TELEVISION, SHORT-WAVE AND BEGINNERS' SUPPLEMENTS

Practical and Amateur Wireless

3d. EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 5.. No. 128.
March 2nd, 1935.

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PRAC. 2/3/35

CIRCULATES ALL OVER THE WORLD!

Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff:
W. J. Delaney, H. J. Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.

VOL. V. No. 128. March 2nd, 1935.

ROUND *the* WORLD *of* WIRELESS

Great Television Revival

OUR postbag indicates an enormous interest in television, and we have received hundreds of letters from our readers relating to various aspects of the new hobby. Thousands of readers are preparing for the opening of the new station towards the end of the year by reading our new series of articles, specially written in non-technical language for the beginner. Many thousands of readers have already reserved copies of the reprinted edition of NEWNES TELEVISION AND SHORT-WAVE HANDBOOK which contains lucid explanations with hundreds of photographs and drawings of the practice and principles involved in the various television systems. The stocks of this reprinted edition are now very low, and you should therefore avail yourself at once of our offer.

The volume is, of course, uniform in style and size with our previous presentation volumes.

Two More Bulgarian Stations

IN view of the increased popularity of broadcasting in Bulgaria, the authorities have decided to instal a 2-kilowatt station at Varna and at Stara Zagora. They will be equipped with studios to permit the transmission of local programmes. As the telephony cable system is not sufficiently developed in Bulgaria for the broadcast of news bulletins and concerts from the capital city, the Sofia transmissions will be taken, when required, by wireless link. The Government has also voted the sum of forty million levas to defray the cost of a station to be built at Ikhtiman, thirty-five miles to the south-east of Sofia.

Temporary Portuguese Station

IN order to carry out the necessary alterations to the Heilsberg transmitter with a view to an increase in the power of the Koenigsberg programmes, the station has been temporarily closed down and replaced for a period, extending until the end of April, by a 17-kilowatt transmitter. As the signals are now weaker, it is an easier matter to pick up the concerts of the CT1GL, Parede (Portugal) station working on the same channel.

On the Free List

IN addition to the granting of a substantial reduction in the cost of receiving licences for schools, free listening permits for the blind, and special dispensations for the unemployed, the German Government has decreed that a further 180,000 persons are to be allowed to possess sets without going to the expense of paying the monthly tax. Lack of means, it is reported, will not be the main consideration for placing those selected on a free list.

London Regional's Unreliable Neighbour

RADIO AGEN (France) which for some time has been seeking a place in the sun, has now moved to 345.6 metres (868 kc/s), a position which, in view of its recent deviations, may not be a source of comfort to London Regional. This channel was allotted to the still non-existent Marrakesh station in French Morocco.

Brussels Will Double Its Power

DURING the course of the year the Belgian Authorities will reconstruct the twin Velthem transmitters with a view to raising the power to 30 kilowatts. The decision to provide 100-kilowatt plants for both Brussels No. 1 and No. 2 is still in abeyance.

Radio Parede (CT1GL)

NOTWITHSTANDING numerous rumours to the effect that the station had closed down, the 5-kilowatt transmitter of the Radio Club Portuguēs is still operating nightly on 291 metres, between G.M.T. 21.00 and midnight. Although the greater part of the programme is destined to Portuguese listeners, announcements are frequently made in French and Spanish. The call is heard as *Rah-dec-oh Par-ay-day*, and the name of the Club (Portuguēs) often accompanies it.

Listen to Cairo

ALTHOUGH the Cairo station broadcasts on the same channel as Brussels No. 1 (483.9 metres, 620 kc/s), transmissions from Egypt can be picked up in the early mornings and sometimes in the afternoon hours. Cairo is on the air at G.M.T. 06.45 daily with physical exercises followed by readings from the Koran in Arabic. At G.M.T. 16.30 and at 22.00 a time signal is given by dots similar to those relayed by the B.B.C. from Greenwich. The call put out by the station is usually in both English and French.

Manchukuo on the Air

MTCY is the call sign of the new 100-kilowatt broadcasting station at Kuangchengtzu, near Ksinking, the capital of Manchukuo. Transmissions on 535 metres are made daily between 22.00-14.30, an English news bulletin being sent out at G.M.T. 13.40. The station is operated by the Manchukuo Telephone and Telegraph Company.

Still Crystal Gazers

ALTHOUGH Poland possesses a population of some thirty-two millions, and eight broadcasting stations, there are only roughly 324,000 radio receivers in the entire country—of these some 117,000, or 36 per cent., are primitive crystal sets.

"Both Sides of the Shop Window"

THIS is the title of a discussion on modern standards of quality and display which listeners in the West will hear between J. Ralph Edwards, representing potential purchasers, and Crofton E. Gane, representing manufacturers, on March 4th.

Dance Songs from Midland Regional

DANCE songs from eight countries will be sung in a Midland recital on March 9th, by Mavis Bennett-Levin, a well-known Midland soprano, who recently broadcast a programme of Jenny Lind songs.

ROUND the WORLD of WIRELESS (Continued)

A New Wireless Station

A NEW wireless station has recently been completed at Kimberley, in South Africa. This station has two masts 70ft. in height, and will have the latest equipment for long- and short-wave reception and transmissions as well as a direction-finding apparatus.

Listen to North Africa

SINCE January 20, Radio Maroc, at Rabat (Morocco) has increased its power to 25 kilowatts, and may now be heard nightly on 499.2 metres (601 kc/s) between Florence and Vienna. The station, as a rule, works until G.M.T. 23.00, but on some nights will still be found on the air at midnight. Native Arab concerts are usually broadcast towards G.M.T. 19.00. With the exception of these special transmissions, all announcements are made in the French language.

The Re-discovery of America!

EVERY Saturday afternoon, as from February 16th, the B.B.C. will relay a programme from the National Broadcasting Company of America. Hitherto for these purposes the transatlantic telephone service has been used, but, following satisfactory tests, in future the broadcasts are to be taken through the B.B.C.'s own receiving station at Tatsfield. The intention is to give British listeners—and others—an opportunity of listening to the American morning radio entertainments. The relay is timed to take place regularly at G.M.T. 16.45, corresponding to 11.45 a.m. Eastern Standard Time.

A New Wired-wireless System

FOR its radiodiffusion services of the broadcast entertainments, the German authorities have been trying out the superimposing on the telephone network of three separate transmissions on channels varying between 1,000 and 2,000 metres. By this means telephone subscribers may listen to any of these programmes by means of their ordinary wireless set. If desired, an outdoor aerial may still be used for the reception of other radio transmissions. Experiments of this nature are now being carried out in various parts of Germany.

"Theatre Royal"

AN excerpt from "Theatre Royal," Noel Coward's production at the Lyric Theatre, has been chosen for the next programme, on March 1st, in the series called "From the London Theatre." Marie Tempest, Madge Titheradge, Robert Douglas, and a supporting cast will come to a studio to broadcast a scene from the play for Regional listeners.

Carillon Music

CARILLON music will be discussed on March 6th, by George Cadbury, with illustrations by Clifford Ball, relayed from the carillon at Bournville. This carillon was founded by the late George Cadbury, and extended by gifts from his son, who is taking part in this programme, and his widow, Dame Elizabeth Cadbury. It now consists of forty-eight bells, ranging in size from 12lbs. to 3¼ tons, and has the largest compass of any in this country. It was the first carillon to be made by an English bellfounder, the first to be recorded for the gramophone, and the first to be broadcast.

INTERESTING and TOPICAL PARAGRAPHS

BETWEEN THE TURNS

Renee and Billie Houston, the famous radio and stage stars, while away the time before their turn, with their new Cossor receiver.

Novel Dance Music Programme

DANCE music lasting forty-five minutes without a vocal refrain is a novelty which Howard Jacobs and his Orchestra will introduce on March 5th. Solos will be a feature of the programme, but these will be instrumental in place of the usual vocal. The orchestra will play popular music and when the refrain is reached a solo instrument, which may be a saxophone, a violin, or a trumpet, will be heard instead of a voice. Every soloist will be a virtuoso.

Stanton Ironworks Band

IN the Midland Regional programme on March 4th, John Turner conducts the Stanton Ironworks Band in a popular programme, and J. W. Mallard, of Smethwick, tells Black Country stories in the interlude.

"Standard English"

A MOST interesting subject has been chosen for "Conversations in the Train" on March 16th—"Standard English." The cause will be championed by one who is well-known to listeners, and the other characters in the railway compartment will be an American visitor to England and an English countryman speaking in dialect.

Broadcast Plays During March

PLAYS to be broadcast during March include two written specially for the microphone, a Shakespearean comedy, a Tchekov production, and "Ambrose Applejohn's Adventure," a comedy by Walter Hackett which ran for many months at a London theatre with the late Sir Charles Hawtrey in the name part. Peter Creswell will produce "The Taming of the Shrew" on Sunday, March 10th, and in the same week "The Three Sisters," by Tchekov, will be broadcast, Barbara Burnham producing. The plays specially written for broadcasting are a dramatisation of Sir Walter Raleigh's "Last Voyage" and "Charlemagne," by Mirande.

Village Life Broadcast

VILLAGE life of the present day in its various aspects, and the effect upon it of such recent changes as the growth of the motor bus service, will be the subject of a discussion in the Midland programme on March 4th. Those taking part in this broadcast are Geoffrey Boumphrey and Graham Castle.

"Weather Forecast"

THIS is the title of a dramatic talk, by J. S. A. Salt, which will give listeners an impression of how the weather forecast is made. The talk will be broadcast on the National wavelength on March 9th. After a short reconstruction of the history of weather forecasting, listeners will be given a demonstration of how reports come into the Meteorological Office from all parts of Europe, and from ships crossing the Atlantic. An explanation will follow of how from these reports a weather map is prepared every morning, and how the weather forecast, which the announcer reads at the microphone, is compiled. The immense amount of work behind this very important service is full of interest and inherent drama.

SOLVE THIS!

Problem No. 128

The two-valve battery receiver which James was using had suddenly developed a peculiar scratching sound at one point on the tuning scale. He thought that this was, perhaps, due to condenser vanes short-circuits, and accordingly proceeded to test the receiver to that end. He connected a voltmeter in series with a 1.5-volt cell and joined this across the two terminals on his variable condenser. He found that a reading was obtained on the meter, no matter where the condenser was adjusted, and he therefore assumed that the condenser was shorting. What was wrong with his test? Three books will be awarded for the first three correct solutions opened. Mark your envelopes Problem No. 128 and address them to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received by the first post Monday.

Solution to Problem No. 127

The choke was of such a size that it had an extensive field. Its position in the receiver caused the field to interact with that of the grid coil and thus caused oscillation, irrespective of that which was caused by the reaction circuit proper. The choke should have been mounted at right angles, or screened.

The first three correct solutions opened in respect of Problem No. 126 were from the undermentioned readers, and books are being forwarded to them: M. Elsen, 2, Carlton Street, Liverpool, 3; R. F. Alden, 185, Henley Road, Ilford, Essex; R. Press, 75, Effingham Road, Hornsey, N.8.

IMPORTANT NEW SERIES

TELEVISION FOR ALL—3

Cathode-ray Tube Television

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

LAST week readers were given a general survey of the reception of high-definition television signals, but since this involves so many new conditions, when compared to everyday wireless listening, it is necessary to sectionalise the equipment involved, and in this way appreciate how the individual parts perform their own specific function.

Perhaps the most unfamiliar part of the equipment, which is shown so well as an artist's pictorial impression in Fig. 4 in last week's article, is the cathode-ray tube itself. This component, wholly electrical in its operation, that is to say, it includes no mechanical moving parts, has proved, up to the moment, the only really satisfactory item for reproducing at high efficiency the proposed 240-line television images which are to be radiated from the television station when it is built.

In Passing

It should be said straight away, however, that while cathode-ray tubes hold a rather undisputed position for this work now, it is not a natural corollary to assume that this will always be so. It certainly is difficult to conceive how a mechanical substitute can carry out a similar task with the same results, but I am sure that this condition will not pass unchallenged by protagonists of other mechanical or electrical methods. This form of healthy competition will stimulate further improvements in every direction, so that lookers will in this way reap considerable benefit and hasten the day when "perfect" results will give complete satisfaction to the greatest majority.

It must not be imagined that a cathode-ray tube takes only one form. Just as in the case of wireless valves, so there are several types manufactured for certain specific purposes, and every tube is not suitable for building up high-definition television pictures. Some tubes are filled with gas to give internal ionisation, while others are completely evacuated. The *general* principles of operation are the same, however, so these will be discussed first and suggestions can then be made for the choice of the best types of tube which can be employed to give really good results.

Electron Emission

In the ordinary course of events a specially-shaped glass envelope encloses the whole electrode assembly. The shape of this is such that a long cylindrical section encloses the individual electrodes (there are several of them) and at the end it takes on a pear shape to terminate in an almost flat circular end which acts finally as the viewing screen.

The essential electrodes of these tubes are shown in the top compartment in Fig. 4 (previously referred to), and taking these separately the first is the cathode or filament. This is a thick oxide-coated filament through which is passed a steady direct current of just under an ampere as a general rule. This brings about an action identical to that taking place in the receiving valves of your own radio set. The flow of current is really an electron movement (it is as well to remind readers that electrons are really minute particles of negatively charged electricity) in the wire, and this movement is so violent that many of the electrons overcome the wire's surface tension, and are "boiled off" or escape, just the same as vapour will rise from the surface of a boiling liquid.

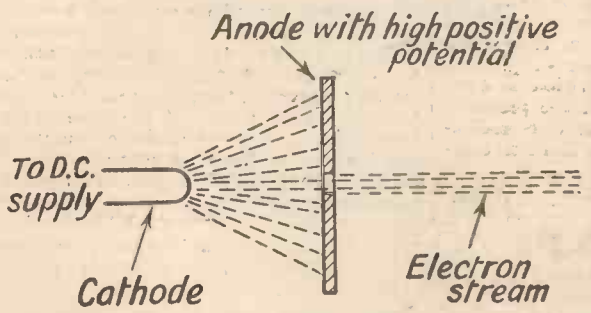


Fig. 1.—Indicating the effect of the anode on the electrons.

Producing an Electron Beam

If left in this condition the electrons would merely return to the filament surface, this agitation or movement continuing all the time a current is made to flow through the cathode. It is necessary to remove some of these electrons, however, and here again we "borrow" from valve technique by placing in front of the filament an anode in the form of a circular disc, to which is applied a high positive potential. This will attract the free electrons to its surface just the same as the anode or plate of a receiving valve, as shown in Fig. 2.

The real function of this electrode is, however, not a "collector" of electrons, but really an accelerator of electrons. That is to say, it attracts these negative particles of electricity away from the filament not with the purpose of making them flow in any external circuit, but to direct them forward with an extremely high velocity towards the belled out front end of the tube.

Now it is essential that the beam or stream of electrons which pass forward in this manner should be of narrow section, or, what is a better way of expressing the condition, they must be "focused" to a small "point" sectional area on the front screen. This is done in a dual way. First of all, the anode is pierced at its centre with a small orifice so that electrons can pass right through it, as shown in Fig. 1. The diagram shows, however, that many of the electrons are lost in so far as their passage through the hole is concerned.

Focusing

To neutralise this a focusing electrode or gun (often referred to as the Wehnelt cylinder, after the first scientist who developed the idea) is interposed between the filament and the anode. Actually, this cylinder surrounds the filament as a shield, and if a negative potential is applied to it the effect will be to produce a "repulsive" field as far as electron divergence is concerned. The electrons are in this way concentrated or directed in a stream towards the anode aperture (see Fig. 3) where they immediately come under the influence of the positive potential applied to it, and are thereby accelerated at an enormously high speed through the orifice to pass towards the front screen as a beam.

The front screen is the large, nearly flat, glass surface, the interior of which is sprayed carefully during the course of manufacture with a chemical preparation, which, when dry, gives the appearance of a light greyish paint. Owing to the extremely high velocity of the electrons they cause the screen to fluoresce or glow brightly at the point of impingement. Provided the potentials applied to the shield and anode have been adjusted correctly in relation to one another, then the glow is limited to a minute area of light where the beam is focused on to the screen.

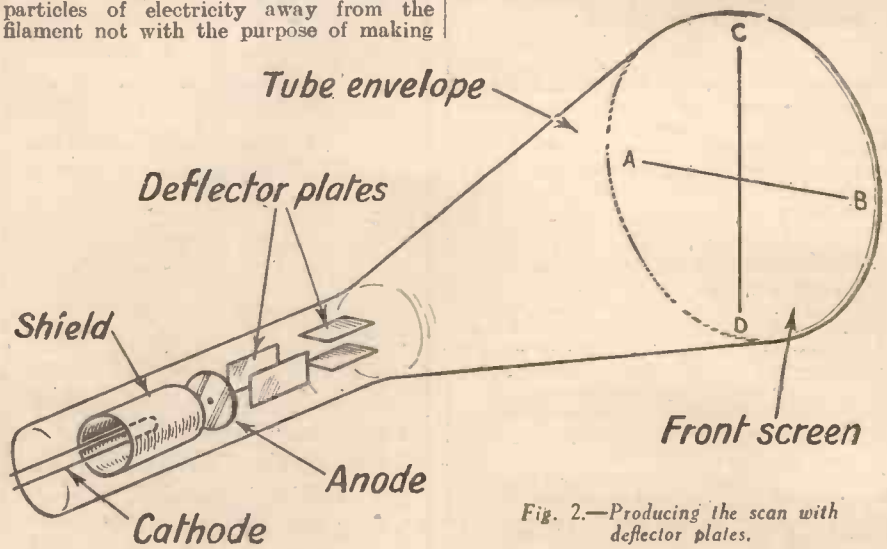


Fig. 2.—Producing the scan with deflector plates.

856

Moving the Spot

This is really the scanning spot, whose function is to carry out a movement geometrically similar to the scanning operation at the transmitting end, and so build up a picture in terms of light intensity variations. The next thing to consider, therefore, is the method employed to control the position of the spot throughout the whole scanning operation. In practice this is effected by static or magnetic

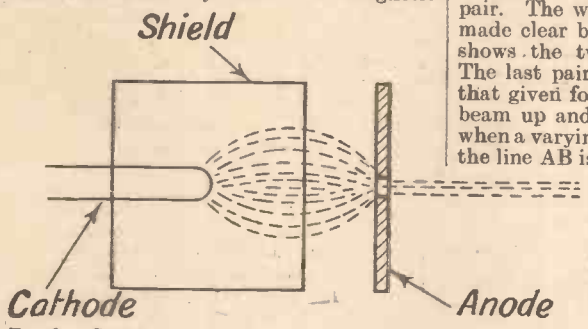


Fig. 3.—Showing the "focusing" effect produced by the shield.

deflection. Each method has its own particular advantages (and disadvantages), but for the purpose of explanation the static deflection scheme will be described.

Consider for a moment what the cathode-ray tube is doing with the arrangements we have just detailed. The cathode shield and anode have brought into action a steady stream of electrons moving at high velocity towards a screen which fluoresces at the point where the electrons strike the interior surface. This is equivalent to a water hose with a fine nozzle, where the high pressure of water forces it out of the nozzle orifice so that it can be directed in a straight stream, say, against a wall. To cover the wall with water it would be necessary to move the nozzle with the hand so that section by section the water impinged on the wall surface, these sections being chosen haphazardly or in well-defined "lines."

Static Deflection

Reverting to our electron stream we could, of course, move the electrode system bodily within the tube to give this screen coverage in the same way as our garden hose, but the complications introduced by a scheme of this character would be enormous. The very nature of the electron stream, that is, moving negative particles of electricity, provide the clue to the easy solution of our problem. Suppose that near the anode, but between the anode and the screen, is placed vertically a pair of metal plates so that the electron stream passes between the plates on its way to the screen. Without any potential applied to the plates, and hence no field of static lines of force between them, the stream of electrons will be undisturbed and continue to pass to the same point on the screen.

A potential applied to the plates, however, will cause the beam of electrons to move to the left or to the right according to the direction of the static field. If, therefore, the potential is varied continuously (say, for example, by the application of a sine wave voltage) the beam will move to and fro in a horizontal direction in sympathy with these voltage variations. This will cause the spot on the screen to trace out a horizontal line, and if the voltage variations are fast enough, the spot will move to and fro so rapidly that the eye will receive the impression of a continuous line of light owing to the phenomena known as persistence of vision.

Double Movement

To give a complete scanning motion, however, it is necessary to impart a vertical movement to the spot of light. This is effected very simply by placing a second pair of small rectangular metal plates between the first deflector plates and the anode, the mounting of these plates being horizontal or at right angles to the first pair. The whole scheme of things will be made clear by a reference to Fig. 2 which shows the two pairs of deflector plates. The last pair, from a reasoning similar to that given for the first pair, will move the beam up and down in a vertical direction when a varying potential is applied. Hence, the line AB is derived through the medium of the vertical deflector plates, while the line CD results from the horizontal deflector plates.

In television parlance we say that the vertical plates give the high-frequency scan or line definition, while the horizontal plates bring about the low-frequency scan which is equivalent to the number of pictures per second used in the television system. To take the concrete case of the proposed high-definition television service recommended by the P.M.G. television committee we have 240-line definition and 25 pictures per second. The frequency of the L.F. scanning potential is therefore 25 per second, this being applied to the horizontal plates, while in the case of the high-frequency scan this becomes 240 by 25, that is 6,000. Ways and means for bringing about this double effect must be devised and this will be explained in next week's issue.

CATHODE-RAY TUBE COATING

THE new and specialised technique which is now being developed in connection with cathode-ray tube manufacture and use is intensely interesting. Coupled with this is the fact that at the moment it seems highly probable that these electron image devices will serve as the medium for producing the initial high-definition television pictures. Any special feature in connection with them, therefore, should be studied by readers so that when the appropriate time comes they will at least be familiar with the devices, if only from a theoretical standpoint.

With ordinary thermionic valves it is not possible to see the electrode assembly with most types, owing to the silvered appearance of the inside of the glass envelope resulting from the process known as "gettering." If a cathode-ray tube is examined a similar opacity will be observed, but for an entirely different reason. It is quite a common procedure in C.R. tube manufacture, the internal coating of the glass walls extending from the narrow neck of the tube at the base right up to the bell-shaped mouth at the far end to the edge of the screen of fluorescent material. This coating is actually a conducting layer, being brought into play frequently in connection with the focusing on to the screen of the stream of electrons emitted from the incandescent cathode.

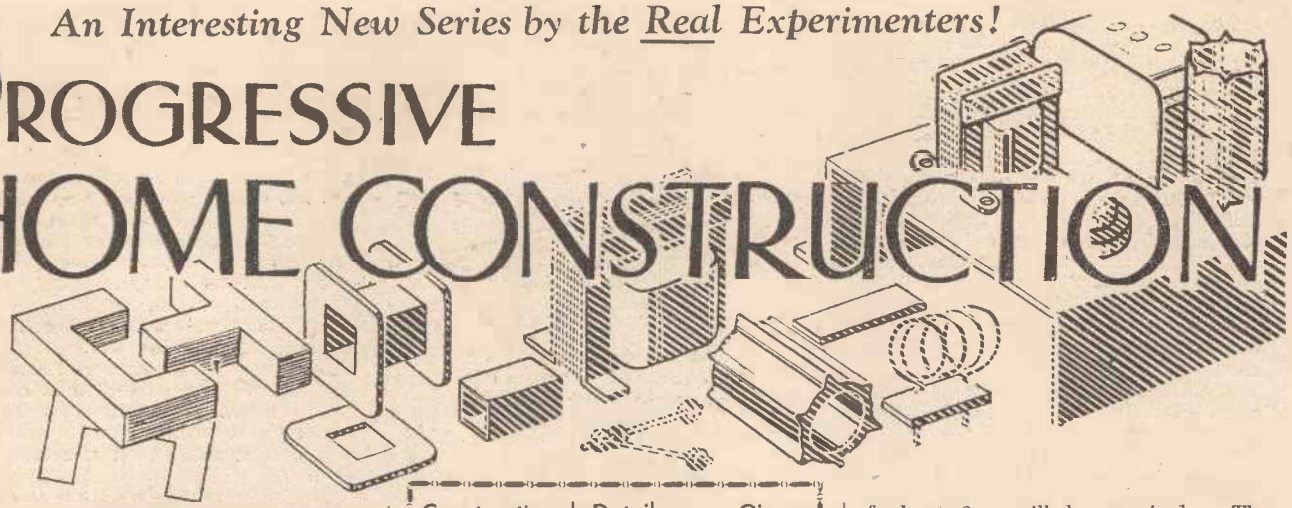
If this internal layer has a bright surface it can quite frequently cause trouble, owing to the light reflections which inevitably occur. It is for this reason that recourse is made to a proprietory product called "Aquadag," which in effect is colloidal graphited water containing about 20 per cent. by weight of graphite. This is deposited on the glass of the tube, and results in a rather dark matt surface, which is quite opaque but electrically conductive.

When used in this colloidal form it adheres very readily to the glass in the form of a film of uniform thickness, the desired depth being governed very easily in the coating operation by controlling the concentration of the graphite employed (the Aquadag in use is generally diluted with a quantity of electrolyte-free water) and also the number of coatings applied.

The process of coating is really quite a simple one, although of course due precautions must be taken to see that the solution is quite free from impurities. Each film on the glass is formed by syphoning the liquid from a chamber into the C.R. tube, having suitable air vents and overflow pipes to govern exactly the height to which the liquid will rise. When more than one coating is to be applied it is best to let each layer dry before another is given, the drying process being carried out by passing warm filtered air into the tube. Quite apart from the electrical properties imparted by this dark matt coating it is generally conceded that the appearance of the cathode-ray tubes are enhanced also.

An Interesting New Series by the Real Experimenters!

PROGRESSIVE HOME CONSTRUCTION



Constructional Details are Given for a High Tension Battery Eliminator for D.C. Operation, all the Chief Components being Home-made

by The Experimenters

LAST week we finished the description of the L.F. amplifier, and before going on to describe the construction of the parts for an H.F. unit, we thought it better to deal with the construction of an H.T. battery eliminator. There will naturally be some readers who require an eliminator for operation from D.C. mains, whilst others will wish to feed the unit from an A.C. supply. So that both requirements may be met we will start by describing a D.C. unit, later dealing with the additional parts needed to convert it for A.C. In order to make this matter perfectly clear, perhaps we ought to explain that an A.C. unit actually comprises a D.C. unit with the addition of a mains transformer and rectifier; consequently, all of the parts specified for the simpler model will be required for the other one.

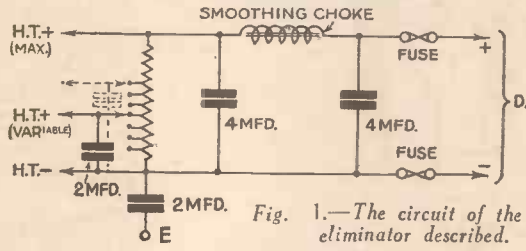


Fig. 1.—The circuit of the D.C. eliminator described.

An H.T. battery eliminator to operate from direct current is a particularly simple piece of apparatus, consisting of nothing more than a smoothing choke, two or more smoothing condensers and the necessary resistances for providing different output voltages. The circuit of the simple unit to be described is given in Fig. 1, where the parts are marked for easy identification by those readers who are as yet unfamiliar with theoretical diagrams.

Alternative Voltages

It will be seen that a tapped resistance is connected in parallel with the output leads, and the purpose of this is to provide any particular voltage that may be required between the maximum and zero. This tapped resistance is generally referred to as a potential divider, for obvious reasons; and although this system of variable voltage supply is not now widely employed, it is the best for our particular purpose, since it simplifies the constructional work. As shown, the circuit has provision for one variable tapping only, this being in addition to the maximum voltage point for feeding large power valves, but any number of additional tappings could easily be provided by using the extra connection shown in broken lines.

Making the Smoothing Choke

But it is time we started to consider the constructional work, for there is a good deal to be done. The components that we shall have to make are the smoothing choke, potential divider, and fuses, since it will be practically essential to buy the smoothing condensers ready made, for reasons explained last week. Suppose we start with the choke, because this is made in almost exactly the same manner as the L.F. transformer described last week. The choke requires to have an inductance of approximately 25 henries when carrying the full output current—in the present instance about 20 milliamps will be ample, this being sufficient for the average three-valve battery receiver. The choke can therefore be made by using three dozen No. 5 stalloy stampings, like those for the L.F. transformer, for the core. A winding spool like that described last week, but without the central "cheek," will also be required, and this should be filled with 40-gauge enamelled wire, of which a total of about 6oz. will be required. There is no need to describe the method of winding, since this is exactly as in the case of the transformer. The same remarks apply to the fitting of the core stampings and the provision of a terminal plate, although in the present instance only two terminals will be required.

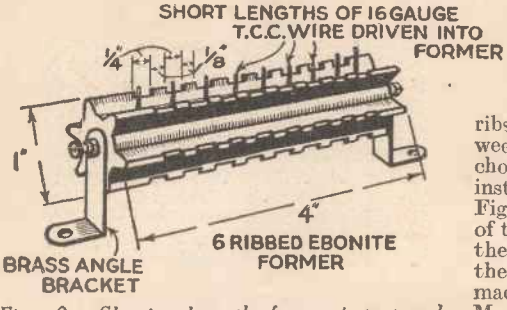


Fig. 2.—Showing how the former is prepared for the potential divider.

We should mention in passing that the whole of the current passed through the smoothing choke will not be available for high-tension purposes, since there will be a "waste" of about 8 milliamps across the potential divider. If, therefore, it is desired to have an output in excess of about 12 milliamps it will be necessary to use a choke of larger size, and this might well be made round a core consisting of No. 4 stalloy stampings. The method of making such a choke was fully described in the issue of PRACTICAL WIRELESS dated December 23rd, 1933, and we would ask those readers who are interested to turn up that back number; if it has been misplaced, a copy can be obtained from The Back No. Dept., Geo. Newnes, Ltd., Exeter Street, Strand, London, W.C.2, for 4d. post paid.

The Potential Divider

Attention can now be turned to the potential divider, and this component can be made fairly easily by winding approximately 1oz. of 40-gauge silk-covered nickel chrome resistance wire on a ribbed ebonite coil former. The ribs must be slotted, as described three weeks ago in connection with the H.F. choke, but there should be eight slots instead of six; dimensions are given in Fig. 2. Terminals are fitted to the ends of the former exactly as for the choke, but these are used as a means of mounting the component on small angle brackets made from strip brass, or taken from a Meccano set.

A number of tappings are required, and

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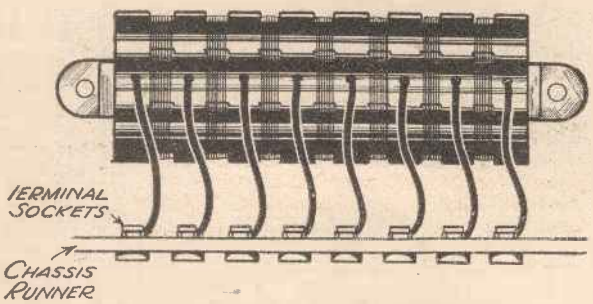


Fig. 3.—Showing how the potential divider is mounted on the underside of the chassis and flexible leads taken from the tappings to terminal sockets mounted on the chassis runner.

PROGRESSIVE HOME CONSTRUCTION

(Continued from previous page)

some simple and reliable method must be devised for making these, especially since the fine wire we are using is so easily broken. The best method is to fit a number of short lengths of 16-gauge tinned copper wire into the former at various points, as shown in Fig. 2. This is done by drilling 1/32in. holes into the ebonite, roughly tapering the ends of the short lengths of d.c.c. wire, and driving these into the holes. It will be found that a tight fit can be obtained in this way, and that the tapping leads will remain firmly in position, even when connections are subsequently soldered to them.

With regard to the winding of the resistance wire, this is quite simple by comparison with the winding of the L.F. transformer and smoothing choke. If the slots in the former have been made about ⅛in. deep the wire will just about fill the eight of them, but there is no need to count the turns, provided that approximately the same amount of wire is wound in each section.

Winding and Tapping

Start by carefully baring the end of the wire, either with the blunt edge of a knife blade, or by burning off the silk covering with a lighted match, and then bind the bared end round the first projecting length of 16-gauge wire. Do not solder it yet, but proceed to wind on the resistance wire until the first slot is nearly full. Then, *very carefully*, bare the wire for about 1in., without cutting or breaking it, and wind the bared portion round the second projecting lead. Again continue with the winding, repeating the tapping process at the end of each section. It might be found as the end of the former is reached that too much or too little wire has been wound in the earlier slots; even if this is so it does not matter very much, and the remaining wire can be divided out among the later slots.

When the winding is complete apply a trace of non-corrosive flux (Fluxite, for example) at the points where the resistance wire has been bound round the tapping leads and then *quickly* touch each of these points with a well-tinned, hot soldering iron.

The resistance unit can next be mounted on the eliminator chassis as shown in Fig. 3. As may be seen, leads are next taken from the tappings on the potential divider to terminal sockets fitted to one of the chassis runners. These sockets may be Clix or Belling Lee, and should be provided with insulating washers. Connections from the tappings to the sockets are made by means of short lengths of flex soldered to the projecting leads on the potential divider.

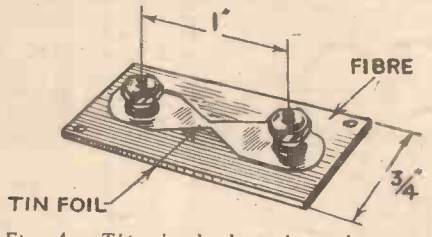


Fig. 4.—This sketch shows how the mains fuses can easily be made.

Here again, care must be taken in soldering the leads to ensure that the iron is hot and is applied only for a few seconds.

