HIGH-DEFINITION TELEVISION SERVICE—Official Technical Data

Practical and Amateur Wireless

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

a GEORGE NEWNES Publication

Vol. 7. No. 159.
October 5th, 1935.

AND AMATEUR TELEVISION

Designing Your Own WIRELESS SET

FREE Handbook with Next Week's Issue! SEE BELOW

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. VII. No. 159. October 5th, 1935.

ROUND *the* WORLD *of* WIRELESS

Next week's issue marks a further milestone in the history of this journal. To signalise the commencement of our new volume, we shall present with every copy of next week's issue a complete, exhaustive and authoritative volume entitled "The Practical and Amateur Wireless Short-Wave Handbook." This valuable book is a complete treatise on short-wave work; it tells you how to start, what circuits to use, deals with special aerial arrangements and short-wave components, how to build a short-wave adapter, an ultra-short-wave converter, a three-valve short-wave set, short-wave faults, how to report amateur transmissions, the Q.R.S. Code—in fact, it is a complete, well-illustrated treatise which every constructor will treasure. Mr. F. J. Camm also starts the autumn season in home construction with full constructional details of his latest design—*a marked advance on anything he has hitherto produced.* Order next week's copy at once!

Binding Cases and Indexes for Volume 6.

Binding cases and indexes for Volume 6 of "Practical and Amateur Wireless" are now available. The binding case, complete with title page and index, costs 3s. 6d., and the index alone 7d. by post.

New French Broadcaster

LISTENERS may have picked up a new French call, namely, *Ici Radio Cité.* It is that of the old Radio LL, Paris, station, which has been bought by *L'Intransigeant,* a well-known evening newspaper. The wavelength used is 280.9 metres (1,068 kc/s), a channel shared with the U.S.S.R. Tiraspol 4-kilowatt transmitter. All announcements, as in the case of Poste Parisien, Paris, will be made in both French and English.

Rome to Relay from Africa

ACCORDING to a recent statement made by the Chief of the Italian Broadcasting Services, arrangements are to be made to relay details of important happenings in Erytrea, relative to Abyssinia, *via* the Asmara and Tripoli stations, to Rome. for rebroadcast through the Italian medium-wave network.

Sea versus Radio

A LARGE sum of money has been voted by the Danish Government for defraying the cost of protective measures to the Kalundborg high-power station. The site of the transmitter is so close to the sea that the station is in constant danger of damage by storms. It is stated that unless the coastline can be adequately strengthened there is great danger of the station being put out of action.

International Concert Relays

AS arranged by the U.I.R., at Geneva, the next concerts arranged for broadcast throughout Europe and America will be transmitted respectively from Vienna and Warsaw on October 22nd and December 3rd.

The New Lahti Super-power Station

WORK on the 220-kilowatt broadcasting transmitter at Lahti is nearing completion, and listeners will do well to stand by for the first tests which may be carried out during this month. The plant has been so planned that the output power can be doubled if necessary. The channel used (1,807 metres) will be found between Moscow 1 and Kootwijk.

FREE WITH EVERY COPY OF NEXT WEEK'S ISSUE!

Informative, Up-to-date and Complete Volume, entitled:

Practical & Amateur Wireless Short-Wave Handbook!

This issue also contains full constructional details of Mr. F. J. Camm's novel 1936 Receiver

ORDER YOUR COPY TO-DAY!

Another Publicity Radio Station

FOLLOWING the example of Fécamp, Madrid, Paris, and other cities, Kuldiga (Latvia), on 238.5 metres, is now broadcasting sponsored programmes in the English and Scandinavian languages.

Wavelength Changes in Australia

ON September 1st most of the seventy-two broadcasting stations in the Australian Commonwealth changed over to the new wave plan. Three transmitters are to be opened shortly at Townsville (Queensland), Grafton (New South Wales), and Gippsland (Victoria). Although starting with a power of 7.5 kilowatts, this will be increased in the near future to 30 kilowatts.

The Difficulties Besetting Indian Broadcasts

FOR the new broadcasting service which is to be established by the Hyderabad Government (British India), four transmitters will be necessary, for whereas the central station will offer programmes in Urdu and English, other centres will be compelled to transmit in the Marathi, Canarese, and Telugu languages.

The Two Dutch Transmitters

SO much confusion seems to have arisen in the minds of listeners to the Dutch broadcasts, since the closing down of the Huizen station, that a few words of explanation may assist in their identification. Until the end of September, KRO and NCRV are being broadcast through Hilversum No. 1 on 301.5 metres (995 kc/s) and VARA, AVRO, and VPRO, through Hilversum No. 2, working on 1,875 metres (160 kc/s). This is the 120-kilowatt station. From October 1st, the two groups of programme organisers exchange stations for a period of three months.

Italy's Two Groups

THERE is no longer any necessity to search for a number of programmes from the Italian stations, as the studios have been amalgamated into two groups, namely, Northern and Southern. In the former, Milan, Bolzano, Florence, Genoa, Trieste, and Turin work simultaneously, and Rome, Naples, and Bari, with occasionally Palermo, provide the alternative radio entertainment.

Better Signals from Heilsberg

THE Heilsberg station is now working on its full power of 100 kilowatts and has also been equipped with a new non-fading aerial system.

Stand-by for Sottens

WORK on the reconstruction of Switzerland's second high-power transmitter is now completed, and the station will operate on 100 kilowatts in the course of the next week or so.

ROUND the WORLD of WIRELESS (Continued)

Leipzig Again at Full Power

IN view of reconstruction the Leipzig programmes have been broadcast since June 3rd at low power. The station will now shortly resume its transmissions on 120 kilowatts, and has been provided with an ultra-modern non-fading aerial system.

An Inadequate Response

ALTHOUGH Czechoslovakia now operates six broadcasting stations, the total number of registered licence holders at the end of July, 1935, had not reached 730,000. The authorities are of the opinion that a large number of pirates must be enjoying the radio programmes—free of charge.

Cabaret Broadcasts

DURING the autumn, a fortnightly West End Cabaret series will be broadcast, when listeners will hear the finest artists then appearing in the various cabaret shows in London. Carroll Gibbons and his band will give light thirty-minute shows, to which guest artists will be invited, and a series of Old Time Ballad Concerts will be presented by Stanford Robinson. Mickey Mouse is again to broadcast in a series under the ægis of John Watt, his next programme falling on October 8th.

Concert by City of Birmingham Orchestra

ON October 3rd, Midland listeners will hear a concert by the City of Birmingham Orchestra, conducted by Leslie Howard. The first part contains Haydn's "Surprise" symphony and "Brigg Fair," by Delius. During the interval, H. Foster Clark, the Midland Music Director, will give a talk on the coming music season. The second part of the concert includes Elgar's "Falstaff" and the Fifth Brandenburg Concerto (Bach), with Alfred Cave, George Barrett, and Victor Hely-Hutchinson as the soloists.

INTERESTING and TOPICAL PARAGRAPHS

Concert for Northern Listeners

A CONCERT by Walter Wright's Quintet will be heard by Northern listeners on October 8th. Included in the concert will be an item by Mae Bamber and partner, who broadcast recently. Miss Bamber, who originally broadcast from the Northern transmitter in dramatic productions, was known to American radio audiences as a vaudeville artist during her visit to the U.S.A.

"Quayside Nights"

POOLE, Dorset, will be dealt with on October 11th in the fifth of the Western series called "Quayside Nights." Poole is a very famous yachting centre, and it is known all over the world for its safe and ample harbourage.

"Stories of Storr"

ON October 9th, Mr. C. B. Pulman will give the third of his "Stories of Storr," tales of life in a Pennine village as it is lived to-day. The story is called "Timothy Saunders," and it will be heard by Northern listeners.

Concert Relay from Bath

RONALD FRANKAU makes a welcome return to the West on October 12th, when he will be the star attraction in a relay from the Pavilion, Bath. Listeners may remember that he ran a concert party for a season in Weston-super-Mare a few years ago and since then his broadcasts have been looked upon as return visits to his innumerable friends and admirers.

A Link with the Past

THE two 450-feet aerial masts of the 5XX Chelmsford broadcasting station are being taken down; it will take about thirty men five months to dismantle them piece by piece. It was from this aerial that Melba, in 1920, sang for the first time to ether listeners, and it was also used for the transmission of the first short-wave broadcast to the Empire on November 11th, 1927.

A MUSICAL INTERLUDE

Jack Jackson and his Orchestra listening to the "His Master's Voice Superhet Five-forty-one Radiogram" during an interval in a recording session at the "His Master's Voice" studios.

The Radio Follies

THIS popular concert party returns to the Midland programme on October 11th, following a successful engagement during August at Borth. Michael North and Richard Spencer will present this concert party.

Leicester Symphony Orchestra

ON October 10th Midland listeners will hear a relay of part of the Leicester Symphony Orchestra's concert from the De Montfort Hall, Leicester. A feature of the concert is that Dr. Malcolm Sargent, the conductor, makes one of his rare appearances as a solo pianist. For the Concerto in which he plays, Grace Burrows will conduct the orchestra.

Midday Concerts from Leeds University

ON October 10th, the first of this winter's Midday Concerts will be relayed from Leeds University to Northern listeners. The soloists are Alice Ehlers (harpsichord), Lupton Whitelock (flute) and Reginald Stead (violin), supported by the Chamber Orchestra, conducted by Edward Allam.

Colliery Band Broadcast

OLLERTON COLLIERY BAND, from the Mansfield district of Nottinghamshire, which is singularly rich in bands, has its first Midland broadcast on October 9th, when Ernest Slack will conduct a popular programme.

SOLVE THIS!

PROBLEM No. 159

Marshall had two broadcast receivers—one a detector two L.F. model and one a single valver. Being desirous of getting short-wave stations he decided to adapt the two receivers, and accordingly took the 'phone lead in the single valve receiver (which was joined to the H.F. choke) to the aerial terminal of his three-valver, tuned this to 2,000 metres, and endeavoured to tune in short-wave stations by plugging short-wave coils into the one-valver. As signals were not received, he decided that the three-valver was not functioning correctly, and accordingly turned up the reaction until the receiver was just oscillating. Still signals were not obtainable. Why? Three books will be awarded for the first three correct solutions opened. Envelopes 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. 159 in the bottom left-hand corner, and must be posted to reach this office not later than the first post Monday, October 7th, 1935.

Solution to Problem No. 158

The bias by-pass condenser in Rogers' receiver had broken down, and was short-circuiting the resistance. Thus, the cathode was only connected direct to earth, consequently there was no bias applied to the valve. The following three readers successfully solved Problem No. 157, and books are accordingly being forwarded to them:

R. Frock, 72, Plumstead Road, Plumstead, S.E.18; J. W. W. Winckworth, 41, The Avenue, Southampton; C.O. Smith, 56, Thurston Road, Pontypridd, Glam.

Noise-free Aerial Systems—2

Untuned Feeders and Downlead Arrangements are Amongst the Subjects Dealt With in this Article

By G. V. COLLE

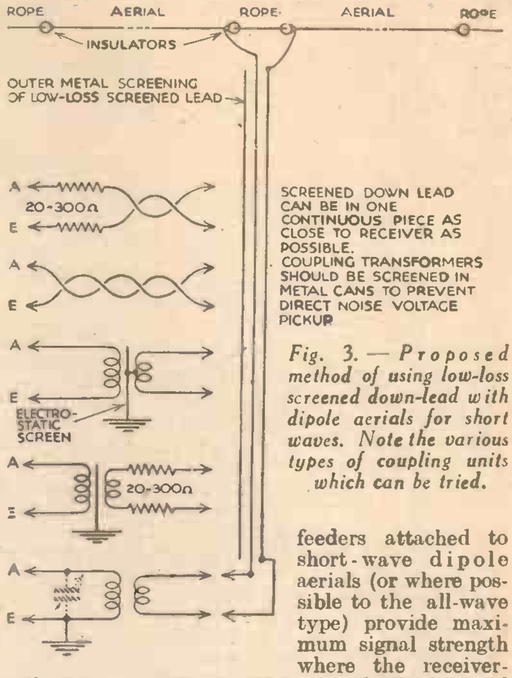


Fig. 3.—Proposed method of using low-loss screened down-lead with dipole aerials for short waves. Note the various types of coupling units which can be tried.

IN a previous article of this series it was shown that the design of an all-wave aerial must be ultimately fixed by the short-wave requirements. The difficulty of providing a tuned feeder which allows for uniform short-wave reception was also mentioned, although reasons for such limitations were not advanced.

Judging from experiments, a tuned feeder does not require impedance matching, although it must be adjusted rather critically as to length. A tuning arrangement at the receiving end allows for covering a band of wave-lengths, but owing to the feeder carrying the full oscillatory aerial current, it is liable to be affected, unless carefully erected, by extraneous electrical static waves. For this latter reason, and the limitation that the feeder can only be a defined length, it is not always possible to erect the horizontal aerial well clear of interference "blankets," such as extend around a building.

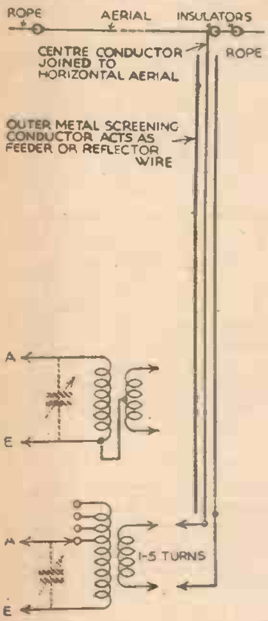


Fig. 1.—An inverted L aerial arranged for short waves as mentioned in the text. Further S.W. couplings, as shown in Fig. 3, can be tried.

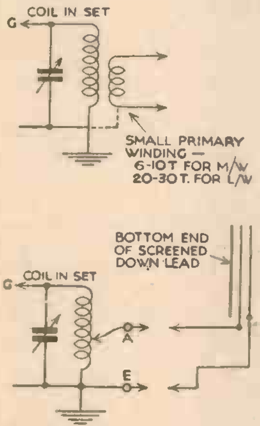


Fig. 2.—The same aerial arrangement as Fig. 1, but showing the method of coupling to the receiver for medium and long waves. The low tapping point should be maintained on both wavebands by changing over the aerial connections by switch or sockets.

Untuned Feeders

An untuned feeder, on the other hand, is unaffected by passing electrical static waves, because it does not carry the full oscillatory aerial current. When connected to dipole aerials (which the writer consistently advocates), the voltages received on the feeder wires are 180 degrees out of phase, and hence they cancel out. The effect on the receiver is as if the feeder downlead did not exist, and was merely connected direct to the aerial.

Provided the feeder impedance is in this case matched to the input of the set, its length is quite immaterial. In fact, we can make it up to about 400 feet before losses become noticeable. For these reasons untuned feeders are, and will doubtless be, made the basis of the short-wave operation of all-wave aerial systems.

Unfortunately, several facts reduce the possibility of the downlead and aerial providing their maximum performance. The maker of the aerial equipment is unaware of the tuning system provided in the receiver, unless supplied by him, which is unlikely.

The adoption of aperiodic aerial tuning in the set, which it is interesting to note is becoming recognised as a "means to an end" in all-wave commercial sets for short-wave reception, is likely to provide the solution to the problem. We must not forget that the untuned feeder is employed with a fixed wavelength aerial, and therefore provides optimum signal efficiency at one point corresponding to the natural frequency of the aerial. By connecting the download *via* a suitable coupling transformer to the untuned input of the receiver, the efficiency may not be high, but it should at least be fairly constant and, combined with the noise-reducing properties of the downlead, will provide a flexible and workable arrangement.

Unless the receiver has been built by the user to satisfy the aerial-coupling requirements, it would be quite incorrect to assume a tuned feeder will provide better efficiency with respect to signal strength. Indeed, a commercial set with aperiodic aerial coupling is more likely to operate better with the untuned feeder, which has the greater advantages.

It is now possible to make the following fairly obvious deductions :—

(1) The short-wave operation of an all-wave aerial system is unlikely to provide a degree of efficiency equal to that obtainable from a separate short-wave aerial unless the receiver input is aperiodic, in which case the advantage lies with the former aerial.

(2) An untuned "feeder" downlead is superior to the tuned type with regard to noise - proof qualities and versatility.

(3) Tuned feeders attached to short-wave dipole aerials (or where possible to the all-wave type) provide maximum signal strength where the receiver-input is tuned. Noise-proof qualities and application are limited in respect to all-wave sets.

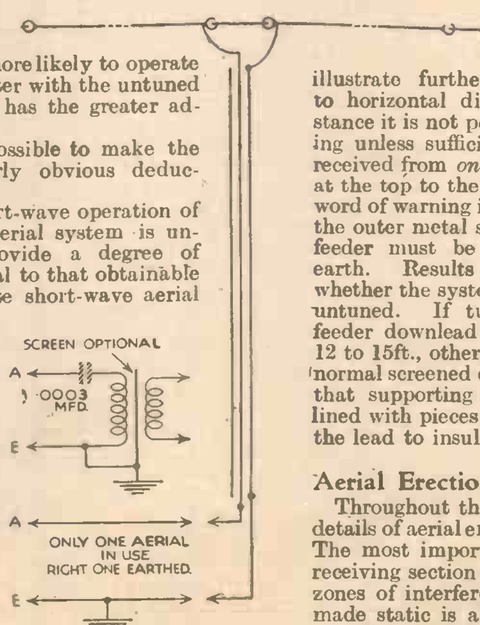


Fig. 4.—The same aerial system as that shown in Fig. 3, arranged for medium and long-wave reception. Note remarks with reference to coupling units.

