meaning to the word in order to see how the trouble arises. It has already been shown in various articles that a musical note consists of a fundamental accompanied by harmonics. A banjo and a violin both utilise a string for the formation of a note, and can both play an identical musical note, but even the non-musical listener knows the difference between the two instruments, even without seeing them. This difference is due to the harmonics, and thus the first essential of distortionless reception is a correct harmonic response. Unequal amplification of various frequencies can

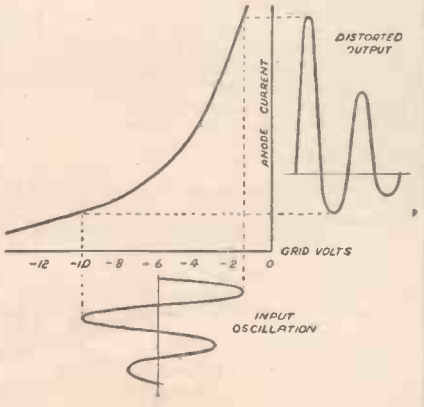



*Fig. 1.—This diagram shows the effect of a weak signal, or a wrong type of valve used as an anode-bend rectifier.*

also cause distortion and can be considered apart from poor harmonic response, although the latter may be due to such uneven amplification. These are the two principal forms of distortion which concern the average listener, although there is a further type known as "waveform" distortion, and this can give rise to various effects in a received signal.

## High-note Loss

It has been stated that the frequency range of the B.B.C. transmitters is from 30 to 9,000 cycles per second, and the first requirement of distortionless reproduction is an even response to this band of frequencies in the tuned circuits. This may be carried out by using a very flatly tuned circuit, or by an efficiently-designed sharply-tuned circuit, but the latter is rarely met with, owing to the difficulties associated with the design. In its simplest form the listener will recognise the band-pass tuner, with a square peak over a band of, roughly, 9 to 10 kilocycles, but unfortunately it is very difficult to obtain this shape of response curve from 200 to 550 metres, and the response varies according to the frequency to which the circuit is tuned.

One of the great advantages of permeability tuning is to be found in the fact that the response (or dynamic resistance) at all frequencies is identical, and thus this form of distortion may be easily avoided. If the circuit is sufficiently flatly tuned, the response over the desired band may be sufficiently even to pass on to the detector valve the full frequency band from the transmitter.

## Anode-bend Distortion

In the case of a detector valve working on the anode-bend principle, if the signal is very weak, and only operates on the bent portion of the curve, or, alternatively, if the valve which is chosen has a curve which does not have the sudden bend in it (Fig. 1), then second harmonic distortion will be present, and according to the degree of modulation of the transmitted signal, the music will be distorted. On the other hand, if the signal is too strong, it will pass over into the positive side and thus come into the conditions required for grid rectification, with the result that grid current will flow, and as there is no resistance fitted in the grid circuit this current will pass into the detector tuned circuit and will not only introduce serious damping but will cause distortion of the signal oscillations already present in the circuit. There is also the possibility, with certain conditions, that grid current will flow even when the oscillation or incoming signal is negative, but then the increase during the positive half cycles would be greater than the decrease during the negative half cycles, thus giving further distortion (Fig. 2).

## Grid Leak Distortion

The grid leak rectifier acts in almost a similar manner when fed with a very weak signal—namely, second harmonic distortion is caused. But a more serious fault is frequency distortion, caused by the grid leak and condenser combination. The impedance of these two components will vary at different frequencies, and they are included in the grid circuit of a valve which also has an impedance. There is thus a constantly varying effect which, unfortunately, is different at various wavelengths, and thus it is not a simple matter to calculate just what particular values should be used at any given point. In general practice it is found that with a suitable valve, that is, one of medium impedance, a combination now popularly referred to as "power grid" offers the best results. For this effect a low value condenser is employed, generally .0001 mfd., and the grid leak

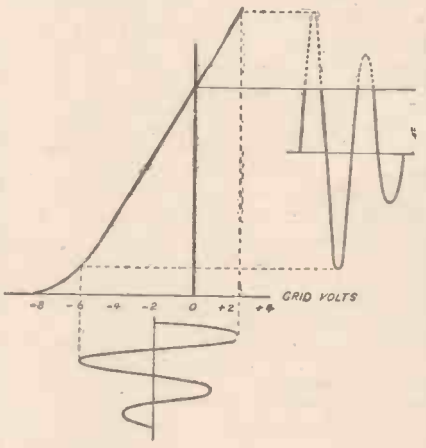
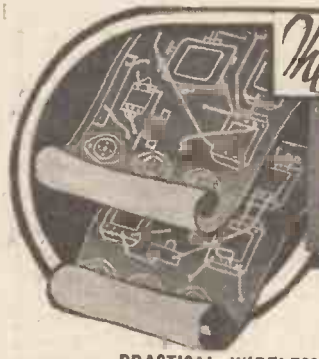



*Fig. 2.—If a signal is too powerful, or the wrong type of valve is employed, grid current will flow and introduce distortion.*

also has a low value. either .25 or .5 megohms. But, even so, there are conditions when even this combination will produce distortion, but with the average type of broadcast receiver used under modern conditions the risk is much less, and the listener may rely upon obtaining better signals with this method of rectification, provided that the reaction control is not used unthinkingly. The use of the reaction condenser as a producer of distortion is, of course, too well known to require explanation here, and in these days the reaction control is used with discrimination.



# The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

**These blueprints are full-size. Copies of appropriate issues of "Practical Wireless," "Practical Mechanics," "Amateur Wireless" and of "Wireless Magazine" containing descriptions of these sets can in most cases be obtained at 4d., 7½d. and 1s. 3d. each, respectively, post paid. Index letters "P.W." refer to "Practical Wireless" sets, "P.M." to "Practical Mechanics" sets, "A.W." refer to "Amateur Wireless" sets, and "W.M." to "Wireless Magazine" sets. Send, preferably, a postal order (stamps over sixpence unacceptable) to "Practical and Amateur Wireless" Blueprint Dept., Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.**

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| Cameo Midget Three | 8.6.35 | PW51 |
| 2-valve Superhet | 13.7.35. | PW52 |

## AMATEUR WIRELESS AND WIRELESS MAGAZINE.

### CRYSTAL SETS.

| Blueprints, 6d. each. | | |
|---|---|---|
| Four-station Crystal Set | — | AW427 |
| 1934 Crystal Set | 4.8.34 | AW444 |
| 150-mile Crystal Set | — | AW450 |

### STRAIGHT SETS. Battery Operated.

| One-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| B.B.C. One-valver | — | AW344 |
| B.B.C. Special One-valver | — | AW387 |
| Twenty-station Loud-speaker One-valver (Class B) | — | AW449 |
| **Two-valvers : Blueprints, 1s. each.** | | |
| Melody Ranger Two (D, Trans.) | — | AW388 |
| Full-volume Two (SG.-Det., Pen.) | 17.6.33 | AW392 |
| Iron-core Two (D, Trans.) | — | AW395 |
| Iron-core Two (D, QPP) | 12.8.33 | AW396 |
| 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 |
| Family Two (D, Trans.) | — | WM278 |
| **Three-valvers : Blueprints, 1s. each.** | | |
| £8 Radiogram (D, RC, Trans.) | — | AW343 |
| P.T.P. Three (Pentode-Triode-Pentode) | *June* '35 | WM389 |
| New Regional Three (D, RC, Trans) | 25.6.32 | AW349 |
| Class-B Three (D, Trans, Class B) | 22.4.33 | AW386 |
| New Britain's Favourite] Three (D, Trans., Class B) | 15.7.33 | AW394 |
| Home-built Coil Three (SG, D, Trans) | 14.10.33 | 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) | 20.1.34 | AW417 |
| 1934 Ether Searcher, Chassis Model (SG, D, Pen) | 3.2.34 | AW419 |
| Lucerne Ranger (SG, D, Trans) | — | AW422 |
| Cossor Melody Maker with Lucerne Coils | — | AW423 |
| P.W.H. Mascot with Lucerne Coils (D, RC, Trans) | 17.3.34 | AW337A |
| Mullard Master Three with Lucerne Coils | — | AW424 |
| Pentaquester (HF Pen, D., Pen) | 14.4.34 | AW431 |
| £5 5s. Three: De-luxe Version (SG, D, Trans) | 19.5.34 | AW435 |
| Lucerne Straight Three (D, RC, Trans) | — | AW437 |
| All Britain Three (HFPen, D, Pen) | — | AW448 |
| "Wireless League" Three (HF Pen, D. Pen) | 3.1.34 | AW451 |
| Transportable Three (SG, D, Pen) | — | WM271 |
| Multi-Mag Three (D, 2 Trans) | — | WM288 |
| Percy Harris Radiogram (HF, D, Trans) | *Aug.* '32 | WM294 |
| £6 6s. Radiogram (D, RC, Trans) | *Apr.* '33 | WM318 |
| Simple-tune Three (SG, D, Pen) | *June* '33 | WM327 |
| Tyers Iron-core Three (SG, D, Pen) | *July* '33 | WM330 |
| C.-B Three (D, LF, Class B) | — | WM333 |
| Economy-pentode Three (SG, D, Pen) | *Oct.* '33 | WM337 |
| All-wave Three (D, 2LF) | *Jan.* '34 | WM348 |
| "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, QP21) | *June* '34 | WM362 |
| 1935 £6 6s. Battery Three (SG, D, Pen) | *Oct.* '34 | WM371 |
| Graduating to a Low-frequency Stage (D, 2LF) | *Jan.* '35 | WM378 |

| Four-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| 65/- Four (SG, D, RC, Trans) | — | AW370 |
| "A.W." Ideal Four (2SG, D, Pen) | 16.9.33 | AW402 |
| 2 H.F.Four (2SG, D, Pen) | — | AW421 |
| Crusaders' A.V.C. 4 (2 H.F., D, QP21) | 18.8.34 | AW445 |
| (Pentode and Class-B Outputs for above: blueprints 6d. each) | 25.8.34 | AW445A |
| Quadradyne (2SG, D, Pen) | — | WM273 |
| Calibrator (SG, D, RC, Trans) | *Oct.*, '32 | WM300 |
| Table Quad (SG, D, RC, Trans) | — | WM303 |
| Calibrator de Luxe (SG, D, RC, Trans) | *Apr.* '33 | WM316 |
| Self-contained Four (SG, D, LF, Class-B) | *Aug.* '33 | WM331 |
| Lucerne-Straight Four(SG, D, LF, Trans) | — | WM350 |
| £5 5s. Battery Four (H.F., D, 2LF) | *Feb.* '35 | WM381 |
| The H.K. Four | *Mar.* '35 | WM384 |

| Five-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| Super-quality Five (2HF, D, RC, Trans) | *May* '33 | WM320 |
| New Class-B Five (2SG, D, LF, Class-B) | *Nov.* '33 | WM340 |
| Class-B Quadradyne (2 SG, D, LF, Class-B) | *Dec.* '33 | WM344 |
| 1935 Super Five (Battery Superhet) | *Jan.* '35 | WM379 |

### Mains Operated

| Two-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| Consoelectric Two (D, Pen) A.C. | 28.9.33 | AW403 |
| Economy A.C. Two (D, Trans) A.C. | — | WM286 |
| **Three-valvers : Blueprints, 1s. each.** | | |
| Home-lover's New All-electric Three (SG, D, Trans) A.C. | 25.3.33 | AW383 |
| S.G. Three (SG, D, Pen) A.C. | 3.6.33 | 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 |
| D.C. Calibrator (SG, D, Push-pull Pen) D.C. | *July* '33 | WM328 |
| Simplicity A.C. Radiogram (SG, D, Pen) A.C. | *Oct.* '33 | WM338 |
| Six-guinea A.C./D.C. Three (HF Pen, D, Trans) A.C./D.C. | *July* '34 | WM364 |
| Mantovani A.C. Three (HF Pen, D, Pen) A.C. | *Nov.* '34 | WM374 |

| Four-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| A.C. Melody Ranger (SG, DC, RC, Trans) A.C. | — | AW380 |
| A.C./D.C. Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C. | 8.9.34 | AW446 |
| A.C. Quadradyne (2SG, D, Trans) A.C. | — | WM279 |
| All Metal Four (2SG, D, Pen) | *July* '33 | WM329 |
| "W.M." A.C./D.C. Super Four | *Feb.* '35 | WM382 |
| Harris Jubilee Radiogram | *May* '35 | WM386 |

### SUPERHETS.

| Battery Sets : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| 1934 Century Super | 9.12.33 | AW413 |
| Super Senior | — | WM256 |
| 1932 Super 60 | — | WM269 |
| Q.P.P. Super 60 | *Apr.* '33 | WM319 |
| "W.M." Stenode | *Oct.* '34 | WM373 |
| Modern Super Senior | *Nov.* '34 | WM375 |

| Mains Sets : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| 1934 A.C. Century Super, A.C. | 10.3.34 | AW425 |
| 1932 A.C. Super 60, A.C. | — | WM272 |
| Seventy-seven Super, A.C. | — | WM305 |
| "W.M." D.C. Super, D.C. | *May* '33 | WM321 |
| Merrymaker Super, A.C. | *Dec.* '33 | WM345 |
| Heptode Super Three, A.C. | *May* '34 | WM359 |
| "W.M." Radiogram Super, A.C. | *July* '34 | WM366 |
| "W.M." Stenode, A.C. | *Sep.* '34 | WM370 |
| 1935 A.C. Stenode | *Apr.* '35 | WM385 |

### PORTABLES.

| Four-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| General-purpose Portable (SG, D, RC, Trans) | — | AW351 |
| 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 |
| Town and Country Four (SG, D, RC, Trans) | — | WM282 |
| Two H.F. Portable (2 SG, D, QP21) | *June* '34 | WM363 |
| Tyers Portable (SG, D, 2 Trans) | *Aug.* '34 | WM367 |

### SHORT-WAVERS. Battery Operated.

| One-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| S.W. One-valve | — | AW329 |
| S.W. One-valve for America | — | AW429 |
| Roma Short-waver | 10.11.34 | AW452 |

| Two-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| Home-made Coil Two (D, Pen) | 14.7.34 | AW440 |

| Three-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| World-ranger Short-wave 3 (D, RC, Trans) | — | AW355 |
| Experimenter's 5-metre Set (D, Trans, Super-regen) | 30.6.34 | AW433 |
| Experimenter's Short-waver | *Jan.* 19, '35 | AW463 |
| Short-wave Adapter | *Dec.* 1, '34 | AW456 |
| Superhet, Converter | *Dec.* 1, '34 | AW457 |
| The Carrier Short-waver | *July* '35 | WM390 |

| Four-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| "A.W." Short-wave World Beater (HF Pen, D, RC, Trans) | 2.6.34 | AW436 |
| Empire Short-waver (SG, D, RC, Trans) | *Mar.* '33 | WM318 |
| Standard Four-valve Short-waver | *Mar.* '35 | WM383 |

### Mains Operated.

| Two-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| Two-valve Mains Short-waver (D, Pen) A.C. | 10.11.34 | AW453 |
| "W.M." Band-spread Short-waver (D, Pen) A.C./D.C. | *Aug.* '34 | WM368 |
| "W.M." Long-wave Converter | *Jan.* '35 | WM380 |

| Three-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| Emigrator (SG, D, Pen), A.C. | — | WM352 |

| Four-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| Gold Coaster (SG, D, RC, Trans) A.C. | *Aug.* '32 | WM292 |
| Trickle Charger | *Jan.* 5 '35 | AW462 |

### MISCELLANEOUS.

| | | |
|---|---|---|
| Enthusiasts Power Amplifier (1/6) | *June* '35 | WM387 |
| Newstyle Short-wave Adapter (1/-) | *June* '35 | WM388 |

# 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.*

**SLADE RADIO**

ON Sunday afternoon, June 23rd, sixty members and friends of the Slade Radio took part in a direction-finding contest. The transmitter had been concealed at Preston Bagot, and the competitors in cars with direction-finding radio sets commenced to hunt down the transmitter, using map and compass. So well was the transmitter hidden that only four were successful in locating its position before transmission ceased at 5.30.

Each party carried a sealed envelope which was not to be opened until after transmission had ceased, as it contained the directions for the tea-rooms. Tea was held at The White House tea-rooms in Henley-in-Arden, the Harcourt Challenge cup and Amateur's cup and third prize being presented. A most enjoyable run was spent in excellent weather, all competitors being in a very happy mood and looking forward to the next contest.—Hon. Sec., C. Game, 40, West Drive, Heathfield Park, Handsworth, Birmingham.

**THE RADIO, PHYSICAL AND TELEVISION SOCIETY**

A VERY interesting lecture on Microphones was given to the above Society by Mr. E. G. Nurse (G.J.N.R.), at a meeting held on Friday, June 28th. The lecturer gave a short résumé of the history of the microphone, mentioning the water-jet instrument, and the first solid back "mikes." The Reisz type microphone was dealt with very fully, and Mr. Nurse had several interesting models which were demonstrated, and the construction of which was dealt with in detail. One instrument was built up of sheets of ebonite and used crushed carbon for granules. It was surprising to note that this "mike" gave results almost equal to those of an instrument using the best of materials, including a marble body. As a result of considerable amount of experiment, the lecturer said that he had found that best results were obtained with Reisz "mikes" using very fine granules. After the lecture several questions were raised regarding the practical operation of microphones.

The next meeting of the Society will be held on Friday, July 12th, at 8 p.m. Headquarters of this Society are at 72a, North End Road (off Tolgarth Road), West Kensington, and readers of PRACTICAL AND AMATEUR WIRELESS are invited to attend our meetings. For further details write M. E. Arnold (Assistant Hon. Sec.), 12, Nassau Road, Barnes, S.W.13.

# CATALOGUES RECEIVED

*To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.*

**TECHNICAL BOOKS**

MESSRS. W. and G. Foyle Ltd., of 119-125, Charing Cross Road, London, W.C.2, are able to supply practically any new or second-hand book on almost every subject. A new catalogue of books on Technical Subjects and Applied Science has just been issued, and this contains 120 pages, each having two columns of books on these subjects, and those who are anxious to study any particular branch of science will do well to obtain a copy of this catalogue before purchasing any books. Some of the second-hand prices are particularly attractive, and there is a very complete wireless section. The catalogue may be obtained free.

**ELECTRADIX SALE LIST**

A NEW sale list has been issued by Electradix Radios of Upper Thames Street, London, E.C.4, and this contains numerous items of particular interest to the wireless experimenter. From simple lead-in tubes at 6d. each, the list embraces all types of apparatus up to radio gramophones and complete transmitters. Valves, tuners, bridges, motor generators, loudspeakers, recorders, relays, all find their place in this interesting sale list, and some particularly attractive bargains are to be obtained.

**HALCYON RADIO**

A NEW leaflet has been received from Halcyon Radio Ltd. concerning two new receivers which they have just introduced. These are the AC/7 and the AC/7G, the former being a table model and the latter a radiogram, but both employing a similar circuit. This is a seven-stage, seven-tuned circuit superhet for A.C. mains use, and has such modern features as visual light tuning, A.V.C., silent tuning non-radiating oscillator, double-diode-triode valve and image-suppression circuits. The AC/7 costs 14 guineas, and the AC/7G costs 24 guineas. The address of Halcyon Radio is Sterling Works, Dagenham, Essex.

*When writing to Advertisers please mention Practical & Amateur Wireless*

# LETTERS FROM READERS

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

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

## S.W. Results on Two Valves

SIR,—It may interest you to know that on Saturday last, between 2 and 3 p.m., I received Japan, JUH Tokio, on a two-valve set (detector and low frequency) on 14,600 kilocycles. The reception was particularly clear and continuous. They were trying to make contact with Amsterdam, PCJ and PHI and reported that the reception on 19.71 metres was much better than that on 16.88 metres. They stated that it looked hopeless to get contact with Amsterdam and then said "please *meet* me at 12 G.M.T. to-morrow, Sunday."—ERNEST TURNER (Heaton, Bradford).

## A Combination Switch

SIR,—I am writing to thank you for publishing a wrinkle of mine in a recent issue of PRACTICAL AND AMATEUR WIRELESS. I would like to say that there is a slight error in diagram of cam block in second position. This should be cut as fourth position only on left side instead of right. I thought I should bring this item forward in case anyone should experience some trouble with same, as being left uncut it will leave gram and radio connected to grid at same time.—THOS. C. HUMPHRIS (Leytonstone).

## A Reader's Thanks

SIR,—I wish to thank you for the information in answer to my query, in your issue of the 15th June, under the heading of C.C. (S.E.22). I am pleased to tell you that parallel feeding my transformer has made a wonderful difference in the tone of my M.C. speaker. Thanking you again for your help.—C. CAVELL (E. Dulwich).

## A Television Enthusiast

SIR,—I am very keen on amateur wireless and television, and should be glad to know of a wireless or television club that I could join—not too far from here. Also would you please say if you know of a good practical book on television for the amateur?—B. W. BARNES (The Square, Riverhead, Sevenoaks, Kent).

[*Will the nearest club secretary please get into touch with this reader?*—ED.]

## The £5 Superhet

SIR,—I am writing to you in order to obtain a little technical information with regard to the battery version of the £5 Superhet Three, which I built quite recently. The only fault I have to find with the amazing performance of this truly remarkable set is an accentuated bass response. This is particularly noticeable as volume is increased, and the response from the speaker (I am using a Stentorian senior M.C.) is terrific during the playing of any of the numerous bass instruments.

I have tried varying the tapping at the back of the speaker, but with little success.

If I can cure this one fault, I am certain I have the ideal set for all purposes. It is the envy of many of my friends, the majority of whom possess all-mains commercial models, and I am justly proud that I decided to build the £5 Superhet Three. There is little doubt that it is far ahead of all its rivals in design, and gives much better results than many all-mains models.—WM. FRENCH (Winchester).

[*The high-note response may be improved by disconnecting the .01 condenser joined between the P. terminal of the output valve and M.B.*—*Ed.*].

## A Dance Fan's View

SIR,—Re your editorial comment to G. Bonell's letter in June 8th issue on "Jazz."

I have always admired your quiet and unassuming journalistic efforts on radio topics and consider you competent to hold the high esteem of your readers in this sphere.

However, as thousands of people have spent money in tuition and study, to earn an honest living in dance bands, etc., it is very unfair of you to enter this controversy.

To many tired workers dance music is very soothing and does not require the same concentration as "straight" music.

I am confident that you know as much about radio as you do about music, but as a radio engineer should keep to this field where your observations are valued.—J. M. LEISHMAN (Glasgow).

## An Early "Pocket" Set

SIR,—Allow me to offer my sincerest congratulations on your latest triumph—the first of the midget sets employing "Hivac" tiny tubes. A sound little set, it seems, and one that should hand it out like "nobody's business." A little extra time spent on sound construction of this little receiver will repay the constructor many times, and if I may offer advice I should certainly suggest this being done.

As a reader, contributor, professional-amateur, and die-hard enthusiast—one whose memory-cells bear the word "wireless" back and front—I am always delighted to see something *different*, something new (even new wireless words). It all helps to keep enthusiasm alive.

Midget sets have always interested me, and as far back as 1927 I designed and built a "pocket" set—probably the first in existence—the result of a wager.

No published designs in those days! No midget components; no friendly co-operation; no "P.W."!—F. J. GOUGH (Ellesmere),

CUT THIS OUT EACH WEEK.

### Do you know

—THAT a metal-cased pick-up when used with an A.C. mains receiver can deliver a nasty shock in certain cases.
—THAT for the above reason care should be taken in the wiring of this part of the circuit.
—THAT special tone-compensators are obtainable for use with a gramophone pick-up and standard gramophone records.
—THAT the H.F. choke is an important component and is often treated as being of little use.
—THAT various faults can develop in a receiver due to a poorly-designed or defective H.F. choke.
—THAT hum in a receiver can often be caused acoustically and not electrically, and this fact should be borne in mind when searching for the cause of hum.
—THAT one of the commonest instances of the above trouble is in the loose laminations of a mains transformer or choke.

*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, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

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

## The Best Dance Band?

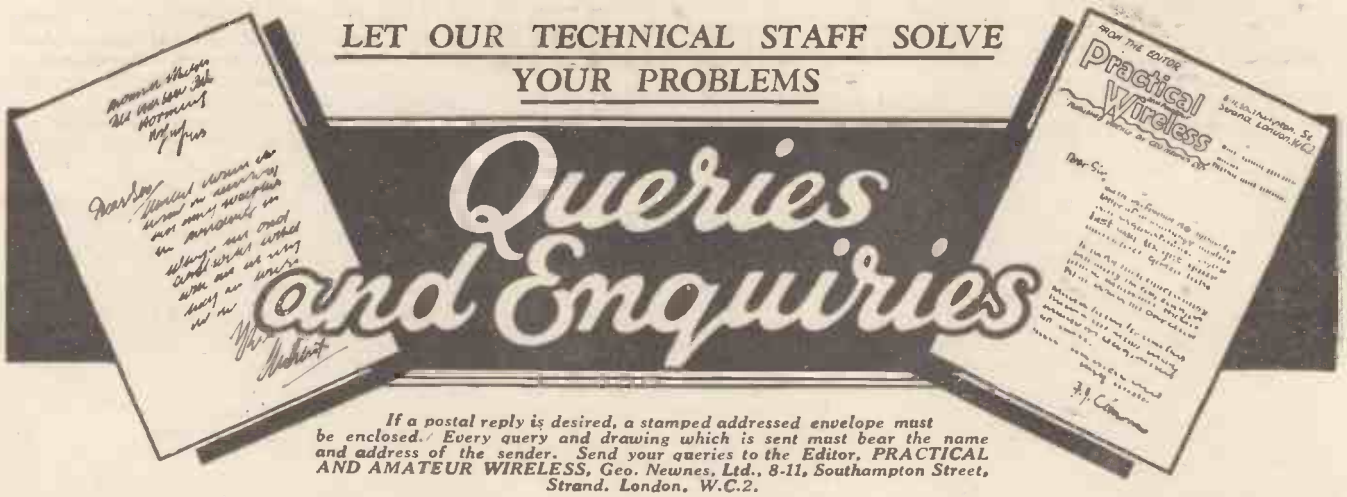
SIR,—Re your request for opinions as to the best dance band on the air. I presume you mean English dance bands? If so, then without a doubt Ambrose's Embassy Club Band is best. As for not recognising dance bands by their playing I think I could recognise any one of the more important broadcasting dance bands, more certainly than you could recognise a band of your liking out of the same number of bands, even if they be philharmonic orchestras or military bands. Whilst I am writing I would defend crooning by saying that Bing Crosby is by far the most popular singer of any description in the world. As he is reputed to be the second highest paid man in the world, I should imagine that there is something in crooning after all!—H. PHILLIPS (Birmingham).

## A Universal Silver Souvenir?

SIR,—I am a P.W. and A.W. fan, and have been for years. I have constructed quite a number of your sets from the blueprints supplied. I'm still a very keen amateur, you see, and I must say a child could build a receiver the way you explain each detail, no high-sounding technical phrases, but just plain language. I am mighty interested in your All-Wave Silver Souvenir, and I hope a long cherished wish of mine will be granted, a Universal All-wave set, sponsored by you. I am sure a great many of your readers are like me, hoping you'll find time to print details of such a set. I will be eagerly scanning your articles in PRACTICAL AND AMATEUR WIRELESS for the Universal All-wave Silver Souvenir. I have started building a radio-gram. cabinet, and I should like an all-waver to put in it.—J. BYRNE (Birkenhead).

## Keeping Circuits Ganged

SIR,—It was with great interest that we observed in a recent article in PRACTICAL WIRELESS, a paragraph headed "Station Marked Dials." You mentioned that well-designed and accurately-calibrated receivers fell out of calibration, for no apparent reason, after having been in use for some time. We handle a large service business, and long ago encountered this same trouble, but the fault is by no means obscure. It is due, in nearly every case, to humidity. Cotton-covered coils absorb moisture and affect the ganging to a sometimes remarkable degree. Especially is this true of coils in superhet oscillator circuits. The cure is simply to remove the dampness, by warming in an oven, then lightly shellac the coils and re-gang. The American practice of thoroughly impregnating all coils with wax may seem reprehensible to us, as we all appear to admire a beautiful row of ganged and unvarnished coils, but we never have any trouble with American sets from this point. We should be greatly obliged if you could give this letter prominence. It may help those who have encountered this difficulty without knowing how it can be overcome.—Messrs. COLLINS and GEE (Dalston).




*If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.*

**SPECIAL NOTE**

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.

## H.F. Instability

**"I should be very glad if you could tell me how to reduce the reaction in my set. This is a modified commercial set and, although I have reduced the reaction condenser from .0005 mfd. to .0001 mfd. there is still oscillation on nearly every station. I do not want to alter the coils as they are all stuck down with some sort of varnish."—H. T. (Bromley).**

IN view of your remarks we would suggest that you are not experiencing excessive reaction effects, but that there is some H.F. instability. The fact that (presumably) a .0005 mfd. reaction condenser was originally fitted, and that the coils have not been modified, it is extremely unlikely that the set would oscillate efficiently with a .0001 mfd. reaction condenser, and you should therefore examine the H.F. stage. Some wires may have become displaced or the layout modified, and thus introduced interaction between the anode and grid circuits, or the voltages applied to the H.F. valve may be incorrect.

## Fuse and Mains Unit

**"I have just completed a mains unit from various pieces of information I have picked up from your pages. I do not want to have the expense of buying a new mains transformer at some future date, and therefore wish to fit some form of fuse. What is the best type and where should I put it to afford greatest protection?"—R. Y. O. (Boston).**

IT is possible to put a .5 amp. fuse in each lead to the anodes of the rectifier valve if you are using a full-wave rectifier. This does not afford complete protection in all forms of breakdown, although it is adequate for normal purposes. In general it may be stated that probably the best form of fuse is one of .5 amps. joined in the common H.T. negative lead, preferably right next to the terminal on the mains transformer which is connected to the centre tap of the H.T. winding. If a lower value is used there is a risk of it blowing when switching on, but if some form of delay switch is fitted, or certain types of valve are in use, a lower value may be safely used.

## Aerial Defect

**"Although I am using your £5 Superhet, I find it very difficult to cut out the local station. I notice, however, that on the other stations the selectivity is perfect, but at certain places I experience a peculiar whistle with the transmission. Various suggestions have been made by friends as to the causes of these faults, but I should like your valued opinion as to the cause and the cure."—T. B. G. (Barnet).**

FROM your situation we should imagine that all the trouble is traceable to your aerial system. This is probably a very good aerial, erected well clear of building, etc., and is directional so far as the Brookmans Park transmitters are concerned. Consequently, in addition to the risk of overloading of the first valve from the very strong signal input, the carrier from this station modulates other stations at harmonics of the local frequencies, and consequently you experience second-channel whistles. If you remove the aerial and use a short indoor aerial, and find that the troubles are removed, then the indication is that your aerial should be modified. Owing to the good amplification of this set you will probably find that you can use quite a small aerial without any loss of power on distant stations which offer good programme value.

## Dial-light Wiring

**"I am fitting a dial light to my A.C. receiver, but there is one point about which I am not clear. The casing of the ganged condenser is in contact with the metallised chassis, and I should think that a wire could be joined from the lamp-holder to the condenser casing, and a single wire run from the other lamp-holder lug to the nearest heater terminal. What is wrong with this scheme, and why is it necessary to use ordinary flex for the purpose?"—G. B. (Hounslow).**

YOU have apparently overlooked the fact that the heater leads are not connected to earth. Therefore, by joining one side of your lamp to earth you will be connecting the heater circuit to earth and this will affect various parts of your circuit. Twisted flex is used because the leads are carrying A.C. and therefore it is necessary to guard against the introduction of these currents into any other wiring in the receiver with the risk of hum. The twisted flex more or less cancels out the field of the A.C. which surrounds an ordinary wire.

## Interference

**"Owing to the local trams, which pass near my house, and the various other forms of electrical apparatus which are situated round my road I find great difficulty in receiving distant programmes without loud crackles. Can I cure these for certain? I do not want to spend money on some device which might or might not work, nor one which will only reduce the strength of the noises. I would sooner put up with them than waste money, so I should like your opinion."—G. J. O. (Brighton).**

WE feel certain that a correctly-erected screened aerial system would cure your troubles. Write to Messrs. Ward and Goldstone for a catalogue showing the various parts of the system and then work out the length of wire, etc., which you will need. You will no doubt find that if you carry out this work efficiently you will have no more trouble from the interference. Write also to Messrs. Belling & Lee.

## Transformer Ratios

**"I am a new-comer to the radio game and have decided to build a set. What puzzles me, however, is how to choose the correct L.F. transformer, as I see that there are several different ratios all made by the various firms. What is the rule?"—F. R. (York).**

THERE is no rule regarding transformer ratios, but it is necessary to take precautions to avoid overloading of the output valve by not choosing very high ratios when more than one L.F. stage is in use. For a single stage the highest ratios may be used, and for each succeeding stage a lower ratio should be used, but in general you will probably find that a ratio of, say, 3 to 1 may be used in most stages without difficulty. A volume control may always be fitted if it is found that overloading is taking place, and this should be connected across the secondary of the transformer which is causing the trouble.

**FREE ADVICE BUREAU**

**COUPON**

This coupon is available until July 20, 1935, and must be attached to all letters containing queries.

PRACTICAL AND AMATEUR WIRELESS, 13/7/35.

## Miscellaneous Advertisements

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ANNOUNCE a City Branch at 165 and 165a, Fleet Street, E.C.4 (next door to Anderton's Hotel), for the convenience of callers; post orders and callers to High Street, Clapham.

OFFER the following Manufacturers' Unused Surplus goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra; I.F.S. and abroad, carriage extra; orders under 5/- cannot be sent C.O.D.; please send 1½d. stamp for large new illustrated catalogue.

WORLD Famous Continental Valve Manufacturer: mains types, 4/6 each, H.L., L. power; high and low magnification, screen grid; variable Mu screen grid; 1, 3, and 4 watt A.C. output, directly heated pentodes; 250 volt 60 m.a. full wave rectifiers; A.C D.C. types, 20 volts, 0.18 amp. filaments; screen grid; variable mu screen grid; H., H.L., power and pentodes.

THE following Types, 5/6 each; 350v. 120 m.a. full wave rectifiers, 500v. 120 m.a. full wave rectifiers, 2½ watt indirectly heated pentodes.

2-volt H.F., L.F., 2/3; power, low consumption power, super power, 2/9; screened grid, variable mu screened grid, 5- or 4-pin pentodes.

THE following American Types, 4/6; 250, 210, 245, 47, 46, 24, 35, 51, 57, 58, 55, 37, 80, 6A7, 2A7, 27, 77, 78, 2A5, 281. All other types, 6/6.

B.T.H. Moving Coil Speakers, matched pairs, 8in. 1,500 ohms. 7,500 ohms. (1,500 speaker as choke 7,500 speaker in parallel with H.T. supply), with output transformer for pentode, 15/6 per pair; A.C. kit for pair, 12/6.

M.C. Multi-ratio, output transformers, 2/6; 2-1 or 1-1 output transformers, 2/6; microphone transformers, 50 and 100-1, 2/6; 3 henry chokes, 2/6; 100 henry chokes, 2/6.

A LARGE Selection of Pedestal, table and radiogram cabinets at a fraction of original cost.

BLUE-SPOT 29P.M. P.M. Moving Coil multi-ratio transformers, 15/-; handles 4 watts. Sonochorde ditto. Ideal for Battery Sets.

ELIMINATOR kits, condensers, resistances and diagrams, 120v. 20 m.a., 20/-; Trickle charger, 8/- extra, 150v. 30 m.a. with 4v. 2-4 amp. C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps, with 4v. 3-5 amps., C.T., L.T., 30/-; 300v. 60 m.a. with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps. L.T., 27/6.

PREMIER L.T. Charger kits, Westinghouse rectifier, input 200-250v. A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

B.T.H. Truspeed Induction Type A.C. only, Gramophone Motors, 100-250v. 30/- complete; ditto, D.C., 42/6.

COLLARO Gramophone Unit, consisting of A.C. motor 200-250v. high quality pick-up and volume control, 49/-; without volume control, 46/-. Motor only, 35/-.

EDISON BELL Double Spring Gramophone Motors, complete with turntable and all fittings, 15/-.

WIRE Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 100,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna, 2,500 ohms, 37/6; all complete with humbucking coils; state whether power or pentode; A.C. conversion kit for above, 10/-; P.M.7 in. cone, 16/6; 9in. cone, 22/6.

12 TO 2,000 Metres without Coil Changing; huge purchase of all-band 2-gang screened coils, suitable for screen grid H.F. stage (tuned) screen grid detector type receiver, complete circuit supplied, 12/6.

BRITISH made Meters, moving iron flush mounting, 0-10, 0-15, 0-50 m.a., 0-100, 0-250 m.a., 0-1, 0-5 amps., all at 6/-; read A.C. and D.C.

POTENTIOMETERS by Best Manufacturers, 200, 350, 500, 1,000, 2,500, 5,000, 8,000, 10,000, 15,000, 25,000, 50,000, 100,000, 250,000, 500,000, 1 meg., 2/-; 5,000, 10,000, 15,000, with mains switch, 2/-.

1,000 OHM 150 milliamp, Semi-variable resistance, 2/-; 1,000 ohm 250 milliamp, tapped, for any number, .18 valves, 2/6; 800 ohms, 350 m.a., tapped, 2/-.

COSMOCORD pick-ups with Arm and Volume Control, wonderful value, 10/6.

THE following Lines 6d. Each or 5/- per dozen: 4- or 5-pin baseboard or 4-, 5-, 6-, or 7-pin chassis mounting valve holders, American valve holders, 1 watt resistances, wire end, every value; tubular wire end condensers, 1,500 volt, every value up to 0.5, 0.3 amp., 2- or 3-point switches, Cyldon double trimmers, 6 yds. Systoflex, 1, 1.5, 2 or 2.5 mm., 1 yd. 7-way cable, 9ft. resincored solder, 6yds. push-back connecting wire.

*(Continued at top of column three)*

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**KIT "A"** CASH or C.O.D. Carriage Paid **£4 : 4 : 0**
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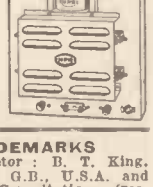

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KINGS PATENT AGENCY (Director: B. T. King, C.I.M.E., Regd. Patent Agent G.B., U.S.A. and Canada). Advice, Handbook and Consultations free. 49 years' refs.—146a, Queen Victoria Street, E.C.4. 'Phone: City 6161.

*(Continued from foot of column one)*

L.F. transformers, Ferranti AF3, 8/6; AF8, 6/6; R.I.DUX, 4/-; Benjamin Transfeeda, 4/6; Telsen Radiogrand, 2/0; Voltra, 2/-; manufacturers type, 1/-.

ELECTROLYTIC Condensers T.C.C. 8mf. 440v., 3/-; 550v., 4/-; 15 mf. 50v., 1/-; 15mf. 100v., 1/-; 15mf. 12v., 1/-; Dubiller 4 or 8mf. 500v., 3/-; plus 4 500v., 4/-; 50v. 50mf., 1/9; 12mf. 20v., 6d. U.S.A. 4, 8 or 12mf. 550v., 1/9; 100mf. 12v., 1/3; 2,000mf. 12v., 6/-.

PAPER Condensers. Dubilier 4mf. 500v. working, 4/-; ditto 700v., 5/-; ditto, 800v., 6/-; Western Electric, 250v. working 1mf., 6d.; 2mf. 1/-; 4mf., 2/-; 1mf. 2,000v. working, 3/-.

CONDENSER Blocks 250v. working, various taps 6mf., 2/-; 10mf., 3/-; 8.5 mf., 2/6.