Mains Fuses

The two fuses in the mains leads may be made next—unless the constructor prefers to buy them in ready-made form, or to employ a couple of flash-lamp bulbs mounted in suitable holders. They can easily be made, however, by using a strip of tinfoil held between two terminals mounted on a strip of fibre, as shown in Fig. 4. The tinfoil should be cut away in the centre until the junction is as thin as possible, and to ensure that it will melt should the current rise to more than ¼ amp. or so. These fuses are only to protect the smoothing choke and mains supply in case of a short circuit, and should be additional to any safety fuse fitted in the receiver itself.

The method of connecting the various parts is shown in Fig. 5, the components are not shown mounted, since the size of the chassis will depend upon whether or not the A.C. portion (mains transformer and rectifier) is to be added later. If the unit is for D.C. use only, a chassis measuring approximately 10in. by 8in., and having 1½in. side runners will be suitable, but the complete A.C. eliminator will require a chassis just about twice this size, if the rectifier units to be described next week are employed. Alternatively, the present unit may be made up as shown, and the A.C. section added later as a second small unit.

It will be seen from Figs. 1 and 5 that a fixed condenser is included between the negative H.T. lead and earth; this may not be essential, if the negative lead is earthed, but it is always desirable as a safety measure. When the condenser is included, the earth lead should be transferred from the terminal provided on the receiver to the appropriate terminal on the condenser.

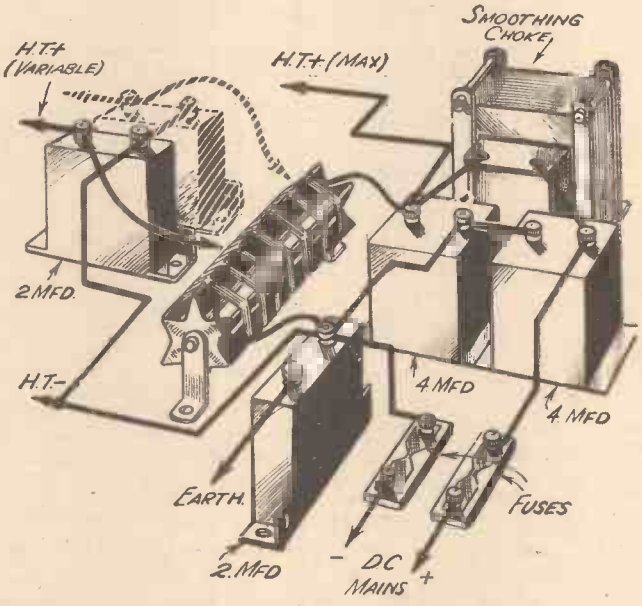


Fig. 5.—A pictorial diagram of the circuit shown in Fig. 1, showing the connections to the various components.

The Smoothing Condensers

All the smoothing condensers shown should be rated at not less than 250 volts working when the unit is for D.C. only, or not less than 350 volts working when the A.C. unit is being made. Any good make of condensers may be used, but it is important that they should be of reputable British make—"cheap and nasty" foreign condensers will rarely stand up to their rated voltages.

With regard to the voltages to be obtained from the various tappings, it can be taken that the voltage from any particular tapping point will be very approximately in proportion to the distance of that point from the positive and negative ends of the potential divider. For example, the middle tapping would provide about half the total (mains) voltage, the third tapping from the positive end (after the second winding section) would provide a voltage of about two-thirds the mains voltage, and so on. The tappings may be used for feeding the anodes of detector, H.F. or L.F. valves, as well as for feeding the screening grids and auxiliary grids of S.G. valves and output pentodes.

CIVIL AVIATION WIRELESS PLANS

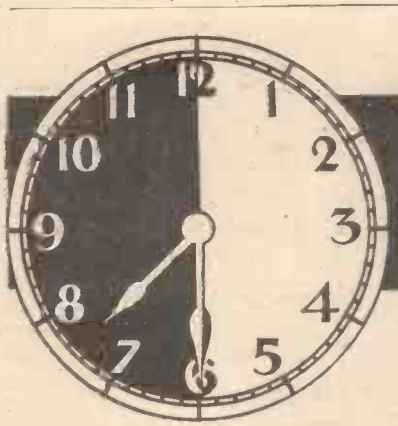
ACCORDING to a recent announcement by the Air Ministry, plans have been approved for the establishment of new civil aviation wireless stations in this country which will provide openings for a substantial number of experienced wireless operators. For the present, applications will be entertained only from time-expired wireless operators of the Royal Air Force who have extensive practical experience of direction-finding, ground stations, radio telephony and telegraphy, and general maintenance of wireless. Good rates of pay are offered. Applications should be addressed to the Secretary, Air Ministry, Kingsway, London, W.C.2. The detailed plans referred to provide for the establishment of a chain of wireless stations throughout the country so as to afford full facilities for direction finding, for communication with aircraft, and between airports.

Six More!

Three new stations came into operation last year at Hull, Portsmouth, and Newtownards (Belfast). A further six are under construction and will be placed at suitable sites during 1935. These sites are being chosen with the object of providing a direction-finding network covering the new internal routes, as well as to serve the needs of individual aerodromes. As the exact course of the development of new air lines in Great Britain cannot at this stage be accurately predicted, the wireless equipment will be mounted on vehicles capable of being easily moved from place to place.

At Heston

In addition to these mobile stations, a limited number of permanent stations of higher power are to be erected. The first of these will be established at Heston Airport to relieve the growing congestion at Croydon. It is also the intention of the local authorities to build a station in the Channel Isles.



Half-Hour Experiments

The Subject of this Week's Article is Automatic Volume Control

By Frank Preston

ALTHOUGH there have been several previous articles dealing with the subject of automatic volume control, there is still plenty to be written on this subject, especially for the experimenter. It is well known that there are many different methods of fitting A.V.C. to a receiver, and it is interesting to try the various systems and to compare the results obtained, preferably making notes of these

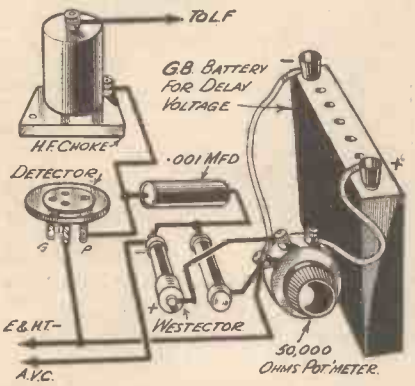


Fig. 2.—This skeleton pictorial circuit shows how the arrangement illustrated in Fig. 1 can be modified to provide delayed A.V.C.

in the log book which every experimenter should keep.

In this series the aim has been to describe interesting tests and experiments that could quickly be made, and so the present article must not be considered as a complete guide to A.V.C., but rather as an attempt to show where experiment is desirable, and to show how some of the simpler forms of A.V.C. may be tried out.

Limitations of A.V.C.

In the first place it should be pointed out, mainly for the benefit of the less-experienced experimenter, that automatic volume control can only be applied to receivers having at least one stage of high-frequency or intermediate-frequency amplification. It is, in fact, not possible to get a very valuable amount of A.V.C. action without the use of two H.F. stages. Nevertheless, the principle of automatic volume control can be applied to the simplest of sets in which a variable-mu valve is fitted. The most convenient arrangement for the preliminary trial is that shown in Fig. 1, where it will be seen that a fixed condenser and a WX6 "Westector" are connected in series between the anode of the detector valve and earth, a fixed "load" resistance of 100,000 ohms being connected in parallel with the high-frequency metal rectifier. A lead is then taken from the "top" end of the rectifier to the lead (from the tuning coil) that previously was joined to the slider of the variable-mu potentiometer.

How the Circuit Functions

This circuit arrangement is well known and is by no means new, but there are doubtless still many constructors who have not tried it for some reason or other. The principle of operation is very straightforward and simple, being as follows: A certain amount of the high-frequency energy in the anode circuit of the detector valve passes through the .001-mfd. fixed condenser to the "Westector"; here it is rectified in the normal manner, so that one end of the rectifier becomes negative with respect to the other. In other words, a D.C. voltage is developed across the

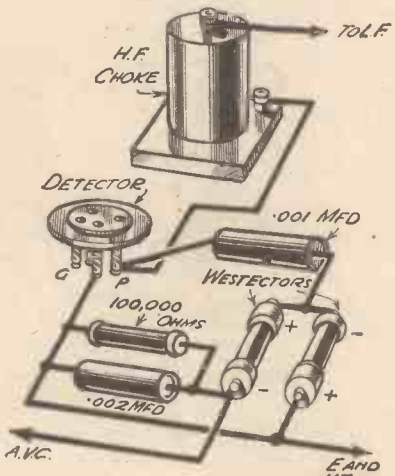


Fig. 3.—A greater measure of A.V.C. can be obtained in a single H.F. receiver by using the "voltage-doubler" rectifier circuit shown here.

rectifier, and the extent of this voltage depends upon the intensity of the signal currents in the detector anode circuit. Thus, as the signal intensity increases, the voltage between the ends of the rectifier increases, and *vice versa*. And since the latter voltage is applied to the grid of the variable-mu valve in the form of negative bias, the bias increases in the same proportion as does the output from the detector valve. It is known that the amount of amplification provided by the variable-mu valve varies inversely as the grid-bias voltage, and it can therefore be seen that the function of the circuit is to reduce the degree of amplification on stronger signals.

The main objection to this, however, is that the rectifier causes a certain loss of energy due to its by-passing a certain amount of the useful signal current in the detector anode circuit to earth. It does this on all signals, whether strong or weak, and thus affects the range of the receiver to a certain extent. At the same time this loss may not be very great, and probably no more than that which occurs when a fixed anode by-pass condenser of about .0003 mfd. is employed. The A.V.C. circuit does, however, cause the H.F. valve to be biased on all signals, and thus limits the degree of amplification available on weak stations.

Delayed A.V.C.

This trouble can to a large extent be overcome by arranging that the A.V.C. action is delayed, or not applied until the output from the detector reaches a certain value. To delay the application of additional negative bias to the variable-mu valves it is only necessary to con-

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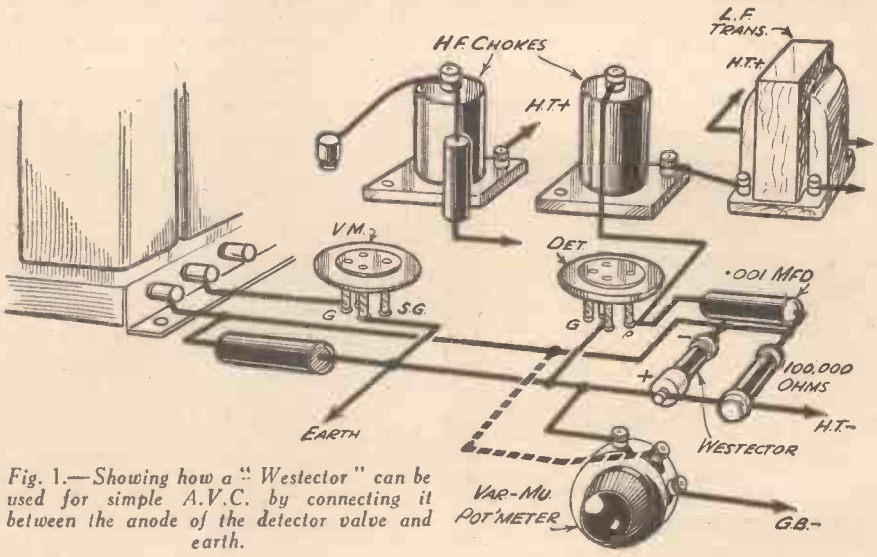


Fig. 1.—Showing how a "Westector" can be used for simple A.V.C. by connecting it between the anode of the detector valve and earth.

(Continued from previous page)

nect a battery of suitable voltage in series with the "Westector," the poles of the battery being so connected that the voltage "opposes" that provided by the rectifier. The idea is shown in Fig. 2, where a potentiometer is wired in parallel with the "delay" battery, so that the exactly-correct voltage may be found by trial.

In trying out the two simple arrangements described above, it is important to

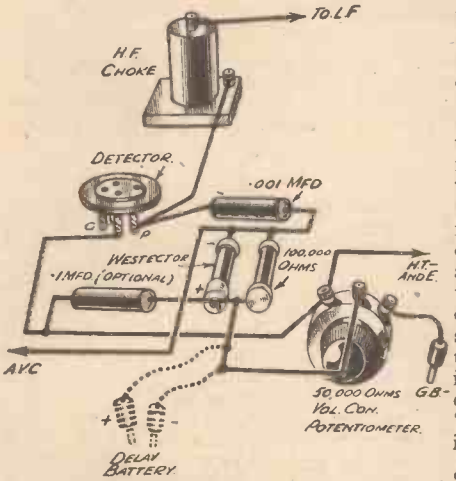


Fig. 4.—Manual and automatic volume control can be obtained by using the connections shown here.

disconnect any by-pass condenser connected from the anode of the detector to earth, and to disconnect one set of fixed vanes of the differential reaction condenser, where this is provided. If this were not done the condenser would be in parallel with the rectifier and would therefore "rob" the latter of the H.F. current which should feed it.

The very simple A.V.C. circuits described above will not prove very satisfactory in the case of a receiver having only a single H.F. stage, because the bias voltage developed will be insufficient to reduce the amplification of the valve by the necessary amount. A somewhat greater bias voltage may be obtained by using the circuit shown in Fig. 3, and in which two "Westectors" are used in series to provide a "voltage-doubler" arrangement. The bias voltage obtained by using this circuit is nearly twice as great as that provided by the previous arrangement, so that fairly satisfactory control can often be secured even when only a single variable-mu valve is employed, provided that this is of the high-amplification type. In this circuit arrangement, as in those previously mentioned, a delay action can be introduced by inserting a grid-bias battery between the positive end of the "lower" H.F. rectifier and earth.

Combined Automatic and Manual Control

One of the objections to adding A.V.C. by one of the methods described above is that the manual variable-mu volume control is dispensed with. There is no reason why this should be so, however, for it is possible to combine the manual and automatic controls quite easily. In the case of a mains set, of course, the manual control is provided by means of a variable resistance connected in the cathode lead from the variable-mu valves, and therefore that portion of the circuit remains unaltered when A.V.C. is added. The position is rather different in a battery receiver, but one method of combining the manual and automatic controls is that shown in Fig. 4, where it will be seen that the positive end of the "Westector," and also the corresponding end of the load resistance, is joined to the slider of the bias potentiometer instead of directly to earth. When it is desired to have a delayed action, the "delay" battery may be inserted as indicated by broken lines.

Superhet Arrangements

The particulars given above and the circuits suggested may be used equally well with either a "straight" receiver or

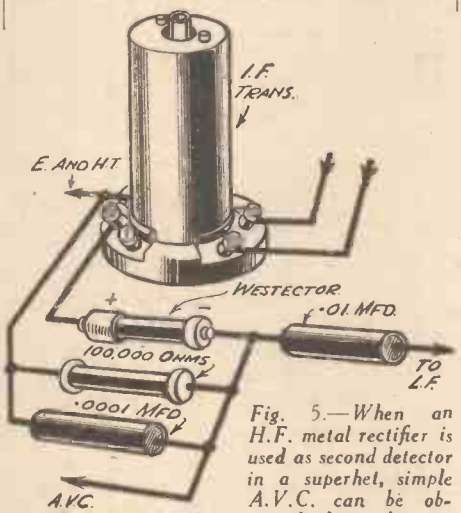


Fig. 5.—When an H.F. metal rectifier is used as second detector in a superhet, simple A.V.C. can be obtained by taking a lead from the negative end to the grid circuits of the V.M. valves.

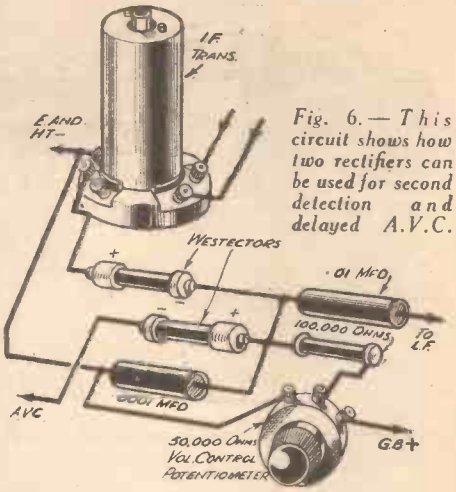


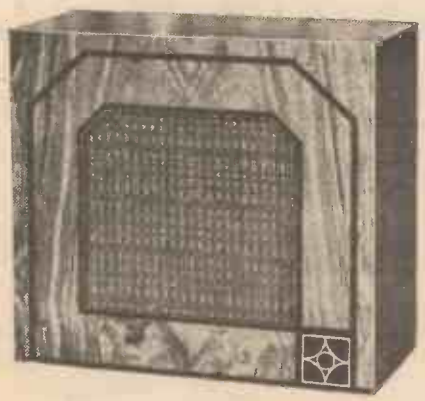
Fig. 6.—This circuit shows how two rectifiers can be used for second detection and delayed A.V.C.

with a superheterodyne, although in the latter case an even simpler circuit arrangement is possible, for the H.F. rectifier can be used in place of the second detector valve, the circuit being as shown in Fig. 5. Here the "Westector" acts as both the second detector and the A.V. control, thus effecting an economy. The A.V.C. may be applied to the intermediate-frequency valves and also to a pre-detector H.F. stage, or to the pentagrid (where such a valve is used). It will be obvious that, when two or more valves are controlled from the same source, the A.V.C. lead to each must be decoupled, and it will be found that a .25 megohm grid leak used in conjunction with the usual .1-mfd. fixed condenser connecting the earth terminal of the coil to H.T.— will give all the decoupling that is required to prevent all possibility of interaction.

The circuit shown in Fig. 5 might well be elaborated to that given in Fig. 6, when a greater measure of A.V.C. action is required, and when it is desired to include a delay control. Here two "Westectors" are employed, and the most suitable degree of delay may be controlled by means of the potentiometer shown. The same idea may be applied to a mains receiver by using the voltage drop across a variable resistance included in the main H.T.— lead for delay purposes. The resistance should be chosen to give a total voltage drop of about 10 volts, so that if the H.T.— current consumption of the receiver were, say, 30 milliamps, the resistance should have a maximum value of approximately 300 ohms. If the consumption were 20 milliamps, a resistance of 500 ohms would be correct.

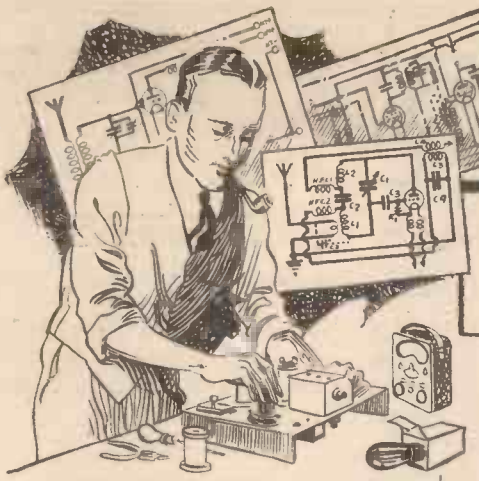
BLUE SPOT EXTENSION LOUD-SPEAKERS

ON page 754 of our issue dated February 9th, we illustrated and commented on "Blue Spot" extension loud-speakers. The photograph supplied to us for the purpose of illustrating our remarks applied to earlier models which are not now in production. We reproduce herewith photographs of the "Blue Spot Star" (which retails at 98s.), and the "Blue Spot Junior" (which retails at 48s. 6d.). Fuller details are available from British Blue Spot Company.



The Blue Spot "Junior."

The Blue Spot "Star."



CIRCUITS AND SETS FOR ALL

Practical Details are Given for the Construction of a Two-valve Self-tuned Receiver with Q.P.-P. Output

ALTHOUGH the average constructor seems to be more interested in the number of stations he can receive with his set than in the ease with which they can be tuned in, there are occasions when he wishes to make a simple receiver for "family" use and which may be as nearly "automatic" as possible. Generally speaking, a semi-automatic receiver must be of complicated design if it is intended for the reception of a large number of transmissions, but if the user is content to listen to the local Regional and National programmes, with the addition of Droitwich, a perfectly simple instrument will suffice.

Simple Station Selection

The circuit given on this page represents a remarkably efficient, simple, and inexpensive two-valve battery receiver by means of which three (or more in some cases) stations can be received merely by inserting a wander-plug into different sockets. Thus it is only necessary to mount three Belling Lee sockets on the panel and to have a plug, attached to a length of flex, which can be transferred from one to the other. If small labels are glued to the panel above the sockets the names of the particular stations to be received can be indicated on these so that station selection is entirely automatic and foolproof.

It will be seen from the circuit that each of the sockets is connected to one side of a pre-set condenser, the other terminal of which is connected to the "grid" end of the tuning coil. Each pre-set condenser is adjusted in turn so that it tunes the coil to the wavelength of one of the stations to be received. If it were desired to have the set so that it could be tuned to any other wavelength at will, it would only be necessary to fit an extra socket and connect this to one terminal of a normal variable tuning condenser.

Special Features

Apart from the unusual tuning arrangements the circuit has other interesting features, such as the H.F.-pentode detector, double pentode for Q.P.P. amplification, and a variable tone control acting upon the output stage. Reaction is provided for use when necessary, but normally it will be possible to set the reaction condenser to about its midway position and then to leave it alone unless a little extra volume is required on some particular programme. It is for this reason that the reaction condenser is shown as being of the pre-set type; it can be then mounted inside the set so that a minimum number of controls are required on the panel. The same remark applies to the tone control, for here the W.B. control unit is mounted on the baseboard or chassis; normally it will require to be adjusted only at occasional intervals.

The Components

With regard to the components required, it will be desirable to follow the specification given in the panel on this page, but there is no reason why slight modifications and simplifications should not be introduced.

LIST OF PRINCIPAL COMPONENTS REQUIRED

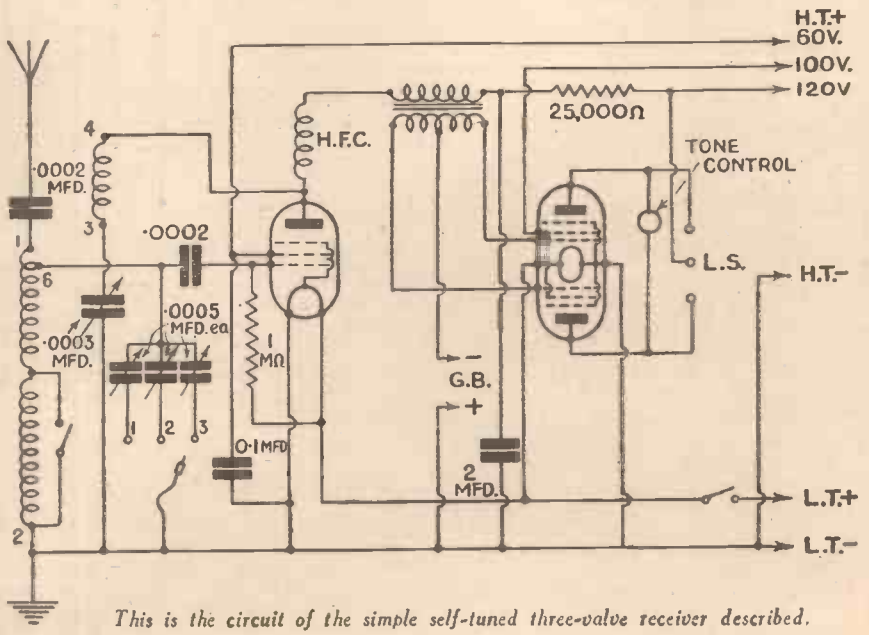
- Two valve-holders, one 4-pin and one 7-pin (Clix)
- Two .0002-mfd. fixed condensers (Dubilier, type 670)
- Four pre-set condensers, three .0005-mfd. and one .0003-mfd. (Polar)
- One .1-mfd. tubular condenser (T.M.C.).
- One 2-mfd. fixed condenser (T.M.C., type 25).
- One 1-megohm grid-leak (Dubilier).
- One type K.G.R. coil (Colvern).
- One screened H.F. choke (Graham Farish, type H.M.S.).
- One Q.P.-P. input transformer (Varley, type D.P.36).
- One 25,000-ohm fixed resistance (Dubilier 1-watt).
- One tone-control unit (W.B.).
- One on-off switch (Graham Farish).
- Three panel-mounting sockets (Belling Lee).
- Connecting wire, screws, flex, terminals, etc.
- One "Stentorian" loud-speaker (W.B.)
- One H.F.-pentode valve (Hivac).
- One Q.P.240 valve (Hivac).

For example, the H.F.-pentode valve may be replaced by a three-electrode valve of normal detector pattern, or the tone control might in some cases be replaced by a .01-mfd. fixed condenser when it is only desired to "mellow" the tone and not to control it. If it is proposed to employ a different coil a certain amount of care should be exercised in its choice, because if some coils were used reaction would have to be varied for nearly every station, whereas the tuner specified provides fairly uniform reaction over the whole of both wavebands with a fixed setting of the reaction condenser.

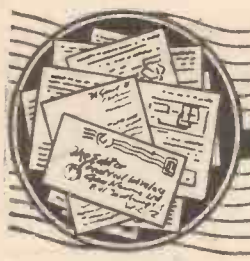
Chassis Lay-out

The arrangement of the parts is not very critical, and a fairly standard lay-out can be adopted, using a metallised chassis measuring approximately 10in. long by 8in. deep, and fitted with 2in. deep side runners. If the coil is mounted on the left with the wave-change-switch spindle projecting through the panel, the on-off switch can be placed at the opposite end of the panel, where it will match up with the wave-change knob. The sockets for station selection can then be placed in a line in the centre of the panel, the flexible lead with wander-plug attached coming through the panel near the bottom and half-way along. The valve-holders can most conveniently be placed in line at the rear of the chassis, the Q.P.P. transformer "balancing" with the coil. There will then be space for the three pre-set condensers in the centre of the chassis and near to the corresponding sockets. Space will also be found on the upper surface of the chassis for the reaction condenser and the tone control, whilst practically all the remaining components can be mounted conveniently underneath the chassis baseboard. Battery connections can best be made by means of a battery-cord assembly, of which the leads are joined directly to the respective components. The leads for aerial, earth, and speaker can be taken to a couple of terminal-socket strips mounted

(Continued on page 873)



This is the circuit of the simple self-tuned three-valve receiver described.

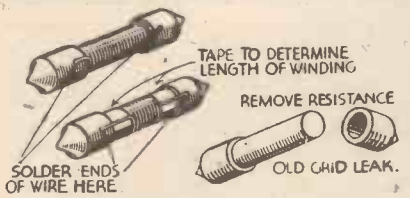


READERS' WRINKLES

THE HALF-GUINEA PAGE

Making Short-wave Chokes

FOR the short-wave enthusiasts, plug-in choke coils will be found very useful, enabling different size chokes on the various bands to be tried out. Most



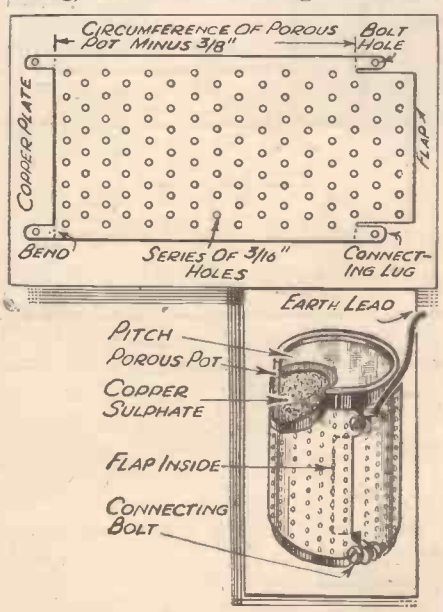
A simple method of making short-wave chokes.

experimenters have some of the grid-leaks enclosed in glass tubes lying around, so why not put them into use as follows: Take off the brass end caps, remove the resistance wire, then glue the caps back on the tube.

You now have an H.F. choke former with a winding space that will accommodate enough wire for chokes in the 160-metre and other bands.—J. S. (Huddersfield).

An Efficient Earth Unit

AN earth unit having useful hygroscopic properties can easily be made from an old Daniell cell. The first step is to thoroughly scrape the porous pot, continually rinsing under a running water tap. Then, after drying, fill to within half an inch of the top with powdered copper sulphate. Obtain some pieces of pitch from the top of an old high-tension battery, melt them, and pour over the top of the sulphate to the level of the porous pot top. The next step is to cut down the side of the copper container and hammer it out flat, discarding the bottom. Now mark off on the flat copper plate the outline of the casing, as shown in the diagram. Cut it



An efficient earth made from a disused Daniell cell.

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.

out, and drill through a series of 3-16in. holes. Now bend the plate around the porous pot, slipping two brass bolts through the holes in the lugs respectively, and tighten the nuts till the porous pot is gripped firmly. Make the earth connection to the upper bolt firmly, and after burying the unit in the earth pour a few buckets of water around the area.—G. McGAHON (Sunderland).

A Simple Remote Control Switch

THIS remote control switching device consists of a bobbin (non-magnetic) 3in. long by ¾in. diameter, wound with 26 s.w.g. wire in two coils, two spring contacts, iron core, and two bell pushes. These parts are assembled as shown in

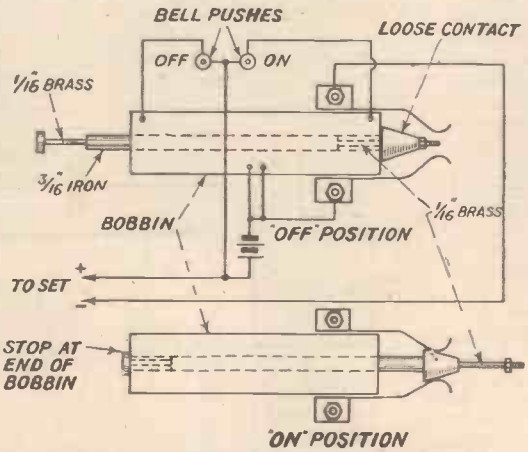
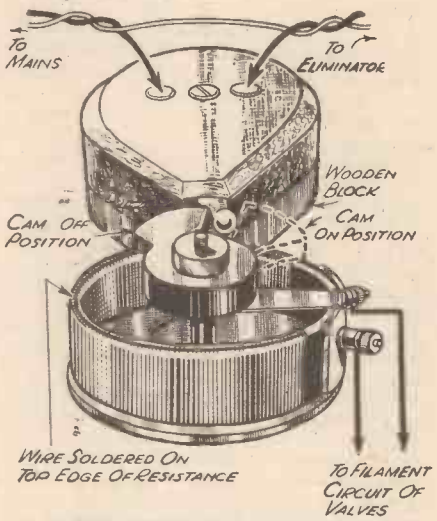


Fig. 1.—Details of a simple remote control switch, showing connections.

the accompanying sketch, Fig. 1. On pressing the "off" push the core is drawn in, and the nut on the end of the brass bolt head presses on the loose contact piece and draws it back to the "off" position.

On pressing the "on" push the action is reversed and contact is made by a sliding movement which keeps the contacts clean; a glance at the sketch will explain. Fig. 2 shows the completed switch, which switches the low-tension accumulator.—T. A. GURR (Wallsend-on-Tyne).

A Combined Filament and Eliminator Switch



A useful combined filament and eliminator switch.

THE accompanying sketch illustrates the combined action of a handy filament and eliminator switch in the "on and off" positions.

The filament switch is an old rheostat, and is used for a delayed action, allowing time for the valve filaments to warm up, and also to take the load off condensers, etc., before switching on the main switch. The old spindle is taken out of the rheostat, and a 2B.A. rod substituted of sufficient length to take the necessary parts. The resistance should be "shorted" so as not to have any resistance in circuit. The slider is fitted with a nut on each side, and the cam is tapped and screwed on and locked with the nut. The "cam" should be timed so that when the slider on

Fig. 2.—The completed remote control switch.

the rheostat is about three-quarters of the way round towards the full-on position, the cam is touching the lever on the main switch. When turning back in the "off" position the slider will nearly be "off" when the cam is about to turn off the main switch.—T. LANE (Sandown, I. of W.).

AN INTERESTING MULTI-PURPOSE VALVE

A Description of the Recently-introduced Mazda ACHL.DDD Valve, which Provides Detection, Delayed A.V.C. with Aural Tuning, and Inter-station Noise Suppression

THERE is no doubt that automatic volume control has proved extremely popular, in spite of the few disadvantages which it normally entails, and although it does generally necessitate the use of rather more complicated circuits than are otherwise required. When A.V.C. was first introduced there were many points against it, but these have gradually been eradicated by constant experiment and by extensive research work on the part of valve manufacturers.

One of the greatest drawbacks to A.V.C. when it was first used a year or two ago was that, although it tended to eliminate fading and prevent the detector valve from being overloaded, it made the process of tuning a powerful receiver a rather unpleasant task. This was because the set became more sensitive when not in tune with a strong signal, so that the general "mush" which comprises what is referred to as inter-station noise became very prominent. Thus, as the tuning dial was rotated one heard a series of stations interposed by loud scratching, hissing and generally unpleasant noises. This difficulty was overcome by using a separate valve to give "quiet" A.V.C., but the extra valve naturally added to the complication of the set. The principle upon which the first form of Q.A.V.C. worked (as the quiet system is called) was that when signal strength fell below a certain predetermined minimum a high negative bias was applied to the first L.F. valve. In consequence of this the valve became inoperative when the receiver was off tune, or when tuned to a very weak signal. This undoubtedly eliminated inter-station noise, but fairly accurate voltage adjustments were required to cause the negative bias applied to the L.F. valve to come into, and pass out of, operation at rather critical signal voltages. The valve had to function as a "trigger," and so the extra valve used to control the bias voltage had to work on a sharp bend in its characteristic curve.

Quiet A.V.C.