Downlead Arrangements

A downlead which offers interesting possibilities for noise-free all-wave reception is the large diameter low-loss screened type, arranged as in Fig. 1. The coupling at the receiver end will be modified as in Fig. 2 for broadcast-wave reception. It should be clearly understood that the depicted arrangements in Figs. 1, 3 and 4 have not yet been tried by the writer. Electrical static pick-up on the downlead will be completely excluded on medium and long waves by earthing the outer (screening) conductor in the known manner. Figs. 3 and 4 illustrate further alternatives as applied to horizontal dipoles. In this latter instance it is not possible to earth the screening unless sufficient signal energy can be received from *one* aerial, as the one joined at the top to the screening is earthed. One word of warning in connection with Fig. 3—the outer metal screening of the concentric feeder must be carefully insulated from earth. Results are problematical as to whether the system functions best tuned or untuned. If tuned, keep the complete feeder downlead clear of the building by 12 to 15ft., otherwise it can be treated as a normal screened downlead, with the proviso that supporting wall brackets should be lined with pieces of rubber where they grip the lead to insulate the latter.

Aerial Erection

Throughout this series of articles several details of aerial erection have been assumed. The most important is for the horizontal receiving section of the aerial to be outside zones of interference. Obviously, if man-made static is allowed to impinge on the aerial proper, a noise-proof downlead will be futile. An aerial erected only a few feet above a roof will not usually prove as efficient as one, say, 15ft. or so above the ground level but well clear of a building.

(Continued on page 83)

HIGH-DEFINITION

In Accordance with the Terms of the B.B.C. Television Contract, The have now Released Full Details of the Nature of the Signals, and We the Wave-forms of the Two Separate Transmitters. The Information Design of Apparatus for the Reception of Television

Details of the Signal Radiated by the Baird Company's Apparatus

Wave-form

FIG. 1 gives complete details of the wave-form for picture modulation and synchronising impulses of this system. From this it will be seen that, using the arbitrary aerial current units of zero to 100, the total modulation for synchronising (black) extends between the tolerance limits of zero to 5 and 37.5 to 42.5, while the picture modulation (black to white) extends between the tolerance limits of 37.5 to 42.5 and 100.

It will be noted that the high-frequency synchronising impulse is rectangular in shape and is maintained for 8 per cent. of the total time taken in tracing the line, and occurs between the *line* traversals. The low-frequency synchronising impulse, which is also rectangular in shape, is maintained during the time that twelve lines are traced, and occurs between the *frame* traversals. These traversals, as seen by an observer looking at the received image from the front, scan from left to right (line) and from top to bottom (frame).

The diagram also shows that, in addition to the above 8 per cent. of the line-traversal time occupied by the high-frequency synchronising impulse, a further 2 per cent. is masked off to form a black edging. Similarly, an additional eight lines are masked off in the case of the low-frequency synchronising impulse for the same purpose.

Additional Details

The total number of lines in the complete picture is 240, scanned sequentially and horizontally at twenty-five picture traversals per second and twenty-five complete frames per second. The line frequency is thus 6,000 impulses per second and the frame frequency twenty-five impulses per second. The dimensions of the observed picture have the ratio of four horizontal to three vertical.

Amplitude modulation is employed, which results in light intensity modulation in the observed picture, the transmitter carrier increasing towards the white. The line synchronising signals and the frame synchronising signals are in the sense opposite to increasing picture modulation. The maximum frequency band involved in the transmission is 2 megacycles, and the average component of light in the picture is transmitted, a black in the picture being transmitted as black and a white transmitted as white, in accordance with the modulation percentages referred to above.

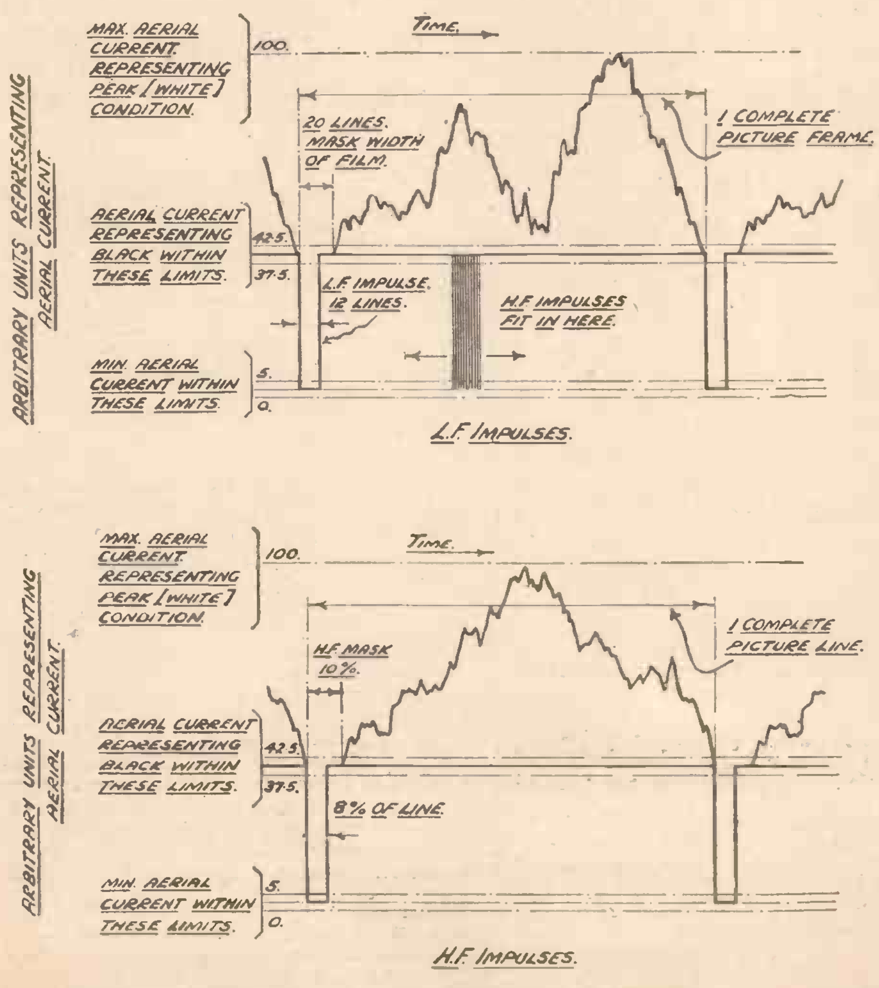


Fig. 1.—Picture modulation and synchronising impulses of the Baird system. These drawings are made from tracings taken from the vision transmitter monitoring oscillograph.

Details of the Marconi-E.M.I. System

THE Marconi-E.M.I. television system transmits 25 complete pictures per second, each of 405 total lines. These lines are interlaced so that the frame and flicker frequency is 50 per second. The transmitter will radiate signals with side-bands extending to about 2 megacycles either side of the carrier frequency. Good pictures can be received utilising only a fraction of the radiated band, but naturally the quality of the received picture will depend upon the degree to which the receiver makes use of the transmitter band width. The transmitted wave-form is shown in Fig. 2 attached.

(1) Line Frequency

Ten thousand one hundred and twenty-five lines per second, scanned from left to right when looking at the received picture.

(2) Frame Frequency

Fifty frames per second, scanned from top to bottom of the received picture.

(3) Type of Scanning

The scanning is interlaced. Two frames, each of 202.5 lines, are interlaced to give a total of 405 lines with a complete picture speed of 25 per second. The line component and the frame component of scanning are regularly recurrent, the interlace being derived from the fractional relationship between line and frame frequencies. An explanation of the method of interlacing is given at the end of this article.

(4) Interval Between Lines

There will be intervals between the vision signals of successive lines, which intervals provide time for the transmission of a line synchronising signal, and also provide time for the return of the cathode-ray beam to the beginning of the next line. The minimum interval between the vision signal of successive lines will be 15 per cent.

TELEVISION OFFICIAL STATEMENTS By BAIRD & E.M.I.

Baird Television Company and the Marconi-E.M.I. Television Company Publish Herewith the Important Details, together with Diagrams showing given will Enable Designers and Experimenters to Proceed with the Transmissions employing the Baird and E.M.I. systems

of the total line period (1/10,125 sec.), the first 10 per cent. of this interval between lines being occupied by the line synchronising signal and the remaining 5 per cent. by a signal corresponding to "black" in intensity. The remaining 85 per cent. of the total line period is available for transmitting vision signals.

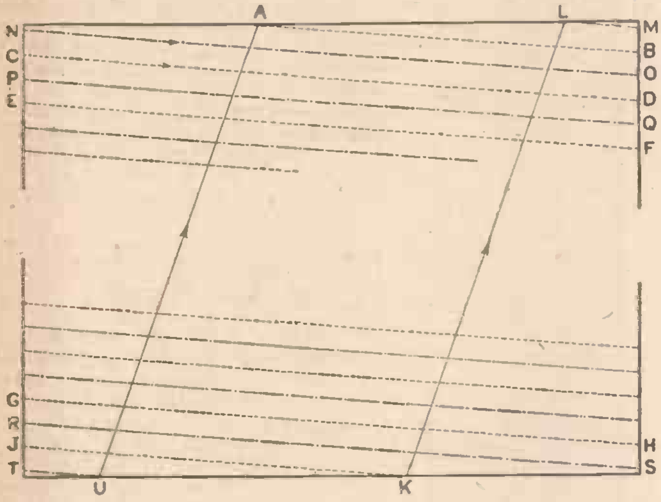


Fig. 3.—Diagram explaining the E.M.I. system of interlaced scanning.

(5) Interval Between Frames

There will be intervals between the vision signals of successive frames. The minimum interval between frames will be 10 lines, leaving a maximum of 192.5 active lines per frame, or 385 active lines per complete picture.

(6) Picture Ratio

The picture ratio will be 5 : 4, that is to say, the distance scanned during the active 85 per cent. of the total line period will be 5/4 times the distance scanned during the 192.5 active lines of the frame.

(7) D.C. Modulation

The picture brightness component (or the D.C. modulation component) is transmitted as an amplitude modulation so that a definite carrier value is associated with a definite brightness. This has been called "D.C. working," and results in there being no fixed value of average carrier, since the average carrier varies with picture brightness. The radio-frequency transmitter output is specified in what follows as a percentage of the peak output. This percentage is in terms of current (or voltage) and not in terms of power.

(8) Vision Modulation

The vision modulation is applied in such a direction that an increase in carrier represents an increase in picture brightness. Vision signals occupy values between 30 per cent. and 100 per cent. of peak carrier. The amount by which the transmitted carrier exceeds 30 per cent. represents the brightness of the point being scanned.

(9) Synchronising Modulation

Signals below 30 per cent. of peak carrier represent synchronising signals. All synchronising signals are rectangular in shape and extend downwards from 30 per cent. peak carrier to effective zero carrier.

(10) Line Synchronising Signals

The line synchronising signals are of one tenth of a line duration, and are followed by a minimum of one twentieth of a line of black (30 per cent. peak) signal.

(11) Frame Synchronising Signals

The frame synchronising signals comprise a train of two pulses per line, each occupying four tenths of a line and having one tenth of a line interval of black (30 per cent. peak) signal between them. At the end of even frames, the first frame pulse starts coincident with what would have been a line signal. At the end of odd frames the first frame pulse starts half a line after the preceding line signal. At least, six frame signals will be transmitted at the end of each frame, but the number may be increased to any number up to 12 pulses (6 lines). During the remainder of the intervals between frames, normal line synchronising signals will be transmitted with black (30 per cent. peak) signals during the remaining nine-tenths of the line.

It will be noted that throughout the interval between frames (as during the whole transmission), the carrier falls from 30 per cent. to zero regularly at line frequency and in phase with the beginning of the normal line synchronising pulses.

(12) Variations in Transmitted Wave-form

The 15 per cent. interval between vision signals of successive lines, and the 10 lines interval between successive frames are minimum intervals used at the transmitter. During the initial development of the transmitter, certain transmissions may have longer intervals between lines and between frames, which lengthened intervals correspond to the transmission of a black border round the picture.

The 30 per cent. carrier is the "black level" below which no vision signals exist and above which no synchronising signals extend. The mean black level of any transmission will be 30 per cent $\pm$ 3 per cent. of peak carrier. The black level during any one transmission will not vary by more than 3 per cent. of peak carrier from the mean value of that transmission.

(*Continued on page 83*)

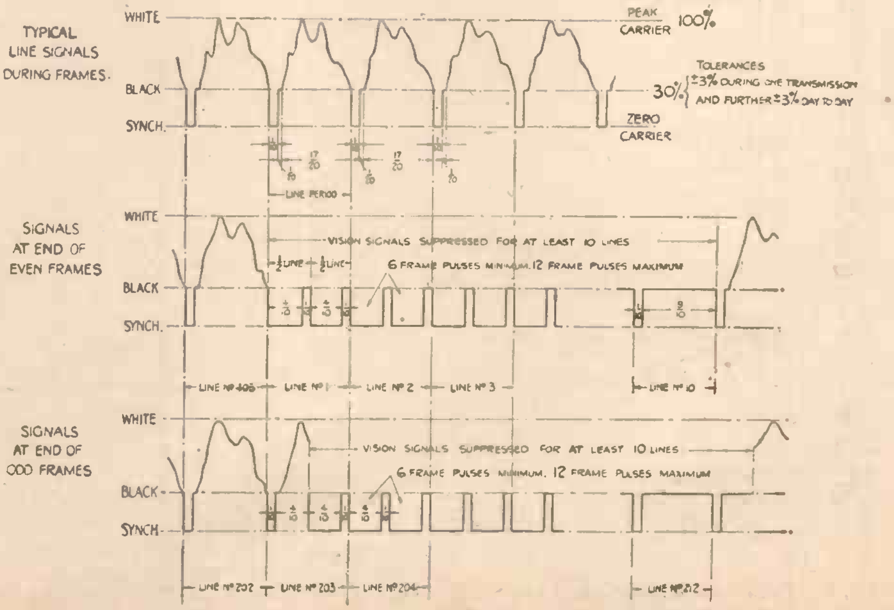


Fig. 2.—The transmitted wave-form of the Marconi-E.M.I. high-definition system.

Designing Your Own Wireless Set

FINDING THE BEST OUTPUT STAGE

The Simpler Types of Output Circuit for a Mains-operated Receiver are Given and Discussed this week

In the last two articles in this series the L.F. amplifier for a battery-operated receiver has been dealt with at some length, so we can now pass to the L.F. stage of a mains set. Generally speaking, there is a similar choice of circuits as in a battery set, but the possibilities are greater due to the more diverse types of valves capable of providing a wide variety of undistorted outputs. On the other hand, Class B and Q.P.P. amplifiers are not normally applicable to this type of receiver, although the push-pull counterpart is extremely valuable.

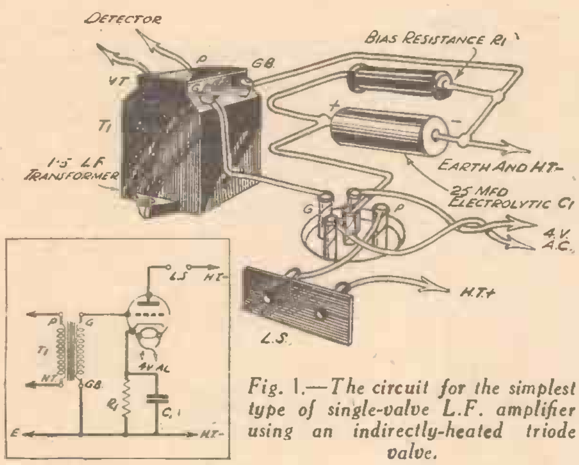


Fig. 1.—The circuit for the simplest type of single-valve L.F. amplifier using an indirectly-heated triode valve.

A Single Triode

The simplest possible single-valve L.F. circuit is that shown in Fig. 1, where it will be seen that a triode power valve is used, this being fed by a 1.5 L.F. transformer and being provided with automatic grid bias. This fundamental circuit can include any valve having a rated maximum undistorted output from, say, 1 watt to 10 watts, but it must be remembered that the *available* output is dependent upon the input from the detector and upon the high-tension supply which can be obtained. The first consideration is most important in practice and, assuming the use of a leaky-grid detector immediately prior to the transformer shown, it is rarely possible to obtain an output greatly in excess of 1 watt; even for this output the L.F. transformer should provide a step-up of 1.4 or 1.5. A slightly greater output—up to nearly 1½ watts—can be obtained by using a transformer or resistance-fed coupling unit which provides a ratio of 1.7 or so, but especial care must then be taken to avoid instability and distortion.

Automatic Grid Bias

If it is assumed in the first place that a maximum output of at least 1 watt is required, that the detector is of the leaky-grid kind, and that the power-supply unit has an unsmoothed output of 250 volts at 60 milliamps., a valve such as the Cossor 41 M.P. would be very suitable. This takes an average anode current of 24 m/A at a maximum of 200 volts, and with 7.5 volts G.B., and has a rated output of 1,250 milliwatts (1¼ watts). It has a mutual conductance of 7.5 m/A volts, and therefore gives a good measure of amplification. The first point to decide concerns the correct value of bias resistance, and after that the H.T. voltage and output coupling circuit must be settled. It can be assumed that the H.T. voltage will be made correct (200), and it is known that the bias required is 7.5 volts when the valve is passing 24 m/A The resistance value is found by applying the Ohm's Law formula: Resistance (ohms) equals voltage to be dropped divided by the current passing (amps.), so that we get: Resistance equals 7.5 divided by 24/1,000, which is the same as saying 7,500 divided by 24, which is about 310 ohms. A value of 300 ohms would be used, as being the nearest obtainable in the standard range.

