SIMPLE L.F. AMPLIFIERS—PART II

SEE PAGE 787

Practical and Amateur Wireless

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 7. No. 181. March 7th, 1936.

AND PRACTICAL TELEVISION

REACTION

FAULTS and REMEDIES

COMING SHORTLY! F. J. CAMM'S "TUTOR" THREE

Practical and Amateur Wireless

Edited by F. J. CAMM

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VOL. VII. No. 181. March 7th, 1936.

ROUND *the* WORLD *of* WIRELESS

"The Furnace"

THIS play, which is to be broadcast from the Midland Regional on March 5th, will be produced by Owen Reed. It is by Francis Brett Young, the novelist, who is a native of Halesowen, Worcestershire, and William Armstrong, of the Liverpool Repertory. The action takes place just before the war, and the scene is a large iron and steel works on the Worcestershire side of the Black Country. The fortunes of the works are at a critical stage, and the story is complicated by the son of the managing director running away with the wife of the chief engineer, who has invented a new steel. The curtain falls on the young man's return, and the prospect of prosperity for the works in the making of armaments.

Cathedral Organ Relay

THE eleventh relay in the series "Midland Organs and Organists" will come from Worcester Cathedral, and will be given in the Midland Regional programme on March 4th. The organ there will be described and played by Sir Ivor Atkins. Sir Ivor was appointed Organist and Master of Choristers at Worcester thirty-nine years ago. He has conducted the Worcester meetings of the Three Choirs Festival since 1899, and also conducts the Worcester Festival Choral Society, the Worcester Orchestral Society, and other bodies in the Faithful City and the county. He is the composer of a cantata "Hymn of Faith" and a number of settings for the Festivals.

Radio Cité, Paris

AS already reported, the 800-watt transmitter is to be replaced by a more powerful station, now being installed at Argenteuil, near the French capital. It is expected that the transmitter will be formally inaugurated next September. The wavelength of 280.9 metres (1,068 kc/s) is likely to be retained. Poste Parisien and Radio Cité, although competitors, have come to an arrangement by which the stations will broadcast nightly a different kind of wireless programme.

Morse Opening and Closing Signals

DURING the course of the Olympic Ice Sports at Garmisch-Partenkirchen Germany), all transmissions relating to these athletic competitions were preceded by a fanfare of trumpets and a morse signal—not only from Germany but from all foreign countries taking a running commentary. Germany used the letter D (– . .); Austria, A (.–); Poland, P (. – – .); Yugo-Slavia, Y (–. – –); Norway, N (–.); Finland, X (– . .–); Sweden, S (. . .); Czecho-Slovakia, C (–.–.); Hungary, H (. . . .); Italy, I (. .). Switzerland has adopted for Beromünster CH (– – – –); Monte Ceneri, M (– –); Sottens, O (– – –). France for the PTT transmitters has adopted F (. .–.), and for the Poste Parisien, V (. . .–). Even in the Argentine Republic, for the same purpose, the letter L (.–. .) has been chosen; for Canada, K (–.–), U (. .–) for the NBC, B (–. . .) for the Columbia Broadcasting System, and Q (– –.–) for Japan. On the short waves, the German Zeesen transmitter precedes the broadcast with the letter W (.– –). In view of the help it gives for the identification of the transmissions, it is expected that the same procedure will be used for all other Olympic competitions during 1936.

Egypt in London

ALMOST daily reports are received from listeners who hear weird strains of music as a background to the Brussels programmes. These may be traced to Cairo, which shares the same channel, namely, 483.9 metres (620 kc/s). In some instances, the call can be heard clearly. Fortunately, the Egyptian station closes down towards G.M.T. 21.45-22.00, and thus clears the ether.

French High-power Stations

ALTHOUGH much has been published regarding the power of the French State broadcasting stations, it has been left to the Ministry of Posts and Telegraphs to announce the exact number of kilowatts on which they are at present working. They are officially given as under: Paris PTT, 12 kW.; Strasbourg and Lyons, 100 kW.; Radio-Paris, 80 kW.; PTT Nord (Lille), 60 kW.; Rennes, 40 kW.; Grenoble and Poste Colonial, 15 kW.; Eiffel Tower, 7 kW.; Marseilles still on 1.6 kW.; Montpellier 5 kW.; Toulouse working on 1.2 kW., and Limoges 1 kW. PTT, Nice and Marseilles Realtor are testing on various powers, and their ultimate output will be given out later.

Useful Weather Forecasts

THE aviation weather reports and forecasts broadcast by the Air Ministry, London, are of considerable interest to the general public, as they are given at frequent intervals throughout the day on 1,186 metres (253 kc/s). If it is inconvenient to listen to Droitwich National at G.M.T. 10.30, tune in to Borough Hill at G.M.T. 08.45, 09.30, 11.30, 12.30, 14.30, 15.30, 16.30. The report is broadcast at first slowly to permit transcription, and then later repeated at an accelerated tempo. The next transmission is always announced, and the bulletin covers the British Isles. The call, which is always repeated, is: "Weather London."

Testing Condenser Readings

SOME receivers with scales marked with names of stations or even with wavelengths can be accurately calibrated by tuning in the B.B.C. German or Italian transmissions which maintain considerable accuracy. If exact calibration is desired, try Berlin (356.7 m.—841.001 kc/s) between G.M.T. 23.00-00.00, or Hamburg (331.9 m.—904 kc/s) between G.M.T. 05.00-23.00. Alternately, Langenberg (455.9 m.—658.002 kc/s) and Mühlacker (522.6 m.—573.988 kc/s) at the same times can also be relied upon. By adopting this method you can ascertain the reliability of the condenser scale markings.

ROUND the WORLD of WIRELESS (Contd.)

Variety from Morecambe

AN excerpt from the variety bill will be relayed from the Winter Gardens, Morecambe, in the Northern programme on March 11th.

Victorian Melodies

THIS is a programme of period music by the Norris Stanley Sextet, with Horace Priestley (tenor), which will be given from the Midland Regional on March 9th. It includes such songs as "Flight of Ages" and "Beauty's Eyes," and a waltz medley, "The Gay Nineties." It is followed by a studio concert by Munn and Felton's Band, from Kettering, and Louise Atherton, the Derby violinist. This band won the championship at the Crystal Palace last autumn. S. H. Boddington will conduct.

Birmingham City Police Band

LOVERS of bands in the Midlands have learned with pleasure of the return to the broadcast programmes of the Birmingham City Police Band, the premier Police Band in the country. Richard Wassell will conduct a programme on March 12th, which includes a selection from "Das Rheingold" and Schubert's "Ave Maria" with P. C. Cook as solo cornet player. Nora Savage (soprano) will sing two groups of songs.

"Nets in the Sea"

IN the third talk of the series, "Nets in the Sea," to be broadcast on March 9th from the Western Regional, Lieutenant W. B. Luard will bring a Brixham fisherman to the microphone. Listeners will hear of the conditions now obtaining in the fishing industry in the south-west and some suggestions will be put forward for dealing with the special problems of the industry both on sea and on land.

Cornish Concert

A CORNISH concert will be relayed from the Foster Hall, Bodmin, on March 10th, when the artists will be Anne Jeffery (mezzo-soprano), Marcel Kingdon (tenor), and the Bodmin Centenary Choir, conducted by Adelaide M. Hearn.

INTERESTING and TOPICAL PARAGRAPHS

A Haunted House Thriller

THE short thriller, "Just Off Piccadilly," by James Parish, which is to be given in the Midland Regional programme on March 13th, is being produced by Owen Reed with Noel F. Johnson, Gwen Muspratt, and Lee Fox as the players. The plot concerns a haunted house where the heroine goes ghost hunting. All three players have had stage experience.

Feature Programme

THE first feature programme to be prepared with the assistance of the B.B.C. Mobile Recording Unit will be revived in the Regional programme on March 11th, almost exactly a year after the original production. "Gale Warning" portrays in sound the drama of the men and the organisation behind the public services affected by a gale. Battersea Power Station, Ramsgate Coastguard Station, a liner in mid-ocean, a lighthouse, and a lightship, the London Fire Brigade—these are some of the sources from which the programme was built up. "Gale Warning" was the forerunner of several feature programmes, including "Cable Ship," "Dinner is Served," and "Fog." Listeners will be interested to compare this original effort with subsequent productions of the same type, and to note for themselves the progress which has since been made. The production is in the hands of Laurence Gilliam.

"Orpheus" from Leeds

A CONCERT version of Gluck's opera, "Orpheus," as performed by the Leeds Choral Union, supported by the Northern Philharmonic Orchestra, is to be relayed from the Town Hall, Leeds, on March 10th. Choir and orchestra will be conducted by Norman Strafford, while the soloists will be Mary Jarred (as Orpheus), Hilda Hanson (Eurydice), and Audrey Dover (Amor).

"Variety of Theatres"

FOR the next of the series called "Variety of Theatres," Prince Littler's theatre, the Leicester Opera House, has been chosen. There have been relays of pantomimes from there occasionally, and the orchestra has been regularly on the air for some months. A representative of Mr. Littler will give reminiscences of the theatre in an interview with David Gretton; and a relay of the variety bill will follow, with Tommy Handley and Company as the star turn. This broadcast will be given from the Midland Regional on March 12th.

Chamber Music Concert

A CHAMBER Music Concert by the Cardiff Ensemble will be relayed from the Reardon Smith Lecture Theatre of the National Museum of Wales on March 14th.

Highland Hollywood

"HIGHLAND HOLLYWOOD," another Scottish musical comedy, will be heard on March 12th. It will be the first attempt to satirise the American film producer's idea of the Highlands in a Highland setting. Alan Melville is the author of this musical burlesque, and George McNeill has written the music. Robin Russell will produce.

A Musical Mélange

FOR this musical mélange, which is to be given in the Midland programme on March 7th, Martyn C. Webster has chosen the title "Moonshine," to indicate its non-serious nature, though there will also be a good deal about the moon and its effect upon crooners. The solo vocalists are to be Mary Pollock, Cuthbert Ford, and Geoffrey Dams, and the pianist, Jack Wilson. Reginald Burston will conduct the B.B.C. Midland Orchestra and Revue Chorus.

A POPULAR BAND LEADER LISTENS-IN

Mr. Henry Hall, the conductor of the B.B.C. Dance Orchestra, with his new Marconiphone Model 345 All-wave receiver.

SOLVE THIS!

PROBLEM No. 181.

Jones built the Centaur Three described in the issue of PRACTICAL AND AMATEUR WIRELESS dated December 7th, 1935, but instead of using a metallised baseboard he decided to use a plain plywood type, joining all the points marked M.B. by means of ordinary connecting wire. He was surprised to find that although reception was satisfactory on the long-wave band no medium-wave stations could be picked up. Why was this? Three books will be awarded for the first three correct solutions opened. Address your letters 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. 181 in the bottom left-hand corner, and must be posted to reach this office not later than the first post Monday, March 9th, 1936.

Solution to Problem No. 180.

Tomkins should have substituted a fixed condenser of approximately .0005 mfd. for the variable reaction condenser; this should have been connected between the anode and the negative filament pin of the detector valve. A by-pass condenser is necessary in this position in order to smooth the high-frequency component in the detector anode circuit.

Only two readers successfully solved Problem No. 179, and books are accordingly being forwarded to them: H. Street, 31, John Street, Bush Hill Park, Enfield, Middx; W. P. Edmunds, Culreoch, Stranraer, Wigtownshire.

Fig. 1.—In this receiver the method of connecting the H.F. choke to ensure smooth reaction may be seen.

Reaction Faults and Remedies

A Practical Article Pointing Out the Advantages of Reaction, and Describing Various Methods of Treating Faults

PRACTICALLY every "straight" receiver employs variable reaction, but those receivers in which reaction works properly are, more than likely, in the minority. Before dealing with reaction faults, it may be as well to consider what reaction is, how it is obtained and why it is used.

A simple reaction circuit, devoid of all but the bare essentials, is shown in Fig. 3. When signals are received by a radio set, they are first of all amplified and selected by the high-frequency stage and then passed on to the grid of the detector valve *via* the tuned circuit L.1. C.1. in Fig. 3, where they are rectified (or detected) and passed on as amplified signals to the L.F. stages of the receiver. These rectified currents appear at the anode of the detector valve, but despite the detecting properties of the valve, and its associated grid leak R.1 and condenser C.2, high-frequency potentials are also superimposed on the grid, and appear at the anode to be passed on to the L.F. stages with the amplified rectified signals. Now these high-frequency currents are of no use to us in the L.F. stages. In fact they can do a great deal of harm, but if we include a reaction coil L.2 in the anode circuit, we can arrange for at least the greater percentage of these H.F. currents to return to earth through the coil. If this coil is brought close to the tuning coil L.1, the H.F. currents flowing through it will induce further H.F. currents into coil L.1, so that the original H.F. currents appearing at the grid of the detector valve will be greatly strengthened. The closer the two coils are brought together, the greater the induced currents in coil L.1, and thus the greater the signals will be increased. If brought too close together, however, the valve will oscillate of its own accord, independent of the incoming signals. In current practice, the reaction coil is fixed in relation to its closeness to the tuning coil L.1, and the degree of feed-back of the H.F. currents for reaction purposes is controlled by a variable condenser in series with coil L.2, but, whatever method is used, one thing is common to all, that is the H.F. currents appearing at the anode of the valve, and which would otherwise be wasted, are fed back to the grid circuit so that the currents already there are strengthened.

Advantages of Reaction

The benefits of reaction are not merely confined to increasing volume, for its effect is the same as reducing the resistance, and thus damping, of the circuit. However good modern tuning coils and their associated condensers may be, a certain amount of loss is bound to exist. Since reaction helps to reduce the resistance of the circuit, it follows that the efficiency of the circuit is improved by its use, and therefore it is made more selective and efficient.

Reaction may be obtained from a detector valve or an H.F. valve, and, in some extreme cases, even a separate valve may be employed; a moving coil or a fixed coil may be used, and, in the latter case, the degree of reaction obtained may be altered by means of a variable condenser or a variable resistance, and the coil may

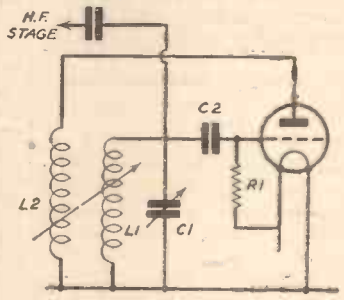


Fig. 3.—Theoretical diagram of a standard reaction circuit.

be in series or in parallel with the anode circuit of the valve.

For the purpose of dealing with reaction faults, we will consider the most popular method in use to-day, *i.e.*, the choke-fed system, with fixed coil and variable condenser in parallel with the anode circuit.

A typical reaction circuit is shown in Fig. 4, with indications showing why reaction may be faulty. In this particular circuit, the H.F. currents appearing at the anode of the valve are prevented from getting into the low-frequency circuits by means of the H.F. choke H.F.C.1, and they are by-passed to earth *via* the reaction coil L.2 and condenser C.2, the latter controlling the degree of reaction obtained. A small fixed condenser C.4 is also connected in parallel with the anode circuit, the purpose of this being to by-pass any H.F. currents not wanted for reaction purposes, and to prevent "Miller effect" when reaction is at zero.

The following are the faults most commonly met with in reaction circuits:—

1. Reaction not sufficient.
2. Reaction too fierce.
3. Reaction only effective on one wave-band.
4. Reaction only effective over one part of a wave-band.
5. Reaction flattens tuning and reduces volume.
6. Hand-capacity effects.

There are, of course, many other reaction difficulties, but they are supplementary to, and will be dealt with under, one of the above headings.

Reaction Not Sufficient

Every set should, if working properly, be capable of being made to oscillate at all settings of the tuning condenser by means of increasing reaction. If this is not so, there are a variety of reasons and remedies. There may be a loose or dry joint in one of the connections, the grid leak and or condenser may be of the wrong value, or the valve may not make good contact in its valve-holder. We will presume that all connections have been examined and that, except for reaction, the set is working efficiently. Probably the greatest cause of inadequate reaction, presuming the valve is good, the coils efficient and the right value of reaction condenser is being used, is low H.T. on the anode of the valve, or a wrong value of by-pass condenser (C.4 in Fig. 4). A common cause of inadequate high tension is too high a value for the decoupling resistance R2 in the anode circuit. If, say, 60 volts are recommended,

(*Continued overleaf*)

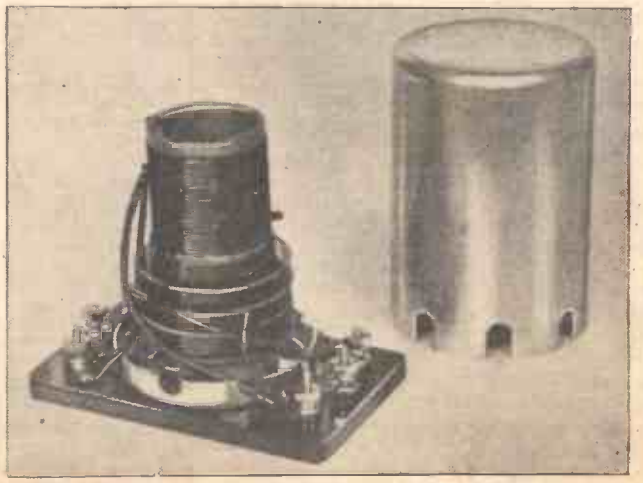


Fig. 2.—A home-made coil in which the reaction winding may be moved or rearranged in order to obtain better reaction effects.

REACTION FAULTS AND REMEDIES.

(*Continued from previous page*)

the constructor should not try a drastic increase, even if this does seem to improve reaction, as this is more than likely not the real cause of failure, the large increase in high tension merely enabling reaction to be obtained while hiding the true fault. A small increase of about 10 volts only can be of benefit, but more should not be tried. If the high tension applied to the valve is too low, the anode resistance R.2 is either too high or else the decoupling condenser C.5 is leaky. The voltage, both sides of the resistance, should be measured with a high-resistance moving-coil voltmeter (a cheap moving-iron instrument is of no use for reasons that have been pointed out in these pages from time to time). If there is a very great difference (say 120 volts at the battery end, and only 20 volts on the anode side), the resistance is obviously dropping too many volts, and may be conveniently reduced in value. On the other hand, if this resistance is being used as a coupling resistance to the next stage of the receiver, care should be taken not to reduce its value too much, as this will cause the amplification of the stage to be lowered. In such a case, the resistance should never be lowered in value to less than twice the impedance of the valve.

If this slight increase in H.T. has no beneficial result, the by-pass condenser C.4 should be reduced in value. The next step should be to increase the capacity of the reaction condenser C.2 by fixing a small condenser of say .0001 mfd. capacity across its terminals.

An inefficient or shorted H.F. choke will cause insufficient reaction, as this will allow the H.F. currents required for reaction to get into the L.F. stages. Such a state of affairs would generally be easily traceable as it would be accompanied by distortion due to the presence of the H.F. currents in the L.F. stages.

If reaction works properly when a new H.T. battery and a fully charged accumulator are in use, then nothing can be gained as it is obvious that the receiver has been correctly designed, and that the reaction fault is due to either a run-down H.T. battery or accumulator.

Reaction Too Fierce

This state of affairs is just as bad as insufficient reaction. Probably worse, because a very slight increase in reaction causes the set to become unstable and to burst into oscillation. Because reaction is too fierce, it must not be assumed that the H.T. on the anode is of too high a value. Reducing the H.T. severely is just as bad as increasing the value of grid-bias applied to an H.F. valve to prevent instability. Both are but half-measures, and will greatly affect the sensitivity. If a few volts reduction does not smooth out reaction, a fixed resistance of about 250 to 500 ohms should be connected between the anode of the valve and the reaction coil. The value of this resistance depends a good deal on the value of the by-pass condenser and a series of different values for both these components should be tried. Wrong values of grid leak and/or condenser will also cause excessive reaction, and these may conveniently be lowered.

A great deal of fierce reaction may also be caused by instability in the high-frequency stage of the receiver. If the latter uses a variable-mu valve, the volume should be reduced so as to almost cut out the signals. This H.F. stage will then be biased to such a degree as to prevent any instability in it and reaction should be tried. If it is now quite smooth, the fault obviously does not lie in the reaction circuit, but in the H.F. stage, which should be tested for instability.

Reaction only Effective on One Waveband

This fault may be remedied in the same manner as described for insufficient reaction, but it may also be due to a faulty coil, especially where a common reaction coil serves for both medium and long waves. At any rate, some improvement may be obtained by treating as outlined above, but perhaps at the expense of rather fierce reaction on the band which was normally working satisfactorily.

With highly efficient coils, especially the modern ones using iron cores, parasitic oscillation is likely to be generated in the detector valves. This is shown by the set going into oscillation on the long waves with the usual slight "pop," but without giving the usual squeal on the received carrier, and before the full amplification from reaction has been obtained. This is due to the detector valve going into oscillation at a frequency determined by the combined constants of the reaction circuit and that portion of the grid circuit between the grid, and the earth line of the receiver.

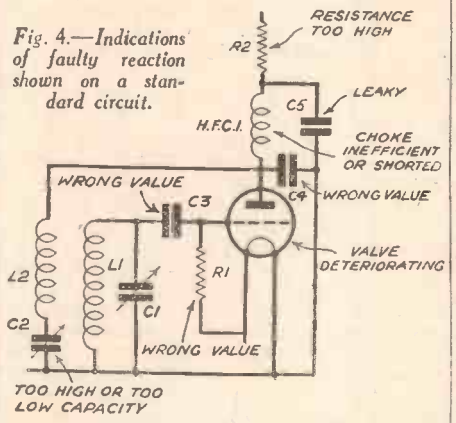


Fig. 4.—Indications of faulty reaction shown on a standard circuit.

Parasitic oscillation is easily cured by including a stopping resistance in the reaction circuit as explained above. By making this resistance high enough, the long-wave band may be made to work with satisfactory reaction, but it may then be found that at the lower end of the medium-wave band reaction has become unsatisfactory. From our experience, we have found that the values which give the best results are 250 ohms for the resistance, a by-pass condenser of .0002 mfd. capacity, and a reaction condenser of .0002 mfd. capacity. These will give satisfactory operation over the whole of both wavebands, provided, of course, the rest of the circuit is in order.

Reaction Only Effective over One Part of a Waveband

This is another fault which may be due to a variety of reasons, and the constructor will have to carry out all the tests already described if he wants to put matters right. Probably a slight increase in high-tension, and an alteration of the value of the by-pass condenser will be found to be most beneficial, but it must always be remembered that, even in the best of sets, there is bound to be a slight difference in the degree of reaction obtained at the bottom and top of a waveband.

Reaction Flattens Tuning and Reduces Volume

This fault is obvious—either the reaction coil is connected the wrong way round or else the reaction condenser (if a differential condenser is being used) has been wrongly connected. It is thus a very simple matter to put things right.