With the introduction of the double-diode triode it became possible to secure a measure of inter-station noise suppression—which is really another name for quiet A.V.C. or "squelch"—by using one of the diode sections for the purpose. Another rather important difficulty still remained, however, which was that of securing accurate tuning. The reason for this was that any station could be heard at almost equal strength over a comparatively wide band of the tuning scale, due to the fact that as the set became slightly de-tuned the amplification of the H.F. stages was caused to be increased. For the benefit of those readers who are not quite familiar with the method of functioning of A.V.C. it should be explained that the A.V.C. valve or rectifier causes the H.F. valves to give less amplification—due to the application of more negative grid bias—when the strength of the rectified signal is increased. On the other hand, when the rectified signal voltages are reduced, as they are when the set is de-tuned, the degree of H.F. amplification is increased. From this it will be seen why tuning appears to be broadened when A.V.C. is employed, and why the exact resonance point cannot so easily be found.

RATING	
Heater Voltage	4.0
Heater Current (Amps.) ...	1.0
Triode Section	
Maximum Anode Voltage	250.0
Maximum Heater to Cathode Voltage	150.0
**Mutual Conductance (mA/V)*	2.7
**Amplification Factor* ...	35.0
**Anode Impedance* ...	13,000.0
* *at Ea = 100 ; Eg = 0.*	

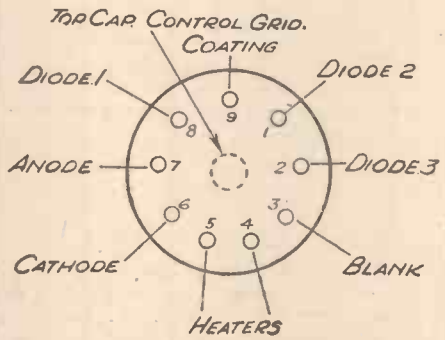


Fig. 2.—Showing the connections for the pins of the triple-diode triode described.

Visual and Aural Tuning

As the receiver is de-tuned, however, there is always a falling-off in quality, as can be observed to a lesser degree even when operating an ordinary set without A.V.C., due to the side-bands of the transmission being responded to in different degrees. The objection just mentioned can be overcome by fitting some form of visual-tuning indicator which shows when the true resonance point has been reached, but this is not always desirable, since the indicator rather adds to the complication of the set, and introduces another possible source of trouble.

Later experiment showed that it was possible to overcome to a great extent the tuning difficulty by the use of an additional diode connected to a double-humped tuning circuit preceding that used for feeding the diode which provides the A.V.C. voltage. This development was due to the Mazda valve engineers, and the triple-diode triode was introduced as a result of their experiments. This valve, of which a circuit diagram is given in Fig. 1, not only provides amplified automatic volume control, but also gives inter-station noise suppression, and makes aural tuning perfectly satisfactory. The valve has six different electrodes (in addition to the heater) and is so constructed that the diode portion is completely screened from the triode which serves as first low-frequency amplifier. It has a 9-pin base, the connections for which are given in Fig. 2.

It will be appreciated from what has been written that this valve performs every combination of functions which can be performed by a double-diode triode, but performs four of these instead of only three, and thus represents a distinct advance. Of the three diode anodes shown in Fig. 1, that marked D1 serves for diode detection (preferably second detection in a super-heterodyne), D2 is for compensated A.V.C., and D3 serves for noise suppression. It

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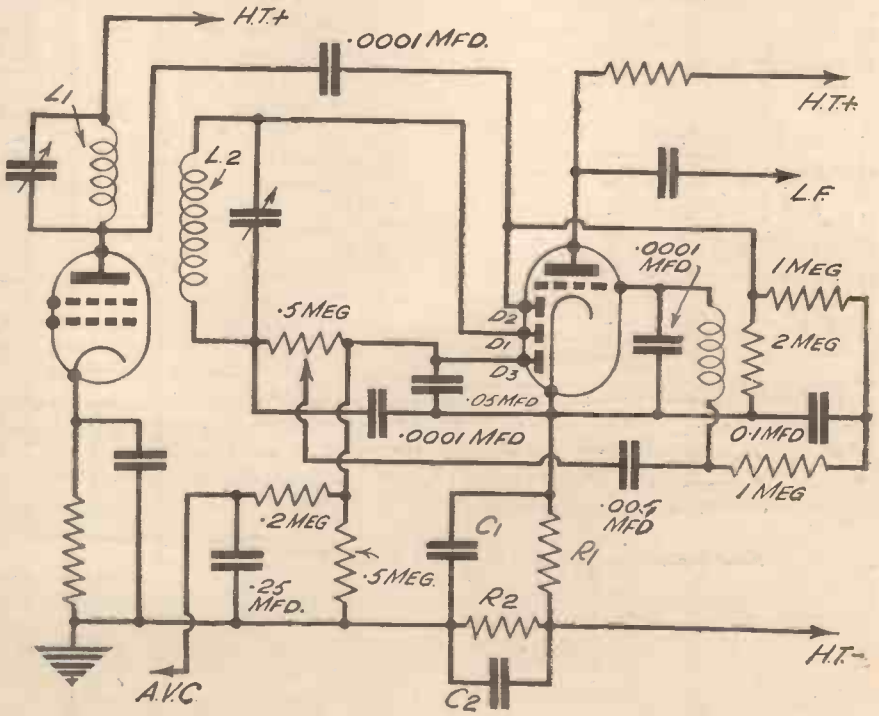


Fig. 1.—This circuit shows the connections for the valve when used for second detector, A.V.C. noise suppressor, and first L.F. amplifier.

On Your Wavelength

by Thermion

Single-range Coils

DUAL-WAVE and "all-wave" coils are all the rage to-day, and the close limits of accuracy to which they are made win nothing but admiration. Yet there are times when I, and perhaps many other listeners, have need of single-wave coils and are unable to get them.

Here is a case in point. I recently wanted to make a two-station set of the "quality" type which had to be as simple as possible because it was for the personal use of an old lady utterly devoid of mechanical ability. As she was living well within the service area of the Brookmans Park transmitters, the short-wave National and the London Regional were chosen as the two "selected stations." One H.F. stage was decided upon, with a variable two-gang condenser for tuning, as the set would then provide a limited number of the more powerful foreign stations for light relief when the local stations failed to charm. The long-wave stations were not required, partly because they would mean an additional control, and partly because their programme value was not considered worth the extra complications.

Two "gangable" 200-500-metre coils were therefore wanted. I would *not* have dual coils, on the principle that I objected to paying for the long-wave sections which were not required, and I had not time at the moment to make the coils myself. Catalogue after catalogue was searched, and no suitable coils were discovered. And then, at last, I found what I wanted. I shall not say where, but I will give a clue—they are listed by a firm specialising in short-wave equipment, of all things! I firmly believe that there is still a market for modern and efficient single-range (200-550 metres) coils, accurately matched for "ganging."

A Scanning Suggestion

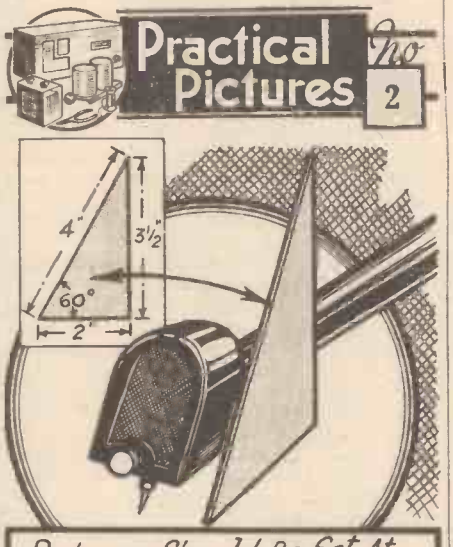
IT is inevitable that many serious-minded experimenters should now turn their attention to television, especially when it is realised that the Television Committee's report stated quite definitely that the systems employed at the transmitting end should include, from time to time, any new developments that warranted a trial as a result of the Advisory Committee's investigations. The fact that high-definition pictures are to be transmitted has made it necessary to use ultra-short waves as the radiating medium, as this is the only known method which will accommodate the enormously high modulation frequencies involved.

Many investigators still pin their faith on the possibility of utilising the medium waves for high-definition television, and the scanning methods proposed are something in the nature of a compromise—really a form of graduated exploration, such as was incorporated in the original commercial form of Baird disc-model Televisor. [Here the first and last three holes in the disc were rectangular and of larger area than the remaining twenty-four holes which were of square shape. In this, way the picture detail was of a higher grade in the centre of the picture where, say, for a close-up head and shoulder figure it was most required, while at the edges a coarser grain resulted.

Multi-spiral Scanning

ONE particular scheme which is interesting in this connection gives a high-definition effect at the centre of the picture (this section, in practice, is circular), and allows the definition to fall off towards the edges, where it is claimed the eye can best tolerate such loss. In carrying this out the scanning spot is made to follow rather an unusual course. It starts at the centre and travels outwards in a gradually increasing spiral. Then, on reaching the edges of the circle it returns to the centre by a gradually contracting spiral, this cycle of operations continuing during the whole time that a transmission is in progress.

The angular velocity of the exploring spot is kept constant, and in consequence the linear velocity near the centre is low (comparatively speaking), and this is claimed to give a form of high definition at a modulation frequency which can be accommodated on the normal broadcast band of wavelengths. On leaving the centre of the picture the modulation frequencies increase to give the same degree of definition, but with this system it is proposed to cut off these higher frequencies since they cannot be transmitted within the allocated sideband. The effect, therefore, is to give a picture which is graded in definition, and no doubt for certain limited purposes this would prove satisfactory. Unfortunately, the subject matter which could be transmitted would have to be chosen so carefully that the resulting programme would tend to be artificial in character and have little entertainment value.



Pick-ups Should Be Set At An Angle Of 60°. A Cardboard Set Square Made To The Dimensions Shown Above Will Be Found Useful For Checking Up This Angle.

Letters from Readers

ONE of the most cheerful aspects of a journalist's lot is the correspondence he receives from his readers. It is nice to know that one's writings are read and friendly letters from readers appear as oases in the dreary desert of journalistic work. I am certain that many music-hall turns feel somewhat as journalists do, and you will no doubt recall the gag which some of them adopt. "Will any member of the audience give me a number between one and ten." Someone in the audience, of course, immediately blurts out "seven." "Thanks," says the entertainer; "I just wanted to know whether any member of the audience was paying attention." So a letter from a reader does indicate that readers pay attention to what one writes. All journalists receive letters which can broadly be classified into two groups—those which are calculated to make him purr, and those which make him see red and incense him so much that he is tempted to land the editor into an action for libel by writing a rude answer; but the gentle answer turneth away wrath, and however rude a reader's letter may be (and some of them are rude when a particularly choice paragraph of mine touches them on the raw) one must turn the other cheek, write a pleasant, smoothing reply, and utter the curses *sotto voce*.

Please Don't

THESE musings are prompted by letters I occasionally receive from readers who ask my advice on altering a particular design. Having conveyed everything regarding their family history, past and present, short of showing me the family album, and occupied about two pages of their letter saying precisely nothing, they warm up to the real purport of their letter. It usually runs something like this: "I have been thinking for a very long time about making a receiver for a maiden aunt, a dear old soul that I should very much like to please. I do not know very much about wireless, and neither does she. I would be glad if you could tell me how I could make a receiver from the enclosed list of junk which I have by me. (Here follows list of junk.) I do not want to be put to any expense, and if you have a blueprint which you can alter so that I can use these parts I should be very grateful. Of course, my aunt will want to receive all of the Continental and British stations, and as she lives ten miles from the nearest wireless shop, if possible she would prefer a crystal set. As I have said before, I do not want to spend a lot of money, and if you could help me I should be more than obliged. I have been a regular reader of your paper since No. 1." Funny how every letter I receive seems to come from a reader who has taken the paper since No. 1—funny because they all seem to be blessed with particularly short memories. They ask questions which have been answered many times before!

How to Write a Letter

NOW, much as I like to hear from my readers, I simply have not the time to read a digest of their family history; and I think it is hitting below the belt to appeal to the sentimental strain which swells within me by introducing hard-luck stories about being out of work. Have I any old junk which I would like to get rid of? Cannot afford to buy any more parts, etc.. etc.

(*Continued overleaf*).

(*Continued from previous page*)

If a reader wants my advice I hope he will not mind my suggesting that he should be brief, get down to brass tacks, so to speak, straight away. For example, the above letter could have been written thus: "I have some odd parts by me, as shown in the attached list. Do you issue a blueprint which will incorporate most of them?" Some letters wander about all over the place. A reader will write for advice, send an order for a back issue, enclose a coupon which should be sent to our Presentation Dept., submit a wrinkle, and add a paragraph for publication. All in one letter, mark you! Letters for publication should be sent separately; wrinkles should be sent separately; orders for back issues should be sent to the Back Issue Dept.; queries should be sent separately, and gift coupons should be sent to the Presentation Dept. Do take this friendly hint, there's good chaps. Have a thought now and again for the hard-working contributor as well as the hard-working editor and make his job as easy as you can. If you disagree with something which I write, don't hesitate to write to me about it, but be polite. I destroy all rude letters.

An Interesting Proposal

THE trouble is, however, that although a set of coils of one make are of equal inductance within very fine tolerances, a set of similar coils of a competing make, while "gangable" among themselves, may be of quite different inductance from the first set. Similarly, two commercial condensers of different makes will have different characteristics. Therefore, any given condenser and its appropriate wavelength dial will only be calibrated accurately with coils of a certain inductance, and it is possible to obtain reliable calibrations only with a carefully-chosen selection of components. This makes it very awkward for those constructors—and there are very many of them—who happen to have on hand quite good condensers and coils which they wish to embody in a new set.

What I should like to see on the market is a range of efficient slow-motion drives, the indicating device of which is a knife-edge pointer moving over an absolutely plain scale. The material of the scale might be translucent so that it could be illuminated if desired, and the surface should be of matt finish, so that the user can mark on it in pencil or ink any scale he may choose—wavelength, frequency, or station names. Or perhaps some enterprising manufacturer may be prepared to supply uncalibrated matt scales for use with existing condenser drives—components which have reached to-day a very high mechanical and artistic standard.

Start a Technical Data Book

HOW many times, when in the throes of designing a new set, or when trying to solve a technical problem, do you have to delve into your well-thumbed files of PRACTICAL WIRELESS to find some tit-bit of information which you know was published—"let me see, I think it was just before the show—or just after"! And how many times do you have to get a scrap of paper and a pencil and work out some formula or calculation which you have probably worked out dozens of times before but have forgotten the answer?

I used to be like this, until I contracted the habit of this Technical Data Book—a habit which I heartily recommend to you. Mine is an ordinary stiff-covered exercise book, but anything from a small pocket book upwards will do. In this book I jot down essential and useful facts and figures which turn up in the ordinary course of my work and which appear likely to be useful on future occasions. The advantage of such a book is that it never contains anything that you don't want. So many expensive printed books cover too wide a ground—they have to because they cater for everyone.

Notes from the Test Bench

A READER who had built the £5 Superhet complained that reproduction was not up to his expectations, there being a definite lack of bass response. He mentioned in his letter, however, that he was using a more expensive transformer than that specified by the designer, and on making further inquiries we found that this particular transformer had a much lower primary inductance than the one specified, and this, of course, accounted for his lack of bass. In this receiver there is no direct current passing through the primary winding of the transformer, and therefore an expensive component will not give better results than a cheaper type. The specified transformer has a primary inductance of approximately 80 henries when connected as shown on the wiring diagram and therefore a good bass response is obtained. We would point out, however, that even this high value of inductance is barely sufficient in receivers of the straight H.F. type using a WX6 Westector. When the WX6 is used it is suggested that resistance coupling should be used.

Substituting Pentode for Power Valve

MANY of the older types of receivers have a power valve in the output stage and volume is sometimes found to be inadequate. Substitution of a pentode for the power valve can be relied upon to increase the volume provided that the speaker has a pentode-matching transformer attached. When the new valve is fitted, it will only be necessary to plug it into the power valve-holder and connect its side terminal to 100 or 120 volts on the H.T. battery if the valve is of the four-pin type. If a five-pin pentode is used, however, it will be necessary to substitute a five-pin holder for the four-pin type, the centre pin being connected to the H.T. battery socket as mentioned above. There is one point that must be particularly emphasised when this substitution is made, however. The average pentode, especially the economy type, is very easily overloaded and therefore it is advisable to fit a volume control in the pentode grid circuit. This may take the form of a 500,000 ohm potentiometer. The two end terminals of this component should be connected to terminals G and G.B. of the L.F. transformer and the centre terminal to the grid of the pentode. It may also be found that treble response will be slightly accentuated when the pentode is in use, but this can easily be corrected by connecting a fixed condenser of approximately .0002 mfd. across the G and G.B. terminals of the L.F. transformer; alternatively, a .005 mfd. condenser may be connected across the speaker terminals. If desired, the tone may be varied by connecting a potentiometer of approximately 20,000 ohms in series with the .005 condenser.

Home-made Resistances

MANY listeners like to make fixed resistors of the wire-wound type for themselves. Eureka wire is one of the best for this purpose, but a calculation of approximate lengths of suitable size usually involves a perusal of a complicated table giving resistance in ohms per 1,000 yards; weight in pounds per 1,000 yards, and current-carrying capacity. I have compiled a handy table of the most useful sizes and figures, which I pass on to you.

Eureka Wire.

Size S.W.G.	Ohms per yard (approx.)	Current-carrying Capacity
22	1	2 amps.
34	10	350 m.a.
42	53	125 m.a.
44	83	100 m.a.
46	148	70 m.a.

All you have to do, therefore, is to select the size of wire, divide the required resistance by the appropriate figure in column 2, and the answer is the number of yards wanted. The figures in column 2 are accurate to within 1 per cent., and for safety are on the low side. The current-carrying capacities are conservative, and are based on a 100 degree C. temperature rise.

It's Coming!

I EXPECTED it. A newspaper is offering a television receiver as a prize. This is indeed taking time by the forelock, and I shall be interested to know what the winner does with it should he happen to reside in the Midlands. Will he keep it until the station opens in his district? Will he sell it to a more fortunately-situated relative in London? I expect it will be at least two years before the ten television stations are erected.

A True Story

I RECEIVED a request the other day from a reader who had made up Mr. F. J. Camm's fascinating £5 Superhet. The whole world has been clamouring for selectivity, and he gave it to them in this receiver in abundance, *in excelsis* and *animato agitato*. But this reader actually asked whether I could tell him *how to make it less selective*! What is a set designer to do?

Tuning Scales

THE recent reshuffle of some of the B.B.C. wavelengths revives the old question of tuning scales. So many receivers to-day are fitted with scales marked with the names of stations—these will require new scales. The principal set-makers are prepared to supply revised scales at quite reasonable prices, and it is not a difficult matter for the service man or handy engineer to fit them in place of the old ones.

Listeners whose sets are calibrated in wavelengths or frequencies, or those who use the arbitrary 0-100 or 0-180 dials, will, of course, hardly be affected, except that they will have to take due note of the new wavelengths in their log charts. But it is just this matter of the 0-100 and 0-180 dials which jumps to my mind at the present moment. A calibration of this sort was, of course, the only possible method in the early days of radio, when neither condensers nor coils were made to close limits of accuracy. But now that coils whose inductances are correct to a milli-henry or so, and condensers which are accurate to the order of a micro-micro-farad are available, there is really no excuse for even a home-made set to use anything but a wavelength or station name dial.

All About TELEVISION

READ in the March number of "PRACTICAL TELEVISION" the first article of a great new Television series for beginners. Written in simple language it describes the principle of Television Reception and Transmissions.

Other big features in this month's issue include:

SIMPLE TELEVISION RECEIVER SUGGESTIONS.

Describes the Disc Television Receiver which, because of its inherent simplicity and cheapness, provides a useful introduction to the subject for readers who are making an immediate start on Television reception.

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BUILDING A PORTABLE TELEVISION RECEIVER.

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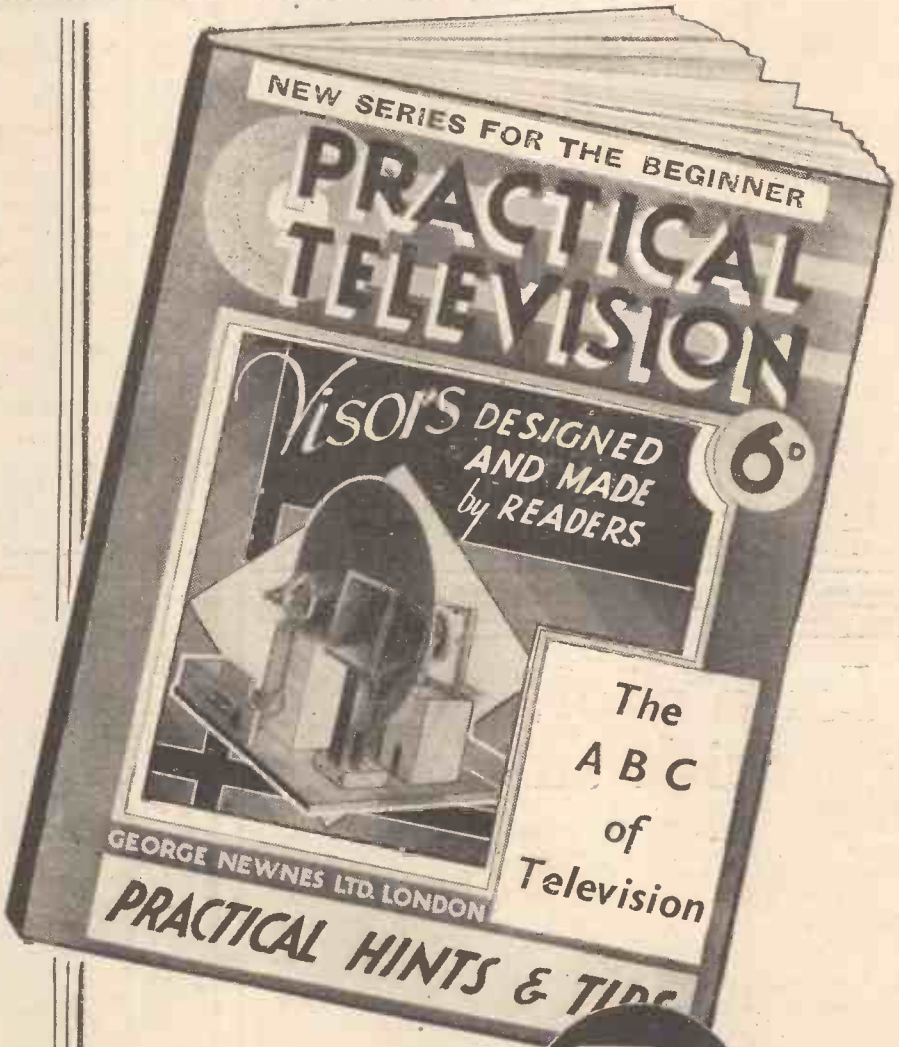
DAYLIGHT TELEVISION: THEN AND NOW, etc., etc.

"PRACTICAL TELEVISION" gives you full news of Television personalities and programmes, and is invaluable to every home constructor. You must have the March number, out now.



Out Now—THE MARCH

6D

PRACTICAL TELEVISION

KEEPS YOU IN TOUCH—*in simple language*

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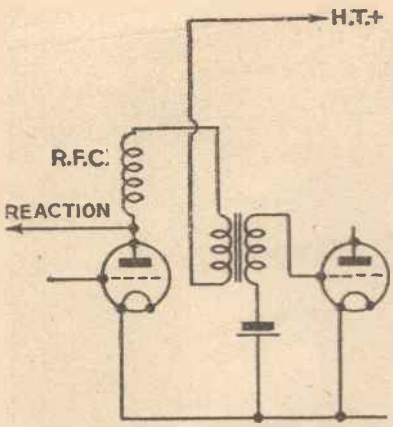


Fig. 1.—The plate circuit of a detector valve without decoupling arrangements.

RESISTANCES: GOOD and BAD

An Article dealing with the Importance of Using Resistances of Correct Values

By PERCY W. HARRIS, M.I.R.E.

IT is strange, when you come to think of it, that in wiring up a radio set half of the trouble is to set the current to flow as easily as possible with a minimum of obstruction, while the other half is to make it very difficult!

My thoughts turned this way the other evening when I was struggling to correct the faults in a new wireless set. When I had discovered the troubles they turned out to be of two kinds—firstly, bad contacts which gave high-resistance paths for certain currents which should flow freely, and secondly, too low resistance paths due to incorrect markings of certain fixed resistors.

A great deal of attention has been given in constructional and other articles to the necessity of making good, sound, soldered joints and clean contacts before the screws are finally tightened up. You cannot go wrong at any time by following this advice, but it should be remembered that high resistance may be just as important in other parts of the circuit. Take, for example, the use of resistances for decoupling—a very important use when stability and high quality are sought after in a set. Look at Fig. 1, which shows the plate circuit of a detector without decoupling, and at Fig. 2, which shows the same circuit with the addition of a resistance and condenser for decoupling purposes. This is following the conventional way of drawing such a circuit—a method which is very convenient in circuit diagrams, but one which does not help very much in simple explanations of just what is happening. For this reason, in an explanatory article of this kind, I prefer to show the two arrangements in a much simplified form, as in Figs. 3 and 4. This is very much easier to understand. You will notice that the path from the plate of the valve goes first to a radio-frequency choke, R.F.C., next through the primary of the transformer, then through the high-tension battery, H.T., back to filament. The radio-frequency choke prevents radio frequencies getting to the transformer, and deflects them along the line marked "Reaction" to the reaction condenser. If we use differential reaction there is also another path straight to earth from the plate. What I want you particularly to notice is the connection marked "To other valve circuits" from immediately above the high-tension positive of the battery. This one battery has to supply *all* the plate circuits of the set, and in doing so it will also provide the current (probably quite a heavy one) for the output valve. This current will rise and fall with the fluctuations of the loud-speaker signals, and as the battery itself has a certain resistance these variations of current will bring about corresponding variations of voltage across the terminals of this battery. For a given current the lower the resistance of the battery the lower the voltage fluctuation.

Voltage Changes

Now as this battery is also common to the detector circuit you will understand that if there are considerable voltage changes in it set up by the output signals these voltage changes *must* be applied to the detector, for this is the only voltage source. We shall thus get a "feed-back" and, in many circumstances, it may be enough to spoil the quality, while in others it may set up the squawk or howl which is found in unstable sets. It is, in fact, low-frequency reaction similar to the high-frequency reaction we deliberately set up with our reaction condenser.

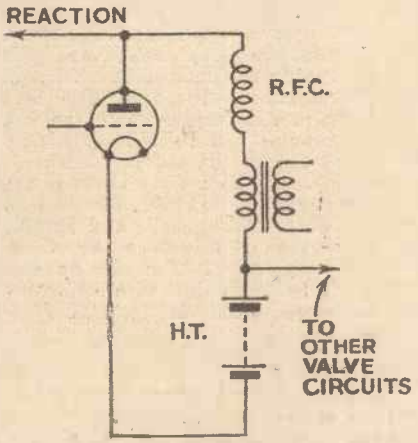


Fig. 3.—A simplified form of the detector circuit shown in Fig. 1.

You will now realise why in the heading I speak about "resistances good and bad." This is a case of *bad* resistance, for we want to keep the resistance of our high-tension supply down as much as possible in order to prevent undesirable feed-back. A new good quality high-tension battery will have a very low internal resistance, but as it gets older the resistance will go up till finally it may be very considerable. You may have two batteries looking exactly the same outside, both showing a full 120 volts on a high-resistance voltmeter (which does not pass much current), but one may be a good battery with low internal resistance and the other may be a bad battery with a high internal resistance. If the internal resistance of the battery is high, then its voltage will drop rapidly as we take more current out of it. All 120-volt high-tension batteries do not have the same internal resistance any more than all six-cylinder cars have the same horse-power. If your set does not take much current then you may get fairly good results with an inferior high-tension battery, but if it is a powerful set taking a lot of current, you will soon find the difference!

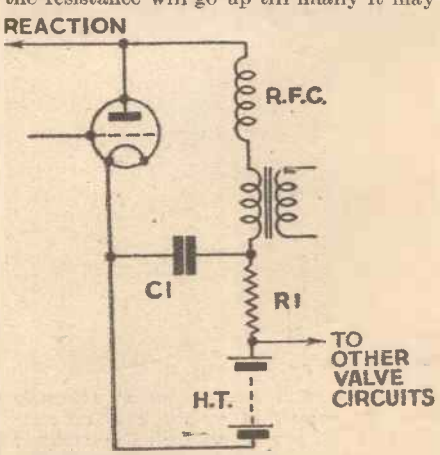


Fig. 4.—A simplified form of the decoupled detector circuit shown in Fig. 2.

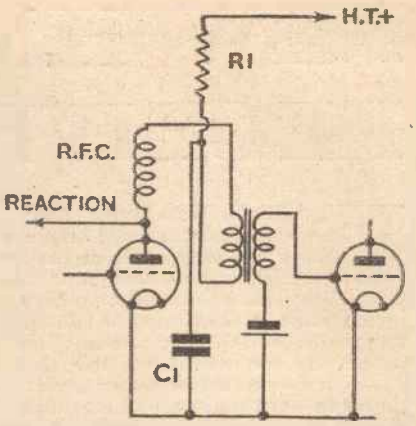


Fig. 2.—The same circuit as in Fig. 1, but with decoupling resistance and condenser added.

Decoupling Resistance

But to get back to our decoupling resistance and its effects. Look now at Fig 4, where I have introduced a resistance R1 and a condenser C1 in exactly the same theoretical position as was shown in Fig. 2, but drawn much more simply. You can now have quite considerable rapid fluctuations of voltage in the high-tension battery, for in the condenser C1 (which should be not less than 2 mfds.) we have a short circuit to filament for all pulsating voltages, and also a kind of reservoir of voltage (you will notice it is always kept charged through the resistance R1) which will take care of any sudden demand by the detector valve. Similarly, the fluctuations in the detector circuit will not reach the battery, for the condenser C1 will short-circuit the quick changes to filament.

Now the actual resistance of R1 is important. If it offers no more opposition to the flow of fluctuating current than does C1, half of these fluctuations will go through the resistance in the battery and the other half through C1, and thus part of our object will be defeated. It is generally estimated that a suitable value is one which gives about ten times more opposition to these fluctuating currents than does the condenser C1, but as the opposition to fluctuating currents of C1 depends on the frequency of the currents, being much less to high frequency than low, and as the opposition of the resistance is equal to all frequencies, some kind of a compromise is reached. Again, the presence of this resistance in the high-tension path from the battery to the plate cuts down the voltage applied to the plate, and sometimes we do not want to cut this down too much for fear of sacrificing detector efficiency; 50,000 ohms for the resistance R and 2 to 4 microfarads for the condenser C1 are quite common values and work very satisfactorily.

NEW H.M.V. RECEIVERS

Three Fine Superhets, including an All-mains Table Model

THE "His Master's Voice" Company have recently released three new radio instruments incorporating a five-valve (including rectifier) A.C. chassis. The latest technical improvements are incorporated in the design of this chassis. The amplified Q.A.V.C. circuit renders station selection extremely simple, no background noises whatever being heard when tuning between stations, and the output for all stations is constant, as set by the volume control. The most inexpensive of the new instruments is the Model 441, a table model

The new "His Master's Voice" "Superhet Five-Forty-One Radiogram" represents remarkable value for money at 22 guineas. It has a highly-figured console cabinet, and the powerful superheterodyne chassis with Q.A.V.C. provides good quality radio and record reproduction.

with a highly figured walnut cabinet, inlaid with macassar ebony. This retails at 12½ guineas.

In the H.M.V. "Console Superhet Five" the chassis is built into a handsome walnut console-type cabinet of modern design. At 17 guineas this instrument represents good value for money. Reproduction is naturally of better quality than that of its companion table model, owing to the larger baffle area available.

A Radio-Gramophone

The same chassis is used in the H.M.V. "Superhet Five-Forty-One Radiogram." Although it costs only 22 guineas, the cabinet of this instrument will be considered by many to belong to a radio-gramophone of considerably higher price. Its proportions are similar to the more expensive H.M.V. radiograms.

The controls of all the models have been designed for simplification in tuning. In the console instrument the scale is set at a convenient angle, and if need be, the receiver can be operated easily from an arm-chair. The chassis has a tone-compensated volume control, ensuring equal tonal balance at all volumes, whilst each instrument may be perfectly matched to the user's local conditions by an adjustable "Q" threshold control, which compensates for the amount of atmospherics or static. In the radio-gramophone the pick-up and carrying arm are combined in a single bakelite case, spring-loaded to facilitate needle changing, and a heavy duty H.M.V. electric motor is fitted with an automatic brake, which can be disconnected at will.

All models have an undistorted output of 2 watts, and the energised-field moving-coil loud-speaker is of massive design. The consumption of the radio models is 70 watts, whilst the radio-gramophone, when used for records, takes 100 watts. An A.C. voltage range of 200-250 volts and 50-60 cycles is provided for the standard models, whilst models for other A.C. voltages and frequencies can be supplied at a slightly extra cost.