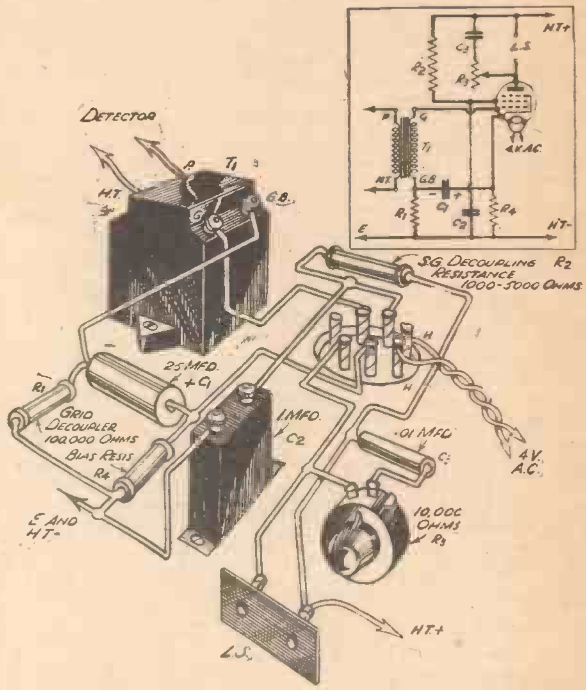


Fig 3.—Showing the method of decoupling the grid and screening-grid circuits of an indirectly-heated pentode.

H.T. Considerations

As to the H.T. voltage, if the output from the rectifier is 250 as assumed, the voltage drop across the smoothing choke, across the primary of the output transformer, and across the bias resistance will just about reduce the voltage actually applied to the anode to the required 200 volts. This can easily be checked by using the formula given above and determining the voltage dropped by the choke (in this case using the anode-current figure representing that for all of the valves in the set), and across the transformer primary (using the current figure for the output valve only). If it is found that the total anode-current consumption for all the valves together would be less than 60 m/A, it would be necessary to connect a resistance in parallel with the H.T. supply, whilst, if the figure exceeded 60 m/A, a different type of rectifier or output-valve would have to be used; this matter will be considered when dealing with the design of the power unit.

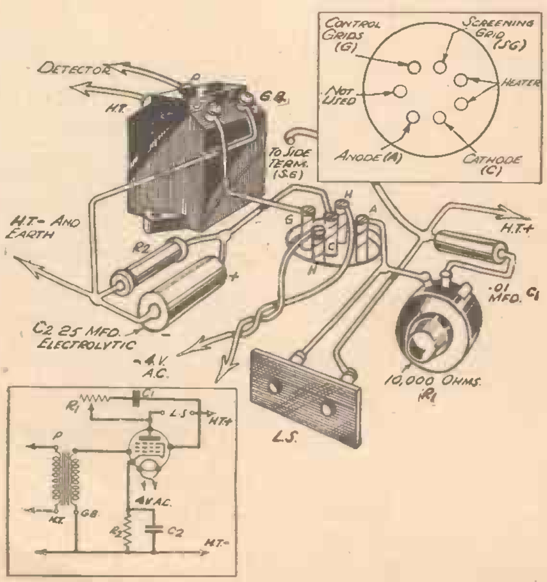


Fig. 2.—The connections for an indirectly-heated pentode. The pictorial view shows the valve connections when using a pentode with side-base screening-grid terminal, but inset are connections when using a seven-pin valve.

The output transformer is nearly always made integral with the loud-speaker in modern instruments, and it is therefore only necessary to order a speaker suitable for matching the output valve employed. Alternatively, a speaker with multi-ratio transformer may be employed, and the most suitable primary tapping found by trial.

Pentode Advantages

Although the output circuit dealt with above is entirely satisfactory when a modest output is required, it becomes necessary to use a pentode if greater volume is desired, and if it is preferred to retain a single-valve amplifier for reasons of economy. Modern indirectly-heated pentodes of high efficiency will provide an undistorted output up to about 3 watts for an H.T. current consumption of about 35 milliamps., and can be used in the simple circuit shown in Fig. 2. This is very similar to the arrangement in Fig. 1, with the exception that an additional high-tension lead is used to feed the screening grid, and that a tone-compensating arrangement is used in the output circuit to prevent undue prominence from being given to the higher frequencies. The value of bias resistance is calculated exactly as before, but it should be observed that the type of pentode under consideration is designed to give its maximum undistorted output when the voltage applied to the anode and screening grid is 250, *not* 200. In consequence of this, the output actually obtainable when the power-supply unit gives only 250 volts before smoothing should not be expected to be more than about three-quarters of the maximum. This need not affect the calculation of bias-resistance value, and the figures applying to maximum voltage (and generally given on the makers' instruction sheets) can be taken. The reason for this is that the resistance is largely self-compensating; in other words, a reduction in anode voltage causes a reduction in anode current, which means that the bias voltage is also reduced, as is required.

Preventing Instability

When using the simple arrangement shown in Fig. 2 there is always a possibility that distortion may be introduced, due to the valve being slightly unstable in consequence of the extremely high degree of amplification which is afforded. This can be prevented by decoupling either the grid circuit, the screening-grid circuit, or both, as shown in Fig. 3. A 100,000-ohm resistance is used to decouple the grid circuit, and this is included between the secondary of the L.F. transformer and earth, the bias by-pass condenser being joined between the transformer winding and the cathode of the valve. As to the screening-grid, this is decoupled by taking the H.T. supply to it through a fixed resistance having a value between 1,000 and 5,000 ohms, and by using a 1-mfd. by-pass condenser. It will be appreciated that the resistance will have the effect of reducing the H.T. voltage available and should therefore have the lowest value possible consistent with its being effective.

Resistance Ratings

No mention has been made of the wattage rating of the resistances employed, principally because in every case considered the usual rating of 1 watt would be sufficient. This will not always apply, however, and it is therefore wise to check the actual wattage dissipated before obtaining the components. The required figure is obtained by multiplying the square of the current by the ohmic resistance. Thus, if the value is 300 ohms, and the current 24 m/A the dissipation is 24/1,000 multiplied by 24/1,000, and multiplied by 300. This is equivalent to $\frac{24 \times 24 \times 300}{1,000 \times 1,000}$ or $\frac{1,728}{10,000}$, which is less than 1/5 watt. The grid-decoupling resistance does not carry any D.C., and could therefore have a rating of only a fraction of a watt.

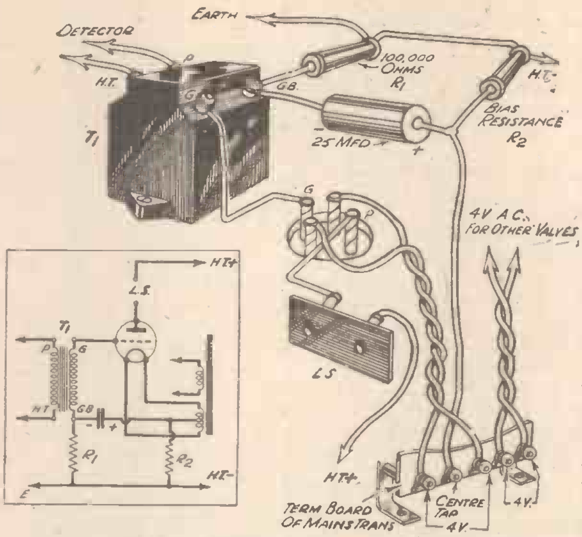


Fig. 4.—Showing the connections for a directly-heated output valve.

Directly-heated Valves

In the three circuits so far discussed the valves shown have been of the indirectly-heated-cathode type, but it is sometimes preferable to use a directly-heated valve. This is desirable when the rectifier is of the directly-heated valve type, and also in some cases where it is found that the output and current consumption of a directly-heated valve are more suitable for the conditions obtaining in the receiver being designed. The connections are very similar to those already shown, and are indicated in Fig. 4. In this case it is best to employ a separate winding on the mains transformer to supply the filament of the output valve, whereas in the other instances the same winding as is used for the other valves in the set can be used. Additionally, the bias resistance is included between the centre tapping on the filament winding and H.T.—. Apart from these small points the general arrangement is unchanged, and the connections indicated apply to the L.T. circuit of either a triode or pentode valve.

Choke-capacity Output

It is sometimes required to use a choke-capacity output circuit, as, for example, when the speaker is to be used at a distance from the receiver, or when the speaker transformer is not suitable for carrying the full anode current. The connections in this case are as shown in Fig. 5, where the methods to employ for both directly- and indirectly-heated valves are given. It should be noticed that the "return" lead from the speaker is connected directly to the cathode and to the centre-tapping of the transformer winding respectively, and not to the earth line. This is not always important, but in many cases the bias resistance causes an appreciable loss in volume when it is included in the speaker circuit—as it is when the lead is taken to earth.

The output choke should be a good component easily capable of carrying the full anode current passed by the valve, and having an inductance under working conditions of approximately 20 henrys for a triode and 45 henrys for a pentode. Additionally, the D.C. resistance should not be higher than about 400 ohms, because if it is there

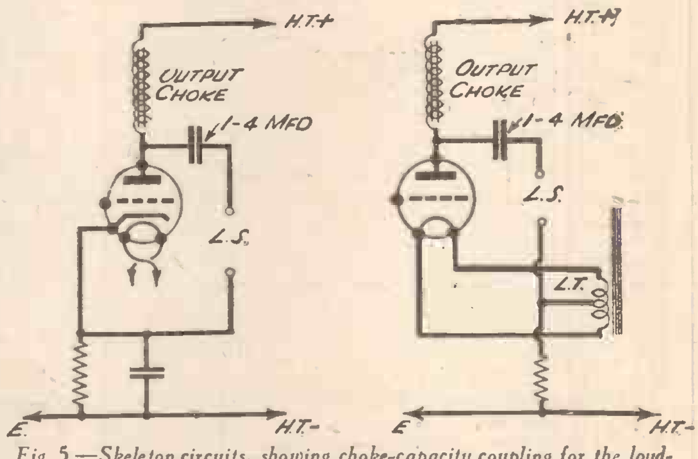


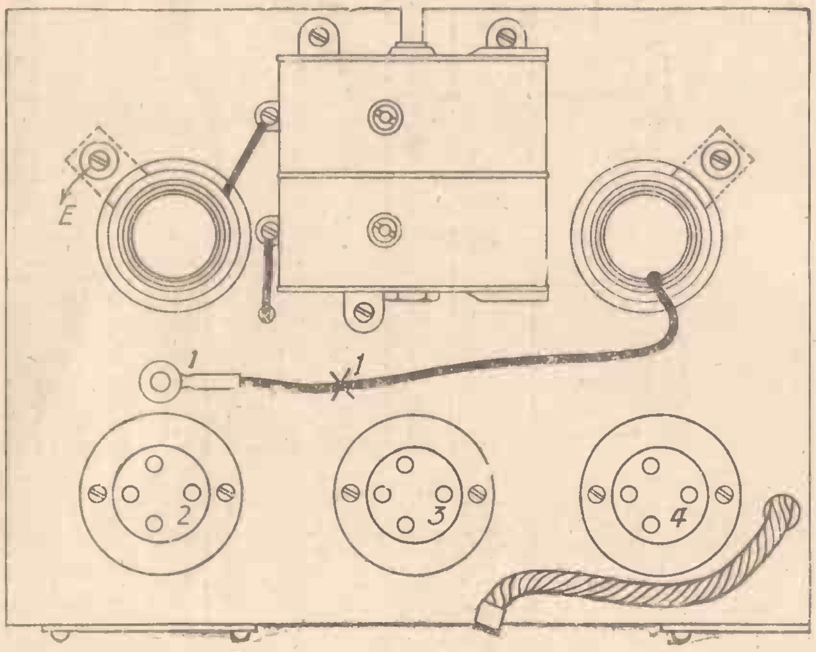
Fig. 5.—Skeleton circuits, showing choke-capacity coupling for the loudspeaker when using indirectly- and directly-heated valves.

will be a loss of voltage which can rarely be afforded. There are several suitable chokes on the market, but these are, of necessity, rather expensive components. Readers are warned that results may be ruined completely by using a cheap, unbranded choke, the inductance of which might be considerably below the figure at which it is rated.

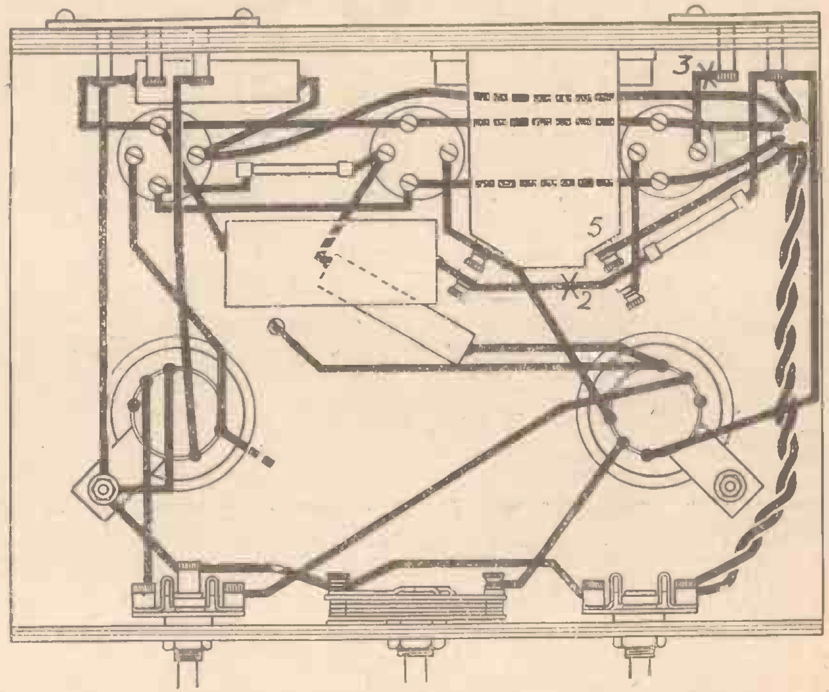
In the next article of this series amplifiers capable of an undistorted output up to 7 watts or so will be dealt with, reference being made to push-pull and "cascade" arrangements of valves. Connections will be given for both triodes and pentodes of directly and indirectly-heated types.

The power-supply portion of the mains receiver will be dealt with in a separate, later article.

Practical and Amateur Wireless SERVICE DATA SHEET No. 4 FOR THE HALL-MARK THREE



Top of Chassis View



Underside of Chassis

Approximate Voltage Readings

Voltmeter — to E.
„ + to 1=120 volts.
„ + to 2=60 volts.
„ + to 3=60 volts.
„ + to 4=115 volts.
Voltmeter + to E.
„ — to 5=9 volts.

Approximate Resistance Readings

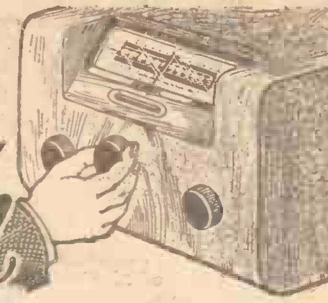
Coil No. 1.
Ohmmeter across White and Yellow leads=2½ ohms.
„ „ White and Black „ =15 ohms.
„ „ Blue and Black „ =15 ohms.
Coil No. 2.
Ohmmeter across White and Yellow leads=2½ ohms.
„ „ Red and Black „ =15 ohms.
„ „ Blue and Green „ =10 ohms.
„ „ White lead and Bracket=15 ohms.

L.F. Transformer.
Ohmmeter across G. and G.B. terminals=3,500 ohms.
„ „ P. and H.T. terminals=600 ohms.

Approximate Current Readings

Milliammeter connected at X1=2½ m.a.
„ „ „ X2=1½ m.a.
„ „ „ X3=10 m.a.

On Your Wavelength



By Thermion

And So It Goes On!

I THOUGHT I had written my final word about crooning, but not so. Correspondence continues to pour into the office from the ayes and the nays. I have been accused of using meiosis and hyperbole in my contumacious remarks about that lowest form of life. My remarks may not have been the essence of quiddity, nor my style the sovran cache of the grammarian. I am, however, sincere and I have already admitted that as many people like crooning as dislike it. Take the following from one who supports the hidy-highnesses of hi-de-ho. This correspondent, C. S. F., whose demesne bears the suggestive title, "Hidy-Ho" writes as follows :—

"As an admirer of yours, I was sorry to note you had fallen for the somewhat hackneyed sport of 'knocking the crooners.' As a man of sense, you must realise there is another side—in fact, several—to this question, otherwise how comes the admittedly immense popularity of these folk? For the sake of brevity, I will number the points in the crooners' favour.

Readers who write.

"1. You can hear every word they sing. (N.B.—I, for one, cannot think of more than three 'straight' concert-singers of whom this could be said.)

"2. They never shout or strain—they never rally all their forces for that top note. They just sing softly—is that a crime?

"3. They are not responsible for the numbers they have to feature. Admittedly, some of them are fairly dreadful—but the public taste is at fault.

"4. As many of the songs are American and often Negroid in subject, they would lose in effectiveness unless rendered in suitable accent.

"All that over, I must admit that I deplore the archness that some of these artists use to 'get across,' but not more than I detest the same thing in variety performers on the stage (or in columnists—not you, of course.)

"Regarding jazz generally, syncopation, unless I have been grossly misinformed, consists in accenting the beat not usually accented in straight music, thus emphasising the rhythmic aspect of the melody. Some unfortunates have apparently never got used to the idea, although for dancing or any form of light music it would rather seem the obvious thing. Inasmuch as plenty of folk with a keen appreciation of the loftiest of the classical composers can yet understand and enjoy syncopated music it would seem that those out of sympathy with the latter are probably missing something.

"They seem to me to occupy a similar position with the individual who boasts of being unable to read Wodehouse.

"Such folk should try to remember that syncopation, in its comparatively short existence, has given the world some gems of song which can stand comparison with *any* type of melody-line music. Might I remind you of a few examples?

"'Tip-toe through the Tulips.'
"'Lady be Good.'
"'Let's do it, Let's fall in Love.'
"'Chlöe.'
"'That's why Darkies were Born.'
"'The House is Haunted.'
"'Round the Bend of the Road.'
"'Miss Otis Regrets.'
"'Old Man River.'
"'Ill Wind.'
"'Remember my Forgotten Man.'
"'We're in the Money.'
"'Sitting on Top of the World.'
"'The Birth of the Blues.'
"'My Heart Stood Still.'