Hand-capacity Effects

A set that "squeals" every time a hand is brought near the reaction condenser can never work at its best. It usually happens that, even if the set does not actually oscillate as the hand approaches, the volume is reduced considerably when the hand is taken away from the reaction control after the latter has been used to bring up the volume of a foreign station.

This fault only appears when the reaction condenser is connected between the coil and the anode of the detector valve itself. Some coils have the "earth" side of the reaction coil permanently joined to a common earth terminal on the coil base. In such cases, the reaction condenser can only be connected between the coil and anode, and the only remedy is to fix an aluminium or copper shield behind the panel, but in front of the reaction coil. When this shield is joined to the earth line of the receiver, it prevents the capacity of the hand and body from affecting the reaction condenser. An improvement may also be made by making sure that the fixed vanes of the condenser, and not the moving ones, are connected to the anode.

If the coil has both ends of the reaction winding free, the reaction condenser should be connected between the "earth" end of the reaction coil and the earth lines of the receiver. Here, again, make sure that the moving vanes of the reaction condenser are connected to earth and the fixed vanes to the coil. Other faults which appear in reaction circuits are generally variations of the above.

REACTION FAULTS TABLE.

FAULT.	REMEDY.
Reaction insufficient.	Increase H.T. on anode slightly. Decrease value of by-pass condenser. Increase value of reaction condenser. Test H.F. choke and decoupling condenser. Alter values of grid leak and condenser. Replace valve.
Reaction too fierce.	Decrease H.T. on anode slightly. Increase value of by-pass condenser. Add small fixed stopping resistance in reaction circuit. Decrease value of grid condenser. Connect grid leak to negative instead of positive side of filament.
Reaction only effective on one waveband.	Treat as for insufficient reaction. Carry out cure for parasitic oscillation, i.e., add stopping resistance in reaction circuit.
Reaction only effective over one part of a waveband.	Increase H.T. Try different values of by-pass condenser.
Reaction flattens tuning and reduces volume.	Reverse connections to reaction coil, or, if a differential reaction condenser is in use, reverse connections to the two sets of fixed plates.
Hand-capacity effects.	Connect condenser between "earth" side of coil and earth line of the receiver. If condenser must be connected between coil and anode, use larger knob and shield the condenser.
Crackling.	Clean reaction condenser. Test for shorts between fixed and moving vanes.

F. J. Camm's Monitor 3

Detailed Instructions for Operating the Second Stage Version of the Monitor are Given This Week, Together with Further Details of the Coil Wiring

By F. J. CAMM

EASY TO BUILD— —GUARANTEED!

MOST readers who are building the Monitor will have finished the constructional work by now and will be anxiously awaiting further instructions. In case beginners have experienced slight difficulty in mounting and wiring the coil of the original Monitor to the new chassis, however, it is proposed to give further details of the coil and wave-change switch wiring before proceeding to the operating instructions.

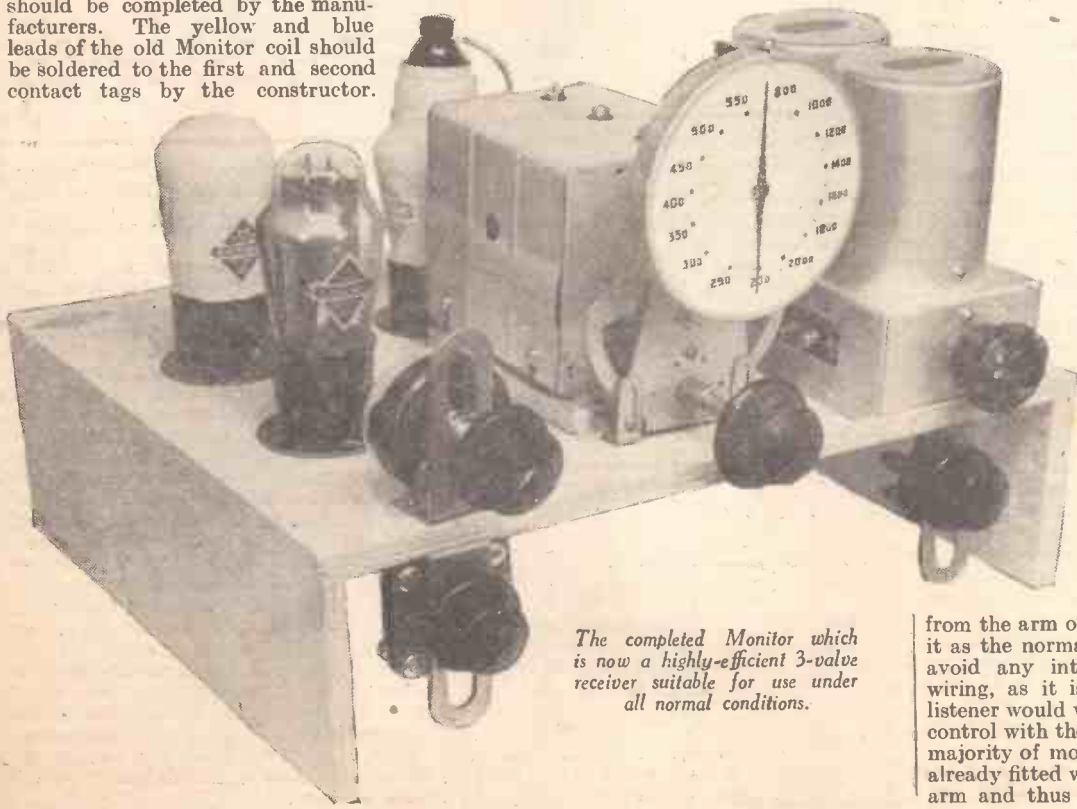
Mounting the Coil

The original Monitor coil should be removed from the metaplex chassis and mounted on the new metal chassis, care being taken to see that the lower end of the coil is exactly in the centre of the chassis hole. The coil leads should then be pulled through the hole and soldered to the correct tags inside the chassis. It will be noted that the new coil has already been wired by the manufacturers, but it will be advisable to check this wiring before attaching the leads of the old coil. The switch has ten contact tags, and viewing these from the control knob end, the third, fourth, and fifth should be connected to the chassis, and the yellow and blue leads of the new coil respectively—this wiring should be completed by the manufacturers. The yellow and blue leads of the old Monitor coil should be soldered to the first and second contact tags by the constructor. Of the inside tags attached to the chassis terminals, those joined to terminals marked 3, 4, and 5 should be soldered to the white, brown, and black leads of the new coil by the manufacturers. The tags attached to terminals 1 and 2 should be soldered to the black and white leads of the old Monitor coil by the constructor, and the tags of terminals 6 and 7 should be soldered to the 8th and 9th contact tags of the switch; the only contact tags of the switch that are not used are, therefore, the 6th, 7th, and 10th. The coil chassis must be securely bolted to the metallised surface of the receiver chassis, and the nuts marked M.B. underneath the receiver chassis are those attached to the coil chassis fixing bolts—the leads attached to the bolts are therefore in contact with the metallised surface of the Metaplex chassis.

Adjusting and Operating

After the wiring has been carefully checked, the battery, speaker, aerial and earth leads may be joined to their respective sockets. H.T.2 lead should be plugged into the 120-volt socket of the H.T. battery, H.T.1 into the 60 or 72-volt socket, and H.T.— into the — socket. The G.B.+, G.B.—1, G.B.—2, and G.B.—3 leads should then be plugged into the +, —1½, —4½, and —9 volt sockets of the G.B. battery respectively, and the L.T.— and L.T.+ leads should be joined to the — and + terminals of the L.T. accumulator.

After these connections have been completed the set may be switched on by means of the three-point switch mounted underneath the coils; this switch should be pulled out to switch on. Volume is then controlled by means of the reaction condenser and the potentiometer mounted above it. As these components are on the left-hand side of the chassis they have been wired so that volume is increased when the controls are rotated in an anti-clockwise direction. For preliminary searching the potentiometer control should therefore be rotated to the maximum anti-clockwise setting, and the reaction condenser should be kept near its oscillation (plopping) point. To obtain maximum selectivity the reaction control should be kept near this oscillation point, and if a very long aerial is used it will be advisable to connect a .0003 mfd. pre-set condenser between the aerial lead and the aerial socket of the receiver; in most cases this condenser will not be found necessary, however, and has not been included in the design.



The completed Monitor which is now a highly-efficient 3-valve receiver suitable for use under all normal conditions.

Trimming

Stations should be picked up the first time the tuning control is rotated, but in order to obtain optimum results it will be found necessary to adjust the trimmer condensers attached to the gang condenser; this may be done by tuning to a moderately weak station and adjusting the trimmers by means of a screw-driver until maximum volume is obtained.

When gramophone reproduction is desired the pick-up leads should be plugged into the sockets of the P.U. terminal strip and the control attached to the coil chassis rotated to the setting marked G. If volume control is desired on the record reproduction it is preferable to fit the control across the pick-up, using the two connections from the arm of the control and one end of it as the normal pick-up leads. This will avoid any interference with the circuit wiring, as it is not anticipated that any listener would wish to gang an L.F. volume control with the present H.F. control. The majority of modern pick-ups are, however, already fitted with the control on the carrier arm and thus all difficulty is avoided.

Phase Reversal—1

An Interesting Explanation of the Methods Adopted for the Operation of Push-pull Output Systems. By W. J. DELANEY

A NUMBER of newcomers to radio are apparently mystified by the term "phase" and its application to the ordinary wireless circuit. Some confusion also seems to exist among even the older type of experimenter as to the meaning of this term, and consequently fail to appreciate properly why a push-pull output arrangement is sometimes adopted. Without going into deep technical theories it may be explained in a fairly simple manner that "phase" is merely the relation between a current as compared with a zero point. To make this clear it is necessary first to remember that a wireless signal, no matter in what part of the circuit we locate it, consists of a fluctuating current. Now every amateur is familiar with the theoretical symbol which is used to identify an alternating current supply, and which is merely a letter "S" lying on its side, thus ~.

This symbol is known as a "sine curve" and is mathematically produced from a circle by taking the variation of the sine of the angle as it varies from 0 to 360 degrees. Now every schoolboy knows that there are 360 degrees in a circle, and if the circle is divided into four parts there will be 90 degrees in each part. Thus, one half of a circle consists of 180 degrees.

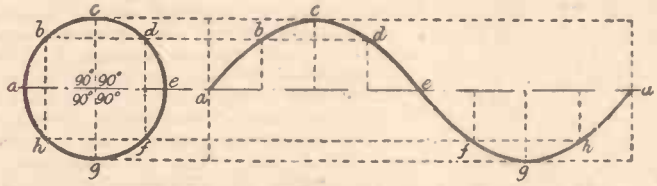


Fig. 1.—Diagram showing the development of the sine curve which is helpful in understanding the meaning of the term "out of phase."

Developing the Sine Curve

Now if we take our circle and continue the centre line as shown in Fig. 1, we can mark vertical lines along this line equal in distance to those shown in the circle by the broken lines, and by projecting these horizontally the points of intersection will give the projection of the sine curve. In Fig. 1 the points *a*, *b*, *c*, etc., are shown round the periphery of the circle as well as along the sine curve. Now, point *c* on the circle is 90 degrees from (or differs in phase from) point *e*, whilst points *c* and *g* are 180 degrees out of phase. By glancing at the sine curve it may be seen that point *c* is just as far above the zero line as point *g*, but there is a phase difference in the two points, and it is general to consider the points above the horizontal zero line as positive and those below as negative.

Now, if we consider the sine curve in Fig. 1 as part of an actual wireless signal, we may consider it as starting at zero, rising to a certain positive value, falling back to zero, then passing to a negative value and coming back to zero. If such a current is applied to the diaphragm of a loud-speaker or other similar reproducer the current variation would result in movement of the diaphragm, but an exactly similar movement may be caused to the diaphragm if the curve is applied upside down—that is, from zero passing to negative and so on as shown in the two comparisons in Figs. 2 and 3. If we imagine that the positive half draws the diaphragm down, and the negative half repels it, then in Fig. 2 the diaphragm is first drawn down and then driven back, whereas in Fig. 3 it is driven away first and then drawn down. The air is thus set in motion in the form of a wave, and it matters not whether the air is driven forward or backward—the sound will be exactly the same.

Stage Reversal

This point is of vital importance when considering the differences between the old type of television reception and sound reception, as there is a definite relation to be maintained in receiving a picture, in view of the fact that if the signal is 180 degrees out of phase (that is, in other words, negative instead of positive) the blacks in the picture will appear white and vice versa. Each stage in an amplifier results in a complete reversal of the phase and thus it was necessary with the television receiver to use the correct number of stages in order that a positive picture could be seen. Thus, in any L.F. anode circuit there is present a fluctuating current which varies according to the type of item which is being received, and from the various articles which have appeared the reader will be aware that a current flowing through a resistance will cause a voltage drop from one end of the resistance to the other.

In Fig. 4 a resistance is shown joined across a voltage supply, and if the value of

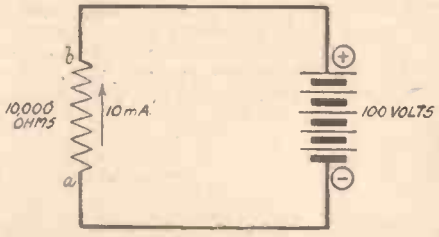


Fig. 4.—A simple circuit which illustrates the flow of a current through a resistance.

the resistance is 10,000 ohms and the voltage supply is 100, then a current of 10 mA. will be flowing across the resistance. Point *b* will be, therefore, 100 volts more positive than point *a*.

The Centre Tap

If Fig. 4 is now re-drawn with a source of alternating supply in place of the battery, the same remarks apply, provided that the circuit is examined *at any one instant*. In view of the fact that the alternating

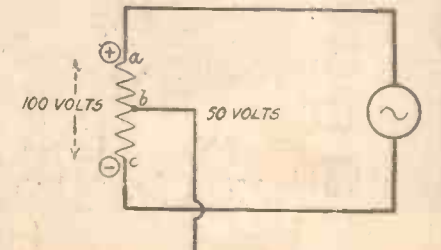
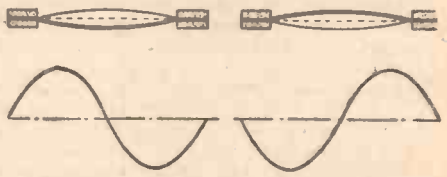


Fig. 5.—In this development of Fig. 4, A.C. is applied to the resistance which is now centre-tapped.

supply will make point *b* positive one moment and negative the next, it is necessary to consider the A.C. circuit at any given instant, and, as above-mentioned, the conditions are then exactly as for a D.C. circuit. Now, if we take a tapping from the electrical centre of this resistance, as shown in Fig. 5, we shall find a different set of conditions. If we still keep our supply at 100 volts, we find that at any given moment point *a* would be 100 volts more positive than point *c*, but at the point *b* there is a difference of 50 volts from either *a* or *c*. In other words *b* is 50 volts negative with respect to *a*, and is 50 volts positive with respect to point *c*. Therefore, point *b* may be termed the zero point and the remaining two ends of the circuit (*a* and *c*) are at equal and opposite potentials, or, to put it more simply, are 180 degrees out of phase. To



Figs. 2 and 3.—The upper illustration represents a speaker diaphragm, and it will be seen that the effect in both cases is identical, although in one case the current is applied in a different phase.

compare this circuit with Fig. 1 points *a* and *c* in Fig. 5 correspond to points *c* and *g* in Fig. 1, whilst point *b* (Fig. 5) is the zero point corresponding to the points *a* and *e* in Fig. 1. Having ascertained now how the signal (which may be compared to the alternating supply in Fig. 5) produces across a load (the resistance in Fig. 5) a signal which can be split into two sections exactly 180 degrees out of phase, we are able to understand how each half of this signal may be employed to operate a split amplifier, and the usual push-pull, paraphase, and duophase amplifications systems will be described next week.

Twenty Minutes with Philip Ridgeway

PHILIP RIDGEWAY, well known to listeners for his famous "Parades," will return to the microphone on March 11th in a variety feature entertainment with his partner, "Irene." This young lady, though only fifteen years old, is an experienced variety artist, and the pair have appeared with success all over the country. Ridgeway, who is always on the look-out for new talent, will give on this occasion several of his new "discoveries" their first big chance by introducing them into his programme. Four children, all under fifteen, will be heard, and it can confidently be predicted that the skill and finish of their performances will impress and amuse all who hear them. From London come Joan Gates, the possessor of a soprano voice of a clear timbre eminently suitable for broadcasting, and Dorothy Dakin, a young contralto, with an extraordinarily deep voice and a perfect sense of rhythm. Northern England is represented by Percy Bellingham, a small boy who whistles in a most astonishing manner. The last of this batch of talented children is Doreen Williamson, who hails from Margate.

Making L.F. Amplifiers—2

In This Second Article, Constructional Details are Given of Mains-operated Amplifiers of A.C., D.C., and Universal Types. By Frank Preston

A PREVIOUS article dealt with the construction of simple L.F. amplifiers suitable for battery operation, so it is now proposed to give corresponding particulars of a few very simple units for operation from the mains. The simplest possible type of mains-operated amplifier is that for use with D.C. mains, and a suitable circuit is given in Fig. 1, along with a wiring plan. The latter shows the use of a flat, metallised baseboard, but a chassis could be used if preferred; it was thought, however, that the construction would be simplified by using the baseboard.

A Single-valve D.C. Amplifier

The general circuit arrangement is very similar to one of those given for battery amplifiers, a single pentode valve being used with input arrangements suitable for either radio, microphone, or pick-up. It is for this reason that both choke-capacity and direct coupling are indicated. One point which should be observed is that a fixed condenser is included in one pick-up lead as a safeguard against shocks. With some types of pick-up, however—piezo-electric types in particular—the condenser must be omitted, because it is necessary that there should be a complete electrical circuit through the pick-up and volume control. In such cases, greater care must be taken in handling the apparatus, and the power supply should be switched off when connecting or disconnecting any piece of apparatus. This is a wise precaution, even when the condenser is included, but is not absolutely essential.

The Circuit Explained

The valve used is a Cossor 40 P.P.A., which has a heater consumption of .2 ampere at 40 volts, and which requires a total of about 40 mA at 150 anode volts, as well as a bias potential of approximately —25 volts. The mains voltage is dropped to the necessary figure for the heater by including in series a 240-volt 60-watt lamp. This has a resistance of rather less than 1,000 ohms, whilst the resistance of the valve heater is 200 ohms, so that the total resistance in circuit is about 1,200 ohms. This means that when the voltage of the mains is, say, 240, the current flowing will be 1,200 divided by 240, or ⅕ amp., which is the correct figure. Actually, it is not essential that the current should be precisely this figure, and therefore the amplifier can be used on supply voltages of 230 to 250 volts quite safely. But even if the voltage were only 210, for example, the heater would be only slightly under-fed, and results would not suffer to any serious extent. In order to obtain maximum results with less than 220 volts, however, it would be desirable to use a lamp rated at 60 watts, 220 volts.

Power Supply

The high-tension supply is smoothed by means of the smoothing choke marked L.F. 14, this being the designation of a suitable Bulgin component. Additional smoothing is provided by the resistance of the lamp and by the two 8-mfd. electrolytic condensers shown. It is preferable that these condensers be of the "reversible" type, such as Dubilier type 0281, so that they will not be damaged should the mains leads be wrongly connected. The correct polarity is easily found by trial; if the amplifier does not function after being switched on for a minute the mains leads should be reversed, or the plug reversed in its socket.

Grid bias is obtained by including a 600-ohm 1-watt fixed resistance in series with the cathode lead, and this is by-passed by means of a 25-mfd. 50-volt tubular electrolytic condenser, of which there is a suitable component in either the T.C.C. or Dubilier range.

Suitable Parts

It is not necessary to give a complete list of components, since the main parts are similar to those used in the battery amplifiers previously described. A suitable choke for the input circuit is a Ferranti type B.8, which has an inductance of 25 henries when carrying 10 mA. The holder for the electric lamp is of the ordinary batten type and can be bought at any electrical store. It should be noted that a .002-mfd. fixed condenser is connected in parallel with the speaker terminals, this being to prevent over-accentuation of the high notes. This condenser should have a rated working voltage of not less than 500, but any make can be used. Should any constructors wish to make use of a smoothing choke which is on hand, it should be mentioned that the component suggested above has an inductance of 20 henries at 50 mA and a D.C. resistance of 400 ohms. This resistance, combined with that of the bias resistance and of the loud-speaker transformer, reduces the anode voltage to just about 150, which is the maximum rating for the Cossor 40 P.P.A.

Layout

With regard to the constructional details, it should be explained that the layout is not very critical, although it is desirable that the two chokes should be mounted at opposite ends of the baseboard or chassis, with their axes at right angles. When using a baseboard, the two 8-mfd. electrolytic condensers have to be mounted on a metal

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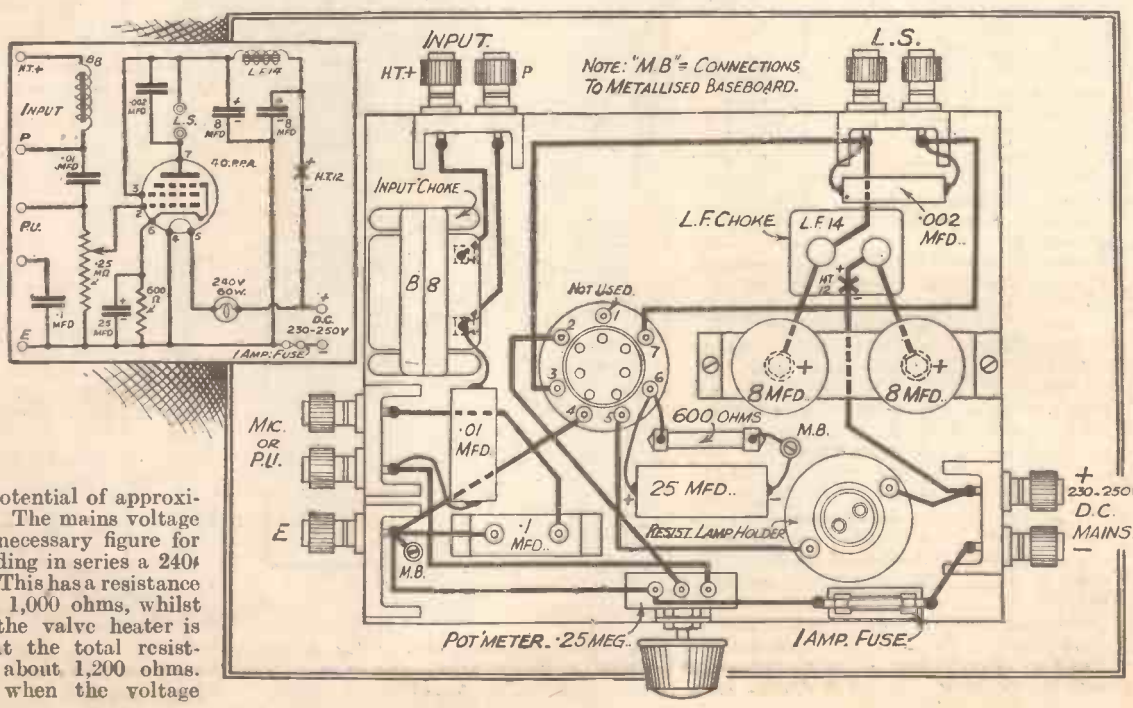


Fig. 1.—Details are here given for the construction of a simple D.C. amplifier which can be used on either A.C. or D.C. mains by inserting a rectifier at the point marked X.