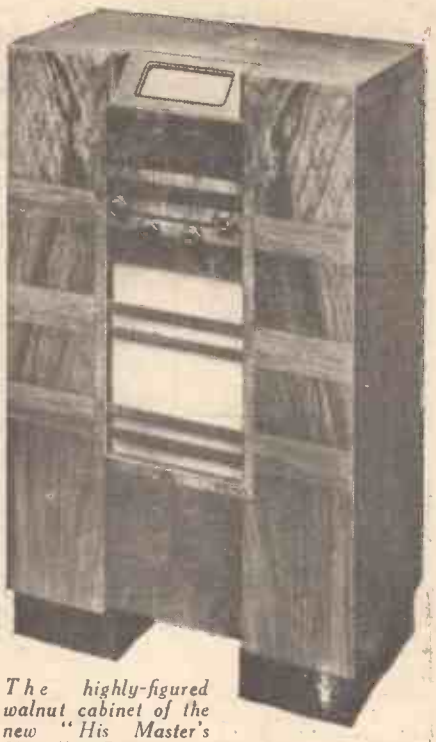
Free Records

As from February 1st every purchaser of a new H.M.V. radio-gramophone will receive a presentation album containing three records, which have been specially chosen as a nucleus to start a record library. These albums are cloth covered and gold blocked, having six pockets and a list of specially recommended records. The three records which will be given with the first batch of albums will be H.M.V. B3850, two items from the "Pirates of Penzance," by members of the D'Oyly Carte Opera Company; H.M.V. DA1391, two ballads sung by John McCormack; and H.M.V. B8112, orchestral selections by John Barbirolli's Orchestra. The albums and records will be despatched with all instruments delivered from the factories from February 1st.

Price Increase

It is announced that as from February 1st, the price of the H.M.V. Model 580 "Duo-diffusion Autoradiogram," nine-valve instrument, will be increased from 48 guineas to 52 guineas, in view of increased manufacturing costs. It will be recollected that on January 1st the "His Master's Voice" battery superhet, Model 146, was

The new "His Master's Voice" Model 441 radio receiver has an extremely handsome cabinet of walnut and macassar ebony. This five valve (including rectifier) A.C. mains superheterodyne receiver has Q.A.V.C. and retails for 12½ guineas.



The highly-figured walnut cabinet of the new "His Master's Voice" "Console Superhet Five," Model 444 is of particularly pleasing design. The wavelength scales are set at a convenient angle and the instrument can be operated from an arm-chair. It has a five-valve (including rectifier) superheterodyne chassis, and retails at 17 guineas.

advanced in price from 11 guineas to 12 guineas.

HERE AND THERE

Paris-Moscow Wireless Link

A REGULAR public telephony service has been opened between Paris and Moscow, but in view of existing difficulties as regards land-lines, communication is carried out by wireless link. Conversations between the two capitals may be picked up on 24.55 metres (12,220 kc/s).

Welsh Choral Concert

THE Annual Concert of the Pontypridd and District Male Choir will be relayed for listeners in the West from the New Town Hall, Pontypridd, on March 6th. The artists will be Robert Murgatroyd (tenor) and Keith Falkner (baritone), and the Choir will be conducted by Gwilym T. Jones.

Variety from Midland Regional

MARTYN WEBSTER has an attractive bill for the "Divertissement" programme which is to be broadcast twice (afternoon and evening) to Midland listeners on March 7th. V. C. Clinton Baddeley's dramatisation of the Stephen Leacock story "Winsome Winnie" will be acted, and there is a short sketch by Charles Hatton, a Black Country journalist, in which the characters to be represented are two B.B.C. announcers and Miss Mae West. The title is "Censored." Other artists in the bill are Thomas O'Hara (piano accordion), Helmar Fernback (tenor), Jack Wilson (pianist), Janet Joye, who will read the Irish poem, "The Old Woman of the Roads," and David Needham, who will give animal and bird imitations.

Baird's Outstanding Television Demonstration

The Editor Visits Demonstration of Baird Home Television Receivers

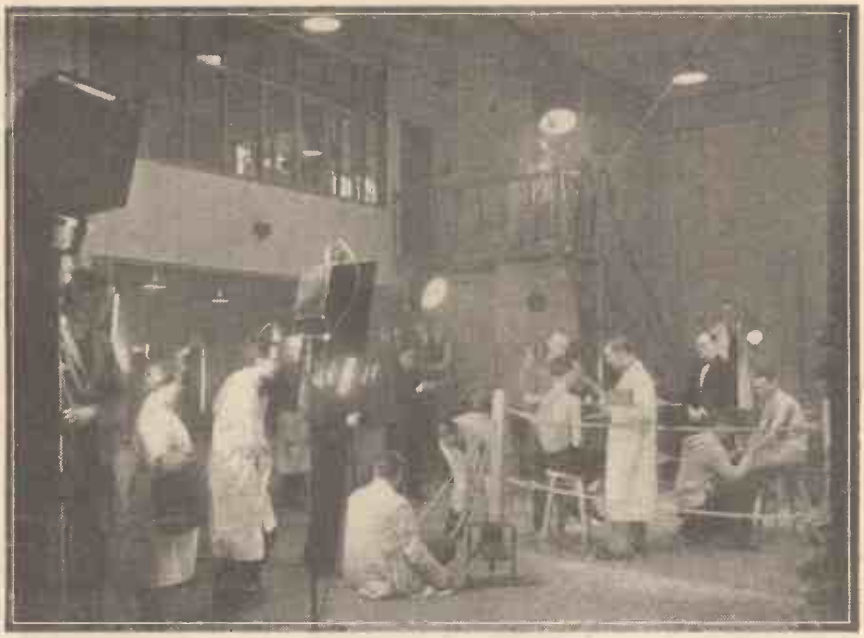


Fig. 1.—Preparing for a boxing scene in No. 1 studio, and showing the camera and control rooms.

BY special invitation the Editor of PRACTICAL AND AMATEUR WIRELESS recently visited the Baird offices and witnessed an hour's radio programme of high-definition television. The transmission emanated from the studios and laboratories at the Crystal Palace, a wavelength of 7.0 metres being employed for the vision signals and 8.5 metres for the accompanying sound, with powers of 10 kilowatts and ½ kilowatt respectively. The images were watched on two separate models of home receivers (illustrated in last week's issue), the screen sizes being 12in. by 9in., having black and white images for the first receiver, while the second set showed sepia and cream images on a screen size of 8in. by 6in.

Programme Details

The programme opened with a very lucid description of the three distinct processes employed for the transmission, that is, light spot, tele-cine, and intermediate film. These were shown separately, and it was most impressive to witness the rapidity and flexibility of the change-over from film to real artist, and *vice versa*, throughout the show. In addition to the announcer in the spot-light studio, there was entertainment by a lady artist, and also a short lecture for the purpose of emphasising the educational value of television.

Employing the intermediate-film process, exterior scenes of horses racing and jumping on a terrace 200 yards away from the camera were shown in addition to an interior scene of a boxing match enacted in No. 1 studio. Finally, selections from a number of talking films were transmitted.

In every case the degree of definition was 180-line scanning, and the images were bright and clear with considerable detail, while at no time did they "hunt" or go out of synchronism. Undoubtedly, the whole demonstration was a striking tribute to the enormous progress made by the Baird Company, and showed quite clearly that the transmission of high-definition television pictures over a large area was already an accomplished fact. No one could deny that there was ample entertainment value to ensure sustained public interest, while the absence of any form of interference was remarkable. It is known that ultra-short-wave reception is particularly susceptible to interference from the ignition systems of motor-cars, but not a trace of this was evident on the two sets shown.

Fig. 2.—Operating the micro-wave transmitter to act as a radio link for handling the high-definition television signals.

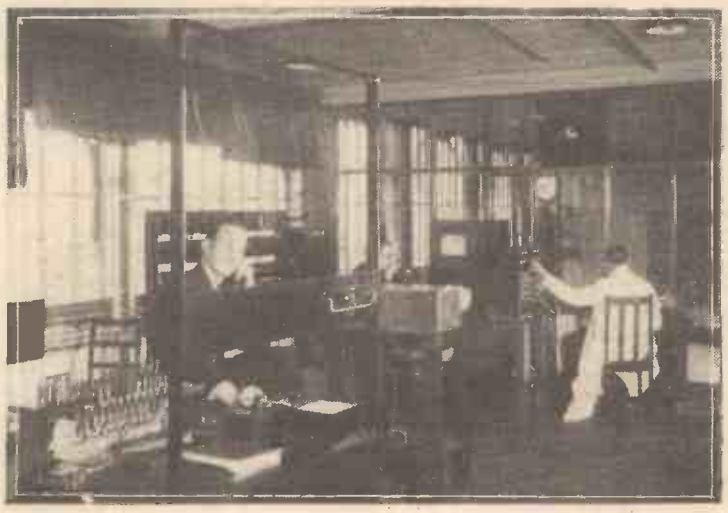


Fig. 3.—At work in the control room where the vision synchronising and sound signals are controlled.

Touring the Studios

An inspection of the section of the Crystal Palace taken over by the Baird Company in June, 1934, followed, and it was learned that the premises embraced a floor area of about 40,000 sq. ft. This included studios, radio transmitters (two are necessary for the radiation of *both* sound and vision), offices, laboratories, workshops, and stores.

First of all, in the lofty No. 1 studio, an area of 2,400 sq. ft. enables large interior scenes to be enacted, the walls being sound-proofed and covered with a wire mesh to isolate the studio from interference. This is seen in Fig. 1, preparations being made for a boxing scene.

The large plate-glass window to the left separates the studio from the intermediate-film camera-room, while above this is the control-room (or "nerve centre").

Flanking the camera-room are studios Nos. 2 and 3 with 1,500 and 800 sq. ft. of space respectively. In the former, provision has been made for what is termed back projection, whereby any still or moving scene can be superimposed on the performance taking place in order artificially and easily to give the required atmosphere in the resultant transmitted pictures. The back projected scene is focused on to a large translucent screen some twelve-feet square. The smaller of the two studios (both, of course, are acoustically treated) at the demonstration was fitted out with an electron camera, an all-electric device which has no moving mechanical parts for scanning purposes, and is capable of adjusting its degree of definition from 100 to 500 lines at will.

Relay Link

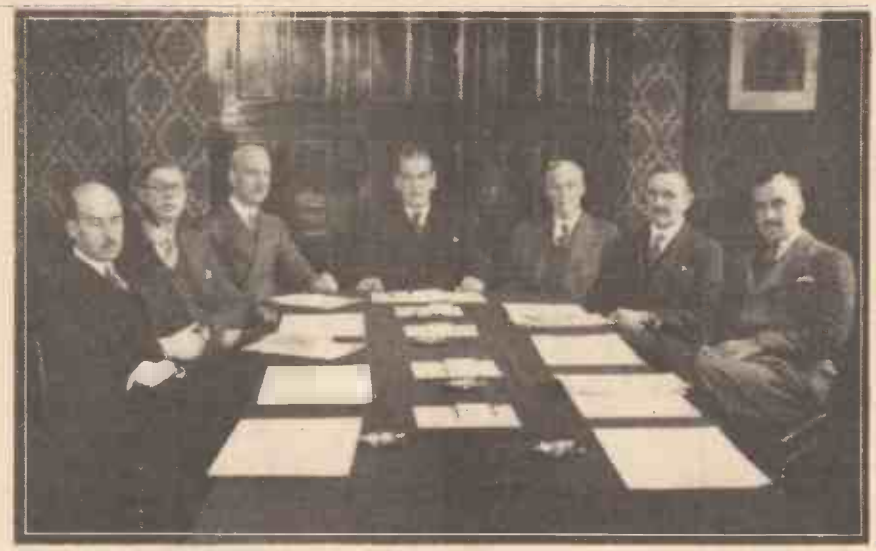
The production of a high-definition television signal requires a frequency side-band from 10 to between 2 and 3 million cycles. Assuming, therefore, that any particular scanner has produced this, it is impossible to transmit the signal over any distance by line (except a very short one) in order to link up with the ultra-short-wave radio transmitter for radiating the signals over a service area. It has been necessary, therefore, to develop a micro-wave radio link capable of embracing the whole gamut of frequencies stated. This can be used over distances up to ten miles, yet uses an extremely small power. One form of this device which was demonstrated is shown in Fig. 2. Mounted on a stand and capable of being moved in any direction was a directional aerial array, the only other equipment required, apart from the power supply (seen on the ground), being two valves of the super-power type.

To illustrate its operation this apparatus was modulated with sound signals, and when the aerial array was directed to a small receiver with a short horizontal aerial, the music was reproduced in a loud-speaker. On swinging the horizontal beam through a small angle, however, the music stopped. This form of micro-wave relay link will prove invaluable when a choice of site forces a separation between the ultra-short-wave transmitter and the studios with their associated scanners, and also when it is desired to televise outdoor scenes for radiation from a distant station.

The fourth studio was built for the purpose of employing the original Baird method of light spot scanning, a rapidly-rotating disc working in conjunction with a high-powered automatic arc producing the scanning operation. Adjoining this was the tele-cine room where two projectors are employed for the purpose of televising ordinary talking films. In the first machine disc scanning is used, but the second showed how an electron scanner could perform the same operation without revolving parts.

Returning to the original camera room, this housed the intermediate film apparatus. By means of a special camera this recorded both the picture of the scene and the accompanying sound on a film. This film was then fed to tanks containing chemicals maintained at a constant temperature for the purpose of developing, fixing, and washing. The finished film negative in a wet condition was then scanned by a disc to produce the television signals, the delay between the filming of the scene and its translation into a television signal being only thirty seconds.

Immediately above this camera room was located the control room which handles the vision, synchronising, and sound signals from all four studios and the two tele-cine scanners. This is an extremely important link in any television service, for in addition to controlling the relative volume and phase, it is here that the change-over is made between the various studios and the radio transmitter according to cues in the programmes being radiated. The arrangements for this purpose are shown in Fig. 3, vision and synchronising signals being handled in the foreground, and sound by the far window. In addition to line checks for sound and vision there is an additional radio check, so that this nerve centre is able to control exactly the required input and output signals.



The newly appointed advisory Committee on television held its first meeting in London recently, and laid down a definite plan of action to provide London with high-definition television service. The members of the Committee are: Noel Ashbridge, B.B.C.; Sir Frank Smith; Lord Selsdon, the Chairman, centre; F. W. Phillips, Assistant Secretary of the G.P.O.; Colonel Angwin, Assistant Engineering Chief of the G.P.O.; Vice-Admiral Sir Charles Carpendale; and V. Roberts, the Secretary. This photo shows some of the members of the Advisory Committee.

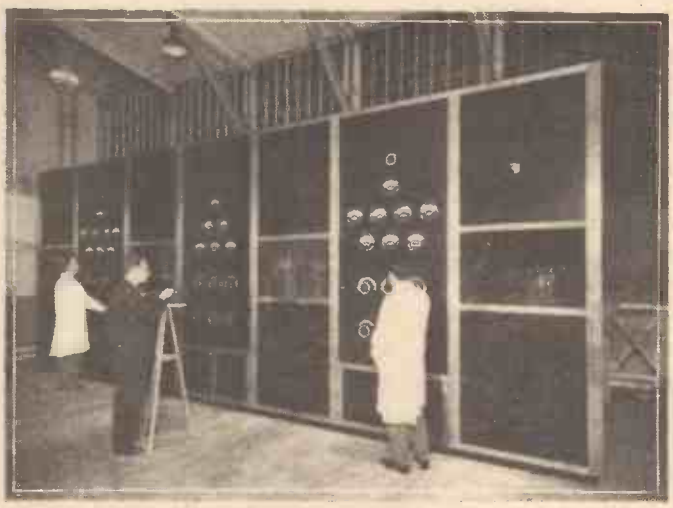


Fig. 4.—The 10-kilowatt ultra-short-wave radio transmitter, which handles the vision signals on a wavelength of 7 metres.

The last link in the chain of items for the Baird television service is the ultra-short-wave radio transmitter. This is shown in Fig. 4, being designed for a power of 10 kilowatts (20 kilowatts peak). It was designed completely by the Baird engineers and is seen to consist of three distinct meter panels controlling the three separate stages. Water-cooled valves are in the output stage, while the whole equipment is copper lined in order to remove the effects of the high electro-magnetic fields formed by the equipment. It works on a wavelength of 7 metres and is capable of being modulated by signals with a frequency exceeding three megacycles. The low-powered sound radio transmitter which radiates the synchronised sound signals is situated on the first floor of the South Tower itself.

Fig. 5.—Using a cathode-ray tube for recording television images on a film for subsequent projection on to a screen.

Television Picture Recording

The items just enumerated complete the sections essential to the provision of a high-definition radio television service, but the visit to the Baird premises revealed many other forms of development which are sure to have an important bearing on television in general. One particularly intriguing process is shown in Fig. 5. This illustrates the application of the cathode-ray tube for the purposes of recording television pictures on a film for reproduction in cinemas.

(*Continued on facing page*)

BAIRD'S OUTSTANDING TELEVISION DEMONSTRATION

(*Continued from facing page*)

In the foreground on the right is the camera (side removed to reveal the mechanism) with the film box mounted above. In front of this is the recording cathode-ray tube with its associated time base, power packs, and modulation amplifiers.

Photo-electric-cell research, testing cathode-ray tubes, work on time bases and methods of synchronising, together with large workshop facilities, were all revealed during the visit. It showed beyond all doubt that the company concerned have not only achieved very practical results in both the transmission and reception of television, but have established a centre at the Crystal Palace capable of giving almost any type of entertainment.

CIRCUITS AND SETS FOR ALL

(*Continued from page 862*)

on the back of the chassis, and a similar form of connection could be employed for pick-up leads, if these were to be used.

Preliminary Adjustments

After the set has been made there will be little difficulty in putting it into operation, and after connecting the batteries and speaker the pre-set tuning condensers will have to be adjusted. First insert the plug into the socket marked 1, and turn the adjusting screw of the corresponding condenser (preferably by means of a long screwdriver) until one of the required stations is accurately tuned in. When this has been done the capacity of the reaction condenser may be increased, if necessary, to bring the signals up to the required strength. Next transfer the plug to socket number 2 and repeat the process for another station, not altering the reaction setting unless essential—due to the detector falling into oscillation, for instance. If these two adjustments have been made with the wave-change switch in the medium-wave position, it should next be turned to long waves and the third condenser set for Droitwich. It will be evident that additional pre-set condensers and sockets could be added to accommodate other transmitters, provided that it was found that the set was capable of receiving the additional programmes in a reliable manner. At the same time, it would be futile to make provision for other stations if these could not be well received without making delicate reaction adjustments, or if they gave sufficiently powerful signals only in particularly good conditions.

Just one final note: use a large-capacity H.T. battery or an eliminator of a type intended for Q.P.-P. or class B; an ordinary standard-capacity battery will have a short life and will not permit of good-quality reproduction from a quiescent output stage.

SHORT-WAVE NOTES

Russian Transmissions

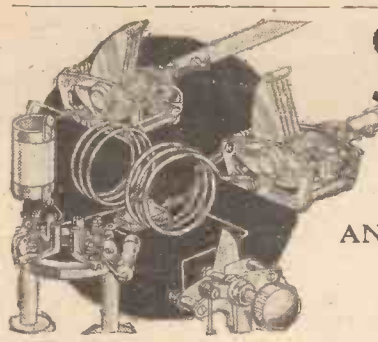
TWO of the most powerful European transmissions to be picked up are undoubtedly those emanating from Moscow (U.S.S.R.) on Sundays. RNE on 25 metres (12,000 kc/s) gives English talks at G.M.T. 03.00, 10.00 and 15.00 and RV59 comes on the air with a broadcast in the same language at G.M.T. 21.00. The 25-metre station does not work on weekdays, but you may turn to RV59 nightly at G.M.T. 20.00 for a relay from the studio of Moscow (1) on 1,724 metres.

A station for which I have been so far searching in vain is HJ5ABD, Cali (Colombia), on 46.3 metres (6,480 kc/s), which is said to be on the ether with a programme every night (except Monday) at G.M.T. 03.00. The only hint I have been given, in addition to the channel, is the fact that it uses a cockcrow as an interval signal, and that its call, as heard phonetically, is: *achay hota sinko ah bay day, La Voz* (the voice) *de Valle.*

Abandon any search you may have planned for XETE, Mexico City, on 31.25 metres (9,600 kc/s) which, until December, was a fairly regular capture, as the station has now closed down for an indefinite period. As a substitute for your log, try for VK3LR, Lindhurst, Victoria, which, notwithstanding rumours to the contrary, would appear to be still working daily between G.M.T. 08.15-12.30 on 31.32 metres (9,580 kc/s). VK2ME, Sydney, on 31.28 metres (9,590 kc/s) maintains its Sunday schedule only (G.M.T. 06.00-08.00 and 10.00-16.00). This facilitates identification muchly, as any pick-up on a weekday of an Australian programme on or about 31 metres must now be necessarily from Lindhurst.

VUB, Bombay

Just a fraction higher you should succeed in logging VUB, Bombay, on 31.36 metres (9,565 kc/s), of which the reception has been good lately. The announcer will let you know that it is "VUB calling, India State Broadcasting Service." Transmissions are usually made on Wednesdays and Saturdays between G.M.T. 16.30-17.30 and 15.30-16.30 on Sundays. Occasionally they may be picked up on Mondays and Thursdays, but there is no fixed schedule for these days. As a landmark for starting a search, tune in DJA, Zeesen, on 31.38 metres (9,560 kc/s) which will be found working until 16.30; a very slight movement of the condenser will then give you the Bombay dial readings.



Short Wave Section

AN EXPERIMENTAL SHORT-WAVE RECEIVER

By K. E. B. JAY

THE simple two-valve receiver offers a wide field for experiment to the newcomer to short waves. As a matter of fact, much can be done with a single-valve detector, but the addition of an L.F. stage greatly increases signal strength. A useful circuit is given in Fig. 1.

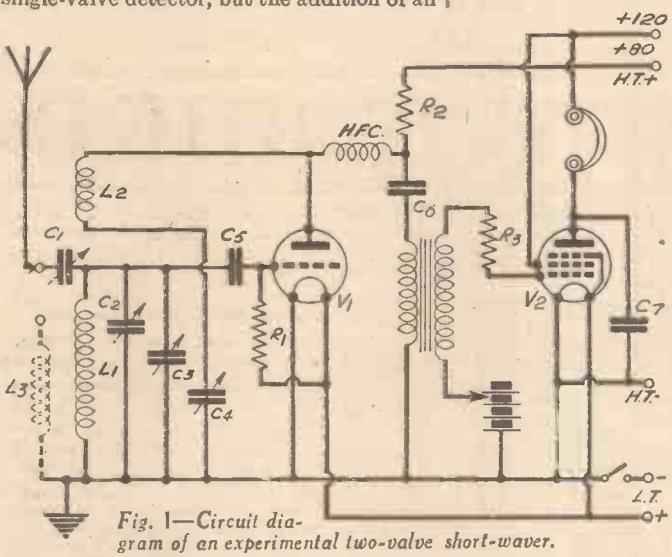


Fig. 1—Circuit diagram of an experimental two-valve short-waver.

In this circuit V_1 is the detector valve and V_2 the L.F. valve; a pentode is shown, but a triode will do, especially if headphones only are used. C_1 is a small air-dielectric variable condenser of about .00005 mfds. capacity; a neutralising or trimming condenser is suitable. A home-made fixed condenser of similar capacity could be used, but the variable feature is useful. This condenser couples the aerial to the tuned circuit. Two tuning condensers are used to give band-spread tuning, C_2 being the band-setting condenser of .0001 mfd. and C_3 the band-spreading condenser of about .000025 mfd. This system was described in detail in a recent article in PRACTICAL WIRELESS. The smaller condenser C_3 is used as main tuning condenser in order to make adjustment easier. Both C_2 and C_3 should be fitted with slow-motion dials. C_4 is the .00015 mfd. reaction condenser; its capacity is not critical. H.F.C. is a good-quality short-wave high-frequency choke. C_5 is the .0001 mfd. grid condenser and R_1 a 3- to 5-megohm grid leak.

One of the complete resistance-fed transformer units is suitable for the L.F. coupling, or if the constructor already possesses a transformer it can be used with a 30,000-ohm resistance for R_2 and a 1-mfd. condenser for C_6. The 100,000-ohm resistance R_3 is intended to prevent parasitic oscillation, but it may not be necessary. C_7 is a .001 mfd. bypass condenser used to prevent capacity effects between the headphone cords and the operator, but if these are still noticeable a high-frequency choke inserted between the plate of the pentode and the headphones should complete the cure.

Above-baseboard Mounting

Since experimenting with a circuit involves many changes of wiring, etc., it is best to avoid the popular under-baseboard method of construction and mount all the components on the top of the baseboard. Fig. 2 shows a good layout. The base can be either wood or metallised. If the latter is used care must be taken to keep all wires and components at high H.F. potential well away from the baseboard. Such wires are those connected to the grid and plate of the detector valve and to the aerial. The tuning condensers may be mounted some distance from the panel and provided with extension handles to avoid hand-capacity, or a metal panel may be used, in which case such precautions should not be necessary.

Leave plenty of room for coils on the baseboard, since many interesting experiments can be made in trying different kinds. There are two main types, dual- or triple-range coils fitted with a wave-change switch, and plug-in coils.

Plug-in Coils

Multi-range coils have the disadvantage that the switch introduces losses, and that generally their full wavelength range can only be obtained by using a fairly large tuning condenser, between .00025 and .0003 mfd., which leads to very difficult tuning. There are also dead-end losses from unused windings. Their sole claim to consideration is the simplicity of wave-changing, which requires only the turn of a switch.

Plug-in coils may be wound so as to give a limited wavelength range with corresponding ease of tuning, and there are no switch losses or dead-end losses. Their disadvantages are that a number of them is needed and changing wavelength involves a gymnastic operation in the middle of the receiver. Most experienced amateurs find them infinitely preferable to switched coils, however.

Recently an attempt has been made to combine the advantages of the two types by producing tuning units consisting of a set of plug-in coils that are switched into circuit as required by means of a multiple-contact switch, while those not in use are completely isolated from the circuit.

Coils of either type can be bought ready-made. There are two kinds of plug-in coil, those having a single winding and intended to plug into the old-fashioned plug

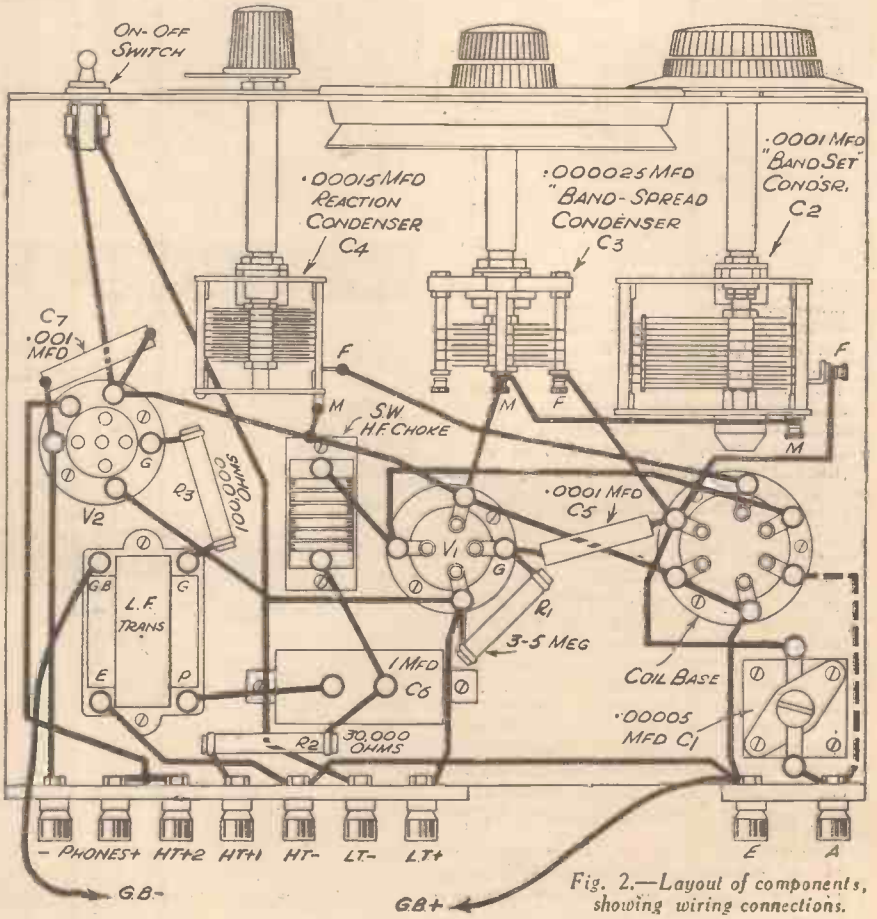


Fig. 2.—Layout of components, showing wiring connections.

and—socket coil mounting, and those consisting of two or three windings on a single former intended to plug into a four- or six-pin base. These are smaller in diameter than the single coils and, therefore, their magnetic field is smaller, and so interaction with other components is reduced. As they are wound to work together smooth reaction is automatically ensured. The four-pin types are intended to plug-in to valve-holders and are suitable for the circuit shown in Fig. 1, where the aerial is coupled through a condenser.

Six-pin Coils

A variation of the circuit, however, is to couple the aerial through another coil L_3 (shown dotted). This sometimes reduces interference from supply mains noises and similar sources. Six-pin coils are generally used for this circuit.

The experimenter can wind his own coils, and for this the bases of old valves make excellent formers. Owing to the small diameter of the bases it is not possible to say exactly what range of wavelengths will be covered by a certain number of turns, but an approximate idea is given by the following figures for the grid coil L_1. The wire used is 24 S.W.G. enamelled.

4 turns: 16 to 36 metres
7 turns: 22 to 51 metres
13 turns: 31 to 78 metres
} Total tuning capacity (C_2C_3) is .00015mfd.

The reaction windings L_2 would require about 3, 5 and 10 turns respectively. They are varied until smooth control is obtained all over the dial. These coils may be wound on purchased formers if desired. Valve bases are, of course, cheaper, but probably not as efficient, although the writer has found them very satisfactory.

A triple-range coil should be wound on a 1in. or 1½in. ribbed ebonite former, using a total of about thirteen turns tapped at the fourth and seventh turns. It is not easy to obtain satisfactory reaction over each range, however: splitting the reaction coil up and putting part of it between the seventh and eighth turns of the grid winding may be advantageous.

After experimenting with the coils the constructor may try alterations to other parts of the circuit. Variations in the values of the grid condenser and leak may be of benefit in improving sensitivity and smoothness of reaction control. A recent article in this journal described several alternative methods of reaction control, all of which can be investigated with a receiver such as this. Of those discussed, throttle control is particularly worth while; personally the writer prefers it to any other method, though the Reinartz system shown in Fig. 1 is more common now.

With a set made up as described, it is easy to test any new arrangement that comes to light, to try other detector valves, screen grid or pentode, and at the same time to tap the programmes of the world.

SHORT-WAVE SUPERHETS

THE superheterodyne receiver has been greatly in readers' minds of late in view of the tremendous interest evinced by Mr. F. J. Camm's three-valve superhet. Sufficient has been said in the articles describing the various forms of that receiver to explain fully the working of a superhet and the many advantages it has over a straight receiver. It is, therefore, proposed merely to describe in this article some of the various superheterodyne circuits which are usable on short waves, and to give some hints on using them. The superhet has been found of particular application to short-wave working owing to the fact that ordinary high-frequency amplification on these wavelengths is very difficult to obtain. Furthermore, a short-wave superhet can be of much simpler design than one for broadcast bands and is very easy to use. The superhet, however, is inclined to be noisier than an ordinary regenerative receiver, and as the "noise: signal" ratio must be kept very small for long-distance reception of weak signals, the superhet has not found so much favour with those amateurs whose delight in short-wave listening is to sit with 'phones glued to their ears searching for the distant ends of the earth. However, the loud-speaker is now coming into its own even on short waves, and consequently the superhet will become more popular.

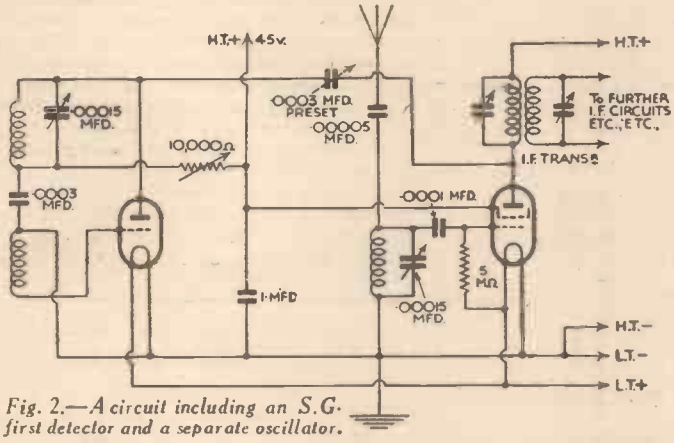


Fig. 2.—A circuit including an S.G. first detector and a separate oscillator.

Adapting the £5 Superhet Three

However, there may be some readers who have built the £5 Superhet Three and may care to experiment in adapting it for short-wave work. The circuit is shown in Fig. 1. L1 and L2 may be standard short-wave coils, and C1 and C2 condensers of .00015 mfd. each. Separate condensers should be used but tuning will be found quite easy. This set utilises a single pentogrid valve as both first detector and oscillator, but as these valves are as yet rather rare among amateurs, separate valves can be used by any who possess intermediate transformers and would like to try a short-wave superhet. The circuit is shown in Fig. 2, and it will be noticed that once again two separate condensers are used. Now, owing to the tremendously high frequencies which are dealt with on short waves, compared with those of the medium and long wavebands, it is possible to dispense with separate circuits for aerial and oscillator tuning. It is as though the circuit comprising the lower half of the pentagrid shown in Fig. 1 were "folded over" on to that forming the upper half, leaving but one tuned circuit and two grids to the valve. A circuit which was designed on this basis is shown in Fig. 3, and is particularly simple to use in that the only controls are one tuning condenser and a volume control. This latter is a variable potentiometer acting on the screening grids of the intermediate frequency amplifying valves. Readers of *Amateur Wireless* will probably remember this as being the circuit of a set described in that journal a year or so ago. Amateurs who care to experiment with it may find it advantageous to use variable-mu screen-grid or pentode valves for the I.F. stages, and a little decoupling would probably be to good effect. The .0003 mfd. reaction condenser is pre-set and mounted on the baseboard. It must be so adjusted as to keep the first valve gently oscillating over the whole tuning range.