"One could go on for pages and pages. And *please note*: the words of any of the above will bear scrutiny. Some are pure poetry—others gems of humour. Would you—Could anybody?—try to maintain that these are in any way inferior to the appalling drivel which constituted the popular song of a generation ago? Even a modern crooner doesn't insult our intelligence with such masterpieces as 'Daddy Wouldn't Buy Me a Bow-wow.' And, sentiment apart, are the words even of 'Lily of Laguna' remarkable for their wit and wisdom? I mean reading them in cold blood. Be fair!

"I'm as sick as anybody of sticky sentimentality (of which the popular singers of this period by no means have a monopoly), but do not, on that account, condemn all so-called 'crooners.'"

My answer is that *every* paper catering for intelligent people is damning jazz, and I have a fine collection of cuttings. Jazz to me is the music of Harlem, where it rightly belongs—among half-baked negroes of doubtful origin. Better music is played in the gutters of London streets, and better musicians are compelled to play there. Jazz to-day is merely a racket.

And Then Some!

OF course, all of this correspondent's remarks have been said before. What answer can he make to the following correspondent, D. R. H. (Streatham)?

"I wish to thank you for the great amusement your weekly hate against 'crooners' gives me. I agree with you up to a certain point, but you condemn *all* people who vocalise with dance bands as 'crooners.' This is *not* so. The word, according to Chambers' dictionary, means—to utter a low, monotonous, inarticulate sound like a baby: to sing or hum in an undertone. The word is wrongly applied when used to refer to such people as Sam Brown, Pat O'Mally, Joe Ferrie, etc. Their diction is better than a lot of 'straight' singers, and they *sing*. I, myself, divide male voices into seven types; here they are :—

"1. The roaring bass—sings usually 'Asleep in the Deep' kind of song.

"2. The bathroom baritone—is usually calling to Maud to come into the garden. Both these types suffer from a peculiar complaint that makes them sing very throatily.

"3. The mincing tenor; this kind sings anything, from 'Hearts of EWK' to 'Ai want toh beh Happeh,' and the B.B.C. is very fond of this sort, for its 'Songs from the Shows' and reviews; so is the stage!!

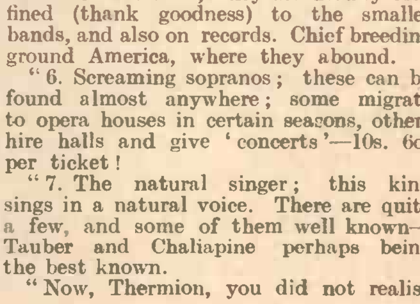
"4. The church choir type; this is a nondescript kind of voice, and usually sings in between the intervals of a brass band concert on the wireless.

"5. The crooner; there are not many of these 'on the air'; they are usually confined (thank goodness) to the smaller bands, and also on records. Chief breeding ground America, where they abound.

"6. Screaming sopranos; these can be found almost anywhere; some migrate to opera houses in certain seasons, others hire halls and give 'concerts'—10s. 6d. per ticket!

"7. The natural singer; this kind sings in a natural voice. There are quite a few, and some of them well known—Tauber and Chaliapine perhaps being the best known.

"Now, Thermion, you did not realise how many other kinds of singers there were, most of them quite as painful to listen to as the bad dance band vocalist, did you? Why not transfer your hate to some of the kinds I have mentioned?"



Wonderful portables.

Here's Another Specimen

MY friend from "Hidy-Ho" may also like to read the following, from a reader whose signature is undecipherable but lives at Thorpe Bay :—

(Continued overleaf)

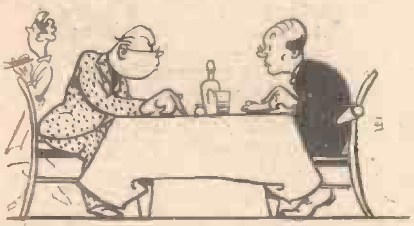
(Continued from previous page)

"Your indictment of hellish croonings and jazzings is good, sane English.

"My calling takes me across the width of this London nightly. I can vouch for the statement made by you that, bar a few shady 'chips' and coffee shacks, the Londoner bars those dreadful unending decadent dins oozed forth by Izzy and sundry dago 'bhoys,' with a Jack, Joe, Al, Alf, Sid, Lew, of pure Anglo-Saxon ancestry as 'conductor' with oscillating haunches and shovel-mouthed leerings. The busy 'hush' of night having fallen, we find that lecherous kidney frequenting that 'travellers' joy' of the wayside where vestals do sport ungarbed midst fœtid waters and reeking stale gin, plus rising incense, and swinging their beefy Bramah haunches and macaroni thighs. The debauched herd that passes sewage offal for dairy-fed produce is financially interested in this disgusting thugging of England's youth. *Fleet Street knows.*

"A cunning fry, centred in the West-end and W.C., coupled with Bowery horrors, and aided and abetted by some so-called musical critics, and meeting round festive boards in the N.W., or in Rabbi's sundry afternoon parlours—with 'In tourist' flavourings, set the week's rhythm. Rhythm! What a dope!!

"The criminal on the treadmill, the plunging sea-craft, even Lysy, or Sisyphus and his boulder, all have rhythm!



Your Editor takes me to lunch and to task.

Even the swinging form on the gibbet has *rhythm*!! In Russia, in 1914, they called this clinic swab the *scude* and found the other side of Aldgate pump and in the octopus-tentacled 'diaspora' closing in to the N.E., N., and N.W.

"Enclosed is the front page taken from my little daughter's weekly *Children's Newspaper*, and here you will read that the editor, who is usually very tender when handing out his lactic delicacies, devotes a whole column to the devastation wrought in kids' lives by this lewd and cancerous mewling. Who are this bevy of 'Saxhorn' Herewards, clustered like limpets at Ariel's Taj Mahal, where foreigners and Scots and anyone but an Englishman and other yeomen on Avon's banks, provide this '*overcast* with sickly wail of *bought*' (a little bit mutilated)? Who really gets this python gorge of hideous putridity over to the herd that pays *but does not and must not call the tune*?

"No licence is taken by the plucker of everything, dog-minded, red-headed, bulging-lipped—this viperous hoyden thing; nor by that leprous 'snow' gutter crawler. That is the whole secret. Who fathers these 'perpetuum mobile' Satanic vomits and Sunday midday and afternoon effeminate squeals and gorilla belchings? Who is the musical, or music-hall director, who takes his fat fee from the subscribers' dibs and dispenses this eternal bilious jalap with every honest soul's very vitals in active eruption?

"Why can't English kiddies hear good music? The reason is that it *pays someone to continue things.* I'd like the B.B.C. to show a real bit of their Puritan upbringing and, in spite of the dance band fans, ply the lash on the Taj's steps and disperse that fawning, blighting '*judengeld*' kidney! All power to your K.O.'s."

Am I to gather that this reader does not like jazz?

Modulation Hum

HUM which maintains a steady intensity regardless of the position of the tuning control can generally be traced to a defective smoothing condenser, insufficient smoothing capacity, or interaction between receiver and mains unit inductances. There is a peculiar type of hum which is only noticeable when the receiver is tuned in to a strong transmission, however. This is termed modulation hum, and can, in most cases, be eliminated by connecting a .001 mfd. condenser across each half of the H.T. secondary winding of the mains transformer. It is essential, of course, to use condensers having a sufficiently high voltage rating to withstand the voltage across the transformer winding. It is also pointed out that this type of hum is sometimes confused with interference due to loose tuning condenser vanes. If the vanes are not rigid, vibration and consequent interference is set up when a strong signal is received.

Obtaining Selectivity

OWING to the increasing number of high-power transmitters operating on the Continent, it has become a difficult task to design a receiver that will separate the transmissions and at the same time provide reasonably good quality of reproduction. It is true that the majority of the 1936 superhets are capable of providing the necessary degree of selectivity, but in many cases the quality obtainable leaves a good deal to be desired, and one seldom finds a superhet that is entirely clear of whistles. It would seem that a good deal of further research work is called for in the design of frequency-changers before the superhet can oust the straight type of receiver. It is true that remarkable improvements have been made during the past eighteen months, but there is no doubt that the frequency-changing valve is still the weak link in the superheterodyne. While the valve manufacturers have been devoting their time to the improvement of this valve, the coil manufacturers have been improving their products, and to-day we find that a well-designed straight set having four tuned circuits is capable of giving as high a degree of selectivity as the average superhet.

Straight Sets

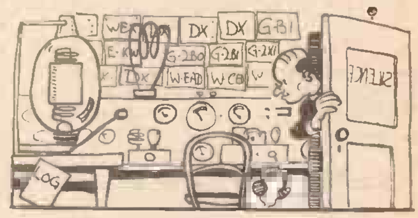
TO obtain the degree of selectivity associated with a superhet, the four coils of the straight set must be well designed and must be arranged in the proper order. In the past it has been usual to place the band-pass filter before the first valve, in order to avoid cross modulation due to overloading of the screen-grid valve, but since the advent of the modern H.F. pentode cross modulation has disappeared, and it is found that the band-pass filter can be used to the best advantage between the first and second H.F. amplifying valves. In order to obtain entirely satisfactory results with four tuned stages it is essential, of course, to use perfectly matched coils and tuning condensers.

The American Point of View

I HAD the pleasure the other day of a chat with Mr. Hugo Gernsback, who, as my readers know, edits a number of the well-known American technical publications. He brought a refreshing outlook on the television situation and thinks that real television is still a long way off. He agreed that, as with radio, the new science must pass through its present phase, but thinks that America was, four years ago, at the stage where England and Germany is to-day. Maybe, but at present there are no television systems worth while in America. He tells me that short-wave American fans disdain their own short-wave programmes, and prefer to listen to those radiated from Great Britain, India, Africa, Australia, and the Continent. It is illuminating to chat with one so well able to present the American point of view.

Empire Service Extension

I AM glad to see that two new short-wave Empire broadcasting stations are shortly to be erected, for this country is still inclined to lag behind some of the others in its short-wave service. It seems evident to me that the number of short-wave transmissions must of necessity become greater, and I am of the opinion that it will not be so very many years before we have regular programmes on these wavelengths, not only for Empire "consumption," but for reception by domestic sets in this country. Despite the fact that short waves are especially suited to long-distance work, they should also prove ideal for "local" transmission and reception. In fact, I should not be at all surprised to find, in the course of a few years, that many of the relay stations which are intended to provide a purely local service use wavelengths below 50 metres. One advantage of this would be that there would be less interference between different transmissions (although there can be little complaint on this score at the moment) but a more important advantage would be that it would be possible to allocate a wider frequency band to each transmitter. This would permit of far better quality in the transmissions and would thus enable us at the receiver end to enjoy more realistic reproduction. Besides, these local-service short-wave transmitters could "get over" by using very low power, which would represent a decided economy.



My wireless den.

What of Q.P.P.?

QUIESCENT push-pull amplification seems to have fallen from popularity during the past year or more, but I still believe that there is ample scope for the system. I was testing out a Q.P.P. battery set only a few days ago, and the volume and quality were both very praiseworthy, and was as good as I have ever heard from a battery set.

A PAGE OF PRACTICAL HINTS

SUBMIT YOUR IDEA

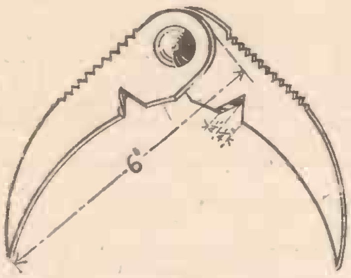
READERS WRINKLES

THE HALF-GUINEA PAGE

A Useful Multiple Tool

THIS handy tool can easily be made from a broken hack-saw blade.

It can be used as a wire stripper, knife, tweezers, inside and outside calipers,



A multiple tool made with parts of a hack-saw blade.

dividers, paint remover, and for testing components by short circuits. A 6in. length is broken off both ends of the blade and ground to the shape shown in the sketch. A sharp edge is put on, and it is then riveted at the joint.—K. S. KERR (Liverpool).

Calculating the Current Consumed

THE following notes will be useful to those readers who do not know how to calculate the energy consumed, also the cost of running a mains receiver, or other apparatus.

To find out the cost of running an electric receiver, fan, or iron, it is first necessary to ascertain the power expended, that is "watts." In the case of domestic appliances, such as electric fans, irons, and kettles, etc., the "watts" or, as in some cases, "kilowatts" (*i.e.* 1,000 watts), are stamped on a small plate with the particulars of voltage and other details, but with regard to radio sets the manufacturer gives the consumption in "watts" in the specification of the receiver. Once the "watts" are known, the "kilowatt-hour" or Board of Trade unit, more simply known as the "unit," is easily found by simple division and multiplication, as shown by the following equation, which applies to this particular instance :—

$$\left.\begin{matrix}\text{Kilowatt-hour or}\\ \text{Board of Trade unit}\end{matrix}\right\} = \frac{\text{watts} \times \text{hours}}{1{,}000}$$

Therefore, as an example :—

To find out the cost of running a mains set for five hours, with electrical energy at 5d. per unit, the set "wattage" being given as 60 watts, proceed as follows :—

$$\text{Since B.T. units} = \frac{\text{watts} \times \text{hours}}{1{,}000}$$

$$\therefore \text{B.T. Units consumed} = \frac{60 \text{ watts} \times 5 \text{ hours}}{1{,}000} = \frac{300}{1{,}000} = \frac{3}{10} \text{unit}$$

THAT DODGE OF YOURS!

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

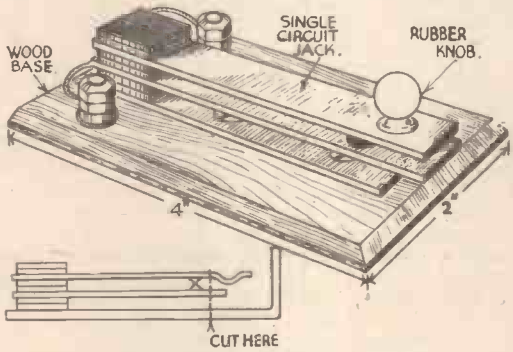
$$\text{Hence cost} = \frac{3}{10} \text{unit} \times 5\text{d. (cost per unit)}$$

$$= \frac{3 \times 5}{10} = \frac{3}{2} = 1\tfrac{1}{2}\text{d.}$$

The same method obviously could be applied for other domestic electric apparatus. Decimal fractions have not been used, also the example has been treated in an elementary manner for clearness.

The following equations may be of interest to other readers :—

$$\text{B.T.U.} = \frac{\text{watts} \times \text{hours}}{1{,}000} = \frac{C \times V \times \text{hrs.}}{1{,}000}$$



A telegraph key made from a jack.

$$\text{or } \frac{C^2 \times R \times \text{hrs.}}{1{,}000}$$

$$\text{or } \frac{V^2 \times \text{hrs.}}{R \times 1{,}000}$$

Where V = voltage, C = current, and R = resistance.

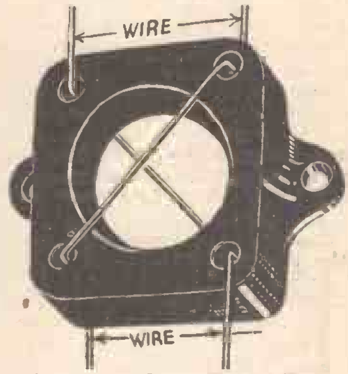
T. PHILLIPS (Leyton).

A Makeshift Telegraph Key

A SIMPLE telegraph key can be made for a few pence with an old single-circuit jack, a block of wood, and a small rubber knob, as shown in the sketch. The base is cut in half, as indicated, and two small holes are drilled in the part left on the jack. The upper blade of the jack is either straightened out or cut off, and a hole is drilled in the upper blade, in which a small rubber knob is fastened. The base is a piece of wood measuring 4in. by 2½in. by ½in., and holes are drilled at one end for two terminals. Two wires should then be soldered to the end of the jack blades and taken to the terminals.—B. L. BLAKEY (Nelson, Lancs.).

A Cheap Transposition Block

ALL that is required for this block is an old bakelite square valve-holder, which can usually be requisitioned from the junk box. Remove the centre from the base by unscrewing the terminals and



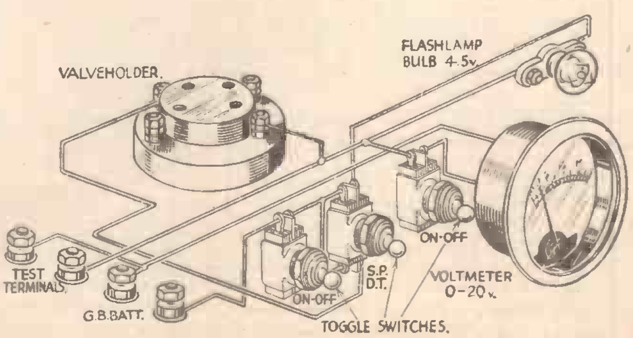
An improvised transposition block.

nuts, and thread the aerial wire through the four corner holes, as shown in the accompanying sketch.—D. A. HARBORD, (Wavertree).

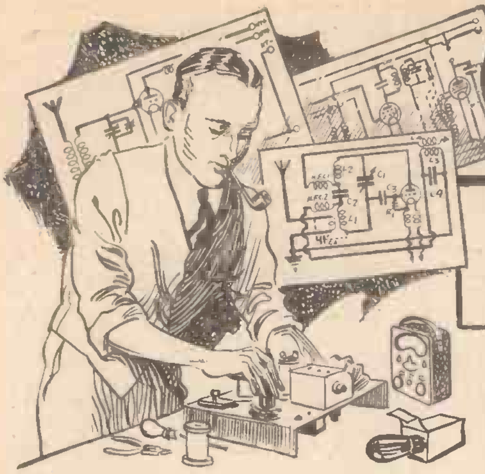
Filament Testing Apparatus

THE accompanying sketch gives details of an arrangement which I have found very useful for testing valve filaments and other wireless components. The various components are screwed down on a baseboard measuring 12in. by 7in., and a grid bias battery is used for supplying current.