MAINS Transformers. Premier all have tapped primaries, C.T., L.T.'s and Engraved terminal Board. H.T.8 plus H.T.9, 2 L.T.'s, 10/-; Rectifier, 8/6 extra; H.T.10 2 L.T.'s, 10/-; Rectifier, 9/6 extra; 250 plus 250 60 m.a. 3 L.T.'s, 10/-; 350 plus 350 150 m.a. 3 L.T.'s, 12/6.

WESTERN ELECTRIC Manufacturers type 300 plus 300, 60 m.a. 2 L.T.'s, 6/6; 350 plus 350 120 m.a. 3 L.T.'s, 9/6; 500 plus 500 150 m.a. 5 L.T.'s, 19/6.

VARIABLE condensers. Premier, all brass, short wave, .00015 slow motion, 3/9; British Radiophone, all brass, 2-gang .00015 each section, 5/6; Ormond, .00025, 1/6; Polar, all brass, .0005 slow motion 3/11; Lissen 2-gang, .0005, front trimmer, disc drive, 5/11; Utility 3-gang fully screened trimmers and disc drive, 7/6.

BAKELITE reaction condensers, .00015, .00035, .0005, .00075, 9d.

LISSEN 3-gang superhet coils, 6/-; Lotus 3-gang band-pass coils, 12/6; Iron core coils with circuit, 2/11 each; Varley band-pass aerial coils, B.P.5 type, 2/9; ditto band-pass transformer, B.P.8, 2/6.

H.F. Chokes Premier screened, 1/6; Premier short-wave, 9d.; pre-sets, any value, 6d.

PREMIER smoothing chokes, 25ma. 20 henries, 2/9; 40ma. 30 henries, 4/-; 60ma. 40 henries, 5/6; 150 ma. 40 henries, 10/6; 60 ma. 80 henries, 2,500 speaker replacement, 5/6.

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WOBURN ELIMINATORS.—Owing to repeated enquiries we are again manufacturing Woburn eliminators. All incorporate Westinghouse Rectifiers. 12 months' guarantee. A.C. Model, 21/-. A.C. model with trickle charger, 2, 4, or 6v., ½ amp., 32/6, carriage 1/-. Output on all models, 150v., 30 m.a., three positive H.T. tappings.
TRADE List now ready, send business heading and stamp.
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FOR THE RADIO ENTHUSIAST.—"The Wireless Constructor's Encyclopædia," by F. J. Camm (Editor of "Practical and Amateur Wireless"), third edition. Compiled by one of the most accomplished designers and writers on the practical side of Wireless, it covers the whole field. A veritable Treasury of Wireless Knowledge. Price 5s., from all Booksellers and Newsagents.—George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.

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**Parts for any set. Any make of speaker.**
New goods obtained for every order.
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**Senior P.M. Speaker.**
Cash Price £2/2/0, or 2/6 with order and 11 monthly payments of 4/-

**Standard P.M. Speaker.**
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**LONDON RADIO SUPPLY COMPANY** (Est. 1925)
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DO NOT PURCHASE ANY RADIO RECEIVING VALVES until you have considered the 362 Valve Range.
DO NOT BE TEMPTED to try "the next best." There is only ONE BEST—362. Replacements for all Standard Types.
THE ENTIRELY BRITISH VALVE. THE ONLY VALVE WITH A 6 MONTHS REPLACEMENT GUARANTEE. Latest Lists Post Free from:—
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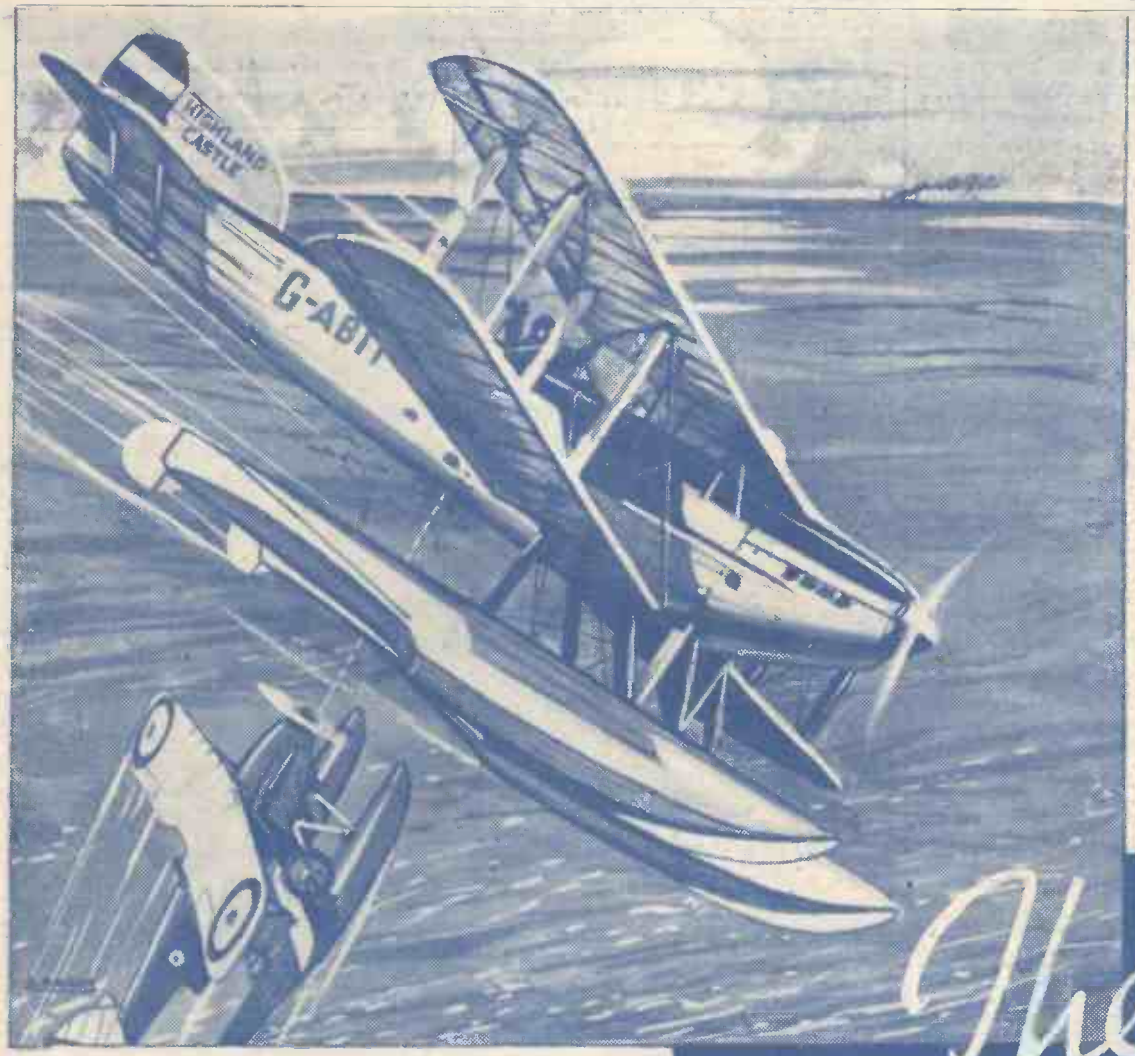


*Bob nosed up again and let a short burst of Vickers belch full into the belly of the mail-carrier.*

# The Catapult of Death

*WHAT was the dread secret of the Calthorpe Catapult that brought death, swift and terrible, to those who worked it? Even the Intelligence Service was powerless to arrest the grim sequence of disasters until Bob Rollins, Test Pilot and Adventure Seeker, found the clue to a ruthless plan of murder on the high seas.*

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OUT JULY 11

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# Practical and Amateur Wireless

3d. EVERY WEDNESDAY

Edited by F. J. CAMM

AND AMATEUR TELEVISION

a GEORGE NEWNES Publication

Vol. 6. No. 148.
July 20th, 1935.

THERMION'S NOTES ARE ON PAGE 499


# 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. VI. No. 148. July 20th, 1935.


# ROUND *the* WORLD *of* WIRELESS

### U.S.A. Studies European Broadcasts

JOHN ROYAL, the Vice-President of the National Broadcasting Company of America, is carrying out a tour of Italy, France, Germany, U.S.S.R., Great Britain, Sweden, Denmark, Switzerland and Poland, with a view to studying individual methods of programme presentation. The relays of radio entertainments carried out by U.S.A. transmitters have shown the authorities that there is something to learn from old Europe after all!

### PTT Lyons-Tramoyes Testing

EXPERIMENTAL broadcasts by the new high-power transmitter on 463 metres (648 kc/s) are being carried out at the conclusion of the daily programmes transmitted by Lyons-la-Doua.

### Television on Board Ship

THE first television transmission to be received on board a liner was recently made on the Hamburg-American twin-screw steamer *Caribia*. Although the reception was not, perhaps, as good as on receivers in the vicinity of Berlin, the German Post Office authorities found it sufficiently encouraging to induce them to carry out further and more exhaustive tests in the near future.

### Radio-Jerusalem

WORK on the 20-kilowatt Marconi broadcasting station which is being erected in the vicinity of Ram Allah, situated roughly ten and fifteen miles from Jerusalem and Jericho, is proceeding as per schedule. Two 330ft. masts have been erected and it is expected that tests on 449.1 metres (668 kc/s) will be made in August next. This channel is already used by North Regional. Studios will be built in the Central Post Office, Jerusalem.

### Ravag's New Headquarters

VIENNA'S new Broadcasting House, which is being erected at the cost of 6.5 million Austrian schillings (roughly £260,000), will be the most modern of its kind in Europe. It was only planned after the authorities had visited in turn the existing buildings used by other European broadcasting associations. The building is so far forward that a provisional date may shortly be fixed for its official opening in August.

### "It's an Ill Wind," etc.

IN view of the veto decreed against sponsored programmes from State transmitters, several privately owned stations in France have considerably increased their income from this source. Radio LL, Paris, having now trebled its capital proposes to utilise a large sum for the reconstruction of its present broadcasting plant with a view to securing higher power.



### German Railways and the Berlin Radio Exhibition

IN order to encourage visits to the Berlin Radio Show, the Minister of Railways has decreed that a number of special excursion trains from all parts of the country are to be run to Berlin during the period of the Exhibition. Fares are to be reduced by 75 per cent.

### Misunderstood!

IN a suburb of Leipzig, passers-by, seeing a man sling a rope over the branch of a tree in his garden, rushed forward and prevented what they feared was an attempt at suicide. The rescuers, however, were dumbfounded when they learnt in forcible language that the radio fan was installing a new outside aerial!

### Public Television Rooms

AS a result of the rush made by the general public to the first free Television Room at the Post Office Central Headquarters, the Reichs Rundfunk has now opened five other public halls, including one at Potsdam.

### New Interval Signal

BRNO, so far, has been the only Czech station without a musical signal. It has now adopted the first bars of an old Moravian folk song: "Morava, Morava"; it is played between broadcasts on an electric piano.

### To Encourage Italian Listeners

IN order to increase the number of licence holders, the E.I.A.R. has started a special advertising campaign. As in previous years, a lottery has been organised, in which all purchasers of new wireless receivers are given tickets.

### Poland's Eleven-station Network

IN the course of the summer further extensions are to be made to the Polish Broadcasting System. It is planned to open a 20-kilowatt short-wave transmitter for the relay of the Warsaw programmes and to erect at Pinsk (East Poland) a medium-wave station.

### Sofia's High-power Transmitter

IN the neighbourhood of the capital the Bulgarian Authorities are installing a 50-kilowatt station to replace the small plant at present working on 352.9 metres (850 kc/s). In addition, two relays are to be built at Varna and Stara Zagora.

### Third Time Lucky!

THE 1.2-kilowatt transmitter which broadcast the first Oslo programmes and was transferred to Trondheim in 1930, has been again dismantled and is being re-erected at Aalesund to relay the radio entertainments from Norway's capital.

### Wireless Patent Agreement

MARCONI'S Wireless Telegraph Co., Ltd., has concluded an agreement with British Radiostat Corporation Ltd., and has acquired rights under present and future patents controlled by the latter company, including exclusive licensing rights under the Stenode broadcast reception (sound and television) patents in Great Britain and Ireland. All future applications for a licence in the last-mentioned field should therefore be addressed to Marconi's Wireless Telegraph Co., Ltd., of Electra House, Victoria Embankment, London, W.C.2.

# ROUND the WORLD of WIRELESS (Continued)

## An Adventure in Tibet

B.B.C. drama department's arrangements for the summer months include many programmes of interest. "Lost Horizon," James Hilton's thrilling story of adventure in Tibet, will shortly be produced. This eerie play was first presented over the microphone last year, when it created a profound impression. "Alice through the Looking-Glass," Cecil Lewis's adaptation of Lewis Carroll's world-famous phantasy, was last heard by listeners in 1930, and will be given further performances on July 22nd and 23rd. Barbara Couper, who assisted in the preparation of the broadcast version of "Wuthering Heights," has written a new play for the microphone entitled "Pleasant Portion." This will be heard by listeners in August. Other plans include repeat performances of Lord Dunsany's "The Use of Man," and "Reconnaissance," by E. King Bull and Geoffrey Askew.

## Juvenile Stars

HUGHIE GREEN and his Gang return to the microphone on July 29th. Since their first introduction to the microphone they have scored an uninterrupted success. This juvenile radio feature owes its success to the showmanship and versatility of its leader, Hughie Green, who, despite his youth, has all the knowledge and resource of an experienced artist. It is a brilliant performance that he gives in compering the gang, several of his imitations of characters being incredibly clever for a youth of fifteen years.

## For Gardeners

MANY people believe that, owing to the experiments for improving the colour and shape of flowers made in recent years, several flowers have lost their scent. Those who love the smell of a garden full of flowers should listen to the talk which Gwendoline Andrews is giving in the Northern programme on July 26th, entitled, "Are Your Flowers Scented?" Miss Andrews, who in addition to having held many important gardening appointments, lectures to Women's Institutes in Cheshire, will recommend a number of flowers, mostly the "old-fashioned" variety which still retain their scent.

## Other Points of View

PATRICK MAITLAND, who gives the "Seeing Life" talk on July 24th, represented one of the national dailies in Vienna and the Balkans last year. His home is at Ingestre Rectory, near Stafford. He began training for the priesthood himself, but for intellectual reasons decided not to continue; but to devote himself through the medium of journalism to the cause of freedom which, in his view, "demands all the service of a religious man."

## The Boggart

THOSE who are fond of lying in bed in the morning probably know what it is like to be rudely awakened by having the bedclothes pulled off only too well; and they will, no doubt, sympathise with little Bob Cheetham, the chief victim of the mischievous persecution of "Boggart of Boggart Hole Clough," who lived—nobody knows quite how long ago—in what is now a public park at Blakeley, near Manchester. Assuming the personality of the unfortunate Bob, D. G. Bridson will tell Northern listeners the story of the queer tricks played by the boggart, or bar-gaist, when he contributes an "eye-witness account" to the Northern programme "Legends Live" series, on July 23rd.

**INTERESTING and TOPICAL PARAGRAPHS**

### THE MASTS OF SEVERAC

*The new French station will enable ships to talk to France from any part of the world.*

## The Royal Welsh Agricultural Show

A BROADCAST from the Show Ground of the Royal Welsh Agricultural Show at Haverfordwest will be taken for Western listeners on the opening day, July 24th. Although there were agricultural societies and shows in the Principality before the formation of the Royal Welsh, they were all of more or less local interest, and it was in order to have the co-ordinating power of the National body that the present society was started. It was not however until 1904 that a meeting was held in Aberystwyth at which a society was formed. Amongst other decisions arrived at, it was resolved to hold annual shows and Aberystwyth was selected as the venue for the first three shows.

## "On Foot Over Dartmoor"

THIS is the title of a talk by Ralegh Phillpotts on July 27th, in which he will ask Western listeners to accompany him in a walk up the Dart River from the hamlet of Post Bridge to Cranmere Pool. He will describe the nature of the ground, some of the antiquities and birds and animals which may be seen. Mr. Phillpotts, who is a cousin of the well-known Dartmoor novelist, Eden Phillpotts, is recognised as an authority on Dartmoor, both as regards topography and its law and customs; he has had the honour on more than one occasion of acting as guide over Dartmoor to the Prince of Wales, who is the hereditary proprietor of a large portion of the moor.

## The Tewkesbury Festival

PART of the Tewkesbury Festival on July 25th is to be relayed in the Midland programme. Owen Reed will be the commentator, and excerpts from the open-air production of Milton's "Samson Agonistes," by Nevill K. Coghill, who is a don in English at Exeter College, Oxford, will be included. Mr. Coghill was responsible for the first open-air production of "Samson Agonistes" in Exeter College Gardens in 1930; he produced the O.U.D.S. in "Hamlet" and wrote the one-act comedy, "The Tudor Touch," which was recently broadcast. The lawns in front of the west end of Tewkesbury's famous Abbey will be the auditorium for the performance of Milton's drama.

## For the Air-minded

MR. LINDSAY EVERARD, M.P. for the Melton Division, will give the closing talk in the "Looking to the Air" series on July 23rd. He has his own aerodrome at Ratcliffe, near Leicester, and has done a good deal of flying on the Continent and in this country. He was Chariman of the Organisation Committee for the recent England-Australia Air Race, and is a Vice-Chairman of the Royal Aero Club.

## SOLVE THIS!

### PROBLEM No. 148.

After some months of good service Jackson's receiver suddenly ceased to function. He tested the H.T. and L.T. batteries and found these in good order and the grid bias battery was only slightly below the rated figures. He inserted a milliammeter in each anode circuit and found the anode current on the first two valves was normal, but was slightly high on the output valve. He therefore suspected the valve, but to make quite certain he changed the value of the grid bias applied to the valve but found that no alteration in anode current was obtained. What was wrong? Three books will be awarded for the first three correct solutions opened. Envelopes must be marked Problem No. 148 in the bottom left-hand corner, and must be addressed to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received not later than the first post Monday, July 22nd, 1935.

### Solution to Problem No. 147.

The wire which Jerrold wrapped round the anode lead formed a small inductance and thus, coupling with the inner lead produced a stronger field with consequent greater inter-action. He should have used bare wire, and run solder across the adjacent turns to remove the inductive effect, or obtained the correct type of metallic braiding, when his trouble would have been removed. The following three readers successfully solved Problem No. 146 and books are accordingly being forwarded to them: W. G. English, 29 Kirkpatrick Road, Mile Cross, Norwich; A. Yazdi, c/o Wireless College, Colwyn Bay; H. Nightingale, 4 Hillside Avenue, Darwen.

# DESIGNING YOUR OWN WIRELESS SET

In this Second Article of the New Series the Essentials of the Superheterodyne are Explained from the Point of View of the Practical Man

By FRANK PRESTON

WE started this series of articles last week by making an attempt to persuade all those readers who had not previously understood circuit diagrams to learn to do so at once. The examples of circuits which were given were of the simplest possible types, but were representative of theoretical circuits of all kinds. In consequence, if you found, after comparing the theoretical and pictorial diagrams, that you were able to follow the former, you will find that you can very soon master any variety of circuit diagram.

Before proceeding to the more practical details of design and construction it will be better if we apply the experience gained to the circuit of a superheterodyne receiver. Actually, such a circuit is merely a repetition of certain of the valve stages represented last week, but arranged in a particular sequence. The arrangement of the stages is shown diagrammatically in Fig. 1, where it will be seen that a detector stage is fed from the aerial and is connected in parallel (strictly speaking the stages are not in parallel, but this explanation will suffice for the moment and will make the arrangement easier to understand) with an oscillator stage. The output from these two stages combined is applied to an intermediate amplifier, from which it is led to another detector—the second detector—and from thence to the output valve and the loud-speaker. With the exception of the combined oscillator-first-detector, the principle of the various stages is precisely the same as was described last week; the I.F., or intermediate-frequency amplifier is merely a high-frequency stage designed to operate at a fixed frequency or wavelength, the second detector is like the leaky-grid detector shown last week, but with fixed tuning, whilst the low-frequency output valve does not differ in the slightest from the corresponding stage previously illustrated.

## The Frequency Changer

The only portion of the superheterodyne which we need to examine at all closely at this point is, clearly, the first stage, or rather the combined first two stages, and a circuit of them is shown at Fig. 2. Although there are two functions to be performed, only a single valve is used in modern receivers, this generally being of the pentagrid or octode type, of which the former is shown. This valve is in every respect equivalent to two valves, and in order to make this quite clear the

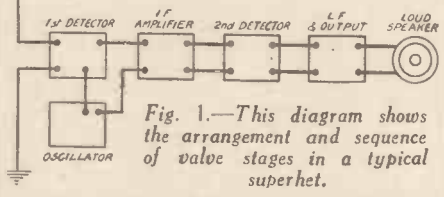



*Fig. 1.—This diagram shows the arrangement and sequence of valve stages in a typical superhet.*

detector portion of the circuit is shown in full lines, and the oscillator is indicated by broken lines, whilst those portions which are common to both circuits are shown in heavier lines. It can now be seen that the first detector is of the variable-mu screen-grid type, the oscillator being a three-electrode or triode valve.

If we quickly trace through the circuit we find that the preliminary tuning circuit includes a band-pass filter connected between the control grid and filament of the S.G. detector valve, which in this case functions on the anode-bend system. It might be mentioned here that a leaky-grid detector *could* be used in this first stage, but it is not so convenient since the variable-mu characteristics of the valve could not be employed with such an arrangement. There are other reasons which need not be discussed here. The first detector behaves in a manner very similar to that of the ordinary detector described previously, since it functions at

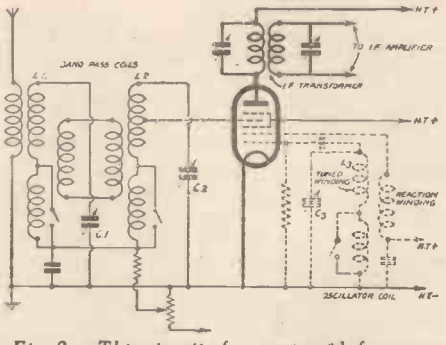



*Fig. 2.—This circuit of a pentagrid frequency changer shows that the valve actually comprises two sets of electrodes. The circuit of the S.G. first detector portion is shown in full lines, that of the triode oscillator in broken lines, and that portion which is common to both is in heavy lines. Values of components are not shown because these are interdependent.*

the frequency of the received signals; this means that the band-pass coils for a superhet are just the same as those which would be used in a "straight" circuit.

## Intermediate Frequency

The principle of the superhet, however, is that the frequency or wavelength of the received signals is changed before high-frequency amplification takes place, and this is done by "mixing" with the rectified signals oscillations of an entirely different frequency. This is where the oscillator part of the pentagrid comes in; if this valve is caused to produce oscillations of a frequency higher or lower than that of the received signals there is a resultant frequency equal to the difference between the two original frequencies. It can be seen that the triode portion of the first valve can be made to oscillate because its grid circuit is tuned, and a reaction winding—coupled to the tuned winding—is included between its anode (a grid acts as an anode in this case) and H.T.+. The "mixing" of the two sets of oscillations takes place inside the valve, so that the output from the anode circuit of the double valve is at the "difference," or intermediate frequency. This frequency is determined primarily by the tuning of the oscillator circuit, and is therefore governed by the size of the coil marked L3 and by the setting of condenser C3. But as it is usual to employ a three-gang condenser for C1, C2, and C3, the coil is the main

*(Continued overleaf)*

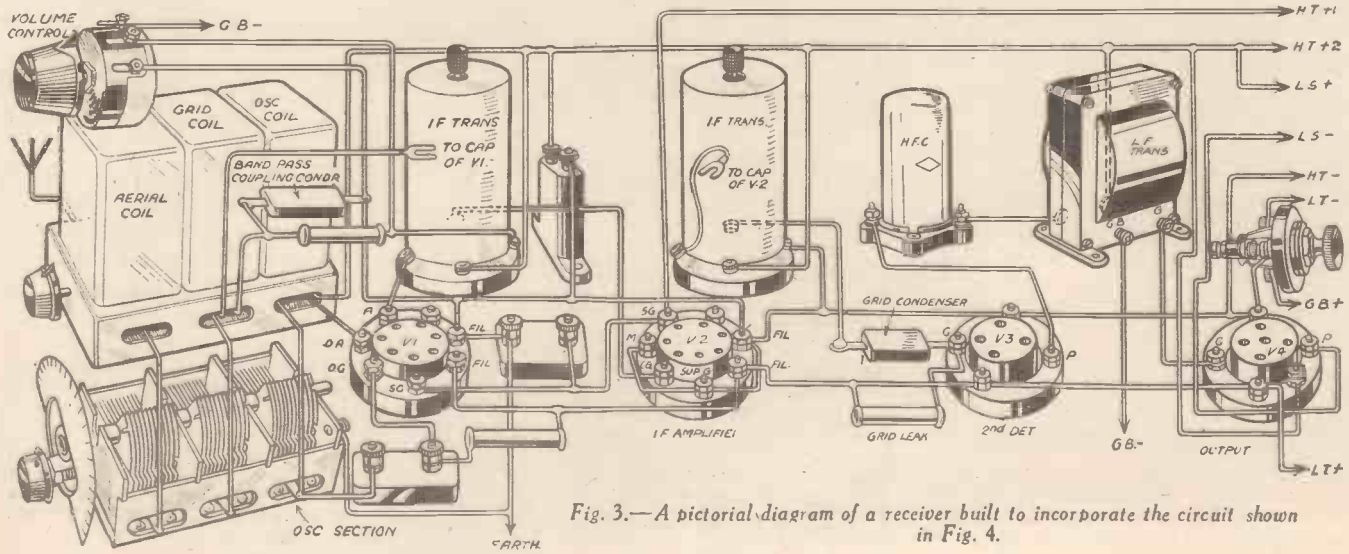



*Fig. 3.—A pictorial diagram of a receiver built to incorporate the circuit shown in Fig. 4.*

(Continued from previous page)

factor which requires consideration. At the same time, however, the condenser has to be chosen according to the intermediate frequency to be employed, because the vanes of the oscillator section are specially shaped to provide the same frequency difference over the complete tuning range.

### Choice of Frequency

Although, as already stated, the intermediate frequency is not altered when the set is in use, there is no definite standard for this frequency, and different designers prefer different frequencies. We will discuss the advantages of the various frequencies later, and let it suffice for the moment to state that the most commonly used I.F. at present is probably 110 kilocycles (equivalent to about 2,700 metres), but the higher frequencies of 126 kc/s, 150 kc/s, and even 465 kc/s are rapidly coming into greater use, the latter mainly in short-wave receivers.

It will be seen from this that the three coils and the gang condenser must be chosen according to the frequency to be employed. After that, the intermediate-frequency transformers can be chosen, and these must, naturally, be designed to tune to the same frequency. These transformers, incidentally, consist essentially of two windings, each of which can be brought into resonance at the intermediate frequency by means of a pre-set condenser connected in parallel with it.

### A Typical Arrangement

As it is not intended to make this series of articles too theoretical in character we will not explain the principles of the superhet in any greater detail, but complete this particular instalment by examining the theoretical and practical circuits of the simplest type of four-valve superhet. The circuits in question are shown in Figs. 3 and 4, but it must be explained that these circuits do not necessarily represent the design of a complete and satisfactory receiver; they merely show the essentials, which we may enlarge upon in later articles.

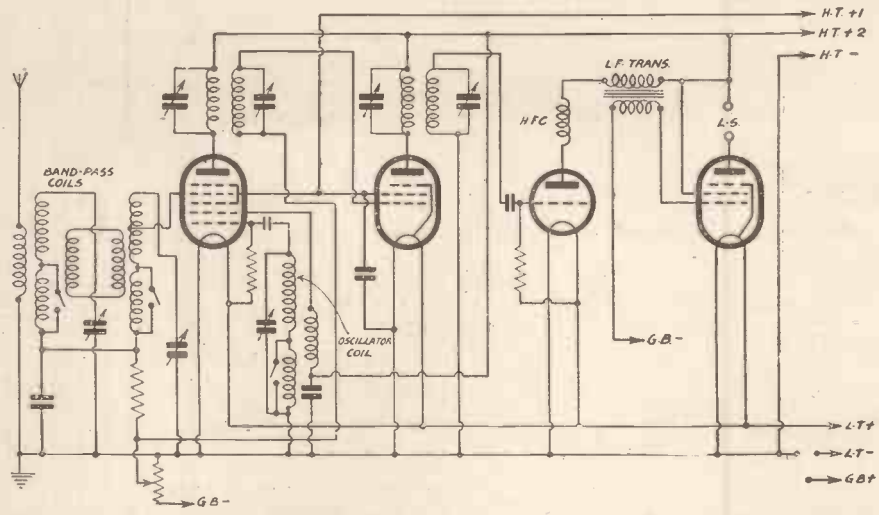



*Fig. 4.—A theoretical circuit showing the principal features of a modern 4-valve superhet of simple type.*

The circuits show a pentagrid first-detector-oscillator followed by a variable-mu pentode intermediate-frequency amplifier, a leaky-grid second detector, and a pentode output valve. A very complete control of volume is provided by the potentiometer which serves to vary the grid-bias applied to the first and second valves, but such things as automatic volume control, visual tuning, low-frequency volume control and decoupling have been omitted with the sole object of simplifying the diagrams. The latter are, in any case, merely refinements, although decoupling in some form would probably prove to be a practical essential if the receiver were to operate satisfactorily.

In the next article we will turn our attention to the choice of a circuit to cope with individual requirements, and also deal with the question of component layout and wiring. Afterwards we can deal more completely with the actual design of the various stages, considering the advantages and disadvantages of various forms of inter-valve coupling, the most suitable valves for various purposes and all other practical details. In the meantime readers will find it very helpful to study various circuit diagrams, attempting in every case to understand the function of the various components and to appreciate the reasons for the many variations from the simple arrangements which have been discussed. In doing this, remember that the Free Advice Bureau of PRACTICAL AND AMATEUR WIRELESS exists to help *you*, and if there is any point which is not fully appreciated the Technical Staff will be only too pleased to provide a solution to the difficulty.

# An Eliminator Point

WHEN choosing a high-tension battery eliminator it is usual to settle on a unit which is rated to give as nearly as possible the H.T. current required by the receiver. In normal circumstances, if the eliminator has an output of, say, 50 milliamps, and the receiver takes only 20 milliamps, there is a danger of damaging the valves, due to the fact that the voltage delivered by the mains unit is considerably in excess of the rated figure.

Despite this, however, it is often a very good plan to buy an eliminator which gives appreciably more current than is actually required, since this allows the instrument to be used successfully at a later date when a larger set is constructed. For this scheme to prove satisfactory it is necessary that some means be adopted to "absorb" the surplus current so that the output voltage does not rise unduly. A simple method of doing this is to connect a resistance in parallel with the output terminals of the mains unit, the value of the resistance being so chosen that it will pass the "difference" current between that supplied by the eliminator and that consumed by the receiver. The calculation of resistance value is easy, for it is necessary only to divide the voltage of the eliminator by the "difference" current, the result being the resistance required in *thousands of ohms*. It is evident that the wattage rating of the resistance must be sufficiently high to avoid overloading, and in nearly every case a 10-watt component will prove perfectly adequate.

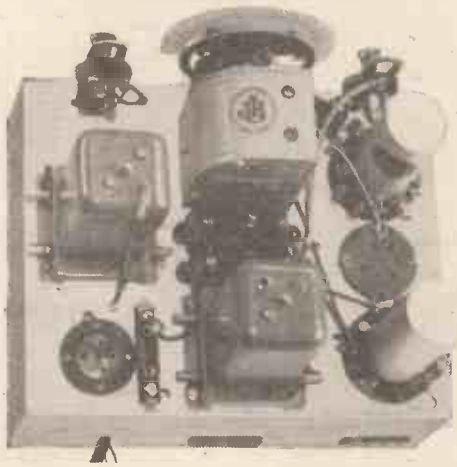
A far more satisfactory solution to the difficulty is to use the field winding of an energised moving-coil speaker in place of the resistance; this will "absorb" the necessary amount of current without wasting it—whilst there is the additional advantage of the greater sensitivity of the energised speaker as compared with a permanent-magnet model. In the majority of cases a D.C.-type speaker is to be preferred, since this has a field resistance in the region of 6,000 ohms (different models vary from about 4,000 to 7,500 ohms). A resistance of this value passes a current of rather more than 30 milliamps when the applied voltage is 200, but a field resistance appropriate to the excess current can generally be obtained.

Another method is to employ a speaker of the type having a field winding of 2,500 ohms resistance (as used in most A.C. receivers), and to connect this in series with a fixed resistance across the eliminator output. The resistance should be chosen so that a current of at least 30 milliamps flows through the field windings. The advantage of this system is that when a larger receiver is built later, or when the valves are changed for those of the A.C. type, the field winding can be connected in series with one supply lead from the eliminator so that it may be used as a smoothing choke, as is usual in commercially-built A.C. receivers.

# Tuning and Adjusting My Two-Valve Superhet

Hints on Matching the I.F. Transformers and Obtaining Correct Adjustment Between the Various Circuits so as to Obtain Maximum Efficiency from this Interesting Receiver By F J CAMM

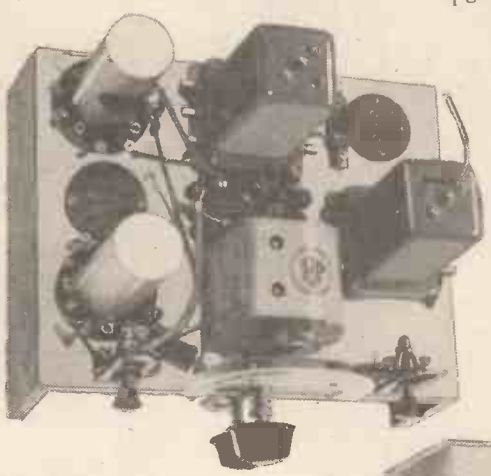
ALTHOUGH the information which was given last week should have enabled the majority of constructors to obtain good results with this receiver, it is quite possible that some will experience a little difficulty in trimming. Those readers who have made this their first home-constructed set, or who are making their first acquaintance with the superhet circuit, may quite possibly feel confused at the thought of adjusting two controls on each of the two I.F. transformers and two trimmers on

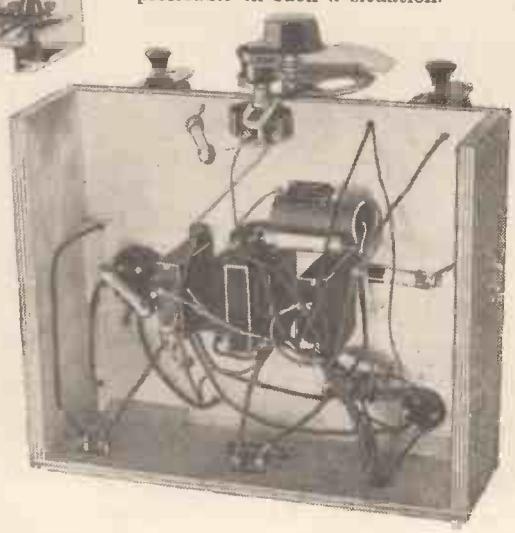


the two-gang condenser. Actually there is nothing complicated in this adjusting procedure, and if carried out in the correct manner is no more difficult than ganging a three-circuit receiver. First of all, the trimmer nearest the panel on the two-gang condenser is really unimportant. If you utilise a wavelength calibrated dial then you will have to shift the tuning point on the condenser so that the dial reading agrees with the marked scale, and, therefore, this trimmer will have to be adjusted. If, however, you use an ordinary, or degree-marked scale, then there will be no necessity to touch this trimmer except in so far as it governs the maximum and minimum wavelength of the receiver. Thus, if you find that the minimum wavelength to which the receiver tunes is not quite low enough to get a particular station, you may reduce the minimum by unscrewing the first trimmer, and to increase the highest wavelength the trimmer may be screwed in. It should not, however, be adjusted when once the best position has been found for your particular situation, as it will necessitate further adjustment of the remaining controls in all probability.

## The Oscillator

The other trimmer on the gang condenser adjusts the frequency of the oscillator-tuning section, and this must be carefully carried out, as the reception of many stations will depend upon the accuracy of this circuit and of the I.F. transformers. Therefore select a weak station (or reduce the volume of a powerful station by means of the volume control) at the lower end of the scale, preferably about 200 metres, and having tuned to the loudest position carefully adjust the trimmer C2 whilst rotating the tuning control backwards and forwards over a few degrees. In this way the best setting will be found and will be indicated by greater signal strength. Always reduce the volume as soon as any improvement is obtained, in order that the slightest variation will be discernible. Now turn to the upper end of the medium waveband, and having located a station, carefully swing the tuning control backwards and forwards as before, whilst turning the trimmer C2 slowly first one way and then the other. If there is any modification needed, return to the lower end and ascertain whether the new adjustment is also good for that end. If not, readjust C1 slightly, and proceed in this manner, first at one end and then at the other, until the best combination of C1 and C2 is found. Now turn to the I.F. transformers and carefully adjust the two screws situated on top of the metal cans, carrying out the same procedure. Remember always to reduce signals to almost inaudibility with the volume control so that the slightest change in volume can be distinguished, and work first at one end of the medium-wave band and then at the other end, adopting that combination of settings which gives best results in both positions. It is, unfortunately, generally found that the maximum position at one end of the scale cannot be maintained in view of losses at the opposite end, but there should not be a great loss in volume if the receiver is correctly wired and all components are in good condition.





Three views of the Two-valve Superhet showing the compactness and simplicity of wiring.

## Battery Voltages

When once the trimming has been completed the actual voltage applied to each part of the circuit may be experimented with. If the receiver appears dead in a certain position, that is an indication that the oscillator is not functioning, and this will probably be due to insufficient voltage at H.T.+1. A loud rushing sound, accompanied by a loud chirp on nearly every station, will probably indicate that the I.F. valve is oscillating, and the voltage on H.T.+2 should be reduced. The grid-bias applied to this valve should also be modified, and the plug marked G.B.—1 should be moved until signals are quite clear and undistorted. There are no other variable adjustments, and, therefore, there should be no reason why the receiver should not be put into thorough working order in the space of about half an hour. Do not be tempted to rush things. A hurriedly-adjusted superhet is next to worthless, but a correctly-adjusted receiver of this type is a valuable acquisition, and it may be relied upon to give the choice of many good programmes from all parts of Europe. If, of course, you have access to a signal generator or oscillator, then the correct adjustment of the various circuits is rendered very much simpler, and the I.F. transformers should in that case be adjusted first. The generator should be coupled to the primary of I.F.T.2, and the primary and secondary adjusted for maximum response, when the connection should be transferred to the primary of I.F.T.1, and the two trimmers on this adjusted. Next, the generator should be coupled to the aerial circuit, and the aerial-tuning control and the oscillator section both adjusted for maximum response.

If you are situated close to a main B.B.C. station, it may be essential to reduce the size of the aerial, or to modify its position so as to avoid the production of whistles.

A good indoor aerial may be found preferable in such a situation.

# QUALITY EQUIPMENT

An H.F. and Detector Unit and Alternative Amplifiers are Described in this Article. By G. W. DAVEY

THE receiver and amplifiers forming the subject of this article were designed and built in the course of the seemingly never-ending search for quality. So good have they proved that no alteration is likely to be made to them for some time to come, and, in particular, with a good moving-coil speaker the quality given by the larger amplifier—called the "P.A." on account of its bigger output—is excellent. The smaller amplifier, the circuit for which is given in Fig. 1, is an exact copy of this, except for the mains-rectifying section, which gives a somewhat lower voltage, resulting in a smaller output valve being used. This latter amplifier was built for home use, as it was found that the P.A. model was always being worked with the volume control so much "in" that its use was quite uneconomic in a small room. In a small hall, or in the open, this larger amplifier is appreciated to the full, and gives an output of about 3½ watts, the output valve being a Tungsram PP15/400. This has a voltage of approximately 370 on the anode, for although the voltage given by the secondaries of the mains transformer is only 350 at 120 milliamps, the current taken by the set is but half this, and therefore the voltage on load rises to about 410. The circuit diagram is given in Fig. 2.