A Special Circuit

All the foregoing circuits have been of sets which use special intermediate-frequency transformers, but it is possible to dispense with these. Readers are no doubt familiar with the methods of using short-wave adaptors and converters, but to-day

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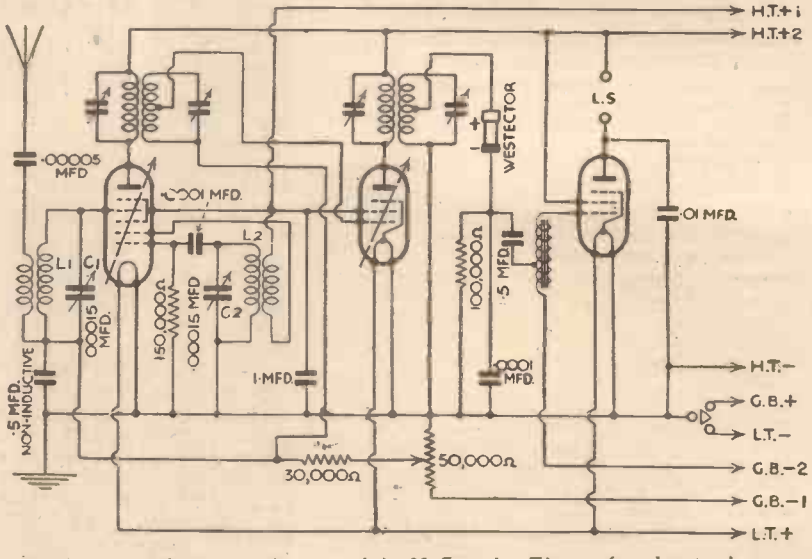

Fig. 1.—A modified circuit diagram of the £5 Superhet Three referred to in the text.

(*Continued from page 875*)

it is generally conceded that short-wave work is best done with a special set designed for the purpose, but in the earlier days converters were designed to convert an ordinary receiver into a short-wave superhet. Actually these consisted of nothing more than the first valve of Fig. 3, which was "tacked on" in front of the broadcast set. This latter was tuned to long waves and the H.F. valve or valves acted as I.F. amplifiers. There is no reason why a complete set on these lines should not be built up, and Fig. 4 shows the circuit of one which the writer intends to try out. The reaction condenser may be pre-set, as the first valve must be kept oscillating over the whole waveband and once set R.C. may be left alone. The tuned I.F. circuits—which are shown in Fig. 4 as simple single-circuit tuners between the first four valves—may be long-wave plug-in coils and tuned by pre-set condensers of .0005 mfd. capacity. They should be tuned to any wavelength where no broadcast takes place, as, should they tune to the wave of, say, Droitwich, it is quite likely that this station would be picked up and so cause interference. The wavelength, therefore, should be either between 600 metres and 1,000 metres (there are only Russian stations on this band and they are very unlikely to be picked up), or else above 2,000 metres. The best way to make sure they are both tuned to the same frequency is, of course, to use an oscillator, but should there be none available here is another method. One L.T. lead to the first valve-holder should be disconnected or the valve switched off by other means (*not* by removing the valve, as the self-capacity would have some effect on tuning). Then the first pre-set must be screwed right down—to tune the coil to roughly 2,000 metres. With the second reaction condenser turned so that the valve is gently oscillating the second and third pre-sets may be rotated until a whistle indicates the point of resonance. It seems that a certain amount of screening would be required between stages, and the plug-in coils should be arranged at right-angles one to another. Provided that a certain amount of care is taken there seems to be no reason why the set should not be successful.

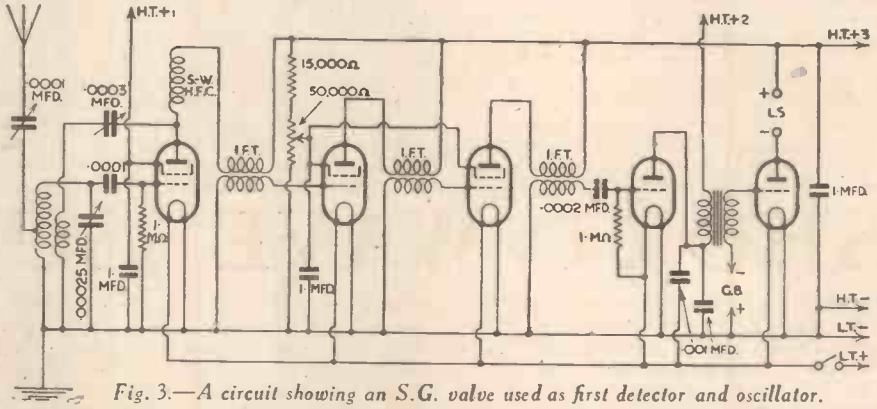

Fig. 3.—A circuit showing an S.G. valve used as first detector and oscillator.

The Set of the Future

The previous points set out appear to cover most of the ground regarding short-wave superheterodynes as has so far been explored. It is highly evident that the superhet will become "the" short-wave set of the future, both for the ordinary short-wave bands and for the ultra-short waves in connection with television. There are a small number of all-wave superhets on the market—that is to say, sets covering a band of from 20 to 2,000 metres—as well as a few short-wave converters, but the writer does not know of any commercial receiver for short waves only. In the United States, however, there are many short-wave superhets on the market. One particular make of set covers the broadcast band and the most interesting portion of the short-wave band, *i.e.*, 18 metres to 55 metres. The circuit is more or less typical of commercial short-wave practice in U.S.A., and combines several interesting features—showing the extent to which short-wave receivers have been developed in that country. It incorporates a heptode mixer valve, H.F. pentode first I.F. stage, A.V.C., and a duo-diode pentode, which latter is arranged to perform a novel reflex action. This one valve has four separate functions, detection and A.V.C. by the duo-diode section, and second stage

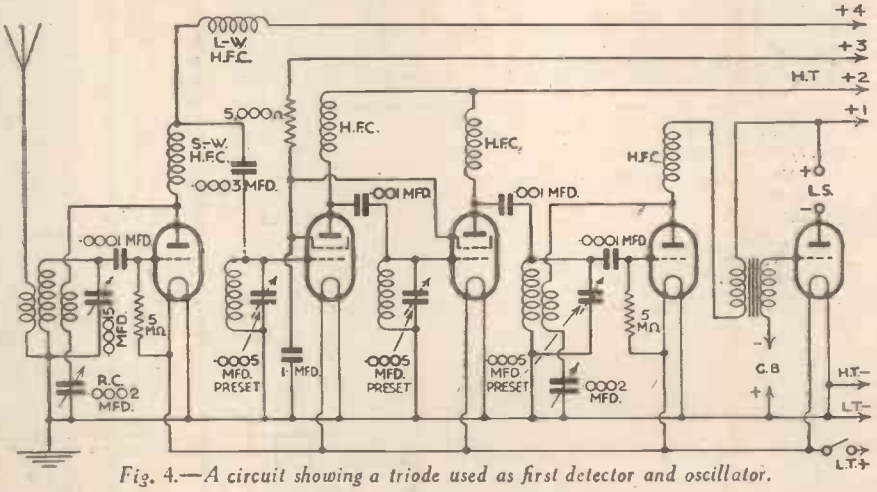

Fig. 4.—A circuit showing a triode used as first detector and oscillator.

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I.F. amplification and first stage L.F. amplification by the pentode section. This is then resistance-capacity coupled to an output pentode which feeds an energised moving-coil speaker—the whole outfit is, of course, mains-operated. There are three controls only—wave-change, volume, and tuning, both broadcast and short-wave bands being calibrated. World-wide loud-speaker reception is claimed at any hour of the day or night. It is certainly an ambitious form of short-wave receiver, but a type about which we may be hearing more in the near future.

LEAVES FROM A SHORT-WAVE LOG

THE incentive created by the establishment of a regular Empire service by the B.B.C. has induced many Continental States to follow this policy. To-day, the short-wave listener finds a number of powerful transmissions at his disposal from Germany, Denmark, Russia, Norway, Italy, Spain, Portugal, Switzerland, Romania, Austria, and others, in Europe alone, and to these must be added the almost innumerable broadcasts which may be picked up from the other four Continents.

There is a growing tendency of the nations to put out programmes through the short-wave stations which are *not broadcast* on the medium-wave band, and in consequence this policy affords a new field for the capture of radio entertainments. To facilitate these searches, therefore, in these columns details will be regularly given of any new-comers to the ether, as well as alterations in time schedules, calls, or interval signals. By this means, the short-wave listener's log can be kept up to date.

Calibration Signals

Calibration signals are very useful, and it is worth while making a note of the following transmissions which are being carried out on behalf of the U.S.A. National Bureau of Standards by WWV, Baltisville, Washington. They are of sufficient power to be received throughout the Western Hemisphere. The schedule is as under: Every Tuesday and Friday (Holy days excepted), G.M.T. 17.00-18.00, 20 metres (15,000 kc/s); 18.15-19.15, 30 metres (10,000 kc/s); 19.30-20.30, 60 metres (5,000 kc/s). The broadcast opens with the call CQ de WWV, and is followed by the indication of frequency and one long dash. In particular, the 60-metre signal will be heard at good strength. This by the way.

LKJ1, Jeloy, through which you may listen to the Oslo (Norway) broadcasts, is still using in the morning 31.45 metres (9,540 kc/s), but for the afternoon and evening transmissions switches over to 48.94 metres (6,128 kc/s). On the lower wavelength you will be given an opportunity of logging the station on Sundays until March 17, between G.M.T. 15.00-16.00, but the call will be put out in morse. As it takes its programmes from the Norwegian capital, it is the Oslo opening and interval signals which will help identification. The same dial position, within a hair's breadth, should bring you DJN, Zeesen, which transmits a special programme for Southern Asia daily between G.M.T. 08.45-16.30, and one for Central America between G.M.T. 02.15-03.30 daily.

IMPRESSIONS ON THE WAX

By T. ONEARM.

A FIRST recording of Schubert's Quartet in G (No. 15) on Columbia this month is welcome news for music lovers, for chamber music of this character will give a deserved spurt to "classical" music. It is, without doubt, the finest quartet ever written, simple in construction and a most fascinating and scholarly composition. So startling is it in its originality that the work was refused for publication during the composer's lifetime. It was over a quarter of a century after his death that the composition was published. It is recorded on four Columbia records, Nos. *LX*357 to *LX*360, which are obtainable in an art album, and is played by the Kolisch Quartet, who participate in the success of this issue by their keen sense of interpretation.

Another important "first recording" is the Vincent d'Indy Symphony for orchestra and pianoforte, played by the Colonne Orchestra of Paris. Vincent d'Indy was the most eminent French musician of his day. As composer, conductor, teacher, and critic, he dominated the scene for many years. This composition is founded on a Mountaineer's Song, from the birthplace of the composer. It is the first composition of d'Indy issued by the Columbia Company, and the soloist is Marguerite Long, the pianist who has made such a success in Paris and whose recording a few years ago won the French gramophone Grand Prix. The Symphony is recorded on six sides of three records, Nos. *LX*362 to *LX*364.

Sandler Serenades

Albert Sandler gives us a good idea on one of his two Columbia records this month. He has taken half a dozen of the famous serenades with which his name has been associated, and played them under the title "Sandler Serenades." The record includes the two Heykens serenades that Sandler introduced to this country, and the serenades of Toselli, Schubert, "Les Millions d'Arlequin," and Léhar's "Frasquita." The number of this record is *Columbia DX*667. His other record, *Columbia DB*1493, includes Paul Rubens' "Violin Song," from "Tina," which has received few performances such as Sandler gives it, and the exquisite "L'Heure Exquise" of Reynaldo Hahn.

An established success as a recording artist, as well as a furore on the operatic stage, Charles Kullman displays his lyrical qualities in "Beneath thy Window" (O Sole Mio), and Toselli's Serenade (Come Back) on *Columbia DB*1492. It was expressly because of Kullman's flair for expression and the warmth of his tone that he was chosen to sing them.

As an interpreter of the late Peter Warlock's songs, Parry Jones has strengthened his reputation; his record of "Take, O Take those Lips Away" and "There is a Lady Sweet and Kind" is still fresh in the memory. The new issue of the Columbia Collector's List contains yet a further two Warlock gems by the celebrated tenor—"As Ever I Saw" and "The Passionate Shepherd" on *Columbia DB*1489.

A Link with the Past

Columbia present this month a combination that will be welcomed in all homes where spontaneous music-making has not died out. It is the Angelus Glee Club, a specially chosen group of men and women singers, rendering Barnby's setting of Tennyson's "Sweet and Low" and de Pearsall's joyous "O, Who Will O'er the Downs so free," on *Columbia DB*1495. This is a happy gesture of Columbia's, for it provides a link with the past, when every influential household had its glees, madrigals, motets, and other forms of communal singing.

Eleventh of the fourteen Gilbert and Sullivan operas, "Yeomen of the Guard" stands out as the only serious work of the whole series. But though the music may be along more dramatic lines there are a host of numbers in the "Yeomen" well loved for their haunting lyrics and typically Sullivan melodiousness. "When a maiden Loves," "A Man Who Would Woo a Fair Maid," "I have a Song to Sing O," these and some half-dozen others are incorporated in a "Yeomen of the Guard" Selection by Debroy Somers' Band, on *Columbia DB*1494. This is the third of Debroy Somers' recent series of Gilbert and Sullivan selections.

Solex Records

Two records which should make their appeal are *Solex SX*118, on which Kitty Masters, the popular lady crooner of Henry Hall's Band, sings "That's me without you", and "When he comes home," and Reginald King and his orchestra playing "In a Pagoda" and "One Life, one Love" on *Solex SX*113.

All the latest dance tunes are obtainable on Solex records, and are played by such popular bands as Sydney Lipton and the Grosvenor House Band, Teddy Joyce and Dance Band, and Billy Merrin and his Commanders.

THE EASY ROAD TO RADIO.

THE BEGINNER'S SUPPLEMENT

SITE AND SET DESIGN

By H. BEAT HEAVYCHURCH

HAS it ever occurred to you to inquire why such a large variety of set designs are in use at the present time? Why, for example, while tens of thousands of listeners employ superhets of the latest type there are almost as many who prefer the "straight" receivers with two high-frequency valves; still more who can boast only one high-frequency stage, and a very considerable remainder who are still faithful to sets of the old detector and low-frequency variety.

There are, of course, a number of reasons. For example, the question of expense looms large as a factor in the problem, and many listeners who would willingly pension off their old receivers and adopt something more up to date cannot afford to do so.

Performance

Then there is the matter of performance. Everyone knows that, under given reception conditions, a set with one high-frequency stage will receive more stations than one having only a detector, and that two high-frequency stages give a still wider range of choice of programmes. But many people are quite contented with a restricted range, and have no desire nor need to employ a highly-sensitive receiver. I have met many listeners who, when taken to task on account of their ancient and inefficient receivers, have said, "Well, it gives me all that I want, so why change?" This matter of the desired performance is, I think, probably a bigger factor in the perpetuation of so many different types of receiver than is the matter of cost.

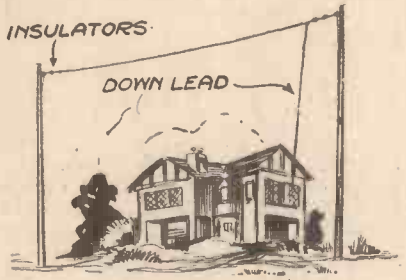
When all these causes of the infinite variety of receivers have been discussed, there remains one which should certainly be the deciding factor in the choice and design of every home-built receiver—namely the locality in which the set is to be operated. By this is meant that, once the listener has decided approximately on the performance he requires to obtain from his radio, he should, before buying or commencing to build a set, ascertain what type of receiver will best give the desired performance in the particular district in which he lives. It must be realized that any particular type of set will not necessarily give the same entertainment value in one place as it will in another. It all depends upon "local conditions."

Analysing the Conditions

In the first place, and almost the most important, is the matter of what kind of aerial it is possible to use. A set which, other things being equal, would give a very satisfying performance when used with a good aerial, may be hopeless when used with a poor aerial and earth system.

The next factor is the distance between the listener's home and the local broadcasting station. A set that at Hampstead will give wonderful strength from the National and Regional programmes may yield uncomfortably feeble volume at Slough.

Thirdly, there is a distinct connection between the distance separating the



A common form of outside aerial known as an inverted L type.

listener's home and the nearest broadcasting station having a wavelength close to that of the local British transmitter, and the angles at which these two and other powerful stations lie from the house. And, finally, the geographical position of the listener's home has a profound effect upon reception conditions and, therefore, on the type of receiver which must be installed if satisfactory listening is to be experienced.

Simplest Type

We may take it that the simplest type of set which is used to-day in any considerable quantities is the detector-L.F. combination, comprising either detector and pentode or detector, first L.F. amplifier, and triode output valve. Under what circumstances will a set of this type give a satisfactory performance? Well, in the first place, it could not be recommended for use at a distance of more than about seventy-five miles from the nearest B.B.C. station as a general rule. This is a very rough estimate, and I know of several such sets which are doing good service at over twice that distance. However, within the seventy-five miles radius one ought to be able to obtain ample volume from the local programmes.

But this is not the whole story, and the statement must be qualified by adding that if you are living within, say, ten miles of the local station, a set of this type will have great difficulty in separating the local programmes from more distant transmissions, and you will be almost limited to listening to the local programmes. Moreover, even if you are well outside the ten-mile limit—say forty or even seventy-five miles from the B.B.C. station—you may have difficulty in separating stations, especially in cutting out a station whose field strength is approximately equal to that of the local. For example, a set of the detector—L.F. type is utterly impossible to use at most places on the East Coast, owing to the strength of the German transmissions.

Another Case

The second class of receiver to be considered is the straight three-valver having one H.F. stage, either screened-grid or screened-pentode. Now here is a set which has a considerably greater degree of selectivity than the simple sets just referred to, and is also very much more sensitive. Its reasonable range can be placed at 150 miles from a main B.B.C. station—a conservative estimate, perhaps, but one which gives a nice little reserve in hand for foreign listening. The straight three with one H.F. stage has always two, and sometimes three, tuned circuits, and may be relied upon to separate the local stations from each other in almost every part of the country. It will probably not be able to receive free from interference those stations using the three or four channels on each side of the nearest B.B.C. stations, but unless you are living under the shadow of a main broadcasting

(Continued on next page)

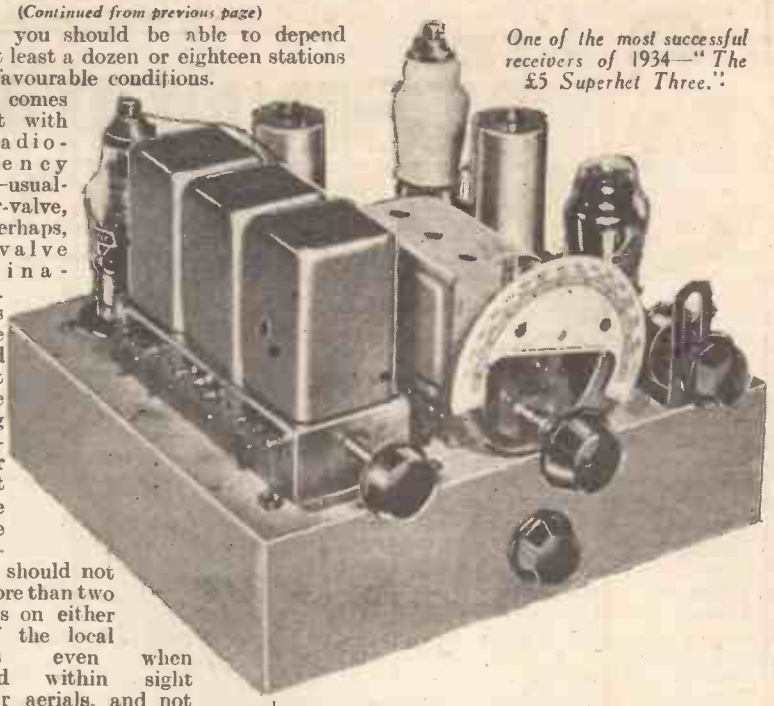
A three-quarter rear view of the "Fury Four," showing the neat lay-out of the components.

(Continued from previous page)

station, you should be able to depend upon at least a dozen or eighteen stations under favourable conditions.

Now comes the set with two radio-frequency stages—usually four-valve, or, perhaps, five-valve combinations. This may be summed up at once as being suitable for almost any site in the country. It should not miss more than two channels on either side of the local stations even when installed within sight of their aerials, and not more than one adjacent channel in the case of the more powerful Continental stations. Moreover, a set of this class will give a reasonably good account of itself with quite a small indoor aerial, or, in the case of a mains set, with a mains aerial. Naturally, in such cases, the power and number of stations will be cut down considerably, but at a conservative estimate a dozen stations should be receivable with ease almost anywhere.

One of the most successful receivers of 1934—"The £5 Superhet Three."



Finally, we come to the superhet class. Apart from details of design, these can be roughly divided into the four- or five-valvers, having no high-frequency valve and only one intermediate-frequency stage, and five- or six-valve combinations having one H.F. valve before the frequency-changer stage. Performance of the former ranges from that of a straight set with one radio-frequency stage to a straight set with two radio-frequency stages so far as sensitivity is concerned, but selectivity is considerably better than that of a straight three, although a four-valve superhet has usually very little advantage on this score with a straight set having two radio-frequency stages and band-pass tuning.

The superhet with a pre-amplifying H.F. valve, however, probably represents the high-water mark of both sensitivity and selectivity, at any rate as far as conventional sets are concerned, and may be used anywhere with the certain knowledge that practically every station of real programme value will be received with a good aerial, and many dozens of the chief stations when using a mains or frame aerial. The latter arrangement, of course, will further increase selectivity and is useful in the case of stations on adjacent channels being located at different angles from the house in which the set is installed.

BLUEPRINT SERVICE

MISCELLANEOUS.

Blueprints, 1s. each.

Short-wave Superhet Converter	23.1.32	AW329
Simple Trickle Charger ..	16.7.32	AW352
Battery-operated Amplifier ..	22.10.32	AW362
D.C. High-tension Unit	26.11.32	AW360
A.C. High-tension Adaptor ..	26.11.32	AW369A
Short-wave Plug-in Adaptor ..	23.1.33	AW326
"A.W." Push-pull Amplifier ..	11.2.33	AW376
Short-wave Adaptor	18.3.33	AW382
Superhet Short-wave Adaptor ..	8.4.33	AW385
Class-B Gramophone Amplifier ..	10.6.33	AW391
Three Class-B Units	2.9.33	AW400
Universal A.C. Amplifier (3-valve)	18.11.33	AW411
Valve and Set Tester	6.1.34	AW415
Experimenters' D.C. Mains Unit .	7.4.34	AW430
Experimenters' A.C. Mains Unit .	21.4.34	AW432
Valve Voltmeter	28.7.34	AW442
Add-on Two-valve Amplifier (battery)	28.7.34	AW443
Economy Gramophone Amplifier (battery)	*Apr.* '32	WM277
Dual-speaker Amplifier (A.C.) ..	*Nov.* '32	WM304
A.C. Mains H.T. Unit	*Jan.* '33	WM310
Five Q.P.P. Output Units ..	*Mar.* '33	WM315
Class-B Mains Unit	*June* '33	WM324
A.C. Short-wave Converter ..	*Mar.* '34	WM353
10-watt A.C. Amplifier	*June* '34	WM360
"W.M." Electric Gramophone ..	*Sept.* '34	WM369

WRIGHT AND WEAIRE "LUCERNE" COILS

A SERIES of sets published in *Amateur Wireless* during the past few months were known as the "Lucerne Ranger," "Lucerne Straight 3," "Lucerne Major," etc., and Messrs. Wright and Weaire were one of the listed firms to supply the coils. These coils were of a special nature, and we would remind late "A.W." readers that these coils are still easily obtainable from the firm mentioned, the prices being 5s. for the aerial coil and 5s. 6d. for the anode coil.

PRACTICAL 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)

Is A.V.C. Worth While?

SIR,—I have noticed with interest that most modern receivers of commercial type are provided with A.V.C., yet it seems significant that receivers described in PRACTICAL AND AMATEUR WIRELESS have not been so fitted. After trying A.V.C. I think it is over-rated and feel sure that you are right in not fitting it to your sets.—B. J. (Watford).

No Intermediate L.F.

SIR,—Please allow me to congratulate you on your set—the "A.C. Hall-Mark." I shall build it as soon as possible. One point slightly surprises me, namely, that the push-pull output follows the leaky-grid detector without any intermediate L.-F. stage. I am sure you must have good reason for this. An article on "following the signal through the receiver" would interest many. I also hope you will give details of the actual working voltages and the current taken by the various valves.—D. B. F. MCANDREW (Glasgow).

[*In the receiver in question there is a high-ratio transformer between the detector and the push-pull stage, obviating the necessity for any intermediate L.-F. stage.*—ED.]

Short-wave Reception

SIR,—The following remarks on short-wave reception in the North of Scotland may be of interest to other readers. Results on the 13 to 14-metre band are practically nil. Only a few commercial morse stations and occasionally W8XK can be heard. The average strength is about R3-4. The 19-metre band shows a great improvement. W8XK (19.72 m.) comes through R 5-6/N/X. Zeesen DJB is also a very good signal. The Philips Experimental Station on 19 metres comes through R9x/FFSS/X and provides good entertainment. The 25-metre band is very reliable and amongst the many stations heard are RNE, GSE, FYA, and 2RO, all coming in at about R7-9.

On the 31-metre band Sydney VK2ME and Lindhurst VK3LR are frequently heard about noon (G.M.T.). The laugh of the kookaburra gives one a great thrill. On this band GSB, GSC, W2XAF, LCL, CT1AA and HBL are very good signals. The most reliable band is on 48 to 50 metres, and on this band RW59, DJC, and GSA come in at R99. The Americans, W8XAL, W3XAL and W8XK can be plainly heard after 10 p.m. (G.M.T.).

I might also add that good entertainment can be had from the amateur bands on 20, 40, and 80 metres. The 40-metre band is by far the most reliable and the 20-metre amateurs are seldom heard. The 80-metre band is only of use after 11 p.m. G.M.T., when quite good signals are obtained.

I might add that my set is the PRACTICAL WIRELESS Empire Short-Wave Three with which I am delighted.

May I close by thanking you for the excellent books which I received under your gift scheme and by congratulating you on the successful union of two excellent technical papers?—A. H. MILLER (Strathpeffer).

Prices of Components

SIR,—I should like to support your recent remarks regarding wireless dealers. The more I see of them the more incompetent they appear to become. One point about which they are especially slack is the price of components. Prices are being continually reduced, but they make absolutely no effort to keep abreast of the times. One retailer even denied to me that he had a trade catalogue!—O. C. UHTHOFF (Cambridge).

Our £5 Superhet

SIR,—I have much pleasure in informing you that I have constructed your Battery Model £5 Superhet Three, and it is everything it is claimed to be. Thank you for the pleasure it gave me during construction, and the satisfaction it is now giving me and mine in performance.—C. R. MARTIN (Liverpool).

Our Short-wave Section

SIR,—I quite agree with your correspondent, A. Blakeley, that a large number of readers would be pleased to see an extension of your short-wave section in PRACTICAL AND AMATEUR WIRELESS. I have now no patience to read other wireless periodicals, but it has always occurred to me that the short-wave section was too small. I know that short-wave "fans" are still in the minority, but I feel that an extension of this section would be very much appreciated.

The theoretical diagrams given are excellent, but a suggested lay-out should also be given so that proper care and attention can be given to screening with a view to obtaining the last "ounce" of punch which is so essential in short-wave work.—J. S. RALPH (Barrow-in-Furness).

CUT THIS OUT EACH WEEK

Do you know

—THAT the addition of sodium silicate to accumulator acid renders it non-liquid.

—THAT a non-spillable accumulator for a portable may be obtained by adding the above chemical until the desired consistency is obtained.

—THAT the well-known light-sensitive material, selenium, is insoluble.

—THAT "metallised" valves are not coated with aluminium as popularly supposed, but with zinc.

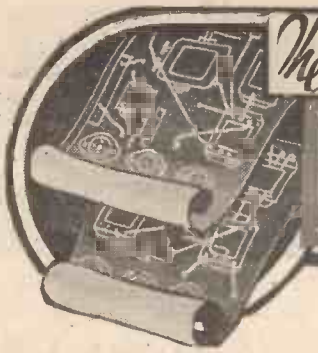
—THAT all A.C. mains units should be protected by means of a fuse on the input and on the output portions.

—THAT a .5 amp fuse to each input lead will provide ample protection on the input side, and a similar fuse should be joined in the lead to the centre-tap of the secondary of the mains transformer.

—THAT A.C. receivers designed for 50-cycle mains should not be used on mains of lower periodicity.

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

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



The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

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

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Argus Three Mains Unit	26.11.32	PW6A
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Superset	19.8.33	PW26
Auto-B Three	19.8.33	PW27
All-Wave Two	19.8.33	PW28
A.C. Three	16.9.33	PW29
Premier Super	23.9.33	PW30
Experimenter's Short-Wave Three	23.9.33	PW30A
A.C.-D.C. Two	7.10.33	PW31
All-Wave Unipen	14.10.33	PW31A
F.J.C. 3-valve A.V.C. (Transfer Print)	4.11.33	PW32
Luxus A.C. Superhet	14.10.33	PW33
A.C. Quadpak	2.12.33	PW34
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Fury Four Super	27.1.34	PW34C
A.C. Fury Four Super	10.2.34	PW34D
Leader Three	10.3.34	PW35
D.C. Premier	31.3.34	PW35B
A.C. Leader	7.4.34	PW35C
Prima Mains Three	5.4.34	PW35D
Master Midget Two	12.5.34	PW35E
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Ublque	28.7.34	PW36A
Four-Range Super-Mag. Two	11.8.34	PW36B
Summit Three	18.8.34	PW37
Armada Mains Three	18.8.34	PW38
Midget Short-Wave Two	15.9.34	PW38A
All-Pentode Three	22.9.34	PW39
£5 Superhet Three	27.10.34	PW40
A.C. £5 Superhet Three	24.11.34	PW43
D.C. £5 Superhet Three	1.12.34	PW42
Hall-Mark Three	8.12.34	PW41
F. J. Camm's Universal £5 Superhet	15.12.34	PW44
A.C. Hall-Mark	26.1.35	PW45
Battery Hall-Mark 4	2.2.35	PW46
Universal Hall-Mark	9.2.35	PW47

AMATEUR WIRELESS AND WIRELESS MAGAZINE.

CRYSTAL SETS.

Blueprints, 6d. each.

Four-station Crystal Set	31.3.34	AW427
1934 Crystal Set	4.8.34	AW444
150-mile Crystal Set	Out of print	AW450

STRAIGHT SETS. Battery Operated.

One-valvers: Blueprints, 1s. each.

B.B.C. One-valver	Out of print	AW344
B.B.C. Special One-valver	Out of print	AW387
Twenty-station Loud-speaker One-valver (Class B)	Out of print	AW449

Two-valvers: Blueprints, 1s. each.

Melody Ranger Two (D, Trans)	Out of print	AW388
Full-volume Two (SG, Det, Pen)	17.6.33	AW392
Iron-core Two (D, Trans)	Out of print	AW395
Iron-core Two (D, QPP)	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D. Trans)	Out of print	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans)	Out of print	AW338A
Lucerne Minor (D. Pen)	Out of print	AW426
Family Two (D. Trans)	*Apr.* '32	WM278

Three-valvers: Blueprints, 1s. each.

£8 Radiogram (D, RC, Trans)	Out of print	AW343
New Regional Three (D, RC, Trans)	25.6.32	AW349
Class-B Three (D. Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D. Trans, Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans. Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher: Chassis Model (SG, D, Pen)	3.2.34	AW419
Lucerne Ranger (SG, D, Trans)	Out of print	AW422
Cossor Melody Maker with Lucerne Coils	Out of print	AW423
P.W.H. Mascot with Lucerne Coils (Det, R.C., Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	Out of print	AW424
Pentaquester (HF, Pen, D, Pen)	14.4.34	AW431
£5 5s. Three: De-luxe Version (SG,D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	9.6.34	AW437
All-Britain Three (HF Pen,D,Pen)	Out of print	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.1.34	AW451
Transportable Three (SG, D, Pen)	*Feb.* '32	WM271
Multi-Mag Three (D. 2 Trans)	*June* '32	WM288
Percy Harris Radiogram (HF, D, Trans)	*Aug.* '32	WM294
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Tyers Iron-core Three (SG, D, Pen)	*July* '33	WM330
C.-B. Three (D, LF, Class B)	Out of print	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
All-wave Three (D, 2LF)	*Jan.* '34	WM343
"W.M." 1934 Standard Three (SG, D, Pen)	*Feb.* '34	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	*Oct.* '34	WM371

Four-valvers: Blueprints, 1s. 6d. each.

65/- Four (SG, D, RC, Trans)	Out of print	AW370
"A.W." Ideal Four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D, Pen)	Out of print	AW421
Crusaders' A.V.C. 4 (2 H.F, D, QP21)	18.8.34	AW445
(Pentode and Class-B outputs for above; blueprints 6d. each)	25.8.34	AW445A
Quadradyne (2SG, D, Pen)	*Feb.* '32	WM273
Calibrator (SG, D, RC, Trans)	*Oct.* '32	WM300
Table Quad (SG, D, RC, Trans)	*Nov.* '32	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
Self-contained Four (SG, D, LF, Class-B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	*Feb.* '34	WM350

Five-valvers: Blueprints, 1s. 6d. each.