For testing the filament of a valve, place the valve in the holder with the voltmeter in circuit. Switch on a supply of 2 volts, and if the filament is good the needle of the voltmeter will be deflected to nearly two volts. If the filament is burnt out the needle will remain at zero. With the 4.5 volt bulb in circuit, coils, etc., can be tested in the usual way by connecting the component under test across the test terminals.—A. J. HIRAM (Gloucester).



A simple apparatus for testing valve filaments.



CIRCUITS AND SETS FOR ALL

BUILDING A FOUR-VALVE S.W. SUPERHET

Full Circuit Details for a Highly-efficient and Modern Set Which Can be Built and Operated in the Simplest Possible Manner.

THE superhet has become well established as an ideal circuit arrangement for short-wave reception when complete reliability and simplicity of operation are desired. And the efficiency of the modern S.W. superhet is due in no small measure to the use of the pentagrid or heptode frequency changer. Despite this, however, there are still many constructors who avoid this type of valve because it is generally believed that it necessarily entails the use of two ganged tuning circuits, which they imagine are difficult to match and to keep in trim whilst operating the set. Actually, these difficulties are more imaginary than real, but the circuit illustrated on this page has been prepared in order to avoid them completely. As a result, the receiver to be described is even simpler to operate than the older autodyne arrangement; at the same time it is considerably more sensitive and reliable.

Ultra-simple Tuning Arrangements

It will be seen that the aerial circuit, and hence the grid circuit of the first-detector portion of the pentagrid valve, is untuned, and simply consists of a .25-megohm grid leak which provides a suitably high impedance over the wave ranges covered. The oscillator portion of the frequency-changer is tuned in the usual manner by means of a .00016-mfd. condenser in parallel with the anode winding of the tuner.

In theory, this simple system of tuning appears rather crude, but it is perfectly satisfactory in practice, especially since an extremely high degree of selectivity is not required on short waves. It certainly has the advantage of requiring only a single tuning condenser, and not calling for any preliminary trimming adjustments. Thus it is possible to receive a large number of stations merely by rotating the slow-motion dial of the tuning condenser; there is no reaction control in the usual sense, because the condenser in this circuit can be set to a suitable value and then left entirely alone.

465 Kc/s I.F.s

The intermediate-frequency transformers specified are of the new, high-efficiency type with air-spaced trimming condensers, but components of the older type can be used if they are already on hand. The transformers have an optimum frequency peak of 465 kc/s, and it will be found that these are considerably better than those tuning to 110 or 150 kc/s, particularly in the present circuit where the aerial circuit is aperiodic.

An ordinary three-electrode valve of the "super detector" variety is used as second detector, and it is connected in a fairly conventional manner. There is no H.F. choke in its anode circuit, for this is found to be unnecessary, but a .0003-mfd. fixed condenser is connected between the anode and earth by-passing any H.F. which might pass through the valve. The small L.F. transformer is resistance-fed, and a 20,000-ohm resistance is used in conjunction with a 2-mfd. condenser for decoupling purposes. Further to ensure that no H.F. should leak into the pentode output valve a 100,000-ohm resistance is included in the grid lead. In most cases this would be unnecessary, but its use is a safeguard against L.F. instability, besides which it tends to improve the tone of reproduction.

Chiefly with the idea of ensuring complete simplicity, variable bias is not applied

(Continued on page 81)

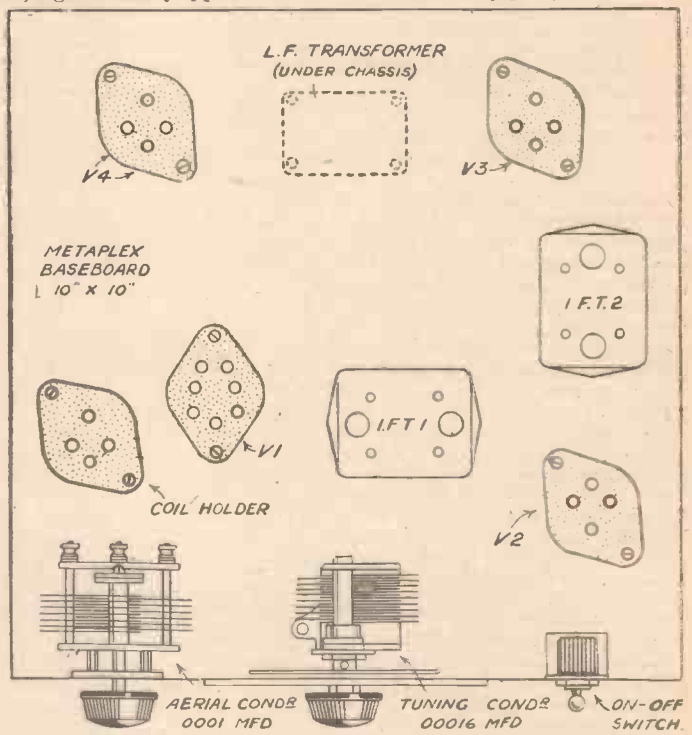


Fig. 2.—This illustration gives a good idea of a suitable component lay-out for the circuit described.

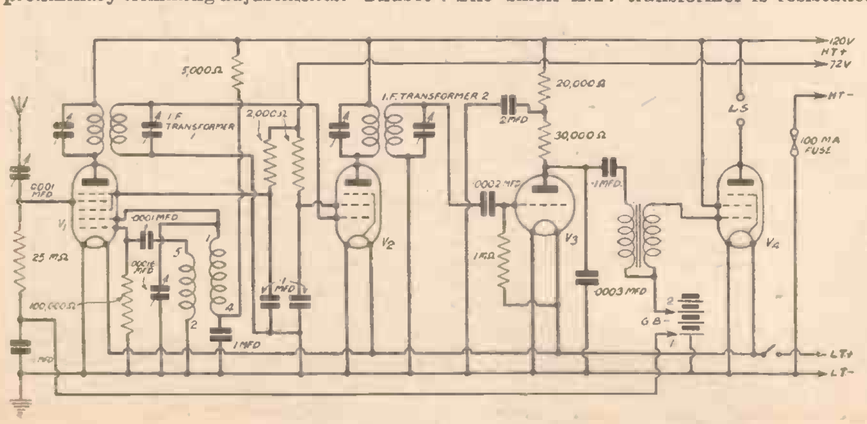


Fig. 1.—The simple circuit of the four-valve battery-operated superhet described.

PRINCIPAL COMPONENTS REQUIRED.

- One Metaplex Chassis, 12in. by 10in., with 3in. runners (Peto-Scott).
- Four 4-pin Ceramic-type Valve-holders (Clix).
- One 7-pin Ceramic-type Valve-holder (Clix).
- One .00016-mfd. S.W. Tuning Condenser (Polar, type E).
- One Micro-Drive (Polar, horizontal).
- One .0001-mfd. Variable Condenser (J.B., "Short-wave Special").
- 4-pin Plug-in Coils (according to wave-length ranges) (Eddystone, 4-pin type).
- Two 465 kc/s Intermediate-frequency Transformers (Varley "Air-Tune").
- One Midget 1 : 3 L.F. Transformer (B.T.S.).
- Nine ½-watt Fixed Resistors: 2, 2,000 ohms; 1, 5,000 ohms; 1, 20,000 ohms; 1, 30,000 ohms; 2, 100,000 ohms; 1, .25 megohm; 1, 1 megohm (Erie).
- Six Tubular Fixed Condensers: 1, .0001 mfd.; 1, .0002 mfd.; 4, .1 mfd. (T.C.C., type 250).
- Two Fixed Condensers: 1 mfd. and 2 mfd. (T.C.C., type 50).
- One 100 m.a. Fuse and Holder (Microfuse).
- One Q.M.B. on-off Switch (Bulgin).
- Four Valves: 210 P.G.; 210 V.P.T.; 210 Det.; and 220 H.P.T. (Cossor).

TESTING YOUR OWN VALVES

BEGINNER'S SUPPLEMENT

It is Possible to Calculate the Degree of Distortion Existing in an Output Stage and the Method is here Explained. By W. J. DELANEY.

IN Fig. 3 of last week's issue the line A B C was shown crossing the dissipation line, but in actual practice it is necessary to keep the load line below this value and the two should not cross. However, to plot the load line the following procedure is adopted. The point A in the figure in question, which is repeated this week in a simplified form at Fig. 1, is the point of normal working, namely the point denoting maximum H.T. volts, maximum G.B., and the normal anode current at these two figures. This position, of course, represents the actual condition of the valve when no signal is being received. Now to denote the maximum and minimum values we have to take into account the fact that in the anode circuit there is an inductive load, and the impedance of this load varies with the frequency. If the load were of infinite impedance the line A B C in the diagram would be a horizontal line, for the voltage would be reduced to zero with a sufficiently high grid input, and thus we must calculate our output with the correct anode load. Now the makers state this figure, or we may take it as twice the normal anode impedance for a triode valve and we can then calculate the position of minimum voltage by multiplying the load by the normal anode current and dividing by 1,000. Now where this voltage line is crossed by the line representing zero grid bias a dot must be made, and through this point and the point already made a line is drawn, continuing to the line representing double the normal bias. These three points are represented in the diagram respectively as A (normal working point), B (minimum voltage) and C (maximum voltage).

A.C. Power Output

We can now drop a line from each of these points and they will represent what might be termed instantaneous values, and it will be seen from Fig. 1 that point B corresponds to an anode voltage of 240 volts (D), whilst point C corresponds to a voltage of 520 volts (F). Now the anode current at point B is 120 milliamps., and this represents a maximum value at this point of 120 mA. At point C the anode current is only 10 mA and this represents a change of only 10 mA. We may state, therefore, that the R.M.S. value of the anode current swing is $\frac{120-10}{2\sqrt{2}}$. The A.C. (Ohm's Law) formula for power, as we saw last week, is current² × resistance, and thus the figures above, for our example, may be set down and the A.C. power for this particular example represented as $\left(\frac{BD-CF}{2\sqrt{2}}\right)^2 \times 4{,}000$.

Wattage also equals current multiplied by voltage, and as the total voltage swing is in our example 240—520 volts, or 280 volts, we can take the R.M.S. value of this and multiply it by the current value shown above. Thus, our formula would be $\left(\frac{BD-CF}{2\sqrt{2}}\right)^2 \times \frac{280}{2\sqrt{2}}$

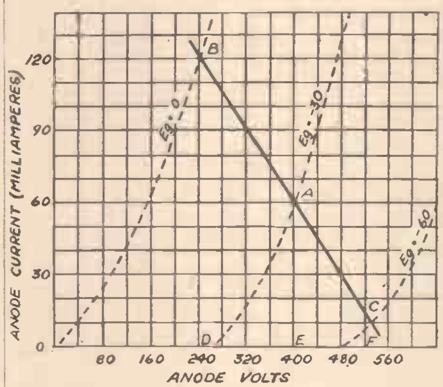


Fig. 1.—The complete curve referred to in the text, with all unnecessary curves omitted to make the diagram clear.

Distortion

Now, due to the characteristics of the valve, and the value and type of the anode load, there will, unfortunately, be some degree of distortion present in our output, and we can ascertain this by comparing the anode current change on either side of the normal point. In other words, we take the average of the changes above and below normal (which in our example may be expressed as $\frac{BD+CF}{2}$) and by subtracting this from the normal current represented by AE, we may express the following formula:

$$\frac{\frac{BD+CF-AE}{2}}{AE}$$

and by multiplying this by 100 we may express the final result as the percentage of distortion.

It will be seen from the above calculations that the anode load has a vital effect upon the actual working of the valve, as well as upon the amount of distortion which is present, and these small calculations should prove invaluable to the experimenter who is anxious to obtain all stages working in the maximum and most efficient manner.

Class B and Other Output Stages

It is not proposed to deal in this series with the testing of Class B, double pentode, and other types of output valve, in which various complicated calculations must be gone into. Neither is it proposed to discuss the effects of resistive instead of inductive loads in an output stage, as the series was intended to be purely for the experimenter who wishes to *test* valves. The points which have been given will enable anyone, with the simplest of meters, to test every valve in a receiver, and at the same time to ensure that each stage is working efficiently, as the various points which have been given obviously can be interpreted into terms of working characteristics. Where, however, stages comprising two or more valves are in use—such for instance as normal push-pull stages—the ordinary calculations which have been given may be applied, and each valve may be individually tested and checked. In the case of certain multiple valves a similar procedure may be adopted, by taking each section of the valve and checking it, although in the case of a double-diode-triode it will only be necessary to check the triode portion, treating it as a normal triode valve.

Measuring Instruments

For all of the tests which have been described it is recommended that good meters be employed. To the beginner who has at present no apparatus of this nature, the best advice is to buy one good milliammeter, preferably one reading only up to 1 mA. Then, with the addition of multipliers (which may be standard resistances, or may be home-made), and one of the Westinghouse special meter rectifiers which has already been referred to, a complete testing equipment may be made up to read practically anything, and the degree of error will be very small indeed. If an instrument is to be purchased complete, remember that a resistance of about 1,000 ohms per volt should be aimed at, in order that such details as screen-grid current may be measured without error.

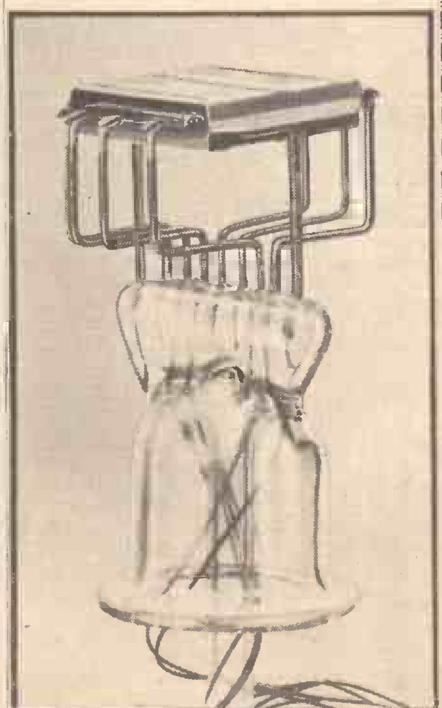


Fig. 2.—A modern valve, showing the method of electrode assembly.

Tracing Faults in a Superhet

Methods of Tracing Systematically the Portion of the Circuit in Which the Fault Occurs, Without the Use of Apparatus, are Simply Described

By FRANK PRESTON

IN principle, the location of faults in a superheterodyne receiver is the same as with a "straight" receiver, but there are many additional actual tests which should be applied. When a multi-range meter is available it is, of course, a fairly simple matter to check the various components; but before doing this it often saves time to trace the fault to the particular portion of the circuit in which it exists. For example, if it is first ascertained that it lies in the intermediate-frequency amplifier, comparatively few components have to be tested to find the defective one; but if it is simply known that the fault is in a part of the circuit previous to the L.F. amplifier, a good deal of time might be wasted in testing every individual component in that part of the set.

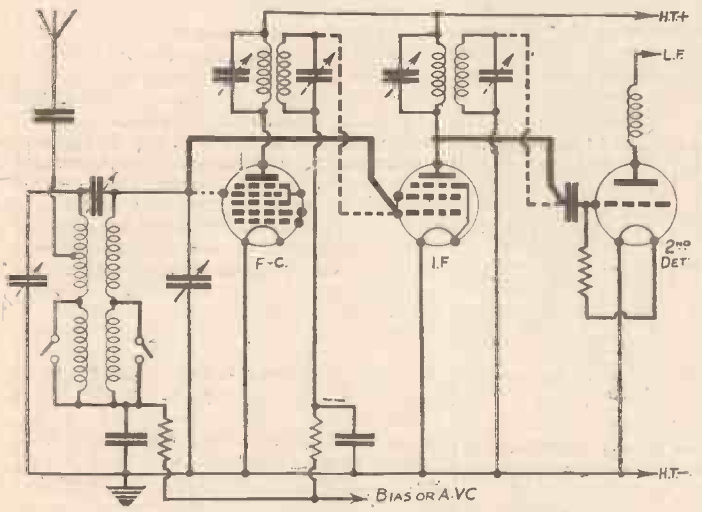


Fig. 1.—This skeleton circuit shows how the frequency-changer of a typical superheterodyne can be cut out of circuit, so converting the set into a "straight" arrangement. Broken lines indicate original connections, and heavy lines the new connections.

A Process of Elimination

It is fairly common knowledge that a "straight" receiver employing both high- and low-frequency stages can be tested stage by stage by connecting the loud-speaker, or a pair of 'phones, in the anode circuit of each of the L.F. valves and the detector, and by transferring the aerial lead from the first valve to each consequent H.F. valve, and then to the grid circuit of the detector. Up to a point, the same idea holds good with a superhet, but it is obviously impossible to eliminate H.F. stages, because there probably are none. The I.F. valves correspond to the H.F. valves in a "straight" arrangement, but they are not tuned to the signal frequency, but to another frequency outside the range of broadcast wavelengths. For this reason it would be useless to transfer the aerial lead-in to the grid terminal of one of the I.F. valves.

Converting to a "Straight" Circuit

The simplest procedure in a case like this is to transfer the lead which normally goes from the grid terminal of the aerial-tuning circuit to the grid of the first detector or frequency-changer to the grid of the I.F. valve, and to break the connection from the latter to the I.F. transformer. This is shown in Fig. 1, where the original connections are indicated by broken lines and the new ones by heavy lines. When this has been done it is evident that the I.F. valve is used as an ordinary H.F. amplifier, its input circuit being tuned to the frequency of the signals to be received.

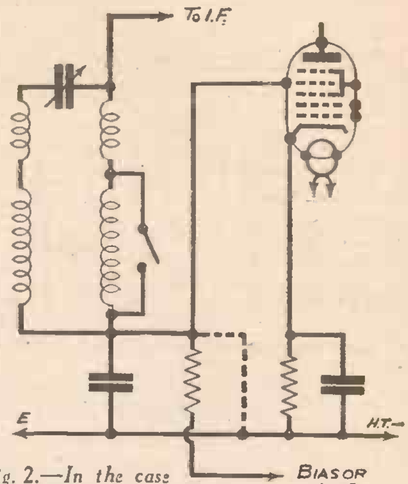


Fig. 2.—In the case of a mains-operated set the detector grid of the frequency-changer should be connected so as to receive the normal bias, as shown, when using the modified connections shown in Fig. 1.