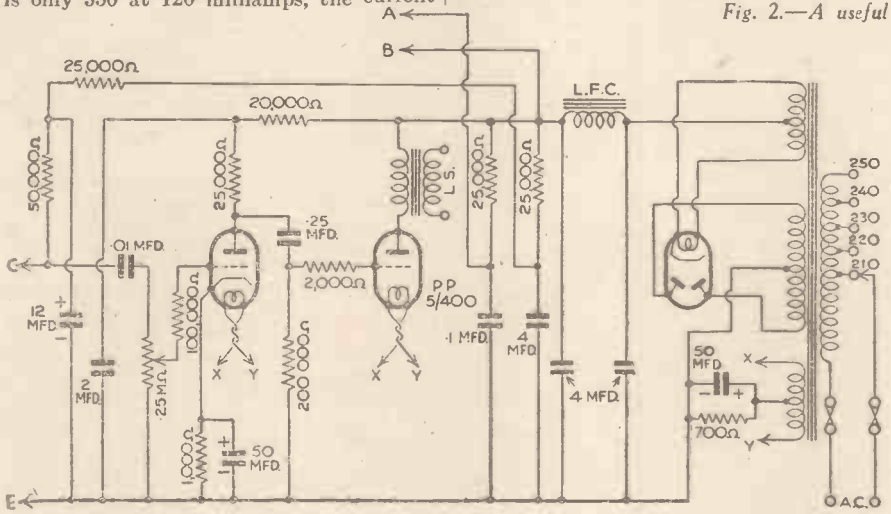



*Fig. 1.—Circuit of a small A.C. mains amplifier.*

## Auto-grid Bias

As readers are well aware, when automatic grid bias is used, the grid-bias voltage is subtracted from the available voltage on the anode of the valve, and is in this instance 37 volts. The smaller amplifier has an output of 2½ watts, using the Marconi PX4 valve with the maximum anode voltage of 250. This is with a grid-bias voltage of 34, which together make up 284 volts, the approximate voltage given by the H.T.8 metal rectifier as worked in this unit. Apart from the output valves the L.F. amplifying arrangements are in every other respect similar in both amplifiers. The first L.F. valve must be of about 8,000 ohms impedance, as a valve with a higher value will spoil the overall balance of tone. It will be noticed that a volume control is placed in the grid circuit of this valve, but this is actually left at maximum, all control of volume being done by variation of the grid bias of the variable-mu valve in the H.F. and detector unit. Incidentally, the amplifiers were designed to follow this unit, and have not been found to give sufficient amplification for gramophone work alone. For this reason it will be noticed that pick-up switching is incorporated in the grid circuit of the detector valve. This results in a tremendous output, and, therefore, a volume control must be placed across the pick-up as shown.

## H.F. and Detector Unit

With regard to the circuit of the H.F. and detector unit, this has several interesting features, as will be seen by reference to Fig. 3. The detector, it will be seen, is an H.F. pentode, which, although having the requisite values of grid leak and grid condenser, does not work on the true power-grid principle owing to the actual voltage on the anode being comparatively small. Nevertheless, this valve will accept a very large input, has not been found to overload, and gives an excellent output with negligible distortion. The large volume of this output, as a result of the high amplification of the valve, amply compensates for any loss of volume which may be sustained due to the complete elimination of the L.F. transformer in favour of an all-resistance-coupled amplifier. Reaction is incorporated, and is useful both for its normal purpose and in assisting to sharpen the selectivity when searching. Incidentally, thirty-five stations have been received at

(Continued on page 507)

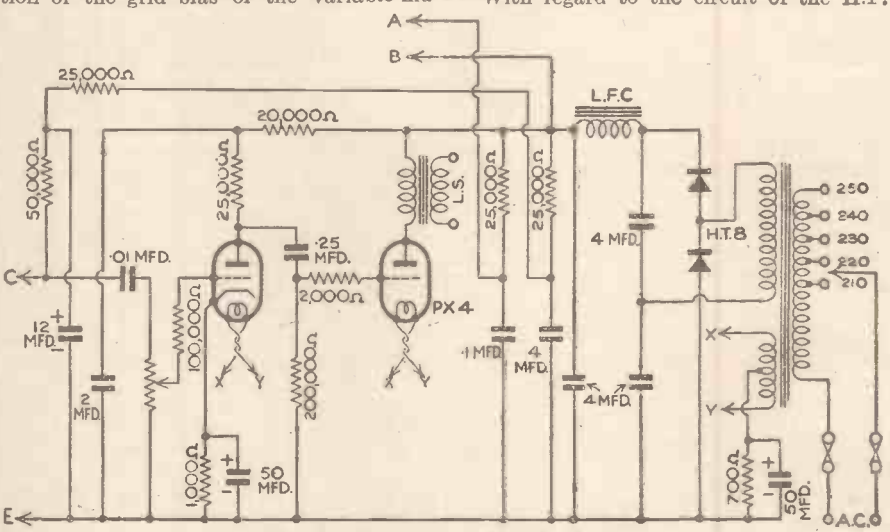



*Fig. 2.—A useful amplifier for home use.*

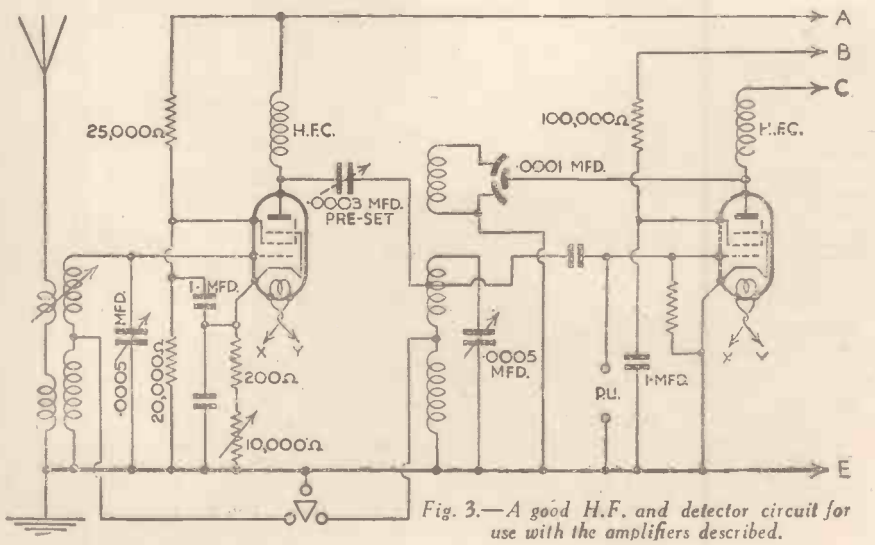



*Fig. 3.—A good H.F. and detector circuit for use with the amplifiers described.*

# A PAGE OF PRACTICAL HINTS

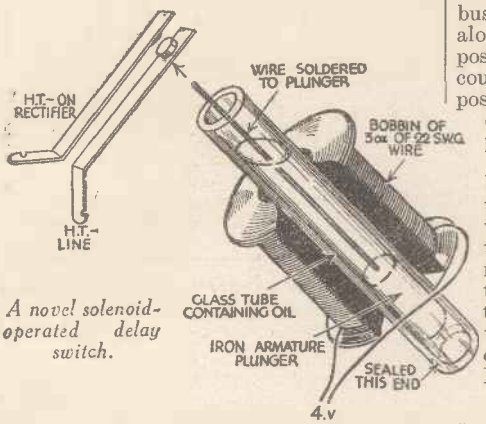
SUBMIT YOUR IDEA — READERS WRINKLES — THE HALF-GUINEA PAGE

## 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.**

### An Efficient Delay Switch

I HAVE recently made some alterations to my receiver, with the result that the output valve receives an H.T. voltage of 500 whilst the preceding valves receive just under 200 volts. The output valve is directly heated (4v. A.C.) whilst the preceding valves are directly heated from an accumulator. As the H.T. is derived from the mains I considered it dangerous not to have some sort of delay switch in this circuit. The high-frequency and detector valves only took about one second to heat up, and as I could not make a thermal-delay switch to operate in less than about twelve seconds I devised the switch shown in the accompanying sketch. About 3ozs. of 22-gauge enamelled copper wire was wound on a bobbin 3ins. long which just




*A novel solenoid-operated delay switch.*

fitted on a glass tube 4ins. long, having one end sealed off (inside bore approx. ⅜in.). A piece of iron rod 1½in. long and a slack fit in the glass tube has a piece of stiff wire 3in. long soldered to one end. The rod is slipped inside the tube and this is then half filled with light lubricating oil. A pair of very light contact springs are arranged so that they are closed by the piece of wire when the iron rod is in the centre of the solenoid. The assembly is then fixed at an angle of approximately 45 degrees (this angle may be made variable to give different operating times) and the solenoid connected to a 4-volt source of A.C. or D.C. The contacts are, of course, joined in the common H.T. circuit. — R. W. BAYLIFF (Upper Norwood).

### An Improvised Turns Counter

THE accompanying sketches illustrate a practical method of adapting an alarm clock for use as a turns counter. Fig. 1 shows the necessary wheels inside the frame. The dial, or motion, wheels, operating outside the front plate, are also required. To permit the seconds spindle to work in its new position, the hole, "C," in the back plate, requires to be reamered, and the hole "D," in the front plate, requires to be bushed. The lantern pinion is moved along the spindle from the dotted line position. The flexible shaft allows the counter to be mounted in a convenient position on the winder. If the direction of rotation of the winding machine permits the use of the dial shown at "B," the alarm operating gear can also be utilised. The alarm can then be set to give an audible indication when the required number of turns have been wound. The numbers on the outer circle of the dial refer to movement of the minute hand, and those on the inner circle to movement of the hour hand.—STEENSON RAINEY (Wishaw).

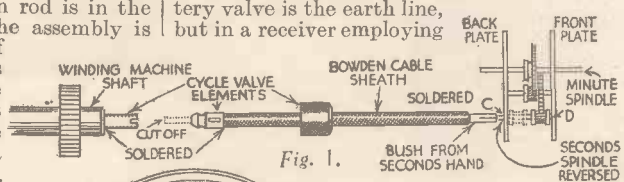



*Fig. 1.*

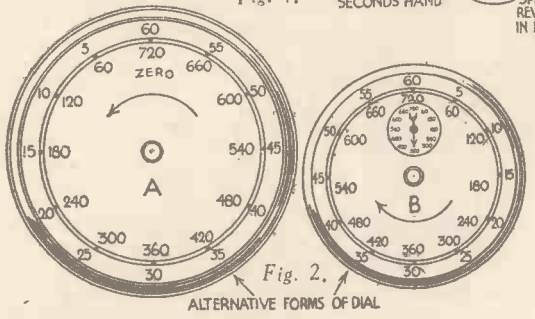



*Fig. 2.*

*Adapting the works of an alarm clock for use as a turns counter.*

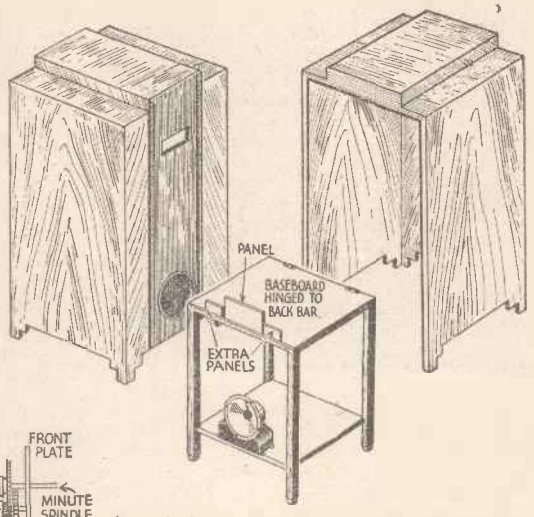
### Stability and A.C. Receivers

IN an examination into the causes and cures of certain types of instability, it has been found that certain so-called "rules" are not infallible. For instance, it is generally admitted that decoupling condensers should be joined to the cathode, which in an ordinary battery valve is the earth line, but in a receiver employing indirectly-heated A.C. valves is a separate connection. Sometimes the cathode is joined direct to earth, but more often than not there is a bias resistance and by-pass condenser in the cathode lead, and thus the decoupling condenser, if joined to the cathode, will be in series with the biasing components. Stability is not ensured when the decoupling condenser is so connected, and it has been found that in many cases the removal of the condenser from this position, and the connection of it direct to the earth line (H.T.—) will cure an otherwise obstinate receiver.—W. D. (Hendon).

### Novel Cabinet Construction

WISHING to build a new cabinet for my set, I was faced with the problem of how best to combine appearance with the facility for experimenting.

My choice was as illustrated in the accompanying sketches. I made a cabinet, to match the existing furniture, in the usual way, the only difference being that the back was left completely open and without bottom or shelves. I next built a table frame to fit neatly inside the cabinet so that the legs of the table would be hidden by those of the cabinet, the top bar of the




*A method of cabinet construction which combines good appearance with easy accessibility.*

table being just below the bottom of the panel hole in the cabinet. A lower shelf in the table carries the batteries and speaker, or a baffle could be fixed to the front legs. The top shelf, or baseboard, for the set is hinged to the back bar to allow the components mounted below it to be easily accessible. On each side of the main panel I fixed a smaller one to carry additional controls, which are covered when the cabinet is placed in front.

To avoid any vibration between the table and cabinet rubber buffers are fixed between the two, and four small turn buttons hold them rigidly.—J. S. (Rothesay).

# Scratch Filters

## *Details of the Requirements of Noise-suppressing Devices, and their Application to Radiogram Receivers*

IN order to obtain satisfactory reproduction from gramophone records, it is necessary to provide means for controlling the frequency output from the pick-up. Just as it is essential to regulate the voltage output to compensate for the variations in the recording, so it is equally desirable to correct the frequency range to suit the amplifier and loud-speaker characteristics. The volume of sound will naturally be regulated by the usual control, which will be either incorporated on the base of the pick-up itself, on the motor-board, or even in the radiogram, where it may be doing double duty for both radio and gramophone reproduction.

On the majority of commercial sets no further provision is made for the pick-up, although, if the receiver includes a "tone control," this will sometimes act to restrict the higher audio frequencies, which in the region of about 3,500 cycles coincide with the scratch noises. For a number of technical reasons later explained, such tone controls are apt to spoil reproduction rather than improve it. The main reason is that the "tone control" merely consists of a by-passing scheme for high notes, and in cutting off at any desired frequency within its scope it seriously attenuates all adjacent lower high notes, due to the broad tuning effect.

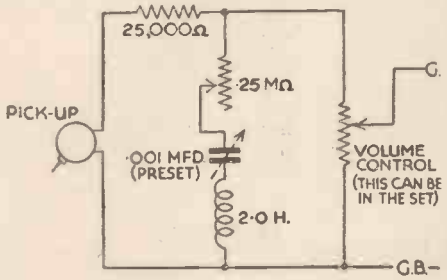



*Fig. 1.—One method of controlling the output from the pick-up.*

### High-note Loss

Consequently, in attempting the suppression of scratch, the user, unless very careful in manipulating the control, is likely to rob the recording of its "brilliance," imparted to the reproduction by those frequencies immediately below 3,500 cycles. A tone-control transformer included as an L.F. coupling will offer somewhat greater scope, but even so, in attempting the suppression of scratch noises, the response curve will be tilted to the bass end, these latter frequencies then becoming more prominent.

Due to the limited bass notes on a modern electrical recording, this over-emphasis by the tone control is a good fault and will "level up" the output, provided, of course, the correction is not overdone. These remarks are tantamount to putting the cart before the horse, in that it is necessary to discover the causes of background noises in a pick-up before one is in a position to cure them.

Nearly all pick-ups operating on the electro-magnetic-mechanical principle give rise to resonances at the upper end of the frequency response curve. Modern versions possess substantially uniform characteristics, with a peak, due to the mechanical resonance of the armature, between 3,000 and 5,000 cycles, followed by a falling response up to about 7,000 cycles. Owing also to the movement of the needle point on the record, a further needle scratch noise is heard. From investigations made into these problems, the following interesting conclusions have been reached. (1) When needle scratch is superimposed on the resonance noise, the resultant background is loud because of the increase in amplification which is incident to the resonant circuit. (2) As the noise is thus at its loudest at the armature resonance point, reducing the amplification at the frequency of the armature will substantially reduce the background. (3) An asymmetrical condition of the pick-up armature—that is, when it does not affect both magnetic poles equally, due to being slightly out of mechanical centre or unequal magnetic pull—will result in the scratch varying in pitch with all pure high notes reproduced. (4) The surface noise of a gramophone record, due to it extending over a large range of frequencies, will quickly stimulate the pick-up armature into its natural resonance.

### A Practical Scheme

It is obvious from the above that the removal of the natural resonance at the frequency at which it occurs offers the best solution to pick-up noises, rather than the entire removal of all frequencies on and above the resonant point such as would occur with so-called tone-controls. The use of a scratch filter, therefore, imposes the limitation that it must only suppress at the resonant frequency, leaving frequencies above that point unattenuated. A scheme as shown in Fig. 1 or in Fig. 2 will be found to fulfil these conditions, as both circuits are fundamentally the same.

By careful adjustment of the variable controls provided on either device, it is possible to find the resonance point of the particular pick-up in use, as the action of the filter is to cause a trough in the frequency response by acting as a short-circuit to alternating currents of the frequency to which it is tuned. This loss in the filter network can be made to cancel out the resonance gain, the nett result being a more level overall pick-up voltage output. Prospective users of these filters should note that the inclusion of the series resistance restricts the voltage output of the pick-up and, therefore, the amplifier must possess sufficient overall gain to load the output valve from a pick-up input about half that stated by the makers.

### Surface Noise

The loss of output is unavoidable, as the filter circuit must of necessity include the series resistance to maintain a correct impedance ratio to the pick-up. On the other hand, the reduction of the resonance peak progresses at a greater rate than the loss of volume, and in most cases full correction will coincide with a loss not exceeding 40 per cent. When adjusting a scratch filter it is essential that the tone control (if used) be set to maximum brilliance, as this will allow the effect of the filter to be more easily observed. In any event, a low (mellow !) setting of the tone-control is likely to mask settings of the filter which may then appear to have no noticeable effect on the reproduction.

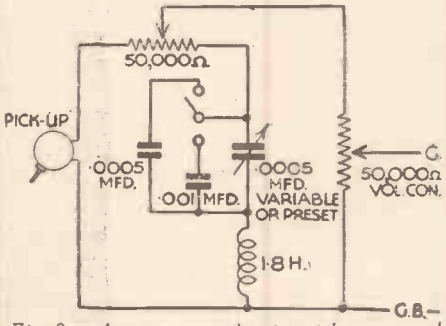



*Fig. 2.—A more comprehensive pick-up control circuit.*

Noises due to the friction of the needle on the surface of the record are unlikely to be restricted by the use of these filters except at the point of resonance, and short of excluding all frequencies between the middle and top note register (which would naturally ruin reproduction completely), there does not appear to be any possibility of restricting them. The writer suggests that these surface noises are on a par with those which were incidental to sound on film about a year ago. Researches into the granular formation of film only brought about a slight improvement, and it was not until a system of masking the silent part of the sound track came into being that the fault was overcome.

## PROGRAMME NOTES

### A First Broadcast

BURTON EXCELSIOR BAND will have its first broadcast in the Midland programme on July 27th. It was formerly a mission band, run and conducted by Mr. E. S. Cox, under whom it had notable successes at Skegness, the Crystal Palace, and the Leicester Festival. He retired in February and was made a life member. Under his successor, Fred Adams, the Band, with only three weeks' preparation, won the Wycliff Cup at Leicester. The members are all working men and are principally employed in Burton breweries or at collieries in the district.

### Old School-days

"DOMINIE DAYS" is to be the subject of another "Auld Wives' Tale" to be broadcast from Aberdeen on July 23rd. This fourth instalment will consist of songs and stories about schools of the olden time. The old dominie was a man of character and lent himself to tale-making. He was, however, with the parish minister, one of the most important people in the countryside. Lads o' pairts were given a fine opportunity to develop their powers under his individuality, and nothing pleased them more than to return to the old school and greet the old dominie. On such occasions the successful pupil was paraded before the youngsters as a living example of what talent and industry can do.

# Circuits Readers Ask For

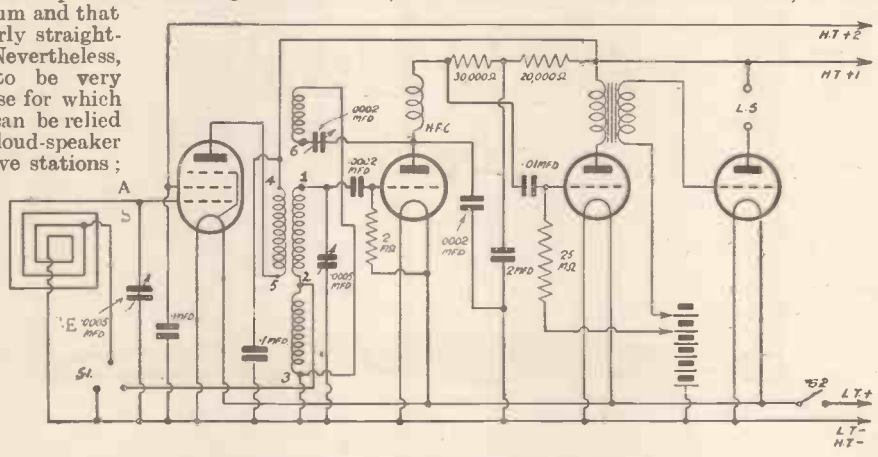
**Details Are Here Given of a Simple Four-valve Portable Receiver.**

AT this time of the year there is a constant demand by readers for details of various types of portable receivers, so it is proposed here to describe the circuit of a simple instrument of a reliable type. Full constructional details have been given in recent issues for midget portables using modern small components, but the circuit shown on this page is intended especially for those readers who have a number of parts on hand, and who do not, therefore, wish to buy all new materials. There is nothing very original about the circuit illustrated, but it represents a well-tried arrangement, which is not too critical with regard to the components, and which is easy to build and to operate.

## Circuit Details

Four valves are used, these being arranged as high-frequency amplifier, leaky-grid detector, resistance-capacity-coupled first L.F., and small-power output. It will be seen that the number of parts has been kept down to a minimum and that the circuit is particularly straightforward throughout. Nevertheless, it has been proved to be very effective for the purpose for which it is intended, and it can be relied upon to give good loud-speaker reception of four or five stations; this is actually a very conservative estimate, and many readers will find that a score of different transmissions are well within its range.

There may be some constructors who will question the value of using two three-electrode L.F. valves instead of a single pentode, which would probably give quite as much amplification. The point is that stability and ease of control are considerably improved, and the layout rendered far less sensitive to exact positioning of parts when two "low-gain" stages are used in place of a single high-amplification stage. These are important considerations in the design of a portable, especially when full constructional details with wiring plans, etc., are not provided. In addition to the advantages mentioned it will generally be found that better quality of reproduction is to be obtained by using two stages, and when it is pointed out that the cost of the necessary parts is quite low, it will be appreciated that this is probably the best type of circuit to meet readers' requirements.




*A simple but efficient 4-valve portable circuit.*

## Screened H.F. Pentode

A screened pentode is used in the first stage, but an ordinary S.G. valve can be used if preferred, and this will provide almost equally-good results. The input to this valve is from a frame aerial—of which details will be given later—and the output is fed to the detector through a high-frequency transformer type of coil. This latter eliminates the need for an H.F. choke in the anode circuit of the S.G. valve, and is also slightly more efficient. Reaction is obtained in the usual manner by means of a plain .0002-mfd. variable condenser, and a fixed condenser of similar value is connected between the anode of the detector valve and earth; this helps to prevent self-oscillation and also "smooths" reaction control.

The coupling resistance in the detector anode circuit has a value of 30,000 ohms, which suits most types of detector valve, and is correct for the valve specified. Additionally, there is a 20,000-ohm decoupling resistance in the same anode circuit, the two resistances limiting the anode voltage and preventing the liability for the set to fall into self-oscillation, which is rather usual with some portables, and which cannot be controlled properly.

## The Components

A list of recommended components is given elsewhere, but there is no need to follow this implicitly provided that parts with similar characteristics are used. It should be noted that metallised valves are specified for the first three stages, for the screening thus provided is really useful in a set of this kind. The two .1-mfd. fixed condensers should be non-inductive, and this point should be watched when using surplus components, because trouble is likely to ensue if ordinary "paper" condensers are substituted. The coil is of the air-core type, and this is preferable to an iron-core coil in a circuit of this type. Iron-core coils are more efficient and may cause the receiver to become unstable; they are also more selective and, due to the selective properties of the frame aerial, would make tuning appreciably more difficult. The rest of the components do not call for comment, for they are of perfectly standard types and by no means critical.

## Layout

The arrangement of the parts will depend very largely upon the type of cabinet or containing case into which the receiver is to be built, so it is possible only to generalise in describing their best relative positions. It will usually be found, however, that they can be mounted above and below a flat baseboard measuring about 12in. by 9in., this being supported on fillets inside a framework made from two pieces of 5-ply measuring 12in. by 9in., and two measuring about 14in. by 9in. This frame will take the windings for the frame aerial, and a polished 3-ply panel can be fixed to the front to receive the controls and the speaker; to prevent resonance, however, the speaker portion of the panel should be reinforced on the inside with a piece of soft wood, stout cardboard, or the fibrous material sold specially for this purpose.

The valve-holders can be mounted in line on the baseboard, when the coil should be placed in the centre, with the .0005-mfd. tuning condensers one on each side and the reaction condenser towards the top of the panel. The three-point wave-change switch may then be placed in the centre of the panel, and the on-off switch directly below it. There will then be sufficient space for the .1-mfd. condensers on top of the baseboard, and the other components can conveniently be mounted on the underside.

## The Frame Aerial

The aerial windings consist of 24-gauge d.c.c. wire, of which approximately 75ft. will be required for the medium-wave winding (between points A and S), and about 200ft. for the long-wave portion (between points S and E). This means that if the frame is made according to the dimensions mentioned above, 16 turns will be required for medium waves and 44 for long waves, making 60 turns in all. The turns might well be wound side by side, since this enables the largest "pick-up" area to be obtained, but in some circumstances space might not permit of this, and it might be necessary to pile-wind the long-wave portion in four sections of 11 turns each.

Although the range of the receiver when using the frame aerial should be sufficient for most purposes, there may be some readers who would prefer to extend it on occasion by adding normal aerial and earth connection. This can easily be done by winding about three turns of insulated wire round the existing windings and connecting aerial and earth leads to the two ends of this; try reversing the leads to find the more suitable end for the aerial.

**THE PRINCIPAL COMPONENTS REQUIRED**

One Wearite Universal coil, Type A.
Two .0005-mfd. Utility "Mite" variable condensers.
One .0002-mfd. J. B. "Dilecon" reaction condenser.
One Graham Farish three-point switch (for S.1).
One Graham Farish on-off switch (for S.2).
Five T.M.C. tubular condensers; two .1 mfd., two .0002 mfd. and one, .01 mfd.
One T.M.C. 2-mfd. fixed condenser, type 25.
Four Dubilier 1-watt metallised resistances: one each, 20,000 ohms, 30,000 ohms, .25 megohm and 2 megohm.
One Ferranti low-frequency transformer, type AF 10.
Four Clix four-pin chassis-mounting valve-holders.
Four Cossor valves, types 210 SPT, 210 Det., 210 H.F. (all three with metallised bulbs), and 220 P.
One Rola type FR5 PM loud-speaker (6-in. diameter cone).

# On Your Wavelength

By Thermion

## Remote Control

I RECEIVED an interesting letter from a Mr. W. T. Palmer concerning his remote control, and no doubt it will interest my readers. Here it is:—

"Dear Thermion,

"This morning, as usual, I settled myself comfortably in my favourite armchair, lit up, and spent nearly an hour trying to make out what the remote control circuit was all about. To start off with, what type of set is it for? And again, as far as I can make out, there are two nice large batteries and no less than three switches at the control point!

"I wish I had not looked at the confounded circuit, for it completely spoilt my whole day.

"My set is a straight det. and 2 L.F., worked off a 2-volt accumulator, and a 100-volt H.T. accumulator. It has no filter choke or transformer output built in the set, so the wires I have running to sockets all over the house carry the H.T. They were laid down years ago, and no more wires could possibly be laid down with them, since in some places new lino and wallpaper and skirting boards and things like that have been put down on top of them.

"I decided that as any fool can switch a set on and off from a distance, I was going to change stations from a distance. I also decided that my relays should be *impulse* actuated. I was only going to waste current for an instant, while a bell-push was jabbed. Again, I wasn't going to be mutt enough to have two nice large batteries and three switches at my control point; all I wanted was a single simple bell-push. Again, I wasn't going to muck my set up, all the stuff would have to be in an add-on-unit.

"Well, it is now 7 p.m., and I am telling you all about it, and I am in the front room, some 30 yds. from the set, and hanging down from the loud-speaker plug and socket is a pear bell-push. The L.S. is pumping out London Regional. If I get up and push the bell-push for an instant the L.S. will give me National; push again, Regional, and so on *ad infinitum*. And what is more, this discreet bell-push is the only addition in this room; there are no nice large batteries, etc. And, again, the device wastes no current, as current only flows for the instant the bell-push is depressed. And again, it is a nice add-on-unit, which I can take off the set in about two jiffies.

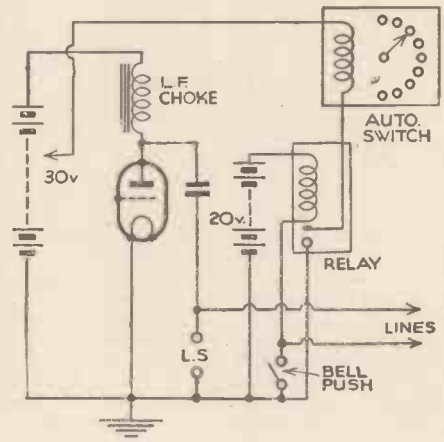
"And now I suppose you are thirsting to hear all about it. The device can be *simply* modified to switch on and give me as many stations as I have pre-sets, wave-changing whenever the station chosen requires it.

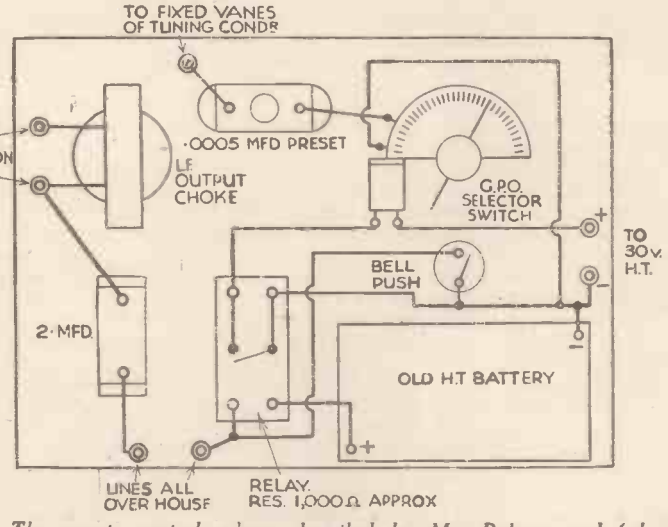
"Of course the whole thing revolves round the automatic selector switch. If you have never seen one, I can't possibly sketch or describe it, but it consists of a semi-circle of contacts, over which an arm is moved one at a time by a sprocket connected to an electromagnet, so that it is an impulse-actuated device. I have wired alternate contacts together, so that the added capacity of the preset is put on and off, and accordingly the programme changes from National to Regional, the main dial on the set being kept permanently at National.

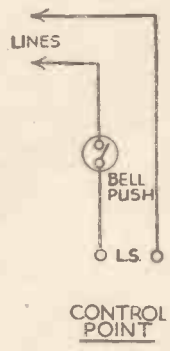
"As the electromagnet takes a fairly heavy current, I thought it inadvisable to have it wandering all over the house, so introduced the relay to operate it. This relay needs only very few milliamps., so a wire is saved by using an earth return.

"As the automatic selector switch has about a dozen sets of arms and contacts all insulated from one another, I hope you can see the justification for my claim of on-off switching, multiple station selecting, with wave-changing whenever necessary, all by just jabbing a bell-push, and only one simple control at the control point, which may be as far as you like from the set. A variable resistance can be added to the control point, across the L.S. terminals if you want to control volume, of course; so could another one, namely a condenser, if you wanted to control tone! Our local junk shop is selling these automatic selector switches for 1s. (twelve pence). An amazing bargain!

"W. T. PALMER."




*The remote control scheme described by Mr. Palmer, and (above) the method of connecting to the receiver.*

## Marconi Broadcasting Activities

THE continued interest in broadcasting throughout the world is illustrated by the great activity at the Marconi Company's works, where no fewer than ten medium and long-wave broadcasting transmitters are going through the shops and test rooms. The largest of these, which is nearing completion, is a 220-kilowatt long-wave transmitter to be installed at Lahti in Finland.

A 20-kilowatt station, which will be erected seven miles north of Jerusalem, is now undergoing its final tests, and a ten-kilowatt transmitter has been despatched to Radio-Tupi for installation at Rio de Janeiro.

Five half-kilowatt broadcast transmitters are rapidly nearing completion. Three of these are for relaying programmes from a main station, semi-automatic in operation, and are to be installed in small localities in Sweden, while the other two installations will be sent to Cairo and Alexandria respectively, to replace temporary stations now giving alternative

(Continued overleaf)

(Continued from previous page)

broadcasting services to those provided by the permanent main Marconi stations.

The Swedish relay stations consist of two units with a rectifier unit. Crystal drives with a precision of one in one million are incorporated. The installations are so arranged that warning of over or under modulation of the carrier wave is given by means of a bell alarm, thus obviating the necessity for constant attention by a skilled engineer.

These miniature broadcast stations fully comply with the recommendations of the C.C.I.R. Committee at Copenhagen, and their distortion factor will not be greater than 4 per cent. at 95 per cent. modulation.

## Fatal Shocks

APROPOS my note in the issue dated July 6th, I have received the following from E. W. (Cricklewood) :—

"May I, as a reader of *Practical Wireless* since its first issue, be allowed to point out that to some readers your statement with regard to the possibility of fatal shocks being received from the apparatus required to energise cathode-ray tubes may be a little misleading.

"The current required to kill a human being is much smaller than is popularly supposed, and is a matter of 80-100 milliamperes of D.C. and less with A.C.

"I would refer you to page 85 of a Text Book of Electrical Engineering, by Dr. Adolf Thomalen, translated by Prof. G. W. O. Howe, F.R.S., and also to an interesting article by Prof. A. V. Hill, F.R.S., Prof. of Applied Physiology, University College, London, which appeared in the B.B.C. Year Book, 1930 (page 211).

"Please do not think that I am trying to pull your leg in any way; I appreciate your paper too much to think of doing so, and also the matter is too serious.

"Even a small eliminator delivering 400 volts can quite easily give a shock which is dangerous to life if the current in its path happens to pass through the heart, and I think that this ought to be pointed out to your readers; in a diplomatic way, of course, so as not to frighten them off."

[Although there is some truth in my correspondent's remarks, I would add that the possibilities which he mentions are very remote, besides which the current required by a cathode-ray tube is well below the "danger limit" which he quotes. In fact, the voltage can be considered as practically watt-less.]

## The Laughometer

SO the ubiquitous microphone has been put to a further use, this time by an ingenious circus proprietor. I am credibly informed that this device is fitted in the tent of the Belle Vue Circus, Manchester. It consists of four microphones suspended from the roof and connected to a recording shaft where an automatic pen makes a permanent record of the intensity of the laughs produced by the antics and jokes of the performers. It was invented by James Edgar, the chief electrician, and William Rubinstein. The laughometer recorded an average of 69.5 laughs per hour. If such a device could also record the thoughts of some listeners concerning some of the programmes, and particularly our friend Nigger Jazz, I am sure that its needle would record zero or violently swing to the negative side. This provokes me to suggest that someone should now produce the thoughtometer, the objectionometer, and the vote-of-no-thanks-ometer, the uses of which do not require the exercise of a very fertile imagination.

# Notes from the Test Bench

## Using Mains Units

WHEN a mains supply is available it is cheaper to obtain the necessary H.T. current from a mains unit than from batteries. When a mains unit, or battery eliminator as it is commonly called, is used, however, it should be ascertained that the rated current output of the unit is slightly in excess of the normal current consumption of the receiver valves, and that the tapping voltages are of the correct value for the particular valves in use. There are several units available having only two H.T.+ terminals, one giving the maximum available voltage and the other, approximately, 80 volts for the anode of the detector valve. We receive numerous inquiries from readers concerning the use of these simple units for supplying receivers having an S.G. H.F. stage. It is emphasised that although the screen of most S.G. and H.F. pentode valves require 60 to 80 volts, this voltage must not be supplied from the 80-volt detector tapping of the unit, as the current consumption of the average detector valve is much higher than that of the S.G. screen, and, therefore, the actual voltage applied to the screen would be much too high if the detector tapping were used. The easiest method of providing an S.G. screen tap is to connect two fixed resistances of approximately 30,000 ohms in series across the H.T.+ and H.T.— terminals of the eliminator, and then connecting the S.G. screen lead to the junction of these two resistances.

## G.B. Voltage Supply

THERE are several commercial receivers available that have been designed for use in conjunction with a common H.T.— G.B. battery. These are not supplied with a G.B.+ lead, as the H.T.— socket of the battery acts as the H.T.— and the G.B.+ socket. When battery renewals are necessary it is sometimes found difficult to obtain a common battery, and, therefore, separate H.T. and G.B. batteries have to be employed. This necessitates the connection of a G.B.+ lead to the L.T.— terminal of the receiver. This lead should be plugged into the G.B.+ socket of the G.B. battery, the G.B.— leads being then plugged into their respective sockets in the same battery, and the H.T.— lead into the H.T.— socket of the H.T. battery.

## Varying Wavelength Range

MOST of the broadcast-band stations lie between 200 and 550 metres, and between 900 and 2,000 metres, and the majority of tuning coils are designed to enable the listener to tune to these wavelengths. It is sometimes desirable, for special reasons, to vary these wavelength ranges, however. Some listeners are desirous of picking up transmissions on 160 metres, whereas others like to tune to ship transmissions on 600 metres. The minimum wavelength to which a receiver can be tuned may be reduced by removing turns from the tuned winding of the coil. This procedure also reduces the maximum tuneable wavelength, of course, but this can be increased, if desired, by connecting a condenser across the tuning condenser.

## Clubs that Extract Half-crowns

A READER informs me of a new trick which certain dishonest persons have been practising on our readers, and I pass the information along so that you can be wary. Apparently these dishonest people have sent innocuous-looking documents to the Editor, announcing the formation of a new wireless club and inviting other readers to get into touch with them. When readers do so they promptly receive a letter asking for a membership fee of 2s. 6d. and a further 2s. 6d. for the first year's subscription. All subsequent letters are ignored. Be careful, therefore, and satisfy yourself of the bona fides of the club before parting with your money. It is very unwise to have anything to do with a club operating from some private address, the correspondence being written in an illegible hand on ordinary sheets of notepaper. If printed notepaper is used make certain that it includes the names and addresses of two or three responsible people.

## Scientific Fairy Stories

THERE are many so-called modern scientists who are merely interesting and successful writers of scientific fairy stories which, unfortunately, are absorbed by the youthful and considered as gospel. We have had several talks recently from such scientific dreamers who indulge in the most flagrant flights of fancy, knowing full well that no one can contradict their statements. As a man with some scientific training I object to this sort of thing, which is all the more reprehensible when it is remembered that some of the sponsors of this pseudo-scientific drivel occupy important social positions. It has always been a mystery to me how some of these people ever came to be considered as scientists; as propounders of theses which are later proved to be wrong, they are most prolix, as creators of something tangible and useful to the scientific world they are ignoble failures. Let us stop the rot.