Super-quality Five (2 HF, D, RC, Trans)	*May* '33	WM320
New Class-B Five (SG, D, LF, Class B)	*Nov.* '33	WM340
Class-B Quadradyne (2 SG, D, LF, Class B)	*Dec.* '33	WM344

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Consoelectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C.Two(D, Trans)A.C.	*June* '32	WM286
Three-lover's New All-electric Three (SG, D, Trans) A.C.	25.3.33	AW383
S.G. Three (SG, D, Pen) A.C.	3.6.33	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen) A.C.	23.6.34	AW439
D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July* '33	WM328
Simplicity A.C. Radiogram (SG, D, Pen) A.C.	*Oct.* '33	WM333
Six-guinea AC/DC Three (HF,Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF, Pen, D, Pen) A.C.	*Nov.* '34	WM374

Four-valvers: Blueprints, 1s. 6d. each.

A.C. Melody Ranger (SG, DC, RC, Trans) A.C.	Out of print	AW380
AC/DC Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C.	8.9.34	AW446
A.C. Quadradyne (2SG, D, Trans) A.C.	*Apr.* '32	WM279
All Metal Four (2SG, D, Pen) A.C.	*July* '33	WM329

SUPER-HETS.

Battery Sets: Blueprints, 1s. 6d. each.

1934 Century Super	9.12.33	AW413
Super Senior	*Oct.* '31	WM256
1932 Super 60	*Jan.* '32	WM269
Q.P.P. Super 60	*Apr.* '33	WM319
"W.M." Stenode	*Oct.* '34	WM373
Modern Super Senior	*Nov.* '34	WM375

Mains Sets: Blueprints, 1s. 6d. each.

1934 A.C. Century Super, A.C.	10.3.34	AW425
1932 A.C. Super 60, A.C.	*Feb.* '32	WM272
Seventy-seven Super, A.C.	*Dec.* '32	WM305
"W.M." D.C. Super, D.C.	*May* '33	WM321
Merrymaker Super, A.C.	*Dec.* '33	WM345
Heptode Super Three, A.C.	*May* '34	WM350
"W.M." Radiogram Super, A.C.	*July* '34	WM366
"W.M." Stenode, A.C.	*Sep.* '34	WM370

PORTABLES.

Four-valvers: Blueprints, 1s. 6d. each.

General-purpose Portable (SG, D R.C, Trans)	Out of print	AW351
Midget Class-B Portable (SG, D, LF, Class-B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	*May* '32	WM287
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM362
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM363

SHORT-WAVERS. Battery Operated.

One-valvers: Blueprints, 1s. each.

S.W. One-valve	Out of print	AW329
S.W. One-valver for America	Out of print	AW429
Roma Short-waver	10.11.34	AW452

Two-valvers: Blueprints, 1s. each.

Home-made Coil Two (D. Pen)	14.7.34	AW440

Three-valvers: Blueprints, 1s. each.

World-ranger Short-wave 3 (D, R.C, Trans)	Out of print	AW355
Experimenter's 5-metre Set (D. Trans. Super-regen)	30.6.34	AW438
Experimenter's Short-waver	*Jan.* 19,'35	AW463
Short-wave Adapter	*Dec.* 1.'34	AW456
Superhet. Converter	*Dec.* 1.'34	AW457

Four-valvers: Blueprints, 1s. 6d. each.

"A.W." Short-wave World Beater (HF Pen, D, RC, Trans)	2.6.34	AW436
Empire Short-waver (SG, D, RC, Trans)	*Mar.* '33	WM318

Super-hets: Blueprints, 1s. 6d. each.

Quartz-crystal Super	*Oct.* '34	WM372

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Two-valve Mains Short-waver (D, Pen) A.C.	10.11.34	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	*Aug.* '34	WM368

Three-valvers: Blueprints, 1s. each.

Emigrator (S.G, D, Pen), A.C.	*Feb.* '34	WM352

Four-valvers: Blueprints, 1s. 6d. each.

Gold Coaster (SG, D, RC, Trans) A.C.	*Aug.* '32	WM292
Trickle Charger	*Jan.* 5.'35	AW462

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.

SOCIETY OF WIRELESS PIONEERS

THIS society announces the appointment of Mr. R. W. Stewart, of 8, East View Terrace, Seaton Carew, West Hartlepool, Co. Durham, as Hon. Director of the Durham and Yorks area. A chapter is in process of being formed, and it is requested that all pioneers in short-wave work will communicate with Mr. Stewart; a stamp for reply will be appreciated. The Society of Wireless Pioneers also announces its own monthly journal, edited by the famous American writer, Alice R. Bourke, W9DXX, for many years reporter on the *Chicago Tribune*. The Society will always be pleased to hear of pioneers of eleven or more years standing: H. B. Shields, 35, Bluestone Road, Moston, Manchester 10; R. W. Stewart, 8, East View Terrace, Seaton Carew, W. Hartlepool; R. L. Rawles, Blackwater, Isle of Wight.

THE CROYDON RADIO SOCIETY

MR. P. K. TURNER, the famous loud-speaker designer, lectured and demonstrated on "A Modern Radio-Gramophone" at the Croydon Radio Society's meeting in St. Peter's Hall, South Croydon, on Tuesday, February 12th. In the Chair was Mr. H. Bevan-Swift, late President of the Radio Society of Great Britain. The trouble, said the lecturer, had been people who sought quality from a good loud-speaker, but used it with an inferior amplifier. He had designed, therefore, a receiver to operate the Hartley-Turner speaker, and went on to discuss its technical features, such as transformer design and push-pull output stage.

Regarding records, the piezo-electric pick-up was used and its excellent response up to 8,000 cycles and its big output were very advantageous. He played many records, and the operation of tone-control on each one was most instructive. Even better quality, of course, was obtained on radio-reproduction, which to most members was as lifelike as they had ever heard.

On Tuesday, March 5th, comes another popular loud-speaker night, and, although a crowded meeting is expected, the society will welcome, as usual, any PRACTICAL AND AMATEUR WIRELESS readers who care to come and join us. Hon Sec.: E. L. Cumbers, Maycourt, Campden Road, South Croydon.

AN INTERESTING MULTI-PURPOSE VALVE

(Continued from page 864)

will be seen that D2, instead of being connected to the secondary winding (L2) of the tuned H.F. transformer, is joined instead to the primary (L1), this winding not being so sharply tuned as L2 and being designed to produce what is generally known as double-humped tuning. Thus, as the tuning condenser is set slightly to either side of the resonance point, the maximum A.V.C. voltage is developed.

In addition to automatic volume controls manual control is provided by means of the .5-megohm potentiometer in series with the anode marked D3. The values of all the principal components are indicated on the circuit diagram, but it will be seen that no values are given for the two resistances marked R1 and R2, nor for their corresponding by-pass condensers C1 and C2. The object of the two resistances is to provide delayed A.V.C., the object of which is to prevent the application of bias to the H.F. valves until signals of a certain minimum voltage are tuned in. By this means the A.V.C. is prevented from curtailing the volume of signals that are already rather weak, and long-distance reception is not, therefore, impaired by the A.V.C. action. The idea is that the "earth" end of resistance R2 is positive in respect to the end that is connected to H.T. negative, and negative in respect of the diode cathode. The two resistances are chosen to be of such a value that the difference in the voltage-drop across each is 40, this constituting the "delay" voltage. As the anode current for all the valves preceding the triple-diode-triode has to pass through R2 the voltage-drop across this resistance is dependent upon that part of the current.

FACTS & FIGURES

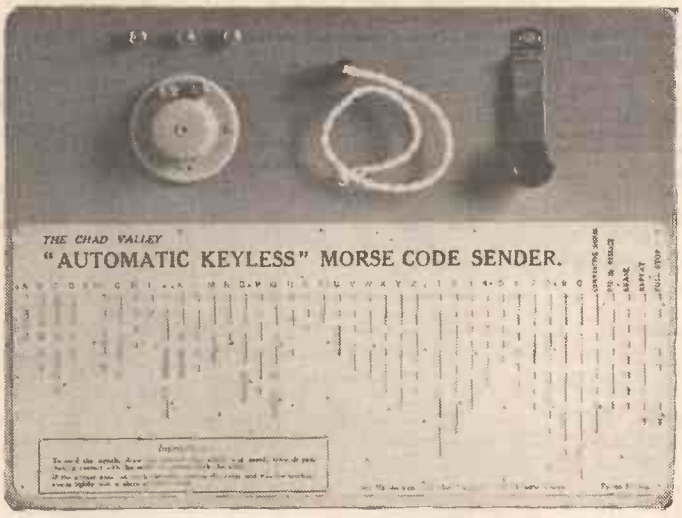
Components tested in our Laboratories

Morse Practice Simplified

IT has always been an advantage to the wireless experimenter to be able to receive in the morse code, but the task of learning the code is generally considered as being a somewhat irksome one. Generally, the would-be morse-code learner has found it best to work in conjunction with a friend so that one may transmit and the other receive, using a buzzer for transmission purposes. This is all very well up to a point, but it is unsatisfactory to attempt to learn to read morse when the person "transmitting" it is himself a learner. The reason is that the code is generally badly "timed" and thus inaccurate. Practically all of the normal difficulties of learning morse are overcome, however, by making use of the Chad Valley "Automatic Keyless" Morse Code Sender, illustrated on this page. It will be seen from the illustration that the neat instrument consists of a high-note buzzer, a tapping key, and a "keying board," the latter consisting of a thin sheet of tough fibre which is pierced with a series of square holes and long slots behind which is a sheet of brass foil. The various perforations are arranged in order for all of the letters of the alphabet, figures from 0 to 9, and various abbreviation signs.

There is a handy plug attached to a length of flex, and by rubbing the plug over the series of perforations corresponding to any letter or figure an accurate morse counterpart is signalled by the buzzer. By moving the plug quickly or slowly the speed of "transmission" may be varied to suit the requirements of the learner.

All that is required, in addition to the unit illustrated, is an ordinary 4½-volt flashlamp battery (or a 2-volt accumulator if this is more convenient), and this is joined to two of the three terminals provided. After the learner has learnt the morse alphabet he can "transmit" by means of the tapping key, simply by joining the battery to a different pair of terminals. A special connector can also be supplied by the makers for joining together two of the units illustrated.



The Chad Valley "Automatic Keyless" Morse Code Sender.

The Amplion "Dragon" Speaker

RECENTLY introduced by Amplion (1932) Ltd., the Amplion "Dragon" moving-coil loud-speaker will find a ready market. It is fitted with a universal matching transformer, and costs 29s. 6d. The transformer enables the speaker to be used satisfactorily with practically every type of output stage, whether it incorporates a small or large-power valve, a pentode, two valves in push-pull, or a Class B valve, and input impedances of from 3,000 to 20,000 ohms are obtainable by using the various tappings. We have tested the speaker very thoroughly and formed the opinion that it is an excellent unit, giving good response to a very wide range of frequencies, as well as being particularly sensitive. The high sensitivity is no doubt largely brought about by the use of a large magnet system and by careful design. Due to the free mounting of the 7in. cone we found that the response to very low frequencies was particularly good, although there was no apparent tendency towards resonance at the upper end of the frequency scale.

Apparently the makers do not make any claim concerning the maximum output which the speaker will carry without distortion, but we found that it handled well over two watts without giving any signs of distress. The Amplion "Dragon" can, therefore, be relied upon to give every satisfaction when used with the average home receiver, whether it is a two-valve battery-operated one, or a mains superheterodyne.

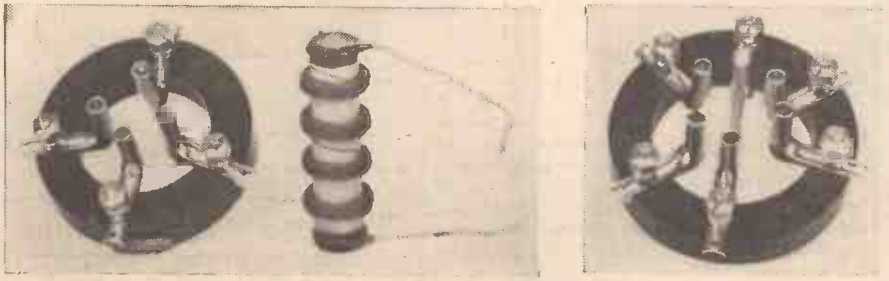
Eddystone Short-wave Components

WE have just completed our test on a further batch of the well-known Eddystone components, which are illustrated on this page. The components in question are: a baseboard-mounting short-wave valve-holder, a six-pin low-loss coil-holder, and a very interesting short-wave choke.

The valve-holder is built up on a bakelite ring, the sockets being air-spaced and made in single pieces of metal. The latter is an important point in short-wave work, since it eliminates all possibility of bad connection between the actual sockets and their soldering connections. These valve-holders are listed at 1s. 3d. in four-pin type, and 1s. 6d. in five-pin type.

The coil-holder is identical with the valve-holders in every respect, excepting the positioning of the six sockets; these are arranged to take the efficient plug-in six-pin coils of Eddystone manufacture. The holders cost 2s. 3d. each.

As to the short-wave choke, this is of extremely efficient design and consists of four series-connected honeycomb coils rigidly mounted on a hollow steatite former. The choke covers all wavelengths from 10 to 200 metres, and we have found that it does not exhibit any noticeable resonance peak over the whole of this range. The component measures only 2in. by 7/16in. and, therefore, has a very small external field. It has wire end connections, so that it can be attached directly to other components in the receiver. The price is only 2s. 9d.



A group of Eddystone S.-W. components described above.

The Pix Invisible Aerial

OUR attention has been drawn to a paragraph which appeared in the article entitled "Efficient Aerial Systems," and which was published on page 677 of PRACTICAL AND AMATEUR WIRELESS dated January 26th. In this article the author stated that picture-rail aerials were, generally speaking, inefficient and only really satisfactory when used in conjunction with a powerful receiver. In making this statement the author had not in mind the various special aerial materials sold for attaching to the walls of the room—one of the best-known of which is the Pix—but was thinking more of the makeshift type of "collector" employing a length of ordinary cotton-covered wire.

So as to remove any misunderstanding that the above-mentioned paragraph might have created I feel that I should, in fairness to The British Pix Co., Ltd., state that I have in the past used several Pix Invisible Aerials with complete satisfaction. I have, in fact, frequently found these to be superior to outside aerials, especially when interference-free reception was an important consideration, and when selectivity was of the utmost importance.—F. J. CAMM.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

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

SPECIAL NOTE

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

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

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.

Coils for 7 Metres

"I want to experiment on the new television wavelengths, and should welcome your recommendations as to the most suitable type of coil, *i.e.*, size of former, type of wire, etc."—R. G. Y. (Barrow).

For a normal type of circuit you should make the coils from heavy gauge bare wire, say No. 16 or 18. To avoid losses due to oxidation tinned copper wire will be found most suitable. Obtain a former having a diameter of about ¾in. and wind the wire with adjacent turns touching. When the required number of turns have been wound the wire should be released, when it will spring out slightly larger than the former and adjacent turns will separate. The coil should be mounted direct into position without a mount and without the former. A single turn may be used as an aerial coupling coil, and three turns (tuned by a 50 mmfd. condenser) will probably be found most suitable for the grid coil. This may be modified according to the type of circuit you decide to use, and will serve as a basis for experiment.

Modifying a Disc

"I have built a disc television receiver which I have been using for some time, and this I understand will be obsolete in the near future. Is there any way in which I can alter the disc so as to see the high-definition pictures?"—O. T. (Richmond).

At the present moment we cannot offer you assistance in this direction. You must bear in mind, however, that the 30-line transmissions will continue for some time yet and they will not cease as soon as the high-definition transmissions begin. In that respect, therefore, your present apparatus will serve you for some time to come. On the other hand, it may be possible in the future to modify your apparatus to take advantage of the newer transmissions, and if so, details will be given in this paper.

Speaker versus Receiver

"I have just obtained a moving-coil speaker which is advertised in your pages every week. I spent a lot on this as it is boosted such a lot, but am very disappointed with the results. Not only does it give quieter volume than my old trumpet, but the quality is not so good. It's deep and "woofy," and there are no top notes at all. How can you boost a thing like that?"—F. G. (Aylesbury).

We are afraid you have fallen into an old pit. You may be a new reader of our journal and have thus not made yourself acquainted with the conditions necessary for good wireless signals. You should bear in mind that the loud-speaker only delivers what is fed into it, and therefore you must first of all obtain a circuit which will do justice to a good loud-speaker. As you were using a trumpet type of speaker we presume that your receiver is also of rather old design, and as the old speaker was deficient in bass response the circuit was probably full of bass resonance and also deficient in top note response. Thus, on your horn speaker you heard what was apparently bass, and the squeaky nature of the speaker gave you what you imagined were top notes. Now you are using a speaker which is a faithful reproducer without resonances, and consequently it shows up the defects in your set. To convince yourself that this is indeed so, take the speaker to a local dealer and get him to test it on a modern set; if it sounds all right, you must bring your set up to date, and then you will be able to obtain really high-quality signals.

Some Facts about Earths

"I have a buried earth plate, with a seven foot stranded cable joined to it. The soldered joint is quite sound and well painted, and the cable is unbroken. Yet when I disconnect the lead the weak stations remain unaltered, and reaction does not seem to be affected. As I understand it, this points to an inefficient earth. How can this be with my arrangement?"—G. T. (Woking).

It is, of course, quite possible to have an arrangement such as yours which is, nevertheless, inefficient. The requirements of an earth are not low resistance wire and good, large earth plate, but a low-resistance path throughout. To ensure this, it is obvious that there must be good connection between the plate and earth, and it is probably here that your trouble lies. If you are situated on sandy soil, and your plate is buried in dry sand, it would be inefficient. If possible, the plate should be in moist clay, although if that is not possible, you should make a large hole and pack the plate with coke and if possible some such material as soda, sal-ammoniac, etc. You will then find that your earth is O.K.

Not to Specification

"I have built up your Hall-Mark set, although I did not use the parts you gave. I had some by me and a local store has a lot of dismantled gear from well-known commercial sets, and I got some of these as they seem equal to those sold to home-constructors. I also made one or two slight modifications to the circuit to suit my needs. I find that it is not a patch on an old two-valve set which has been in use four years. I have tested the parts carefully, and have wired them to your published circuit, but with no better results. Could you examine this in your laboratory and tell me where I have gone wrong? I will pay any expenses incurred."—G. C. W. (Harringay).

No, we are sorry we cannot look at your set. Firstly, we must take the standpoint that if you know sufficient to be able to state that the parts which you have bought are equivalent to those we specified, and are able also to modify a circuit, then you should be fully capable of finding a fault or two.

Reactance of a Condenser

"I am carrying out some experiments, and wish to know the formula for the reactance of a condenser. The book in which I kept such details has unfortunately been destroyed in a fire which consumed not only all my wireless books, but also the entire contents of my workshop and three wireless sets. I hope you can give me this information as soon as possible."—T. R. (Birmingham).

The formula you require is: $\frac{10^6}{2\pi f c}$

where f is the frequency in cycles per second, and c is the capacity in microfarads.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face type and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. Radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," 8, Southampton Street, Strand, London.

PREMIER SUPPLY STORES

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

OFFER the Following Manufacturers' Surplus New Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra, I.F.S. and abroad, carriage extra. Orders under 5/- cannot be sent c.o.d. Please send for Illustrated catalogue, post free.

ALL-ELECTRIC 3-stage Amplifiers, 200-250v., 40-60 cycles, 10 watts undistorted output, complete with 5 valves and Magnavox Super 66 energised speaker, £12/10/0.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, condensers, resistances, and diagram, 120v. 20 m.a., 20/-; trickle charger, 8/- extra; 150v. 30 milliamps with 4v. 2-4 amps. C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps., with 4v. 3-5 amps. C.T., L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps. L.T., 27/6.

PREMIER Chokes, 40 milliamps, 25 hys., 4/-; 65 milliamps, 30 hys., 5/6; 150 milliamps, 30 hys., 10/6; 60 milliamps, 80 hys., 2,500 ohms, 5/6; 25 milliamps, 20 hys., 2/9; 250 milliamps, 30 hys., 20/-.

ALL Premier Mains Transformers have engraved panels, terminal connections, all low-tension windings centre tapped, tapped and screened primaries 200/250 volts.

PREMIER 250-0-250 60 milliamps, 4 volts 1-2 amps, 4 volts 2-3 amps, 4 volts 3-4 amps., 10/-.

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

PREMIER combined HT8 and HT9 transformer rectified output 250 or 300 volts 60 milliamps, 4 volts 1-2 amps, 4 volts 3-5 amps, 10/-, or with Westinghouse Rectifier, either type, 18/6.

PREMIER HT10 transformer rectified output 200 volts, 100 milliamps, 4 volts 1-2 amps, 4 volts 3-5 amps, 10/-, or with Westinghouse Rectifier, 10/6.

PREMIER HT11 transformer 500 volts 120 milliamps rectified output, 4 volts 2 amps, 4 volts 2 amps, 4 volts 3-5 amps, 22/6; with Westinghouse Rectifier, 42/6.

SPECIAL offer Western Electric mains transformers input 200/250 volts, output 350-0-350 volts, 120 milliamps screened primary 4 volts 1-2 amps, 4 volts 2-3 amps, 4 volts 3-5 amps, 9/6. Input 100/250 volts, 300-0-300 volts 60 milliamps 4 volts 1-2 amps, 4 volts 2-3 amps, 6/6. Input 200/250 volts screen primary output 500-0-500 volts 150 milliamps 4 volts 3-5 amps, 4 volts 2-3 amps, 4 volts 2-3 amps, 4 volts 1 amp, 4 volts, 1 amp, 19/6.

MAINS transformer with Westinghouse Rectifier output 150 volts, 30 milliamps and 4 volts, 2 amps LT., 15/- the pair.

USA. 3-gang condenser with trimmers, 3/11; a really solid job.

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

B.T.H. Truspeed Induction Type (A.C. Only), Electric Gramophone Motors, 100-250v., 30/- complete. D.C. model Truspeed, 100/250v., 42/6.

COLLARO Gramo. Unit, consisting of A.C. motor, 200-250v. high quality pick-up and volume control, 49/-; without volume control, 40/-.

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

SPECIAL Offer of Wire-Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

CENTRALAB Potentiometers, 400 ohms, 1/-; 50,000, 100,000, ½ meg., any value, 2/-; 200 ohms, wire-wound, 1/-.

RELIABLE Canned Coils with Circuit accurately matched, dual range, iron cored, 2/11.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 144, 2,500 ohms, 12/6; D.C. 152 magna, 2,500 ohms, 37/6, all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M., 7in. cone, 16/6; 9in. cone, 22/6.

SPECIAL offer .00015 brass short-wave tuning condensers with slow-motion and complete dial, 3/9. Short-wave chokes 10-200 metres, 9d.

DUBILIER electrolytic condensers, 12 microfarads, 20 volts 6d., 8 plus 4 microfarads 500 volts 4/-, 50 mf. 50 volts, 1/9.

AMERICAN G.E.C. auto-transformers 450 watts, one side 110 volts, other 90/240 volts in 5 volt steps, 30/-.

(Continued at top of column three)

Guaranteed WORLD WIDE Short Wave RECEPTION

New DISCOVERER H.F.P.3

BUILD IT YOURSELF!

OBTAINABLE ONLY DIRECT FROM PETO-SCOTT

COVERS 13 TO 98 METRES 12,000 MILES TUNING RANGE.

DON'T miss all the thrills of S.W. reception because you are not an expert. The New Discoverer H.F.P.3 is as simple to control as any broadcast set. Reception of S.W. Stations has never before been so simple. Build it yourself in an evening and taste the fascination of world-wide programmes below 100 metres. Here's your first chance to build a splendid S.W. Set that embodies many exclusive technical refinements.

- H.F. Pentode, Detector and PENTODE OUTPUT.
- 100-1 Slow Motion Tuning.
- Tuned Aerial and Grid Circuits.
- Slow Motion Reaction.
- Special Throttle Control Reaction.
- Parallel Feed L.F. Amplification.
- Output sockets for Speaker or 'Phones.

FREE FULL-SIZE BLUEPRINT

KIT "A" Comprises all necessary parts to build, with 6 coils (13-96 metres), less valves and cabinet. With Full Size Blueprint and detailed instructions. Cash or C.O.D. Carriage Paid. £4.15.0, or 7/6 Deposit and 11 monthly payments of 9/-. **YOURS FOR 7/6**

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A customer in South America writes:

"I have to acknowledge your Kit Set. No doubt you will be interested to hear of its performance upon its FIRST NIGHT upon the ether. Hereunder please find my 'log' up to the present. LSX—Argentina; KFZ—American South Pole Expedition; PRF5—Brazil; GSC—Daventry; DJA—Germany; W2XAF—U.S.A.; PCJ—Holland; OX4AC—Peru, and a whole host of other stations unidentified. Needless to say, I am delighted with this truly amazing performance, and will not hesitate to recommend your sets to my friends.

"W. H. J. C., PARAGUAY, South America."

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Please send me descriptive literature of the Peto-Scott NEW DISCOVERER H.F.P.3, together with FREE 1/- FULL SIZE BLUEPRINT, for which I enclose 3d. in stamps to cover postage.

NAME .....

ADDRESS .....

..... Pr.W.12

(Continued from foot of column one)

BRITISH Radiophone fully screened 3-gang .0005 top trimmers with complete, slow-motion drive, 7/6.

MAINS transformer input, 200/250 volts, 6 volts 1 amp, 4/6. 10 volts .5 amp., 4/6.

SPECIAL OFFER. Kolster-Brandes (shop-soiled) Receivers, 2-valve Battery Pup, with self-contained Speaker, Valves and Batteries, 27/6.

POLAR Star Manufacturers' model, 3-gang condensers, fully screened, 7/6, with trimmers; unscreened, 5/-.

RELIABLE Intervalve Transformers, 2/-; multi-ratio output transformers, 2/6; Microphone transformers, 50-1 and 100-1; 2/6; 1-1 or 2-1 Output Transformers, 2/6.

UTILITY 3-gang Condensers, 0.0005, fully screened, with trimmers, ball bearing straight or superhet, 6/9, complete; with illuminated disc drive, 7/11; the best 3-gang available.

T.C.C. Condensers, 4mf. 450v. working, 4/-; 4mf. 750v. working, 6/-.

VARLEY Constant Square Peak Coils, bandpass type B.P.7 brand new, in maker's cartons, with instructions and diagram, 2/4.

VARLEY H.F. Intervalve Coils, B.P.8, band-pass, complete with instruction, in original cartons. 2/6.

PREMIER British-made Meters, moving iron, flush mounting, accurate, 0-10, 0-15, 0-50 m.a., 0-100, 0-250 ma.; 0-1, 0-5 amps.; all at 6/-.

WESTERN Electric Condensers, 250v. working, 1 mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 400v. working, 1 mf., 1/-; 2 mf., 1/6.

WIRE-WOUND Potentiometers, 1,000, 2,500, 50,000, 500,000, 2/- each; 1,000 ohm, semi-variable, carry 150 m.a., 2/-.

A LARGE Selection of Pedestal, Table and Radiogram cabinets, by best manufacturers at a fraction of original cost. Send for list.

THE following Lines 6d. each, or 5/- per dozen.—Chassis valve holders 5-, 6-, or 7-pin, screened screen-grid leads, any value 1-watt wire resistances, wire end condensers 0.0001 to 0.5, 3 amp. main switches, Cyldon double capacitors.

SUPER-MOVING Coil Speakers, handle 10 watts, energised directly from A.C. mains, manufactured by world-famous radio and gramophone company, 40/-.

T.C.C. Electrolytic condensers, 8 mfd. 440v. working, 3/-; 4 mf. 440v. working, 3/-; 15 mf. 50v. working 1/-; 50 mfd. 12v. working, 1/-; 15 mf. 100v. working, 1/3.

CONDENSER Blocks, H.M.V. 400v. working, 4+2+1+1+1+.5, 3/9; 2+2+1+1+1+.5, 3/-; Dubilier 300v. working, 4+4+2+.1, 3/-; Phillips 6+4+2+1+1, 4/6.

GRAMPIAN Permanent Magnet 9 inch Moving Coil Speakers, handles 4 watts. Universal Transformers, 18/6. Ditto Energised, handles 5 watts, 2,500 ohms, 21/-.

10,000 12,000, 15,000 ohm wire-wound potentiometers with mains switch, 1/6.

SCOTT Aerial and Anode Coils Dual Range with Circuit, 2/6 per pair.

SPECIAL OFFER. Guaranteed U.S.A. Electrolytics. 4 mf. 1/9, 8 mf. 1/9, 12 mf. 1/9, all 550v. Peak Working.

DARIO directly-heated 1 watt, 200v. Mains Power Valves, 2/6.

BLUE SPOT 45 P.M. Speaker, multi-ratio transformer, handles 4 watts, listed 45/-, at 25/-, or in handsome walnut cabinet, 35/-. Blue Spot 99 P.M. Speaker, multi-ratio transformer, handles 5 watts, listed 59/6, at 31/-.

BLUE SPOT Energised Speakers 2,500 ohms type 29D.C., Power and Pentode Transformer, 9/11.

SUPER Moving-Coil Speaker by world-famous radio and gramophone company, 300v. 80 m.a. field (10,000 ohms), 25/-.

PREMIER SUPPLY STORES Announce the Purchase of the Complete Stock of a world famous Continental valve manufacturer; 2 volt Battery Valves, H.F.: Det.: L.F.: 2-3: Power: Low Consumption Power, Super Power, 2/9; Screen Grid, 4 and 5 pin Pentodes, 5/-: all the following standard mains types, fully guaranteed, 4/6 each; H.F. Pentodes, Variable-Mu H.F. Pentodes, H.L., L. Power, medium, high, low mag. and variable-mu Screen-grids, one, three, and four watt A.C. output directly-heated Pentodes: 250v. 60 m.a. full-wave rectifiers: D.C. types, 20v. 18 amp., filaments, Screen-grid V.M.: H.: H.L.: Power: Pentodes: H.F. Pentodes: Variable-Mu H.F. Pentodes.

The Following Types, 5/6 each: 350v. 120 m.a., full-wave rectifier, 500v. 120 m.a., full-wave rectifier, 2½ watt indirectly-heated Pentode.

The Following American Types, 4/6: 250, 112, 171, 210, 245, 226, 47, 46, 24, 35, 51, 57, 58, 55, 37, 80, 6A7, 2A7, 83, 27, 2A5, 77, 78.

The Following Types, 6/6 each: 42, 25Z5, 36, 38, 83, 39, 44, 53, 6B7, 2A6, 267, 5Z3, 6C6, 6A4, 6D6, 6F7, 43, 59. Send for Complete Valve List.

PREMIER SUPPLY STORES

(Dept. O.N.), 20-22, High St., Clapham, S.W.4. 'Phone: Macaulay 2188. Nearest station: Clapham North, Underground.

UNIVERSAL RADIO BARGAINS.—Sets, Kits, Speakers, Valves, Pick-ups, Coils, Transformers and all other components at Keen Prices. Stamp for Lists and Prints.—"Universal," 20, Victoria Road, Peckham, S.E.15.

WANTED, good modern wireless parts, sets, eliminators, meters, valves, speakers, etc. Spot cash waiting. Exchanges. Send or bring. We pay more than any other dealer. Open 9-8.—University Radio, 142, Drummond St., Euston, N.W.1.

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RADIO CLEARANCE First Bargain List is now Available, send 1½d. stamp to cover cost and postage.

RADIO CLEARANCE Makes Special Offer of a Limited quantity S.T.600 Dorchester Kits to Designers' Specification, including Colvern coils, Polar condensers, T.C.C. fixed condensers, R.1 Hypermite transformer, ready drilled panel and terminal strip, list price £5/17; our price, £3/10.

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RADIO CLEARANCE.—Standard Telephones and Cables mains transformers, shrouded type, for H.T.8 rectifier with 4v. 4 amp. C.T., L.T. winding; exceptional value at 6/- each.

RADIO CLEARANCE.—British Radiophone 3-gang Midget type superhet. condensers, fully screened with trimmers 2 0.0005 sections and 110 kc. oscillator section; 7/6 each.

RADIO CLEARANCE.—British Radiophone 3-gang Midget type straight condensers, fully screened with trimmers, 3 0.0005 sections, 7/6 each.

RADIO CLEARANCE.—British Radiophone 3-gang superhet, condensers, unscreened, 2 0.0005 sections and 110 kc. section, 4/11.

RADIO CLEARANCE.—British Radiophone 110 kcs. intermediate frequency transformers; 3/- each.

RADIO CLEARANCE.—British Radiophone set of band-pass coils, manufacturer's type, with circuit diagram, suitable for tuned grid or tuned anode; set of 3 coils, 4/-.

RADIO CLEARANCE.—British Radiophone set of superhet. coils, manufacturers' type, with circuit diagram, suitable for use with above advertised condenser; 5/6 per set of 3.

RADIO CLEARANCE.—5-pin chassis mounting valve holders; 3d. each.

RADIO CLEARANCE.—British Radiophone volume controls, 10,000 ohm, 25,000 ohm, 50,000 ohm, 200,000 ohm, 500,000 ohm, 1 meg., at 1/6; volume controls, with switch, 1 meg., 1/9.

RADIO CLEARANCE.—8 mfd. dry electrolytics 500v. working, well-known make; 2/6 each.

RADIO CLEARANCE.—8,000 ohms volume controls log type, with Q.M.B. switch, by G.E.C., 2/- each.

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RADIO CLEARANCE.—Telsen 0.0001 and 0.00015 reaction condensers; 5d. each.

RADIO CLEARANCE.—Steel chassis, cadmium plated, drilled ready for use; 4 valve, 1/6 each.

RADIO CLEARANCE.—4 mfd. Post Office Condensers, 250 v. D.C. working; 1/6 each.

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THE following unused set manufacturers' Surplus; all goods guaranteed perfect; immediate delivery.

MAGNAVOX speakers, complete with hum-bucking coil, output transformers, etc. DC152 (9in. cone), 22/6. DC154 (7in. cone), 16/-. All with 2,500 or 6,500 ohms fields.