MAKING L.F. AMPLIFIERS

(*Continued from previous page*)

" bridge " so that their cases are earthed to the baseboard and connection to the positive terminals can be made on the underside of the " bridge." If it is not wished to make the mounting bracket, two separate brackets can be bought ready made from many dealers. Other constructional details are obvious from Fig. 1.

The amplifier can be used in conjunction with either a D.C. or battery set, and will provide a maximum output or more than 2 watts. It is recommended that it be fed from mains whose negative lead is earthed, in which case the terminal marked E can be joined either to a separate earth lead or to the earth terminal on the set. Where the positive mains are earthed, it can be used with a D.C. receiver by joining the E terminal to the negative line in the set, and in no circumstance should a direct earth connection be made to the amplifier. Microphone or pick-up can be used by following the general instructions given in the previous article.

It will be understood that the full output of the valve will be obtained only when the input is sufficiently high, for which reason the pick-up or microphone employed should be one of the most sensitive pattern. The amplifier can be used in conjunction with a receiver of which the output is not more than about 300 milliwatts, and of which the last valve does not pass more than a maximum of 15 m/A.

The speaker may be of the permanent-magnet type, but better results will be obtained by using a D.C. energised speaker, the field coil being connected directly to the positive and negative supply terminals.

Universal Mains Working

Should the amplifier be required for either A.C. or D.C. operation at will, this can be provided quite easily by inserting a Westinghouse style H.T.12 metal rectifier at the point marked X, wiring the positive and negative terminals of this as indicated. The rectifier can be left in circuit whether the supply is D.C. or A.C., for it will simply act as a small resistance to D.C.

A Good A.C. Amplifier

Details of an A.C. amplifier capable of providing a greater degree of amplification are given in Fig. 2, where it will be seen that two triode valves are used for amplification, with a full-wave rectifying valve for the H.T. supply. The valves recommended are: Osram M.H. 41 for the first stage, Cossor 41 M.P. for the second, and Cossor 506 B.U. for rectifying. The input choke is the same as that used for the D.C. unit, and the L.F. transformer should be a high-quality component, such as the Varley D.P. 3, which has a ratio of 1 : 5 and a primary current-carrying capacity of up to 20 m/A. The mains transformer may be a Wearite type T-21 A, whilst the mains switch should be of the Q.M.B. pattern.

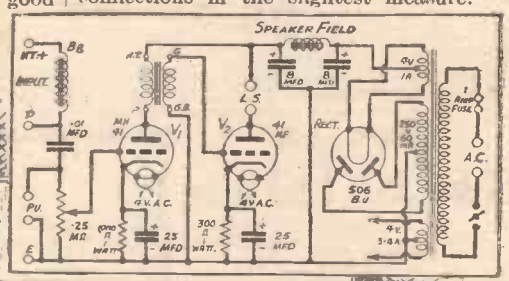
In order to save the expense of a smoothing choke, it is suggested that a 2,500-ohm field energised moving-coil speaker should be used, since this will reduce the 270 volts supplied by the rectifier (at half load) to a suitable value for the valve anodes. The energising wattage will be on the low side—just over 2 watts—but this will provide results as good as those to be obtained when using permanent-magnet speakers of the less-sensitive type. When the highest possible output is required, however, the speaker field should be replaced by a Wearite H.T.14 smoothing choke, and a good permanent-magnet speaker, such as the "Stentorian," should be joined to the speaker terminals. The 8-mfd. electrolytic condensers should be rated at 500 volts peak working, and should be mounted on a " bridge " as described above.

A suitable method of arranging the components is shown in Fig. 2, but the parts shown are not intended to represent those of a particular maker, so the reader can make use of any that are on hand, provided that they have characteristics similar to those detailed above. Where new parts are to be bought it is advised that constructors use those of which the makes have been mentioned, for it is known that these are perfectly suitable.

Connections

The mains amplifier can be used in the same manner as those previously described, but when used with a receiver it should follow the detector or second detector, because it is not intended for a high input. This does not mean that it could not be used with a set having an L.F. stage, but in that case the volume control would have to be set almost to its minimum. so that a good deal of amplification would be lost and one of the valves would be " wasted." It has a maximum undistorted output of 1,250 milliwatts, and is therefore unsuitable for public-address work or anything of that nature, for which details of excellent amplifiers have previously been given in these pages.

It is worth mentioning in conclusion that, in any of the amplifiers described, the input choke and .01-mfd. coupling condenser may simply be omitted if microphone and pick-up only are to be used, since these components are included purely for the purpose of " radio " and do not affect the pick-up connections in the slightest measure.



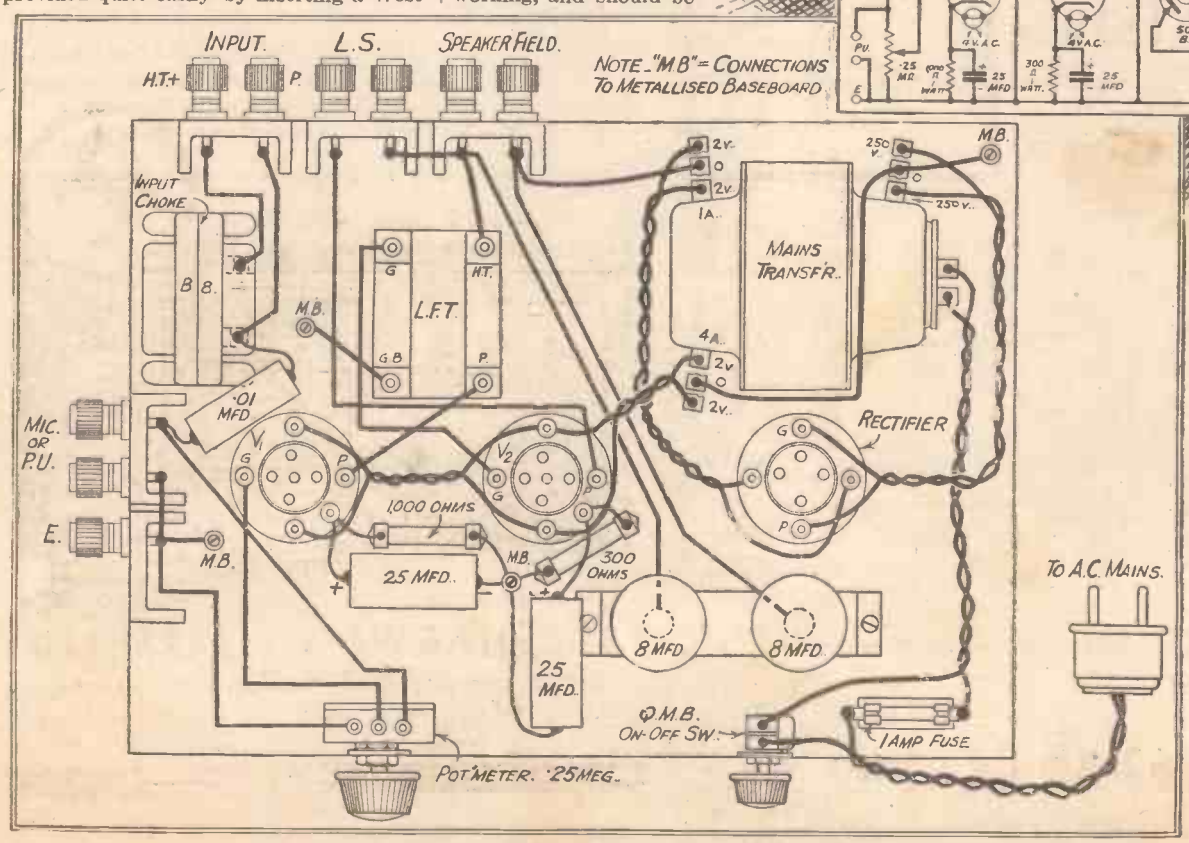


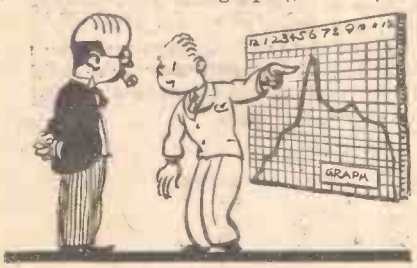
Fig. 2.—Circuit and layout for a simple and effective 2-valve A.C. amplifier.

On Your Wavelength

By Thermion

Public Taste

THERE has been much criticism—admittedly most of it destructive—regarding the material which is broadcast by the B.B.C. We read that variety does not really appeal to the majority of listeners, or that the Bach programmes really interest the greater portion of the music-loving British public. Every daily paper has its radio critic who advises its readers concerning their likes and dislikes, and it would appear that the B.B.C. takes notice of these epistolary effusions when planning their programmes. However, we may all take courage now, as definite data regarding just what you and I like and dislike is now forthcoming in the form of a graph recording of the times or listening of users on a relay system. As no doubt the majority of my readers are aware, there are, in certain parts of the country, distributing stations from which the B.B.C. programmes (and in certain cases one or two foreign programmes) are



Public taste revealed.

relayed over ordinary wires to renters of loud-speakers and amplifiers, and for the payment of a small fee they are able to turn on the programmes just when they wish. The Brighton and Hove relay station decided to fit a recording machine to indicate the load which was applied to their output stage in order to make the necessary compensations and maintain a constant output, and a standard system was installed which gives some valuable information concerning the residents of this salubrious resort. On a Saturday it was found that the peak was reached at the first News Bulletin, from 6 to 6.20 p.m. Whilst disposing of their lunch between 2 and 2.30, 75 per cent. of the users of this relay system were also listening to the programme, but immediately their gastronomic exertions were over they apparently switched off, for the load dropped to 30 per cent. This coincided with the broadcast of a football commentary and no doubt this, combined with the preceding exertions, led to somnolent reclination. Incidentally, the broadcasting of the football results after the News Bulletin also is indicated on the graph by a drop in the curve, which is restored at 7 p.m. coincident with the Saturday Magazine. It appears that from this moment until 10 p.m. the load is heaviest, but—shades of Eurus—by 11 p.m. less than 50 per cent. were listening, and only 25 per cent. were awake at midnight. Where are all these dance fans I hear so much about? Surely there are more than 50 per cent. of the listening public who class themselves under this heading, or does it indicate that the abusive missives which I receive come from a noisy minority?

However, all this goes to show that the B.B.C can really have some definite data to work upon in their endeavours to ascertain just what the public does want.

Into the Unknown

THE B.B.C. are going to attempt to enter the unknown on March 10th next, and I hesitate to switch on my receiver on that date. You have probably read that they are going to attempt to make a relay from a haunted house. Why should they tamper with psychic matters in this way? Do they realise the damage that might arise by bringing this modern miracle into the reach of the inhabitants of the nether regions? Who knows just what use an earthbound spirit might make of the handy microphone and the etheric link between it and the homes of the great big British public. At least all this is what my Aunt Agatha says, and she has forbidden me to switch on in case some spectral horror should suddenly materialise from the loud-speaker during the broadcast, and she assures me (and she has read a number of books on the subject) that an earthbound spirit may quite easily adopt this method of changing its abode. But (and a very big but too), if I hear a steady, monotonous, "thump, thump" accompanied by a faint clanking of chains, how shall I know that it is a ghost, and not the ever-faithful Effects Department "doing their stuff"?

Aerial Forests

I HAVE complained before of the eyesore which many listeners seem to erect in their garden as part of their standard radio equipment. One has only to look out of the window of the 8.30 to town to see the most amazing display of untidiness that it is conceivable to arrange in an endeavour to pick up the broadcast material. Poles which have seen better days, odd lengths of timber nailed together, lengths of various thicknesses of rope tied to trees, and odd lengths of gas and water pipe are employed with no attention to such details as insulation and direction. These odd supports lean at all angles, and the wire running to the houses droops and sags so that, if viewed from one end, it almost appears as though one is viewing Brixham Harbour. But all this is to be amended in one suburban locality, where the builder has drawn up an agreement to be signed by the tenants in which they undertake only to erect poles acquired from him, to maintain them in a vertical and safe manner, and to remove them should they prove an eyesore or objection to a neighbour. Even so, I dislike the marring of an otherwise decent landscape by wireless poles and wires, and much prefer the vertical arrangement which is almost invisible against the actual building and is, in most cases, just as efficient. In fact, with many receivers, the vertical lead will be found more efficient, and certainly overcomes many difficulties which arise purely due to directional effects of the ordinary inverted "L" aerial.

Period Furniture

HAVE you ever considered the difficulty of cabinet design in connection with radio? The wireless set is an ultra-modern invention, and naturally demands an ultra-modern cabinet (although many of the cabinets now made are actually futuristic). However, it would really be incongruous to fit a modern 9-valve superhet in a Sheraton style cabinet, and although in the early days there were some Sheraton and Queen Anne style cabinets available, they soon died a natural death. Now what does the old person do, who is sufficiently interested to want a good modern receiver but who lives in one of these delightful old-world cottages, where every part breathes the atmosphere of the Victorian era? I was forcibly brought home to this point when I called upon some old friends in the depths of Devonshire recently. In a room which was crowded with knick-knacks, a whatnot and an aspidistra, stood a massive radio-gram in walnut and maple. My sense of beauty was offended, and when I commented on the oddity I was told that they had written to practically every firm exhibiting at the last Radio Exhibition, but could not get a cabinet to suit the room without having it specially made—at an exorbitant cost. Shame!

Why Fret?

I THINK it has already been mooted that the front of a radio cabinet should not be adorned (or should it be spoiled?) by a gracefully-cut-out opening. No doubt many of my readers remember the earlier cabinets in which rising suns, ships at sea, and lyres and harps formed the main feature of the loud-speaker opening. Many manufacturers have, however, now reduced this opening to a mere rectangle, behind which is fitted a neat piece of silk or similar material in a single shade, designed to tone with the cabinet and any other furnishings

A spook from the speaker.

which may be included in the room with the cabinet. But, as I have said before, why have this opening? The old type pianoforte utilised a gracefully-fretted front with a piece of nice crimson silk behind it, and did you ever, as a child, wipe your finger round

(Continued overleaf)

ON YOUR WAVELENGTH

(*Continued from previous page*)

one of the fretted edges and then write your name on the piano top with the dust which adhered to your finger? If you are making a new cabinet, try adopting the scheme now used in a piano, that is, keep the cabinet slightly away from the wall, and make the front in two parts, with a fair space separating the lower section from the upper. By using a nicely-figured walnut panel (preferably quartered) for the lower section, and sloping this back, a really neat cabinet may be made up, and the sound would issue from the back and down the sloping front. I have not tried this out, but it seems that it should be productive of a smaller cabinet and better tonal quality, with, perhaps, a masking of the usual directional effects.

Can Battery Radio Equal Mains?

THERE is a quite widespread belief that a battery job can never equal the performance of a mains receiver unless, of course (as your pseudo "expert" will assure you) it has a roomful of batteries to run it. Well, the Cossor radio people have produced a new Class "B" battery superhet which they claim proves this idea to be a snare and delusion. The set has five valves in seven stages, a combination which it is said compares very favourably with a four-valve mains receiver. A special anti-fading superhet circuit is used with Class "B" amplification in the output stage. This system which, by the way, was pioneered by A. C. Cossor, Ltd., is remarkable for its development of high undistorted output with the smallest possible battery-current consumption. Almost every refinement that one can find on a mains receiver has been worked into the specification of this model. It has a moving-coil speaker and a velvet-smooth tuning control with dial calibrated in wavelengths and with a detachable station nameplate. The cabinet is artistic, though the lines are somewhat severe. This, however, cannot be said of the price, for this remarkable receiver costs only £9 19s. It is known as model 376B.

The Mysterious I.F.

WITH the various "initial letter references" now incorporated in wireless circuits there is a great deal of confusion regarding the actual functions of the circuits. I am glad that a lot of these refer-

Like Brixham Harbour.

ences are being dropped, for what can the poor amateur do who is told that a set is of the H.F., F.C., I.F., D.D.T., P. type with A.V.C. and Q.P.P. designed by Bill Bloggs, M.I.W.T., F.I.R.E., etc.? I think he might well be pardoned for believing that the set had been included in the New Year's Honours List. The present tendency of superhets has led to a very frequent use of the term I.F., which, of course, merely means "intermediate frequency." This is the stage between the frequency-changing circuits and the second detector. Intermediate-frequency amplification is carried out in exactly the same manner as normal high-frequency amplification, and one, or more, variable-mu pentodes is used. After amplification in this manner the signals at the new frequency are applied to another I.F. transformer and then to the second detector, which separates the low, or audio-frequency, impulses from the high-frequency ones which are used as "carriers" between the transmitting and receiving aerials. After that, the audio frequencies are magnified and passed on to the loud-speaker, where they are changed into sounds corresponding with those impinging on the microphone at the transmitting station.

Improving Selectivity

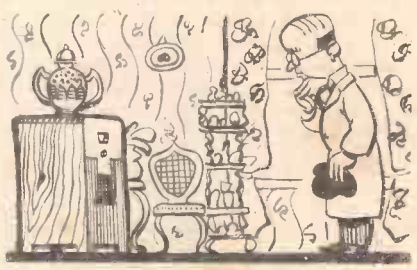
THE selectivity of the average two tuned-stage straight receiver is not adequate for present-day requirements. In cases where long aerials are used to pick up distant stations, an improvement in selectivity can often be effected without materially affecting the range of the set by connecting a preset condenser of approximately .0003 mfd. maximum capacity in the aerial lead. When selectivity is inadequate with short aerials in use, however, this simple method is not sufficiently effective. In such cases an extra tuned stage should be added. This may be connected between the H.F. and detector valves, or between the aerial and the existing aerial-tuned circuit. In most cases it is easier to connect it in the latter manner. This extra circuit should consist of a .0005 mfd. condenser and a coil having the same inductance values as the existing aerial coil.

Band-pass Coupling

THERE are several methods of coupling this extra circuit to the existing tuned circuit, the easiest being the connection of a low-capacity condenser (approximately 20 mmfd.) between the fixed vanes of the new tuning condenser and those of the first tuning condenser in the set. Some coils have coupling windings incorporated for this purpose, however, and where this is the case it is only necessary to join the two coupling windings, omitting the above-mentioned condenser. Another method is what is known as bottom-capacity coupling. With this method the earth end of each of the grid windings of the two coils is disconnected from the moving vanes of the tuning condenser. These two ends are then joined together and connected to the condenser moving vanes (or earth terminal) *via* a fixed condenser of approximately .03 mfd. A resistance of approximately 100,000 ohms should be joined across this condenser in order to provide a leakage path for the grid of the H.F. valve. By varying the size of the condenser the degree of selectivity may be varied. To obtain the best effect a combination of the coupling coil and coupling condenser methods should be employed, but this is seldom done in practice.

Tuning Dials

A READER complained to us the other day that stations did not tune in at the correct setting on his tuning dial. Investigation revealed however that he was not using the specified dial. Tuning scales marked in wavelengths must be used in conjunction with the gang condenser for which they were designed, and the coils which are tuned by the sections of the condenser must also have a predetermined inductance if the correct wavelength reading is to be obtained at all points on the scale. Fortunately, however, most commercial coils of reliable make have the same medium- and long-wave winding inductance; this has been standardised by the Radio Component Manufacturers' Association.



Lost among antiquities.

B.B.C. and Schools Questionnaire

STATISTICAL experts at the B.B.C. are in for a busy time. At the beginning of November the Central Council for School Broadcasting sent over 2,500 listening schools a questionnaire covering every subject dealt by broadcasts to schools. And now the replies, nearly 1,900 of them, have come in for examination and analysis.

This is the third attempt made by the Central Council, which arranges the B.B.C.'s schools programmes, to ascertain from the schools themselves what they like and what they do not like. The schools, in fact, occupy the unique position of being the only section of wireless listeners able by means of such thorough questioning to influence the choice of its programmes.

The B.B.C. and the School Broadcasting Council throw themselves entirely open to criticism; in fact, demand it. Teachers have been asked to answer such general questions as: "Is there any way in which you think broadcasting might be of greater service to schools than it is at present?" "Do you encourage your pupils to discuss the merits and demerits of the different broadcasts?" "Have you any evidence that school listening is training (a) older pupils, (b) ex-pupils to listen with discrimination to the evening programmes?" In addition to such questions of a general nature, each of the twenty individual broadcast courses is the subject of a separate questionnaire. Do straight History talks of twenty minutes have a good effect on concentration? Is the Travel Talks map-work excessive, dull, even necessary at all? Which English broadcasts have been successful; which have failed? These, and dozens of other questions, have been asked to ascertain what the children enjoy and what they think "stodgy," what the teacher likes and what he considers to be useless.

Broadcasts for Malta

BRITISH residents in Malta owe a debt of gratitude to the Naval authorities who, for their benefit, relay the B.B.C. Empire news bulletin on 230.2 metres (1,303 kc/s), and also supply for the inhabitants a Maltese translation.

Japan's High-power Stations

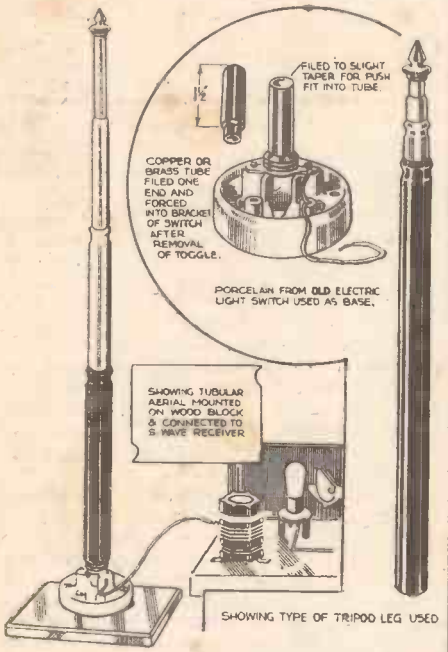
IT is reported that work on the two 150-kilowatt medium transmitters installed in the neighbourhood of Tokio is progressing rapidly and that the stations may take the air before the autumn of 1936.