This is not sufficient to provide reception, though, because the anode circuit of the I.F. valve is still tuned to the intermediate frequency, and so nothing—or very little—in the way of signals would be passed on to the detector. The next step, therefore, is to modify the anode-circuit arrangement so that it will respond to the frequency of the received signals. One method would be to replace the primary winding of the I.F. transformer with an H.F. choke; but a simpler idea is merely to transfer the grid-condenser connection from the secondary winding of the transformer to the anode terminal of the primary winding; this also is indicated in Fig. 1.

A Good Makeshift

After making the simple alterations described—they may be made very roughly, and without disturbing the rest of the set—the receiver becomes a simple "straight" three-valver comprising an H.F. amplifier, choke coupled to a leaky-grid detector, and L.F. amplifier. As such, it should be capable of providing good reception from at least half a dozen stations,

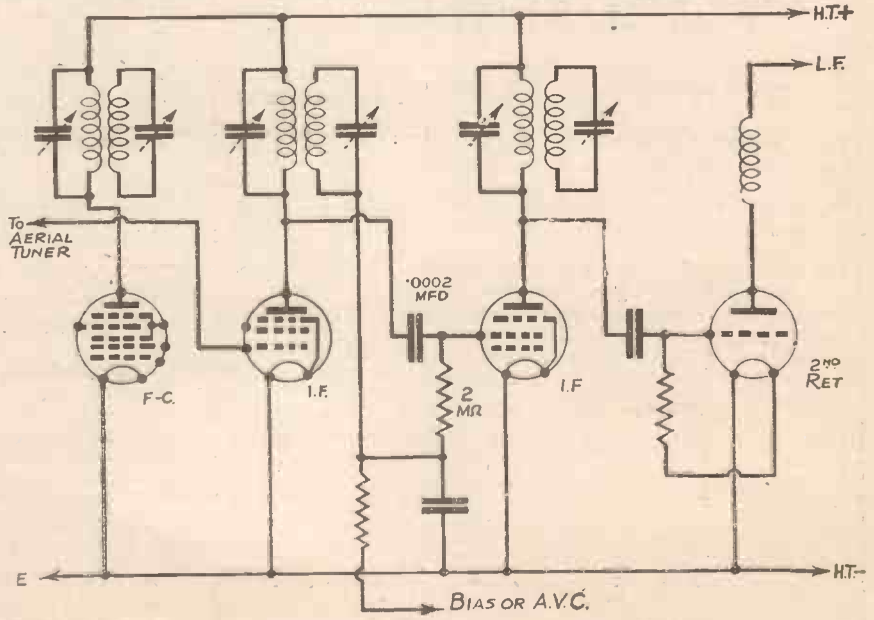


Fig. 3.—A skeleton circuit showing the connections used in eliminating the frequency-changer when there are two I.F. valves.

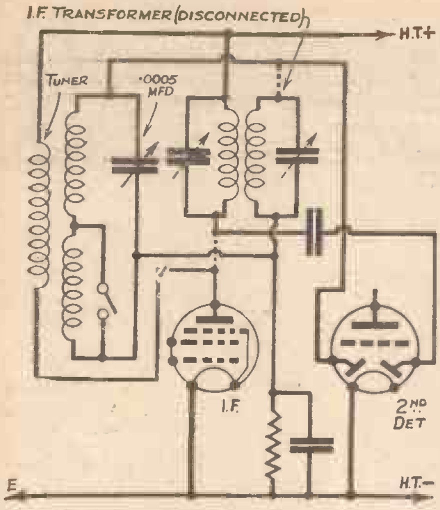


Fig. 4.—When a double-diode-triode type of valve is used as second detector the I.F. transformer which feeds it should be replaced by a double-wound tuner and .0005 mfd. variable condenser as shown here.

assuming that the original fault was in the frequency changer, as had been assumed. Super-selectivity should not be expected, nor should long range, because there are only two tuning circuits (the original band-pass tuner) and reaction is not employed. Nevertheless, should it be found that a new component or valve is required, and this cannot be obtained immediately, the receiver can be used as a reasonably-efficient three-valver for an indefinite period.

A Precaution with Mains Sets

In making the above suggestions it has been assumed that the receiver was a four-valve battery-operated instrument of the simplest type, embodying a pentagrid frequency-changer, followed by a single I.F. amplifier, a leaky-grid detector, and a pentode output valve. The general idea holds good, however, for most other types of set, but in the case of a mains receiver it is better, after changing the connection from the band-pass filter, to connect the grid of the first valve direct to the lower end of the tuning circuit, so that it receives its usual bias voltage. If this were not done the valve would pass more than its normal H.T. current, and if the valve were removed from its holder the H.T. and L.T. voltages applied to the other valves might become too high. The method of "earthing" the grid is shown in Fig. 2, where it will be seen that the grid must be connected to the A.V.C. line (where provided), to the variable-bias supply, or directly to the earth line.

When there are two I.F. valves the anode circuits of both must be modified, whilst a .0002-mfd. grid condenser and a 2-megohm leak should be included in the grid circuit of the first, as shown in Fig. 3. The objects of these components are to prevent the grid from being biased positively by the H.T. voltage, and to ensure that the bias voltage remains as before.

If the set still refuses to function after making these minor alterations to the wiring, it can be treated in a similar manner to a "straight" arrangement by taking the lead from the grid terminal of the band-pass tuner to the grid of the second I.F. valve, and then to the grid condenser of the detector. Even with the latter connection the set should operate, although signals will naturally be rather weak; nevertheless, it is possible in this way to check the I.F. valves and their corresponding circuits.

With a Diode Second Detector

The position is not quite so straightforward when a double-diode-triode or similar valve is used as second detector, but even then the main principles may be applied, as shown in Fig. 4. In this case one end of each winding of the I.F. transformer which feeds into the diode is disconnected and replaced by a double-wound coil and a .0005-mfd. variable condenser. The coil may be of any type having primary and secondary windings, one of the type used for aerial-circuit tuning being quite satisfactory. The corresponding tuning condenser has to be operated at the same time as the original gang condenser, of course, but no difficulty should be found in obtaining some sort of reception.

Component Tests

It is not proposed to describe here the methods of testing individual components, nor of making the normal tests as applied to "straight" receivers, since these have been dealt with adequately in previous issues. In this respect, readers who are interested are recommended to refer to the following articles in the issues of the dates given: "Test Your Components," November 19th, 1932; "Testing Your Own Valves" (Beginner's Supplement), August 31st, September 7th, and September 28th; and "Testing by Short-Circuit," June 22nd, 1933. Methods of testing Practical and Amateur Wireless receivers are also being detailed in the series of Service Data Sheets which are being given week by week; the first appeared in the issue dated September 14th.

SHORT WAVE SECTION

Circuits for the Experimenter

Three Highly Efficient, yet Simple Circuits are dealt with in this article

THE new short-wave experimenter will find during his early experiments that amazing results may be obtained with simple apparatus. The circuits dealt with in the present article have been tried and used during all kinds of conditions, with satisfactory results, and will be found particularly suitable as a basis of experiment.

Before going further, just a few words of sound advice. Never rush the construction and wiring of an experimental receiver, or, for that matter, any receiver. To do so may, and often does, end in failure. An hour or more spent in studying the proposed lay-out before fastening down the baseboard components is time well spent and may save trouble later.

Fig. 1 shows a detector, and one L.F. stage combination, embodying aperiodic aerial coupling, throttle-controlled reaction which has a minimum effect upon tuning, parallel grid leak and condenser, and transformer coupled low-frequency stage, which will produce just a little more amplification than R.C.C., yet if correct voltages and bias are applied will give a high signal ratio.

GL-2 is, of course, a grid stopper resistance, and should not be omitted. Incidentally, many experimenters who have really good receivers, apart from head capacity effects, will find that the inclusion of grid stoppers will effectively remove the trouble, and is sometimes more effective than series headphone chokes. Another good idea when two L.F. stages are used is to fit a grid stopper in series with the grid lead of first L.F. valve, and an S.W. H.F. choke in series with the second.

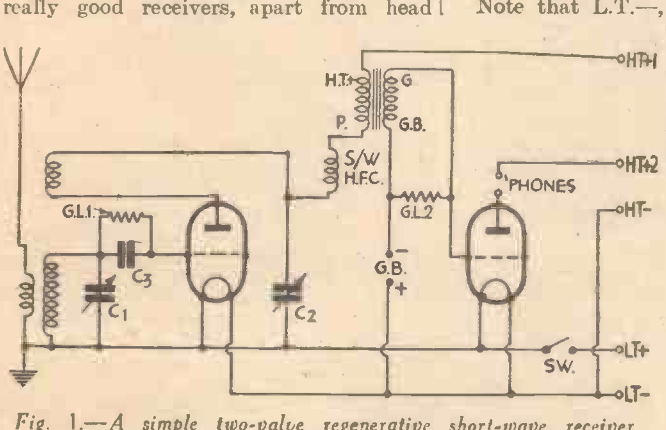


Fig. 1.—A simple two-valve regenerative short-wave receiver. C1=.0001 mfd., C2=.0003 mfd., C3=.0001 mfd., GL1=2 to 5 megohms, GL2=1 megohm.

An S.G. Detector and R.C.C. Circuit

Writers in the past have stressed the advantages of the screen-grid valve as a detector. Fig. 2 shows a most suitable arrangement, and consists of an S.G. detector, and R.C.C. L.F. stage. Aperiodic aerial coupling and parallel grid leak and condenser are again specified, reaction being applied to the plate of the S.G. detector in this instance, and not to the screen.

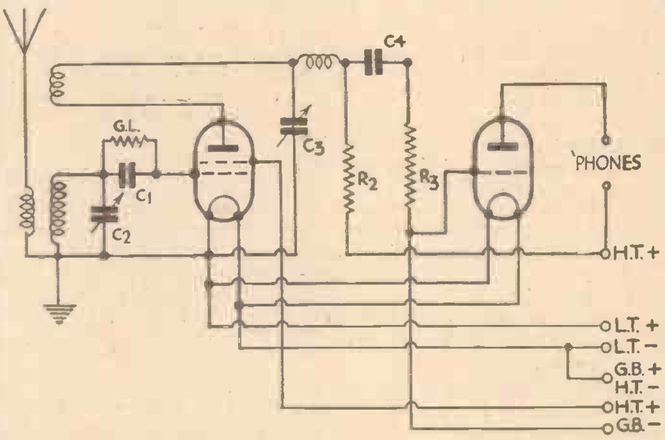


Fig. 2.—A circuit incorporating S.G. Detector, and R.C.C. L.F. stage. C1=.0001 mfd., C2=.0001 mfd. to .00016 mfd., C3=.0001 mfd. to .00016 mfd., C4=.01 mfd., GL=3 megohms, R2=100,000 ohms, and R3=½ megohm.

Note that L.T.—, H.T.—, and G.B.+ are coupled. It may be found necessary to fit a .0005 mfd. or 1 mfd. non-inductive by-pass condenser between the screening grid and earthed side of filament, to improve regeneration. This, however, will depend upon the type of S.G. valve and coupling of the coil windings used.

It is claimed that relative to background noise, reaction applied to the screening grid is a better method than the plate, as shown.

This may be, but valve noises are not unknown, especially in the S.G. detector type. The R.C.C. stage, has, of course, a lot to do with such satisfactory results and freedom from noise. Wire-wound resistances are advisable, but if composition type are used, these should be above suspicion, as in some instances a constant background of mush will be experienced.

A fixed condenser is not shown across the output of the circuits under discussion. Reaction, however, may sometimes be improved by fixing a .002 mfd., .006 mfd. or .01 mfd. fixed condenser across the 'phone terminals. Naturally, top note response will be reduced, but even so it is often worth while. This applies not only to simple sets, but to multi-stage receivers of all types when fitted with headphone output, which, due to high sensitivity, sometimes bring up mush during adverse reception conditions.

Reverting to Fig. 2, experimenters are strongly advised to give this combination a thorough test over a long period under various reception conditions. When using

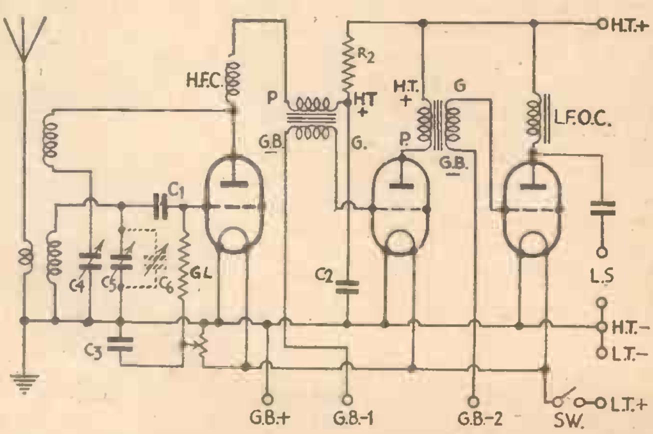


Fig. 3.—Circuit for a straight three-valve short-wave receiver with two stages of L.F. transformer coupling. C1=.0001 mfd., C2=2 mfd., C3=1 mfd., C4=.00016 mfd., C5=.00016 mfd., C6=Band Spread (capacity will depend upon coils used), R2=20,000 ohms, GL=2-3-5 megohms, R3=400 ohms potentiometer, SW=on-off switch.

this receiver the writer was very impressed with the quiet background and consequent clear signals. In certain instances the S.G. detector is associated with the production of high-pitched signals, but so far as the writer's experience is concerned, this idea would appear to be erroneous.

When using the S.G. valve as a detector, screen and plate voltage relations are most critical, and it is quite a good idea to feed the former *via* a 50,000 ohms variable resistance in series with the H.T.+ to screen lead.

An 0-v-2 Receiver

Fig. 3 shows the theoretical circuit diagram of what may be called a de-luxe arrangement of the popular 0-v-2 receiver. Band-spread tuning C6, potentiometer control R3, aperiodic aerial coupling, L.F. choke output, efficient decoupling arrangements, and two transformer-coupled low-frequency stages, are the salient features.

Whilst one stage of R.C.C. coupling is preferred, there are, no doubt, a few readers who wish to incorporate two transformer-coupled L.F. stages in an 0-v-2 experimental receiver.

As outlined in previous articles, it is difficult to do so and obtain stability. Unless very carefully laid out, wired, and decoupled, hand capacity effects and threshold or fringe howl may be experienced.

The circuit outlined, however, incorporates efficient decoupling arrangements, and the troubles previously mentioned, if experienced, may be due to bad lay-out, faulty wiring, interaction between grid and plate wiring, too high plate voltage on the detector valve, or too tightly coupling the aperiodic aerial coil to the grid coil.

If experiments with this circuit are contemplated, remember that the valves mentioned should be adhered to, and that no unnecessary components are included in the diagram. To omit the L.F. output, decoupling, or any other components would undoubtedly cause trouble.

A receiver using this circuit and enclosed in a copper foil lined cabinet will be found to be really worth having, and, if during the experimental period snags are experienced, it is well worth while to try to overcome them.

It has been stated that the capacity of the band-spread condenser must be found by experiment. A midget .0001 mfd., which is constructed so that plates may be removed, is useful for this purpose. If, however, a .00005 mfd. is to hand, it should be tried.

Coils

A lot depends upon the coils used in the receiver. If commercial ones are used, no doubt the manufacturers will be pleased to advise as to the most suitable capacity.

Theoretical circuits are only intended to show the electrical constants of a receiver, but the lay-out must be given due consideration. It is therefore unwise to go ahead without first studying the lay-outs of various types of receivers.

You may hear a fellow enthusiast boast that, given a theoretical circuit, he can go straight ahead, but statements of this nature should be ignored. An experimenter with years of experience may be able to do so, because he has a sound general knowledge of receiver design and construction to draw upon but, even so, he does not fail to consult books of reference in cases of doubt.

The opinions expressed in this article are personal ones based on practical experience. In short-wave work circuit differences, component lay-out, valve and component tolerances, together with different standards of constructive ability, govern results on the technical side.

It will be appreciated, after taking these factors into consideration, that the best receiver circuit is left for the individual to decide, and, taking the broad view, the reader may rest assured that the most satisfactory short-wave apparatus is that which enables the experimenter and enthusiast to obtain satisfactory reception, with stability and ease of operation.

Leaves from a Short-wave Log

FROM the point of view of the short-wave listener, the autumn months, as a rule, mark the beginning of an active season; it is also at this period of the year that we must begin to revise our lists of frequencies and wavelengths, as most transmitters are preparing to change over to channels—or adopt new ones—for the shorter days of the year. In consequence, from now onwards, it is likely we shall find a decreasing number of stations working on the higher frequencies and proportionately more in the 30-, 40-, and 50-metre bands. The higher wavelengths will also be captured earlier in the evening than has been the case since summer came in.

For some time there has been some difficulty in picking up transmissions from Morocco, and in the past CNR, Rabat, had always been a good signal. It is now learned that the station is entirely monopolised by its duties in radio telephony and telegraphy with Paris, and consequently has entirely suspended the relays of Radio Maroc on both 23.38 and 37.33 metres. There is a possibility that Algiers, in the near future, may possess a short-wave outlet.

Swiss Transmissions

Commencing last month, and henceforth on every first Monday in the month, special short-wave broadcasts are given for the benefit of Swiss nationals abroad. They are to be transmitted from B.S.T. 21.10-22.15 through the following stations: HB9B, Basle, 21.07 metres (14,236 kc/s); HB9H, St. Gall, 42.83 metres (7,005 kc/s) and HB9J, Zurich, on 20.83 metres (14,400 kc/s), destined to North America, Europe, Australia, North and Central America, South and Central America. The broadcasts will be repeated at midnight. Moreover, to ensure reception overseas the transmissions will also be relayed through the League of Nations' station at Prangins, namely HBL, 31.27 metres (9,595 kc/s) and HBP, 38.47 metres (7,797 kc/s). From midnight, B.S.T., in addition, the broadcast will also be made by HB9AT, Biel, on 20.99 metres (14,290 kc/s). So far monthly programmes have been arranged up to and including Monday, February 3rd, 1936.