## Religious Talks

THUS K. B., of Winsford, Cheshire :—

"I have never written to you before, although I have read "P.W." since it came out, and "A.W." for a couple of years before that; but some remarks of yours in reply to one, G. B., of West Didsbury, have made me do so.

"I am not a particularly religious person, and I would not call myself one of the 'go to church on Sunday brigade'; but in between enjoying myself I usually find time to drop into some church for one service, even if I can only stay half an hour.

"I absolutely agree with you in the rest of your remarks except for the remark about the parson and the old people, the way you have phrased it seems to imply that a parson is no use except to 'aged, infirm, and sick people.' I beg to differ, and I think it best to leave it at that, as every man has his own opinion.

"I agree, as I said before, absolutely with the rest of your remarks; I think the children should have merely the great principles of Christianity instilled in them at school, and let them choose which sect they feel best when they are old enough to know their own mind.

"With reference to the great controversy about jazz music. I have a theory that we are in for another kind of music altogether, just as the waltz superseded the minuet.

"A lot of dancers I know tell me they are sick of jazz and would like some other kind of music to dance to. I would like other views about this. I am not a parson!"

# SHORT WAVE SECTION

## At the Shortwaver's Bench—12

A Novel Coil Former, and Points About Report Cards are Among the Subjects Discussed in this Article

### Condenser Breakdowns in the Short-waver.

I HAVE been having much trouble lately due to the fact that the decoupling resistance in my short-waver has been continually breaking-down after a few weeks' use. The reason for its so doing was undoubtedly excessive current passing through it, and this was found, after a careful search, to be due to the breakdown of the associated decoupling condenser. This condenser was causing almost a direct short-circuit between the detector H.T. supply and earth, and replacing it with a new one has brought a great improvement in its train. Reaction is more readily available and is smoother, the detector valve is getting a better H.T. voltage, and as a result improved efficiency has been obtained from it, besides the elimination of many mysterious cracklings and other noises. A good tip for all "fans" is, therefore: Look over your "big" fixed condensers and see that they are still up to par. Trouble may be expected, particularly if any connected with the detector circuit have broken down or are leaking. Some of the smaller size condensers may also be causing unsuspected trouble. The condensers referred to are those of .002 mfd. capacity and upward which are used for intervalve resistance-coupling or for H.F. bypassing in various positions.

### A Short-wave Coil Former

A useful former for a short-wave coil can be made by means of four small combs which are screwed one on each side of a 1in. square block of wood. The accompanying sketch will explain the idea.

A rigid coil of thick wire may easily be wound in between the slots with any desired spacing. If each turn is pushed down into its slot as far as it will go the whole assembly will be extremely rigid. The finished coil may either be provided with pins, or else may be mounted and connections made to it by means of crocodile clips. The reaction winding may either be hank wound in a slot at the end of the grid winding or may be wound in intermediate slots between the grid winding. The correct gauge of wire for the reaction coil would be No. 32 d.s.c. or d.c.c.

### Report Cards

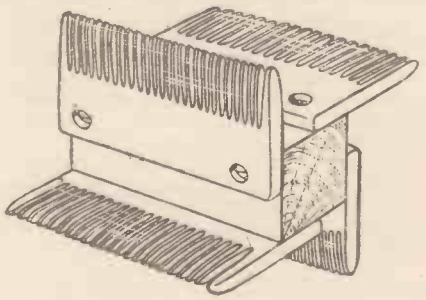
Those readers who do a large amount of "dx" work as a result of which they send many reports of reception to various stations, may like the idea of having their own report cards printed. This idea, of course, is by no means confined to amateur transmitters, and my own particular form of report card is shown below.

Report to.....Station. Address. England.
Your signals on.....k.c. were received here on..... 193..... at .....G.M.T
Signal Strength..... Quality.....
Fading.....Interference.....
Receiver used..... Aerial.....
Remarks.....
[Name]

This is only a general idea of the type of card that is required, and may naturally be carried out in any particular style you fancy: the printing should be done by any local printer quite cheaply. In registering time the 24-hour system should be used, and you will note that on the card shown the words G.M.T. are printed in. In summer, do not forget this is an hour earlier than B.S.T. and should be entered accordingly. The frequency in kilocycles is the best to quote, and is necessary because of the diversity of bands upon which one station may work.

### The Short-wave Reaction Condenser

It is often advocated that the reaction condenser in a short-waver should have air dielectric for the sake of extra efficiency. Actually, as readers will know, this is somewhat of a fallacy, as reaction in itself suffices to overcome the bad effects of rather high H.F. losses. Furthermore, the use of a bakelite or bakelised paper dielectric reaction is often preferable as the following small experience may show. I was using a short-waver which incorporated an air dielectric reaction variable and which had been lying idle for a short time. On operating the reaction control there was a most disconcerting display of crackles and bangs which proved very elusive to trace for a long time. Finally, they proved to be due to the old trouble of dust between the



*A short-wave coil former made with combs.*

condenser vanes—this time the reaction condenser, in spite of the fact that there was a fixed condenser in series with it to obviate the trouble. Of course, a solid dielectric condenser makes such a difficulty impossible and is therefore, I suggest, preferable to the air-spaced component.

## LEAVES FROM A SHORT-WAVE LOG

CONDITIONS, generally, have been very favourable recently for the capture of distant transmissions, if the period of the year is taken into consideration. As a rule, there is a great falling off in the strength of signals during June, July, and August, but the dullness and wetness of the past month, so far, have made reception somewhat better than might have been expected.

The peculiarities of short-wave transmission are now better understood, and it is with more assurance that certain channels are chosen for particular periods of the day or night, or for certain weather conditions at different times of the year. The question of skip distance also is still being carefully studied, inasmuch as it is so strongly influenced by time and frequency. It is at its minimum at noon and at its maximum at midnight, and it is clearly established that it is greater as the frequency is higher. It is at sunrise and at sunset that the most rapid changes are noted. Variations, however, occur throughout the year and the range, in consequence of the sky wave, shows an increase or a decrease according to the season. You may take it that during the next three months better reception will be obtained all round on the higher frequencies than on channels below, say, 8,000 kilocycles. The shorter waves are less affected by atmospheric disturbances, and, as you may already have had occasion to observe, distant stations on wavelengths of, say, between 16 and 20 metres can be picked up clearly even when the weather is distinctly thundery. Unfortunately, however, these frequencies are strongly affected by passing motor-cars, refrigerator motors, and generally all types of unscreened electrical apparatus.

Another of the new 50-kilowatt short-wave Zeesen transmitters has been brought into action. Without any fanfare of trumpets or special announcement, DJO, on 25.43 metres (11,795 kc/s) appears to have taken over the duties previously carried out by DJD on 25.49 metres (11,770 kc/s). If you wish to tune in powerful signals try for DJO between B.S.T. 18.00 and 22.30 and again between B.S.T. 23.05 and 04.30. The programmes are respectively broadcast for Africa and North America.

# Reporting Amateur Transmissions

## *How to Write to Various Stations, and Some Points which Should Be Avoided. By G6FO*

THERE are many short-wave enthusiasts who are interested in, and devote a good deal of time to, the amateur wavebands, while, of these listeners, a large number make a practice of reporting to both CW and telephony amateur stations. The idea of such reports is, of course, to obtain the transmitter's "QSL card," or verification of the reception, which is generally in the form of a printed card with the call-sign of the station and details of the equipment used. These cards are then pinned up on the walls as trophies, the number so obtained being in some measure an indication of the receiving station's efficiency and usefulness. QSL'ing has grown from the custom first started among amateur transmitters of exchanging a card as confirmation of a contact, thus adding the personal touch and providing stations with a record of their work.

The purpose of this article is to indicate the lines along which a listener should work who is anxious not only to get cards in reply to his reports, but to be of real use to transmitting amateurs, thereby deriving valuable contact with and experience of transmission work which will stand him in good stead if he should "go on the air."

### The Various Bands

Firstly, it is essential to understand the uses to which the various amateur wavebands are put and their normal range capabilities. An earlier article in this paper —p. 187, PRACTICAL AND AMATEUR WIRELESS, April 27th—gave the limits and positions of these bands in the short-wave spectrum. They are known as the 160-, 80-, 40-, 20-, 10- and 5-metre bands, or in terms of frequency, 1.7, 3.5, 7, 14, 28, and 56 m.c. ("megacycle").

The 160-metre band is ordinarily used for local working only, giving a daylight range of some thirty to forty miles. After dark, much greater ranges are, of course, possible, and during the last three years the Atlantic has been crossed several times by 10-watt stations on both CW and telephony. While a transmitter in Scotland would be very glad to have an after-dark 'phone report from the South of England, there would be no point in a listener sending confirmation of reception, unless he had something very unusual to say, to a transmitter in the same town who is in regular contact with stations in his neighbourhood. But this is the sort of thing which happens every week! On 160m., under good conditions, real DX can be heard and many east-coast American and Canadian CW and 'phone stations come across after midnight and in the early hours of the morning. As the DX possibilities of this band are just being rediscovered after nearly twelve years, reports are usually welcome.

Next, the 80-m. band, which provides good contact over the United Kingdom in daylight and DX even to the Antipodes at certain times when conditions are good, usually the early mornings. American and Continental 'phone stations are interested in reports from this country, but leave the G stations who work all over England every Sunday morning alone. They know you can hear them! But, as before, discrimination is needed. A new station, or one formerly working CW only, may come on with an initial telephony attempt, and your report may be valuable.


*A group of QSL cards received by the writer.*

On 40 metres—the "international night" band—the whole of Europe can be covered in daylight under normal conditions, and DX at the right times, such as the Antipodes and more distant Americans early in the morning and long-distance eastern stations in the late evening, is usually expected. British stations use this band a lot for 'phone working, but there is no use QSL'ing everybody you hear on a Sunday morning. Listen for new call-signs and stations which do not seem to be getting contacts and send them detailed reports. Continental telephony stations are glad of reports from English listeners, but remember that the powerful stations working regularly get *thousands*. The QSL'ing of stations on this, as on any other band, is a matter of using common sense; do not bother about the man who can work anybody anywhere, and there are quite a number of them, for he *knows* he's being heard all over the world and, in any case, is already getting more cards than he can cope with.

The next band is 20 metres—the "international day" — when American amateurs can be heard on 'phones in the middle of the afternoon. There are many who are regularly in touch with stations on this side, so look for the man who puts out calls without reply and seems to be working with nobody. He will value your report. In general, any telephony transmission heard on 20 m. is DX, and is of interest accordingly.

### The Shorter Wave-bands

The ten- and five-metre bands can be taken together, since at present they are purely experimental frequency-channels, not used for regular communication outside ground-wave range, of which little is known. They are, therefore, of particular interest to the experimenter, and listeners can be most helpful. *Any* transmission is worth reporting, as not only amateurs but the research laboratories are still groping in the dark as regards the uses of these bands for contact outside the ground-wave range. On five metres particularly there is much amateur activity, and the reception of any 5-metre transmission outside the optical range is of the greatest interest and might be very important. The 10-metre band is also an adventurous field for the listener; perhaps after weeks and months of nothing but harmonics from high-power commercial stations and amateurs on 20 m., American and Australian amateur stations suddenly appear at R9!

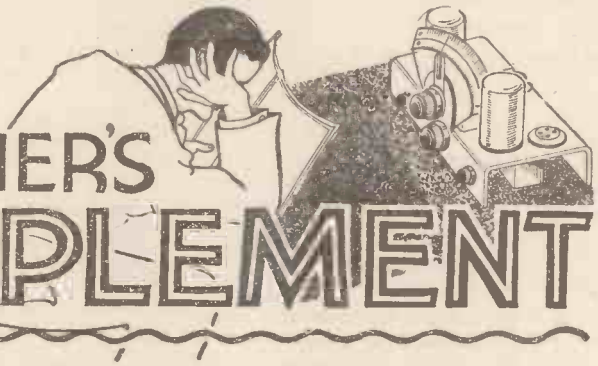
Having outlined briefly the uses of the various bands, we can now turn to the form reports should take. The usual method is to have a printed card, on which is given details of the listener's receiving apparatus, with spaces for filling in the report data. This should be as complete as possible, giving date, exact time (G.M.T.), signal strength in the R code (R9-R1), readability (QSA5-QSA1), depth of modulation (approximate percentage), quality of speech, whether radio interference (QRM) or static disturbance (QRN) was being experienced, fading (QSB), if any, and, if possible, a comparison as regards signal strength between the station being reported to and others in the same neighbourhood. It is also useful to include some indication of the general radio conditions during the period of reception, and for completeness some brief weather (Wx) data can be added. If the report is on a CW transmission, the quality of the note in the tone code (T9-T1) should be mentioned. Such a report, complete in itself and containing much useful information, could still be expanded to cover the results of observations over a period, in which case peak strengths and the depth and duration of any fading could also be noted.

### Avoid Waste of Time

It will now be clear that the sort of report every amateur has received at some time—"Your sigs. very loud here on 3 valves. Pse QSL"—is only fit for the W.P.B.

(*Continued on page* 507)

MEASURING INSTRUMENTS



# BEGINNER'S SUPPLEMENT

**Some Useful Hints Regarding the Selection of Apparatus for Testing Purposes, and Their Importance to the Keen Constructor.**

By H. J. BARTON CHAPPLE, B.Sc., A.M.I.E.E.

IN these days of complex circuits and technical refinements, adjustments of voltages, resistances, and capacities are far more critical than ever. Comparatively small differences in component values may make all the difference between good and mediocre performance, and in the case of ganged circuits a fraction

*A useful and inexpensive test meter—the Avominor*

of a turn of the trimmer condenser screw may cause signals to disappear altogether. Adjustments of this kind can, of course, be carried out entirely by ear, on a "hit or miss" principle, but one can never be sure that optimum settings have been obtained, and the listener is therefore tempted to fiddle continuously with the trimmers—treatment which they are not designed to withstand.

All critical adjustments should be made once and for all when the set is built, and thereafter should never, or very seldom, need further attention. Accuracy and finality can, however, be obtained only by quantitative measurements made with reliable instruments. In this respect, therefore, instruments are a good investment because they save endless time and are a guarantee of optimum results.

## Not an Expensive Luxury

In other directions, too, a reasonably complete kit of measuring instruments repays its cost many times. Any home-built set ought to be tested for continuity and insulation before current is applied to it. Faults or mistakes thus discovered and rectified may easily save the expense of a complete set of new valves to replace those which might be ruined by an undetected wrong connection. Again, it is as well to make periodical measurements on such components as valves, batteries, and other "consumable" accessories in order to ascertain that they are still in serviceable condition, and to make regular measurements of output in order to be certain that the set as a whole is keeping up to standard. Finally, no serious experimenting can be done without accurate measurement, and even the most elementary work is made far more instructive and interesting if a record of test results is kept.

Yet in spite of all this many listeners look upon measuring instruments as a rather expensive luxury rather than as an investment, or content themselves with a cheap and unreliable pocket instrument as a slight concession to technical opinion.

## Making a Start

Sometimes I am asked, "If you had to equip yourself with a kit of instruments,

*Another handy testing instrument—the Avo Oscillator.*

and were strictly limited as to expenditure, what would you select?" This is the question which confronts many a serious amateur at the present moment, and in answering it I say, first of all, "provide the barest essentials, but for these buy the best you can afford." Additional apparatus can be purchased if necessary afterwards, but with a skeleton selection of a few good meters, many useful combinations can be rigged up by the intelligent experimenter. As a matter of fact two, or at the most three, meters cover nearly all requirements, for with the aid of resistances and shunts their range can be extended almost indefinitely, and thus permit any desired measurements of resistance, voltage, and current to be made.

Thus, my first choice would be a milliammeter of the moving-coil type, reading from zero to 1 milliamp., or 2 milliamps. only. Line resistances of suitable value will convert this into a sensitive voltmeter of any desired range. Moreover, shunts, having resistances equal to a known fraction of the meter resistance, render the instrument suitable for measuring higher current values. Details of how to calculate resistance and shunt values for these purposes have been published quite recently in PRACTICAL AND AMATEUR WIRELESS, and it is therefore not intended to again give these in detail.

## A Precaution

Having thus provided for D.C. voltage and current testing over a wide range of values, it is only necessary to remind readers that resistances can be measured quite accurately by connecting them in series with a battery of known voltage and measuring the current passed, a simple application of Ohm's Law enabling the resistance to be calculated. It is, however, advisable to connect permanently in the circuit a resistance of such a value that if the resistance under test is short-circuited the total current taken by the circuit is equal to that required for a full-scale deflection of the instrument. The value of this safety resistance must then be deducted from the resistance calculated from the test readings.

So much for D.C. testing. It may well be asked what quality of instrument is recommended for this service. Unhesitatingly I would say, a good class and accurate moving-coil meter, costing something in the neighbourhood of 30s. to £2, to form the nucleus of the test equipment.

## Dual Purpose

Now for ordinary A.C. measurements. Unless you are using A.C. mains, A.C. gear will not be required, but if you are I would suggest a voltmeter reading up to, say, 6 or 10 volts for checking heater voltages, and an ammeter reading to about 5 amps. for heater currents. These may be comparatively cheap instruments, costing from 10s. apiece, but I do not consider them so essential as the moving-coil instrument, although it must be remembered that the A.C. meters would be of the moving-iron type, and are, therefore, suitable for both A.C. and D.C. measurements.

Another extremely useful instrument is a milliammeter reading up to 50 or 100 milliamperes, or about twice the anode current of the largest power valve likely

(*Continued overleaf.*)

*A modulated oscillator which is invaluable for trimming superhets and making other receiver adjustments.*

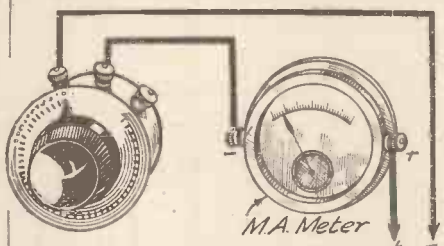
(*Continued from previous page*)

to be employed. Its main use would be in the anode circuit of the output valve to indicate whether the valve were being seriously overloaded.

Turning to simpler and less expensive test gear, I would suggest installing a flash-lamp battery with headphones and test prods in series for simple fault location; and a high-tension battery, neon lamp and prods for similar work where a higher voltage is necessary. This completes a very comprehensive range of equipment which would cost under five pounds, inclusive of shunts, line resistances and, if desired, a panel, cabinet, plugs and switches to make up a really professional-looking multi-range service test kit. In those cases where the expenditure can be afforded it is an admirable investment to secure one of the combination instruments such as an Avometer, for they are designed to cover a wide series of tests with comprehensive ranges for both A.C. and D.C. Compact and adaptable to varying set conditions, they enable the user to examine quantitatively every stage in the receiver, and so ensure efficient working, quite apart from their use in the case of rapid fault testing.

## A Service Oscillator

There are many other pieces of apparatus which would prove of inestimable benefit. Chief of these is a service oscillator. Of these many types are available, but in basic principle they all consist of a valve adjusted to a condition of oscillation, and with provision for varying the frequency, by tuning, over a range covering the broadcast radio bands and also the usual intermediate frequencies used in superhets, and also for imposing upon this high-frequency oscillation a musical note. The object of the oscillator is to provide an artificial modulated signal of any desired wavelength and intensity which can be used for general testing, for lining up ganged circuits and trimming I.F. transformers, and also as a wavemeter for calibrating sets or for identifying transmissions whose call-signs cannot be ascertained.




*Calibrating a variable resistance by means of a milliammeter and battery.*

The construction of an oscillator of sufficient accuracy for all normal use is well within the capacity of the amateur, and is not an expensive matter. Designs have already appeared in previous issues.

There are a number of special purpose instruments which, although very useful, may not be so frequently employed as to justify their cost. Sometimes, however, they may be obtained cheaply second-hand, when the bargain should not be missed. For example, a standard resistance box or "Post Office Bridge" provides an excellent and accurate alternative for measuring resistances, the method being to balance the unknown resistance against a known and adjustable resistance. The same bridge can, by the addition of a few simple components, be converted into a capacity bridge.

## Leakage Tests

It is not always recognised to what extent quite small leakages can effect the efficiency of a receiver, especially on the radio-frequency side; insulation which appears excellent on an ordinary low-voltage test may actually have a resistance of only a megohm or so—and the listener well knows how seriously reception might be disturbed by connecting a grid leak of a megohm or so between some part of the H.F. system and earth. If, therefore, in a position to extend your equipment, invest in an inexpensive form of insulation tester of the kind comprising a magneto-generator developing 250 volts combined with an instrument calibrated in megohms.

One could continue over many pages with descriptions of additional equipment which one would like to have; a good micro-ammeter, for example, and also instructions for setting up existing instruments for special tests, such as a valve voltmeter arrangement in which small A.C. voltages, say, audio-frequency signals, are measured by finding the change of anode current in what amounts to an anode-bend detector valve; but enough has been said to convince the reader of the utility and necessity of at least a minimum number of accurate instruments.

# Long Leads

Although Troubles May Arise from Undue Lengths of Certain Wires it is Often Essential to Employ a Long Connection, and it is Necessary to Know What Precautions to Take and How to Obtain the Best from such a Lead. The Various Points Concerned are Here Discussed by W. J. DELANEY

THE first advice to the beginner in receiver construction includes the injunction to keep leads short, and, although such advice is very sound, unfortunately it cannot be adhered to implicitly. There are many points in the complete wireless equipment where it is imperative to have a long lead, but if the advice to keep leads short is carefully borne in mind it will become evident that some kind of precaution must be taken when a long lead is employed. Let us deal first with the reason for keeping leads short. In general, it may be stated that there are two effects obtained from any wire in a receiver—resistance and an electro-magnetic (or similar) field. The resistance is due to the thickness of the wire, and, consequently, will vary according to the current which is carried through that wire; and the surrounding field is due to the type of circuit which the wire feeds. In a high-frequency circuit, for instance, there will be quite a large field round the majority of the leads, whilst if alternating currents of the type found in the ordinary house wiring are carried we shall again have a surrounding field which can be the source of considerable trouble to the wireless constructor.

## H.F. Wiring

Dealing first of all with the question of H.F. circuits, it may be broadly stated that no wiring should be permitted to run parallel, and the quickest path from one point to another should be followed. In the H.F. circuits we have alternating currents, and, consequently, a field surrounds the majority of the wires. If two wires are brought close together the surrounding fields will intermingle with various effects; thus, a lead in the anode circuit of a valve in this part of the circuit, if passing close to a wire in the grid circuit, will cause some of the energy to be fed back, with consequent instability. The ordinary listener will immediately recognise the reaction circuit in the above description, and no further emphasis should be necessary. Similarly, the grid circuit wiring of one stage should be kept remote from that of another stage. The above precautions necessitate a careful layout of the various component parts, and this is one reason why the home-constructor of little experience is advised to follow a standard design when building a receiver, and not to attempt such work without previous experience.

## L.F. Wiring

On the L.F. side of the receiver it will be found that more advantages may be taken without ill-effect, the majority of the wiring here being of such a nature that quite considerable lengths may be employed without interaction. It is, in fact, quite a good scheme to build the L.F. amplifier as a separate unit and to connect this to the H.F. portion by a multi-cable, the two separate units being accommodated in the radio cabinet on different levels. Bearing in mind, however, the advice given regarding H.F. wiring, the output end of the receiver should not be arranged near to the input end, or, to put it in more ordinary language, the aerial and earth leads must be kept well away from the loud-speaker leads. In general, it may be stated that all leads in a grid circuit should be kept as short as possible and as thick

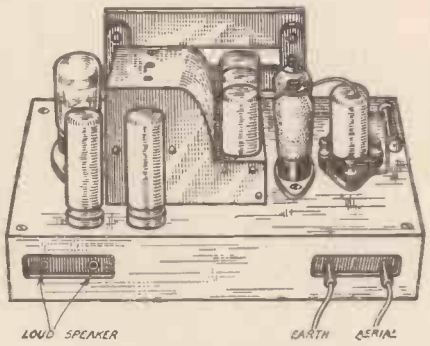



*Fig. 1.—Although apparently arranged for appearance, there is a sound technical reason for the usual arrangement of the aerial, earth, and loud-speaker leads at opposite ends of a receiver.*

as possible, whilst anode leads may be prolonged in most cases, provided they do not pass near to wiring in other parts of the circuit.

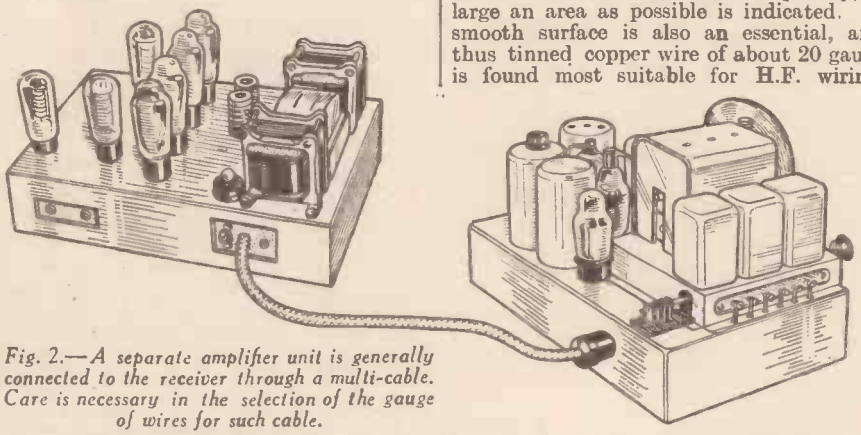


*Fig. 2.—A separate amplifier unit is generally connected to the receiver through a multi-cable. Care is necessary in the selection of the gauge of wires for such cable.*



## Low Periodicity A.C.

In a mains receiver operated from A.C. mains there are a number of wires which carry A.C. current, and as this type of supply is at a low periodicity there is a great risk of audible hum being introduced into a receiver, *viâ* the wiring. The surrounding field can only be avoided by enclosing such wiring in lead sheathing and earthing such covering, but this is unnecessary with the majority of receivers. The wires carrying this current should be twisted together (ordinary lighting flex is quite good enough), and thus the surrounding field is reduced in size owing to the interaction between the various fields which are set up. As pointed out above, however, lead-sheathed cable is permissible.

## Resistance Effects

The problem of the resistances of leads is more simple to understand, provided that the nature of the current carried by a wire is understood. Thus, the battery user knows that his accumulator delivers 2 volts to a certain number of valves, and it is easy to work out the total current. To avoid a voltage loss in the leads to the accumulator the gauge of the wire should therefore be selected with care. On the majority of battery receivers ordinary 5-amp lighting flex is quite suitable, and provided that the connections are clean at each end no losses will occur. On the H.T. side, of course, the current is very much less, and consequently thinner wire could be employed, but in the interests of reliability the same type of flex should be adopted. In the inter-stage wiring of a receiver a standard thickness of wire may be adopted throughout, although the various currents are complex and differ considerably. H.F. currents, for instance, travel on the surface, and, consequently, as large an area as possible is indicated. A smooth surface is also an essential, and thus tinned copper wire of about 20 gauge is found most suitable for H.F. wiring, whilst to avoid losses in the filament circuits the same type of wire should be adhered to. In mains receivers ordinary lighting flex may be adopted for the H.T. circuits, but for the heater supplies great precaution is necessary to avoid inefficiency. The ordinary A.C. valves consume 4 watts each, and thus a multi-valve receiver may have a heater supply of 20 watts or more. As the usual practice is to build the mains unit as a separate unit, and to mount this in a separate part of the cabinet, very heavy flex should be adopted for the heater supply. The type known as 70/36 should be employed, and no constructor should be content with anything finer than this. Apart from the fact that the total supply to the valves may be reduced with resultant low efficiency, there is the risk of heating in the heater leads, with resultant impoverishment of the rubber covering, and finally, arcing, which might result in a fire.

# Facts & Figures

## COMPONENTS TESTED IN OUR LABORATORY

### Clix S.W. Valveholders

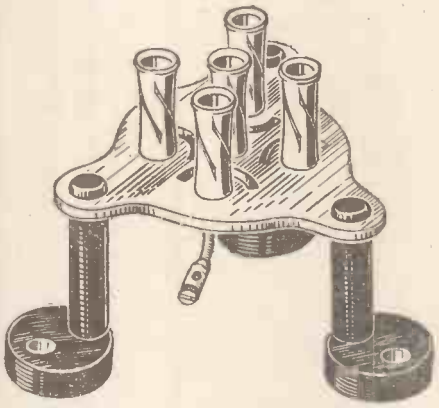
ALTHOUGH the ordinary type of Clix chassis-mounting valveholders may be used in the construction of a short-wave receiver, there is often some risk of inter-connecting wires being unduly lengthened owing to the fact that some components are mounted on the top surface of a chassis, whereas the connections to the valveholder are beneath the chassis. Accordingly Messrs. Clix have developed a holder on the normal Clix lines, but designed for mounting on the upper surface, and having very low-loss characteristics. As may be seen from the illustration on this page, the special sockets are fitted, but the holder is mounted on three small ebonite feet, and the lower portion of each socket is continued in a curve to bring the connecting point outside the holder, thus facilitating connection. The usual screw connection is adopted as may be seen in the illustration, and the holders should prove very satisfactory both for valves and for the mounting of special short-wave coils. To avoid damage when inserting or removing certain types of valve, the paxolin portion of the holder should be held with one hand in order to furnish additional support. With the modern solid pin type of valve, however, the resiliency of the spring portion of the sockets is sufficiently arranged to permit of the valve being inserted and removed without difficulty. The holder may be obtained with 4, 5, 7 and 9 sockets, the prices being 1s. 9d., 2s., 2s. 3d., and 2s. 6d. respectively. For those who prefer the soldered type of connection a special type will be obtainable with any of the above numbers of sockets at 1s. 6d., 1s. 7d., 1s. 9d., and 2s. respectively.

### Belling-Lee Set Lead Suppressor

ALTHOUGH there are many types of noise suppressor available for the wireless listener, it is not often found possible or practicable for the apparatus to be fitted in the correct manner. For instance, the interference may arise from some apparatus in a neighbouring house, or may be of some old pattern in which the fitting of the correct type of suppressor would be a difficult undertaking. The new Suppressor Type 1211, introduced by Messrs. Belling-Lee, will enable the interference to be removed by the user of the listening apparatus without difficulty. It consists of a neat bakelite case containing two air-cored chokes, three fixed condensers, and two fuses, and is provided with a short flexible lead fitted with a standard 5-amp. two-pin plug and an earth terminal. Two sockets are let into the front of the case and are spaced to the standard 5-amp. spacing, thus facilitating the connection of the receiver through the usual type of 5-amp. plug. The device should be mounted on the skirting board close to the lighting socket from which the receiver is fed, and the plug fitted to the device should be inserted in the mains plug, whilst the receiver plug is inserted into the front of the Suppressor. In this manner the two chokes are inserted in series with a fuse and each lead, whilst one condenser is joined direct across the mains on one side of the chokes and two condensers in series are joined across the mains leads to the receiver on the other side of the chokes. The junction of these latter two condensers is taken to earth, and thus the elimination of any type of high-frequency interference is rendered complete. The fuse-holder is of the safety type, thus facilitating replacement without danger, and two retaining screws are fitted to the cover of the fuse-holder to prevent accidental withdrawal of the fuses. The price of this device is 17s. 6d.

### New Drydex Prices

AS from July 1st, the list prices of Drydex batteries in the Blue, Yellow, Orange and Brown Triangle series, and all G.B. ranges, have been substantially reduced. Prices of Red Triangle, Texet and Super-Life ranges and all bell cells, torch, cycle, hand lamp and pocket lamp batteries remain unaltered. In all there are over 140 different listed types of Drydex batteries providing for every possible battery purpose and suiting the pocket of every user. Full details of the types and prices may be obtained on application to Messrs. Exide, 137, Victoria Street, London, S.W.1.



*The new Clix S.W. valveholder for baseboard mounting.*



# 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.*

**INTERNATIONAL DX'ERS ALLIANCE (LONDON CHAPTER)**

A PARTY of members of the London Chapter of the International DX'ers Alliance will, on July 25th, be paying a visit to Messrs. Cossor's works at Highbury. Readers who would care to accompany us on this visit should get into touch as soon as possible with H. M. Blaber, 9, Stanton Road, West Wimbledon, S.W.20, who will be pleased to give them full details as to time and meeting place.—Arnold G. Ward, Publicity Manager, 59, Balaam Street, Plaistow, E.15.

## 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.*

**H. M. (Cawthornes).** The transformer could be used in the manner you indicate, or the grid bias could be joined to the centre-tap to obtain an alternative ratio.

**C. G. (Billericay).** The consumption is approximately 20 watts and the undistorted output just over 2 watts when the output valve is fully loaded. Any modern dual-range coil could be used in the receiver.

**J. McM. (Govanhill).** We have no suitable blueprint here. An all-mains amplifier will be essential for dance band amplification.

**J. W. B. E. (Conway).** Neither of your suggestions is very good. A better scheme would be to connect one speaker direct in the anode circuit, and to use the transformer winding as a choke, with the extra speaker connected in the usual parallel-fed filter arrangement. Additional speakers should then be joined in parallel, retaining the input transformers, which should preferably be tapped to enable the correct matching to be obtained.

**C. W. (Southgate).** We think a microphone of the type you refer to could be obtained from Electradix Radios, Upper Thames Street, E.C.

**M. A. C. C. (W.8).** A.W.329 would be the least expensive to construct, but results from all three receivers would be approximately identical. Probably an examination of the prints at this office would enable you to select the most suitable for your requirements.

**G. B. (South Shields).** The meter in question is very satisfactory and should cover all normal requirements. We cannot, however, give a definite opinion on any commercial article as we cannot appreciate all your requirements, and no doubt your local dealer would be more able to render you this assistance.

**G. A. B. (York).** Your meter is probably of very low resistance and is therefore not suitable for use with an eliminator. A more suitable instrument would have a resistance of about 1,000 ohms per volt, and the scale should be evenly divided—not cramped at one end.

**E. C. E. (South Chingford).** We are sorry that we have no mains receivers on the lines mentioned. Will the Fury Four be of any use to you?

### REPORTING AMATEUR TRANSMISSIONS

(*Continued from page 502*)

Reports must contain definite information in a form which can be studied and compared with others. Moreover, they should go only to those amateurs who either specifically ask for them or to whom they are likely to be of value and interest by reason of the considerations outlined here. Remember that every time a high-power operator opens his mouth on one of the short-wave bands he receives a shoal of reports of every description from far and near. One such of the writer's acquaintance averaged 7,000 a year for nearly five years! To answer such a quantity—only a very small percentage of which contained more than a bare statement that his station was being heard—would have involved a considerable sum in postage and practically all his, or any other amateur's, spare time.

If the listener is a member of the Radio Society of Great Britain, he will have a B.R.S. ("British Receiving Station") official identification number which can be over-printed on his card in the same way as a transmitter's call-sign. This not only gives him status, but the advantage of using the Society's Q.S.L. Bureau for the efficient handling of cards free of charge, while there are, of course, other important advantages of membership to anyone interested in amateur work.

QSL'ing with discretion and thoroughness can be a fascinating hobby, second only to being on the air oneself, as useful data on every phase of short-wave reception is automatically accumulated, often leading to correspondence with amateurs all over the world. An efficient and reliable listener soon makes a reputation for himself and his assistance is sought accordingly.

Finally, indiscriminate QSL'ing is the bane of the whole structure of amateur radio, and at best cannot produce more than 5 per cent. in replies to cards sent out. A good listener, on the other hand, using common sense and his experience as he gains it, can get up to 70 per cent., which can be taken as a high figure, representing a really efficient station.

### QUALITY EQUIPMENT

(*Continued from page 494*)

full volume with excellent quality, although the set was not really designed for long-distance work. The tuning condensers are, of course, ganged, and the aerial coil used has a variable primary for varying the selectivity. With a coil having a fixed primary the same effect may doubtless be obtained by using a variable series aerial condenser. On the local stations this is used in a position of maximum volume and minimum selectivity, in which position it allows the receiver to respond to a very wide band of frequencies, contributing in no small measure to the excellent quality obtained on these stations. There need be no fear of interference from other stations due to the lack of selectivity, as the variable-mu grid-bias control has to be turned so far towards minimum volume on the locals to avoid overloading that nothing else is picked up.

The receiver and both amplifiers are put forward with the hope that they may assist readers endeavouring to "get out of the rut" and improve the quality of their reception. It should be found easy to make up similar units as the designs have proved remarkably stable. The cost need not be high, and the results given are very satisfactory.

# LETTERS FROM READERS

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

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

## Our £5 Superhet 3

SIR,—I have just finished building the £5 Superhet 3, and I feel I must write you a few lines of appreciation.

It is without doubt the best set that I have built. It is so easy to build and the trimming is simplicity itself, in fact when I connected the H.T., L.T., speaker, aerial, and earth, switched on and turned the dial to 1,500 metres, in came Droitwich with fair volume without trimming at all. —W. R. GIRVAN (Monaghan, I.F.S.).

## £5 Superhet Tracking

SIR,—I received your reply to my inquiry for advice on the cause of my superhet not matching on the long wave. I am pleased to say that I have got over the bad tracking of the oscillator, by connecting a pre-set condenser of .0003 maximum capacity across the long-wave winding of the oscillator coil and the .002 padding condenser and suitably adjusting both condensers gives perfect tracking. I can receive Deutschlandsender clear of the National, and Moscow No. 1 clear of Poste National (Radio-Paris), and Kalundborg clear of Luxembourg, so I think that is all that can be expected. I am using a Telsen Superhet unit W476.—N. J. BURBIDGE (Selsey).

## Transmitting Data

SIR,—I have noticed from time to time readers writing for transmitting circuits, and you have replied that you are not in a position to supply these as many readers might use this knowledge for unlawful means, thus getting on the wrong side of the law; and that if they are thinking of going in for a licence they would not write for circuits to you as they would "have to have sufficient knowledge to design a circuit for themselves." This is one side of the argument, but on the other hand many readers no doubt who, like myself, wish to pass the Postmaster-General's test later on but have no means of getting the requisite knowledge, would be pleased to know that at least one book is publishing circuits and explaining the technical side of transmitting, for, if we cannot get this we cannot have enough knowledge to pass for a transmitting licence. I think that many readers would support, say, one page a week dealing with transmitting circuits for the help of readers wishing to obtain transmitting licences. I have in mind articles after the style of that recently published in PRACTICAL AND AMATEUR WIRELESS of June 29th.

Wishing PRACTICAL AND AMATEUR WIRELESS every success in the future.—J. C. JOHNSON (Rubery).

[*We have received several letters in this connection. What do other readers think? —Ed.*]

## Television Amateur Wanted

SIR,—I should be pleased to be put in touch with a Carlisle or Cumberland television enthusiast through the medium of PRACTICAL AND AMATEUR WIRELESS. Thanking you for assistance in the past.—T. GRAHAM (44, Moorhouse Rd., Belle Vue, Carlisle).

## Auto-bias

SIR,—*Re* your interesting article "Auto-bias Problems" in a recent issue—I hope your Technical Staff will follow this up by giving at an early date full particulars and diagrams for applying "auto-bias" to battery sets used with eliminators in a distortionless manner.—E. C. FRANK EVANS (Birmingham).

[*Articles on this subject have already been published.—Ed.*]

## Appreciation

SIR,—It is not often that I have an opportunity to write to Editors, but I must congratulate you on March 30th PRACTICAL AND AMATEUR WIRELESS. For sensible and straightforward articles, all the contents could not be surpassed. I have taken *Amateur Wireless* since No. 1 in 1923—do you remember the old and very dignified black and white cover, and the many descriptions of one-valve and crystal sets? What a thrill we used to get when receiving long-distance stations on the tiniest of sets. I had 2ZY, Manchester, several evenings on one of your crystal sets, from here (near Epsom, Surrey)!