A PAGE OF PRACTICAL HINTS

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

An Improvised Tubular Aerial

HERE is a quickly constructed tubular aerial for use with a short-wave set, which can be made up in a few minutes. The aerial itself consists of a tubular telescopic leg unscrewed from a camera tripod, and mounted in the simple holder



A telescopic short-wave aerial made from a camera tripod-leg.

shown, so that it stands in a vertical position. The holder consists of a discarded porcelain base from a lighting switch, a short length of copper or brass tube being fixed to the bracket piece so that the tubular leg can be pushed on and removed at will. A stout piece of copper wire is also taken from the bracket to one of the switch terminals (the switch mechanism is of course removed) for connection purposes. I have found this improvised aerial remarkably efficient, and it is, of course, quite portable. Experiments can be tried by adjusting the tube to different heights.—R. L. G. (St. Albans).

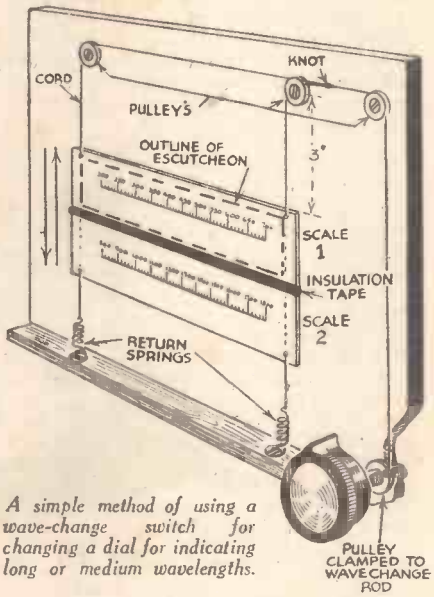
An Automatic Dial-changer

A METHOD of changing the dial of a set when the wave-change switch is tuned from long to medium waves is shown in the accompanying sketch. A grooved wheel is mounted firmly on the wave-change rod, and another wheel fixed directly above it on the panel. A similar wheel is then fixed level with it about 3in. above the top of the dial on both sides of it, as shown in the sketch. The two dials have their long edges joined together with adhesive tape, the corners of the top dial being attached to two cords which

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.

pass over the pulleys. The cords are joined to the cord which is attached to the pulley on the wave-change rod, so that when the rod is turned one dial rises up and the other takes its place. The pulley on the rod must be of such a size so that when it is turned through 180 degrees the dials exactly replace each other. Two return springs

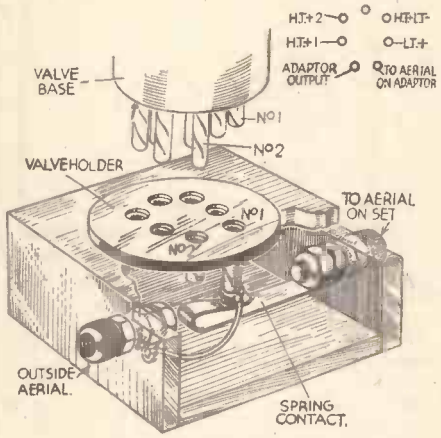


A simple method of using a wave-change switch for changing a dial for indicating long or medium wavelengths.

are fitted so that the dials return to their place when the rod is turned back.—E. PARDY (Blackwood, Mon.).

A Useful Adapter Plug

THE following dodge enables an instantaneous change-over to be made to or from the short waves when using a converter with a broadcast set. The required components are an old seven-pin

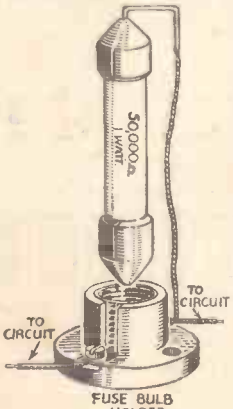


A handy adapter plug.

valve base and chassis-mounting valveholder, a couple of terminals, and a spring contact cut from an old 'phone diaphragm. Take the filament sockets of the valveholder and corresponding pins of the base (Nos. 1 and 2 in sketch) and cut ¼in. off both socket and pin No. 1, and ¼in. off No. 2 socket only, leaving the pin. The parts are then mounted on a small box and connected as shown. The spring contact should have a V-section at the end remote from terminal so as to prevent it slipping off the valve pin. The valve-base is wired as shown, while corresponding sockets on the holder are permanently connected to the batteries in the set. When the valve-base is plugged in the converter receives H.T. and L.T. current, and all necessary aerial alterations are made by the switching device.—WALTER WILSON (Inverness).

A Simple Resistor Holder

DUBILIER resistances are, of course, normally suspended in the wiring of a receiver, but sometimes this method is not convenient. For convenience of interchanging these resistances, I find that the ordinary fuse-bulb holder which can be obtained for twopence makes quite a good resistance-holder. Very little pressure is needed to screw the resistance into the holder, and quite good contact results. The wire must be clipped off from one end of the resistance.—A. E. WHILES (Wolverhampton).



A fuse-bulb holder makes a handy holder for soft-ended resistors.

"FOR THE EXPERIMENTER"

SERVICING SETS FOR PROFIT

9.—Setting and Calibrating the "Beat-Frequency" Oscillator

I ASSUME that, by now, my readers have completed the constructional work entailed in building the low-frequency oscillator and, having checked over all the connections, are ready to commence the calibration.

The first thing to make sure of is that both the radio-frequency oscillators are working. As will be seen from the values of the components chosen, the approximate wavelength of the fixed oscillator should be somewhere near 1,000 metres. Should any reader have incorporated centre-tapped coils other than those specified, he can, provided the inductance of the coils is known, calculate the wavelength of his fixed oscillator by employing the formula—Wavelength in metres = $1885\sqrt{LC}$, where L is the inductance in circuit expressed in microhenries, and C is the capacity in circuit expressed in microfarads. In the case of the Gambrell coils, which have an inductance of 200 microhenries, the formula will read — Wavelength = $1885\sqrt{200 \times .0015}$ or 1,030 metres.

Tuning the Fixed Oscillator

Most broadcast receivers will tune to 1,000 metres, but it will be necessary to make the receiver oscillate if we are to hear anything from our local oscillator. Presuming a suitable receiver is available, tune it roughly to 1,000 metres, which will be approximately the lowest wavelength receivable with a normal receiver switched to "long waves," increase reaction until the receiver oscillates, and then disconnect the aerial lead, replacing it by a short length of wire. Now insert an appropriate valve into the valveholder in the left-hand compartment of the beat-frequency oscillator, switch on and, with the cover removed from the screening box and the short length of wire from the aerial socket of the receiver lying across the top of the oscillator, tune the broadcast receiver until quite a loud "carrier-wave" is heard (Fig. 1). If this can be heard we can quite easily prove that our fixed oscillator is working by switching it off and noting the disappearance of the heterodyne note in the loud-speaker of our receiver. Should it be impossible to tune in the fixed oscillator on the receiver, do not jump to the conclusion that the fixed oscillator is not working, but carefully check over all the connections and connect the 10 milliamp. range of the multi-range meter in the H.T. positive lead to the oscillator. Switch on again and a reading of 2 or 3 milliamps. should be obtained which, if the valve is oscillating, will rise to 4 or 5 milliamps. when the grid connection is touched with a wet finger. This test is infallible for checking oscillation because there will be no change of anode current unless oscillation is taking place. No difficulty has been experienced in obtaining oscillation with this type of Hartley circuit, and failure of the valve to commence oscillating immediately it is switched on has always been traced to a faulty component or a wrong connection.

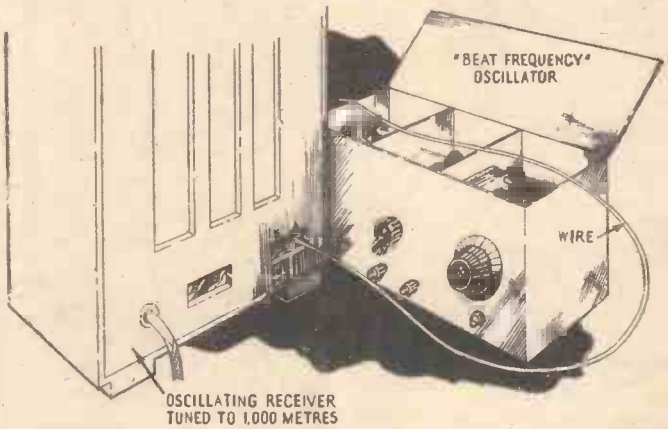


Fig. 1.—Connect a length of wire to the aerial terminal of an oscillating receiver, and lay it across the open top of the oscillator.

Checking the Variable Frequency Oscillator

The next step is to check our variable frequency oscillator in a similar way, and to do this the valve should be removed from the fixed oscillator and inserted in the valve-holder in the right-hand compartment. Set the vanes of the .0001 mfd. variable condenser to minimum and screw up the .002 mfd. pre-set condenser to maximum. We should now hear the carrier-wave from this oscillator in the receiver at a slightly higher setting than the first oscillator gave, but if unable to locate it, satisfy yourself that the valve is oscillating by the "wetted finger" method previously described.

Having satisfactorily proved that both our radio-frequency oscillators are working, we can put all three valves into their sockets and try to mix their outputs to produce the L.F. component we require. Set the 7 mmfd. trimmer condensers to minimum capacity, connect a pair of headphones to the output terminals, turn the volume control to maximum, switch on and *slowly* unscrew the .002 mfd. pre-set condenser. Now, if all is in order, we should hear quite a strong whistle in the 'phones, commencing with an extremely high-pitched tone and coming down the scale till a silent point is reached. What we want to do is to set the pre-set condenser at the silent point and then replace the lid on our screening-box. When this has been achieved we shall find that rotating the dial of the .0001 mfd. variable condenser (which has been in its minimum position until now) causes the note to re-appear and rise gradually in pitch over the whole scale.

The components incorporated in the beat-frequency oscillator have been so selected that the rotation of the variable

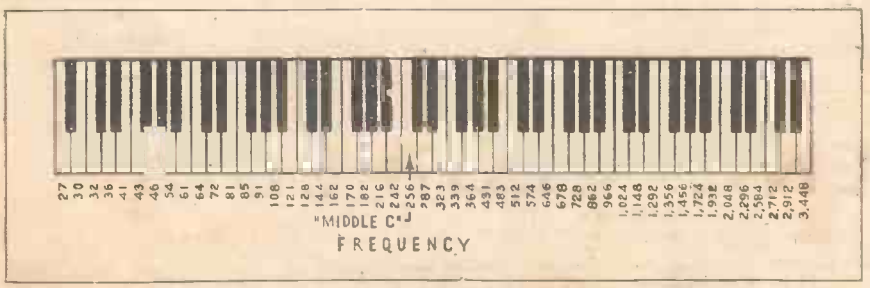


Fig. 2.—The piano keyboard showing corresponding frequencies.

condenser produces an audible note which rises from 0 to approximately 12,000 cycles per second, and, if we find during our checking operations that the wavelength of our fixed oscillator is not reasonably close to 1,000 metres we may expect to find that the range of audible frequencies is restricted owing to our parallel condenser being low in capacity value. That is the reason why I suggest checking the wavelength of the oscillators rather than rely entirely on the "wetted-finger" method of checking for oscillation.

Setting the Trimmers

The next step is to set the 7 mmfd. trimmer condensers for maximum audio-frequency output. In this connection, it has been ascertained that the maximum output will be delivered when the radio-frequency output from the oscillators is mixed at the detector grid in the ratio of 10 to 1. In order to achieve this result the valve-voltmeter should be connected across the output terminals of the beat-frequency oscillator in parallel with our headphones and, with the .0001 mfd. variable condenser set so that an audible note is produced, the trimmer condensers should be adjusted until the valve-voltmeter gives the highest reading. A word of warning is necessary here, however,

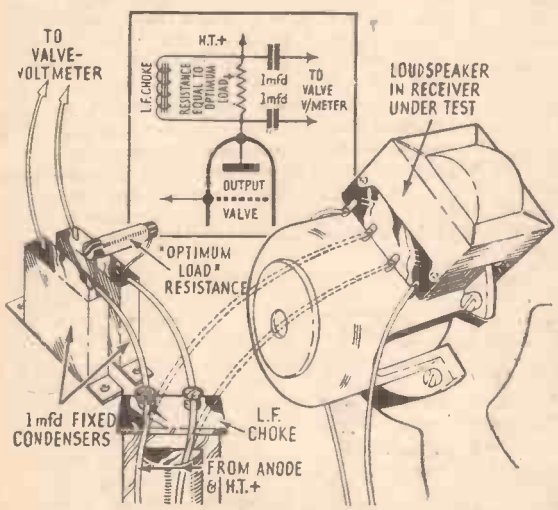


Fig. 3.—Disconnect the speaker from the set and substitute a resistance equal to the optimum load of the output valve in parallel with an L.F. choke.

and is briefly this. Although it may be possible to boost up the audio-frequency note by setting the trimmers to maximum capacity, we shall find that our lower frequencies will have vanished owing to the oscillators having affected each other and pulled into step. The procedure recommended is as follows: Leave the trimmer condenser in the right-hand compartment set at minimum and rotate the trimmer in the left-hand compartment until maximum output, as indicated on the valve-voltmeter, is obtained. Then turn the .0001 mfd. condenser to minimum, set the .002 mfd. pre-set condenser to silent point and ascertain, by swinging the variable condenser, that the lower audio frequencies are still audible. Then increase the capacity of the right-hand trimmer a little and repeat the routine. Continue increasing the capacity until the output is greatest, and the low frequencies are still present. Careful adjustment of my own instrument has enabled me to get nearly 3 volts of audio-frequency output while still producing notes as low as 20 cycles per second.

Calibrating the Dial

Having made the best possible adjustment to our instrument, we can proceed to calibrate the dial of the variable condenser in frequencies. Very few people have access to a calibrated L.F. oscillator or series of tuning forks, but all my readers will undoubtedly be able to find a piano which has recently been tuned, against which to compare their oscillator. Fig. 2 shows which notes on the piano correspond to various frequencies, and if the output from the beat-frequency oscillator is connected to the pick-up terminals of a receiver, an appropriate note struck on the piano and the variable condenser rotated until a similar note is heard in the loud-speaker, the dial setting can be noted down to correspond with the frequency selected. By repeating this process with various notes on the piano, a graph may be drawn showing frequencies against dial settings. As will be seen, the notes on the piano do not reach such high frequencies as our oscillator will produce, but by listening carefully it is possible to tell when the oscillator is producing a note an octave above the note struck on the piano, and if it is remembered that this will correspond to a frequency twice that of the note struck, a calibration of the whole scale will be possible. Readers who are not musical may think it advisable to enlist the services of a musician (a violinist for preference) to assist them in plotting these higher frequencies.

While rotating the variable condenser two things may be noticed:—(1) The appearance at several points on the scale of subsidiary "chirps" and (2) the valve-voltmeter will give different readings for different frequencies. In the case of (1) the "chirps" are caused by harmonics beating with the fundamental to produce further audible frequencies, but as they are relatively weak they may be disregarded rather than that elaborate filter circuits to eliminate them shall be included. Case (2) explains the necessity for an output volume control because when it is desired to take the response curve of the L.F. portion of a receiver or amplifier, it is necessary to make the voltage input equal at all frequencies in order that variations in the output at the speaker terminals may be measured.

The L.F. Response Curve

To take the L.F. response curve of a receiver or amplifier, connect the output of the beat-frequency oscillator at the input or pick-up terminals of the receiver under test and connect the valve-voltmeter across these terminals as well; now rotate the variable condenser and select the lowest voltage obtained as a basis for comparison. Quite a low voltage, say .5 volt will be found suitable if the amplifier has a high gain. Now disconnect the speaker from the set and substitute an output choke with a resistance equal to the optimum load of the output valve, as shown in the manufacturer's valve data charts, in parallel (see Fig. 3.). Set the beat-frequency oscillator at 50 cycles, adjust its output with the valve-voltmeter to the pre-determined level and then transfer the valve-voltmeter to the output end of the amplifier by connecting it across the load

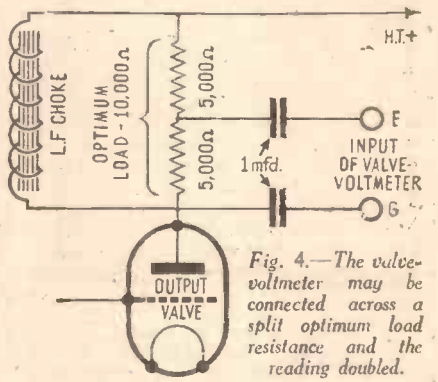


Fig. 4.—The valve-voltmeter may be connected across a split optimum load resistance and the reading doubled.

resistance which we have just inserted. Measure the output volts at this frequency and repeat the procedure at a number of points in the range of audible frequencies. Then plot a graph showing the variation of these voltages with different frequencies and the response curve of the amplifier will be available. We can, of course, if we want to be more technical, reduce these voltage ratios to decibels and plot the result on logarithmic graph paper. This has the effect of telling us more exactly what our amplifier will sound like to the ear, because quite large differences in output voltage may be inaudible to the ear which is itself logarithmic in its response to sound intensity variations.

Proof

However, if we suspect that our amplifier has a pronounced resonance at 5,000 cycles, the figures obtained will soon prove our suspicions, and we can safely assume that, if our amplifier shows a reasonably flat response, then our loud-speaker is providing the resonance.

When testing amplifiers with a high gain, our output voltages may lie outside the range of our valve-voltmeter even with the smallest input we can measure. This, however, is not important, because we can quite easily split our load resistance into two halves, and double the voltage readings obtained on our valve-voltmeter across one-half of the resistance. Fig. 4 will show how to do this.

Apart from the uses of the instrument as a speaker-rattle locator, etc., it provides a source of low-frequency voltage for modulation purposes, and in the next article a radio-frequency oscillator will be described which can be made into a modulated signal-generator by attaching it to the beat-frequency oscillator.

VOLUME CONTROL *for the* "QUALITY" SET

Some Points which are Often Overlooked, and Some Suggestions which You will Find Interesting to Try.

THERE are so many methods by which the volume can be varied that the beginner is often left in doubt as to which is most suitable for his own requirements. It is a general belief that the variable-mu valve provides a perfect control, but there are many designers who do not subscribe to this view, particularly when a "quality" set is being considered. They maintain that, despite the excellence of the present-day variable-mu valve, it is inclined to introduce a certain amount of distortion in certain conditions, particularly if the receiver is not planned with extreme care.

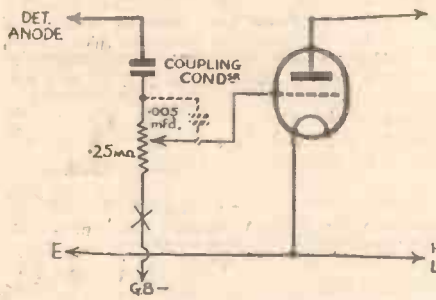


Fig. 1.—This skeleton circuit illustrates a few points raised in relation to an L.F. volume control.

Aerial-input Control

These designers prefer to vary the input to the first valve, rather than to use the valve for altering the output from it. The input can be varied in two or three ways, the simplest of which is by including a variable condenser in series with the aerial lead. This idea is quite sound, but has the disadvantage that alteration of the condenser capacity varies to a slight extent the tuning of the input circuits. Fortunately, however, this objection can be overcome by using a differential condenser, wired as shown in Fig. 2. It may be seen that the moving vanes of the condenser are connected to the aerial terminal on the first coil, while one set of fixed vanes is connected through a .0003-mfd. condenser to earth and the other to the aerial lead-in. The reason for this method of using the differential condenser is that the capacity in parallel with the coil must be kept as nearly uniform as possible over the complete range of the condenser. It is known that the aerial-to-earth capacity of the average aerial system is about .0003 mfd., and this is in parallel with the circuit between points A and B. Thus, when the differential condenser is set to the maximum position (moving vanes fully in mesh with those connected to the aerial) the effective parallel capacity is that of the aerial system in series with that of the differential condenser. When the differential condenser is set to the minimum position an equivalent capacity is provided by the other half of the differential condenser in series with the .0003-mfd. fixed condenser. It may be seen, therefore, that the extra capacity in parallel with the coil remains sensibly constant over the range of the input volume control. This method is not new, but it is apparently not as widely known as it should be.

For Single-circuit Tuning

When using this arrangement the first valve may be either an ordinary H.F. pentode, or it may be one with variable-mu characteristics. In the latter case, a fixed bias voltage of about 1½ should be applied to it. A band-pass circuit is shown, for this is most suitable for use in a "quality" set, but the connections shown can be used with a fair measure of success with a single-circuit tuner, although it is then desirable to replace the fixed condenser with a pre-set of .0005 mfd. maximum capacity so that the correct setting can be found by trial.

It is unlikely that any hand-capacity effects will be experienced when using the method illustrated with most sets with an H.F. stage, but should there be any difficulty in this respect the condenser can be used in conjunction with a short extension spindle.

L.F. Volume control Refinements

When using a pre-detector volume control of any kind it is also necessary to employ another between the detector and L.F. amplifier if a pick-up is used in the detector-grid circuit, and this might take one of a number of different forms. The control is useful on radio also, for it can be set to such a position that the input to the L.F. amplifier is well below that which would cause overloading. This means that the L.F. amplifier can be operated at well below "saturation" point, in consequence of which valve noises can be reduced to a minimum and quality maintained at the highest level.

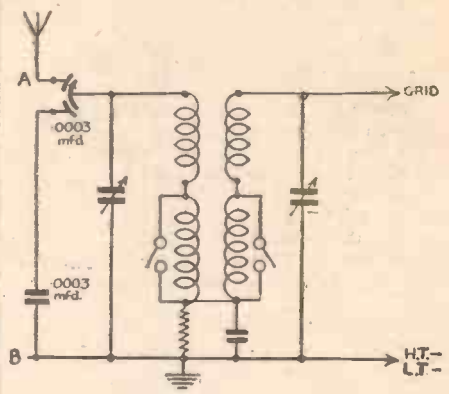


Fig. 2.—Pre-H.F. volume control of an unusual, though effective, type, by means of a differential input condenser.

The most usual L.F. volume control consists of a potentiometer included in the grid circuit of the first L.F. valve, as shown in Fig. 1. This can be used with any form of intervalve coupling, and is successful up to a point. It does fail, however, when the slider is set towards the minimum volume position, however, due to the fact that there is a high resistance between the grid and the coupling condenser or transformer secondary. Because of this it is not unusual to find that reproduction becomes "thin" at low-volume settings of the potentiometer. The best remedy is to connect a fixed condenser, as shown in broken lines, between the slider and the upper end of the potentiometer element. A capacity of about .005 mfd. is suitable, and this acts as a by-pass to the resistance.