WESTINGHOUSE rectifiers, HT8, 9/6. HT9, 10/-. HT10, LT5, LT4, 10/9. Regentone transformers for HT8 or HT9, with 4v. 4amp. LT winding, 7/-. Eliminators, first-class make. Outputs 150v. 25ma, SG and detector. AC type with Westinghouse rectifier, 25/-. AC type with .5 amp. trickle-charger, 30/-. DC type, 12/6.

DUBILIER or TCC dry electrolytic condensers 8mfds or 4mfds, 500v working, 50mfds, 50v, 200 mfds, 10v, 3/3. 50mfds, 15v, and 15mfds, 100v, 2/3. 50mfds, 12v, 2/-. TCC type "M" condensers, any value up to .001 mfds, 6d. Erie resistances. 1 watt type, 7d., 2 watt, 1/2, 3 watt, 1/9. Send for comprehensive list.

WARD, 45, Farringdon Street, London, E.C.4. Telephone: Holborn 9703.

HALL-MARK THREE Superhet Three, ST600 Guaranteed First Specified Kits—Lowest Prices—Easiest Terms—Lists Free—Melfo-rad, Queen's Place, Hove. (Trade supplied.)

REPAIRS to Moving Coil Speakers, Cones and Coils fitted, or rewound. Fields Altered. Prices Quoted Including Eliminators. Loud-Speakers Repaired, 4/-. L.F. and Speech Transformers, 4/- Post Free. Trade Invited. Guaranteed Satisfaction. Prompt Service. Estimates Free. L.S. Repair Service.—5, Balham Grove, London, S.W.12. Battersea 1321.

MAINS Transformers, chokes, etc., to specification, repairs promptly executed. Guaranteed satisfaction. Prices on request. Henry Peace, Ltd., Wednesbury, Staffs.

EXPERIMENTER'S OPPORTUNITY. Parcels containing Wireless Components, 40/- value for 5/6, Carriage 1/-.—Taylor's, Radio House, Macaulay Street, Huddersfield.

VAUXHALL.—Magnavox permanent magnet Speakers universal for Class B, power, pentode or push-pull; 7in. cone, 16/6; 10in. cone, 22/-.

VAUXHALL.—Magnavox energised types, 2,500 or 6,500; 10in. cone, 22/-; 7in. cone, 15/3. All brand new complete with humbucking coils, state power or pentode. Other speakers. Send for particulars.

VAUXHALL.—Practical Wireless Universal superhet chassis, completely built as specified with valves and Magnavox or Rola speaker, carriage paid, £8/15/0.

VAUXHALL.—Radiophone radio-paks R.F. superhets complete with volume control, escutcheon, new Lucerne station named dial, 34/-.

VAUXHALL.—Radiophone Intermediate frequency transformers, on bases with terminals, 5/6.

VAUXHALL.—Radiophone three gang condensers, piano type superhet. or straight fully screened, 8/6; two gang, 6/6.

VAUXHALL.—Benjamin. Class B transformers 1-1½ to 1. Terminals fixing, 6/6 boxed.

VAUXHALL.—Radiophone volume controls, all values from 5,000 to 500,000 with switch, 3/6.

VAUXHALL.—Westinghouse rectifiers set, manufacturers surplus skeleton type H.T.8, 9/6; H.T.9-10, 10/-.

VAUXHALL.—Westinghouse Westectors, W.4, W.X.6, 5/9. Regentone transformers with terminals and H.T.8, 17/6.

VAUXHALL.—Rothermel Piezo electric pick-ups, 30/-; Marconi K25, 21/-; B.T.H. senior, 29/-; Minor, 16/6. Sealed cartons.

VAUXHALL.—Gramophone motors: Collaro 32 model, 32/6. Universal model for 110, D.C. 200/250 AC/DC, 47/6.

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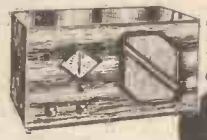

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Vol. 5. No. 129. March 9th, 1935.

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Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff: W. J. Delaney, H. J. Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.

VOL V. No. 129. March 9th, 1935.

ROUND *the* WORLD *of* WIRELESS

Those Extra Weather Reports

IF you have missed the morning Droitwich forecast and want the weather report, there is no need to ring up the Air Ministry. Heston Airport, on its behalf, gives out weather bulletins on 1,202 metres (249.5 kc/s), at G.M.T. 08.45, 09.30, 10.30, 11.30, 12.30, 14.30, 15.30 and 16.30 daily. Although they are mainly intended for aviators, they will be found useful to the general public.

Italy's Projected Super Stations

ALTHOUGH Italy already possesses fourteen transmitters, the broadcasting net will be considerably enlarged this year. The power of the Rome Santa Palomba plant, now working on 420.8 metres, is to be increased from 50 to 120 kilowatts, and a twin station is to be built to ensure alternative programmes. Bolzano, on 559.7 metres, which has been working on 1 kilowatt, will in the course of 1935 see its power increased ten times. By the end of the year the total power of the Italian stations will have jumped from 190 to 450 kilowatts (aerial rating).

New Station for Czecho-Slovakia

WORK has already started on the 30-kilowatt station which the Czech Ministry of Posts and Telegraphs is erecting at Banska Bystrica. When ready, towards the autumn of this year, the transmitter will operate on 765 metres (392 kc/s); it will relay the Prague programmes.

Romania's Broadcasting Service

SO far, the Bucarest wireless entertainments have rarely been available to British listeners, as the power of the capital station, on 364.5 metres, has only been 12 kilowatts. The 150-kilowatt high-power station Radio Romana at Brasov (pre-War Kronstadt) will shortly be brought into action. Already while experimenting on 20 kilowatts it has caused interference with Kootwijk (Holland), whose channel it is sharing, and there is a strong probability that another wavelength for one of these countries may have to be found. Radio Moldova, a third station of 20 kilowatts, is also in its experimental stage; it broadcasts on 212.6 metres (1,411 kc/s).

The Four Moscow Stations

AS a rule, when reference is made to a Moscow broadcast, it is the 1,724-metre transmission which is indicated. Listeners, however, should bear in mind that the U.S.S.R. capital possesses four high-power transmitters in the neighbourhood of that city. They are: RW1, 1,724 metres (174 kc/s), 500 kilowatts; RW43, 1,107 metres (271 kc/s), 100 kilowatts; RW49, 748 metres (401 kc/s), 100 kilowatts, and RW39, 360.6 metres (832 kc/s), 100 kilowatts. All are on the air daily, but are used for different kinds of wireless entertainments.

Norway's Second Long Wave

THE small Tromso station which has been working hitherto on 249.2 metres has now altered its wavelength to 1,186 metres (253 kc/s), which was the original channel allotted to Oslo. As the power is a low one it is hardly likely that any interference will result.

Interesting Statistics

ACCORDING to the International Union of Telecommunications at Berne (Switzerland) during 1934, the number of radio stations in the world has increased by 2,300, bringing the total of all transmitters to 35,638. The majority, namely, 27,927, are utilised by ships and aeroplanes, but of the land stations 1,448 are given over to the broadcasting services.

Augsburg Closes Down

SINCE March 1st, the Augsburg relay station, which has been taking the Munich programmes, has suspended its transmissions. It is possible that it may be dismantled and re-erected on another site in Eastern Germany. As it was sharing a channel with Nurnberg, the signals from the latter station will be found clearer when its partner has closed down.

Philips and Television

WE understand that in Philip's Laboratory at Eindhoven new cathode-ray tubes have been elaborated for use in television experiments which are being carried on in that laboratory. These experiments have already led to the construction of a new receiving apparatus for television, by means of which reception tests were recently conducted in Berlin. Successful results were obtained in the course of these tests.

Young Men in Industry

THE next talk in the "Young Men in Industry" series for Midland listeners will be given by Denis Morris, on March 8. His title is "Politics and Leather." He is a member of a firm of leather factors and has also been engaged in three other occupations, tannery, lithographic printing and advertising.

ROUND the WORLD of WIRELESS (Continued)

"Spring Tidings"

A REVUE having the above title, produced by Francis Worsley, will be broadcast from the West Regional on March 14th. This programme, which is described as a seasonal gambol, will be repeated for Regional listeners in the evening of the same day.

INTERESTING and TOPICAL PARAGRAPHS

in the series "Workaday World," which is described as an inquiry in twelve periods into some of the problems confronting industry in Wales and the south-west.

RADIOGRAM IN JUBILEE FILM

An H.M.V. High Fidelity Radiogram is the star in one scene of the Pathé film—"Twenty-five Years a King"—which is being produced with the collaboration of John Drinkwater and Sir Austen Chamberlain, and which will be released to coincide with the Jubilee celebrations. A family is shown in the film listening to a broadcast by His Majesty on the "His Master's Voice" instrument.

"Off Shore"

THIS is the title of a talk by Captain J. C. Wrake, Master of the Trinity House steamer *Warden*, for listeners in the West on March 16th. Captain Wrake will give an account of the work of relieving lighthouses and lightships.

"Westward Ho!"

PART 1 of an adaptation of the well-known novel, "Westward Ho!" by Charles Kingsley, is to be given on March 9th. Part 2 will be given on March 11th. This novel has been adapted as a radio play in two parts by Louise Drury and will be produced by Cyril Wood for Western listeners. The story divides most conveniently, Part 1 ending with the elopement to the West Indies of the heroine, Rose Salterne, with her Spanish husband, while Part 2 is the story of the efforts of the hero and others to trace her and bring her back.

Talk for Northern Farmers

TWO women will provide the talk "For Northern Farmers in Particular" on March 7th, their subject being "Women's Work" as applied to farming. One of the speakers will be Mrs. Bromley Davenport, member of a prominent Cheshire family, who, from the point of view of the "lady of the manor," so to speak, will carry on a discussion with Mrs. L. B. Boffey, a Cheshire farmer's wife.

"Workaday World"

LISTENERS in the West will hear a discussion between Principal J. F. Rees and James Griffiths in the sixth talk This will be given on March 8th, under the title "One side of the question."

Melodies from Abroad

"SERENADES from Many Lands" is the title of a programme to be given by the Western Studio Orchestra on March 11th. The lands from which the serenades come include Spain, Italy, Egypt, Arabia, Hungary, and the Orient.

Belfast Symphony Orchestra

DR. ADRIAN BOULT will conduct the Belfast Wireless Symphony Orchestra in the last concert of the season given by the B.B.C. in co-operation with the Belfast Corporation, on March 8th. The chief item on the programme will be the performance of Beethoven's Symphony No. 4 in B Flat, Op. 60. Dr. Boult has paid a number of visits to Belfast in the past to conduct the orchestra and his appearance on the platform in the Ulster Hall is always the signal for great enthusiasm from music lovers in the city, who look forward to his concerts with the keenest anticipation.

"An Hour May Destroy"

WORKING on the idea that the sudden withdrawal of magnetism could reduce present-day civilisation to the primitive state, C. H. Averill has written a play entitled "An Hour May Destroy." This is to be produced by Martyn Webster on March 13th, with a cast of over twenty players. The devastating effects of having no ignition on motor-cars, no mechanical signals on railways, no electricity, no telephone, telegraphs or wireless, and only the slowest of transport for food are shown in a series of episodes. A reporter, his wife, and his news editor are the central characters.

"Confession"

AN out-of-work blacksmith's striker in Yorkshire is the author of the one-act play, "Confession," which is to be relayed from the Birmingham Repertory Theatre's special broadcasting studio on March 12th. Henry Shaw, the author, sent in the play to Herbert Prentice, the Repertory Company producer, on chance and it was accepted. The action takes place in a theatre manager's room. The manager, played by Bertram Heyhoe, suspects that his wife has not been loyal to him and, anxious to extort a confession, stages a little play—very much as Hamlet did at the king's court.

"Die Fledermaus"

ACT II of Strauss's opera "Die Fledermaus" (The Bat), as performed by the Carl Rosa Opera Company, will be relayed to Northern listeners from the Theatre Royal, Newcastle-upon-Tyne, on March 15th. The principal singers are Pauline Maunder, Ivor John, and Mabel Baker.

"Golden Legend"

THE Leeds Choral Union and the Leeds Symphony Orchestra, conducted by Norman Strafford, will perform Sullivan's "Golden Legend" on March 12th, and the concert is being relayed to Northern listeners from the Town Hall, Leeds. The soloists are Mabel Ritchie (soprano), Tessa Richardson (contralto), Henry Wendon (tenor), and Frederick Woodhouse (baritone).

SOLVE THIS!

Problem No. 129

Rawlins had two loudspeakers, one of which was connected to his receiver, and one which was spare. The latter was very shrill, probably owing to the type of diaphragm and method of mounting, and it was for that reason that he did not use it. Deciding that perhaps a better overall response could be obtained by using it with his existing speaker, he removed the input transformer on the spare speaker and connected the remaining two leads to the input terminals on his remaining speaker, but instead of getting a better response he obtained a much poorer reproduction with a great reduction in signal strength. Why was this? Three books will be awarded for the first three correct solutions opened. Envelopes must be marked Problem No. 129 and must be addressed to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received not later than the first post Monday.

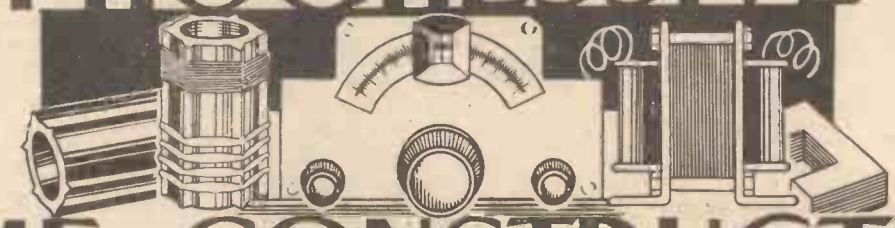
Solution to Problem 128

The medium-wave coil connected across the condenser caused the meter to give a reading. He should either have disconnected the coil or, alternatively, used a more sensitive meter and lower voltage so as to observe differences when the receiver was switched to the alternate wavelengths.

The first three correct solutions opened in respect of Problem No. 127 were from the undermentioned readers, and books are being forwarded to them: H. J. Armand, 8, York Road, Gt. Yarmouth; W. Marshall, The Wireless College, East Parade, Colwyn Bay, N. Wales; G. A. Woolridge, 11, Wilmot Road, Swadlincote, near Burton-on-Trent.

Previous articles in this series were published in the issues for Jan. 26, Feb. 2, Feb. 9, Feb. 16, and Mar. 2.

PROGRESSIVE HOME CONSTRUCTION



The subjects already dealt with include Home-made Components, Making an L.F. Transformer, a Single-valver, and an H.T. Battery Eliminator.

In this informative article "The Experimenters" describe the Construction of an H.T. Rectifier and a Mains Transformer suitable for use in conjunction with the D.C. Unit described last week.

ASSUMING that you have made the D.C. H.T.-battery eliminator described in our last article, and that you wish to run the set from A.C. mains, it will now be necessary to make a rectifier and mains transformer. There is no great difficulty in making these components, and a fairly high degree of efficiency can be obtained from components made in the manner we shall describe. Of the various forms of rectifier available, the best known are the valve, metal, and electrolytic (or wet)

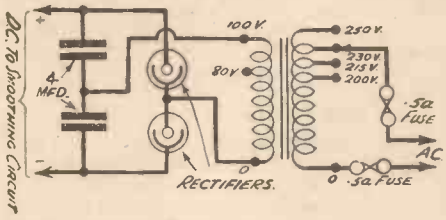


Fig. 1.—The circuit for the transformer and rectifier unit for converting the D.C. eliminator for A.C. operation.

types. The first two cannot be readily made at home, but the construction of an electrolytic rectifier is a perfectly simple matter.

We should point out that a rectifier of this kind is not the best, and it suffers from the fact that it contains a chemical solution which requires occasional replacement, and which is also inclined to be rather "messy." Nevertheless, the cost of a suitable unit is extremely small, so that the construction is justified if only for purely experimental reasons. We should add to this statement that chemical, or wet, rectifiers have been used with complete success by many experimenters for a number of years, so there need be no qualms regarding the question of whether the rectifier, when made, will function.

Alternative Rectifiers

At the same time, for the benefit of those experimenters who do not wish to make a chemical rectifier, or who have a metal rectifier on hand, we have arranged the A.C. portion of the eliminator so that the alternative can be employed. With this idea in mind the transformer to be described is provided with a tapped secondary from which alternative (A.C.) voltages of 80 and 100 can be obtained as required. The lower voltage is suitable for feeding a Westinghouse style H.T. 5 metal rectifier, and the higher voltage is appropriate for the chemical rectifier to be dealt with. In both instances full-wave rectification will be employed—by connecting the rectifier on the voltage-doubler principle as shown in Fig. 1, which is a circuit of the transformer-rectifier portion. The need for the higher input voltage for the chemical rectifier is due to the greater voltage drop which this entails.

The D.C. output from the rectifier (regardless of which type is used) will be approximately 120 volts at 20 m.a., which is adequate for the average two- or three-valve receiver. Should a greater output than this be required, it could be obtained by making the transformer to give outputs of 200 and 250 volts, in which case the metal rectifier, if used, would be a Westinghouse style H.T.8.

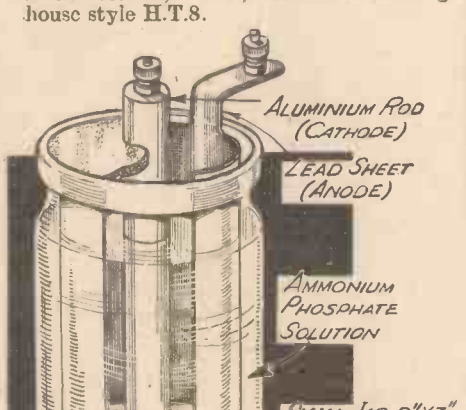


Fig. 2.—Showing how each of the two chemical-rectifier units are made. A fibre disc should be fitted to the cathode to hold it central, but this is omitted from the drawing for clarity.

Perhaps it will be best to start by describing the rectifier, since the construction of the transformer is similar in many respects to that of the smoothing choke described last week. To obtain voltage-doubling the rectifier must consist of two separate cells, and details of each of these will be as shown in Fig. 2. It will be seen that a small glass jar ("sample" jam jars are suitable) is used as the container, and in this are placed two metal electrodes.

by The Experimenters

The cathode consists of a length of half-inch diameter aluminium rod, while a curved sheet of lead serves as the anode. Connection is made to the aluminium by drilling and tapping one end, and screwing a terminal into this; a terminal is fitted to a projecting lug on the sheet lead. The two electrodes must, of course, be insulated from one another, and this is easily arranged by fitting a disc of wax-impregnated fibre round one end of the aluminium rod. It is also desirable to slip one or two rubber rings round the cathode to prevent a short-circuit in case the metal rod should be displaced.

Making the Electrolyte

The electrolyte consists of a strong solution of neutral ammonium phosphate, made by dissolving ½lb. of the salt in a quart of warm water. The salt can be bought fairly cheaply in "commercial" form, but after it has been dissolved it might at first be found that the solution is acid. It must not remain so, for it would quickly eat away the electrodes; a test can be made by means of a few strips of blue litmus paper (obtainable from a chemist for a penny). After the solution has become quite cold a strip of the litmus paper should be dipped into the solution; if the paper turns red, the solution is acidic and should be neutralised by adding a small amount of liquid ammonia. After a few drops of ammonia have been added the litmus test should be repeated, more ammonia being added if necessary, and so on until the litmus paper

(Continued overleaf)

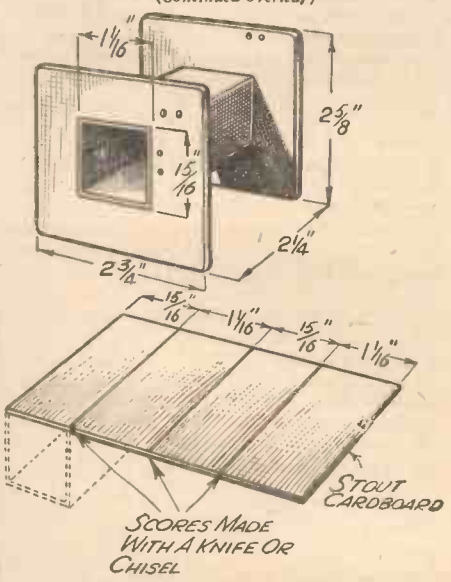


Fig. 3.—Details of the transformer winding spool are given in these sketches.

(Continued from previous page)

just retains its colour when dipped into the solution. The above process might sound rather tedious to those readers who have little knowledge of chemistry, but there is actually nothing to go wrong.

After the electrolyte has been prepared as just described, it should be poured into the jars so that it just covers the lead electrode. After that, a small amount of paraffin oil should be poured over the surface of the liquid to prevent "creeping," and to minimise evaporation.

When the two cells have been made in the manner described, they require to be "formed," but this cannot be done until the transformer has been made, so a description of the process will be deferred until after the construction of the transformer has been described.

The Transformer

For making the transformer you will require 6 doz. pairs of No. 4 Stalloy stampings and a winding spool to fit these. The dimensions of the latter are shown in Fig. 3, from which sketch it will be seen that the spool is rather different from those used for the L.F. transformer and smoothing choke—instead of being circular, it is rectangular in section. The method of making the spool scarcely calls for an explanation, since it is fairly obvious from an examination of Fig. 3, while the matter has previously been dealt with in these pages. (See particularly the issue of PRACTICAL WIRELESS dated April 28th, 1934.)

With regard to the windings for the spool it should be explained that, for 50-cycle mains, 8 turns per volt are adequate. Thus, for the primary—for mains voltages between 200 and 240—a total of 240 x 8 = 1,920 turns will be required. The secondary winding will require to have a total of 100 x 8 = 800 turns, and a tapping must be taken after winding 80 x 8 = 640 turns. The maximum current required from the secondary winding is about 60 milliamps, and so the wire used for winding could be as fine as 40-gauge, but as there is ample space it is more convenient to use 36-gauge enamelled wire. The primary winding has to carry only about 30 milliamps, and could therefore be wound with 42-gauge wire but—for the same reasons as before—it will be better to use 38-gauge enamelled wire.

Tapping the Primary

The method of actually winding the transformer is nearly the same as that followed in making the L.F. transformer, but there are a number of tappings to be taken. Start by soldering a 12in. length

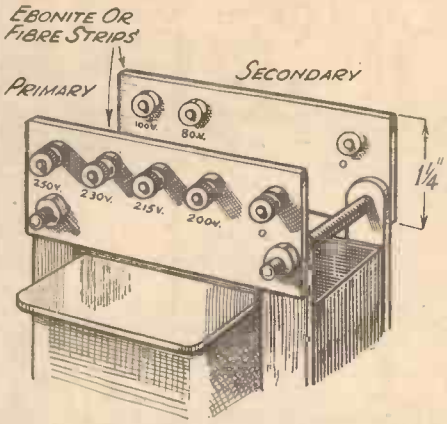


Fig. 4.—This sketch shows a simple method of arranging terminal connections for the mains transformer.

of 22-gauge d.c.c. wire to the end of that to be used for the primary (approximately 2ozs. will be required in all), thread this through a pair of holes in one end cheek, leaving about 5in. of wire projecting outside the spool. Now fit the spool to a wooden handle and wind on the primary turns as evenly as possible and keeping the wire roughly in layers. After winding 1,600 turns, a tapping should be taken for use when the mains voltage is 200. This can

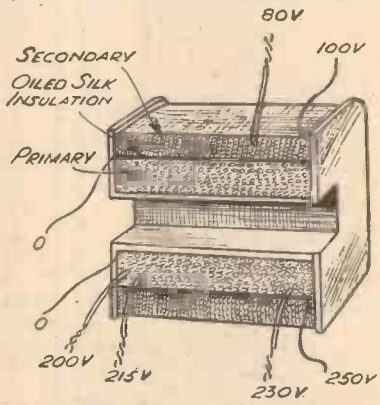


Fig. 5.—The connections for the various transformer tapping are shown in the cut-away sketch.

be done by carefully baring the enamelled wire for a distance of about 1in. and soldering to it a length of 22-gauge d.c.c. wire. In soldering, a non-corrosive flux, like Fluxite, should be employed so as to avoid subsequent corrosion of the joint. When the tapping has been thus made the soldered joint should be covered with a strip of insulating tape and winding continued. Further tappings should be taken after 1,720 turns and 1,840 turns, the winding being completed after the 1,920th turn. The two latter tappings are for mains voltages of 215 and 230 respectively.

On completion of the primary winding the turns should be thoroughly insulated by covering them with a layer of empire tape or oiled silk wound over them. The silk should be so wound that it turns up at the ends of the spool on to the inside faces of the end cheeks; this is to prevent secondary turns from slipping down past it. The secondary can then be wound in exactly the same manner as the primary by using a total of 800 turns of wire, tapped at the 640th turn, as previously explained. Approximately 1¾ozs. of 36-gauge enamelled wire will be needed for this winding. When the secondary has been finished it should also be covered with a layer of oiled silk, the end of this being secured by means of glue or sealing wax.

It then remains to assemble the core, fit the stampings and core clamps, and to devise some form of terminal mounting. The first two of these operations are exactly the same as for the smoothing choke, but the terminal mounts differ, being as shown in Fig. 4. In taking the leads from the tappings to the terminals it will be desirable to run these through lengths of systoflex sleeving to avoid short circuit and to protect the wires. The various connections are clearly shown in Fig. 5.

How the Rectifier is "Formed"

The transformer and rectifier can now be connected together and to the D.C. portion of the unit as shown in Fig. 1, after which the rectifier can be "formed." It will be seen that a pair of 4-mfd. condensers are used to complete the voltage-doubler circuit, and these should be of a type rated for working at not less than 250 volts. For the "forming" process the eliminator should not be connected to the receiver, the only "load" on the rectifier being the potential divider. Connect the mains leads to the appropriate primary terminals and switch on, leaving the unit running in this way for about twenty-four hours. When A.C. current is first applied to the rectifier it will not be rectified, but gradually the electrodes will "form" and proper rectification will take place. Occasionally during this process the rectifier cells should be examined to see that they are not becoming unduly hot; if they do heat up appreciably the mains should be switched off for a short time to allow them to cool.

HERE AND THERE

Radio and the Fishing Fleets

ON the Grand Banks, off Newfoundland, where dense sea fogs are prevalent, large numbers of fishing trawlers have been equipped with wireless apparatus to enable them to keep in touch with land. In addition to VON, St. John's (630 metres), which sends out weather reports at fixed intervals, VAS and VBS, Louisburg (Nova Scotia), also provide information of interest to fishermen. Some of the smaller craft possess low-power transmitters, which enable them to send out signals in morse to the tender accompanying them, and in return are given the necessary instruction, when fog is dense, for rejoining the mother ship.

Sound versus Wireless Waves

IN view of the considerable difference of speed travelled by sound and wireless waves in one second, the chimes of Big Ben when broadcast would be heard via ether earlier by a listener in Australia than by a bystander standing in, say, the centre of Trafalgar Square. In a letter to a Paris paper a French fan writes that he has taken the trouble to work out a similar problem. He demonstrates that a listener at Algiers or Warsaw would hear through his loudspeaker a transmission from the Paris Opera House within two-thousandths of a second of its actual broadcast. The same notes would take seven times longer to reach the ears of a spectator seated at the back of the dress circle in the same Opera House.

Those Fog Beacons

AROUND the channel used by Croydon Airport many morse signals are to be heard. They emanate from lighthouses and lightships acting as fog beacons. One which is frequently heard is MEG (– – . – –.) on 1,008 metres, sent twice in 15¾ seconds, followed after an interval by a warning dash (3 seconds), a silence lasting just over one second and twelve dashes each of one second duration. It is broadcast every six minutes in foggy weather by the East Goodwin Lightship.

A Vast U.S.A. Radio Network

FEW DX searchers realise the number of stations included in the N.B.C. and Columbia Broadcasting Systems, and through which one main programme may be transmitted. When WABC hooks up its entire chain for a special broadcast the Columbia engineers bring into action one hundred and two medium-wave transmitters and, in addition, feed the programme to some short-wave outlets. No wonder on those favourable nights the same sponsored programme may be picked up on many dial readings.

IMPORTANT NEW SERIES

TELEVISION FOR ALL—4

USING TIME BASES

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

IN order to produce the regular scanning lines on the fluorescent screen of the cathode-ray tube and simulate the geometrical formation and line sequence carried out at the transmitting end, we saw last week that one method used static deflector plates inside the tube's electrode system and applied to these varying potentials. Since the beam of electrons has a negative characteristic, the dual static fields produced in this way were effective in causing the spot to trace lines of light, and the first essential of any cathode-ray tube apparatus is to examine carefully how this movement can be controlled in a predetermined manner.

Spot Movement Analysed

Electrical apparatus generally is employed for this purpose, but later in the article a scheme will be described which

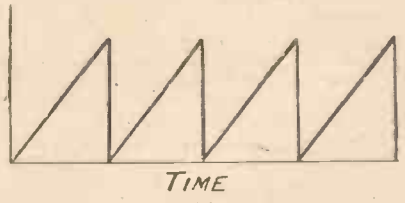


Fig. 1.—A "saw-tooth" movement is in effect traced out by the scanning spot.

works on a different principle. Recall for a moment the actual scanning action, whether this is the B.B.C. television service arrangement which uses a vertical line scanning, or the proposed high-definition schemes which pin their faith in picture dissection by a series of horizontal lines. The scanning apparatus at the transmitting end brings about a steady or uniform spot movement of bottom to top (low-definition B.B.C. method) or left to right (high-definition method) until the scanning area limits are reached. Immediately this single spot travel is finished there is in effect a "quick return" to the starting-line of the light field where the scanning spot performs an exactly similar movement of uniform velocity, but over a path contiguous or adjacent to that just traced.

This combined double movement is repeated line by line until the whole area is scanned, when the complete process is again undertaken, the complete repetitions per second being 25 in the case of high-definition working and 12½ for low definition. A uniform velocity in the direction of traversal, coupled with a theoretical instantaneous return to the starting-point if plotted graphically, will give a graph shape as shown in Fig. 1. This series of right-angled triangles is popularly termed a "saw-tooth movement" owing to the obvious resemblance to the teeth of a saw.

A Dual Effect

It should be clear that the object of any equipment connected to the cathode-ray tubes deflector plates is to produce a voltage variation of a form geometrically similar to that shown in Fig. 1, the potential having a regular and quite uniform rise in value up to a definite pre-arranged limit, this being then followed by an extremely sharp fall to the initial value, the whole cycle of changes being continuously repetitive.

One point cannot be too strongly emphasised, and that is for the reception of television pictures this saw-tooth movement must be dual in action. As indicated last week, one pair of deflector plates (the vertical ones) which bring about the spots horizontal movement for high-definition working, is concerned with a rapid cycle of changes which is known generally as the line traverse periodicity (25 x 240=6,000 pulses per second for the initial high-definition television service), while the second pair of deflector plates (horizontal ones) which cause the lines to appear one below the other is influenced by a much slower cycle of changes giving the picture periodicity, the standard set by the Television Committee's report in this case being 25.

Minor Points

If we examine the line field produced by these methods it will appear as the actual photograph shown in Fig. 2, which wa

Fig. 2.—Showing how the individual scanning lines are produced on the cathode-ray tube screen, together with flyback line form.

taken from the tubes fluorescent screen under actual working conditions. A reference to Fig. 3 shows the same saw-tooth scanning but in a greatly exaggerated form for the purpose of clarity. The heavy line AB is that produced by the uniform voltage rise, while the thin line BC is the quick return to the starting boundary. The zig-zag effect is continued to the bottom of the field when the picture periodicity circuit is "triggered" or acts quickly to give a rapid trace back to the starting-point for the whole cycle of operations to begin again. This is shown clearly as a dotted line in Fig. 3, while the photograph (Fig. 2) indicates the "curved return" in a definite manner.

Although only minor points, it is as well to bring to the notice of readers that since there is really a spot movement in two directions at once (left to right quickly and top to bottom slowly) the scanning lines are not truly horizontal, but incline downwards slightly in the direction of the line traverse. Furthermore, since the return stroke for each line is so rapid it cannot be seen on the screen (fluorescence with an electron beam of uniform intensity is governed by the simple effect that slow movement gives a bright line, while rapid movement gives little or no brilliance). In addition, by special means it is possible to neutralise the line of light produced by the picture periodicity "flyback," and this is the usual practice when using the cathode-ray tubes for television pictures, owing to the slight marring effect on the image which this flyback causes.

An Ingenious Scheme

Since saw-tooth voltage changes are essential for this work, one of the first methods developed for their production combined a mechanical and electrical idea in a very ingenious manner. The bare details of the scheme are shown in Fig. 4. A small motor adapted to run at the synchronous speed required was arranged to drive two separate discs on its shaft. One of these discs had uniform saw teeth actually cut round its periphery, the number of teeth corresponding to the number of lines required for the picture dissection, so that it resembled an ordinary circular saw such as is used in a carpenters shop. The second disc had only one tooth, the whole disc edge being shaped to give this effect.

Between the pair of discs was placed a high intensity projector lamp encased in a box having a narrow slit on each side, the box being positioned so that the two beams of light passed through the slits and focused on to the disc teeth. Against the exterior disc faces were mounted two separate photo-electric cells in metal boxes, so that the active electrodes received light through slits positioned opposite the lamp case slits.

On turning the discs the beam of light was interrupted or masked in accordance with the amount of disc tooth covering the light beam slot, and since the teeth were correctly shaped the light actuation on the cells was such that a voltage variation was produced of a true saw-tooth character. By revolving the discs at a speed corresponding to picture periodicity the necessary two sets of saw-tooth voltage variations were generated, and, after amplification, fed to the respective pairs of deflector platesiincorporated in the cathode-ray tube.