About the two-pentode portable under "Circuits," page 37. I do hope you will elaborate this set further, and show blocks of the circuit assembled in a suitcase or vertical form.—R. C. BONNER (Ashtead).

## Our Superhet

SIR,—Since my last writing you, I built your superhet. *I am more than delighted with it, and offer you my sincere thanks, Sir, in appreciation.*—J. H. OWEN (St. Helens).

**CUT THIS OUT EACH WEEK.**

## Do you know

**—THAT A.C. valves are rated at a low voltage but a high amperage, whereas D.C. valves are rated with a high voltage and a low amperage.**
**—THAT it is important to remember the large voltage differences which may exist between a cathode and a heater in a mains valve.**
**—THAT although fuses are a valuable safeguard in a receiver they should not be fitted indiscriminately.**
**—THAT modern interference suppressing apparatus may be fitted to most electrical gear without the necessity for the removal of any fittings.**
**—THAT the capacity of a variable condenser may be increased by inserting pieces of dielectric material between the vanes.**
**—THAT petroleum jelly smeared round accumulator terminals and leads, after the latter have been attached, will prevent troubles due to corrosion.**
**—THAT a tray of rubber or lead will prove invaluable for standing the accumulator upon, and so avoiding damage to furniture, etc.**

*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, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

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

# IMPRESSIONS ON THE WAX

By T. Onearm

SUMMER weather demands summer fare, and the new "His Master's Voice" records for July have been admirably chosen to provide light music for the light evenings.

The greatest personal successes of the Covent Garden Season were scored by sopranos, Lily Pons and Grace Moore. Two records by Grace Moore deserve special attention, "The Dubarry" and "I give my Heart" on *H.M.V. DA*1309 and "Without your Love," a duet with Richard Crooks on *H.M.V. DA*1306, for they present the great singer and film star at her best. Lily Pons, likewise making her first appearance at Covent Garden, in "The Barber of Seville," was a great success. She sings two songs from the opera (in Italian) on *H.M.V. DB*2501.

## Humorous Records

CICELY COURTNEIDGE'S topical sketch, "A Pleasure Cruise," on *H.M.V. B*8329, must be heard by all holiday makers who are undecided where to go. To hear her holding at bay a Spaniard anxious to explain the delights of a bull fight and a Chinaman putting forward the counter claims of the land of "plentee lice puddings" is as good as a week at the seaside.

Gracie Fields is her racy Lancashire self in two well contrasted ditties on *H.M.V. B*8331, one of which, "I haven't been the same girl since," is extremely funny.

Norah Blaney and Gwen Farrar review some of their past successes, "Fonso," "What'll I do," "Ukelele Lady," "Who tied the can on the old dog's tail," "Nobody's Darling," to mention but a few—on *H.M.V. B*8321.

## Columbia Records

ANYONE who has heard George Gershwin's "Rhapsody in Blue"—and who has not?—will realise that this deservedly popular modern classic makes exceptional demands upon its executants. Imagine, therefore, the effort required to express this remarkable work adequately on a mouth-organ! That is what Larry Adler has done on *Columbia DB*1560. Already, this amazing young virtuoso has given us such diverse and seemingly impossible items as Ravel's "Bolero," de Falla's "Fire Dance," and Kreisler's "Caprice Viennois." It is a triumph of mouth-organ playing, and I specially recommend you to hear this amazing record.

## Military Band Marches

THERE have been many protests that the B.B.C. Military Band, by virtue of its title, should play more military music than it does. So a new Columbia record of marches by the band, under B. Walton O'Donnell, should appeal to all those who hold this view, as well as to those who like the spirit of the march. One of these, "L'Entente Cordiale," is described as Marche Anglais-Français, whilst the reverse "Castaldo" is a vivid tune full of fire. The performances are up to the traditional high standard of the Wireless Military Band. The number of this record is *Columbia DB*1546.

## New Series of Vocal Gems

"WEST End Nights" is the title of a new series of vocal gems, the first of which is issued this month on *Columbia DX*691. One side of this record introduces four songs from "Glamorous Night," and the other offers an equal number shared by "Gay Deceivers" and "Stop Press"—easily among the three most popular musical shows at present running on the London stage. The singers for these "gems" are Muriel Barron, Webster Booth, the wireless tenor, and Marjorie Stedeford, the Australian contralto. The extremely popular "Easter Parade" is included in the "Stop Press" medley on the second side of the record.

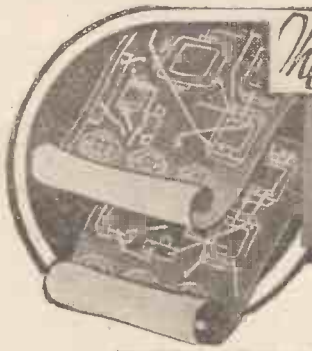
## A Massed Piano Orchestra

COLUMBIA furnish an innovation in their July list with massed piano versions of "The words are in my Heart" and "Lullaby of Broadway," the principal songs from the film "Gold Diggers of 1935." Those readers who have seen the film will recall that these tunes were actually played by rows and rows of grand pianos in a gorgeously mounted setting, and in giving them massed piano treatment in the record, Columbia are virtually presenting a slice of the picture in its original sound form. The artists are the Ivory Keys Grand Piano Orchestra and the number of the record is *Columbia DB*1559.

Every new record by Layton and Johnstone draws nearer to the time when we shall no longer hear these two famous artists together. This month they sing "Down by the River" (from the film "Mississippi") and "Rhythm of the Rain," the big hit song from Maurice Chevalier's picture "The Man from the Folies Bergère," on *Columbia DB*1558. On another record, Turner Layton sings "Wake!" and "I'm not worrying 'bout Anything" on *Columbia DB*1553.

## Boom in Beethoven

DURING the last three years over £24,000 has been spent in England alone on gramophone records of Beethoven's pianoforte Sonatas. This astonishing testimony to the popularity of Beethoven's pianoforte music has been made by the Beethoven Sonata Society, which was formed three years ago for making gramophone records of all of the thirty-two Sonatas, eighteen of which have already been recorded and published. The pianist chosen for this formidable task was Artur Schnabel, who recently came to London specially to make the records for the Seventh Volume of the Society. The First Volume containing seven records, published in March, 1932, was quickly oversubscribed (the edition was limited to two thousand volumes), and is now highly prized as a collector's piece. A second-hand specimen of this volume fetches anything from £6 to £15, according to the condition—over two guineas a record!



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| Armada Mains Three | 18.8.34 | PW38 |
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| £5 Superhet Three | — | PW40 |
| A.C. £5 Superhet Three | 24.11.34 | PW43 |
| D.C. £5 Superhet Three | 1.12.34 | PW42 |
| Hall-Mark Three | 8.12.34 | PW41 |
| F. J. Camm's Universal £5 Superhet | 15.12.34 | PW44 |
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| Battery Hall-Mark 4 | 2.2.35 | PW46 |
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| F. J. Camm's A.C. All-Wave Silver Souvenir Three | 11.5.35 | PW50 |
| Genet Midget Three | June '35 | PM1 |
| Cameo Midget Three | 8.6.35 | PW51 |
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| Full-volume Two (SG.-Det., Pen.) | 17.6.33 | AW392 |
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| Iron-core Two (D, Q.P.P.) | 12.8.33 | AW396 |
| 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 |
| Family Two (D, Trans.) | — | WM278 |
| **Three-valvers : Blueprints, 1s. each** | | |
| £8 Radiogram (D, RC, Trans.) | — | AW343 |
| P.T.P Three (Pentode-Triode-Pentode) | June '35 | WM389 |
| New Regional Three (D, RC, Trans) | 25.6.32 | AW349 |
| Class-B Three (D, Trans, Class B) | 22.4.33 | AW386 |
| New Britain's Favourite Three (D, Trans, Class B) | 15.7.33 | AW394 |
| Home-built Coil Three (SG, D, Trans) | 14.10.33 | 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) | 20.1.34 | AW417 |
| 1934 Ether Searcher, Chassis Model (SG, D, Pen) | 3.2.34 | AW419 |
| Lucerne Ranger (SG, D, Trans) | — | AW422 |
| Cossor Melody Maker with Lucerne Coils | — | AW423 |
| P.W.H. Mascot with Lucerne Coils (D, RC, Trans) | 17.3.34 | AW337A |
| Mullard Master Three with Lucerne Coils | — | AW424 |
| Pentaquester (HF Pen, D, Pen) | 14.4.34 | AW431 |
| £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) | 3.1.34 | AW451 |
| Transportable Three (SG, D, Pen) | — | WM271 |
| Multi-Mag Three (D, 2 Trans) | — | WM288 |
| Percy Harris Radiogram (HF, D, Trans) | Aug. '32 | WM294 |
| £6 6s. Radiogram (D, RC, Trans) | Apr. '33 | WM318 |
| Simple-tune Three (SG, D, Pen) | June, '33 | WM327 |
| Tyers Iron-core Three (SG, D, Pen) | July '33 | WM330 |
| C-B Three (D, LF, Class B) | — | WM333 |
| Economy-pentode Three (SG, D, Pen) | Oct. '33 | WM337 |
| All-wave Three (D, 2LF) | Jan. '34 | WM348 |
| "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, QP21) | June '34 | WM362 |
| 1935 £6 6s. Battery Three (SG, D, Pen) | Oct. '34 | WM371 |
| Graduating to a Low-frequency Stage (D, 2LF) | Jan. '35 | WM378 |

| Four-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| 65/- Four (SG, D, RC, Trans) | — | AW370 |
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| Crusaders' A.V.C. 4 (2 HF., D, QP21) | 18.8.34 | AW445 |
| (Pentode and Class-B Outputs for above: blueprints 6d. each) | 25.8.34 | AW445A |
| Quadradyne (2SG, D, Pen) | — | WM273 |
| Calibrator (SG, D, RC, Trans) | Oct. '32 | WM300 |
| Table Quad (SG, D, RC, Trans) | — | WM303 |
| Calibrator de Luxe (SG, D, RC, Trans) | Apr. '33 | WM316 |
| 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 | Mar. '35 | WM384 |

| Five-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| Super-quality Five (2HF, D, RC, Trans) | May '33 | WM320 |
| New Class-B Five (2SG, D, LF, Class-B) | Nov. '33 | WM340 |
| Class-B Quadradyne (2 SG, D, LF, Class-B) | Dec. '33 | WM344 |
| 1935 Super Five (Battery Superhet) | Jan. '35 | WM379 |

### Mains Operated

| Two-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| Consoelectric Two (D, Pen) A.C. | 23.9.33 | AW403 |
| Economy A.C. Two (D, Trans) A.C. | — | WM286 |

| Three-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| Home-lover's New All-electric Three (SG, D, Trans) A.C. | 25.3.33 | AW383 |
| S.G. Three (SG, D, Pen) A.C. | 3.6.33 | AW393 |
| 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 |
| D.C. Calibrator (SG, D, Push-pull Pen) D.C. | July '33 | WM328 |
| Simplicity A.C. Radiogram (SG, D, Pen) A.C. | Oct. '33 | WM338 |
| Six-guinea A.C./D.C. Three (HF Pen, D, Trans) A.C./D.C. | July '34 | WM364 |
| Mantovani A.C. Three (HF Pen, D, Pen) A.C. | Nov. '34 | WM374 |

| Four-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| A.C. Melody Ranger (SG, DC, RC, Trans) A.C. | — | AW380 |
| A.C./D.C. Straight A.V.C. 4 (2 HF, D, Pen) A.C./D.C. | 8.9.34 | AW446 |
| A.C. Quadradyne (2SG, D, Trans) A.C. | — | WM279 |
| All Metal Four (2SG, D, Pen) | July '33 | WM329 |
| "W.M." A.C./D.C. Super Four | Feb. '35 | WM382 |
| Harris Jubilee Radiogram | May '35 | WM386 |

### SUPERHETS.

| Battery Sets : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| 1934 Century Super | 9.12.33 | AW413 |
| Super Senior | — | WM256 |
| 1932 Super 60 | — | WM269 |
| Q.P.P. Super 60 | Apr. '33 | WM319 |
| "W.M." Stenode | Oct. '34 | WM373 |
| Modern Super Senior | Nov. '34 | WM375 |

| Mains Sets : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| 1934 A.C. Century Super, A.C. | 10.3.34 | AW425 |
| 1932 A.C. Super 60, A.C. | — | WM272 |
| Seventy-seven Super, A.C. | — | WM305 |
| "W.M." D.C. Super, D.C. | May '33 | WM321 |
| Merrymaker Super, A.C. | Dec. '33 | WM345 |
| Heptode Super Three, A.C. | May '34 | WM359 |
| "W.M." Radiogram Super, A.C. | July '34 | WM366 |
| "W.M." Stenode, A.C. | Sep. '34 | WM370 |
| 1935 A.C. Stenode | Apr. '35 | WM385 |

### PORTABLES.

| Four-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| General-purpose Portable (SG, D, RC, Trans) | — | AW351 |
| 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 |
| Town and Country Four (SG, D, RC, Trans) | — | WM282 |
| Two H.F. Portable (2 SG, D, QP21) | June '34 | WM363 |
| Tyers Portable (SG, D, 2 Trans) | Aug. '34 | WM367 |

### SHORT-WAVERS. Battery Operated.

| One-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| S.W. One-valve | — | AW329 |
| S.W. One-valve for America | — | AW429 |
| Roma Short-waver | 10.11.34 | AW452 |

| Two-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| Home-made Coil Two (D, Pen) | 14.7.34 | AW440 |

| Three-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| World-ranger Short-wave 3 (D, RC, Trans) | — | AW355 |
| Experimenter's 5-metre Set (D, Trans, Super-regen) | 30.6.34 | AW433 |
| Experimenter's Short-waver | Jan. 19, '35 | AW463 |
| Short-wave Adapter | Dec. 1, '34 | AW456 |
| Superhet, Converter | Dec. 1, '34 | AW457 |
| The Carrier Short-waver | July '35 | WM390 |

| Four-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| "A.W." Short-wave World Beater (HF Pen, D, RC, Trans) | 2.6.34 | AW436 |
| Empire Short-waver (SG, D, RC, Trans) | Mar. '33 | WM318 |
| Standard Four-valve Short-waver | Mar. '35 | WM383 |

### Mains Operated.

| Two-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| Two-valve Mains Short-waver (D, Pen) A.C. | 10.11.34 | AW453 |
| "W.M." Band-spread Short-waver (D. Pen) A.C./D.C. | Aug. '34 | WM368 |
| "W.M." Long-wave Converter | Jan. '35 | WM380 |

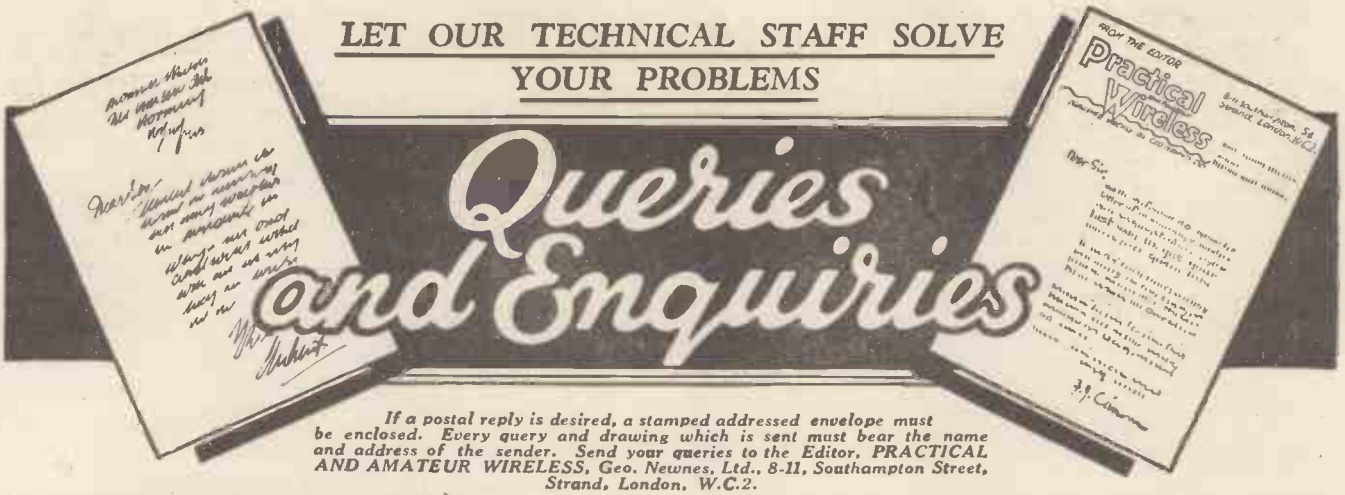
| Three-valvers : Blueprints, 1s. each. | | |
|---|---|---|
| Emigrator (SG, D, Pen), A.C. | — | WM352 |

| Four-valvers : Blueprints, 1s. 6d. each. | | |
|---|---|---|
| Gold Coaster (SG, D, RC, Trans) A.C. | Aug. '32 | WM292 |
| Trickle Charger | Jan. 5, '35 | AW462 |

### MISCELLANEOUS.

| | | |
|---|---|---|
| Enthusiasts Power Amplifier (1/6) | June '35 | WM387 |
| Newstyle Short-wave Adapter (1/-) | June '35 | WM388 |

## LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

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**SPECIAL NOTE**

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.

### The £3 3s. Three

**"I have been introduced to a friend who has a very good receiver, and I am anxious to build one like it. Unfortunately all details have been lost, and all I can gather is that it is called the £3 or Three Guinea Three, and was published last year. Can you please tell me whether it was described in one of your books, whether the necessary issue is obtainable, and whether or not a blueprint is available."—G. Y. (Yarmouth).**

YOU are probably referring to the £3 3s. Three which was described in the March, 1934, issue of the *Wireless Magazine*. The circuit was S.G., detector and a transformer-coupled output stage. A back number is obtainable from our back number department, price 7½d., and the blueprint is number WM.354, and may be obtained for 1s.

### S.W. Reaction

**"Can you explain why my short-wave set will only oscillate under certain conditions? Sometimes I find that the reaction condenser may be turned to a certain point and then the set plops, but if the condenser is turned still further, the signals come back. On other occasions I find that a certain combination of tuning coil and reaction coil is necessary in order to obtain reaction. In fact, it is very difficult to know just what combination I require on any night on any particular wavelength."—W. R. (W. Bromwich).**

WHILST it is quite possible that one of the components in your set is defective, or the H.T. supply is erratic, we think it is more than likely that your aerial-earth system is inefficient. Probably the insulation is poor, and during wet weather, or under conditions when much moisture is present in the atmosphere, the leakage which takes place to earth lowers the efficiency of your tuned circuit, whilst dry weather brings about good efficiency in the aerial-earth system. Attention to this point will no doubt solve your difficulties.

### American Valve Connections

**"I have had six American pattern valves given to me. I should like to experiment with them, but do not know the connections to the pins. Could you give me the connections and tell me what type of English pattern each represents. (Here follows a list of the valves in question)."—H. J. M. (Eden Bridge).**

WE regret that we cannot accede to your request. We think the best plan is to write to one of the English agents for American valves and obtain a catalogue of modern types with pin connections. The Electrical Trading Association, Ltd., of Aldwych House, Aldwych, W.C.2, can supply you with the data concerning the Eta valves, and Messrs. Claude Lyons, of 76, Old Hall Street, Liverpool, can supply data concerning the remaining types.

### Selectivity

**"I have built a one-valve set, but it is my first adventure in radio. I find that, although it works very well, it is not loud enough and not selective. I am prepared to build two L.F. stages so as to work a loud-speaker, but to not know how to adapt the tuning circuit to get the two local stations clear of each other. What is your recommendation? The coil is home-made."—G. T. J. (Hendon).**

IN view of your situation we think you will find it necessary to use a band-pass tuner. A good iron-core coil of modern design might prove effective, but as you are going to use two stages of L.F. we think it will prove necessary to fit band-pass tuning to avoid station overlap. Buy a modern band-pass unit, or obtain two modern coils and wire them according to the makers' instructions to obtain a band-pass effect. A two-gang condenser will, of course, be essential.

### Long-wave Coil Broken

**"I have a three-valve set described in your book, and which has given good results for seven or eight months. Now a peculiar fault has arisen, and I seek your help in tracing it. When I am on the medium-waves the results are as before, but when I push in the wave-change switch there is a peculiar low hum and no signals unless you put your head close to the speaker. Can you trace the trouble from this description?"—W. P. (Underwood).**

IT is almost certain that the trouble is in the coil. The switch is hardly likely to give trouble of the type mentioned, but a break in the long-wave section of the tuning coil would open-circuit the coil and thus leave the grid in the air. A test with battery and 'phones will soon check this point, and we think you will find that this is the cause of your trouble.

### Band-pass Circuit

**"I have amongst my spares two old dual-range coils of the aerial type—that is, with a reaction winding, a primary and a secondary. I wish to try a band-pass circuit. What type of coupling do you recommend? I thought of using the reaction winding as a link coupling, but am not certain whether there is enough or too much wire on this particular winding for the purpose. I should be glad of your advice."—V. D. S. (Liverpool).**

PROBABLY the most efficient coupling with the particular coils you mention would be bottom capacity coupling. A .04 mfd. fixed condenser joined between the junction of the lower ends of the two coils and earth should prove effective, and this may be by-passed with a resistance if you are using grid bias in the circuit. Alternatively, a small capacity may be joined between the "top" ends of the coils. You might try the effect of using the reaction windings as link coils, but we cannot give you any indication of the results to be expected in view of the lack of information concerning these windings.

### Address Wanted

**"You recently mentioned the Mervyn television apparatus, and as I wish to get into touch with the makers, I should be glad if you could give me their name and address. I have not seen any advertisements in your pages from this firm."—T. E. W. (Birmingham).**

THE makers of the Mervyn apparatus are The Mervyn Sound & Vision Co., Ltd., 4, Holborn Place, High Holborn, London, W.C.1.



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

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ANNOUNCE a City Branch at 165 and 165a, Fleet Street, E.C.4 (next door to Anderton's Hotel), for the convenience of callers; post orders and callers to High Street, Clapham.

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WORLD Famous Continental Valve Manufacturer; mains types, 4/6 each, H.L., L. power; high and low magnification, screen grid; variable Mu screen grid; 1, 3, and 4 watt A.C. output, directly heated pentodes; 250 volt 60 m.a. full wave rectifiers; A.C D.C. types, 20 volts, 0.18 amp. filaments; screen grid; variable mu screen grid; H., H.L., power and pentodes.

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2-volt H.F., L.F., 2/3; power, low consumption power, super power, 2/9; screened grid, variable mu screened grid, 5- or 4-pin pentodes.

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PREMIER L.T. Charger kits, Westinghouse rectifier, input 200-250v. A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

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MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna, 2,500 ohms, 37/6; all complete with humbucking coils; state whether power or pentode; A.C. conversion kit for above, 10/-; P.M.7 In. cone, 16/6; 9in. cone, 22/6.

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*(Continued at top of column three)*

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*(Continued from foot of column one)*

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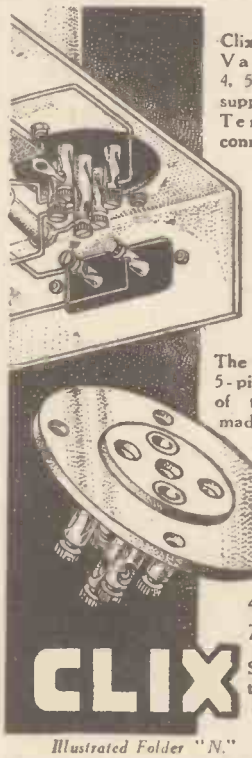

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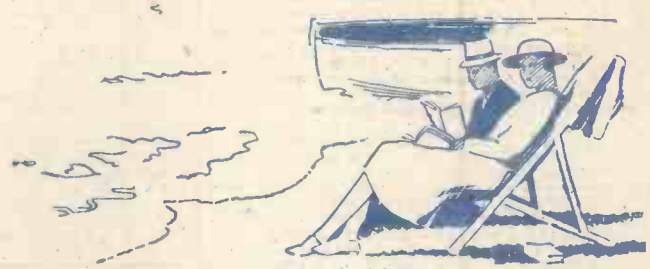
# BEST HOLIDAY READING

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# Practical and Amateur Wireless

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 6. No. 149. July 27th, 1935.

AND AMATEUR TELEVISION

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# 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. VI. No. 149. July 27th, 1935.


# ROUND *the* WORLD *of* WIRELESS

## Norway's Proposed Network

FOR the reorganisation of its system, the Norwegian Broadcasting Administration plans a chain of nine main and ten relay stations with, in addition, one short-wave transmitter. Although the country has only been given one channel in the 1,000-2,000 metre band, the new 10-kilowatt Aalesund-Vigra station will work on a long wavelength.

## Polskie-Radio Torun

THE Polish transmissions which are occasionally picked up on 304.3 metres, a channel shared with Genoa, emanate from the new station at Torun. In almost every case they are relays of the Warsaw radio entertainments. Torun, however, possesses its own interval signal; it consists of two bars of a popular folk melody sung by the timber drifters on the Vistula.

## Weather Forecasts for Fishermen

DAILY at B.S.T. 05.00, VAS, Louisberg, (Nova Scotia), on 441.2 metres (680 kc/s), broadcasts meteorological bulletins destined to ships trawling off the Newfoundland banks. The calls is: *This is VAS, the Marconi station of the Atlantic Broadcasting Company, Nova Scotia.* These transmissions have been picked up in the British Isles.

## International Choral Broadcast

BY arrangement with the U.I.R., following the recent Warsaw Conference, an international broadcast is to be made on October 27th next between G.M.T. 17.00-19.00. *Youth Sings Beyond the Frontiers* is the title of the programme to which groups of youths drawn from organisations in most European countries, and also from states overseas, will each contribute in turn a four-minute broadcast. It will be the first truly international relay in the history of radio entertainment.

## Monsieur Radiolo

UNDER this *nom-de-plume* many listeners will recall Marcel Laporte, who for many years acted as announcer for the Radio-Paris broadcasts. Following engagements at Radio-Vitus and at Juan-les-Pins, he has now been appointed chief announcer at the studio of the new Nice-La Brague P.T.T. high-power station which it is hoped will soon be on the air.

## Canned News Bulletins

FOR some considerable time the Berlin station has featured the broadcast of topical events recorded by its mobile radio van during the day. In future, these transmissions, on a larger scale, are to be given daily except Saturdays, from B.S.T. 19.45-20.00, and again between B.S.T. 22.20-22.30. On Sundays, under the title *German Sport Echo* the broadcast will be given between B.S.T. 19.30-20.00.

### *ON OTHER PAGES*



## France Goes Ahead

NOTWITHSTANDING the number of broadcasting stations operating in Paris so far, registered listeners in the French capital at the end of last April numbered only 871,032; on the other hand, other parts of the country have recently shown a good increase, and the provinces are represented by 1,086,162 licences. By now France may have reached the two million mark which, although registering progress, is far behind what her neighbours have attained in the same period.

## Germany's Proposed Saarbruecken Transmitter

CONTRARY to the decision taken some months ago, the German Authorities now intend to erect an independent station in the Saar district. It will provide its own programmes, but will be connected to the main network for the broadcast of transmissions of a national character.

## Grand Opera on a Football Ground

THE Hohenwarte Football Ground, one of the largest in Austria, is to be used for the presentation of open-air grand opera. It will accommodate an audience of 20,000 spectators, and for the purpose a special platform has been built, capable of staging shows with one thousand singers, and an orchestra of two hundred musicians. Two of the operas will be broadcast by the Vienna station.

## Afghanistan Installs Radio

THE Royal Afghan Government has placed an order with the Marconi Company, London, for the supply of five wireless transmitters to be erected at Kabul, Diyazunghi, Khost, Khanabad, and Maimene. The Kabul station will possess a short-wave plant for direct communication with London, Melbourne, Rio de Janeiro, and Tokyo. This would appear to be a preliminary step to the establishment of a broadcasting system in that country.

## Another Golden Voice

WHEN Stockholm closes down at night, the exact time is given in a feminine voice. The studio is not responsible for the announcement, which is automatically received from the Swedish telephone headquarters. The voice of the sweetest-voiced operator has been recorded on film, which, actuating through rays of light, photo electric cells, connected to amplifiers, broadcasts the exact hour, minute, and second at any time desired.

## From Weston-s.-Mare

THE feature "You pays your money" which is described as a choice of evening entertainments will be taken from Weston-super-Mare for Western listeners on July 24th. This broadcast will be run on similar lines to the others and will take the form of visits to a number of places of entertainment, including the Winter Gardens, where a dance band will be heard; the Odeon Cinema, where an organ recital will be given; Burgess and his orchestra will be relayed from the Madeira Cove; an Alfresco Concert Party will be taken from the Beach; also a Punch and Judy man, and probably a talk by an ice-cream man.

# ROUND the WORLD of WIRELESS (Continued)

## Short-wave Messages Heard 207 Miles Away

MR. DOUGLAS WALTERS proved recently beyond doubt that ultra-short wireless waves can be operated with commercial reliability over much greater distances than has been thought possible. Using a low-power five-metre transmitter on top of Mount Snowdon, Carnarvonshire, Wales, with Mr. David Richards, the Mount Everest radio expert, he established what he believes to be new long-range records. Experimenters operating at Stoke Poges, Buckinghamshire, 160 miles away, and Romford, 207 miles away, heard his speech perfectly.

SHORT-WAVE RADIO RECORDS BEATEN

*Our illustration shows Mr. Douglas Walters (right) and two of his helpers carrying part of their apparatus to the wireless station on Mount Snowdon.*

## "Only a Mill Girl"

ON July 30th Martyn Webster will produce in the Midland studio the mock melodrama "Only a Mill Girl," by the Melluish brothers. He first produced it in London, and it was put on after he was appointed producer at the Birmingham studio. Reginald Burston will conduct the B.B.C. Midland Orchestra and the B.B.C. Midland Revue Chorus, and the cast will include John Lang; Hugh Morton; Alfred Butler, as the villain; Dorothy Summers; and Marjorie Westbury, playing the title part.

## "Playtime"

THIS is the title of a popular show, presented by Nat Day, which will be relayed from the Esplanade Pavilion, Burnham-on-Sea, for Western listeners on August 1st.

## Talk on Rodèos

RODEOS in the Western States and Canada will be described to Midland listeners on July 29th by Brendan K. Vallings, who spent some years out West. He is now in charge of the Ministry of Agriculture's campaign against the musk rat in Shropshire. His capacity for telling a good yarn has already been shown in his broadcast talk "Buffaloes and Bears."

**INTERESTING and TOPICAL PARAGRAPHS**

## "City of Music"

THOUSANDS of musical listeners delighted in Julius Buerger's "Life of Offenbach," a musical story of Offenbach's struggle from youth to his successful career in Paris, where, after the composer's death, his charming operetta "The Tales of Hoffmann" scored an enormous success. Julius Buerger has now turned his gift for pot-pourri to Vienna, and his programme, "City of Music," will be heard on July 24th and 25th. In this pot-pourri listeners will make a journey through 150 years of Viennese music. In the prelude to this programme snatches of the Austrian National Hymn, Strauss's "Blue Danube," and other well-known waltzes of this composer will be included, as well as excerpts from Mozart's "Magic Flute" and the works of Beethoven and Schubert.

## Talk on Cricket

"RECOLLECTIONS of the Great Days" is the title of a talk on cricket which will be given by Sir Ernest Cook for Western listeners on July 29th. Sir Ernest was captain and honorary secretary of Bedminster Cricket Club for twenty years and an old Somerset county player.

## "North Wales Night"

THE Northern Outside Broadcast staff are undertaking another "North Wales Night" feature, which will be broadcast in both Northern and Western programmes on July 31st. Billie Manders' all-male concert party, the "Quaintesques," will be relayed from the Pier Amphitheatre, Rhyl; there will be a recital by Horace Bagot at the organ of the Winter Gardens, Llandudno; and further concert party shows, by the "1935 Evening Follies," from the Arcadian Pavilion, Llandudno, and by the "Colwyn Follies" from the Pier Pavilion, Colwyn Bay.

## Variety from Coventry

THE variety bill for Midland listeners on August 2nd is to be relayed from the Hippodrome Theatre, Coventry.

## Good Fare from the Northern Regional

TRAM-GUARDS and drivers, shed-men, and so forth, comprising the Manchester Corporation Transport Banjo, Mandolin, and Guitar Orchestra, will broadcast a concert in the Northern programme on August 1st. Their conductor is A. F. Hill. On August 3rd the "Bouquets" concert party, presented by Murray Ashford and Wilby Lunn, will broadcast to Northern listeners from the Pier Pavilion, St. Anne's-on-Sea.

## Band Concert for Western Listeners

A BAND concert will be given for Western listeners on July 28th by the Melingriffith Volunteer and Cadet Corps Band, conducted by T. J. Powell. This band was formed more than sixty years ago under the name of the Whitchurch Brass Band; it is now connected with the Melingriffith Company. Most of the members are engaged in the tinplate industry. The conductor is a well-known composer for brass bands, his marches being very frequently used in broadcasts and competitions. The soloist at the broadcast concert will be Olive Gilbert (contralto).

## Pinero's "Sweet Lavender"

THE third of the series of plays by Midland repertory companies is to be broadcast to Midland listeners on July 28th. This is Pinero's "Sweet Lavender," to be performed by the Coventry Repertory Company, and produced in a studio by A. Gardner Davies, the company producer, and Owen Reed, of the Birmingham studios.

# SOLVE THIS!

### PROBLEM No. 149.

Franklin's four-valve receiver was of the universal all-mains type and had given good service for twelve months. One day, however, he found that signals were very weak, and after an hour or so ceased entirely. He tested the valves and found that two of them had broken down, the heater circuits being internally disconnected. As he was using the receiver on A.C. mains he decided that the valves which he should get for replacement should be of the A.C. type, and accordingly purchased two of similar characteristics to those which had broken down. When inserted in the receiver, however, he obtained very poor signals, and he found it impossible to obtain satisfactory results. Why? Three books will be awarded for the first three correct solutions opened. Envelopes must be marked Problem No. 149 in the bottom left-hand corner, and must be addressed to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received not later than the first post Monday, July 29th, 1935.

### Solution to Problem No. 148.

As the anode current was high on the output valve, and yet the H.T. battery had been in use, the inference would be that the grid-bias was low. As a modification of bias did not affect anode current it was obvious that no bias was getting to the grid and, therefore, the grid circuit was open-circuited, due to a breakdown in the transformer secondary (or grid leak should R.C. coupling have been employed).

The following three readers successfully solved Problem No. 147, and books are accordingly being forwarded to them: A.G. Haken, Rossendale, Hyde Street, Winchester; S.C.P. Mears, 14 Foxlands Road, Dagenham, Essex; H. Bolton, 41 Billinge Street, Blackburn.

# TROUBLE TRACKING

Hints on the Equipment Required and the Methods of Locating Faults and Troubles which Might Arise in Battery and Mains-operated Receivers. By L. ORMOND SPARKS

EVERY radio constructor experiences, at one time or another, certain faults which, whether simple or complex, are often irritating and, in many instances, most discouraging. It is fairly safe to say that finding the fault usually takes more time than effecting the actual cure, but this is probably due to a lack of systematic investigation.

While it is obviously impossible to compile a table of every ill a receiver or amplifier is likely to develop, it is a great advantage to classify the numerous faults under suitable headings, thus limiting the field of cause and effect. Such a procedure, if adhered to, and augmented from time to time by notes and observations obtained during trouble tracking, will save a great deal of time and frayed tempers.

If funds only allow one meter, it is suggested that a low-reading milliammeter is the most useful proposition.

## Testing Procedure

To proceed with the actual testing, arrange the milliammeter in series with a 1½-volt dry cell, as shown in Fig. 1. Provide leads at least one yard in length, and

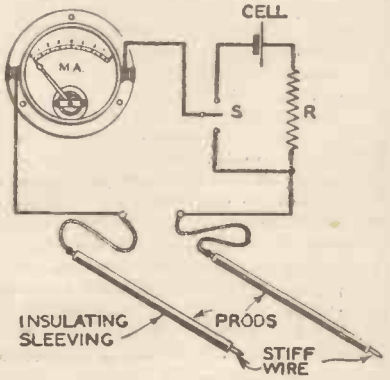



*Fig. 1.—An efficient method of arranging a milliammeter for testing purposes.*

terminate the free ends with a pair of testing prods. These can be purchased for one or two shillings, or can be made quite easily from stiff copper wire covered, except the tips, with insulating sleeving. The resistance R is fitted to protect the meter, and its value should be such that, when the tips of the prods are touched together, the meter deflection is just below maximum. For a 15 m.a. meter, a value of, say, 50 ohms will be ample.

The single-pole double-throw switch S enables a quick change over to be made, from continuity reading to milliamps, and also cuts the battery out of circuit.

Assuming the receiver to be tested is of the battery type, it will be found most helpful if the milliammeter is connected in the negative H.T. lead, as depicted in Fig. 2. After making sure that all batteries are connected, switch on and note the meter reading. This should be approximately the same as the sum of the anode currents of the valves in use, which can be determined from the makers' leaflets.

A slight excess might be caused by low bias or any resistances in the circuit across the H.T. positive and earth. If no reading is obtained, attention must be paid to the L.T. and H.T. batteries, their voltages and connecting leads; the fuse should be test for continuity, while the switch action and contacts must be examined, and, finally, the valve filaments. Assuming the fault is revealed and rectified, the current is noted

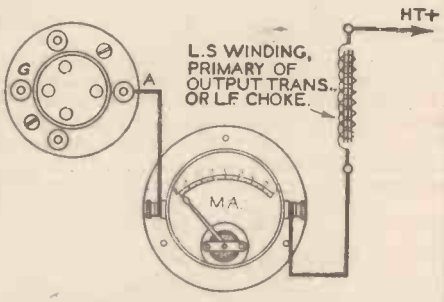



*Fig. 3.—This is the method of checking the output stage for distortion.*

and each valve withdrawn from its holder in turn. With each withdrawal, the current should decrease by an amount equal to the current consumption of the valve removed. No decrease will, of course, point out that

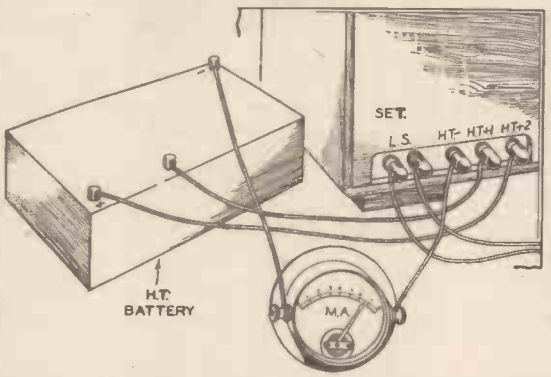



*Fig. 2.—To find the total consumption of H.T. the milliammeter is connected in the H.T. negative lead.*

the valve is not operating, or the H.T. or L.T. circuit to that holder is broken somewhere.

From this test it is possible to determine if various parts of the circuit are satisfactory. For example, with no valves in the receiver, the meter will register any current that may be flowing, due to potentiometers, resistances, or leakage across the H.T. supply. With the S.G. valve in position, the bias or screen control can be tested, by noting their effect on the anode current; while L.F. and output grid circuits can be checked by plugging in the respective valves, adjusting the bias, and again noting meter readings.

If the receiver is mains operated it is advisable to connect milliammeter in the anode circuit of each valve, in turn, and not in the common negative lead, owing to voltage increase across the various resistances when the load is reduced by the removal of a valve. Examine all cathode circuits, bias resistances, and decoupling condensers. If the field of the loud-speaker is energised or used as a smoothing choke, the continuity test should be applied.