Short-circuiting the Valve

There is another objection to this form of volume control, which is that the grid-cathode circuit of the valve is virtually short-circuited when the control is set to its minimum position. This is obviously a bad fault, but it cannot be overcome at very low volume levels unless provision is made for reducing the input to the detector valve, and this is where the H.F. volume control scores.

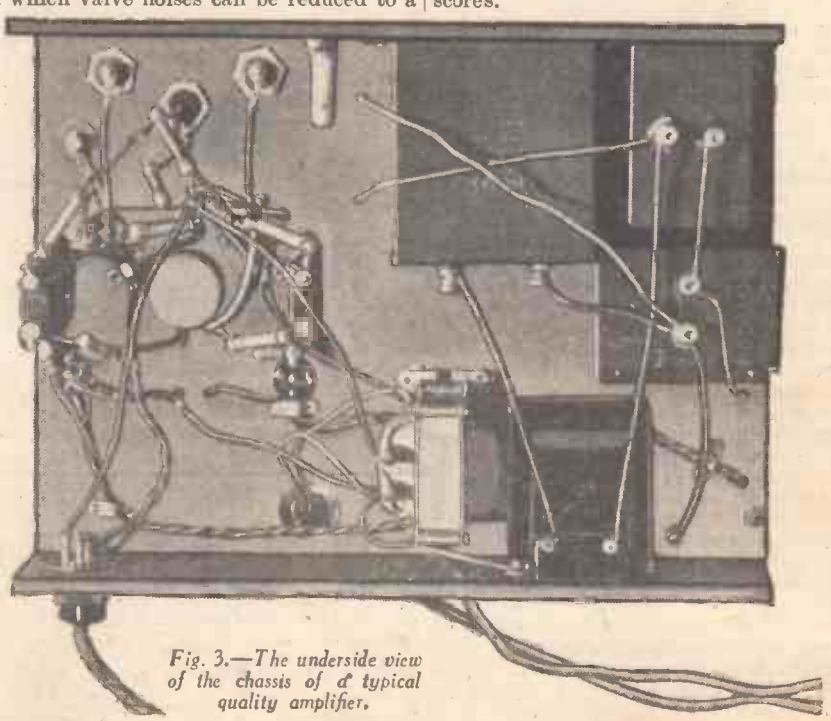


Fig. 3.—The underside view of the chassis of a typical quality amplifier.

Random Jottings

By JACE

An Amateur's Achievement

MR. JIM GAPPER, a sixteen-year-old crippled Axminster wireless enthusiast, received a letter conveying the thanks of His Majesty the King for transmitting to St. James's Palace a message he received on his short-wave wireless set. While scouring the ether Mr. Gapper heard Mr. Warehime, of Carlsbad, New Mexico, speaking. "I hear your 'Big Chief' is dead. Will anyone who hears my message in England forward my sincere sympathies to King Edward?" he said.

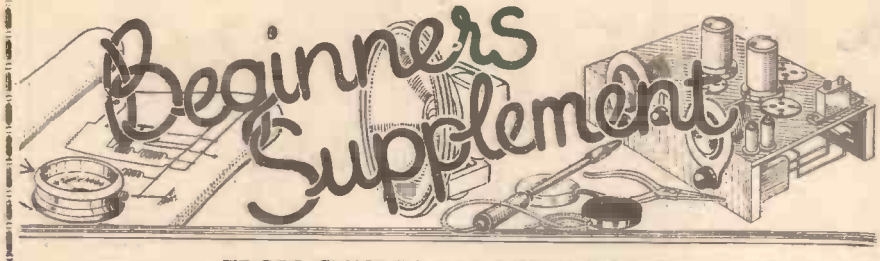
Mr. Gapper despatched the message to the King by post, and received a cordial acknowledgment stating that a reply had also been sent to Mr. Warehime. In twelve months' experimental wireless Mr. Gapper has picked up messages from the five continents and from ninety-two countries. He made his three-valve set himself, and it contains one detector, two L.F. valves, and a resistance coupled Z. L. 2SA. He uses an indoor aerial 10ft. long.

Forthcoming Drama Productions

MANY programmes of interest to lovers of radio drama will be broadcast during the next few months. Sunday Shakespeare productions include "Richard II" and "The Tempest," while Christopher Marlowe's "Edward II" will also be heard again. Listeners will also hear a broadcast version of Noel Coward's famous Drury Lane success, "Cavalcade." A radio version of "Alibi" has been prepared by Michael Morton, who was responsible for the successful stage version of Agatha Christie's thrilling story. Another stage success, "Youth at the Helm," will also be heard. This play was translated from the Austrian by Hubert Griffith, and provided Owen Nares with one of his most delightful parts. The first broadcast of a play by John van Druten is a forthcoming event of importance; the play chosen is "London Wall," a charming comedy of life in a typical city office. Adaptations from films include "Episode," in which Paula Wesseley created a sensation, and the light-hearted thriller "The Thin Man."

Lord Dunsany, whom listeners will remember as the author of the radio drama, "The Use of Man," has written a new play specially for the microphone, entitled, "Mr. Faithful." An important documentary play will be Professor H. W. V. Temperley's "Kitchener," which will be heard on the anniversary of the great soldier's tragic death. Another programme based on actual historical facts will be "The Trial of Titus Oates," by C. Whitaker-Wilson. Val Gielgud's "Gallipoli" will be repeated. This was heard last year on the anniversary of the landing at Suvla Bay. E. M. Delafield, whom listeners will remember as the author of "The Mulberry Bush," has adapted Robert Louis Stevenson's "Treasure Island."

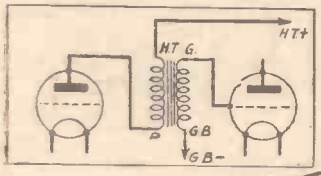
This picture shows Mr. Gapper, referred to in the first paragraph, in his wireless den, with his home-made short-wave receiver.



FROM STUDIO TO LISTENER—7.

A Description of the Low-frequency Amplifier, with Details of Various types of Coupling Unit. By IDRIS EVANS

AS explained in the last article of this series, the current in the output circuit of the detector valve is of a low-frequency nature, which closely represents the music or speech in the transmitting studio. This current may be used to operate a telephone receiver, but is too weak to work a loud-speaker effectively. In broadcast receivers one or more amplifying stages are therefore connected between the detector and the speaker in order to provide sufficient volume.



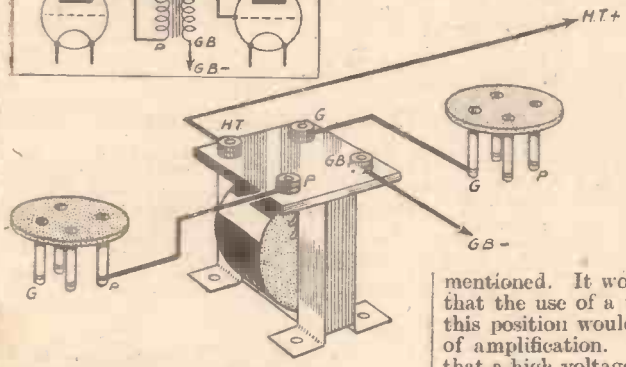


Fig. 1.—The simplest type of low-frequency coupling. This is termed a standard L.F. transformer arrangement.

The Valve as an Amplifier

If a three-electrode valve is used in conjunction with suitable components and the correct voltage is applied to its filament (from the L.T. accumulator) and to its plate (from the H.T. battery), the resultant current passing between plate and filament can be varied by varying the voltage on the valve grid. This property of the valve is made use of in the low-frequency amplifier, amplification being obtained by applying a weak signal in the output circuit of the detector across the grid of another valve which has a component in its plate circuit that impedes the passage of a fluctuating current—this may be a resistance or the primary winding of a low-frequency transformer, as will be explained later. When speech or music is being received, the voltage on the valve grid will be of a varying nature and the resultant plate current variations will pass through the impedance component mentioned above, thereby producing a varying voltage across the impedance which is of a similar nature to that applied to the grid. If the valve is used in conjunction with an impedance of suitable value and the correct steady D.C. voltages are applied to the plate and filament from the batteries, an amplifying effect may be produced—that is, the varying voltage in the output circuit will be greater in amplitude than the input voltage.

Resistance-capacity Coupling

There are three commonly used methods of coupling the low-frequency valves, the simplest of these being the resistance-capacity method shown in Fig. 3. This type of coupling provides faithful reproduction if the correct component values are used, but the degree of amplification obtained is low as compared with that of the other two types. It will be noted that a resistance (R1) is connected between the plate of the valve and the positive socket of the H.T. battery, this constituting the impedance previously mentioned. It would seem at first sight that the use of a very high resistance in this position would ensure a high degree of amplification. This is true provided that a high voltage can be maintained on the plate of the valve; increasing the value of the resistance reduces the voltage of the valve plate, however, and the resistance value which can be used to advantage in practice is governed to a great extent by this fact. In practice good results can be obtained by using a resistance three times greater than the internal resistance of the preceding valve.

The value of the grid coupling condenser (C) and the grid leak of the succeeding valve (R2) are interdependent, and the grid leak must have a much higher value than the anode resistance, as these two resistances are actually in parallel with each other as far as the speech currents are concerned; the use of a very low value grid leak would therefore lower the effective resistance of the anode resistance. A coupling condenser of .01 mfd. works satisfactorily in conjunction with a grid leak of 500,000 ohms. If the value of the leak is halved, the capacity of the condenser should be doubled.

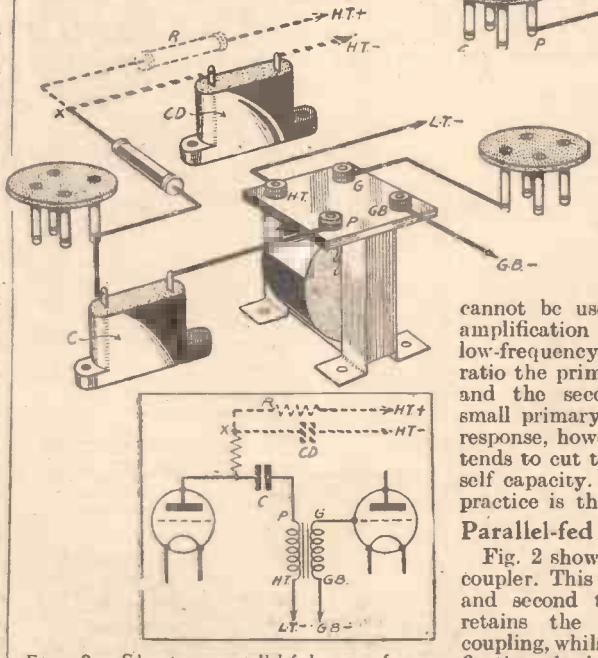


Fig. 2.—Showing parallel-fed transformer coupling.

Transformer Coupling

When a high degree of amplification is desired in the low-frequency stage a transformer should be used for coupling the two valves, as shown in Fig. 1. If a reliable transformer is employed satisfactory reproduction may be obtained with this type of coupler, but if a very cheap transformer is used, loss of bass response is to be expected owing to the low inductance of the primary winding. The beginner is apt to wonder why a transformer having a very high step-up ratio cannot be used in order that sufficient amplification may be obtained from one low-frequency stage. To obtain a high ratio the primary winding must be small and the secondary winding large; a small primary tends to reduce the bass response, however, and a large secondary tends to cut the top notes owing to large self capacity. The normal ratio used in practice is therefore approximately 3/1.

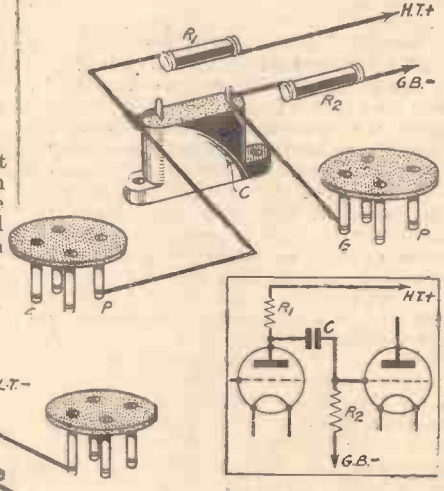


Fig. 3.—Simple resistance - capacity coupling.

Parallel-fed Transformer

Fig. 2 shows a parallel-fed transformer coupler. This is a combination of the first and second types discussed above, and retains the advantages of resistance coupling, whilst giving the increased amplification obtainable from a straight transformer coupling.

SHORT WAVE SECTION

HIGH-EFFICIENCY AERIAL SYSTEMS

The Advantages of the Inverted-V Type Aerial and Feeder Systems are Discussed in This Article

IT is generally agreed that special types of aerial give greater output, particularly on short waves. These special aerials may take the form of a vertical half-wave di-pole, a di-pole, a horizontal doublet, and so on. Some of these special aerials are suitable only for one particular wavelength to which the dimensions are proportionate. By that is meant a half-wave aerial would have a length of 25 metres for 50-metre wave, or a length of 10 metres for a 14-metre wave.

While there is generally no disadvantage in using these special types of aerial, in comparison with an ordinary broadcast aerial, it is worth noting that it is not likely that much advantage will be gained unless the lead-in is correctly terminated at the receiver.

A quarter-wave aerial, an inverted-V aerial, special di-poles, and a feeder line connecting to a distant aerial are of fairly low impedance, and must therefore be connected to a point near the bottom of the aerial coil, whereas a half-wave aerial is of high impedance and should be connected to a point at the top of the aerial coil. It is advisable to find the most suitable point by trial and error before making a more permanent connection, and to remember that the optimum point may differ on various wave ranges.

For reception of short-wave stations covering a band of frequencies it is essential that the most efficient aerial would be one giving the maximum pick-up at all frequencies. Of the many different types of aerial that can be used there is at least one that is most effective. Fig. 1 shows the arrangement suggested. It consists of a single length of wire bent in the form of an inverted V, the apex being supported a distance from the ground. The general design data for this type of aerial are quite simple.

Inverted-V Aerial

For maximum efficiency the apex of the V should be as high as possible, and the length of wire used more than one wave-length longer than its projection on the ground at the fundamental frequency of the aerial. To illustrate this, in Fig. 1 the length of wire shown as C A B should be one wavelength longer than the base line C B. In order to obtain the maximum signal-to-noise ratio it is desirable also that each side of the inverted V should be an odd number of quarter-waves long.

Tables 1 and 2 show the dimensions of aerials for different types of masts, designed to have maximum response at 17, 20, and 25 metres. In general, however, it is not convenient to use higher masts, therefore data for other aerials has been omitted.

The inverted-V aerial, although designed in terms of the fundamental wavelength at which its performance is an optimum, gives a satisfactory response over a wide waveband ranging from .7 to three times the fundamental wavelength. When two alternative transmissions are normally received it will be desirable to make the aerial give maximum response on the shorter wavelength.

The measured performance of the inverted-V aerial designed for 17 metres with a mast 42ft. in height is about five times that of an ordinary aerial on the same wavelength. On 20 metres the gain is about three times. On the 25- and 30-metre bands the inverted-V gave between 1½ times and double the input of an ordinary inverted-L type.

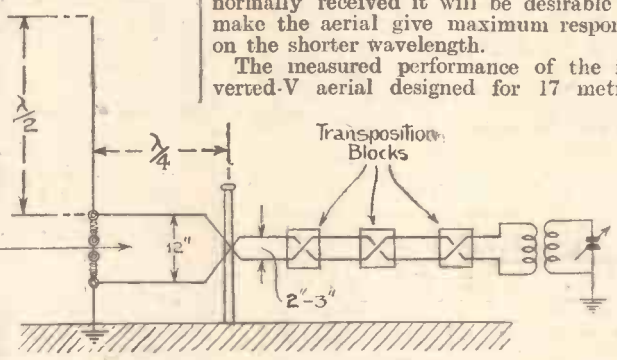


Fig. 3.—An interesting matched aerial circuit.

Important Points

However, one of the most important features with this type of aerial is that it must be terminated at the end away from the receiver by having a non-inductive resistance of about 400 ohms connected between the end point and earth. At the same time, the aerial must be connected to an appropriate point on the input circuit of the receiver. It has been found that a tapping point at a half to one and a half turns from the bottom of the aerial coil is the most satisfactory point. It is also necessary for the condenser of about .001 mfd. to be connected between the tapping point and the aerial since this condenser, having a path to earth *via* the 400-ohm resistance, would short-circuit the grid bias normally applied to the first valve. When it is impossible to connect the aerial to a tapping point as suggested the .001-mfd. condenser should be replaced by a tuning condenser having a capacity of .0005 mfd. A suitable setting for the condenser to give a compromise between sensitivity and selectivity can be found by experiment.

When properly terminated at both ends the inverted-V aerial is directional and

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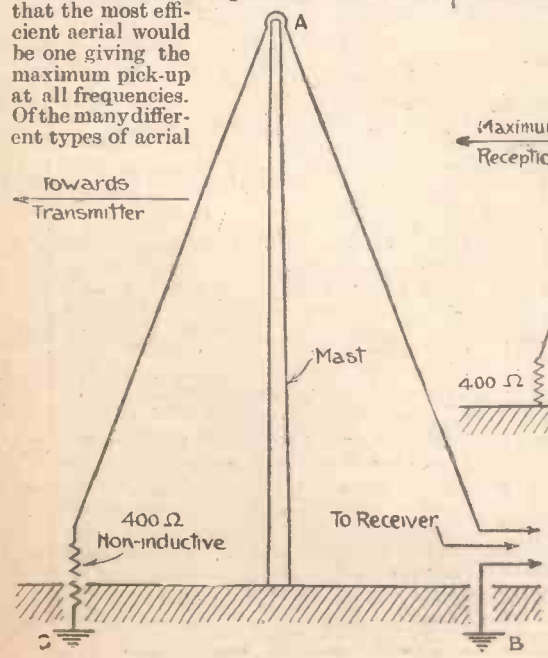


Fig. 1. (left)—Diagram to illustrate the inverted "V" aerial.

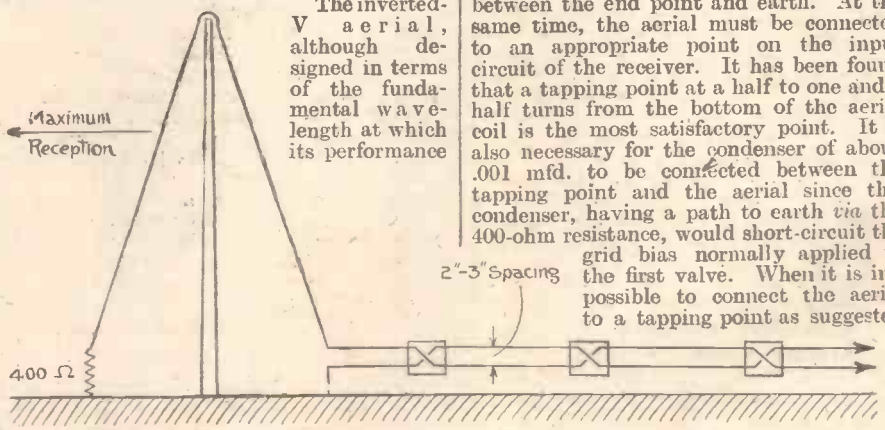


Fig. 2. (above)—The complete arrangement of an inverted "V" aerial and feeder lines.

(*Continued from previous page*)

receives best those stations which are situated in line with the plane of the aerial and whose signals arrive at the end of the aerial terminated by the 400-ohm resistance.

Reducing Interference

It is sometimes desirable to erect the aerial at a distance from the receiver. This is usually necessary when reception is upset owing to interference generated by motor-car ignition systems and local electrical apparatus. The most satisfactory way to deal with this interference is, of course, at the source which is not always possible.

The interference can be very greatly reduced by erecting the aerial as far away as possible from the origin of the interference, and coupling it to the receiver by means of a transmission line.

Transmission lines for medium-wave reception are of little use on short waves, for it must be appreciated that the line has to convey energy from the aerial to the receiver with minimum loss. For short-wave reception the most suitable system is to use two-wire feeder with either twisted or transposed wires as shown in Fig. 2. In this way any signals picked up by successive sections of the feeder automatically cancel out.

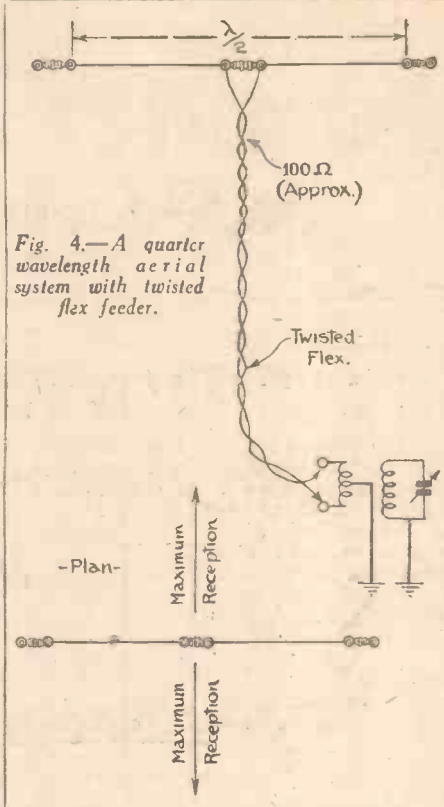


Fig. 4.—A quarter wavelength aerial system with twisted flex feeder.

In order to reduce loss through feeder length it is necessary to match the impedance of the feeder by means of an input transformer, as indicated in Fig. 3. A quarter wavelength aerial or a half-wave type centre-fed generally has an impedance of about 100 ohms, so that this type of aerial (Fig. 4) can conveniently be connected to a feeder consisting of a twisted pair or two adjacent wires. An inverted-V aerial having a characteristic impedance of 400 ohms requires a feeder of corresponding value which can consist of two wires placed two or three inches apart and transposed by means of ceramic blocks two or three times.

Half-wave aerials in which the connection is made to one end have a comparative high impedance of 2,000 ohms, and no feeder can actually be made to match this figure. If, however, a quarter wavelength of open feeder is first used, the remainder of the feeder can be of the low impedance type similar to a quarter-wavelength aerial.

It is never satisfactory to connect the feeder system directly across the grid circuit of a short-wave set. Special transformers that can be fitted between the grid coil and the feeder are quite satisfactory for impedance matching.

Alternatively, a small coupling coil of one or two turns wound on the same former as the grid coil will often be satisfactory. The correct number of turns, however, must be determined by experiments.