Apparently the Germans, anxious to extend their short-wave broadcasting system, are hurrying on the installation at Zeesen of four additional 50-kilowatt transmitters. These should be in operation sometime during the winter. In addition to the stations now in operation, we may expect to hear DJR, 19.56 metres (15,340 kc/s); DJP, 25.31 metres (11,855 kc/s) and DJM, 49.35 metres (6,079 kc/s). DJN on 31.45 metres (9,540 kc/s), DJO, 25.43 metres (11,795 kc/s) and DJQ, 19.63 metres (15,280 kc/s), are already occasionally taking the daily programmes.

Rome

Although, so far, the Rome short-wave transmissions have been given under the call sign I2RO, it appears that officially certain channels possess a definite registration mark. According to the latest official publication, I2RO4 is allotted to the 25.4 metre (11,810 kc/s) channel; I2RO3 to 31.13 metres (9,635 kc/s); I2RO2 to 42.98 metres (6,980 kc/s), and I2RO1 to 49.46 metres (6,065 kc/s). The last two mentioned stations do not appear to have been used. I2RO, without any ultimate figure, seems to remain the property of the 31.25 metre (9,635 kc/s) transmission. All these transmitters are at Prato Smeraldo, near the Italian capital.

I2RO4 now works daily to a new schedule, namely, from B.S.T. 14.15-15.00, 15.15-16.15, 17.45-23.15. For the above, announcements are made in several languages, including English. On Monday, Wednesday, and Friday special broadcasts are carried out for listeners in the United States from 00.00-01.30, and on Tuesday, Thursday, and Saturday, for South America between 01.30-03.00.

W1XAL, the short-wave station of WEEI, Boston, on 49.67 metres (6,040 kc/s), has now announced its winter time schedule. The transmitter is on the air on Sundays from B.S.T. 21.45-23.30, and on Tuesdays and Thursdays from B.S.T. 00.30-02.30. Exceptionally on the first Sunday of each month, the lower channel of 19.67 metres (15,250 kc/s) is used between B.S.T. 15.45-17.00.

Powerful French Transmitter

France also, in her quiet way, would appear to be making a bid for an outstanding short-wave transmitter, as a report from Paris states that the Poste Colonial station which is being built at Palaiseau-Villebon, close to the site of the medium-wave high-power P.T.T. transmitter, will eventually prove to be capable of radiating 80-100 kilowatts in the aerial. This would make it the largest short-waver in the world.

Here are a few notes regarding some stations which have been recently picked up and of which more may be heard later. A correspondent reports having logged musical tests carried out by LSI, Monte Grande, Buenos Aires, a 10 kilowatter working on 30.61 metres (9,800 kc/s); it is a telephony station in use for communication with Europe and the United States.

PKYDA, Bandoeng (Java), which hitherto has been working on 49.02 metres (6,120 kc/s) in the West Java network, has reduced its wavelength to 27.62 metres (10,860 kc/s); it is one of the NIROM stations which closes down with a gramophone record of "When You Come to the End of a Perfect Day."

Facts & Figures

COMPONENTS TESTED IN OUR LABORATORY.

Eddystone Screening Box

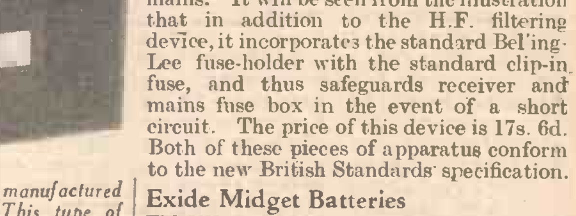
WHEN constructing an efficient short-waver it is always advisable to take every precaution against unwanted capacities affecting tuning. Similarly, when a cabinet is being designed for use in the tropics it is worth while to guard against damage due to climatic changes. The screening box supplied by Messrs. Stratton & Co., makers of the popular Eddystone short-wave accessories, will be found highly suitable for both of the above cases. It consists of a welded steel cabinet, having louvres for ventilation on three sides, a hinged lid, and a separate front which is held in position by means of bolts. The illustration below shows all of these points, and it may also be seen that a slot is cut in the back to facilitate aerial and earth connections, and leads to a battery where the receiver is to be used in conjunction with external batteries. The finish is in stove black "ripple," and the metal panel may, of course, be drilled to take the place of the usual panel and will thus provide a complete earthed screen when the necessary connections are completed. The cabinet may be obtained in two sizes, the smaller measuring 8½in. wide, 9⅜in. high and 9½in. from front to back. This model costs 16s. 6d. The second model measures 17in. wide, and is of the same dimensions as the smaller model in the remaining two directions. It costs 25s., and will comfortably house a modern mains receiver of the superhet type.

The small model screening box manufactured by Messrs. Stratton and Co. This type of cabinet is ideal for short-wave receivers.

Belling-Lee Suppressors

THE two suppressor units shown on the right are Types 1212 and 1211. The former is an appliance plug suppressor, and, as may be seen, it is provided with a plug as well as three sockets. It is intended to be screwed to the skirting board, and the plug inserted into the normal mains plug provided for the purpose. Any appliance which is then to be plugged into the mains is plugged, instead, into the three holes in the Belling Lee device, and thus is fed with the mains supply *via* this device. The rating is the usual 5 amps., and the device contains a 250 H. choke, and two fixed condensers arranged to provide an H.F. filter, and so prevent H.F. interference with radio apparatus. The third pin and socket respectively are, of course, for earthing purposes, and in time this method of connection will be standardised, as it enables the metal parts of any electrical appliance to be connected to an earthing pin and so rendered safe should a short-circuit arise in the internal wiring. The device effectively functions in preventing H.F. radiation through the mains and costs 16s. 6d.

Model 1211 is a suppressor for inclusion in the leads to a receiver plugged into the main, and is interposed between the mains plug and the plug on the receiver. The latter is inserted into the face of the device, and the plug on the latter is inserted in the mains. It will be seen from the illustration that in addition to the H.F. filtering device, it incorporates the standard Belling-Lee fuse-holder with the standard clip-in fuse, and thus safeguards receiver and mains fuse box in the event of a short circuit. The price of this device is 17s. 6d. Both of these pieces of apparatus conform to the new British Standards specification.



Two new suppressor units from the Belling-Lee range. On the left Model 1212, and on the right Model 1211.

Exide Midget Batteries

THERE is a large range of Exide batteries suitable for use with midget receivers employing the new Hivac valves, and the following details will no doubt prove of interest to readers and others who are interested in these small components. The list supplements that given on page 3 of our issued dated September 21st, 1935, concerning Midget components.

Type No.	Voltage	Dimensions	List Price
X81	33	6" x 1 1/16" x 1 13/16"	3s. 9d.
X325	45	3 7/16" x 2 11/16" x 1¾"	5s. 0d.
X329	75	4⅛" x 4⅛" x 3⅛"	7s. 9d.
X335	60	4⅜" x 3¾" x 2½"	6s. 6d.
X359	52½	4⅛" x 3" x 2 3/32"	5s. 9d.
X396	75	5 13/16" x 4 11/16" x 2½"	8s. 0d.
X371	36	3 9/16" x 2⅜" x 2 1/16"	4s. 0d.
X414	73½ & 1½ G.B.	6¼" x 3½" x 2½"	8s. 0d.
X415	36	3⅝" x 2⅜" x 1¾"	4s. 0d.
X416	66 & 9 G.B.	4⅝" x 4⅛" x 3 1/16"	5s. 6d.
X417	70½ & 1½ G.B.	6⅝" x 4½" x 1¼"	7s. 9d.
X418	60	5½" x 2 3/16" x 1 13/16"	6s. 6d.

CIRCUITS AND SETS FOR ALL

(Continued from page 74)

to the H.F. pentode used in the intermediate-frequency stage, although this is of the variable-mu type. At the same time, this addition could easily be made if desired. There is, therefore, no volume control in the usual sense of the term, but the .0001-mfd. variable condenser included in the aerial lead can be used for this purpose.

Simple Modifications

It should also be mentioned that the general circuit arrangement is readily adaptable, and can be modified in two or three respects. For example, a coil similar to that used for the oscillator section of the frequency changer might well be included in the aerial circuit when greater sensitivity is required. This should be tuned by means of a second .00016-mfd. condenser, or a two-gang component could be used, in which case a 35 mmfd. variable condenser should be used as a trimmer in parallel with that section operating on the oscillator coil. As the tuning of the aerial circuit is rarely critical, separate tuning condensers do not make tuning much more complicated, and for this reason it will be found perfectly satisfactory to build the set as shown in the first place, and then to add the second tuning circuit after it has been found to function correctly when using the simpler arrangement.

The components generally do not call for any special comment, but it might be mentioned with regard to the coils that these can be obtained to cover any wavelength from 12 to 170 metres, the types and wavelength ranges being as follows: L B, 12 to 26 metres; Y, 22 to 47 metres; R, 41 to 94 metres; W, 76 to 170 metres. The other parts are not very critical and, provided that they are of reliable make, it is not essential that the exact specification be followed.

Component Lay-out

A suitable layout for the principal components is shown in Fig 2, where it will be seen that a square chassis is employed and that the arrangement is very compact. The smaller parts are not shown, but these can be wired up by means of their own connecting wires, and placed as near as possible to the larger components to which they are attached. The main point to be observed in placing the parts is that the coil-holder is well separated from the L.F. transformer, loud-speaker leads, and the I.F. transformers. The reason is that the plug-in coils are unscreened and must not, therefore, be within the fields of other components, nor must they be "damped" by other earthed screens.

As is the case with all short-wave receivers, it is desirable that a short aerial be used, and the most suitable type is one consisting of a vertical wire about 20ft. long. When using an ordinary broadcast aerial it might be found that "dead spots" (tuning positions where signals cannot be received) are in evidence. This is unlikely, due to the aperiodic aerial circuit, but if it is noticed, the setting of the .0001-mfd. condenser should be varied until reception is normal. The effect of varying the position of the G.B.—1 tapping can be tried, but it will generally be found that 1½ volts provides best results.

About Multiple Valves

In this Article the Author Discusses the Development of Multi-electrode Valves, and Their Uses

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

UP to about a couple of seasons ago, each valve in a receiver could be described by one or two words, representing the work it did in the circuit. It was either a high-frequency amplifier, a detector, a low-frequency amplifier, or an output valve. In fact, "one valve, one job" seemed to be the motto of circuit designers.

Then came the introduction of a host of multiple valves—two or more valves in one—making possible all sorts of new circuit refinements and complications, and producing quite a sharp division of opinion in technical circles. There were some who welcomed the new developments as offering almost unlimited scope for their ingenuity, and a change from the old and stereotyped circuits. Others considered it a retrograde step and argued that, in being forced to perform several functions at once, these valves did not carry out any of them at maximum efficiency.

The final stages of this controversy have not yet been reached, and he would be a bold prophet who ventured a forecast of the valve position a few years hence. But there are signs that the development of multiple valves is being somewhat restricted and standardised, although a number of such valves still survive. The multiple valve will never entirely disappear, but it will be used with perhaps a little more discretion than in its earlier phases.

In the Past

Before coming to an opinion as to the extent to which multiple valves can be a real help, it would be as well to recall the part multiple valves, or at any rate, multi-function valves have played in the past. The original Fleming valve—a diode—was a rectifier, pure and simple, and essentially a single-purpose valve. So was the first triode so long as it was used as an amplifier. But the triode worked as a detector, whether on the leaky grid or anode bend principle, and was most decidedly a dual-function valve, for it is easy to show that the leaky grid detector is, in fact, a diode detector plus a low-frequency amplifier, while the anode bend detector combines high-frequency amplification with detection.

Then, quite early in broadcasting history, a very popular series of circuits were used, known as reflex circuits, in which one valve was made to function as both a high-frequency and a low-frequency amplifier—and similar circuits are being used to-day, not only in home-built sets, but also in some of the latest commercial receivers.

These examples, however, are not quite equivalent to the modern multiple valves, because they only employed one electrode system—they were single valves used simultaneously for more than one purpose. Multiple valves in the modern sense of the term contain two or more electrode systems in a single bulb, and their various duties could quite successfully be performed by an equivalent number of single-purpose simple valves. The question which arises, then, is the extent to which the concentration of several duties in a single bulb gives real practical advantages over the use of separate valves. The problem can be approached in several ways, and it may be best first of all to consider the general advantages and disadvantages of multiple valves.

Advantages and Disadvantages

It will be fairly obvious that on the whole, multiple valves will be cheaper than an equivalent in single-purpose types. Although only a small saving, one valve-holder instead of two or three represents an economy, particularly to commercial set makers. Low-tension current is also reduced, an important point in battery sets, and allowing a cheaper type transformer to be used in A.C. mains models. Space is also saved in the chassis and cabinet, and in many cases the number of wires is reduced.

With regard to the corresponding disadvantages, the question of screening and unwanted couplings between the various elements of a multiple valve need not be discussed, because these problems are settled by the valve makers. But the saving in space may be a mixed blessing for the amateur, because it means that numbers of components, previously laid out in association with several valve-holders, must now be accommodated in fairly close proximity to a single holder, and this makes the problems of neat layout and well spaced wiring a somewhat tricky business.

Moreover, it is not quite so easy to visualise the basic circuit and operation of a multiple valve as that of a number of familiar and simple types. This, however, is a point which experience should rapidly remedy.

Other Considerations

Readers may decide that, on the score of general considerations, there is little to choose between multiple valves and single types, with perhaps a little bias in favour of the multiple valves, so we must fall back on more technical considerations. Reviewing the different varieties of multiple valves which have been produced, they fall into two distinct classes—those which employ a single electron stream, and those using two or more electron streams.

(To be continued)

A multiple valve which has brought the superhet receiver back into popularity. The lower illustration shows the battery version of our £5 Superhet, which was one of the first receivers to make use of the new pentagrid multiple valve.

High-definition Television Data

(*Continued from page 65*)

The residual carrier during the transmission of a synchronising pulse will be less than 5 per cent. of the peak carrier.

The line frequency and the frame frequency will be locked to the 50-cycle supply mains, and therefore will be subjec to the frequency variations of the mains. t

Explanation of Method of Interlacing

The method of interlacing is demonstrated in Fig. 3, which represents the top and bottom portions on the scanned area with the distance between the lines very much enlarged. The lines show the track of the scanning spot, which moves under the influence of a regular downward motion (frame scan) with quick return and a regular left to right motion (line scan) with very quick return (not shown on drawing). The combination of these motions produce the slightly sloping scanning lines. Starting at A, not necessarily at the beginning of a line, the spot completes the line A B, returns to the left and traverses line C D, then E F, and so on down the "dotted" lines on the drawing. At the bottom of the frame the spot travels along line G H and then starts at J and travels to K. At this point the return stroke of the frame motion begins and returns the spot to L at the top of the frame. A complete frame scan has now been made since leaving A, so that 202½ lines have been completed, and the point L is half a line away from A. The downward frame motion now starts again, causing the spot to travel along L M, completing a single line motion J K L M. The spot then returns to the left and traces out line N O, which, due to L being half a line ahead of A, will lie between lines A B and C D. Similarly the next line P Q will lie half-way between C D and E F. The spot now traces down the chain dotted lines to R S and finally traces out T U, at which latter point the frame return causes the spot to rise again to the top. When the spot reaches the top it will have completed 2 frames since leaving A, and, as two frames occupy the time of exactly 405 complete lines, the spot will return exactly to A, after which the cycle begins again.

From the foregoing, it will be seen that the complete picture is scanned in two frames, but as each frame contains an integer number of lines, plus a half, the two frames will interlace. The system does not require the short return times shown for the line and frame scans, nor need the lines begin in the positions shown. Provided the line and frame traversals are regularly recurrent and have the correct frequency ratio (two frames=odd number of lines), an interlaced picture will be obtained.

NOISE-FREE AERIAL SYSTEMS

(*Continued from page 63*)

The point to remember is "the higher the better," and wherever the aerial is fitted, it must be invulnerable to reflected static such as from gutters, drain pipes, lead or zinc roofs, or steelwork.

Satisfactory compliance with these stipulations often makes it necessary to erect the aerials some hundreds of feet from the receiver, and well above surrounding objects capable of electrical radiation. Occasionally the chief or only source of interference may be known, in which case it is best to put as much distance between the aerial and the source as space will allow.

Where one is subjected to a "running fire" of ignition static from passing cars, the horizontal aerials must be erected at right angles, that is, at approximately ninety degrees to the roadway and, of course, again, as far from them as will be permitted by the ground available.

The final angles of the aerials relative to the noise source may not always be in accordance with known directions of maximum signal strength, but this cannot be avoided. It is worth noting that the determination of the aerial position for the exclusion (or reduction) of man-made static will invariably produce a higher signal to interference ratio, the result being a net gain in signal intensity.

All-wave sets which are not affected by electrical radiation should provide a better degree of sensitivity when connected to one of the special triple-purpose aerials described, such as the dipole. It would be a mistake to assume, because static is absent, an inverted "L" or plain "T" type is good enough.

Programme Notes

Light Fare from Blackpool

ERNEST BINNS' "Arcadian Follies" will be relayed from the South Pier, Blackpool, in the Northern programme on October 11th. This will be followed by Brent Wood's gramophone recital, entitled "Smart Set: Syncopated Song-writers of Twentieth Century Society." The song-writer under review is Noel Coward, who is regarded by Brent Wood as the English counterpart of Cole Porter, whose music was reviewed by him recently.