## Tests for Distortion

Distortion will be indicated by violent fluctuation of the needle, and bias or H.T., or both, should be adjusted until the minimum movement, either side of the standing current of the whole circuit, is obtained.

If tests are being applied for distortion only, it is more satisfactory to connect the meter as shown in Fig. 3. Here it will be seen that the reading obtained will be that of the output valve, the current flowing through the L.F. choke, or primary of the speaker transformer, or the L.S. winding, according to the form of output employed. This test, therefore, will give some indication of the efficiency of these components apart from the valve.

Fig. 4 shows the necessary connections to place the meter in the anode circuit of the detector valve. In this position tests can be applied for overloading, instability or operation of reaction circuit, tuning circuit peculiarities, and, in a straight or ordinary H.F. circuit, indication of accurate ganging. It should be remembered that the readings will depend on the form of detection used. If the more common grid-condenser method is used the needle will kick downwards when a state of oscillation is produced, or when a signal is received, the maximum deflection indicating that the associated tuned circuit is dead in tune with the signal. Should the anode-bend method of detection be employed it will be found that the indications are the reverse. The meter reading will *increase* if instability is present, and when the circuit is in tune,

(Continued overleaf)

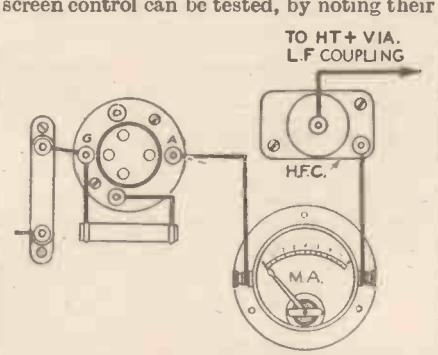



*Fig. 4.—For ascertaining the position regarding overloading, the meter should be used in the detector stage as here shown.*

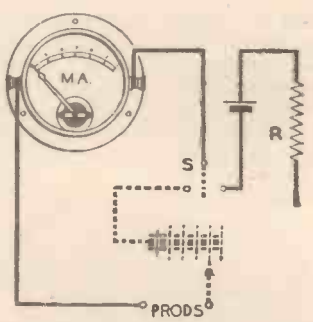



*Fig. 5.—Testing a component, here represented by the resistance "R."*

(Continued from previous page)

With circuits embodying A.V.C., a slightly different procedure is necessary. The meter should be connected in the H.T. lead feeding the H.F. valves to which the A.V.C. voltages are being applied.

It will be noted that the use of a voltmeter has received little mention. There is a two-fold reason for this; unless a good high-resistance meter is used, the readings obtained, especially across any mains-operated apparatus, are likely to be misleading, owing to the current produced through the meter windings. The second reason is that in so many parts of a circuit voltage does not convey a true impression of the operation of the components concerned. For example, if a valve is supposed to pass, say, 4 milliamps for most efficient results, surely it is better to adjust the circuit so that the required current does flow than measure the voltage across the H.T. supply and assume that the correct current is flowing. It is quite possible, owing to anode components, instability, and other electrode potentials, that it may be very wide of its mark. I am, of course, assuming that it is known that the valves are normal.

## Components Tests

There is very little the average constructor can do in the way of accurate testing of components other than continuity, resistance, and current-flow tests. However, it is usually possible to obtain approximate information about inductance and capacity by simple substitution methods.

The continuity circuit already explained will be found quite satisfactory for coils, switches, H.F. chokes, variable condensers, and circuit checking, but for components having a resistance over, say, 500 ohms, it will be necessary to employ a larger voltage than that provided by the cell specified. A 9-volt grid-bias battery will be ample, and providing a low voltage is applied at first, and then increased if the dial reading is too low, no harm is likely to be caused to the meter by the test revealing a dead short. To determine the resistance of a component it may be necessary to use a section of the H.T. battery, according to the meter and the item under test. The switch should be in position to cut out the resistance R, and 1½-volt cell (Fig. 5) and the additional battery connected are as shown by the dotted lines.

It will be seen that the meter is now used as a milliammeter and that the voltage must be measured. If possible this should be adjusted to a round figure to simplify calculations. After applying the prods across the item under test, and noting the m.a. meter reading, Ohm's Law will enable the value of the resistance to be determined, remembering that $R = \frac{\text{Volts} \times 1{,}000}{\text{Milliamps}}$. While it is possible to determine the majority of faults likely to be experienced in a receiver or component by careful application of the above tests and notes, it must be remembered that the remedies are not intended to cope with inherent faults in the design of a circuit or component; similarly, the continuity and resistance tests would not, necessarily, reveal the faults in the characteristic of a component.

## Choosing Instruments

Those readers who have no equipment, and are interested in the subject may find the article in last week's issue on page 503 of interest. This dealt with the various types of measuring and testing instruments and their selection. Complete multi-purpose instruments have also been described in these pages from time to time.

# THE NEW G.E.C. SHADOWBAND FIVE

THE latest radiogram produced by the G.E.C., known as the "Shadowband Five," supplements what is traditionally associated with the firm as regards quality, with added simplicity and accuracy of control, made possible by a shadowband-tuning device. This is a visual indicator for the exact tuning of a required station by "focusing" a shadow, the band of shadow being broadest when the set is not tuned in to the station, and narrowest when the tuning point is reached. A powerful superhet radio chassis ensures an almost unlimited choice of stations, which can be instantly identified on the luminous station-name indicator. Automatic volume control prevents fading of distant stations, and a noise-suppressor control is provided to subdue inter-station background noise. The moving-coil speaker is of the energised concert type. Other refinements include an internal aerial, connections for an extension speaker, a switch to silence the "parent" speaker, and variable tone control, enabling the relation between the higher and lower frequencies to be continuously varied over a very wide range. Dimensions are as follow: height, 34½in.; width, 29½in.; and depth, 16¾in. Cash price, complete with Osram valves, is 23 guineas. The standard model is for 190-250 volts, 40-60 cycles for A.C. mains. In the case of a special for 110-130 and 210-230 volts, 40-60 cycles the price is half-a-guinea more.

*This fine G.E.C. radiogram is fitted with shadowband tuning, A.V.C., and automatic control for the motor-driven turntable.*

## Technical Details

This floor-model receiver has side-by-side deck lay-out. Power consumption is 80 watts on radio, and 100 watts on gramophone. The wave-range is 200-550 metres and 900-2,000 metres. A.C. output is 3 watts.

The instrument embodies the now well-known 13-volt .3 amp. range of universal valves, the filaments of which are run in parallel and fed from the mains transformer at 13 volts. The aerial input is fed by a radio-frequency band-pass filter to the control grid of the heptode. The first I.F. band-pass filter is in the anode circuit of this valve, I.F. amplification being provided by a variable-mu screened pentode. A second I.F. band-pass filter passes the signal in the anode circuit of this valve to the second detector. A double diode-triode, which combines the functions of detector, A.V.C. valve, A.V.C. amplifier and low-frequency amplifier. Resistance capacity coupling is used between the triode of the above valve and the output pentode. Manual volume control varies the input to the output pentode. Automatic volume control, which is delayed to prevent loss of signal strength on weak signals, is of the amplified type and is very complete. The detector diode supplies a voltage varying in accordance with the incoming signal to the grid of the triode portion of the detector valve and the amplified voltage controls the amplification of both the first detector and I.F. amplifier by varying their bias voltages. Intermediate-frequency amplification is carried out at 125 k/cs. The average sensitivity of the receiver over the medium-wave band is some 10 microvolts. This means that for a standard output (50 milliwatts) in the loud-speaker circuit a potential difference of only 10 microvolts at high-frequency modulated to a depth of 30 per cent. need be fed to the aerial and earth terminals.

When the instrument is used as a gramophone reproducer the pick-up is applied between the grid and the cathode of the triode portion of the double-diode-triode valve, the volume being controlled by the potentiometer in the grid circuit of the output pentode. The low resistance of the pick-up automatically rearranges the bias conditions, making them suitable for gramophone pick-up amplification.

The motor is of the induction type and is fitted with an automatic stop and start mechanism which operates on any type of record having a quick run-in groove. The gramophone pick-up, integral with the motor assembly, is of the electro-magnetic type and housed in a neat bakelite moulding.

# Designing Your Own Wireless Set

**The Most Suitable Type of Circuit for Individual Needs is Discussed This Week, and Details of a Receiver Suitable for the Average Person are Given.**

NOW that we have reviewed circuit arrangements as a whole we may consider the matter of choosing a circuit for individual requirements, considering the various portions of the circuit in greater detail. In the first place a decision must be made as to whether the set shall be designed for battery or mains operation and, if the latter, whether it shall operate from A.C., D.C. or both. This question is almost entirely governed by purely domestic conditions, for it would be futile to make a mains receiver if the house were not wired with electricity; on the other hand, if an electric supply is installed there should be no question as to the power supply, for a battery set cannot compare in

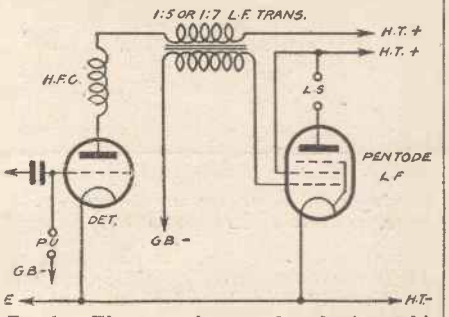



*Fig. 1.—The circuit for a single-valve (pentode) L.F. amplifier suitable for an output of about 500 milliwatts.*

any respect with a mains-operated one of similar type. It appears that there are still a few constructors who are rather dubious regarding their capabilities in the direction of making a mains receiver, and who rather believe that the undertaking is more difficult than the construction of a battery set, and less likely to prove entirely successful. In point of fact, however, there is no reason whatever why this should be so, for a mains set can be made just as easily as one for battery operation and, so long as ordinary precautions are taken, there is no danger involved, and no difficulty in securing completely satisfactory results.

## Use the Mains if Possible

And since the efficiency, valve for valve, of a mains receiver is far greater than for a set drawing its power from batteries, every one who has a mains supply is strongly advised to use it. Of the two kinds of current, A.C. is the more convenient, since its voltage can be changed as required, but a D.C. receiver using modern valves is highly efficient. A difficulty which is often present when D.C. mains are taken into the house is that the supply will be changed—probably at a not very distant date—for A.C. In such cases, a universal receiver, suitable for use with either A.C. or D.C., provides the logical solution. Incidentally, it is worth mentioning that a universal set costs very little more than one intended for use on D.C., so that it is worth while to make the set universal in the first place, rather than providing for D.C. operation with the idea of modifying the instrument at a later date.

## How Many Valves?

The next step is to decide definitely on the number of valves, and the type of circuit which will provide the kind of reception required. In considering this it is always wise to be as generous concerning the number of valves as funds will permit, because more satisfactory reception is usually obtained by using an extra valve not fully loaded than by pressing every valve in the set to the very limit. There are cases to which this cannot be applied, but they are the exceptions which prove the rule; a typical example is the "£5 Superhet," but this is a very special receiver, expertly designed after considerable experiment. It is evident that the number of valves must be determined by the results expected, and the questions of range, selectivity, quality, cost and maximum undistorted output must all be settled individually.

Most constructors to-day are more anxious to have a receiver that will give really good reception of about four British transmissions than to be able to tune in any station in Europe, and their requirements are not hard to satisfy. On the

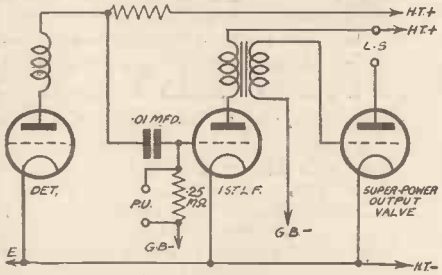



*Fig. 2.—A two-valve L.F. amplifier giving a similar output to the arrangement shown in Fig. 1. It is more suitable when pick-up connections are required, but much "heavier" on H.T. current.*

other hand, there are still a few listeners who are quite content with moderate quality provided that they can bring in at least the more powerful of the Continental transmissions; and it is not very difficult to provide them with what they want. But if world-wide range combined with perfect reproduction are sought, there are many interesting problems to be solved, and a suitable receiver can only be built by spending a not inconsiderable amount of money.

## For Average Requirements

Let us consider first of all the type of circuit most likely to please the man who wants to be able to obtain good reception from a few British stations, and who occasionally would like to listen to the programme from one of the more powerful European stations. Provided that the receiver is well thought out, and that the best possible use is made of modern valves, a high-frequency amplifying stage is not essential, and so a detector-L.F. arrangement can be considered. The next question is the kind of reproduction required—the output volume and the "quality." Unfortunately, the latter is a very comparative term, and the meaning varies considerably according to the listener. At the present time, however, we will assume an average person who likes music, but who has not a critical musical ear. His requirements will be satisfied by an ordinary L.F. amplifier with transformer coupling, and with either a triode or pentode valve in the output stage. This same listener will probably be quite content with an undistorted output of about 500 milliwatts, and this can be obtained by using a single pentode valve transformer coupled to the detector valve, as shown in Fig. 1, or by employing two L.F. valves, the first of which is resistance coupled to the detector, and coupled by means of a 1 : 3 transformer to a super-power output valve, as shown in Fig. 2.

These remarks apply to a battery receiver, and in the case of a mains set (either A.C. or D.C.) the requirements could easily be met by using a single triode valve of the indirectly-heated, small-power type, as shown in Fig. 3. In considering the available output the best course is to refer to the makers' figures regarding the maximum undistorted output for the various valves, or to look up the series of articles published in PRACTICAL AND AMATEUR WIRELESS under the heading of "Valve Types and Uses"; the articles dealing with output valves appeared in the issues dated December 29th, 1934, and January 19th, 1935.

## One or Two L.F. Stages?

A mains-operated set capable of providing an output up to 1 watt or so does not present any difficulty, and the design is perfectly straightforward. In the case of the battery receiver, however, there are several points which must be borne in mind. It is evident from the above statement that either of two entirely different L.F. arrangements will give the required results. The constructor might well ask why a two-L.F.-valve circuit

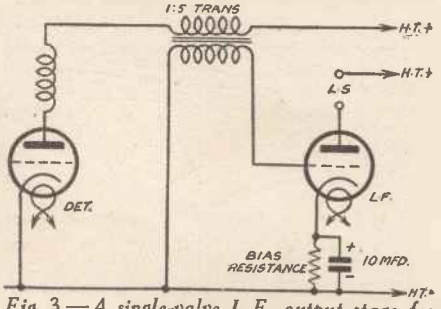



*Fig. 3.—A single-valve L.F. output stage for A.C. operation. This will give an output equal to, or greater than, that provided by the circuits in Figs. 1 and 2.*

should be considered when a similar output can be obtained by using a single pentode valve in a simpler circuit. Evidently, the cost of the latter arrangement must be less than that of the other, so what are the advantages of the two-valve circuit? The chief advantage is that it is somewhat easier to obtain

(*Continued overleaf.*)

(*Continued from previous page*)

"natural" reproduction from the two valves, due to the fact that each valve provides a lesser degree of amplification, so that there is in consequence less risk of instability. This point is one which has been over-emphasised, however, by a few critics who have always contended that a pentode must, of necessity, produce a certain amount of distortion by giving greater amplification to the higher notes. In practice this point is of far less importance than it is in theory, and a modern pentode, properly used, can be trusted to perform very satisfactorily.

### Pick-up Connections

A more important advantage of the two-valve arrangement occurs when the receiver is to be used as a radio-gram., or when pick-up terminals are to be provided. In this case it would be necessary—in order to obtain the required degree of amplification—to connect the pick-up in the detector grid circuit when only a single L.F. valve was employed. This is not an ideal method, especially if the pick-up leads have to be long and if the detector valve is of the high-amplification type. With the two-valve amplifier an adequate degree of amplification, and good quality reproduction, can be ensured by connecting the pick-up in the grid circuit of the first of the two L.F. valves. The two sets of connections referred to are shown in Figs. 1 and 2.

The position is similar, but not quite so difficult, in the case of a mains receiver. At the same time, however, the degree of amplification provided by a mains pentode is very high, and a fair output can be obtained by feeding the output from a modern sensitive pick-up into the grid circuit of the output valve. Despite this, when gramophone reproduction is regarded as being very important there are good reasons for using two L.F. valves.

### Detector-stage Requirements

We can now turn our attention to the detector valve of the hypothetical det.-L.F. circuit under consideration. Since this must be connected directly to the input from the aerial-earth system, it is evident that the valve should be highly efficient, and that it should be preceded by a reasonably selective tuning circuit. In many respects a screen-grid or H.F. pentode valve might be considered most suitable, since this would give a fairly considerable amount of amplification. In practice there are difficulties in matching valves of these types, however, since the impedance in the anode circuit should be something between 500,000 and 1,000,000 ohms; this cannot be provided by the average L.F. transformer, and if a resistance were used it would cause such a drop in the H.T. voltage that the valve would be prevented from functioning correctly. The best plan is thus to use a triode valve having an amplification factor of about twenty-four in the case of a battery receiver, and fifty in the case of a mains set; this means that the valve should be of the H.F. or H.L. type.

Ordinary leaky-grid detection is probably most suitable in a receiver such as that under consideration, but the advantages of other forms of rectification will be explained in later articles in this series. The aerial tuner should for preference be of the iron-core type and should be provided with a loose-coupled aerial winding, the complete detector circuit being as shown in Fig. 4, where both battery and A.C. versions are given. The circuit is a very usual one, but one addition is indicated, this taking the form of a 250-ohm fixed, non-inductive resistance in the reaction circuit. This may not always be essential, but its effect is to "smooth" reaction control, and thus to prevent the detector from bursting into oscillation suddenly. This is an important point, because the absence of H.F. amplification makes it necessary to obtain the greatest possible amount of amplification in the detector stage, which really functions as a combined H.F. amplifier *and* detector.

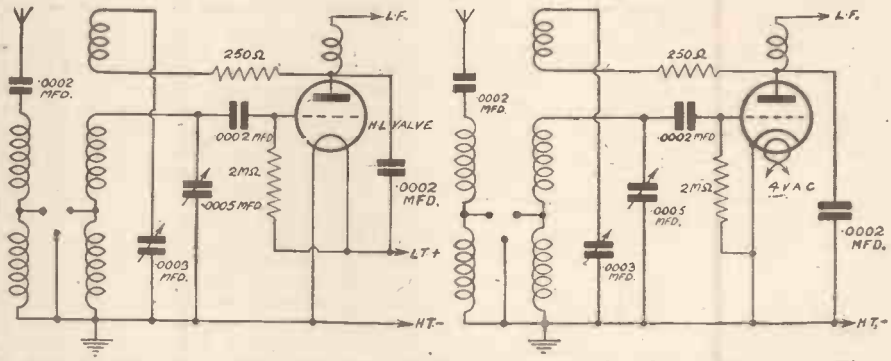



*Fig. 4.—These two circuits show the type of detector circuit referred to on this page. The circuit on the left is for battery operation, and that on the right for A.C.*

# A REMOTE-CONTROL DEVICE

HERE is a device for effecting control of the set from a distance, which is at once compact, neat, and efficient.

Fig. 1 shows the appearance of the arrangement when finished.

The coils should be fixed a sufficient distance apart so as to enable the armature to make close contact when in the "on" position, and just clear the tongue of the contact when "off."

The baseboard should be made of fairly stout wood, say ⅝in. thick, and should, to make a neat job, be stained and polished before the components are mounted.

The coils are made from the sawn-off ends of two cotton reels with two 1in. iron bolts and nuts ¼in. thick, wound with (approx.) 500 turns each of No. 26 D.C.C.

The hinge should move easily so as to enable the armature by its own weight to make good contact with the tongue.

Nos. 1 and 2 terminals are connected to the L.T. battery and set. Nos. 3, 4, and 5 are joined to two distant bell pushes, one contact of each being inter-connected.

Either triple flex or bell wire can be used for the extension.

The loose cover can be made of stout plywood and should be arranged so as to leave the terminals exposed, as shown in Fig 2.

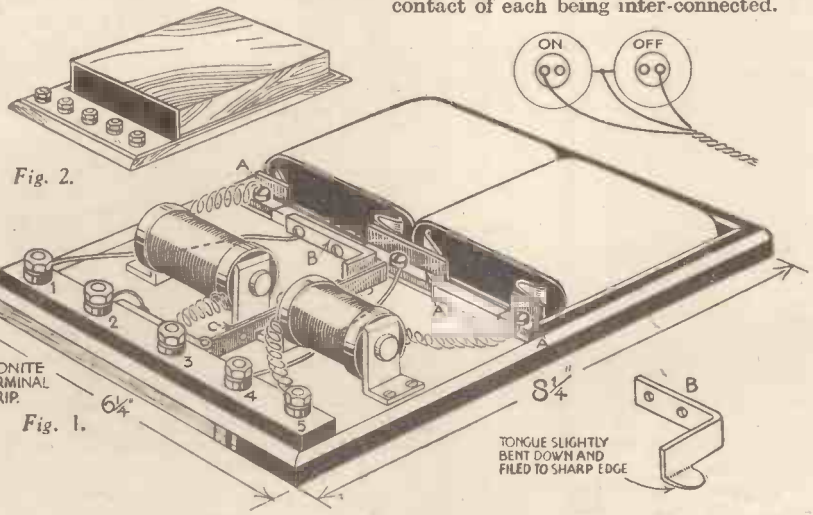



*Fig. 2.*

*Fig. 1.*

*The complete remote-control device, and a view showing the general arrangement of parts.*

## NOTES AND NEWS

### Interesting Statistics

IT has been computed that Europe is now in possession of twenty-three and a half million wireless receivers, and that some twenty-four and a half millions are distributed over the rest of the world, which represents a total of roughly forty-eight million sets. As a conservative estimate this would mean two hundred million listeners. The world population is usually put down at one thousand eight hundred millions, so we must take it that of its inhabitants one out of every nine listen to radio entertainments.

### Proposed New Pilsen Transmitter

THE Czech Broadcasting Company is seeking a site for the new broadcasting station which it has decided to build in the neighbourhood of Pilsen. The studio will take many of its concerts from Carlsbad.

### China Disapproves

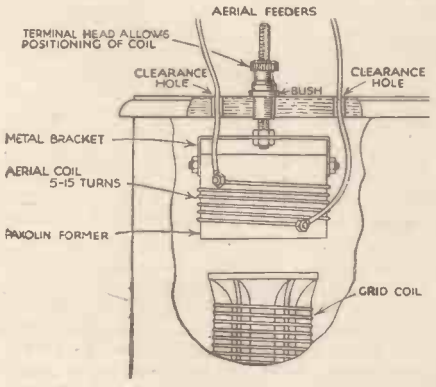
THE Peking Authorities recently decreed that Chinese studios must strictly veto the broadcast of "any songs or stories which may arouse laughter in naughty children." The telling of ghost stories in the children's hour is also forbidden.

# A PAGE OF PRACTICAL HINTS

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

## Variable Aperiodic Aerial Coupling

IN order to achieve stability in a two-valve S.W. set, and knowing that the aerial coupling has a lot to do with this factor, I devised the following scheme. I obtained a paxolin coil former, and to this I attached an angle bracket cut out of scrap tin.




*A variable aperiodic aerial coupling device attached to the lid of a receiver cabinet.*

Fixed to this is a brass threaded rod fixed with nut on each side. I fixed the former to the bracket with a nut and bolt on each side. I next drilled a hole in the lid of the cabinet directly above the tuning coil, and this hole is fitted with a bush suitable to take the brass rod on the aperiodic coil. The number of turns on this coil does not appear to be critical, and there is scope for experiment in this quarter. I use ten turns.

The brass rod on the aperiodic coil is pushed through the bush from the underside and a large terminal fitted. The aerial twin feeder lines are led in through two holes in the lid and are connected to each end of the aperiodic coil. If a single feeder is used the bottom end of coil is connected to earth.

This device has made my set very stable on all the short-wave bands down to 12 metres, and there can be no dead spots once the coupling has been adjusted for the particular wavelength employed. Coil changing is not interfered with in any way, as on raising the lid the coil is raised completely out of the way.—A. TETSTALL (Leicester).

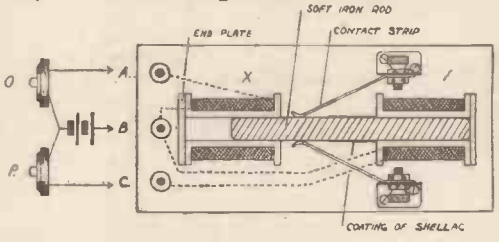
## An Efficient Remote Control Switch

HERE is a scheme for remote control which I have found to give highly satisfactory results in every way. The switching, in particular, is very definite. The base is a piece of ebonite or wood approximately 2in. by 4in., or, alternatively, the control may be built direct on to the baseboard of the receiver. A piece of ¼in. soft iron rod, 2½in. long, is obtained, and two formers for the solenoids are made to slide smoothly on it. These formers are each wound with 200 turns of 26-gauge enamelled wire, and a wooden disc is glued

### *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.**

on one end of each. A band ½in. wide in the centre of the rod is given a good thick coat of shellac and left to harden thoroughly. When this is ready the solenoids are slipped over each end and they are then mounted in their respective positions by clamping under metal bands screwed to the base. The connections to terminals A, B and C may be carried out as shown. The contact strips are cut from very thin sheet aluminium or brass (do not use any magnetic metal, as this would tend to retard the movement of the rod), and are clamped under terminals mounted on two brackets which are in turn fixed to the base. These contacts may rest quite firmly against the rod, but the correct pressure can best be

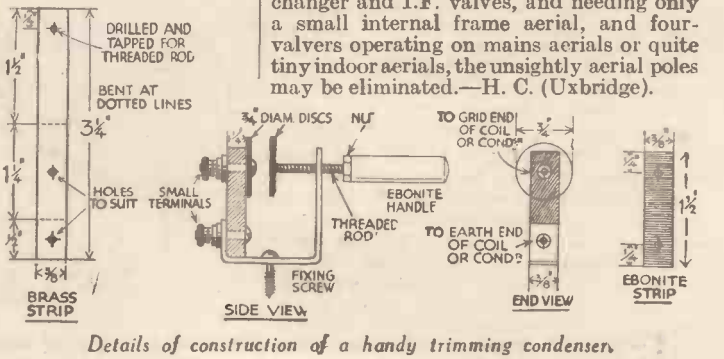



*Sectional view of a solenoid-operated remote control switch.*

found by experiment. Connections are made as indicated in the diagram, O and P being two bell-pushes, and the battery one of the 4½-volt flash-lamp type. When P is pressed the solenoid Y is excited and draws the rod into the position shown, making contact between the two strips. On depressing the other bell-push the rod moves in the reverse direction, the band of shellac breaking the circuit.—JOHN E. DAVEY (South Norwood).

## A Handy Trimming Condenser

THE following particulars are of a small variable condenser, which I have found very successful in resolving stations on my short-wave set. A station is tuned in by adjusting the slow-motion dial of the short-wave condenser in the usual way and the little condenser is then screwed forward or backward till the station is heard at its best. The material required consists of a piece of brass strip drilled and marked off as shown, a small ebonite strip, two ¾in. diam. brass or copper discs, a piece of threaded rod and nut to fit same, a handle from the junk box, two small terminals, and a screw for fixing to baseboard. Bend the brass strip to form a bracket. Attach one of the discs to the end of the threaded rod, then screw the rod into the threaded hole provided, and fix the ebonite handle. Attach the other disc to the ebonite strip by means of one of the small terminals. The other end of the ebonite strip is fixed to the bracket by means of the other small terminal. The condenser can now be fixed to baseboard ready for use, and the handle and nut can be so adjusted that the two metal discs can never touch when the rod is fully screwed forward.—F. T. EELES (New Washington).




*Details of construction of a handy trimming condenser.*

## Good Results with Short Aerials

THE sensitivity of modern receivers employing two radio-frequency stages or their equivalent in a superhet circuit is so great that a considerable amount of latitude is given with regard to aerial efficiency. In fact, many manufacturers of commercial receivers definitely state that their sets are built to give full performance with aerials consisting of from twenty to thirty feet of wire all told. As a matter of interest I have recently been making a few experiments with various types of set in connection with quite short indoor aerials, and with quite astonishing results.

The aerial I have been using is of the indoor type, only ten feet high, and with the horizontal portion only six feet long. It is well insulated, and the earth connection is short and direct to a really hefty earth plate. With this simple collector system, and a very ordinary type of four-valve superhet of good make, I have identified over fifty stations in a short evening, all free from interference, and all at really good strength.

Thus, with five-valve supers having one H.F. stage in addition to the frequency-changer and I.F. valves, and needing only a small internal frame aerial, and four-valvers operating on mains aerials or quite tiny indoor aerials, the unsightly aerial poles may be eliminated.—H. C. (Uxbridge).

# Negative Resistance

An Explanation of a Little-used Term which Sometimes Confuses the Amateur Wireless Experimenter.

By W. J. DELANEY

IN certain textbooks and also in various papers on electricity the term "negative resistance" occurs, and it would appear from correspondence that this term causes a certain amount of confusion in the mind of the non-technical listener. It would seem that this is because the term "positive resistance" is seldom seen, and it is not a simple matter, therefore, to compare two opposite types of resistance in order to arrive at a decision concerning one of them. It is well known that when a voltage is applied to any conductor there is a restraining force at work endeavouring to prevent the flow of electricity. This restraining influence will vary with the material being used and the form in which that material is arranged, and it is practically always referred to as "resistance"—but actually it should be referred to as "positive resistance," if the flow of electricity is a steady unvarying current. Thus in Fig. 1 we see a battery joined to a resistor, which may be the filament of a valve or any similar device, and the current flowing through that resistance will be a steady, unvarying current of a certain value, determined by the voltage of the battery and the size and kind of material from which the resistance is made. This is an example of "positive resistance."

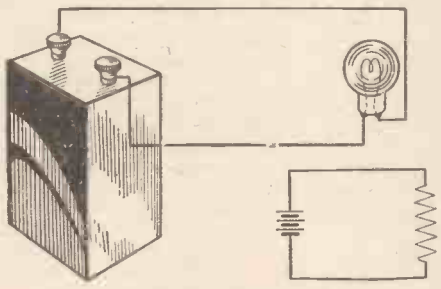


*Fig. 1.—A direct current supply across a resistance.*

## A.C. Instead of D.C.

The supply of current from a battery is, of course, what is known as a direct current, and is flowing always in one direction. If, however, instead of using this type of supply we use an alternating supply, what happens to the current flow when the changes in direction and polarity take place? It has already been explained in these pages that an alternating current starts from zero, rises gradually to a certain positive value, and then, at the same speed, drops back to zero, passing on to a negative value and again returning to zero. Therefore, if an A.C. is applied to a pure resistance, there will be a gradually increasing difference of potential between opposite ends with a periodic change in polarity, and there will be a fixed relationship between the potential difference, and the voltage, and the value of the resistance, just the same as with the direct-current supply. If, however, instead of using a pure resistance we use an ordinary arc, and superimpose an A.C. supply on a D.C. supply applied to that arc, we find a different state of affairs. Firstly, the alternating current will always flow through the arc in the opposite direction to that in which the alternating difference of potential is acting, because the total current will be reduced owing to the fact that at certain moments currents are flowing in an opposite direction. From this it may be seen that instead of an arc consuming energy in a circuit of this nature and thus tending to stop the flow of A.C., it actually encourages the A.C. circuit and supplies energy.

## The Duddell Circuit

Now look at Fig. 2, which shows an ordinary arc circuit across which is joined an oscillatory circuit (a coil and condenser in series). If the resistance is adjusted until the arc is struck there will be a steady flow of current through the arc; but a steady current cannot flow through a condenser and thus it was discovered by Duddell that an alternating current is set up in the circuit formed by the arc and the coil and condenser, and this is due to what is known as the negative resistance of the arc. Due to this fact also, it is found to be impossible to strike an arc from a source having the exact voltage required by the arc itself, but it must be connected to a much higher source of supply with a resistance in series.

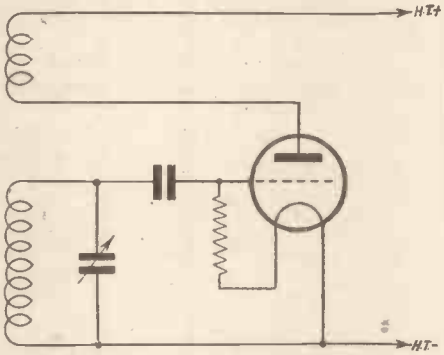



*Fig. 3.—A standard reaction arrangement, the degree of coupling between the coils being variable.*

## The Ordinary Reaction Circuit

The ordinary valve as used in a wireless receiver also has the ability to provide negative resistance under certain conditions, and the most popular arrangement is generally referred to as the reaction circuit. By referring to the ordinary detector valve circuit (Fig. 3) and comparing it with the points just mentioned, we find that if the anode is joined to the positive terminal of a battery (or source of direct current) and the heated filament is joined to the negative pole of that battery, there will be a steady direct current flowing from filament to anode inside the valve. Ignoring, for the time being, the effect of a potential on the grid, if an increase in anode current is required it will be necessary to increase the anode potential, and thus in this condition the valve offers a positive resistance to A.C. We know, however, that the potential on the grid can have a very marked effect on the flow of current in the valve, and for this reason the L.F. valve is biased to reduce the anode current. Thus an increase in anode current may be obtained (without varying the anode voltage) by modifying the grid potential, but if this applied potential is of a certain value it will be found that the increase in current may be obtained and yet the anode potential may be decreased. In this condition the valve offers negative resistance, and the conditions are satisfied by connecting an inductance coil in both anode and grid circuits and arranging these in such a manner that there is a degree of coupling between the two inductances. The degree of negative resistance is governed by the degree of coupling between the two coils, and in theory it should be possible to adjust this coupling to such a point that the resistance could be reduced to zero, but various small fluctuations in the ordinary valve circuit prevent this ideal from being obtained. As the degree of negative resistance increases, however, the changes in anode current due to an applied E.M.F. in the grid circuit will grow, and thus whereas, without the negative resistance effect, a weak signal in the grid circuit would produce no change in anode current, we are enabled, with the aid of this effect, to obtain changes in anode current from very weak signals and thus build up the strength of an otherwise inaudible station. This is, of course, one of the most valuable properties of the reacting detector valve, and the effects are well known to every listener. With reaction it is possible to hear many stations which are otherwise inaudible.

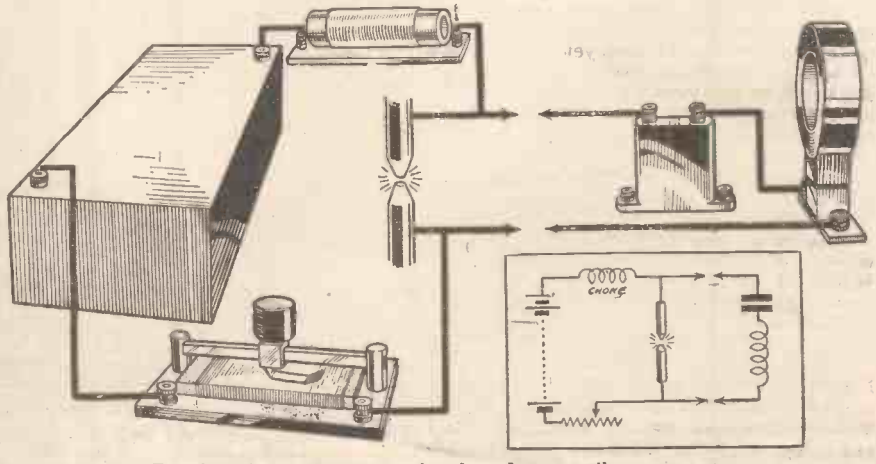
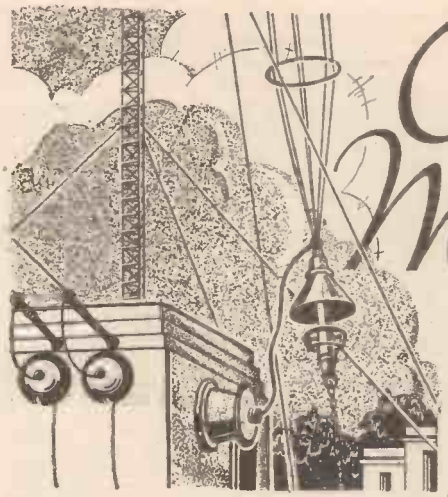
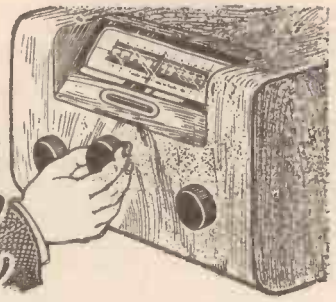



*Fig. 2.—An arc circuit combined with an oscillatory circuit.*



# On Your Wavelength



By Thermion

## Tone Control

ONE of the most important features of the modern receiver is the ability to control the tone of the reproduction. Unfortunately, in the majority of cases, such control merely consists of a suppression of the top notes in order to make the music sound "mellow," and in many cases this suffices. It is really surprising, however, what can be done in the matter of real control of tone when a specially-designed circuit is employed. I have just built a receiver incorporating a transformer of this type, and when used with the potentiometer designed for the purpose a most interesting range of control is obtainable, from "all bass" to "all top." The difference between this kind of control and the mere suppression of one end of the musical scale must be heard to be believed, and I advise those who are interested in this subject to obtain one of these special transformers right away. The suppression of the bass register is particularly useful in the case of those who are hard of hearing, as in some manner it causes speech to be particularly penetrating and without any increase in volume it enables certain persons to follow a wireless talk with a moderate degree of comfort, where the ordinary signal would be almost indistinguishable.

## From a Victim?

H. A., of Leeds, tells me that, after reading my comments, he wondered whether I have ever taken the trouble to listen to the Morning Service in the company of the sick, aged, or infirm, and noticed the reaction. He says: "I myself am both aged and infirm, and for the last two years have not been out of doors. I have also been an inmate at various hospitals, so can claim to be one for whom the broadcasts were intended. I have listened to numerous religious broadcasts and can truthfully state that I have yet to hear one that could be of any real value. I have protested to my local parson and pleaded that if religious broadcasts must be given they should be made strictly non-sectarian. But, better still, cut them out completely. I can assure you that religious broadcasts at any time are useless as consolation for the sick."

This reader does indeed view the matter with hollow eye, wrinkled brow, and jaundiced outlook, and I cannot agree that religious broadcasts are not appreciated by many thousands of people who otherwise would not go to church.

## Police Radio

ONE of my friendly baiters who shall be nameless, since he is employed in the police force, drops me a cheerful note, as one whose job is receiving police calls eight hours per day for six days of the week. He is a "sparks" in the Metropolitan police on one of the Q cars. Let him speak, and hark unto his wisdom, for in the multitude of counsellers shall we learn or obscure the truth! The platform is yours, friend "sparks": "Gadzooks and overhead tramwires! What a life it is. Can't you agitate in your weekly page for all motorists to fit suppressors to their cars? However, your paragraph about Sergeant Smith is really great. Our stuff comes over in fast morse—average 18 to 20 words a minute, and this is coded, so without a code book a message would appear to have no meaning. There is no secret wavelength. Most forces use 149 to 150 metres, and as you suggest, any 'ham' could quickly pick up a transmission. Trolley buses, sparking plugs, and steel buildings are our great bugbear, and some of the amateur transmitters occasionally stray on our frequency and make matters worse. About our gear; we use rotary converters for power worked by Exide accumulators. The set has 2 H.F. stages and the circuit is so arranged that it only covers a little each side of 150 metres. Our methods are similar to those of the navy, most of our 'sparks' being ex-naval operators, although I learnt my stuff with an amateur transmitter before I joined the force. I enjoy your page each week, as I am sure most readers do. Naturally I don't always agree with you (my wife gets particularly sore *re* your references to crooners), but it is always full of interest. I thought we might lose you when *Amateur Wireless* was merged into yours, but am glad to find you still with us. Well, Thermion, that's the lot. Sorry your readers can't hear those famous words, 'Calling all cars!'"