TABLE 1.
Where length of side=3/4 wavelength

Wavelength Metres	Height of Mast in feet	Length of base line in feet	Length of wire (CAB) in feet
17	40	20	84
20	44	33	98′ 6″
25	60	42	125′ 6″

TABLE 2.
Where length of side=5/4 wavelength

Wavelength Metres	Height of Mast in feet	Length of base line in feet	Length of wire (CAB) in feet
17	58	84	140
20	66	98′ 6″	164
25	83′ 6″	125′ 6″	200

Leaves from a Short-wave Log

THE number of short-wave broadcasting stations is increasing so rapidly that, if you want a complete record, it is a wise plan to make a list of them as they are reported, classified under countries, in addition to entering them in a log in the proper position according to wavelength and frequency used.

Three new-comers, of which I have been given preliminary details, are: HI5N, Santo Domingo (Dominican Republic) on 48.92 metres (6,132 kc/s), *La Voz de Almacen*, which works on a channel immediately below COCD, Havana; YV13RV, Valencia (Venezuela) on 47.39 metres (6,330 kc/s), *Ondas de la Tacarigue*, which should also be found immediately below HIZ, Santo Domingo, and TI5HH, San Ramon (Costa Rica), reported on 54.35 metres (5,520 kc/s), broadcasting daily between G.M.T. 20.30-21.00, and again between G.M.T. 01.00-02.00. I have not yet logged these transmissions, so cannot confirm the channel, and it is possible that the wavelength is not definitely fixed, as a correspondent tells me that he has found the station on a lower frequency, namely, 5,480 kilocycles (54.74 metres).

Madrid and Sofia

The Madrid short-wave transmitter, to which I recently referred, and which has been heard testing between G.M.T. 23.00-00.00 and asking for reports, is a new 500-watter which Philips (Eindhoven) are erecting in the immediate vicinity of the Spanish capital. The wavelength on which it will operate is 44.8 metres (6,698 kc/s). The call for the present, while the plant is in the constructors' hands, is: *Philips-Iberica*. Further, although I cannot trace the call, I am advised that the Germans are trying out a new channel almost nightly, namely, 20.82 metres (14,410 kc/s); it has been picked up whilst giving a relay of the Zeesen short-wave programme between G.M.T. 17.00-19.00. Although the call was registered DZE, it would appear to be our old friend DIP, Königs Wusterhausen, which, whilst carrying out experimental transmissions destined to Africa, does not regularly broadcast, but acts as a point-to-point station.

Another new arrival, also in the experimental stage, is LZA, Sofia (Bulgaria) on 20.04 metres (14,970 kc/s), which was recently logged giving a broadcast of records. Announcements were made by a woman. So far no further details have been obtainable, but in the official lists the station is described as working telegraphy only. The power is 7 kilowatts. The call mentioned: *Radio Télégraphie Station LZA*.

Point-to-Point Stations

As mentioned recently, the identification of transmitters is greatly complicated by the fact that for relays to foreign countries use is made of point-to-point commercial stations, *i.e.*, transmitters regularly working with an opposite number in a foreign country. Further instances which have puzzled readers are WEM and WEL, Rocky Point (New York) on respectively 40.54 metres (7,400 kc/s) and 33.52 metres (8,590 kc/s), both 40 kilowatts, which, with WEA, 28.28 metres (10,610 kc/s) have been relaying U.S.A. programmes to European capitals. WEA and WEZ, the latter on 37.15 metres (8,075 kc/s) have been carrying out the transmission of special lectures destined to the French P.T.T. Network, assisted by WOF, Lawrenceville (New Jersey), 30.77 metres (9,750 kc/s). WMA, WMN and WON, Lawrenceville, on respectively 22.4 metres (13,390 kc/s), 20.56 metres (14,590 kc/s), and 30.4 metres (9,870 kc/s), usually working public telephony service with Great Britain, have also been brought into operation for the transmission of U.S.A. programmes to this country, with the use of two further channels, 16.74 metres (17,900 kc/s), and 21.58 metres (13,900 kc/s), giving calls of WLL and WQP, Rocky Point (New York).

U.S.A. Stations

On about 5 metres, KDKA, East Pittsburgh (Pa.), has been putting out a regular schedule of transmissions consisting of re-broadcasts of the medium-wave programmes. These are carried out from G.M.T. 20.00-04.00, the call letters being W8XKA. The power is only 50 watts, but although a great distance is not expected to be covered by these tiny waves, it frequently happens that they are picked up far beyond what engineers consider their service area.

I understand that on 5.4 metres (55,500 kc/s) the Westinghouse Electric and Manufacturing Company are also trying out broadcasts nightly from Philadelphia and Boston, with respectively relays of the KYW and WBZ broadcasts. Again, on 7.3 metres (41,100 kc/s) W8XH is taking the programmes from WBEN, Buffalo (New York), and 7.31 metres (41,040 kc/s), is the sound channel of the Swedish television broadcasts.

TELENEWS

In Russia

ALTHOUGH news from Russia is rather meagre at the moment, from reports that have come to hand it would appear that from the point of view of television they have in no way been standing still. For example, it is frequently overlooked that the inventor of the Iconoscope, namely, Vladimir Zworykin, is a countryman of theirs. Then recently, when Russia commemorated the eleventh anniversary of Lenin's death, a television broadcast showing scenes from his life was made. No doubt this was through the medium of a standard talking-film machine adapted for either disc or electronic scanning. It is now learned that during this year three television stations are to be established complete with mobile and studio scanners, while the manufacture of receiving sets has commenced so that a supply will be available when the stations are finished.

A Strong Combination

IT is stated that W. R. Hearst, the millionaire newspaper proprietor of America, has very large interests in the Farnsworth Television Corporation. Coupled with this there is a close partnership between the Warner Brothers of film fame and Mr. Hearst. It is therefore being suggested quite freely that this alliance may, during the course of this year, bring about a quick development of a television service in America with Farnsworth providing the scanning equipment and receivers, Warners the entertainment, and Hearst the publicity and any associated propaganda. Perhaps it was a combination of this nature that was visualised the other day by Sir Oswald Stoll when he said that he looked forward to a single variety show in one city being reproduced by television simultaneously in many other cities widely separated from one another.

An Interesting Lecture

A FEW days ago Dr. Vladimir Zworykin arrived in this country and gave a most interesting lecture to the Wireless Section of the Institution of Electrical Engineers. His subject was electron optics, and in addition to dealing with a device which functions as an electron telescope, he described and demonstrated one of the latest forms of multiplier tubes. Both these devices are destined to play an important part in all forms of equipment which depend on a flow of electrons for their normal functioning, and if the early promises of the multiplier hold good then there is little doubt that it will replace several stages of thermionic valve amplification in radio, television, and talking picture equipment.

Entertaining M.P.s

QUESTIONS have already been raised in the House of Commons concerning the desirability of installing a television receiver within its walls so that members can see for themselves how far the art has advanced and judge the quality of the programmes radiated. Whether the request will be acceded to seems doubtful as none of the rooms used by M.P.s is even fitted with radio sets, and authority seems to frown on anything which may detract members from strict Parliamentary business.

REPLIES IN BRIEF

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

R. C. H. (Tisbury). It is not proposed to describe the receiver in question for use on A.C. mains, in view of the difficulty of arranging for the modifications of the various voltages.

A. J. R. (South Brent). We regret that we have no details in our records of this particular valve, and suggest you write to the makers who may still be able to supply details.

S. G. (Northampton). The aerial arrangement you mention should work satisfactorily, although you will probably find that better results would be obtained if the wire were left in a vertical position. Ten or fifteen feet of wire should be ample. The average battery is about 11 by 5 by 3, and weighs about 2lbs.

R. G. (E.2). No blueprint of the receiver in question is available at the moment, but it will shortly appear in our blueprint list. A list of components and the constructional article appeared in our issue dated December 7th last.

G. D. (Swansea). The synchronous motor would undoubtedly be the most suitable for your particular case, and avoids the difficulties of obtaining correct musical pitch owing to wrong turntable speeds. On the other hand, if you wish to modify the pitch in order to match an instrument, for instance, an ordinary type of motor would prove more suitable.

S. McM. (Hull). Kit A for the Monitor costs 45s., and the three valves cost £1 12s. 6d. A speaker may be obtained for 32s. 6d.

A. J. H. (Ealing). As we have no details of your Philips receiver we regret that we cannot advise you regarding the conversion. In any case, we do not think it would be wise to attempt to make the all-wave arrangement referred to.

W. R. T. (Edgbaston). A special band-spread condenser may be obtained from Messrs. Jackson Bros., and a component of this type was used in the Prefect Three.

J. G. L. (Croydon). It is possible that instability already exists in the receiver, but that the ordinary speaker fails to reproduce the high notes, and thus does not make the whistle audible. Alternatively, the trouble may be due to mis-matching, and an output matching transformer should be obtained and connected direct to the speech coil of your speaker. The impedance should be ascertained, and a transformer purchased which will provide the correct ratio.

C. H. T. (Midlothian). You cannot compare the "mikes" in the manner you have adopted. Each must be judged on its particular design. Either model will give good results, and no trouble should be experienced. We do not think the loud-speaker will prove of much use, and we would not recommend any modification to enable it to be used.

J. J. (Stratford). We cannot identify the leads merely by the valve sequence. What make of set is it? Is it one of ours or one of our contemporaries? If you care to bring the receiver here we shall be glad to locate the leads for you. You omitted to enclose a stamped addressed envelope.

J. P. (Auchinleck). The coil was not designed by us, and we are, therefore, unable to supply a blueprint of a receiver employing it.

G. G. (Tiverton). The Universal receiver is so named on account of the fact that it may be used universally on any type of mains, that is A.C. or D.C., without modification. There are no step-by-step diagrams for this particular receiver, but complete constructional data is given in our issues dated January 4th and 11th last.

R. J. S. (Loudwater). The receiver should certainly function satisfactorily from your mains unit. In the event of any slight difficulty it would be a simple matter to modify the H.T. supply arrangements to overcome it.

D. N. (Northowram). If the oscillation is due to the detector stage, then no interference would be caused in the neighbourhood. If, however, the oscillation occurs in the H.F. stage, due to some form of instability, interference would be radiated from your aerial.

D. F. (Arbroath). The total consumption would be in the neighbourhood of 20 mA. The meter in question would certainly be satisfactory, but in the event of instability a 2 mfd. fixed condenser should be connected in parallel with it. A good moving-coil instrument would, of course, be preferable.

J. B. (Aberdeen). There is no particular publication giving all the wavelength data, and some of it is maintained a State secret.

J. H. (Goole). The items may be obtained from Electradix Radios, 218, Upper Thames Street, London, E.C.4. You do not state whether you simply require the crystal in a cup (which will cost 6d.) or whether you need the complete detector which costs 2s. 6d.

M. T. E. (Herne Bay). An article on the transmitting licence appeared in last week's issue.

S. S. (Edge Hill). Messrs. Peto-Scott would assemble the parts for you, but we would point out that if you obtain a chassis ready drilled the only tools you require will be a screwdriver and pliers. Your eliminator will probably prove quite satisfactory with the specified valves.

E. M. B. (Leith). The trouble may be due to instability caused by a poor layout or interaction between wiring. On the other hand, your mains unit may be causing the instability owing to back-coupling between the H.T. positive feeds. Try a dry battery to check the latter point, and if necessary re-arrange the H.F. section of the receiver.

W. R. C. (Cardiff). The eliminator has an output, we believe, of 25 mA., and thus would be quite suitable for use with the valves in question.

A. H. K. (Acton). We do not sell blueprints of commercial receivers and are thus unable to be of assistance to you. The theoretical circuit which the makers have sent to you should be quite sufficient to enable you to complete the wiring, but we cannot help you in this connection. You should send the set to the makers or one of their Service Agents for repair.

W. T. W. (Kingston Hill). The usual indication of the glow is that the valve is being over-run, either due to insufficient grid bias or excessive H.T. The valve will get softer and eventually cease to function if the fault is not remedied.

J. F. B. (N.W.3) and Others. The valve in question (210 VPT) may be obtained with either a 4-pin or a 7-pin base and thus there is no mistake in the Monitor wiring plan. If you cannot obtain the 5-pin valve from your local dealer you can easily substitute a 7-pin valveholder and use the alternative type of valve. This will not affect results in the slightest.

W. A. H. (Enfield). The circuit is quite in order. We do not think it will actually produce better results than the other circuit you refer to.

W. H. L. (Aberystwyth). The firm in question is no longer in business.

J. H. (Newtownards). The information cannot be given in view of the fact that the speech coil must be matched to the present transformer. Thus the ratio of this must be known or alternatively some other scheme must be adopted to enable you to utilise the existing parts.

L. H. P. (Wareham). The dial could certainly be employed, and as you will see from last week's issue a gang condenser is now employed.

P. C. (Coldstream). We do not think the batteries would give very satisfactory service, but a great deal will depend upon the drain which is imposed upon them. You give no details of your receiver, and thus it would probably be worth while to try out the scheme for a period in order to compare the actual cost.

E. J. (Merthyr Tydfil). The usual arrangement is to interpose a fixed condenser between H.T.— (or the usual earth connection) and the actual earth lead. This should make no difference from the point of view of efficiency, but merely safeguards against a short circuit of the mains supply. We cannot give you the details of the mains unit and suggest you communicate direct with the makers.

H. H. (Nr. Dudley). You have two alternatives available. You can either buy a new mains transformer and rectifier and then include the field in the H.T. positive lead, or buy a mains transformer and rectifier for the speaker alone. The latter is preferred by many constructors on the ground that it is always complete and no circuit alterations will modify the results from the speaker. For the latter arrangement you need an H.T.12 rectifier and a suitable transformer. Messrs. Heayberd can supply the latter (Type W.45) as well as the rectifier and a suitable condenser and fuse. A complete kit for this purpose costs 45s. 6d.

T. H. S. (West Bromwich). Your remarks are very confusing. Do you require a three-valve set with a push-pull output stage using pentodes, or a two-valve set with a push-pull output stage? In the latter case you could not load the valves and a single pentode would be sufficient. We recommend either the Half-Mark Four, or our Two-In-One Amplifier.

G. W. S. (West Bromwich). We regret that we cannot identify the transformer. It would appear, however, from your reference letters that it is a push-pull output transformer, but whether for Class B, Q.P.P., or ordinary push-pull we cannot state.

A. P. (Smethwick). The selectivity of the present version would not be adequate to enable you to hear many foreigners between Midland and National, but as a superhet you should have no difficulty whatsoever. You will probably find in your locality that nothing short of a superhet will meet your precise requirements.

J. B. W. (Littleborough). H.T. should be 120 volts and screen between 40 and 80—the most suitable value being found by trial. The output transformer should be approximately 1.5 to 1.

W. N. (Forest Hall). It is possible that the acid is too weak and we suggest that you have the cells cleaned out and filled with fresh acid. The makers recommend that this be done periodically.

G. W. V. (Hutton-Rudby). The output from the mike transformer should be joined to the normal pick-up terminals. If no pick-up terminals are fitted, the connections should be made between earth and the grid of the detector valve, and a suitable biasing resistance should be included in the cathode of this valve. The grid leak should be joined direct to the cathode. The usual by-pass condenser must, of course, be joined in parallel with the bias resistance.

B. S. (Hull). The aerial is quite suitable, and to keep down expense you could use the metal foil. You must, however, guard against short circuits due to screws coming into contact with the foil. The choking effect of the H.F.2 would be inadequate for use on the wavelengths covered by the receiver, and this particular component is designed primarily for the ultra-short waves.

A. B. (Shrewsbury). The reading of your meter is much too high to enable you to use it for the purpose mentioned. We do not recommend the valve in question for the set mentioned.

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 Log on the 28 m/c Band

SIR,—Recently, I have seen published in your journal reports of reception of amateur transmitters on 3.5 m/c, 7 m/c and 14 m/c bands, but so far no mention has been made of the 28 m/c band. On Sunday afternoons (14.00-17.30 G.M.T.) I have logged the following amateurs on this band, all on 'phones: W1GBE, W1SZ, W1INC, W1ZE, W1CCZ, W1DF, W1FJN, W2FWK, W2BCR, W2HFS, W2AOG, W2DC, W2BYP, W3AUC, W3BPH, W3AIR, W3ZX, W4MR (on CW), W8MWL, W8AKU, W8BIQ, W9DRD, W9BHT, W9KRE, VE2EE and G5ML. My receiver is an untuned SG-detector-pentode, with 'phones and a 60-ft. inverted-L aerial.—H. J. W. (Leamington Spa).

An Appreciation from Birmingham

SIR,—I have a suspicion that when some of your readers are dissatisfied they do not hesitate to let you know about it, but when they are pleased, I am not at all sure whether they so readily take the trouble to express their gratification. I am therefore going to adopt the possibly unusual procedure of patting you on the back.

Thanks very much for your latest issue of PRACTICAL AND AMATEUR WIRELESS. I am quite sure that it contains interesting material to suit all requirements. The articles on "Resistance, Inductance and Capacity" and "From Studio to Listener" were to me most instructive and interesting. I note, too, that although advanced amateurs were catered for in your issue of February 8, you devoted a fair amount of space for the benefit of beginners. I trust you will continue to spare a kindly smile now and then for those who are not too ambitious as regards logging every foreign station in the world, but who are quite keen nevertheless, and for those who are obliged to construct *battery* sets.—C. E. H. (Birmingham).

A Good Log with a One-valver

SIR,—I feel I must write and tell you how well my S.W. set works. I built it from the design for a one-valver given in "The Television and Short-Wave Handbook," and have hotted it up considerably. I have tested it from Sunday to Sunday inclusive. As I have only made one coil which covers from 25 to 45 metres, I think the following bag is quite good: Fifty-seven amateurs, including G5GC, G2QH, G5CJ, EA3ER (Spain), G6SI, G6IB, OM4IF (Belgium), G6ZQ, PA0DK (Holland), G5PB, G2IL, OM4GU (Belgium), and thirty-six broadcasting stations, including Zeesen DJA, Colombo (Ceylon), Lisbon ECI8P, Schenectady W2XAF, Madrid EAQ, Philadelphia W3XAU.—K. VIGERS (Abbots Ripton).

Back Numbers of "A.W." and "P. and A.W."

SIR,—I have just sent off a copy of "A.W." No. 648 asked for by a reader. It may interest other readers to know that I have a large number of copies of *Amateur Wireless*, PRACTICAL AND AMATEUR WIRELESS, and *Wireless Magazine*, and shall be glad to give a copy of any of these journals to any reader who states his requirements.—E. WEBSTER (Sunnyside, Ruette Braye, Guernsey, C.I.).

An American Amateur Station

SIR,—I wonder if other readers have noticed or heard a rather interesting American amateur who operates on the 20-metre band, call W2BSD (New York).

If one tunes in to him at about 18.45 G.M.T. most evenings, one will get some very interesting pick-ups.

A sample of his calls are:—

W2BSD working G5ML? (England);
" " F8DR (Paris);
" " VO1I (Newfoundland);
" " VQ6P (Johannesburg, (S. Africa).

From these stations he receives weather and condition reports, etc. He "comes over" at good strength and with very little fading.—D. C. LOCKE (Thorney).

Scottish Reader's Appreciation

SIR,—Just a few lines to let you know your efforts in PRACTICAL AND AMATEUR WIRELESS are really becoming more and more just what the keen reader really wants, and I must congratulate you. Your article, "Servicing for Profit," is extremely useful, and I would earnestly suggest you devote a little more space to it every week.

The article on "Inductance, Resistance and Capacity" was good, but I would like to see more articles on the same subject.—J. C. DONALDSON (Sanquhar).

Back Numbers of "A.W." Wanted

SIR,—I shall be grateful if any reader can loan me copies of *Amateur Wireless*, dated April 25th and May 2nd, 1931, in which was described the "Century Super." I have a number of copies of P.W. if any reader should require a back number.—G. MATTHEWS (4, Happaway Ct., Stentifords Hill, Torquay).

An Amplifier for the Deaf!

SIR,—With reference to the remarks of your correspondent "Social Exile," in the February 8th issue, I should like to endorse his statements. There are a lot of deaf people who would make use of such an instrument if they knew its benefit, and by publishing details it would get more widely known. It should be a mains set for home use, as no one nowadays wants to go back to batteries. The question of headphones can easily be arranged by condensers. I should also like to see an up-to-date portable type with midget valves explained, giving particulars of the best kind of microphone to use for these sets.—F. M. BINLEY (Hockley).

Prices of Components for "P. & A. W." Sets

SIR,—I agree with the suggestion of Mr. Leach (Llandudno), regarding an approximate price list for your sets.

I notice Messrs. Peto-Scott has only put the prices of Kit A, etc., in their adverts. lately, although prices of components vary according to the locality one lives in.

Should the suggestion be carried out one could put one's P.O. in an envelope and get the parts specified, and not have to substitute other makes which are offered when the required one is not in stock.

I am pleased to note, however, that Messrs. Peto-Scott has given a price list of all the parts for the Monitor 3.—C. S. WALL (Orpington).

SIR,—I agree with J. W. Leach of Llandudno. As you use only specified components of one particular make, it would assist would-be constructors if the price of each article were stated. Personally, I always look at Peto-Scott's advert. as their list is usually as per the author.—F. Dow (Leyton).

VP3MR (British Guiana)

SIR,—During the past week I have been receiving at good strength the British Guiana short-wave station, VP3MR, of Georgetown, British Guiana, on a wavelength of 42.4 metres. All announcements are made in English, and it appears to be run on the lines of the United States radio stations, as the programme is made up of different items sponsored by different companies. The announcer usually gives his name at the end of a programme. It was announced that the station is operated by the British Guiana Broadcasting Company, and the motto used is "The Voice of British Guiana." The following is the schedule of the station which works daily:—

Weekdays—9.45 p.m.-12.45 a.m. G.M.T.
Sundays—A religious service at 12.45 p.m. or 3.45 p.m., followed by news and a short musical programme. Ordinary programme from 9.45 p.m. till 11.45 p.m.

The above times are given in G.M.T., as the British Guiana time is 3¾ hours behind G.M.T.

Trusting that the above information may be of use to other readers, and thanking you for the excellent lines on which your magazine is run.—DUNCAN T. DONALDSON (St. Andrew's, Fife).

CUT THIS OUT EACH WEEK.

Do you know

—THAT ebonite may be restored to its original colour when it has faded by well oiling.

—THAT when brass parts are treated with non-tarnish material or lacquer, this should be removed where contact has to be made.

—THAT when soldering leads to the chassis-type valveholder sockets a matchstick should first be inserted into the socket to prevent solder from running inside and thus preventing the valve from being inserted.

—THAT the gramophone pick-up should not be joined in the grid circuit of the I.F. valve in a superheterodyne, unless the 2nd detector stage is also modified at the same time.

—THAT the value of a resistor may be reduced in many cases by scraping away the coating over the component, when accurate matching is required.