Torquay Musical Festival

THE opening concert of the Torquay Musical Festival will be relayed from the Pavilion, Torquay, on October 9th, in the Western programme. As the date of the concert is the centenary of the birth of Saint-Saëns, his Pianoforte Concerto No. 4 in C minor has been included in the programme. A new work by Reginald Redman, Music Director of the West Region, will be given its first performance at this concert. It is entitled "A West Country Suite" and has been specially written for the 1935 Festival, being dedicated to Ernest W. Goss and the Torquay Municipal Orchestra.

"Decisions"

UNDER the general title of "Decisions" will be broadcast during the autumn a number of short psychological studies. Nearly all the important decisions in a man's life take place in his own mind and are not suitable for actual dramatic treatment. In these broadcasts, however, the speaker is recollecting the important moment of decision in his life—whether he should have married young or waited until he should have established his position, whether he should have left the bank and become a musical critic, whether he should put labour-saving devices into his factory and throw many employees out of work—or whatever it may be. The decision is presented in soliloquy form with dramatic flash-backs as he recollects the circumstances in which he made his decision.

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).

A Bouquet from an Overseas Reader

SIR,—Just a few words to express my appreciation of your fine weekly, PRACTICAL AND AMATEUR WIRELESS. I have been a reader for a very long time and am sorry I did not take it up before. Being extremely interested in short-wave work, I find that section of your paper very helpful indeed, as, of course, are all the other articles; in fact, I consider your paper to be the best of its kind.—E. V. GILBERT (L.A.C.) (Sarafand).

Transmitting Data: Jamming on the 40 m. Band.

SIR,—I note in recent issues that readers who desire transmitting data are advised to join the R.S.G.B. Now I am of the opinion that the beginner is more likely to find what he requires in PRACTICAL AND AMATEUR WIRELESS than in any Society, or radio handbook. No one will, I think, deny that publications of this type are written assuming their readers have a certain amount of knowledge, and in the main cater for experienced readers. I possess a copy of the American handbook, which is a good one, but nevertheless, apart from one simple transmitter, this book requires careful study and, whilst most useful to myself and others, is not a raw beginner's book. I suggest therefore that a transmission step by step series of articles will help some and interest others, who may find them useful at a later date. Now I have no personal grievance with the R.S.G.B., but in my own mind I regard the three grades of subscription as a thing which if done away with would have increased membership long ago. At present the higher the subscription the greater the benefits. The fraternal spirit of radio and sharing of common interests often stressed is not practised, and usually those who would derive the most benefit, and prove to be enthusiastic members cannot afford 15s. per annum which, by the way, is the cost of a few good components. In conclusion, just one other point. Listening on the 40 metres band one hears low-power transmitting members complaining that when a certain fellow member starts up on high power (above ten watts) they have to close down. Is it right, sporting, or in conformity with British ideas of fair play and justice that one experimenter should be swamped at the will of another? Where is the fraternal spirit here, and what has the R.S.G.B. done about it? Personally, I think there is something wrong somewhere. What do other readers, including R.S.G.B. members who are active transmitters, think? Congested bands is no excuse but all the more reason for live and let live principles.—A. W. MANN (Middlesbrough).

KDKA DX Club Wants Reports

SIR,—Since the amalgamation of PRACTICAL WIRELESS AND AMATEUR WIRELESS it has been my good fortune to receive every copy of your fine magazine. I have noted with interest the increased activities on the short waves shown by your readers, and cordially invite all of them (foreign correspondents especially) to submit accounts of their DXing to be used as material on our weekly KDKA DX Club broadcast, now on the air every Saturday morning from 5.30 to 6 a.m. B.S.T. (news and tips of both S.W. and B.C. are disseminated during the programme).

For S.W. reception I use a three-valve receiver and specialise in reception on the 20-metre amateur 'phone band. Strangely enough, G5NI, Birmingham, is by far the most consistent foreign amateur heard for the past few weeks. In all I have logged sixteen Britishers, six Australians, three Belgians, and also a few amateurs in France, New Zealand, Japan, Hawaii, Lithuania, Norway, Spain, and a host of others on every continent except Africa.

Of the broadcast short-wave stations Japan, Fiji, Australia, the G's, D's, F's, and forty or fifty South and Central Americans are fairly consistent; exclusive of amateurs, my log consists of some 200 S.W. stations from the South Pole to Moscow—all since January, 1935. On the medium waves I've logged Japan, China, Australia, New Zealand, Alaska, Germany, France, England, and several others. About twenty-three different countries altogether. My B.C. receiver is a 1929 T.R.F. seven-valve outfit, 200 to 550 metres.—JOSEPH STOKES, KDKA DX Club (Grant Bldg., Pittsburgh, Pa., U.S.A.).

Jazz versus Classical Music

DEAR THERMION,—I have been a reader of PRACTICAL AND AMATEUR WIRELESS for a few months, and have grown to like your columns. For downright honesty of opinion, such as is written by the Editor and yourself, one may search other periodicals in vain. I have enjoyed his article on "Radiolympia Reflections." I, too, am surprised that "Jazz" has such a hold on listeners, but perhaps it is because it helps many to forget their worries for a short time. You don't come up against many people who really like and will listen to classical music. I sometimes think that large numbers of people would clap and roar if a cat ran across a stage. The "Turns" who receive ovations makes one wonder.—S. JACKSON (Eccles).

CUT THIS OUT EACH WEEK.

Do you know

—THAT, generally speaking, an unscreened choke may safely be screened without making any appreciable difference in characteristics.

—THAT when screening an unscreened type of coil care is necessary to avoid an undue change in inductance value due to the proximity of the screen.

—THAT two full-wave rectifiers may be used in a mains unit to avoid the necessity of operating one rectifier at its maximum rating.

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.

TOTTENHAM SHORT-WAVE CLUB

THIS club held their Field Day on Sunday, September 15th. The morning was spent working out the per cent. modulation of British stations, this proving to be 60 per cent.

There were several outstanding transmissions, but on the whole the transmissions seemed quite good, none falling below 50 per cent. The rest of the day was devoted to DX, and many interesting stations were picked up, some of the best being pulled in on a single-valve set. Finally, new-comers to short waves are welcomed at any of our meetings.—L. Woodhouse, secretary, 57, Pembury Road, Bruce Grove, Tottenham, N.17.

SHORT-WAVE RADIO AND TELEVISION SOCIETY (THORNTON HEATH)

THE weekly meeting of this society was held on Tuesday, September 17th, at St. Paul's Hall, Norfolk Road. Mr. W. J. Nixon, of the General Electric Co., Ltd., gave a talk on the new range of Osram valves. He gave an outline of the methods adopted in the construction of the valves, the steps taken, and tests carried out to ensure perfection, explaining in detail the characteristics of each valve. By means of slides Mr. Nixon was able to illustrate the various stages in the manufacture and testing of the valves.—The hon. sec. is Mr. Jas. T. Webber, of 368, Brigstock Road, Thornton Heath.

INTERNATIONAL SHORT-WAVE CLUB (MANCHESTER CHAPTER)

THE last meeting of the above club was held on Tuesday evening, September 17th, at 8 p.m., at the British Legion, Middleton. During the meeting there was a junk sale, and this was followed by a demonstration of a "Vidor" All-wave receiver, several short-wave stations being tuned in on it. The next meeting was fixed for October 1st, at 8 p.m., when an "Andrea" All-wave receiver will be demonstrated. This chapter meets every first and third Tuesday of each month at its headquarters at the British Legion, Long Street, Middleton, Manchester, commencing at 8 p.m. prompt. The winter programme is now being arranged and full particulars can be obtained by writing to the secretary and enclosing a three-halfpenny stamp. All radio enthusiasts are welcome at the meetings.—R. Lawton, secretary, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, Nr. Manchester.

WIRELESS SOCIETY FOR EALING!

BEING desirous of starting a Wireless Society in the Ealing district, I shall be glad if anyone interested will get in touch with me at the following address: H. A. Williamson, 22, Camborne Avenue, West Ealing, W.13.

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.

G. T. (Berkhamsted). The resistance of the 22-gauge wire is 38.99 ohms per 1,000 yards. It is therefore quite suitable for your purpose.

T. R. A. (Liverpool). The oscillation is in the H.F. stage and not the result of the detector-reaction circuit. The trouble is due to the layout, and the H.F. stage must be screened and the various components isolated.

D. R. (Edinburgh). A standard frame aerial will prove suitable. Use 75ft. of 22 D.C.C. for the normal wave winding, and a total of 200ft. for the medium plus long-wave winding. A short-circuiting switch is connected across the 125ft. of wire to enable wave-changing to be carried out. Any size of former may be used for the aerial.

W. P. (Belfast). We have no suitable diagram, but your idea is quite feasible. In most hospitals, however, a central receiver is fitted, and headphones are provided to each bed.

H. A. M. (Inverness). The fixed condensers in parallel should have functioned, but perhaps it will be found preferable to add a few turns to each coil, as the ganging might have been upset with the fixed condenser idea.

S. R. S. G. (Jersey). The circuit should prove satisfactory, but we regret that we have had no experience with the coils in question and cannot, therefore, state whether the selectivity is up to standard or not.

J. S. (Burslem). We are sorry we have no book suitable for you. So far as we can ascertain there is no book on the market which deals exactly with the points raised.

P. H. (Ayrshire). There are various devices on the market which may be included in a receiver to remove or reduce hum, but we cannot give any definite indication of the most suitable for your case without knowing to what the hum may be attributed.

G. W. (Gloucester). The arrangement is quite satisfactory, and should prove effective in the removal of the trouble.

The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

These blueprints are full-size. Copies of appropriate issues containing descriptions of these sets can in most cases be obtained as follows:—"Practical Wireless" at 4d., "Amateur Wireless" at 4d., "Practical Mechanics" at 7½d., and "Wireless Magazine" at 1/3, 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.

Where date of issue is omitted that particular number is out of print.

PRACTICAL WIRELESS

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Solo Knob Three	10.12.32	PW8
Selectone Battery Three	—	PW10
Fury Four	—	PW11
Featherweight Portable Four	6.5.33	PW12
Alpha Q.P.P. Three	25.3.33	PW14
Ferrocart Q.P.P. Hi-Mag Three	25.3.33 and 1.4.33	PW15
Supersonic Six	—	PW16
Beta Universal Four	15.4.33	PW17
A.C. Twin	22.4.33	PW18
Selectone A.C. Radiogram Two	29.4.33	PW19
A.C. Fury Four	25.2.33	PW20
Radiopax Class B Four	27.5.33	PW21
Three-Valve Push-Pull Detector Set	—	PW22
Double Diode Triode Three	10.6.33	PW23
Three-Star Nicore	24.6.33	PW24
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Auto-B Three	19.8.33	PW27
All-Wave Two	19.8.33	PW28
A.C. Three	16.9.33	PW29
Premier Super	23.9.33	PW30
Experimenter's Short-Wave Three	23.9.33	PW30A
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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	—	PW34C
A.C. Fury Four Super	10.2.34	PW34D
Leader Three	3.3.34	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	—	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
F. J. Camm's 2-valve Superhet	13.7.35	PW52
1936 Sonotone Three-Four	17.8.35	PW53
"Allwave" A.C. Three	17.8.35	PW54
Battery All-wave Three	31.8.35	PW55
A.C. 1936 Sonotone	31.8.35	PW56

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, 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)	—	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
The Certainty Three	Sept. '35	WM393
Minitube Three	Oct. '35	WM396
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 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)	—	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 (2SG, 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
Unicon A.C./D.C. Two	Sept. '35	WM394
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 (2 SG, D, Trans) A.C.	—	WM379
All Metal Four (2 SG, 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
Varsity Four	Oct. '35	WM395
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	Apl. '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	—	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 (H.F, Pen, D, RC, Trans)	2.6.34	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valve Short-waver	Mar. '35	WM383

Mains Operated.

Two-valvers : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	—	AW453
"W.M." Band-spread Short-waver (D, Pen), A.C./D.C.	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
A.C. Standard Four-valve Short-waver	Aug. '35	WM391
Trickle Charger	Jan. 5, '35	AW462

MISCELLANEOUS.

Enthusiasts Power Amplifier (1/6)	June '35	WM387
Newstyle Short-wave Adaptor (1/-)	June '35	WM388
Listeners 5-watt A.C. Amplifier	Sept. '35	WM392

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.

Valve Data Required

"I have just bought three valves from a friend. Would you please give me their data? The numbers are P.M.2.D.X., P.M.12.A and P.M.22."—G. R. F. (Ranelagh, Dublin).

THE main characteristics of the three valves in question are as follow: P.M.2.D.X. 2 volt .1 amp. filament; maximum anode voltage 150. Impedance 12,000 ohms and amplification factor 18. The P.M.12.A is an S.G. valve with a 2 volt .18 amp. filament and rated for a maximum H.T. of 150 volts with 90 volts on the screen. The impedance is 330,000 ohms and amplification factor 500. The P.M.22 is a pentode output valve with a 2 volt .3 amp. filament and is rated at 150 volts on anode and auxiliary grid. The optimum load is 8,000 ohms and the grid bias at maximum H.T. is 10 volts. At 125 volts it is 8 volts and at 100 volts only 6 volts are required. The total maximum anode current is 15 milliamps. but this is reduced to 9 mA when the H.T. and G.B. are reduced to the lowest value given above.

Separating a Circuit

"I wish to build a powerful radio-gram, taking for my circuit various items which have been published by you from time to time, i.e., push-pull amplifier, etc. The only point about which I am worried at the moment is how to get the set into my radio-gram cabinet. This is a commercial cabinet and only allows a small space for the receiver, but the parts which I have got together will take up too much room. Is it practicable to divide the set up and put one part on the shelf and one on the bottom of the cabinet? If this is possible, which is the most appropriate part of the set to split in addition to the complete mains section?" R. T. (Whitstable).

THE arrangement is quite in order, and, in fact, has certain features to recommend it. If you divide the set at the output of the detector stage, you will be able to build the H.F. and detector portions on one chassis, and the L.F. and mains sections on another chassis. Thus, the L.F. may be considered as standard, and should you desire to make any alterations to your set at some future date, the L.F. section could remain for connection to the new arrangement. Use multi-cable for inter-connection, and ordinary 4 or 5-pin plugs with valveholders as junction points. The H.T. and heater leads may be run in one cable, but the input to the amplifier should be kept separate.

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.

Defective Condenser

"I am interested in the parallel-fed transformer coupling which you have mentioned on occasion, but have experienced a difficulty. I have a good transformer, and it works quite satisfactorily. When I tried to use it parallel fed I connected a resistance in place of the primary and took the primary between earth and resistance *via* a condenser, but absolutely no sound could be obtained. Can you explain this? I did not touch the secondary nor the H.T. tapping."—E. Y. (Clapham).

THERE are two explanations, and we think you will find that one will solve your difficulty. Firstly, did you connect the fixed condenser to the correct end of the resistance. It must be joined to the junction of the anode of the valve and the resistance, and not to the H.T. end of the resistance. Secondly, if this arrangement was correctly carried out and still no signals were obtained, the inference is that the fixed condenser is defective and is probably short-circuiting the H.T. supply. This can, of course, be checked with a milliammeter in series with the transformer primary. Change the condenser, and we think you will find the circuit will function satisfactorily.

Baffle Design

"What is the ideal baffle arrangement? I have the Hall-Mark Four working perfectly, and am now worried about a cabinet. The set at present is in a simple box, and the speaker is unboxed. Should I build one of the radio-gram. types of cabinet such as commercial sets employ, or put the set in a small American type cabinet and mount the speaker on a flat baffle? I should like to know which is the ideal arrangement so that I can take full advantage of the set which I have built. I must thank you for the design of this set—I have heard nothing to equal it."—R. J. P. (Clacton).

THERE is no doubt about the ideal arrangement—it is the flat baffle. In most homes, however, this scheme does not look very attractive, although this can be overcome by using good timber, or oak or mahogany-faced plywood and polishing this, mounting some moulding round the edge and supporting it on two ornamental legs somewhat like a fire-screen. A baffle measuring 3ft. or 3ft. 6in. on each side would be quite good enough. On the other hand, the large cabinet looks neater to many, and also enables a gramophone to be incorporated with the apparatus, with, perhaps, storage room for records. Perhaps these details will enable you to choose your design.

The Blattnerphone

"At Olympia I saw in the Post-Office exhibit a metal type belt running on two pulleys through what looked a 'phone bobbin. This in some way was connected to a microphone, and when one spoke into the mike it was repeated about 30 seconds later. Could you possibly explain the principle to me."—P. H. F. (Streatham).

THE arrangement is known as the Blattnerphone, and is the recording device used by the B.B.C. for many of the transmissions which you hear. In brief, it consists of a length of steel tape passing through a magnetic field. This latter is formed from the device you refer to as 'phone bobbins. Steel, as you know, may be magnetised and the current flowing through the bobbin creates a magnetic field through which the steel tape passes. Thus the tape is magnetised, but the field is constantly varying owing to the fact that the speech currents from the microphone are fed to the winding. Therefore the tape receives varying degrees of magnetism and so it may be passed through another fixed field and will vary this according to the variations originally impressed upon it. By connecting this second field to an ordinary amplifier it is possible to reproduce the original sounds.

Obtaining a Transmitting Licence

"Being interested in amateur transmitting, I would like to know what procedure has to be gone through to obtain a transmitting licence for a transmitter using an artificial aerial, and also for one using a radiating aerial."—A. J. E. (Manchester).

DETAILS regarding the transmitting licence were given in our issue dated May 12th, 1934, and several notes regarding the matter have also been given on various dates since that issue.

Miscellaneous Advertisements

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

RECEIVERS, COMPONENTS AND ACCESSORIES

Surplus, Clearance or Secondhand, etc.

PREMIER SUPPLY STORES

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 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, also August bargain supplement.

WORLD Famous Continental Valve Manufacturer; mainstypes, 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; V.H.P., D.D.T., Diode Tetrodes, 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 H.F. Pen., V.M., H.F. Pen., 5/-.

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 radio-gram 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.

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