I am really grateful to this reader for the friendly tone of his letter, and for the information he conveys. I rather like his phrase that "he" does not agree with me, and his later reference to his wife!

## Soldering Tags *versus* Terminals

ANOTHER reader, G. F. F., of Dagenham, entirely disagrees with my opinions concerning soldering tags and terminals. He says that the fitting of terminals to components was a distinct boon to home constructors and helped to popularise radio. Clean and efficient soldering will always remain the hall-mark of an expert, and he thinks that very few constructors are experts at soldering. Whilst he says that he is passably good at soldering he prefers a nice loop fitting snugly over a terminal shank to messing about with a hot iron, flux, etc., and the so-called secure soldering tag with the ever present danger of burning and damaging the interior wires of the component. It is my opinion that terminals should be abolished and an effort made to live down the influence of schoolboy "designers" on the component industry.

## Home Construction *versus* Commercial Tests

ANOTHER of my friendly baiters, J. C. P., of Nottingham, whom, you will remember, crossed swords with me and threw down the gauntlet regarding my statement that you can build cheaper and better than you can buy, has been eagerly perusing my notes ever since with the object apparently of being able to divorce one of my sentences from its context and therefore prove me to be wrong. His latest missive to me asks ingenuously, "Is Saul also among the prophets? In PRACTICAL AND AMATEUR WIRELESS, on page 480, a contributor (not Thermion) says that the inevitable has occurred—that modern commercial designs and manufacturing facilities have been able to produce better general-purpose sets than the average amateur." I should imagine that J. C. P. by this time would have realised that self-evident facts should not need the

(*Continued overleaf*)

**RADIO ON THE AIR LINES**


*An Imperial Airways Liner being serviced by one of the Marconi Service Vans.*

(*Continued from previous page*)

stress which he seeks to place upon his argument. In the words of Macbeth, or somebody, "Methinks thou dost protest too much." If J. C. P. will re-read the article he will find that the contributor referred to does not arrive at the same conclusion as is inferred from this isolated paragraph. J. C. P. must not read only one paragraph of an article. The circulation of this journal is evidence enough of my point of view, and I now leave J. C. P. to the mercy of other readers who will, I trow, proceed to flay him in the correspondence pages. In any case, what's the pother? If J. C. P. wants to lash out his guineas on commercial receivers there is nothing to stop him. I suspect, however, that he would soon return to the fold when something new came along, and which he would want to sample; for the very good reason that he would not be able to do so by adapting a commercial receiver. He would probably be quite at sea as soon as he removed the back and saw the passable imitation of a telephone switch-board there revealed.

## Standards for Radio Interference Suppression Devices

IT will be recalled that the Institution of Electrical Engineers some time ago set up a Committee to consider the whole question of radio-interference. The subject is also being considered internationally by the International Electro-technical Commission, in the work of which body the I.E.E. co-operates through the British Standards Institution. Many of the problems have yet to be solved, in particular the methods of assessing and measuring interference and the limiting values to be imposed for the amount of interference permissible. On such subjects standardisation is not yet possible, but in the meantime, a very useful British Standard specification has been issued for the components to be used in interference-suppression devices. This specification originated in a sub-committee of the I.E.E. Committee, and was completed by the B.S.I., on the Committee of which sat representatives of the Post Office, B.B.C., Electrical Research Association, the Incorporated Municipal Electrical Association and Supply Companies, the Radio Component Manufacturers' Association, Radio Manufacturers' Association, and the B.E.A.M.A. The manufacturers of domestic appliances, through their Association, the B.E.A.M.A., have throughout the whole of the work given their fullest co-operation.

The specification proper deals with the rating, performances, and testing of condensers, inductors, and resistors used in the construction of interference suppressors. To many readers of the specification, however, the most interesting and instructive section will probably be the Appendix, in which are given numerous diagrams of connections and schedules of component values, which have been found satisfactory in practice for the suppression of interference from various types of machines and appliances.

## Limits of Radio Interference

IT is intended that this specification shall be followed by a general specification dealing with the permissible limits of radio interference and methods of measurement of such interference.

In this connection a great deal of experimental work has been carried out in co-operation with various countries, under the auspices of the International Electro-technical Commission. International collaboration and understanding have been of advantage to all countries, in that each has been placed in possession of the knowledge and experience gained by others on this somewhat complicated and difficult subject.

Copies of this specification (B.S.S. No. 613-1935) may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

# Notes from the Test Bench

## Controlling Pentode Voltage

HARMONIC distortion is practically eliminated in a well-designed push-pull output stage, and therefore the use of two valves in push-pull in place of the normal single valve provides a marked improvement in quality of reproduction. When triode valves are used, however, it is necessary to use an intermediate L.F. stage or a very high ratio input push-pull transformer between the detector and the output stage. An ideal arrangement is a detector, resistance-capacity coupled to an L.F. valve, with a low-ratio push-pull transformer coupling this to triode output valves.

In cases where it is not desired to use an intermediate L.F. stage, pentodes may be connected in push-pull in the output stage. When pentodes are used in this manner, however, best results can only be obtained when the priming grid voltages are adjusted until the valves have a similar H.T. current consumption. If the two valves have exactly the same characteristics, it is only necessary to join the priming grids and connect the junction to the required voltage point, but it often happens that valves having similar type numbers have slightly different characteristics. It is therefore advisable to fit a controlling potentiometer in the priming-grid supply circuit. A component having a resistance of between 5,000 and 10,000 ohms is suitable. The two priming grid leads should be joined to the end terminals, respectively, and the centre terminal of the potentiometer to the H.T.+ lead. In most cases it will be found that best results will be obtained when the potentiometer control is at half-way setting, but when the valves are badly matched, rotation of the control from the midway setting will be necessary in order to reduce hum and improve quality of reproduction.

## Universal Receivers

A.C./D.C. receivers, or universal receivers as they are commonly called, have become very popular during the past twelve months, this being probably due to the fact that this type of set is suitable for use on several different types of supply mains, namely, D.C., A.C. 25 cycles, and A.C. 50 cycles. It is sometimes found, however, that a universal set that works quite satisfactorily when supplied from D.C. mains, hums rather badly when connected to A.C. mains. This hum is sometimes due to a defective or inefficient rectifying valve, but it may also be due to bad design, especially if the hum is experienced when the receiver is first put into operation. In the interests of economy, the condensers that should be connected across the mains supply leads are omitted in the cheaper type of set. These condensers should have a capacity of approximately .1mfd. and should be connected in series across the mains leads, the junction being then connected to the earth terminal of the set. It is also found, in some cases, that a condenser having a capacity of 2 or 4 mfd. provides a remedy for excessive hum, if connected between the heater end of the main dropping resistance and the earth terminal or the negative main.

## Safety in the Air

IF you have explored the waveband around 900 metres, no doubt you have heard the Croydon aircraft station calling to machines on the way to and from the Continent. It is quite interesting to hear the Croydon operator call a machine and instruct him regarding his whereabouts, and to hear perhaps a pilot asking for directions owing to poor visibility. All users of this type of travel must feel very safe to know that the machine is in contact with the "home port" the whole of the time, and the Marconi Aircraft Service Department is located on Croydon aerodrome in order to maintain the Marconi receivers and transmitters which are fitted to the large majority of commercial aircraft. The illustration on page 521 shows a Marconi aircraft set being delivered to an Imperial Airways machine for fitting. I suppose that in time the pilot himself will be replaced by a wireless equipment which will guide the machine through the air from one side of the Channel to the other, keep it clear from all obstructions and other aircraft, and bring it safely to the earth at the other side.

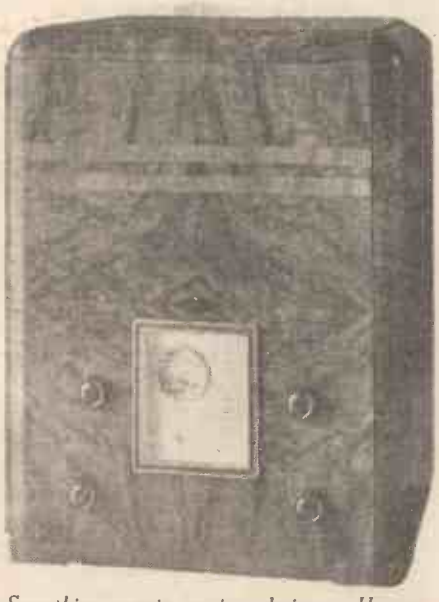
## Metallised Chassis

IT might appear to be a rather superfluous remark, but it is a fact there are metallised chassis *and* metallised chassis. This was made very evident to me the other day in the course of testing a new superhet receiver made by an enthusiastic amateur. The set had been made extremely well, the connections appeared to be perfectly correct, but signals could not be obtained. Continuity test revealed that high-tension current was not being passed by certain valves, and that there was no voltage being applied to their anodes. In view of this the various connecting leads were tested for continuity, whilst the components were checked individually. After a short time it was found that the earth-return leads, which were taken to the chassis, and which should therefore have been well bonded together, were not in electrical contact—in fact, the resistance between some of them was almost infinite. Immediately the various earth connections were joined together by lengths of wire the receiver functioned in a commendable manner.

It was not until all this had been done that the owner of the receiver admitted that he had not used the metallised chassis frequently specified in these pages but had, instead, made the assembly from good ply-wood, and had later sprayed this with aluminium paint obtained from a hardware store. I know that the Technical Staff of PRACTICAL AND AMATEUR WIRELESS have previously pointed out that this paint is useless for the purpose in question, but it seems that another reminder is not out of place!

# RADIOLYMP

## Although Full Details have Not Yet Been Supp Preliminary Information is Available and



*Something new in receiver design. Here an ordinary meter has been fitted for the purpose of a tuning indicator and the control panel thus presents a rather novel appearance.*

ON the eve of the Radio Exhibition the activities of all the exhibitors have risen to a peak, and much of the secrecy which has hitherto veiled the various plans is now removed. Obviously, there are still a number of "hush-hush" plans which will not be disclosed until the doors of Olympia are actually thrown open to the public, but from the various hints which have been dropped here and there, coupled with the information which has been supplied to us by the manufacturers, this bids fair to prove a record Olympia, eclipsing even the show of 1934. As usual, the exhibit of complete radio receivers and radiograms may be regarded as the larger proportion of the Olympia review, although this year the display of components for short-wave and television receivers will be found to be extremely large. No doubt amongst the complete receiver range the automatic radiogram will attract the greatest amount of attention. It will not be the first time that this type of apparatus has been exhibited, but hitherto the price of the automatic instrument has been rather on the high side. With the increased demand, and the improvement of machinery, etc., this apparatus has now been reduced to quite a reasonable figure, and as an example, we may mention the H.M.V. instruments. Even the latest Duo Diffusion Autoradiogram Nine may be obtained at fifty-two guineas, whilst the De Luxe High Fidelity 15-valve Autoradiogram may be obtained for 110 guineas. These amounts are quite large in themselves, but when the apparatus which is obtained is taken into account it will be seen that they represent very good value. In the range of H.M.V. apparatus there will be seen the fluid-light tuning device, an invention which simplifies tuning and which is now being fitted to the majority of commercial receivers in one form or another. In the H.M.V. apparatus this takes the form of a column of light which resembles the mercury in a thermometer, and it varies according to the signal strength.

*One of the new Celestion models. The large magnet system is an important feature in a speaker of this type.*

*A "long receiver"—one of the new H.M.V. lines for the battery user which, in addition to its shape, possesses the novelty of a circular speaker fret.*

### Cossor Tuning Indicator

A somewhat similar scheme is provided in some of the Cossor receivers, but in this case it is employed to indicate the station to which the receiver is tuned instead of the actual strength of the signal. The names of the stations, together with the wavelengths in metres, are printed on a vertical scale at the side of a tube of glass, and a black column appears to rise inside the tube as the control knob is turned, and thereby indicates the wavelength to which the receiver is tuned. The portion of the scale carrying the station names is removable and may be changed should a rearrangement of wavelengths ever be carried out.

In addition to the exhibition of Cossor receivers and valves, we understand that there may be other features which at present are a matter of secrecy. Of course, the cathode-ray apparatus manufactured by this firm will also be on show, and will no doubt attract considerably more attention this year in view of the possibility of television transmissions by the end of the year.

### Testing Instruments

In view of the importance of testing equipment, the amateur will be very interested in the stand of the Automatic Coil Winder Company. Here will be seen the Avominor for D.C. or A.C. testing, the well-known and popular Avometer for either D.C. or A.C. ranges, and other valuable equipment. A new Oscillator for calibration purposes will be seen on this stand, and at a cost of £5 10s. this is a valuable accessory for the service engineer or the keen experimenter. The neat box of testing accessories, which include various lengths of flex, testing prods, crocodile clips, etc., will appeal to every constructor, even although the actual Avo instruments are not in his possession. Messrs. Everett Edgcumbe will be showing the range of Radiolab instruments, which include a device known as a Set Analyser and Valve Tester. This is aptly described as a "fully equipped portable radio laboratory," and will never become obsolete. With it, valves can be tested independently of the set for emission, and the characteristics checked. The arrangement of the apparatus enables every type of wireless receiver to be checked under actual working conditions, and every valve and component may be tested. Multiple switches are provided for carrying out the various tests, and the meter is of a unique design, the scale being set at an angle of 15 degrees to the panel, so enabling ready readings to be obtained. An A.C.-D.C. change-over switch is provided so that no alteration of connections is required, and the apparatus is sold under a full guarantee of twelve months. It costs £12 12s., and weighs 12lbs., and is contained in a neat leather attaché case. Another interesting item on this stand will be the Output Meter, which gives, in a direct scale reading, the output in milliwatts or decibels. A switch enables the milliwatt range to be covered in three different degrees, from 0 to 40 from 0 to 400, or from 0 to 4,000 milliwatts. The price of this is £3 15s.

*Simplified tuning is ob and flood-lit dial—fitt rec*

# IA — 1935

## lied by all the Exhibitors, Certain Given in this Article

### Short-Wave Accessories

The forthcoming ultra-short-wave television transmissions are lending tremendous interest to short-wave work, and no doubt those stands upon which short-wave components are exhibited will be surrounded by enthusiasts who are anxious to learn more about this interesting branch of radio. Messrs. Wingrove and Rogers will be showing their popular type "C" and "E" condensers, and, in addition, will introduce the type "G" Single and Two-gang, which is provided with zinc alloy vanes and an insulated spindle for the two-gang model. In addition, on this stand will be seen the range of Polar-N.S.F. volume controls, resistors, condensers, etc., together with the well-known Polar ranges, an addition to which is a four-gang midget condenser for use principally in superhets.

*A super-radiogram which in addition to offering radio as well as gramophone record reproduction, also avoids record changing. The process of which is carried out automatically.*

*tained with this large d to the McMichael*

The Eddystone components will also be well represented, and they need no emphasis from us regarding their efficiency for short-wave work. Full details of these have, unfortunately, not been released at the time of going to press, but will be dealt with in a later issue.

On the stand of the Radio Society of Great Britain will be seen a 1.25 watt crystal-controlled transmitter for 7 or 14 mc. operation, together with a receiver for use on the 1.7 to 28 mc. band, in 5 separate ranges. Other apparatus of interest to the transmitter will be seen on this stand, and a short-wave converter will no doubt appeal to the amateur whose interest lies solely in the reception of distant stations on the ultra-shorts. As in previous years this stand will form the meeting-place of amateurs from all parts of the world.


*In addition to its use as a tuning accessory and station locator, this Haynes oscillator may also be used to obtain improved results from a gramophone pick-up.*

### Unusual Exhibits

Amongst those exhibits which might be described as unusual, mention may be made of the Haynes Radio high-quality table receiver. This is illustrated on page 524, and, as will be seen, a meter is fitted on the control panel in preference to any other form of visual tuning indicator. This firm is also showing an oscillator, which, in addition to providing a ready form of ganging device, or station locator, may also be used for producing a tone-corrected and modulated transmission from a gramophone pick-up. Thus, this record-reproducing device may be used with any receiver, even although pick-up terminals are not fitted. The quality produced from a gramophone record by this means is much better than when a direct connection is employed.

Another item of rather unusual type is the Carryset, to be shown by Electrico (Croydon), Ltd. This is a canvas and felt device designed to protect sets while they are being taken out for demonstration purposes, and costs 21s. No doubt it will appeal to service engineers and others who find it necessary to convey receivers from one place to another.

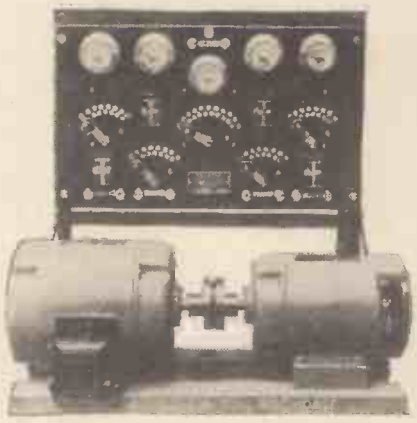
### Bulgin Components

On the Bulgin Stand will be found the usual exhaustive range of small parts which have in the past proved so valuable to the home-constructor. It would, of course, be impossible to describe all of these, and no doubt every visitor to the Exhibition will find the stand of absorbing interest.

(Continued overleaf)

*A powerful auditorium type of speaker which is now to be found in the range of Celestion products.*

*A Westinghouse metal rectifier for use in L.T. circuits and other similar low-voltage equipments. The large cooling surface of the fins is an important feature of this model.*



*A useful complete charging plant.*

(Continued from previous page)

A screened aerial will be seen on the stand of the New London Electron Works, and the Globe aerial, which was first seen last year, will also be on show again on this stand. The "Superial" and the "Simple Strip" will also be featured here, and will take their places with other interesting wire products.

All Power Transformers, Ltd., will for the first time show a new shrouded transformer produced for the amateur set-constructor. These are of exceedingly robust design, and are section wound with paper interleaving, and thus form a very useful accessory.

### Dry Batteries

To the listener who has not the electric light mains at his disposal the question of battery supplies is one which is of continual interest. Vidor, Ltd., will be showing a very exhaustive range in addition to their receivers and radiograms. Messrs. C. A. Vandervell, Ltd., will also be showing an interesting range of batteries, as well as accumulators, and the various price reductions will lend added interest to this exhibit.

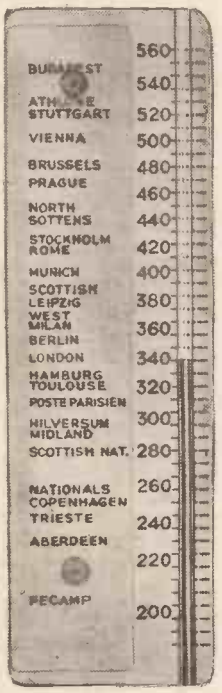
On the stand of H. Clarke and Co. (Manchester), Ltd., a new Atlas Mains Unit will be seen, and this is shown immediately below. It incorporates a Westinghouse Metal Rectifier and delivers an output of 12 mA. at 120 volts. Three tappings are provided, at 60, 90, and 120 volts, and the price is 39s. 6d. Other well-known Atlas Mains units will be seen on this stand. The well-known Full-o'-Power Batteries will be shown by Messrs. Siemens Electric Lamps and Supplies, Ltd., and these are augmented by a range of batteries designed especially for certain types of commercial receivers in which certain particular physical dimensions have to be maintained.

*A new Atlas Mains Unit for the battery user.*

### Midget Valves

The recently-introduced Midget valves will, of course, attract considerable attention to the Hivac stand, and a new idea known as A.V.E. (Automatic Volume Expansion) will also prove a popular feature on this stand. More will be said about this scheme in a later number, but no visitor should miss the special midgets designed for ultra-short-wave work and the special Harries output valves.

Sufficient has been said to show that this exhibition promises to eclipse all previous shows, and every reader should make an effort to visit Olympia in order to see just how the science has progressed in the course of a year.




*Something new in tuning dials. The column rises and falls, and indicates the tuning point.*

## C.W. AND THE SUPERHET

**Can C.W. Be Received with the Average Superhet?—This Question is Analysed Below.**

A FEW weeks ago it was stated in these pages that continuous-wave reception was not normally possible with a superhet unless reaction was applied in the second-detector circuit. This statement was queried by a few readers on technical grounds, and it might therefore be desirable to explain the point in greater detail.

Those readers who have written with regard to the matter rightly point out that there is a beat frequency produced between the received signals and the local oscillations; their point is that, this being the case, the same beat must be produced on C.W. stations and that this should be audible. The fallacy of this can be appreciated at once when it is pointed out that if the idea were correct "chirps" would be heard when tuning to telephony signals, since the beat frequency is of exactly the same form. Everyone who has operated a superhet knows that carrier waves are not heard as whistles unless there is a fault in the receiver, or unless second-channel interference is being experienced.

The explanation is that, although a beat frequency *is* produced between the received signal and the local oscillations, this beat is *not of audible frequency*, its frequency being that to which the I.F. amplifier is tuned—110, 126, 150, 465 kilocycles, etc. Thus, the signal passed on to the second detector is comparable with that applied to the first detector, and the carrier wave cannot be made audible unless the signal is "mixed" with another set of oscillations differing in frequency by a number of cycles which is within the audible spectrum—roughly, between 50 and 20,000 cycles.

When this was explained to one reader he replied that this might be true when a gang condenser was used for tuning, since this ensured that the intermediate frequency was of fixed value. "But what happens when separate tuning condensers are employed?" he asked, "surely in that case the frequency of the oscillator could then be made to differ from the signal frequency by a number of cycles per second which is within the audible range?" He had overlooked the fact that unless the beat frequency was that to which the I.F. transformers were tuned it would not be "accepted" by the intermediate-frequency amplifier, and would therefore not reach the second detector and the loudspeaker.

That seems to clear the misunderstanding.

## METRES AND MEGACYCLES

MANY attempts have been made at different times to induce the constructor and experimenter to adopt the frequency designation instead of describing a transmission in terms of wavelengths in metres, but these have met with little success so far as the broadcasting bands are concerned. This is perhaps unfortunate in many respects, since the frequency notation has much to recommend it, and wavelengths have invariably to be converted to frequencies in order to make calculations of inductance, etc. The position on the short waves, however, is different, for almost every short-wave enthusiast speaks in terms of megacycles, and all amateur transmitters announce the frequency of their transmissions in preference to giving the wavelength.

Because of this the beginner on short waves often finds difficulty in calibrating his receiver by making use of the many available transmissions. Actually, the conversion from megacycles (millions of cycles, or thousands of kilocycles) to wavelengths is perfectly simple, since 1 megacycle is equivalent to 300 metres, 2 megacycles to 150 metres, 3 megacycles to 100 metres, 4 megacycles to 75 metres, 10 megacycles to 30 metres, 15 megacycles to 20 metres, 60 megacycles to 5 metres, and so on. The short-wave experimenter will find it very helpful to cultivate the habit of thinking in terms of megacycles instead of in metres, for this will save a good deal of trouble in applying the simple conversion calculation.

It might at first seem that matters would be complicated by using the megacycle notation, since it is not easy to convert, say, 14.6 megacycles to metres—this works out at approximately 20.548 metres, and is found by dividing 14.6 into 300—but the point to remember is that the transmission was no doubt arranged for 14.6 kilocycles, and not for its metre equivalent. The custom of using the megacycle notation for short-wave transmissions is growing, and may have become universal by the time that the ultra-short-wave television transmissions come into operation. It will therefore be worth while to get accustomed to it now.

# Circuits Readers Ask For

The Circuit Described This Week is for a Four-Valve "Quality" Receiver of Simple Type, and for Operation from A.C. Mains.

By FRANK PRESTON

FOR some time now there has been an insistent demand from a large number of readers for the circuit of a "quality" receiver capable of providing an undistorted output of at least 4 watts. In the previous series of articles entitled "Circuits and Sets for All," details were given for the construction of a "quality" two-valver, but although this fulfilled the requirements of many, it was not quite ambitious enough for others. It was with these facts in mind that the circuit shown on this page was prepared.

A word of explanation seems to be necessary since the exact meaning of the term "quality receiver" would be difficult to define and, whereas some designers may understand this to imply a rather elaborate multi-valve receiver giving an undistorted output of at least 10 watts, others would interpret the term far more liberally. There is another point to be borne in mind, which is that a "quality" receiver is of necessity expensive and, to a certain extent, the cost varies with the degree of quality demanded. But when the requirements of those readers who have been good enough to write to us are "averaged" it is evident that what is most wanted is a set which gives the best possible reproduction consistent with a total cost of parts not greatly exceeding ten pounds (exclusive of valves and speaker); this factor also was closely considered in drawing up the circuit to be described.

## "Quality," Range and Selectivity

When all the various requirements are taken into consideration it becomes fairly clear that the type of circuit most likely to satisfy the majority is one which, although particularly designed to give really good reproduction of two or three comparatively local stations, will, when required, bring in a reasonable number of more distant transmissions. That is why the circuit under consideration is provided with a screened pentode high-frequency amplifier. The addition of this valve provides the further advantage of increasing the degree of selectivity to such a stage that the local transmissions can readily be eliminated when distant reception is desired; it also allows the detector valve to be operated without reaction, even when the set is used in conjunction with an aerial of only moderate efficiency.

## The H.F. Circuit

A pair of iron-core coils are specified because they give better selectivity, and make it possible to dispense with reaction without the loss of reasonably sharp tuning. Despite this, however, a reaction circuit is included, but this need not be used except on those occasions when it is desired to "reach out."

The first valve is of the variable-mu type, so that the volume level can be varied without the introduction of distortion, and also so that detector overloading can be prevented when the set is operated near to a transmitting station and is used with a good outdoor aerial.

The detector valve is a triode of the L.F. type and operates on the popular power-grid principle, the values of the grid leak and condenser, and also of the anode voltage, being suitably chosen for this form of rectification. Following the detector valve are two resistance-capacity-coupled triodes which are worked well within their output and input ratings. Thus, the stage gain is fairly low, but the overall amplification sufficient to ensure an undistorted output of at least 4 watts—the PP5/400 output valve has a rated undistorted output of nearly 6 watts, but it is not fully loaded, whilst the H.T. voltage applied to its anode is slightly less than the maximum of 400.

## Pick-up Connections

A radiogram switch is included in the grid circuit of the first L.F. valve, so that a large output can also be obtained from gramophone records, especially when a modern, sensitive pick-up is employed. It is also worthy of mention that both the grid and anode circuits of this valve are adequately decoupled, with a result that there is no danger of instability, with its consequent distortion. Additionally, there is an L.F. volume control which operates on both radio and gramophone reproduction.

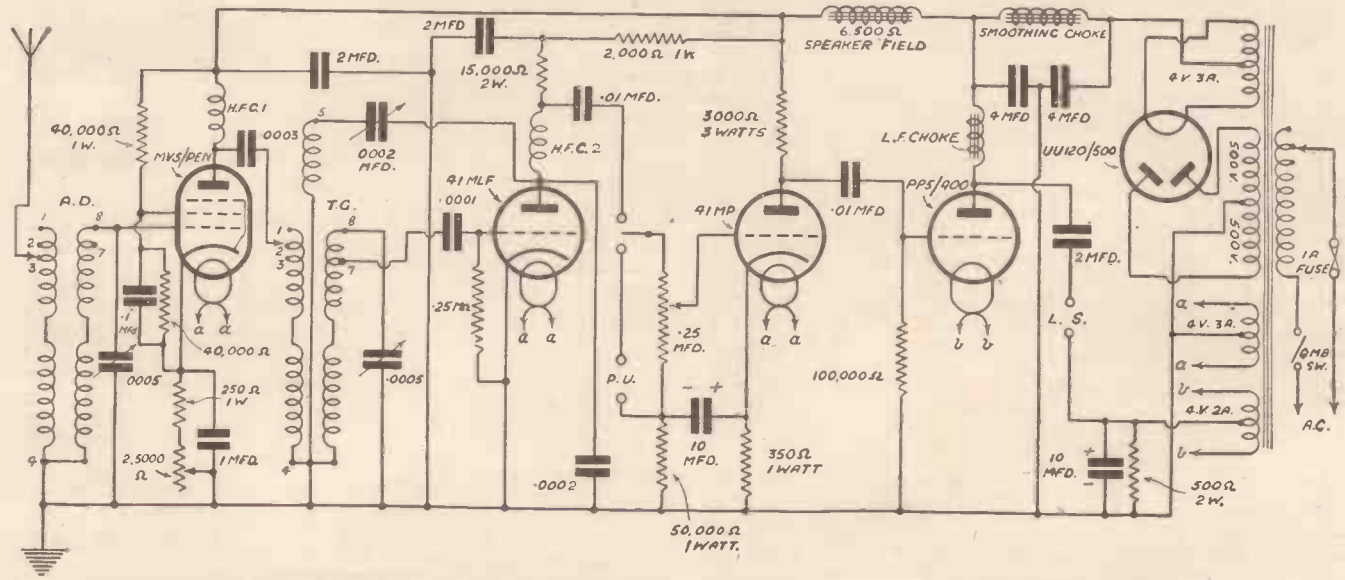
Turning to the power-supply section of the receiver, the rectifying valve is of the full-wave type, and gives a maximum output of 575 volts at 120 milliamps; as the total current load is only about 100 milliamps the actual voltage output from the rectifier is nearly 600 volts. The smoothing and L.F. output chokes, however, reduce this to rather less than 400 volts for the output valve, whilst the 6,500 ohms field winding of the moving-coil speaker reduces the available voltage for the other valves to approximately 200. This is further reduced in the case of the detector valve by the coupling and decoupling resistances, and in the case of the first L.F. valve by the coupling resistance wired in the anode circuit.

Special mention should be made of the method of smoothing, since this is rather unusual. A smoothing choke having a D.C. resistance of 210 ohms carries the anode current for all four valves, whilst the 6,500-ohm field winding of a D.C.-type moving-coil speaker is used in the feed to the first three valves only. This winding provides adequate smoothing, besides dropping the H.T. voltage to the correct value for the first three valves.

The speaker is fed through a choke-capacity filter to ensure that the transformer is not overloaded. The output choke also serves to limit the anode voltage to the output valve.

The first three valves are of the indirectly-heated type, and their heaters are supplied by a 4-volt L.T. winding; the last valve, however, has a directly-heated filament and this is fed by a separate L.T. winding which must provide at least 2 amps. To make the connections quite clear the transformer and valve terminals are marked a,a, and b,b, to correspond with each other. It will be seen from the theoretical circuit diagram that bias for the first three valves is obtained by including resistances, with by-pass condensers in the cathode leads,

(Continued overleaf)




*The circuit described. Wave-change switches are not shown, since they are incorporated in the coils.*

(Continued from previous page)

whilst the bias for the output valve is developed across a resistance included between the centre tapping on the appropriate L.T. winding and H.T. negative.

Electrolytic condensers are used to bypass the bias resistances of the third and fourth valves, and these can be recognised by the polarity indications. The bypass and smoothing condensers in the rest of the circuit are of the usual type, but must be rated at not less than 750 volts working; it is these condensers which add materially to the cost of a receiver employing a high value of H.T. voltage, but it would be fatal to sacrifice quality and expense in this direction.

### Two Units

It is not necessary to describe the lay-out of the components, since this need not be different from that normally employed for a "straight" receiver having similar stages; those readers who are likely to build a receiver of the type described will have had previous experience of set construction, and this particular instrument is not recommended to beginners, who will always find it better to follow a complete design, rather than to work to a circuit alone. It is suggested, however, that it will generally be found most convenient to build the receiver proper on one chassis, and the power unit (including mains transformer, rectifying valve, the two large smoothing condensers, and also perhaps the speaker) on another. By following this system the receiver is more easily handled, and the heavy power unit can be placed in the base of the cabinet instead of on a shelf. Additionally, the receiver itself can be modified and experimented with without disturbing the rest of the equipment.

**PRINCIPAL COMPONENTS REQUIRED**

- Two Wearite Iron-Core Coils* with Switch Spindle, types AD and TG.
- One Polar Two-gang .0005-mfd. Tuning Condenser, "Midget" type.
- One Polar V.P. Horizontal Condenser Drive.
- One J.B. "Midget" .0002-mfd. Condenser (for reaction).
- Three Clix 5-pin Chassis-mounting Valve Holders
- Two Clix 4-pin Chassis-mounting Valve Holders (for output valve and Rectifier)
- One Bulgin H.F. Choke, type H.F.10 (H.F.C.1)
- One Graham Farish "H. M.S." H.F. Choke (H.F.C.2)
- One Varley 2,500-ohm Volume Control.
- One Ferranti .25-megohm Volume Control Potentiometer
- Eight Dubilier 1-watt Metallised Resistances: 100 ohms, 250 ohms, 350 ohms, 5,000 ohms, 40,000 ohms, 50,000 ohms, 100,000 ohms, .25 megohms.
- Two Dubilier 2-watt Metallised Resistances: 500 ohms, 15,000 ohms.
- One Dubilier 3-watt Metallised Resistance, 3,000 ohms.
- Five T.M.C. Tubular Fixed Condensers: .0001 mfd., .0002 mfd., .0003 mfd., .01 mfd., .01 mfd.
- Five T.C.C. type 105 (750 volts working) Fixed Condensers: three 2 mfd., and two 4 mfd.
- Two T.C.C. type 40 Fixed Condensers (non-inductive): .1 mfd., 1mfd.
- Two T.C.C. 10-mfd. Electrolytic Condensers, type 521.
- One Heayberd Mains Transformer, type No. 806.
- One Heayberd Smoothing Choke, type 757.
- One Wearite L.F. Choke, type M.T. 35.
- One Rola, type F/6,500 Energised M.C. Speaker.
- Three Cossor Valves, types MSV/Pen, 41 M.L.F., and 41 M.P.
- Two Mazda Valves, types P.P.5/400 and UU 120/500 (rectifier).

### Selectivity Adjustments

With regard to the operation of the receiver it should be mentioned that the coils specified are provided with tappings on their primary windings so that the degree of selectivity can be varied over a fairly wide range. In the majority of cases it will be found that it is quite satisfactory to attach the two leads from the aerial and from the anode of the first valve to terminals 1 (least selective), but there is no harm in trying the effect of using the other terminals, for even when both are joined to terminals numbered 3, tuning will not be so sharp as to cause any serious side-band cutting, provided that the two-gang condenser is properly trimmed. In connection with this point it might be added that those who prefer to use separate condensers for tuning the two circuits may certainly do so; there is, in fact, a slight advantage in this in that one then has the assurance that both circuits will be exactly in tune at all wavelength settings. The advantage of this is three-fold, for it ensures that selectivity and sensitivity attain maximum values, whilst "quality" is better, due to the absence of side-band cutting which results from two circuits not being exactly in tune.

# A Cycle Receiver

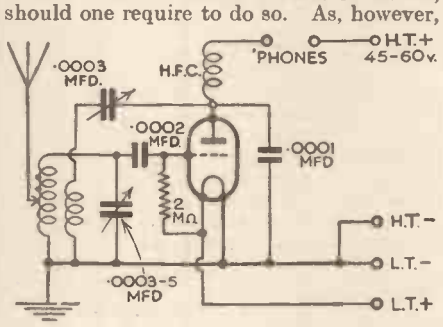
I ATTACH details of a miniature receiver with which I have been experimenting. The cycle frame makes either a good earth or an aerial.

Best results were however obtained when the frame was in use as an earth and a length of insulated wire wound along the tubing as shown in the sketch.

With regard to the circuit of the receiver. The only departure from normal practice is the use of pre-set condensers for tuning and reaction. The receiver being intended mainly for local station reception when cycling, can thus be permanently adjusted and the pre-set knobs locked by means of the locking collars.

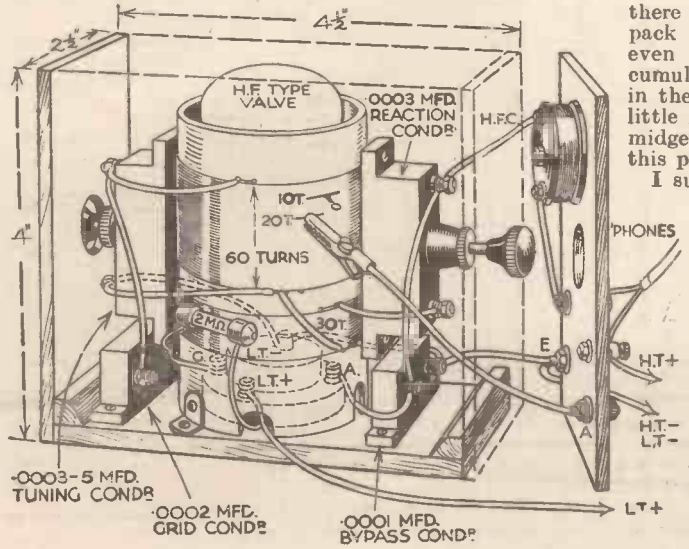
I have used an ordinary full-sized valve for the reason that I have several on hand and also that the receiver could still be kept to diminutive dimensions.

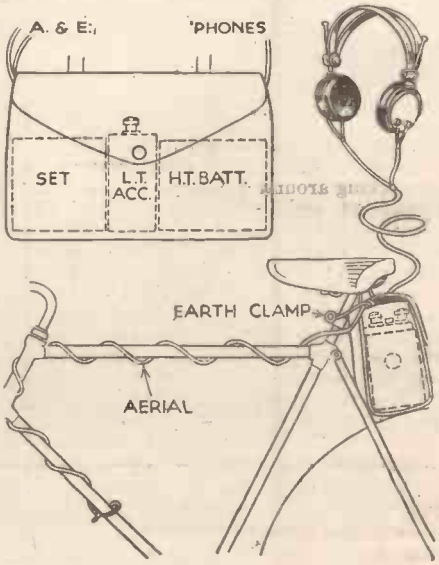
The use of a midget valve and coil would of course further reduce the size of the set, should one require to do so. As, however,




there was still room to pack a cycle cape, etc., even with the set, accumulator and battery in the saddle bag, I saw little reason to adopt the midget arrangement in this particular case.

I submit the idea for what it is worth in the hope that it may be of use to those readers who, like myself, enjoy long distance cycling and wish to make it still more pleasurable.—F. JACKSON (Holywood).

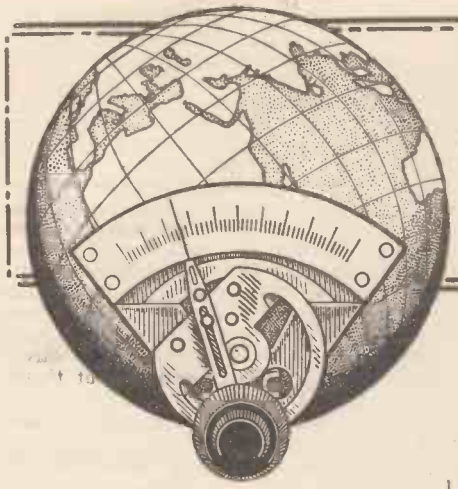



*Above: The theoretical diagram. On the left: A pictorial diagram of the cycle receiver. On the right: Details of the carrying case and aerial.*

## The New Delhi Broadcasting Station

WORK on the 20-kilowatt transmitter has already been started; it will operate on 340 metres. In order to keep in touch with the Motherland, the Indian State Broadcasting Service is also installing a special short-wave receiving station near Delhi, to relay the Empire programmes from Daventry. Most of the radio entertainments will be broadcast in Indian languages, and at the outset the station will be on the air four hours daily. The difficulty with which the Authorities have to contend is that the native population uses some two hundred different dialects.