—THAT disappointing results with a microphone may generally be traced to the fact that an unsuitable input circuit is adopted. A matching transformer is generally required.

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

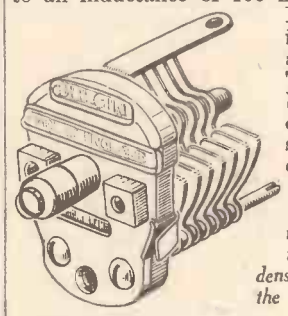
Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

Bulgin High-inductance Choke

WHEN using a power-grid detector, and in certain types of L.F. coupling, it becomes very important to avoid loss of anode voltage due to a high resistance in the anode circuit. The customary anode resistance may then be omitted and a good high-inductance choke employed in its place. For such purposes the Bulgin L.F.34 choke will be found very suitable, as this is wound to an inductance of 100 henries and the D.C. resistance is between 1,800 and 2,000 ohms. The choke may be used in circuits where the steady direct current does not exceed 15 m/A, although at such a figure the inductance will be slightly lower than 100 henries, which figure is given at 10 m/A. The choke is fitted in the standard Bulgin aluminium universal mounting case and insulated terminals are fitted. The price is 12s. 6d., and for apparatus where the screening box is not required it is possible to obtain a "stripped" model for 10s. 6d.



One of the new midget air dielectric pre-set condensers selected from the Bulgin range.

Another interesting item in the Bulgin range is the air dielectric trimming condenser shown above. This may be mounted on a panel or in any special component (such, for instance, as an intermediate-frequency transformer) and two tapped holes are provided in brass bushes mounted on the upper part of this condenser. The adjustment of the rotor is carried out by means of the small screw seen in the centre, and this projects about ¼in. above the top of the condenser, thus permitting it to pass through the panel or other mounting medium. The illustration is actually slightly larger than the original component, so that some idea of the neatness of this accessory may be gathered. It may be obtained with various capacities (from 25 $\mu\mu$F up to 100 $\mu\mu$F), and the price in each case is 3s. The insulating plate is of ceramic material (Microloss) and the condensers are suitable for use right down to the ultra-short wavelengths.

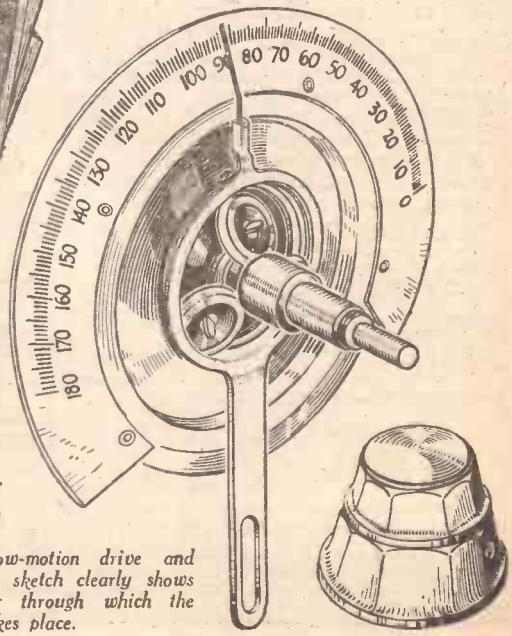
A Combination Trimmer

SERVICE engineers will be interested in a novel combination-trimming tool which has been produced by Electrical and Musical Industries Service, Ltd. This is of the dual screwdriver and box-spanner type, and is designed for use with the majority of ganged condensers and I.F. transformers which are now fitted to receivers. The spanner portion is drilled throughout its length so that the screwdriver may be slipped through when making adjustments to concentric trimmers. The tool has rather long handles which are provided to avoid hand-capacity effects, and the amount of metal has been reduced to a minimum. This latter point is of especial importance when adjusting certain trimmers on I.F. transformer secondaries which are not "earthed," as in certain A.V.C. circuits fitted to superhets. The price is 4s. 6d.

Raymart Tuning Dial

THE dial or friction drive shown below is selected from the Raymart range, and provides a good example of a drive which may be used with ultra-short-wave tuners as well as for normal broadcast components.

The dial is fitted with an epicyclic gear which provides a very smooth drive free from slip, and the condenser may be driven through this gear or direct through the spindle, for which purpose a dual-control knob is employed. The drive is mounted direct on a condenser, and to keep it rigid the slotted arm is screwed to the edge of the baseboard or chassis. An elongated slot is provided to allow for a fairly wide degree of adjustment, and this anchorage point ensures that the drive is rigidly held whilst permitting perfectly free movement to the spindle. The scale is of the bevelled type to permit of easy reading. The price is 3s. 11d.



The Raymart slow-motion drive and escutcheon. This sketch clearly shows the epicyclic gear through which the reduction drive takes place.

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.

BLACKPOOL SHORT-WAVE CLUB

A SHORT-WAVE club has been formed in Blackpool, and interested readers residing in this town are invited to write for full particulars to Mr. Eric Sntcliffe, The Welbeck Hotel, North Promenade, Blackpool.

THE RADIO PHYSICAL AND TELEVISION SOCIETY

MEMBERS of this society had their ideas on quality reproduction sadly shattered when Mr. P. A. G. Voigt gave in his entertaining manner a lecture on his well-known speaker. "The logarithmic curve," he said "is used in the exponential type of speaker and, as all quality experts know, this type of speaker gives the most faithful reproduction. However, n order to obtain a wide frequency range the exponential horn must be of very large dimensions, thus making it impossible to use in the ordinary house." Mr. Voigt explained how he had gradually evolved a curve which was nearly as efficient as the logarithmic curve and which took up far less space.

Other points in his speaker design were dealt with, his methods of safeguarding against resonances, and how he had evolved his cabinet design with an eye to technicalities as well as appearance.

Then came his demonstration, which fully justified his claims. It was heartily agreed that no better quality had ever been heard in the society. The speaker proved itself to be extremely sensitive, and using a 5-watt quality amplifier, radio and gramophone music was heard at its best.

We welcome readers of PRACTICAL AND AMATEUR WIRELESS to our meetings, which are held on alternate Fridays, while a beginners' course, held on the intervening Fridays, includes a morse class under the direction of Mr. A. E. Dowdeswell. Meetings begin at 8 p.m., and are held at 72a, North End Road, West Kensington.

OUR FREE CATALOGUE SERVICE

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

BRYCE PRODUCTS

QUALITY sets require quality components and a comprehensive range of these is given in the latest list issued by W. Andrew Bryce and Co., Woodfield Works, Bury, Lancs. Amongst the mains transformers listed are a wide range of instruments for use with valve rectifiers, or Westinghouse L.T. or H.T. metal rectifiers, heavy duty output transformers, and astatic transformers specially designed for television use. Among the other well-known Bryce components listed are: "Peak" paper dielectric condensers, high-voltage condensers, electrolytic condensers, metallised wire-end resistors, and L.F. and output-filter chokes. Also included in the list are various circuit diagrams with complete lists of components, a page of useful formulæ.

RAYMART SHORT-WAVE COMPONENTS

THE latest ideas in design are embodied in the range of Raymart short-wave components given in a booklet recently issued by the Raymart Manufacturing Co., 44, Holloway Head, Birmingham. Special care should be exercised when selecting components for short and ultra-short-wave work, and in this booklet will be found only high-class components which are the result of several years experience. Included in the comprehensive range are short-wave coils, chokes, micro-variable condensers, stand-off insulators, I.F. transformers, coil formers, and various types of moderately-priced flush-mounting meters. We understand that there are some new models of variable condensers which will be ready shortly, and separate leaflets giving particulars of these will be sent out with the booklet when ready. The price of the booklet is 1½d., post free.

MARCONI VALVES

A CATALOGUE issued recently hy the Marconiphone Company deals entirely with the large range of valves bearing the Marconi trade-mark. In addition to a complete guide to each valve, with all characteristics tabulated, a comparative table of Marconi equivalents is given, together with various technical details, such as valve-holder connections, various A.V.C. circuits, push-pull arrangements, and so on. The catalogue can be obtained free from Radio House, Tottenham Court Road, London, W.1.

The subscription on membership is 2s. per annum, while 3d. is payable at each meeting attended. We have an interesting programme for the coming few months, and those who require further details should apply to the Hon. Sec., M. E. Arnold, 12, Nassau Road, Barnes, S.W.13.

BRITISH SHORT-WAVE LEAGUE

WE wish to apologise for the delay in executing orders for our publication—the "British SWL Review"—caused by the great demand for the first batch of copies; however, readers who have not yet received their "Review" may rest assured that delivery will be made very shortly.—F. A. Beane, Ridgewell, Essex.

THE CARDIFF AND DISTRICT SHORT-WAVE CLUB

A SUCCESSFUL meeting of this society was held at the Barry's Hotel, Cardiff, on Thursday, February 20th, at 8 p.m., at which the attendance, including several well-known transmitters, was twenty-seven. Mr. Raymond Mills gave a very interesting morse practice, and several members showed quite effective turns of speed. It is hoped that these morse practices, in which so many members of the club are interested, will become a regular half-hour feature of the club's fortnightly meetings. All short-wave enthusiasts are cordially invited to attend these meetings, which are open to anyone interested. The next meeting will be held at the aforementioned hotel at 8 p.m. on Thursday, March 5th, 1936. The Secretary, Mr. H. H. Phillips, 132, Clare Road, Cardiff, will be pleased to give further information to any reader on receipt of a stamped addressed envelope.

THE CROYDON RADIO SOCIETY

THE Croydon Radio Society's already rising attendance figures had a big boost on Tuesday, February 18th, when over sixty heard Mr. P. G. A. H. Voigt demonstrate his loud-speaker in St. Peter's Hall, S. Croydon. He began by discussing the need for a horn, and hence its design. A 120-cycle horn of the straight type was all very well, but contending wives would not approve of a loud-speaker stretching half-way across a room. Thus, the Voigt corner horn speaker had come to pass. Much had to be done even then, and a feature was the high note reflector, to avoid listening at the ceiling for those notes. Moreover, this reflector was designed so that frequencies were equally distributed over every part of the room.

During the demonstration results were very faithful. It was distinctly pleasing to hear all bass instruments easily distinguishable, in contrast to the all too usual colourless thump of bass. High notes also were very clear and had an entire absence of resonances.

On Tuesday, March 10th, Mr. Rivers-Moore, president, is giving a talk on: "More about Music Making," with illustrations on various instruments. Hon. Pub. Sec.: E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

QUERIES and ENQUIRIES

Load Resistance

"I have frequently seen in your articles the term load and load resistance, and should be pleased if you would explain this in as simple a manner as possible. I may mention that I am only a beginner, and have no mathematical knowledge, but I derive great pleasure from the articles in your pages."—H. G. T. (Hove).

THE term load is generally applied to the component connected in the anode circuit of a valve. You will appreciate if you have read many of the beginner's articles that there is a fluctuating anode current in a valve when a signal is applied, and this cannot be passed to the following stage unless some component is included in the anode circuit across which the fluctuating current will cause a voltage variation. In the simplest form you may consider the resistance, as you will appreciate that a current flowing through this results in a drop in voltage and thus the ends of the resistance will be at different voltages and this variation may be applied to the following stage. Alternatively, you may consider that the ordinary valve requires to be loaded, by working into some form of impedance, in order to operate in the correct manner, and this is of greater importance in the L.F. and output stages. Diodes and other forms of rectifier also require to be loaded in order to operate in the correct manner, and subsequent articles in this paper will explain the details more fully.

Screening Cable

"I have built a four-valve set in which are two H.F. stages, but I cannot cure instability in it. I have tried all ideas, and even screened the leads to the two anodes. I used the flexible curtain supports for this as it enables the wire to stand up away from other components, and have soldered the earth connection to it. I have not yet put vertical screens between the stages. Do you think this will be required, as I do not want to go to the expense of this if it can possibly be helped?"—B. E. (Norwich).

THE screening which you have employed on the anode leads is probably useless. The ordinary wire curtain support has been recommended in certain journals and we have had a number of receivers here for test in which this was employed. We have found, however, that it provides a greater trouble than existed before its application, as, due to its solenoidal form, it acts as an inductance and gives greater radiation than the single anode lead. This may be overcome by running solder along the entire length of the wire so as to short-circuit the adjacent turns. This, of course, does away with the flexibility. Whilst the metal is perfectly new and clean it may be effective, but dust and dirt effectively insulate the turns in a short time. Replace these screens by the standard screened tubing, and if this does not effect a cure, look to the voltages applied to screens and anodes. It may be found necessary to separate each section ltimately.

Battery Charging Problems

"Can you explain the difference between the constant potential method of charging and the modified constant potential system? I have been told that the former is detrimental to the batteries, and as I propose to set up an accumulator charging station in the village, I wish to adopt the most effective system for my customers."—B. R. (Whyteleafe).

IN the constant potential system the leads from the charging source or mains are at a constant potential or voltage, and thus when the batteries are first placed on circuit a heavy surge flows, and in view of the low resistance of the discharged battery a voltage rise occurs. The current flowing will decrease as charging takes place until it is nearly negligible. The system is not to be recommended in view of the fact that separate supplies must be used for batteries of different voltage or the smaller capacity cells stand a good chance of overcharging. In the modified constant potential system variable resistance strips are inserted across the leads and the batteries and each individual circuit may be separately adjusted. As you propose to set up a commercial charging plant, we advise you to communicate with the makers of such apparatus, and obtain a ready-built plant which will be guaranteed to do the job in the most efficient manner.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications to 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.

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

Graduated Fader

"I want to obtain a special centre-tapped potentiometer with a total value of .5 megohms, but I want each section to be graded for accurate voltage regulation on the output of a mike and gramophone pick-up apparatus which I am going to use for an indoor dance and social. At present I use two separate controls, and should like to dispense with one of the knobs by using a single instrument if there is one made. Perhaps you could help me?"—Y. T. (Newcastle).

A CONTROL of the type outlined by you may be obtained from Messrs. Dubilier. This has two sections each of .25 megohms, and each section is graded logarithmically. In addition, at the centre point there is a slight recess in the element which enables the control to be turned to this point, and it may be felt with the finger tips as the control is manipulated, and it will remain set in this position, provided that it is not submitted to undue vibration. The price is 6s. 6d.

Smoother Reaction

"I have been experimenting with the reaction circuit, but still must confess that I cannot find an ideal arrangement. I have tried the Reinartz, the Colpits, the differential and all the others, but they all seem to affect the actual tuning point. That is to say, I get a foreigner, and as soon as I touch the reaction away it goes and I have to take off the reaction and find the station again. Is there no way in which this can be overcome, as I am sure that many stations would be quite good if only I could bring them up properly?"—F. T. A. (Gosport).

PROBABLY the only real solution to the reaction problem is the separate reactor valve. In its simplest form this consists of a detector valve resistance-capacity coupled to a further valve, the anode circuit of which is joined to the reaction coil and condenser. Thus, the first valve performs the action of rectification, and the second acts only as a reaction control. When properly arranged there is no alteration in the tuning dial setting, and the reaction is much smoother. It will also be found that there is not quite so much variation in tone as is generally produced by the ordinary reaction when it is forced to its limits.

Temperature Tests

"I have just finished building your A.C. Superhet, and although it gives splendid results, I am worried about one point. The output valve gets so hot that you cannot touch it. Quality is very good, and none of the other valves is so hot. Does this indicate a fault?"—B. L. O. (Exeter).

IT is generally found that an output pentode of the mains type runs very hot, although it is usual to find that the sides of the glass bulb are not so hot as on the very top of the valve. After an hour or so, the bulb should probably be so hot that the hand cannot be left on it. You will probably find an ordinary A.C. triode will get nearly as hot, although the anode screens the glass and the heat is thus only perceptible at the very top of the glass. However, in any case of doubt the anode current should be ascertained by means of a suitable meter so that all doubts may be put at rest.

Switch Noises

"There are a lot of crackles on my set, and I have found that they come from the on/off switch. If I turn this, the noises are sometimes worse, and I can set it so that it stops entirely. I have bent the springs to try and get over it, but it does not seem to work. Is it due to any chemical action due to the electricity flowing through it?"—D. T. S. (Penge).

THERE is insufficient current in the ordinary battery receiver to affect the switch as you suggest. The trouble is generally due to the fact that the metal becomes corroded and dirty and this makes poor contact. The remedy is to keep it scrupulously clean and shielded from the dust. A good modern switch should not prove faulty, and the trouble you mention was generally experienced only with the older patterns of this component.

The coupon on cover iii must be attached to every query

THE PREMIER SUPPLY STORES

All goods guaranteed perfect. Set Manufacturers' Surplus. 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. Send 3d. for the most Comprehensive Illustrated Valve and Component Catalogue in the Trade, and save pounds.

SPECIAL OFFER

Complete Kit for 1-Valve Shortwave Receiver or Adaptor, with coils, metal chassis, and circuit **12/6**

VARIABLE CONDENSERS

Utility 0.0005 2-gang bakelite dielectric, semi-shielded condenser, Slow Motion and Uniknob Trimmer, **3/11.** Utility 0.0005 3-gang fully screened with Trimmers and Illuminated Disc Drive, **7/6.** American 0.0005 3-gang with Trimmers, **3/-.** Polar Star (manufacturer's type), 3-gang, 0.0005, fully-screened with Trimmers, **5/6.** Polar 0.0005 with slow motion, **3/11.** Lissen 2-gang 0.0005 with Front Trimmer and Disc Drive, **5/11.** Bakelite Reaction and Tuning Condensers, 0.0001, 0.00015, 0.0002, 0.0003, 0.0005, 0.00075, **9d.** each. Preset Condensers, any value, **6d.** each. Lotus 2-gang Condensers, fully-screened Trimmers and disc drive, **6/6.**

LOUDSPEAKERS

PERMANENT MAGNET. Moving Coil Speakers all fitted with output transformers. Magnavox 254, 7" diameter, **16/6.** Magnavox 252, 9" diameter, **22/6.** Blue Spot 29 PM 8" diameter, **15/-** ; without transformer, **12/6.** Energised Moving Coil Speakers, all fitted with output transformers (unsuitable for battery sets). Kolster Brandes, 7" diameter, 1,500, 2,000 or 2,500 ohm fields, **7/9.** Whiteley Boneham, 8"diameter, 2,500 ohm field, **9/11.** Magnavox DC 154 7" diameter, 2,500 ohm field, 4 watts, **12/6.** Magnavox DC 152 Magna, 9" diameter, 2,500 ohm field, 6 watts, **37/6.** B.T.H., 8" diameter, 1,500 or 7,500 ohm fields, **8/6.** AC Energised Units for any of the above Speakers, **10/-.** B.T.H. matched pairs, 1,500 and 7,500 ohms (1,500 ohm Speaker as choke, 7,500 ohm in parallel with H.T. supply), **15/6** pair. AC Energising Kit, **12/6** extra. Magnavox 6v. Field Model, 6 watts, **12/6.** Magnavox 9" 152, 2,500 ohms, **17/6.** Magnavox Magna DC 154, 2,500 ohm field, 5 watt, **25/-.** Reliable 7" Permanent Magnet Speaker, **10/6.** 8" Cossor or W.B. Permanent Magnet Speakers, **13/6.** All types P.A. Speakers in stock.

FIXED CONDENSERS

Electrolytics.

T.C.C. :
- 8mf. 650v. (surge) 4/-
- 4mf. 650v. (surge) 4/-
- 15mf. 50 v. .. 1/-
- 15mf. 100v. .. 1/-
- 50mf. 12v. .. 1/-

Dubilier :
- 4mf. 500v. .. 3/-
- 8mf. 500v. .. 3/-
- 8+4mf. 500v. .. 4/-
- 50mf. 50v. .. 1/9
- 12mf. 20v. .. 6d.
- 25mf. 25v. .. 1/-

U.S.A. :
- 4, 8, or 12mf. 530v. peak each 1/3
- 100mf. 12v. .. 1/3
- 8+4mf. 500v. peak 2/3
- 4+4mf. 500v. peak 1/6
- 8+8mf. 500v. peak 2/6
- 12+8mf. 500v. peak 2/6
- 12+4mf. 500v. peak 2/6

Paper Types.

Dubilier :
- 4mf. 500v. working 4/-

Paper Types (contd.).
- 4mf. 800v. working 6/-
- 2mf. 750v. working 3/-
- 4mf. 1000v. working 10/6
- 4mf. 2000v. working 13/-

Western Electric :
- 4mf. 250v. working 2/-
- 2mf. 250v. working 1/-
- 1mf. 250v. working .. .. 6d.
- 4mf. 350v. .. 2/6
- 2mf. 350v. working 1/6

CONDENSER BLOCKS

All 250 volts working

Dubilier :
- 2+2+2mf. .. 2/-
- 2+2+1+1+1mf. 2/6

H.M.V. :
- 4+1+1+1+.5+.5+.5mf. .. 1/6

Lissen :
- 4+4+1+1mf. .. 3/-

Wego 1mf. 450v. working **1/-**, 2mf. **1/9**, 4mf. **3/-**. Assorted Resistances and Condensers. Our assortment, twelve different values, **2/-** per dozen.

DIALS

Clarion Moving Light Slow Motion Dial, with 2" knob. Ideal for Short Waves, **2/-.** Simplicon Full Vision Slow Motion Dial, **2/-.** Utility Disc Drive, complete with 2" knob. Ideal for Short Waves, **2/-.** 4" Bakelite Knob-Dials, **6d.**

MICROPHONES

3 Guinea model with stand and transformer, single button type, **19/6.** Western Electric type on base, with transformer, **4/6.** Home Broadcaster Microphones, low priced two-button type with transformer, **7/6.** Carbon Microphone with transformer, in handsome Bakelite case, **10/6.**

H.F. AND L.F. CHOKES

Premier Screened H.F. Choke, 100-2,000 metres, **1/6** each. Premier Screened H.F. Choke, for Short Waves, 10-200 metres, **1/6** each. Premier Short Wave H.F. Choke, 10-200 metres, **9d.** Premier Mains H.F. Choke, carry 1 amp., **1/6.**

PREMIER SMOOTHING CHOKES.

- 25 M.A., 20 henrys 2/9
- 40 M.A., 30 henrys 4/-
- 60 M.A., 40 henrys 5/6
- 150 M.A., 40 henrys 10/-
- 250 M.A., 15 henrys 20/-
- 60 M.A., 80 henrys
- 2,500 ohm for Speaker Replacement 5/6

ENORMOUS SELECTION OF SHORT WAVE COMPONENTS OF THE FINEST QUALITY.