# SHORT WAVE SECTION

## At the Short-waver's Bench

The Aerial System, Reception on 5 Metres, and Loud-speaker Pointers are Among the Subjects Dealt With in This Article

### Short-wave Variables

IT is rather interesting to note how, as short waves have progressed, so the size of the variable condenser used for tuning has decreased. I was reminded of this fact by discovering a .00035 mfd. variable which was used for tuning a short waver some five years ago. The .00025 mfd. size soon became popular, then .0002, and so to .00015 and .0001 mfd. as used to-day. A capacity of .00004 mfd. is now coming into favour as the main tuning condenser in band-spread schemes, and this

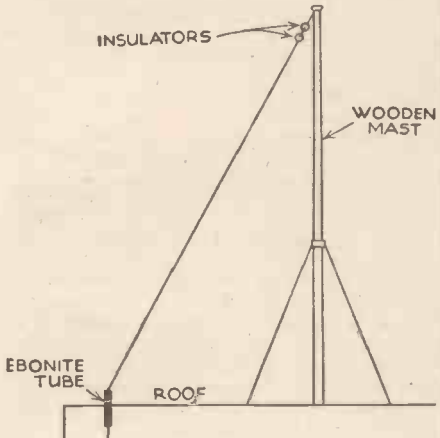



*Fig. 1.—An efficient aerial system for short waves.*

size, down to one as small as .00001 is favoured in the modern ultra-short waver for working around 5 metres. I have just dismantled and reassembled the .00035 condenser previously mentioned with half as many plates. Using the same number of spacers the distance between the plates is doubled and the net result is that the capacity is one quarter that of the original, or, as in the condenser I converted, .00009 mfd.—a very convenient size. Any reader who has one or two of these old "intermediate" capacity condensers in his "junk-box" should find it quite a simple matter to convert them into handy short-wave components.

### The Aerial System

Readers may notice that the aerial is mentioned quite frequently in the Short-wave Section, as this is almost the most important part of the receiving arrangements. Length, height, direction all play their part, and much experimenting is required to arrive at a satisfactory compromise for every waveband. My own aerial has undergone another change with very pleasing results, and details are given herewith for any who care to imitate them. The whole arrangement is quite simple and, as shown in Fig. 1, is a single length of wire (insulated, by the way) led, almost vertically, from the top of the mast to the aerial terminal, through a piece of ebonite rod fixed in the roof of the shed which comprises my "den." From the top end to the terminal the length is exactly five metres, so it will be seen that the height of the mast is nothing extraordinary, nor is the length of the aerial. Results, however, have been much better than those obtained with a 40ft. "inverted-L" previously used. The 20- and 40-metre amateur bands in particular have yielded very gratifying results on this aerial.

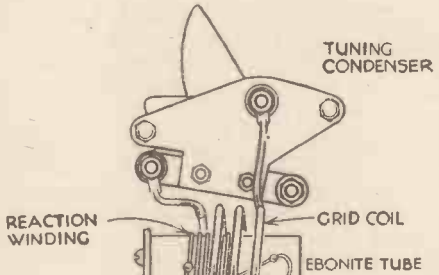



*Fig. 2.—A convenient method of mounting short-wave coils and tuning condenser.*

### On Five Metres

The extended use of five metres as a broadcasting band should reveal a further revival in home-construction as a hobby; not only construction of sets but of components, most of which, for this band, are particularly simple. Coils, for instance, are easily made. Three turns of No. 18 tinned copper wire wound on a 1in. diameter former, with a space of about ⅛in. between adjacent turns, when removed will prove an excellent self-supporting air-spaced coil, which may be mounted directly on the end of the variable condenser. Reaction may be obtained by a similarly mounted coil or by a few turns of wire on a piece of ½in. diameter ebonite rod, so mounted as to slip inside the larger coil (Fig. 2). Incidentally, aerial coupling in a 5-metre receiver need

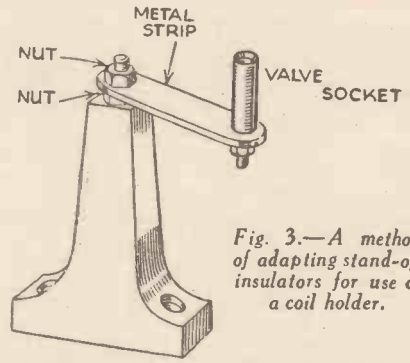



*Fig. 3.—A method of adapting stand-off insulators for use as a coil holder.*

only be very loose, and quite sufficient should be provided by allowing the lead-in to lie on the baseboard below the tuning coil. Some readers may be ingenious enough to make a small-capacity tuning condenser from one or two plates of an old variable, but, if this is done, it must be borne in mind that as little ebonite should be used in the construction as possible. For the short-wave choke ½in. diameter ebonite rod again is useful, and on a suitable length of it about twenty-five turns of No. 32 d.s.c. should be wound. Other items, such as valveholders, grid leaks, and fixed condensers are best bought, though the latter, of the air-spaced variety, may be easily made as described in a recent note.

### Stand-off Insulators

Many amateurs prefer to have their short-wave coils mounted well off the baseboard clear of metal condensers, metallised valves, and baseboards. To this end they very often use stand-off insulators on which the coil-holder is mounted. It recently occurred to me, however, that this is a waste of a component, as the arrangement may be carried out by a simple adaptation of the insulator. A valve-pin socket is mounted on a short strip of metal—aluminium, brass or copper—which in turn is screwed on to the top of the stand-off insulator by means of a piece of B.A. studding and a nut. A further nut allows for connecting purposes, and a number of insulators so fitted may be fixed to the baseboard at suitable angles to allow the insertion of the coil-pins in the sockets. Fig. 3 shows the idea, and depicts the Bulgin stand-off insulator, which is of porcelain with a 2 or 4 B.A. tapping in the top.

# Facts & Figures

## COMPONENTS TESTED IN OUR LABORATORY

### New Camel Batteries

THE well-known Camel accumulators are being improved in design, and the Duralife range of cells is also being modified in a similar manner to avoid all possibility of acid creeping. As all battery-users are aware this creeping of the acid is one of the greatest difficulties with which the user is confronted, and, apart from the risk of damage to the battery connections, there is also the danger of damage to carpets, etc. which might arise due to slight splashing of the acid or even from the fumes. In the newly-designed cells the top is moulded in one piece and lead bushes are fitted for the terminals of the plates. Over these bushes a lead cap is placed and this is welded to it. It will thus be seen that it is impossible for acid to creep through the junction thus formed, and this represents a distinct advance over the usual rotatable type of bush which somehow always manages to work loose through continual use. A point of vital interest to the user is that the cells are available without any increase in price. The makers are Camel Accumulators, Ltd., 9, Newington Causeway, London, S.E.1.

### A Shockproof Receiver

ALTHOUGH a receiver is made up to be used with care, the manufacturers are sufficiently careful to ensure that robustness forms quite a big feature of its make-up. The illustration on this page shows a Marconiphone receiver which was in use on a steam trawler (the *Lord Selbourne*) during last year. Whilst on a voyage north of Scotland in January last, the ship ran into a very bad storm, during which the set was thrown off the shelf on which it had been standing, and crashed to the cabin floor—a distance of about 5ft. When the set was replaced on the shelf and again connected to aerial and earth it was found to be still in good working order, being none the worse for the fall, so far as the electrical side was concerned. Of course, the cabinet was badly damaged, as may be seen in the illustration, but the receiver continued working for another six or seven weeks before the boat came into port and the receiver was put into the agent's hands for repair. No replacements were found to be necessary, which is good testimony to the soundness of valves, components and connections.

### New "Brimar" Valve

MESSRS. STANDARD TELEPHONES AND CABLES, LTD., are adding a new pentode to their range of Brimar valves. This is the 7DC, a Universal A.C.-D.C. valve of the high-slope output type with a heater of the 50-volt .2-amp. type. The anode and auxiliary grid voltage is rated at 250, and the mutual conductance is 10 mA/V. The price of the valve is 18s. 6d.

### Four New Ever Ready Valves

THE Ever Ready Company announce four new types which are to be shortly added to their range. These are a battery triode (K30A) for normal detector stages, and two L.F. triodes (K30B and K30D), together with an A.C.-H.F. pentode (A50A). The battery triodes are of the 2-volt .1-amp. type, the first having an impedance of 22,500 ohms and an amplification factor of 18, whilst the other two have impedances of 12,000 ohms with amplification factors of 11 and 18. In each case the H.T. rating is 150 volts and the price 5s. 6d. Type K30D may be obtained with a clear or metallised bulb. The A.C. valve is of the 4-volt 1-amp. heater type, indirectly heated, and has an impedance of 900,000 ohms and an amplification factor of 2,700. A grid bias of 1.5 volts is required and the anode voltage rating is 200. The price is 17s. 6d.

### B.T.S. Short-wave Coil Unit

FOR covering a number of different wave-ranges on the short-wave band British Television Supplies have produced a neat triple-range unit, covering from 12 to 80 metres. This consists of two coil formers only, arranged at right-angles and separated by a metal screen. The coil formers each carry three windings, and a multi-contact switch is mounted on a small bakelite panel fitted at right-angles to the metal screen. Thus wiring is reduced to a minimum, and the coils are, in effect, mounted direct on to the switch. The two coils and their individual switch contacts are entirely separated electrically, so that the two units may be employed in H.F. and detector circuits using one coil as the aerial coil and the other as a tuned-grid coil, or in a super-het as aerial and oscillator coils, etc. The switch is of the special anti-capacity low-loss type, with self-cleaning contacts and a roller-locking device. A single-hole fixing device enables the entire unit to be mounted on a panel in a receiver without any difficulty. The ranges covered are from 12 to 25, from 19 to 40, and from 30 to 80 metres, using a .0002 mfd. tuning condenser. For reaction purposes a .0001 mfd. condenser is recommended. The price is 17s. 6d., but if a single unit is desired this may be obtained for 12s. 6d.

*A Marconiphone receiver which survived an ordeal! After falling a distance of 5 feet it still functioned.*

## 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. (Glasgow).** You have apparently confused the diagram Fig. 2 with the theoretical circuit. The former is only an illustration of the layout of the *detector* stage, and thus the first apparent valve-holder is the coil-holder. The coil, of course, is fitted with four pins arranged in the manner of a valve. A small power or a pentode valve could be used in the output stage. You will probably find that a short wire, about 15 to 20ft. long and arranged as nearly vertical as possible will give you the best results. This reply was sent to you but returned marked "Gone Away."

**W. H. A. (Liverpool).** The term W.C.E. refers to the Wireless Constructor's Encyclopædia, copies of the fourth Edition of which are now available for 5s. or by post for 5s. 6d.

**J. A. (Funchal).** The arrangement appears quite in order, but we cannot, unfortunately, state what results might be expected.

**G. F. (Bristol).** It would appear that one of the components or valves has failed, but we think it would be most desirable to send the set back to the makers for their opinion.

**L. T. (Kentish Town).** From your description it would appear that a valve is faulty and we would therefore advise you to have these tested.

**R. J. S. (Coryton).** The Sonochorde Speakers may be obtained from R. A. Rothermel Ltd., Rothermel House, Canterbury Road, Kilburn, London, N.W.6.

**H. E. (Birmingham).** In view of the fact that the unit has been modified we regret that it is not possible to help you by giving you details concerning it. The person who rebuilt it will be best able to assist you in this respect.

**J. J. B. (Yorks).** The eliminator will supply the valves in question, but in view of the Class B stage it will be advisable to use a stabiliser with the unit.

**J. H. (Mayhill).** As reaction is the only fault it would appear that the winding is incorrect. Try reversing the connections and increasing the number of turns. We presume that the reaction condenser is in good order and correctly connected.

**W. I. (Notts).** In view of the fact that the set is made from various circuits it is not possible to give you much assistance. Your values may be all wrong, but the click and effects from the volume control rather point to instability in the H.F. stage, the click signifying the bursting into oscillation of this stage and the lack of signals beyond this point confirming instability. This may all be due to wrong H.T., due to the method of combining the various parts of the circuit. The anode of the output valve should certainly not glow red and you should check the circuit very carefully.

**J. C. P. (Nottingham).** Without a signal generator or calibrated oscillator you can only get the exact positions by careful adjustment. When purchased the I.F. transformers are already adjusted and very little movement of the trimmers should be required. If not correctly matched with the oscillator section a further adjustment will be required at certain settings, and this will be your indication that such adjustment is required.

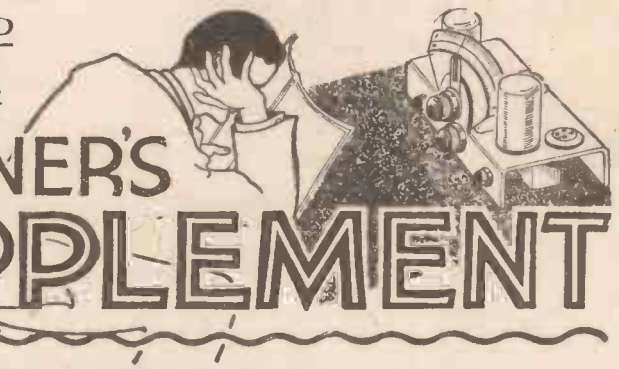
**R. F. (Cubitt Town).** We cannot understand in which direction you desire to improve the receiver. Please write again giving further details.

**H. B. (Penally Camp).** We cannot give you a full list of theoretical symbols, but these are given in the Wireless Constructor's Encyclopædia, which will be a very suitable book for you to read as a beginner. It costs 5s. from your newsageut, or 5s. 6d. from this office by post. Obtain also Everyman's Wireless Book, 3/6, or 3/10 by post from us.

**G. L. (N.3).** We are sorry we cannot tell you what is wrong without further details of the performance. Have you tested the H.T. in each stage? A good milliammeter will enable you to track down the trouble in a very quick and simple manner.

**R. H. (March).** Probably the modification of the volume control has affected results. Probably your all-wave tuner is not efficient on each band, but some sacrifice has to be made to obtain the advantage of all-wave tuning.

CHOOSING AND USING YOUR LOUD-SPEAKER



# BEGINNER'S SUPPLEMENT

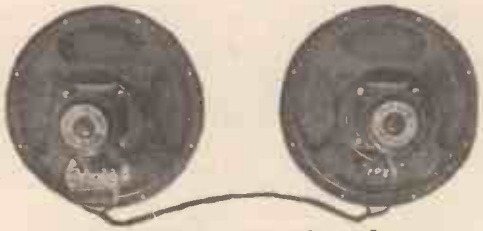
**Some Problems Affecting Selection, Application, and Location.**

By H. J. BARTON CHAPPLE, B.Sc., A.M.I.E.E.

GIVEN a receiver of good design, the success with which a naturalistic reproduction will be achieved depends upon the characteristics of the speaker, the accuracy with which it is used, and the location selected for it by the listener, and all these points are well worthy of discussion.

## Good P.M. Speakers

The good class permanent magnet moving-coil speaker of to-day is a remarkably efficient piece of apparatus, for, thanks to good design and the use of new magnet steels, it is much improved in sensitivity as compared with the first models introduced many years ago, and magnets now retain their magnetism almost indefinitely. For ordinary listening, therefore, a good permanent magnet instrument will be entirely satisfactory. There are, however, advantages accruing from the use of an energised-magnet speaker where electricity mains are available. In the first place, mains energising results in a greater magnetic field strength, and this means increased sensitivity or, as it is sometimes termed, electro-acoustic efficiency. In other words, a mains-energised speaker is capable of giving greater volume for a given receiver output than a permanent-magnet instrument of similar size.



*A dual pair of Rola speakers designed to give a full overall response.*

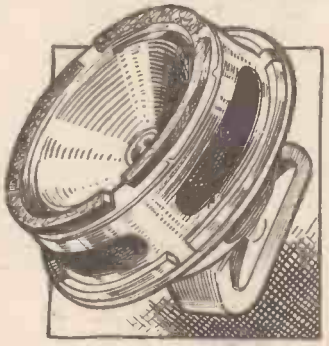
## Loss of Top

The second advantage to be gained from the use of an energised speaker is that, size for size, it is less expensive in first cost, although, of course, the electricity used for energising must be taken into consideration. As, however, the magnet winding can usually be used as the smoothing choke for the high-tension supply, there is an actual economy.

Although speakers very often are deficient in top-note response, this is not of very great moment unless the listener is a real musical connoisseur, especially as modern highly-selective receivers frequently have little output above 4,000 cycles in any case. On the other hand, where good top response is required, even with a selective superhet, an expensive speaker with a reasonable upper register response will give better quality than a general purpose speaker. Another alternative, of course, is to use two speakers, one taking care of the lower and middle register, and the other specially designed to reproduce mainly the notes above 4,000 or 5,000 cycles.

## Using Two Speakers

There are several methods of doing this. You can, for example, have two specially designed moving-coil speakers, or the experimenter can produce quite interesting results by using one good moving-coil speaker as the bass unit, and an old moving-iron instrument for the top notes. Another scheme is to have two speakers of similar characteristics, but to feed one through a filter which passes the top notes to a greater extent than the lower register, while a further alternative is the use of one of the new piezo-electric tweeters for the treble instrument. In the piezo speaker, it should be explained, the output is led to a specially prepared crystal—or, rather, series of crystals—



*The Sinclair dual 2-in-1 speaker.*

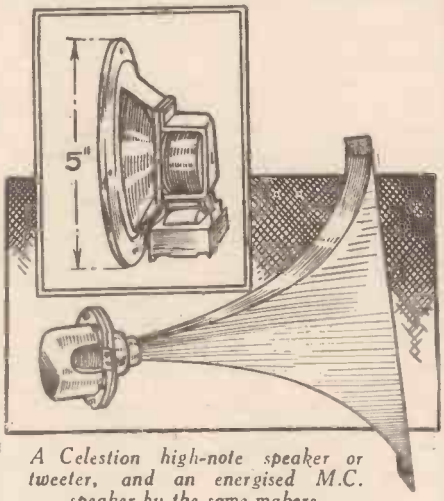
usually of Rochelle salt, having the property of changing its dimensions according to the voltage applied to it. This expansion and contraction is magnified by levers, and applied to a small conical diaphragm.

## Installing a Speaker

It is common knowledge that all speaker units must be mounted on a baffle board in order to avoid losses due to the vibrations at the front of the instrument being cancelled by those at the back. These losses occur mainly in the bass region below, say, 200 cycles, and are particularly serious at frequencies below 100 cycles. For really good performance, a minimum size of 3 ft. square is recommended, although 2ft. is quite satisfactory in many instances. Of course, this refers to baffles not forming part of the receiver cabinet, for when a speaker is built into the cabinet the cabinet itself forms part of the baffle, and a smaller area suffices. There is, however, a risk that the cabinet itself will have resonances within the audible scale, with the result that instead of a true bass, most of the deep notes will consist of a boom at one particular frequency.

## Alternatives

This brings us immediately to the question of the correct procedure—shall the speaker be built into the set, or made a separate unit? Theoretically, the separate unit consisting of speaker and




*A Celestion high-note speaker or tweeter, and an energised M.C. speaker by the same makers.*

really large baffle is the better, but as a large baffle is unwieldy, and is not always a welcome addition to the domestic furniture, in many cases the built-in arrangement is unavoidable.

There are many devices which render a good-sized baffle far from unsightly. For example, it can be disguised as a screen, and sometimes it is possible to build the speaker into a door or even into a wall. Alternatively, a special cabinet may be built for the speaker alone, of ample dimensions for good reproduction. This has the advantage over a built-in speaker that it may be installed in the best position from an acoustic point of view, leaving the set to be placed where it is best served by aerial and earth.

*A Ferranti speaker cabinet of modern design.*

# LETTERS FROM READERS

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

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

## An Ultra Slow-motion Device

SIR,—Looking through the current issue of your paper, I see on page 410 "An ultra slow-motion device." Whilst I appreciate the writer's idea, I should like to suggest that with the data given it is not wholly possible to carry out. For instance, if the second slow-motion dial shown in the sketch (Fig. 2) were to be used as the auxiliary dial, one could not use it in conjunction with the main one to give very accurate calibration, as was intended, because these types of condenser dials are arranged so that when the figures 100 or 180 as the case may be reach the hair line they stop. However, the main dial will still go on revolving, so that the two dials will lose synchronisation. Also, on the auxiliary dial, a half of it will be of no use as it is not calibrated. With the idea I submitted, however, I was most careful to avoid pitfalls like this by using one of the older, raised type condenser dials as the auxiliary dial, and having one calibrated all the way round, or, if one of these was impossible to obtain, two "reading off" spots should be used. I think on the whole it would be better for your readers to use my method in preference to the other one, for the above reasons.

I was very pleased to see the first of your series of Midget Portables described in your pages, and look forward to the next. —S. A. D. C. (Clifton).

## A Midget S.W. Set for Overseas!

SIR,—Being a regular reader of your journal, I sincerely hope you will be kind enough to publish a design for a Cameo Midget short-wave set for those of us who reside in the Far East. The reason for asking this is that we rarely receive any long- and medium-wave stations.

The first valve must be a screen-grid, which is a regulation of our Post Office. The output valve may be either a pentode or a Q.P.P. Like many others, I do not mind the cost of such a set, because we buy expensive American sets here which are very popular.—LIM SIEWHGHEE (Singapore).

## An A.V.C. Four-valver!

SIR,—I have been a regular reader of your publication PRACTICAL WIRELESS since its inception, and have taken advantage of the opportunity afforded of obtaining your splendid books and fine gifts. Please accept my best thanks for same.

I am one of those patient readers who are waiting for a "De Luxe A.V.C." four-valver, to include visual tuning and an ordinary pentode; this latter for economy considerations. Wishing your paper every success.—C. A. LORANGE (Stockport).

## Our Two-valve Superhet: American Valves

SIR,—I read with great interest your article on a two-valve superhet. I must compliment you on your design, which is excellent, considering the limitations you are working under. Other British and Continental valve designers, with few exceptions, are well behind the Americans. "Valve noise" is, of course, the bugbear of multi-valve receivers, especially superhets, and your new design should reduce this annoyance. The most efficient rectifier is, I think, the thermionic valve. Here, of course, you come up against valve design, as you want to keep your valves down to two. The Americans have produced several excellent two-tube superhets using their wonderful series of six-volt tubes. The most popular circuit uses a 6AF as detector-oscillator, and a 6F7 as I.F. amplifier and second detector. The volume from a set of this type would, of course, greatly exceed that of a two-valve superhet. I am sure you will agree with me that our British manufacturers are very slow with their designs and developments. Some component manufacturers seem to have died a natural death, and all research seems to fall on professional set designers. Of course, I except from my list of grumbles our Communications Engineers in the G.P.O. and Services, etc. The trade wireless papers are full of the dangers of cheap American radio sets and cry out for absurd import duties. They say these sets are inefficient and too cheap. The point is this: these sets are midgets and designed as *additions* to an existing installation. Therefore they *must* be cheap or the public will not buy. The real answer to our manufacturer's grumble is that they *cannot* design a cheap set to compete in any way with the Americans. When I say "cheap" I use the word only in connection with prices. The quality of foreign radio goods is every bit as good as British. I shall be pleased to receive your opinions on several of my statements.—T. A. J. JAQUES (Lewisham).

[*Our experience of American valves is just the opposite, but perhaps British manufacturers have a reply to the above criticism.—Ed.*]

## A Log of 20-metre Stations

SIR,—I have been a short-wave listener for over a year, and during that time I have never had such good results as I had the other night. I thought a report of my reception might interest other readers, so I enclose particulars. I was listening to the 20-metre 'phone stations, and I received twenty-one fresh stations in about one and a half hours, and they were all at R7-8, which is particularly good for my set, the usual strength being R4-5. I heard many of the amateurs remarking on the good conditions at the time.

Approximate time, 11.30 p.m. to 1 a.m., W2CB ?, W2HFS, W1IMG, W1KJ, W3MD, W1EEV, W2DVI, W1ARC, W2HHG, W2EUG, W2FYG, W2BTV, W3OZ, WH1MS, W3DI, W2ZB, W8HFU, W2CDL, W2BYG, W1HWD, W1PHE.—L. B. KING (Newbury).

## Amateur Transmissions on 40 Metres

SIR,—Having read in your journal a short time ago a letter from a youthful correspondent regarding reception of amateur stations, my interest and curiosity were aroused. Since then I have learnt much about modulation, Q.R.M.s, amplifiers, microphones, etc., simply by listening to talks and reports exchanged between amateurs. There may be other readers who have paid little attention to these talks, and so as a matter of interest I give the following 40-metre stations logged during the past two weeks: G6VI, G2AO, G5JW, G6KV, G5PT, G6TL, G6GO, G5TP, G5IX, G6MU, G5VD, G6PK, G6UD, G2PX, G2RF, G2XC, ON4LV (Belgium). PAOEO (Holland), G2AV, G5SM, G5HJ, G2QO, G6AU, G5PP, G5GL, G6UI, G5GS, G5XA, G6SR, G6JQ, PAOMQ (Holland), G6QZ, and G2IL.

Finally, on the 20-metre band, the following American stations were received: W1IMG, W1GJE, W3EFS and W2HFS. The best time to log these stations is from 10.30 p.m.—R. HOPPER (March, Cambs.).

## An H.T. Dodge from British Columbia

SIR,—I noticed in your Letters from Readers' Page, a correspondent, "J. H. Clarke," asking for an H.T. unit to be worked from a small accumulator, and I herewith give particulars of my method of solving this problem. I made a satisfactory H.T. unit, called a "B battery," in this country, by taking 6-volt accumulator plates, negative and positive, and cutting them into narrow strips which would fit into test tubes. One negative and one positive was put in each tube with a wooden separator between. I joined each three cells in series by cutting narrow strips from a lead pipe and burning these with a soldering iron into the top edge of the plates. When I use the battery I connect all the six-volt cells in series, and when I am going to charge they are connected in six-volt parallel. This battery has worked very satisfactory.

I am very interested in short-wave work, and think your journal is one of the finest.

I have a seven-valve, or tube, set as they call them in this country, which receives the short and standard broadcast band, and I receive GSE regularly every afternoon. I am very interested in the midget portable sets, and am trying to construct one with American parts.—W. V. DAWNEY (West Kootenay, British Columbia).

CUT THIS OUT EACH WEEK.

## Do you know

—THAT a separate valve may be employed for automatic volume control, and in the opinion of many users is productive of the most constant results.

—THAT abrasives should not be used on the moving parts of switches, owing to the risk of metallic dust being afterwards liberated with noisy working and other troubles.

—THAT ordinary ebonite should not be used in the open air for insulation purposes, etc., unless protected from sun and rain.

—THAT when hum develops in a mains receiver a broken earth connection should be suspected.

—THAT care should be exercised when using ordinary headphones on a mains receiver.

—THAT a centre tap must be provided on the output component for a Class B stage.

—THAT it is not essential for the plate or anode of a valve to be made of solid metal, but a gauze or fine mesh is just as efficient.

*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, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

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

# 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.*

**SHORT-WAVE RADIO AND TELEVISION SOCIETY (THORNTON HEATH)**

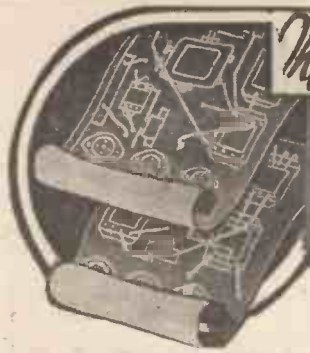
AT the weekly meeting of this society, which was held at St. Paul's Hall, Norfolk Road, on Tuesday, the 9th inst., Mr. Glide, of Ferranti, Limited, gave a talk on low-frequency amplification. One of the most neglected components in a receiver, or amplifier, he said, was the output transformer. Any deficiencies in this component would be reflected in a falling off of the characteristics of the speaker. With regard to the latter, it was now, contrary to general opinion, possible to produce a permanent magnet moving-coil loud-speaker which had a frequency response equal to, or better than, the energised speaker. Mr. Glide then emphasised the need for care in decoupling each stage. Inferior quality could easily be caused by a bad choice in the value of the decoupling components. Grid decoupling was also very necessary, to eliminate feed back. He then described the new Ferranti "Novia" superheterodyne receiver which was capable of giving 2½ watts undistorted output.—J. T. WEBBER, secretary, 368, Brigstock Road, Thornton Heath.

## DIAL LIGHTS

IN a number of instances which have come to our notice recently, several of our readers seem to be difficulties with their dial lights. Generally the trouble is short life, and is in most cases due to the use of wrong bulbs. With any set it is only asking for trouble to use bulbs of the flash-lamp rating, for these will not stand up to continuous operation. Moreover, it is quite unnecessary to have the bulbs burning at full brightness. Thus, for a battery set a bulb rated for 3½ volts is the most suitable, and as it consumes only about 0.2 amp. when used on 2 volts, the battery drain is not serious. If, however, economy is a consideration, a switch may be fitted to cut out the lamp when not required. Against this, however, must be set the fact that, with the lamp extinguished, it no longer acts as a pilot indication that the set is "on," and the saving in L.T. current may one day be offset by the waste of both L.T. and H.T. when the set is inadvertently left connected all night, and part of the next day.

For A.C. mains sets a 6-volt dial lamp is recommended. This will have a good, long life when used on the 4-volt L.T. circuit, and has the advantage that at this voltage it only consumes 0.2 amp., and thus does not cause a serious drop in heater voltage by imposing too great a load on the filament winding of the transformer, while at the same time the voltage rating safeguards the bulb should it be connected to a filament winding designed for more valves than are actually in use, and where, therefore, the voltage may be a bit higher than 4 volts.

In the case of universal sets, the lamp is connected in series with the valve heaters, and must, therefore, be capable of carrying continuously the full heater current—either 0.2 or 0.3 amp. Should a lamp connected in this way burn out, the whole heater circuit is interrupted and the set will be inoperative until the lamp is replaced. As it usually happens that no spare lamp is handy, this is apt to be a nuisance, but it can be avoided by connecting a resistance of, say, 25 ohms in parallel with the lamp-holder, thus shunting the lamp and providing an alternative path for the heater current in the event of the lamp failing. This shunt also results in the lamp being somewhat under-run, thus greatly prolonging its life.—H.C.



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| "W.M." Stenode | Oct. '34 | WM378 |
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| "W.M." D.C. Super, D.C. | May '33 | WM321 |
| Merrymaker Super, A.C. | Dec. '33 | WM345 |
| Heptode Super Three, A.C. | May '34 | WM359 |
| "W.M." Radiogram Super, A.C. | July '34 | WM366 |
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| Roma Short-waver | 10.11.34 | AW452 |
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### MISCELLANEOUS.

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| Newstyle Short-wave Adapter (1/-) | June '35 | WM383 |

| | | |
|---|---|---|
| P.T.P Three (Pentode-Triode-Pentode) | June '35 | WM389 |
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| Class-B Three (D, Trans, Class B) | 22.4.33 | AW386 |
| New Britain's Favourite Three (D, Trans, Class B) | 15.7.33 | AW394 |
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| 1934 Ether Searcher, Chassis Model (SG, D, Pen) | 3.2.34 | AW419 |
| Lucerne Ranger (SG, D, Trans) | — | AW422 |
| Cossor Melody Maker with Lucerne Coils | — | AW423 |
| P.W.H. Mascot with Lucerne Coils (D, RC, Trans) | 17.3.34 | AW337A |
| Mullard Master Three with Lucerne Coils | — | AW424 |
| Pentaquester (HF Pen, D, Pen) | 14.4.34 | AW431 |
| £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) | 3.1.34 | AW451 |
| Transportable Three (SG, D, Pen) | — | WM271 |
| Multi-Mag Three (D, 2 Trans) | — | WM288 |
| Percy Harris Radiogram (HF, D, Trans) | Aug. '32 | WM294 |
| £6 6s. Radiogram (D, RC, Trans) | Apr. '33 | WM318 |
| Simple-tune Three (SG, D, Pen) | June, '33 | WM327 |
| Tyers Iron-core Three (SG, D, Pen) | July '33 | WM330 |
| C-B Three (D, LF, Class B) | — | WM333 |
| Economy-pentode Three (SG, D, Pen) | Oct. '33 | WM337 |
| All-wave Three (D, 2LF) | Jan. '34 | WM348 |
| "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, QP21) | June '34 | WM362 |
| 1935 £6 6s. Battery Three (SG, D, Pen) | Oct. '34 | WM371 |
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| 65/- Four (SG, D, RC, Trans) | — | AW370 |
| "A.W." Ideal Four (2SG, D, Pen) | 16.9.33 | AW402 |
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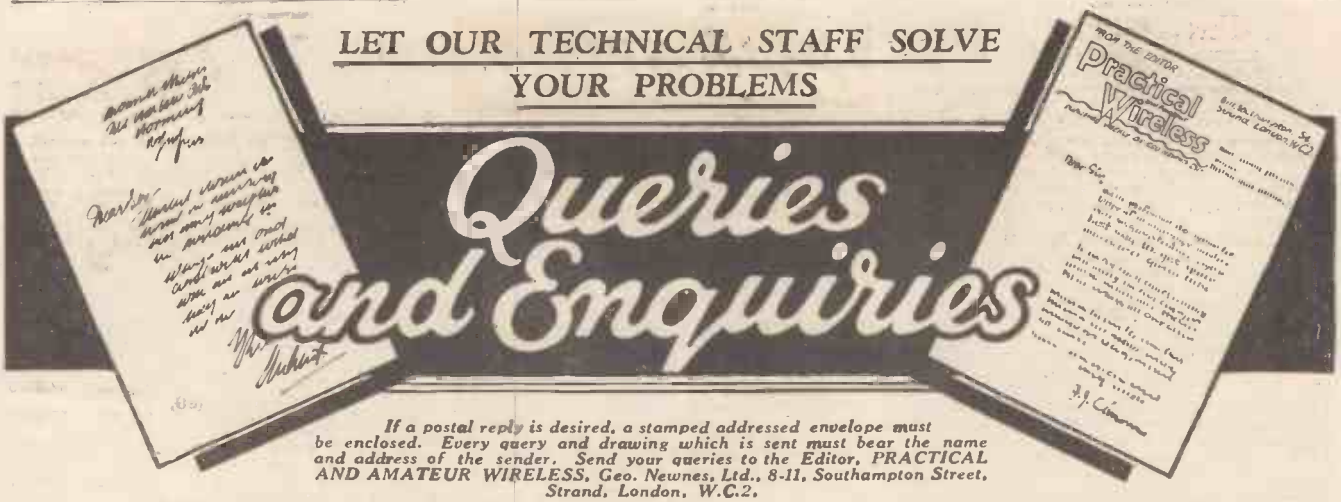


*If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.*

**SPECIAL NOTE**

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.

### A Universal Coil Winder

**"I have been looking through your back numbers and would like to build the universal coil winder described in your issue of September 15th, 1934. Is there a blueprint for this as I cannot understand all details from the article? For instance, I don't quite understand the clutch gear, and would like a drawing for this."—B. S. S. (Itchen).**

WE are sorry that we cannot locate the part of this coil winder which you refer to as a "clutch gear." If you could write us again a little more fully, giving exactly the points which are troubling you, we will endeavour to help you. The details given in the article seem quite adequate, but no blueprint or other drawing has been prepared. If possible, we will endeavour to clear up your difficulty with a rough sketch upon receiving your further query.

### Cutting Down the Bass

**"I have built a splendid A.C. receiver, but it gives rather too much bass for my liking. I believe it is actually due to the loud-speaker, as the values in the circuit are quite standard, and one of the L.F. stages is fed with the transformer. What is the simplest way of reducing the bass notes—if possible, with some sort of adjustable reducer?"—P. S. (Woking).**

A TONE control may be fitted in your loud-speaker circuit if this is used with an output-filter circuit. You need a large-capacity condenser—say, .25 or .5 mfd., and a variable resistance of 15,000 ohms. The latter should be connected across the condenser and the two should then be inserted in series with one loud-speaker lead. Adjustment of the resistance value will vary the degree of low-note response, and, obviously, when the resistance is short-circuited it will short-circuit the condenser and the normal response of the receiver will be obtained.

### A Local Station Set

**"I live just outside North London and wish to build a set to work from the A.C. mains. I am not keen on foreigners, and simply want to hear the B.B.C. programmes with really good quality. What is the minimum number of valves I can use with satisfaction? Can you give me details of a suitable set?"—R. Y. O. (Wood Green).**

YOU would no doubt find an A.C. two-valver would give you adequate results. A band-pass tuner should be used with a power-grid detector, and this should be coupled to a good output pentode through a 5 to 1 L.F. transformer. With a 250-volt mains section you should obtain ample volume with really good quality, and may also find that alternative programmes would be obtained on suitable occasions from the more high-powered foreign stations.

### Using a Converter

**"I should like to try short-wave reception, and would build the short-wave converter-adaptor described in your recent issue. I am not certain, however, whether this will work with my set, which is a 5-valve superhet. If you can assure me on this point I will go ahead with the building."—G. A. D. (Birkenhead).**

UNFORTUNATELY we cannot give you the assurance you ask for. It may work with your set and it may not. We have no circuit details of your set and cannot ascertain the particular circuit which is adopted. If it is a perfectly straightforward superhet you will probably find that the converter may be used by tuning your superhet to a wavelength of about 1,500 to 2,000 metres. To make certain on the point, however, we think it would be wisest to write to the makers of the set and obtain their view, as there may be some peculiar aerial-input arrangement which would prevent good short-wave reception with the converter.

### Danger from Inexperience

**"I have acquired from a second-hand store an all-electric radio-gram. I have thoroughly examined the inside, and although it does not work it appears that the mains output is of the 500-volt type and the valve types are all indicated on a label, which is, unfortunately, torn. As the set used seven valves I wish to economise by cutting out two or three. Can you tell me the best ones to cut out and how to tell when it is safe to switch on?"—R. P. L. (Bow).**

AS you appear to have had no experience with mains receivers, and in view of the high output from the mains section, we think it would be best to leave the modification to a good radio dealer. You may easily do serious damage to the components by an unwise change of circuit, and we cannot give you any indication of the most suitable modification without full circuit details. Furthermore, you may conceivably make some change which will easily result in your obtaining a shock during switching or other operation, and, therefore, if you do not know very much about wireless construction it would be safer, with a receiver of this description, to leave the work to somebody who is in a position to check the alterations and make quite certain that what has been done is theoretically sound.

### Radiolympia

**"I am not certain whether you have yet published the date of the Wireless Exhibition at Olympia. As in previous years I wish to come and see you on the Stand if you are there, but must arrange my holidays to coincide with the time. Can you give us any details yet?"—H. T. E. (Nottingham).**

THE Exhibition is being held this year from August 14th to the 24th, and we shall again be exhibiting at the same spot, Stand No. 9, on the Ground Floor. We shall be pleased to see you during the Exhibition, and members of the Staff will again be in attendance throughout the ten days.

### A Fuse Point

**"I have a shop-built A.C. three-valver and a fuse is fitted on the chassis, but owing to the peculiar all-metal construction I cannot see what part of the circuit it is fitted in. What happens after about a fortnight is that the fuse blows when I switch on. After replacing it about four times I bought one of higher rating, and although this lasted longer it has also blown. It seems that the selection of the makers is too low and the surges cause it to go. My point is this—if I replace it again with a higher value which will not blow through the surge, will it still offer protection in the set?"—B. M. H. J. (Dalkeith).**

IT is very unlikely that the manufacturers would have fitted a fuse of the wrong rating. It would appear, therefore, that some fault has developed in the circuit which causes an unnecessary surge when switching on, and this may be a faulty electrolytic condenser. After the passage of a certain current this automatically becomes sealed and thus the receiver works satisfactorily. Perhaps a good radio dealer could check this point for you. We would not advise the fitting of a larger fuse in view of the danger of damage.

**The coupon on cover iii must be attached to every query.**

*(Continued at top of column three)*



*(Continued from foot of column one)*

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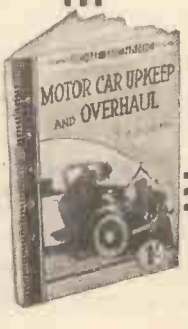


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