Premier Short Wave Tuning condensers (S.L.F.), complete Ceramic Insulation. Silver Sprayed Brass Vanes. Noiseless Pigtail 0.00016, 0.0001, **2/9** each. Double-spaced, 0.00005, 0.000015, 0.000025, **3/-** each. Premier all-brass Short Wave condensers, 0.00015 with integral slow motion, **3/9.** British Radiophones, all brass, 2-gang short wave condensers, 0.00015, each section, **5/6** each. Ormond, 0.00025, O.K. for Short Waves, marvellous value, **1/6** each. With slow motion, **2/-** each. Ormond, 0.00025, slow motion condensers, all brass super value, **2/6.** Ormond, 0.00025 with special Logging Dial, ideal for band setting, **2/-** each. Short Wave Reaction Condensers, all brass, integral, Slow Motion, 0.00015, **2/9** each.

Polymet Midget : Mica Condensers, with wire ends, 0.00002, 0.00003, 0.00004, 0.00005, **6d.** each.

Premier Super Short Wave Coils, with circuit, 4- and 6-pin type, 13-170 meters. Set at 4, either type, **7/-.**

Premier Low Loss, 4- and 6-pin ribbed formers, 1½" diameter, finest quality, **1/-** each.

Please note that only very highest grade Plastic material is used in the manufacture of Premier Short Wave Coils and Formers.

Premier Short Wave Valve Holders, Steatite Insulation, 4-, 5- and 7-pin chassis type, **6d.** each. Baseboard, **8d.** each. Reliable Morse Keys with Code engraved on Bakelite base, **2/-.** Reliable Short Wave Coils, 4-pin, type, 14-150 metres with circuit, **4/-** set of 3. Stand-off Insulators, 1" 2½d., 1⅝" 3d., 2" 4½d , 4" 9d.

WORLD-FAMOUS CONTINENTAL VALVES

Mains Types.

ACHL., ACL. Screen Grid. Variable Mu. 1, 3 and 4 watt directly heated Output Pentodes. H.F. Pentodes. Variable Mu H.F. Pentodes. Double Diode Triodes. Diode Tetrodes. 250 volt 60 m.a. Full-wave Rectifiers. All **4/6** each. 20 volt 18 amp. AC/DC types. Screen Grid. Variable Mu. H. HL. Power. Pentodes. All **4/6** each.

350 volt 120 m.a. Full Wave Rectifiers. 500 volt 120 m.a. Full Wave Rectifiers. 2½ watt indirectly heated Pentodes. 2 watt indirectly heated Power. 2½ watt directly heated Power. All **5/6** each.

2 volt Battery types. H.F. L.F. **2/3.** Power. Low Consumption Power. Super Power, **2/9.** Screen Grid. Variable Mu. 4- or 5-pin Pentodes. Variable Mu., H.F. Pentodes. H.F. Pentodes, Class B valves. All **5/-** each.

American Types : 250, 210, 245, 47, 46, 24, 35, 37, 51, 55, 57, 58, 80, 6A7, 2A7, 2A5, 27, 77, 78, 281. All **4/6** each.

All the following super quality American types : Hytron Brand, **6/6** each : 1A6, 1C6, 2A5, 2A6, 2A7, 2B7, 6A4, 6A7, 6B7, 6C6, 6F7, 12A5, 19, 24A, 26, 27, 30, 31, 32, 33, 34, 35/51, 36, 37, 38, 39/44, 41, 42, 43, 45, 46, 47, 49, 6D6, 53, 55, 56, 57, 58, 59, 75, 76, 77, 78, 79, 85, 89, 6A6, 83, 5Z3, 25Z5, 12Z3, 1V.

All output valves can be supplied in matched pairs at no extra charge.

BARGAIN PARCELS

Special Offer. Bargain Parcels. Every Parcel is amazing value, being genuinely worth several times its cost : available in **5/-, 10/-, 20/-** Parcels.

WIRE-WOUND RESISTANCES

4 watts, any value up to 50,000 ohms, **1/-** each. 8 watts up to 100,000 ohms, **1/6** each. 15 watts up to 50,000 ohms, **2/-** each. 25 watts up to 50,000 ohms, **2/6** each. 15- and 25-watt Resistors can be supplied semi-variable at **6d.** extra. 1,000 ohm, 150 m.a. semi-variable Resistance, **2/-** 1,000 ohm, 250 m.a. Resistance tapped for any number of 0.18 amp. valves, **3/6.** 800 ohm 350 m.a. tapped resistance, **2/-.**

TRANSFORMERS

Premier Mains Transformers have tapped Primaries, and C.T., L.T.'s Engraved Terminal Panels, with N.P. Terminals. All windings paper interleaved. Combined H.T.8 and H.T.9, 4v. 1-2a, and 4v. 3-4a., **10/-.** Westinghouse Rectifier, **8/6** extra. H.T.10 with 4v. 1-2a, and 4v. 3-4a., **10/-.** Westinghouse Rectifier, **9/6** extra. 250+250v 60 m.a. with 4v. 1-2a., 4v. 2-3a., 4v. 3-4a., **10/-.** 300+300v. 60 m.a. with 4v. 1-2a., 4v. 2-3a., 4v. 3-4a., **10/-.** 350+350v. 150 m.a. with 4v. 1-2a., 4v. 2-3a., 4v. 3-4a., **12/6.** Auto Transformers, tapped, 100v., 110v., 200v., 220v., 240v. Step up or down. 100 watts, **10/-.** 50 watts, **7/-.** Manufacturer's type Transformers, 350+350v. 120 m.a. with 4v. 1-2a., 4v. 2-3a., 4v. 3-4a., **10/6.** 500+500v. 150 m.a. with 4v. 2-3a., 4v. 2-3a., 4v. 2-3a., 4v. 3-4a., **19/6.** 500+500v. 200 m.a. with, 4v. 2-3a., 4v. 2-3a., 4v, 3-5a. and 5v. 3a. for American Rectifier, **25/-.** Valve Rectifier, 6/6 extra. 1,000+1,000v. 250 m.a. with 4v. 3a., 4v. 3a., **39/6,** or with 2 G.U.I's. **59/6.**

TRANSFORMERS—continued

High-grade Push-Pull Input Transformers, **4/6** each. High-grade Intervalve Transformers, **3/6** each. "Voltra" Inter-valve Transformers, **1/9** each. Ferranti A.F.3 Transformers, **8/11.** Moving Coil Multi-Ratio Output Transformers, **2/6** each. 1-1 or 2-1 Output Transformers, **2/6** each. Microphone Transformers, 50-1 and 100-1, **2/6** each. Telsen 1.75-1 Radiogrand Transformers, **2/9.** Telsen "Class B" Driver Transformers, **2/9.** Cossor "Class B" Driver and Output Transformers, **2/6** either type. Standard Telephones "Class B" Driver Transformer, **1/6.**

PREMIER ELIMINATOR KITS

All incorporating Westinghouse Rectifiers, high quality Mains Transformers and Chokes. Generous Smoothing and Decoupling Condensers and Resistances. 120 volts 20 m.a., **20/-** ; with Trickle Charger, **28/-.** 150v. 50 m.a. 4v. 3a., **27/6** ; with Trickle Charger, **35/-.** 150 volts 30 m.a. with 4v. 3-4a. C.T.L.T., **25/-** ; with Trickle Charger, **32/6.** 250 volts 60 m.a. with 4v. 3-5a. C.T.L.T., **30/-.** 300 volts 60 m.a. with 4v. 3-5a. C.T.L.T., **37/6.** 200 volts 100 m.a. with 4v. 3-5a. C.T.L.T., **42/6.**

PREMIER L.T. CHARGER KITS

All incorporate Westinghouse Rectifiers.

- 2 to 6 volts at ½ amp. 14/6
- 2 to 6 ,, at 1 ,, 17/6
- 2 to 6 ,, at 2 ,, 27/6
- 2 volts at ½ amp. 11/-
- 30 ,, at 1 ,, 37/6
- 50 ,, at 1 ,, 50/-

Conversion Units for D.C. Sets on A.C. Mains, 40 watts, **25/-** ; 80 watts, **35/-.**

The following lines **5d.** each or **5/-** per dozen :— 4-, 5- or 7-pin Baseboard or 4-, 5-, or 7-pin Chassis Mounting Valve Holders, American Valve Holders, 1 watt resistances, wire end every value ; tubular wire end Condensers, 1,500 volt, every value up to 0.5, 3 amp. ; 2- or 3-point Switches ; Cyldon Double Trimmers ; 6 yds. Systoflex ; 1, 1.5, 2 or 2.5 mm. 1 yd. 7-way Cable ; 9ft. resin cored Solder ; 6 yds. push-back Connecting Wire ; 2in. Knobs. Any type and quantity of Instrument Wire can be supplied from stock.

P.A. AMPLIFIERS

PREMIER Super Public Address Amplifier, incorporating the new 6B5 Valve (see "Wireless World," July 15), 10-watt model, all A.C., enormous gain, phase inversion, **£7 7s.** with valves ; 20-watt model, **£10 10s.** Suitable Speakers in stock. Premier Soldering Irons, 200-250 volts ; consumes 0.2 amps, **2/6.**

POTENTIOMETERS

By best manufacturers, 200, 350, 500, 1,000, 2,500, 5,000, 8,000, 10,000, 15,000, 25,000, 50,000, 100,000, 250,000, 500,000, 1 meg., **2/-** each. 5,000, 10,000, 15,000, 100,000, 500,000, 1 meg. with switch, **2/6** each. Dual Potentiometers : 10,000 and 50,000 ; 5,000 and 50,000 ; 5,000 and 100,000 ; 10,000 and 100,000 ; with switch, **1/6** each.

METERS

British-made Moving Iron Meters. Flush mounting, 2⅜" diameter, 0-10, 0-20, 0-30, 0-50, 0-100, 0-150, 0-250, 0-500 milliamps ; 0-1, 0-3, 0-5 amps. All read A.C. and D.C., **5/9** each. Moving Coil Milliammeters, B.E.S.A., first grade. 0-1 M.A., 2⅜" diameter, **18/6** ; 0-1 M.A. 3½" diameter, **22/6.** Multipliers for same, any range, **1/-** each. All Meters flush mounting bakelite cases. Visual Tuning Meters 6 and 12 milliamp types, **5/-.** Neon Tuners, **3/-** each.

COILS

Lissen 3-gang Band Pass Screened Coils, complete with switching and blueprint, **6/11.** Lissen All-wave 2-gang Screened Coils for Screened Grid Tuned H.F. stage ; and Detector, 12 to 2,000 metres. Complete circuit diagram supplied, **12/6.** Selective Iron Cored Coils with circuit, **2/11** each. Varley Band Pass Aerial Coils, B.P.7, **2/9.** Varley Band Pass Transformer, B.P.8, **2/6.**

Special Offer. Set of three Lissen Band Pass Screened Coils with Switching. Utility 3-gang Condenser and Illuminated Disc Drive, 4-valve Chassis and Valve holders and blueprint, **14/6** the lot.

GRAMOPHONE MOTORS

B.T.H. Truespeed Induction type, A.C. only : 100-250 volts, **30/-.** D.C. ditto, **42/6.** Collaro Gramophone Unit, consisting of A.C. Motor, 100-250 volts, high quality Pick-up and volume control, **45/-.** Collaro Motor only, **30/-.** Collaro Universal Gramophone Motor, 100-250 volts, A.C.-D.C., with high quality Pick-up and volume control, **67/6.** Collaro Universal Motor only, **49/6.** Edison Bell Double Spring Motors, including Turntable and all fittings, **15/-.**

PICK-UPS

Cosmocord Pick-ups, with arm and volume control, wonderful value, **10/6** each. Cosmocord Pick-up only, fits any gramophone tone arm, **4/6.**

20-22, HIGH STREET, CLAPHAM, S.W.4. *MACAULAY 2381/2*
165 & 165A, FLEET STREET, E.C.4. *CENTRAL 2833.* **(Next Door to Anderton's Hotel)**
ALL POST ORDERS TO HIGH STREET, CLAPHAM.

Miscellaneous Advertisements

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RADIO CLEARANCE

63, HIGH HOLBORN, W.C.1.

TEL. : HOLBORN 4631.

FROM NOW ONWARDS WE SHALL BE STOCKING A COMPLETE AND COMPREHENSIVE RANGE OF AMERICAN VALVES, AT MOST COMPETITIVE PRICES.

5/6 TRIAD VALVES, OI-A, 24A, 27, 30, 31, 32, 33, 35, 37, 38, 39, 41, 42, 43, 45, 46, 47, 53, 55, 56, 57, 58, 59, 71A, 75, 78, 80, 6A6, 1C6, 6F7, 2A3, 5Z3, 12A7, 6A7, 6C6, 6D6, 12Z3, 25Z5. ALL THESE VALVES CARRY A 90-DAY GUARANTEE AND FREE REPLACEMENTS, PROVIDED THAT THE FILAMENT OR HEATER IS INTACT AND THE GLASS IS NOT BROKEN WHEN RETURNED TO US : 5/6.

79/6 5-VALVE AMERICAN MIDGET SETS. Long and Short wave. Aeroplane Dial. 200 to 250 volts, A.C. or D.C. Amazing results. In attractive leather-covered Cabinets, colours available : dark brown or red.

75/- 4-VALVE A.C. MAINS CHASSIS. 200 to 250 Volts. By well-known proprietary manufacturer. Mullard Valves. Band-Pass tuned. Suitable for use with energised Moving-Coil Speaker. Brand new.

105/- 4-VALVE A.C. SET. 200 to 250 Volts. By well-known proprietary manufacturer. Mullard Valves, Moving-Coil Speaker, Band-Pass tuned. In handsome Walnut Cabinet. Brand new. Boxed. H.P. terms can be arranged on application.

70/- LISSEN 4-VALVE A.C. SET. Complete in Cabinet with Valves and P.M. Moving-Coil Speaker. Aerial tested. Few only.

79/6 LISSEN BAND-PASS 3 BATTERY SETS. Complete in handsome Walnut Cabinets. Iron-Cored Coils. Band-Pass Tuned. P.M. Moving-Coil Speaker. Brand new.

55/- LISSEN 4-VALVE A.C. CHASSIS. 200 to 250 Volts, complete with Valves. Aerial tested. Few only.

70/- LISSEN 100 STATIONS SET. Complete in Cabinet, with Valves and Speaker. Aerial tested. Few only.

59/6 FEW ONLY LISSEN ALL-WAVE 4's. Complete in Cabinet with P.M. Moving-Coil Speaker. Brand new.

15/- ENERGISED MOVING-COIL SPEAKERS. 2,500 ohms. Made by well-known manufacturer. List price, 35/-.

19/11 P.M. MOVING-COIL SPEAKERS. Made by well-known manufacturers. This season's model. List price, 30/6.

32/6 COLLARO A.C. GRAMOPHONE MOTORS. Suitable for 100 to 250 Volts. Brand new, boxed.

2/6 LISSEN 2-VOLT BATTERY VALVES. L2 Metalised, brand new, boxed.

3/6 LISSEN 2-VOLT CLASS B VALVES. Type BB 220 A. Brand new, boxed.

3/11 LISSEN 3-GANG SUPERHET CONDENSERS 126 k/c section. Complete with dial.

2/11 POLAR 2-GANG CONDENSER. 0.0005 Section, unscreened.

10/6 COMPLETE LISSEN SUPERHET ASSEMBLY. Comprising 3-Gang Superhet Condenser. 126 k/c Oscillator Section. Set of Ganged Superhet Coils with Switch and two 126 k/c I.F. Transformers. A wonderful bargain.

2/11 LISSEN INTERMEDIATE FREQUENCY TRANSFORMERS. 126 k/cs. Brand new, boxed. List price, 8/6.

2/11 LISSEN IRON-CORED OSCILLATOR COILS. 126 kc/s. Fully screened. Brand new, Boxed. List price, 12/6.

BRYCE MAINS TRANSFORMERS.

8/11 250.0.250, 80 m.a., 2.0.2 Volts, 2.5 amps., 2.0.2 volts, 4 amps., Shrouded.

9/6 350.0.350 Volts 120 m.a., 2.0.2 volts 2.5 amps., 2.0.2 volt 4 amps. Shrouded.

11/6 350.0.350 Volts 120 m.a., 2.0.2 Volts 2.5 amps., 2.0.2 Volts 4 amps., 2.0.2 Volts 2 amps. Shrouded.

17/6 500.0.500 Volts 150 m.a., 2.0.2 Volts 2.5 amps., 2.0.2 Volts 6 amps., 2.0.2 Volts 2 amps., 2.0.2 Volts 2 amps. Shrouded.

8/11 H.T.8 TRANSFORMERS, 250 Volts, 60 m.a., 2.0.2 Volts 4 amps.

17/6 DITTO. With H.T.8. Metal Rectifier.

ALL THE ABOVE TRANSFORMERS ARE OF FIRST-CLASS MANUFACTURE, BRAND NEW AND CARRY MAKERS' GUARANTEE.

5/- UTILITY 3 GANG MIDGET SUPERHET CONDENSERS. With 110 k/c Oscillator Section, fully screened.

2/11 BRITISH RADIOPHONE 3-GANG SUPERHET CONDENSERS, With 110 kc/s Oscillator Section, unscreened. Wonderful bargain.

(*Continued at top of column two*)

(*Continued from foot of column one*)

2/6 8 mfd. and 4 mfd. DRY ELECTROLYTIC CONDENSERS, by well-known manufacturer. 450 Volt working, 500 Volt Peak. Brand new.

17/6 HANDSOME WALNUT FLOOR MODEL CONSOLE CABINET. An unrepeatable bargain.

1/11 LISSEN CENTRE TAP OUTPUT CHOKES. Brand new, boxed. List price, 7s. 6d.

1/6 LISSEN INTERVALVE SMOOTHING CHOKES. Brand new, boxed. List price, 7/6.

1/11 LISSEN 3-GANG SUPERHET COILS. Mounted on base, complete with Switch, unscreened, brand new.

2/6 PEAK 4 mfd. PAPER CONDENSERS. 750 Volt test.

1/- PEAK 1 mfd. PAPER CONDENSERS, 500 Volt working.

1/- 4 mfd. POST OFFICE TYPE MAINSBRIDGE CONDENSERS. 250 Volt working.

6d. DRILLED METAL CHASSIS. 3 Valve type.

6d. 1 WATT RESISTANCES. All sizes by well-known manufacturer.

6d. TUBULAR CONDENSERS. All sizes up to 0.1: By well-known manufacturer.

2/- 50 mfd. 100 VOLT WORKING ELECTROLYTIC CONDENSERS. In aluminium Cans.

HIVAC VALVES. Complete range in stock, send for lists.

2/11 G.E.C. 110 K/C INTERMEDIATE FREQUENCY COILS. Complete with two Trimmers.

1/6 G.E.C. 500,000 ohms VOLUME CONTROLS. With Switch.

1/11 G.E.C. MANUFACTURERS TYPE L.F. TRANSFORMERS.

ALL ORDERS VALUE 10/- OR OVER, CARRIAGE PAID IN UNITED KINGDOM. ORDERS UNDER 10/- MUST BE ACCOMPANIED BY A REASONABLE AMOUNT OF POSTAGE. NO ORDERS UNDER 10/- WILL BE DEALT WITH UNLESS POSTAGE IS INCLUDED.

RADIO CLEARANCE

63, HIGH HOLBORN, W.C.1.

TEL. : HOLBORN 4631.

RECEIVERS, COMPONENTS AND ACCESSORIES

Surplus, Clearance or Secondhand, etc.

VAUXHALL.—Polar Midget 3-gang condensers, straight or superhet., 8/9 ; Polar full vision, horizontal or Arcuate dial and drives, 4/6.

VAUXHALL.—Polar station named scales, for horizontal dials, latest settings ; 1/9 each.

VAUXHALL.—Flat, sheet aluminium, hard rolled, 18 gauge. 12in. x 12in., 2/6 ; 18 x 18, 5/-. Other sizes pro rata.

VAUXHALL.—Set manufacturers' surplus, skeleton type Westinghouse rectifiers, H.T.8, 9/6 ; H.T.9, H T.10, 10/- ; complete with fixing brackets ; Westectors, W.4, W.X.6, 5/9.

VAUXHALL.—Erie Resistances and other well-known makes. 1 watt types, all values, 6d. each.

VAUXHALL.—T.C.C. electrolytic condensers, 8 mfd. and 4 mfd., 550 volt, 3/- ; 500 volt, 2/6 ; 450 volt, 2/5.

VAUXHALL.—T.C.C. condensers, tubular, non-inductive, 0.1, 6d. ; 50 mfd., 50v. working, 1/6 ; 50 mfd., 15v., 1/3 ; 0.05, 6d. ; 0.002, 0.0002, 0.001, 0.0001, 4d. each.

VAUXHALL.—T.C.C. mica 0.002, 2,000 volt test, 10d. ; 0.0001, 4d., 0.001, 0.01, 1/- ; 1 mfd. Mainsbridge, 1/3.

VAUXHALL.—Centre-tapped, iron-cored I.F. transformers. Mounted on bases, with terminals, 110 kc/s, 6/6.

VAUXHALL.—Colvern G.1, G.2, G.3, or G.1, G.2 and G.3 superhet. type, 30/- ; Colpaks, £2/4.

VAUXHALL.—Volume controls, Erie, Colvern, Centralab, 2/- ; with switch, 3/- ; all values, from 3,000 to 2 meg. ; Benjamin, class "B" transformers, 1-1½ to 1. 6/6.

VAUXHALL.—B.T.H. Minor, 16/6 : Senior needle armature, 29/- : Piezo-Electric, 33/9.

VAUXHALL.—B.T.H. Trusped gramophone motors, 30/- ; Universal D.C./A.C., 47/6 ; sealed cartons.

VAUXHALL.—Collaro 32 model, 32/6 ; Universal model, 47/6 ; complete unit, A.C. 200-250v., first quality pick-ups and volume control, 48/-.

VAUXHALL.—T.C.C., 200 mfd., 10-volt, 3/- ; Continental valve holders for Universal valves, with terminals, 9d.

VAUXHALL.—Clix valve holders, terminals, 7-pin 9d. ; 5-pin 7d., W.B. 5-pin 4½d. ; baseboard mounting, 6d. ; post paid 2/6 or over, or c.o.d.

VAUXHALL UTILITIES, 163a, Strand, W.C.2, over Denny's the Booksellers. Temple Bar 9338. Send postcard for lists free.

HOME CONSTRUCTORS of Coils, Chokes and Transformers should send for lists.—Lumen Electric Co., Litherland, Liverpool 21.

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

ALL goods advertised in last week's issue still available.

WARD, 46, Farringdon Street, London, E.C.4. Telephone : Holborn 9703.

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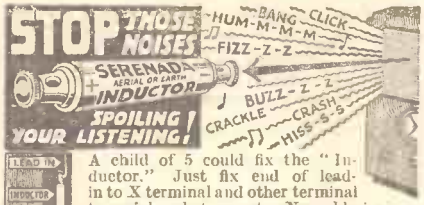

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