A Simple Time Base

Modern development has shown that identical timed pulse effects can be produced

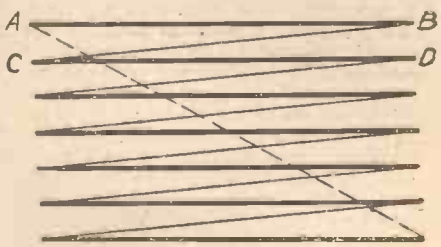


Fig 3.—The heavy and faint lines represent respectively the normal line traverse and quick return stroke.

894

in a much simpler manner, and although electrical time bases have their own difficulties it is easier to control the cathode-ray tube spot movement by employing these methods. The very simplest form in which a circuit of this character can be arranged is shown in Fig. 5. Across one pair of the C.R. tube's deflecting plates is connected a neon lamp discharge tube, while in parallel with this is a condenser. Completing the circuit we have a diode

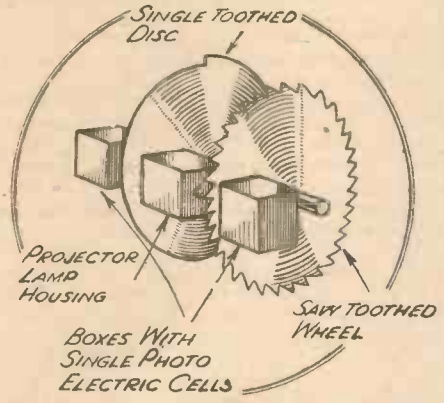


Fig. 4.—Positioning a lamp between two discs, having teeth cut as shown to produce the required signals from photo-electric cells.

valve (a three-electrode valve can be used here by joining the grid and anode electrodes together), fed from H.T. and L.T. supplies with the addition of a rheostat to vary the filament current.

The diode valve is arranged to work in a saturated condition, that is to say, the filament current is kept low so that the anode current flowing through the valve is independent of the voltage across it, being constant over a relatively wide voltage range. There is thus a uniform current flow into the condenser. Now the voltage across a condenser is proportional to the electrical charge in it, and as the circuit has been so arranged that the current flow into the plates is constant while the charging process is taking place, the voltage across the condenser rises uniformly with time, which, of course, is the sloping line effect of the saw-tooth graph of Fig. 1. The process continues uninterrupted until the condenser is charged to such a voltage value that the neon gas tube, which is shunted across it, suddenly ionises or glows with its characteristic orange red colour.

Rapid Discharge

Now this action of the gas ionising demands a relatively high current to pass through the tube, and it is momentarily so heavy that in supplying the current the condenser becomes discharged very rapidly. Obviously, the voltage must drop in sympathy with this, and the process goes on until a point is reached where the voltage available from the condenser is insufficient to maintain the neon gas tube's ionisation and it becomes extinguished. This ionisation effect which causes the rapid drop in voltage corresponds to the vertical line in the saw tooth graph of Fig. 1, so the simple circuit of Fig. 5 has proved effective in simulating the conditions required.

As long as the sources of L.T. and H.T. continue to feed the circuit, the slow rise and sudden fall in potential across the neon gas lamp between its striking and extinguishing voltages will be maintained in the cyclic manner just described. But the cathode ray tube's deflector plates are joined across this neon lamp, and in consequence they are subjected to the same potential conditions. In this way the electron beam can be made to traverse the screen, and by using two time bases the double motion for line traverse periodicity and picture periodicity is secured to give the ordered scanning required.

Sequence of Actions

To obtain the sequence of actions on a correctly calculated basis it will be apparent that a definite relation must exist between the various quantities which together make the complete circuit. The time period of the pulses must be determinable, and for this purpose the following equation can be used when the back stroke time is neglected :—

$$T = RC\frac{V-V_e}{V-V_s}$$

The symbols in this equation have the significance expressed below :—

R = The resistance of the diode valve at the filament current used.
C = The capacity of the condenser.
V = The voltage of the H.T. supply.
V_s = The striking voltage of the neon gas tube.
V_e = The extinguishing voltage of the neon gas tube.

Now although this simple time base circuit is satisfactory for explaining the action of the triggered pulses which control the electron beam movement, under actual television picture reception conditions many refinements have to be introduced, and these will be described fully next week.

[Previous articles in this series appeared in issues dated February 16th, 23rd and March 2nd. A further article will appear next week.—ED.]

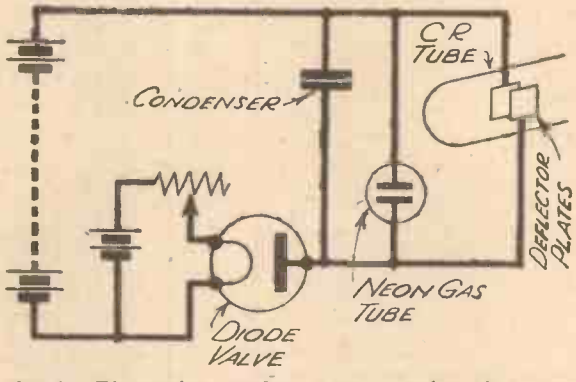


Fig. 5.—The simplest time base circuit to explain the action.

COMPARING RADIO-FREQUENCY STANDARDS

FOR some time the International Union for Radio Research has organised special radio emissions for the international comparison of standards of frequency. Among the Institutions assisting in this work are the National Physical Laboratory, Teddington, and National Laboratories in the U.S.A. and in several countries of Europe.

The growing extension of radio transmission demands continually increasing accuracy and steadiness of frequency ; and it is important that the standard apparatus of different countries used for measuring frequency should agree to a high order of accuracy. An emission of a frequency of great steadiness also enables information to be obtained on the physics of radio propagation, by observing the changes introduced into the waves by their passage to receiving stations at various distances.

In the comparisons of standards of frequency, agreement to one part in ten million has been attained. During the work, differences have been noted in the modes of arrival of the emitted wave, and on the occasion of the next international transmission, during the night of March 12th-13th, 1935, it is hoped to obtain the co-operation of persons and institutions possessing suitable apparatus to assist in the study of these differences.

The inter-comparison of standards of frequency is made by sending out a very steady frequency from a radio transmitting station, the value of which can be measured at any place equipped with the necessary apparatus. The actual measurement is made by observing " beats " between two frequencies which are very near equal.

National Physical Laboratory Tests

In the past, a frequency in the form of a musical note of a value of 1,000 cycles per second has been generated at the National Physical Laboratory, as a " frequency of reference," and it has been emitted as a modulation of a carrier wave by the British Broadcasting Corporation. On the last occasion, in March, 1934, this was done on two carrier frequencies from different stations simultaneously, which enabled their mode of arrival to be compared. It was found that there were distinct differences in the steadiness of the frequency arriving by the two routes. At distances of 400 km. to 800 km. there was a slight variability of the modulation frequency arriving by the lower-carrier frequency, 200 kc/s. The variability was much more pronounced with the higher frequency, 877 kc/s.

Observations of differences in mode of arrival can be made without requiring a local source of steady frequency. A comparison of the modulations arriving by the two carrier frequencies can be made by means of a low-voltage cathode-ray oscillograph supplied from radio receiving apparatus; which must be free from distortion.

The Next Emission

On the occasion of the next emission (March 12th-13th, 1935), the British Broadcasting Corporation has kindly offered to modulate Droitwich and the Scottish Regional and Scottish National stations simultaneously with the frequency of 1,000 cycles per second. A great part of England will be in the " fading " area of the Scottish stations, and it is for physical observations, among which " fading " is an important phenomenon, rather than for quantitative measurements, that the two Scottish stations are being provided. The main emission will last continuously for an hour and a half, preceded and followed by shorter ones for subsidiary purposes.

The National Bureau of Standards, Washington, U.S.A., is co-operating by a special emission of a frequency of reference of 5,000,000 cycles per second. This is expected to be accurate to 1 cycle per second, and to be of sufficient intensity to be received satisfactorily in Europe. In order to make the best use of this opportunity persons and institutions having suitable oscillograph apparatus are invited to assist by making observations, and more detailed information can be had on application to E. H. RAYNER, Chairman, Commission I (Standards), Union Radio Scientifique Internationale, National Physical Laboratory, Teddington, Middlesex.

SOLVING INTERFERENCE PROBLEMS—1

ELECTRIC MOTORS

The Purpose of This Series of Short Articles on the Elimination of Man-made Static is to Provide Readers with Practical Suggestions Concerning the Fitting of Suppressing Devices and Removing Residual Interferences.

MUCH has been written on this subject during the past two years, and some writers have fallen into the error of trying to achieve the impossible; namely, covering the whole ground of electrical interference in the space of one article. Realising this fact, the writer is confining each of these articles to a definite class of apparatus which is capable of creating static.

Many radio listeners experiencing electrical interference are so intent upon blaming overhead tram and bus systems for their disturbances that they are apt to overlook the fact that they may quite probably be contributing an equal, if not greater, amount of the static by the use of electrical devices in the home.

Admitting that these aforementioned systems create an unpleasant noise in the receiver, it is incumbent upon the listener to take all possible steps to eliminate electrical noises from his own appliances. It has been estimated that some 30 to 40 per cent. of the static is produced by domestic appliances, such as vacuum cleaners, refrigerators, fans, small medical H.F. apparatus, washing machines, switches, and sewing-machine motors, etc. The intensity of the static from these sources is not usually severe, and in comparison to the noises which are produced from trams they would seem of no consequence. It is these very devices, however, which raise the static level in a congested residential area, and lead many non-technical listeners to suppose that the various crackles, and other noises, are part and parcel of radio reception.

The normal atmospheric conditions, as compared with many countries nearer the Equator, are such, however, that the static level allows for the reception of the weakest stations, and therefore the general idea of reception in this country is quite incorrect. The listener who attaches some importance to the reception on his receiver, particularly if it is a sensitive one, cannot do better than to apply a suitable suppressing device to every electrical appliance in his possession, whether it is known to be creating interference or not. The assumption is that after prolonged use the appliances, through wear, will create static.

Small Electric Motors

The small fractional-horse-power motors fitted to domestic appliances from the point of radio reception are particularly troublesome, as they can produce far more interference than even their larger counterparts. Due to the fact that the domestic appliances in which they are incorporated have to operate on both A.C. and D.C. mains the motors are invariably of the universal or D.C. types which produce commutator sparking. The noises which these motors cause manifest themselves as continuous crackling, rumbling, buzzing, humming, scraping, spluttering, or singing. The sound will commence low and rise in pitch until it reaches a whine which will probably remain steady, approximating to maximum speed.

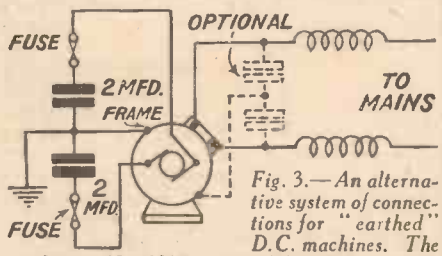


Fig. 3.—An alternative system of connections for "earthed" D.C. machines. The condensers (2 mfd.) are joined directly across the brushes. The chokes are optional.

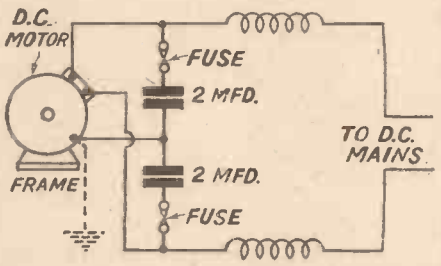


Fig. 1.—For fractional-H.P. fast series-wound motors operating on D.C. supplies the arrangement shown is recommended, the condensers being 2 mfd. each, and the fuses 2 amp. size. Where the machine is a permanent fixture, earthing the machine frame can be tried. For slow-running or shunt-wound motors use 4 mfd. condensers. The heavy-duty H.F. chokesc an be introduced later if the condensers are only partially successful. The chokes for heavy duty should be to G.P.O. design (3 amp.). For smaller machines use 75 to 150 turns No. 18-20 D.C.C. wire, hank-wound on a 3in. diam. former.

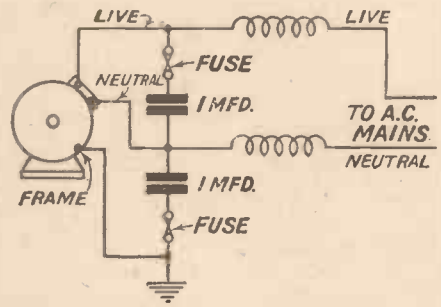


Fig. 2.—Stationary fractional-H.P. universal or A.C. motors operating on A.C. are best silenced as shown, the condensers being 1 mfd. each. Chokes need only be added in difficult cases. The wiring of the condensers depicted is recommended where the brushes are inaccessible. Note that the mains plug must not be reversible.

These noises are characteristic of commutator motors, but slightly larger motors, such as the A.C. repulsion starting type, will usually cause a splutter, whirring, crackling, buzzing, or humming noise, rising in pitch as mentioned. If the listener considers the application of suppressing devices is unjustified on all his electrical appliances then it is easy to trace those which are creating radio interference. It is only necessary to switch on the receiver to maximum sensitivity, tune in a weak station requiring the full use of the manual volume control and then switch on each electrical appliance in turn to note its effect on the receiver.

These devices which produce static noises are best tested with further reference to the receiver by removing the aerial lead, connecting "A" and "E" together, and noting whether the static persists. If it does it will prove that the interfering currents are being conducted to the radio set by the mains leads. Quite apart from showing the desirability of fixing a suitable condenser unit across the mains leads or brushes of the offending machine, the test outlined will indicate that the receiver is prone to pick up mains-borne interference; it is as well to note that when a set is susceptible to such interference a suppressor unit fitted across the mains leads near the master fusebox will earth interfering H.F. currents superimposed on the mains from outside sources.

On A.C. receivers a screened primary on the mains transformer and connected to the common earth lead will invariably perform a similar function. On D.C. mains receivers the absence of a mains transformer necessitates the use of a pair of H.F. chokes capable of carrying the current consumed by the set, and in series with each mains lead, and in conjunction with suitable condensers. All these fitments are clearly illustrated in the accompanying diagrams, Figs. 1 to 7. No reference will be made here to the methods of fixing the condensers and chokes because the installations differ with various makes, and the prospective user cannot do better than to apply to the makers for full fixing instructions.

Fitting Suppressors

Apart from the makers' suggestions, there are a few well-defined principles to be observed in applying these suppression devices, which are summarised as follows:—

(1) The condenser unit must be placed

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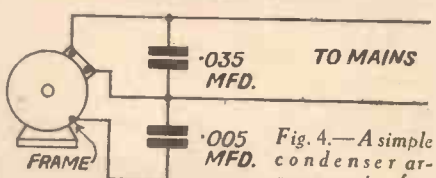


Fig. 4.—A simple condenser arrangement for gramophone motors (D.C. and universal), hair dryers, toy motors, small fans, and similar devices. The system is applicable to commutator motors on both A.C. and D.C. supplies. Earthing the motor frame can be tried, but is not always essential.

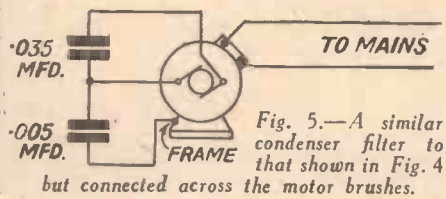


Fig. 5.—A similar condenser filter to that shown in Fig. 4 but connected across the motor brushes.

(Continued from previous page)

as close to the electric motor as can be conveniently arranged.

(2) The leads from the condenser unit must not exceed a foot in length, as the shorter they are the more effective will be the suppression on all wavebands.

(3) The most effective suppressor unit

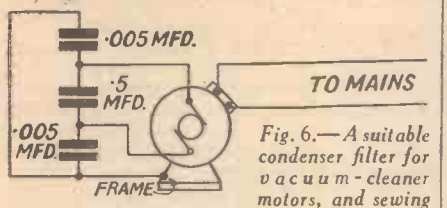


Fig. 6.—A suitable condenser filter for vacuum-cleaner motors, and sewing machines. The mains plug to the motor is reversible.

will give little relief if the motor to which it is attached is in poor running order.

(4) Where sparking is observed at the commutator it should be carefully cleaned while running. A piece of glass paper can be attached to an insulated stick for this purpose, care being taken not to receive a shock.

(5) The brushes on the machine must be well bedded down to the commutator, and shaped to the curve of the latter.

(6) It is usually unnecessary to earth the metal casing or structure of the portable appliance in which the motor is fixed as the earth return of the condenser unit is taken back to the frame, and this restricts the interfering currents to the immediate field of the appliance.

(7) Fractional-H.P. motors are usually series wound, and if the field windings are asymmetrically arranged each side of the armature the suppressing condensers can be reduced to quite low values. A symmetrical arrangement of field windings normally requires larger condensers.

(8) Slow-running motors such as those fixed in refrigerators necessitate larger suppressing condensers and probably the addition of H.F. chokes in series with each lead. Motors of this type which are permanently installed can have their frames earthed.

(9) The use of special interference eliminating condenser units complete with fuses are strongly advised. Ordinary condensers, quite apart from the danger of offering exposed metal parts to non-technical users, are usually unsuitably constructed for incorporating in or near domestic appliances. Where condensers are shown applied to domestic motors, they should therefore be construed as being values assigned to units meeting I.E.E. and G.P.O. recommendations. Commercial units having the capacity values shown are readily available.

Readers wishing to silence electric motors having special uses or connections and which are not covered by these notes are invited to send full particulars to the Editor. Suggestions for overcoming the static, together with diagrams where necessary, will be embodied in later articles in this series.

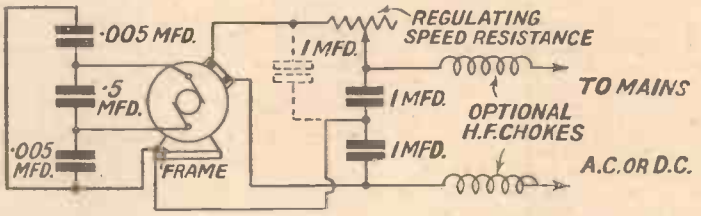


Fig. 7.—Where a sewing-machine motor or fan is fitted with a speed regulator, the additional suppressing devices shown are usually necessary. The metal frames of both motor and regulator should be connected together (not shown), if not already contacted.

Aircraft Telephony

MANY sets, both commercial and home-constructed, are capable of tuning on 862 metres. This is the wavelength allotted to aircraft and ground stations for telephony transmissions.

Perhaps many enthusiasts have listened to Croydon, Manchester, and Portsmouth transmitting, and those who have powerful sets, or who live near to scheduled air routes, have probably heard the machines while they are flying. The majority of the messages are in plain language, others are intermingled with code. It is to explain these messages in a simple manner so that the listener can get an insight of the way wireless helps the air pilot, and makes scheduled airline operation safe and regular, that this short article has been written.

Pilots' Requirements

Pilots flying over routes in bad weather require bearings, positions, weather reports, and particulars of other aircraft in their vicinity. You have probably heard the routine messages passed when aircraft are crossing the Channel, departures from and arrivals at Croydon; these are all in plain language, such as "Passing Dungeness for Le Treport at 3,000ft."

The prefix to all messages is the name of the station or aircraft calling; in the case of the aircraft, the name of the company and the last two letters of the registration group are used; an aircraft of Imperial Airways with registration group G-ACXD would use as a prefix to a message "Imperial XD. Letters are sometimes given in a phonetic alphabet, A for Amsterdam, B for Baltimore, C for Canada, D for Denmark, E for Eddystone, etc.

In the above case it would be "Imperial X Denmark," it being usual to give it in the simplest way to avoid confusion of letters.

You have probably heard messages such as the following:—

"Hullo, Croydon, Hullo, Croydon. Imperial X Denmark calling, Imperial X Denmark calling Q.T.E., please. Q.T.E., please. Over."

This means that Imperial Airways machine G-ACXD requires a true bearing from Croydon, or, instead of Q.T.E., he may ask for a Q.T.E.Q.T.F. This means that he wants a true bearing and distance from the station called. Again, he may ask for a Q.D.M., which is a magnetic reciprocal bearing, to be flown to reach the station, assuming there is no wind.

In each of these cases Croydon will reply as follows:—

"Hullo, Imperial X Denmark, Hullo, Imperial X Denmark. Croydon calling, Croydon calling for your Q.T.E. (or the others). Switch on, please. Over."

Bearings from Croydon

The pilot then switches over to transmission to enable Croydon, and in the case of the Q.T.F. the other stations also, to tune in and obtain a bearing of the aircraft; after half a minute the pilot switches over to reception and Croydon will reply as follows:—

"Hullo, Imperial X Denmark, Hullo, Imperial X Denmark, Croydon answering, Croydon answering your Q.T.E. One hundred and forty degrees, one four oh degrees second class. Over."

The pilot will then repeat this back to Croydon to obtain a correction if wrongly received. This means that the true bearing of the aircraft from Croydon is 140 degrees, and the pilot can then check up whether he is drifting off his course owing to wind.

In the case of the Q.T.E.Q.T.F., the distance of the aircraft from the station called is given as well, enabling the pilot to plot his exact position, assuming that he is flying above the clouds and cannot see the ground. By getting two such bearings and positions within, say, a quarter of an hour he can work out his exact ground speed and track over the ground, and so the time of arrival at his destination. Weather reports for many places at home and abroad can be obtained from Croydon, Manchester, and Portsmouth.

Q.B.I. Call

Another code call you may have heard, particularly during the winter months, is Q.B.I., usually given out as a general call to all aircraft from Croydon as follows:—

"Croydon calling, Croydon calling. Q.B.I. in force at Croydon, Q.B.I. in force at Croydon. Over."

This means that the Croydon controlled zone scheme is in force, which prohibits any aircraft from entering within a certain defined radius of Croydon without permission. This scheme is in force during conditions of bad visibility, and is a safeguard against collisions between aircraft approaching Croydon to land.

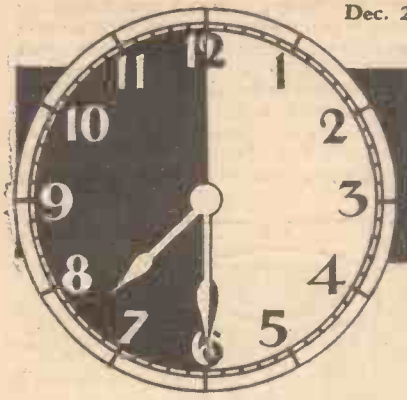
The procedure in this case for a machine wishing to land at Croydon is as follows: Before approaching the limits of the zone the pilot calls up Croydon and asks for permission to proceed to Croydon. This may be given at once, or, in the event of several machines collecting outside the zone, priority of entry will be given, and other machines told to wait outside the zone until given instructions to proceed. You will hear Croydon say:—

"Hullo, so and so, your turn is number three, please keep out of zone until further instructions. Over."

The next time you listen on the aircraft wavelength, we hope you will be able to understand the meaning of the various messages you hear, and realise how wireless is helping the air pilot to maintain his schedule irrespective of the weather conditions he is flying through.

The best time to listen is between 9 a.m. and 4 p.m. Sundays included. If you live in south-east England, you will have no difficulty in hearing Croydon and Portsmouth and machines of the following companies operating regular routes:—Imperial Airways, Ltd., Hillman Airways, Ltd., Spartan Air Lines, Ltd., Jersey Airways, Ltd., and Provincial Air Lines, Ltd.

Previous articles in this series appeared in issues dated Dec. 15th, Dec. 22nd, Dec. 29th, Jan. 5th, Jan. 12th, Jan. 19th, Jan. 26th, Feb. 2nd, Feb. 9th, Feb. 16th, Feb. 23rd, and March 2nd.



Half-Hour Experiments

The Experiments Described This Week are in Connection with the Modification of a Normal Broadcast Receiver for All-wave Operation

IN connection with a competition run in PRACTICAL WIRELESS 1934 Olympia Exhibition Number readers were asked to arrange in order of popularity a number of alternative circuit arrangements. One of the arrangements included in the list was that of an all-wave receiver,

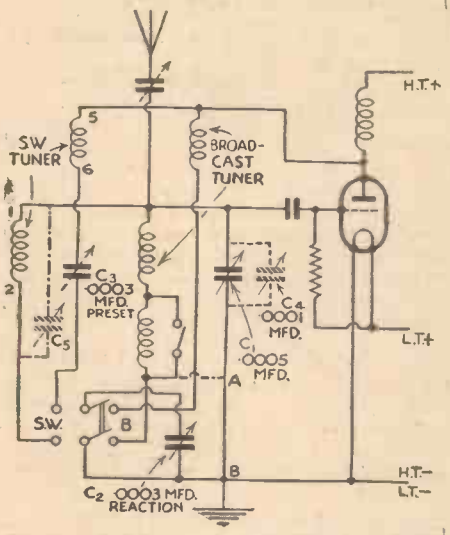


Fig. 1.—This theoretical and pictorial circuit (Fig. 2) show the method of adding a short-wave tuner to a broadcast receiver to enable all-wave reception to be obtained. The condenser shown connected by broken lines, as well as the connections shown by chain lines, is referred to in the text. The link between points A and B should be removed when using the connections shown by chain lines.

and, although this did not receive the maximum number of votes, it certainly proved to be a popular type of circuit with a large number of readers. In all probability, if the competition were repeated the all-wave type of receiver would be given even more votes than before, for there are marked indications that sets which will cover short, medium, and long waves are receiving increasing attention. There is a very good reason for this, which is that more and more transmissions are taking place on the lower wavebands than ever before, whilst the imminence of short-wave television transmissions is playing no small part in causing still further attention to be directed to the higher frequencies.

A Compromise

In the first place I would make it perfectly clear that it is by no means a simple matter to design a receiver that will function equally well on three or four wavebands, and therefore that the modifications to be described will be more in the nature of a compromise than anything else. This does not mean that they will prove unsatisfactory; on the contrary, I know that they will provide reasonably good results, for I have tried them fairly thoroughly on more than one occasion. A point that I would like to drive home, however, is that the practical details of the various schemes have slightly to be modified according to the receiver with which they are tried.

The Simplest Method

Let us first consider the simplest type of receiver having three valves arranged as detector and two low-frequency stages, and employing a circuit similar to that reproduced in Fig. 4. It will be seen that a normal type of dual-range tuner is employed in the aerial circuit, and that this is tuned by the usual .0005-mfd. variable condenser, reaction control being governed by a .0003-mfd. variable condenser. It is obvious that this circuit could be employed for wavelengths other than those embraced by the broadcast band simply by changing the tuner for a similar one designed to cover alternative wavelengths; the matter of switching from one tuner to another, however, presents not a few difficulties, especially when short waves are concerned and stray capacities must be kept down to a minimum.

It might at first appear that a four-pole change-over switch would be required so as to transfer all of the coil connections from one tuning unit to another, but it has been found practicable to simplify this scheme by using the connections shown in Fig. 1. In this case a simple type of double-pole switch serves our purpose perfectly well. The circuit is very nearly self-explanatory, but the purpose of the pre-set condenser marked C3 and of the .0001-mfd. condenser shown in broken lines and marked C4 may call for an explanation. The object of the former is to reduce the capacity of the reaction circuit on short waves, which is desirable in the interests of smooth control. By varying the capacity of the pre-set the total reaction capacity can be altered over wide limits. For example, if the pre-set condenser were adjusted to .0003 mfd., the total capacity of the two condensers in series would be limited to .00015 mfd. (one-half the capacity of either condenser). If the capacity of the pre-set were reduced to .00015 mfd. the overall capacity of the series combination would be limited to .0001 mfd., and so on.

Short-wave Tuning

The purpose of the low-capacity condenser shown in broken lines is to provide a band-spreading arrangement and to

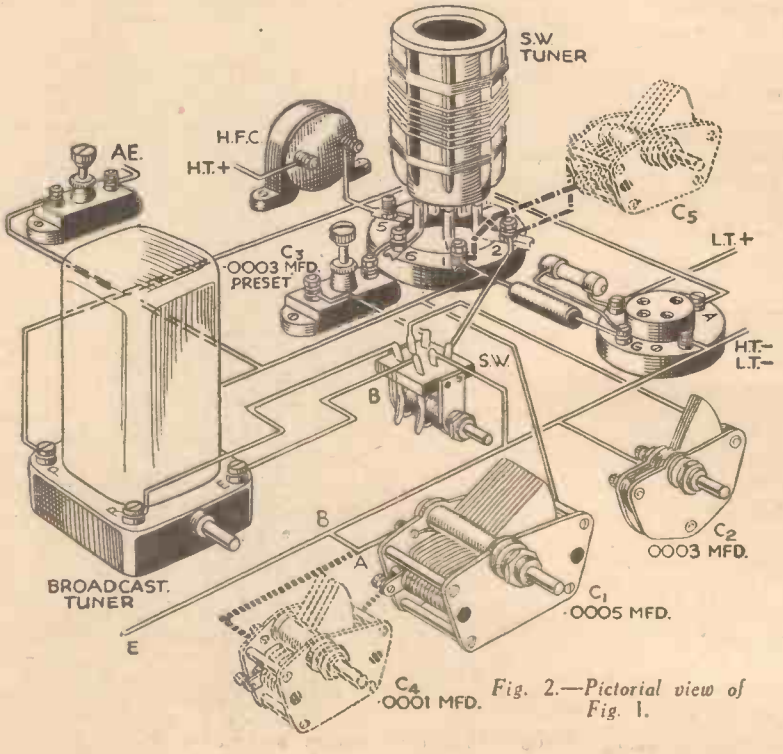


Fig. 2.—Pictorial view of Fig. 1.

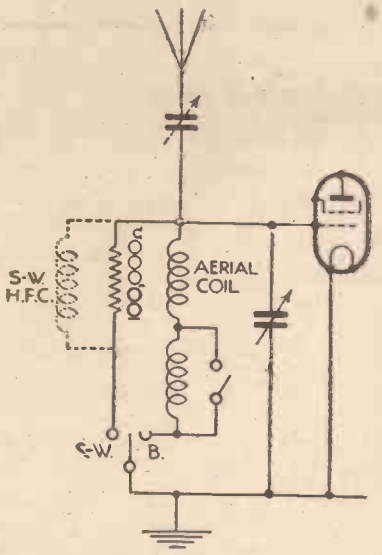


Fig. 3.—Showing how a fixed resistance or S.W. H.F. choke can easily be used in place of the aerial coil in a receiver with an H.F. stage.

simplify short-wave tuning. This condenser is not strictly necessary—that is why it is shown in broken lines—but it is very desirable, especially if the normal tuning condenser is not fitted with a particularly good and smooth-acting slow-motion control. When using the circuit suggested it may be found better to reduce the capacity of the pre-set condenser in series with the aerial when tuning on short waves, but this depends very largely upon the type of aerial in use.

With regard to the short-wave tuner, it can be stated that this may be of any convenient pattern, home-made or otherwise, but it should for preference be of the four-pin-six-pin plug-in pattern so that any required short-wave range can readily be provided for. A few details concerning the construction of suitable coils will be given later.

The change-over switch should be of a low-capacity type, but one of the better-quality Q.M.B. switches can be employed with complete success, provided that it is mounted in such a position that the leads to it are short and direct.

A Better System

One objection to the circuit shown in Fig. 1 is that the minimum tuning capacity is somewhat higher than is desirable due to the fact that the .0005-mfd. condenser is always in circuit. This difficulty can be overcome fairly simply by employing the modified arrangement indicated by chain lines in Fig. 1. In this case an entirely separate tuning condenser, C5, is used for short-wave reception, and the "broadcast" condenser is thrown out of circuit by means of the waveband-changing switch. The extra condenser may have a value between .0001 mfd. and .0002 mfd.; the lower capacity should be used if the condenser is not fitted with a reliable slow-motion drive, but the higher capacity offers certain advantages, in that it gives a wider tuning range with any particular coil when a good slow-motion drive is fitted.

It need scarcely be explained that either of the general circuit arrangements shown in Fig. 1 could be employed equally well where the tuner fitted to the broadcast receiver was provided with a tapped medium-wave winding (the tapping being used for aerial connection), or where there was a loose-coupled aerial winding. In the latter instance, however, it would be most convenient to use a short-wave tuner, also, which was provided with a similar type of loose-coupled aerial winding. The "aerial" end of that winding would be connected to the corresponding end of the loose-coupled winding on the broadcast coil, the "grid" ends of the two windings also being joined together.

For H.F. Receivers

Either of the modifications suggested above could be used, with slight alterations, with a receiver of the kind having an H.F. stage, in which case the connections to the pre-set aerial condenser would correspond with those going to the coupling condenser used between the anode of the H.F. valve and the tuned-grid circuit. It would be possible to duplicate the arrangement in the case of the aerial coil (eliminating the reaction winding, of course), but this is not recommended because of the difficulty in tuning simultaneously two different circuits when receiving on short waves. A far simpler and better method, however, is to arrange that the aerial circuit shall be made aperiodic for short-wave work, and this simply means that the aerial tuner should be replaced by a non-inductive fixed resistance of about 100,000 ohms, or by a good short-wave choke, as shown in Fig. 3. As will be seen, a simple single-pole change-over switch is indicated for replacing the aperiodic aerial component by the tuned circuit, and *vice versa*.

The Reaction Choke

There is just a possibility that when short-wave reception is attempted with the circuits described it will not be possible to secure good reaction control. This will be due to the fact that the H.F. choke used in the detector anode circuit is suitable only for long- and medium-wave reception. Any difficulty in this direction can easily be overcome by inserting a short-wave choke at the point marked X in Fig. 1, between the anode of the detector valve and the "lower" end of the H.F. choke originally fitted; the second choke will have no ill effects on broadcast reception and, therefore, does not require to be switched out of circuit at any time.

Having explained the main points involved we can proceed to consider the construction of suitable short-wave coils. As mentioned above, it is preferable that these should be of the plug-in type, and they can easily be wound on standard six-pin formers by following the dimensions given in Fig. 4. The drawing shows three windings—loose-coupled aerial, grid, and reaction—but it will be understood from what has been written above that the aerial winding will not always be required; in such cases it can simply be ignored. The

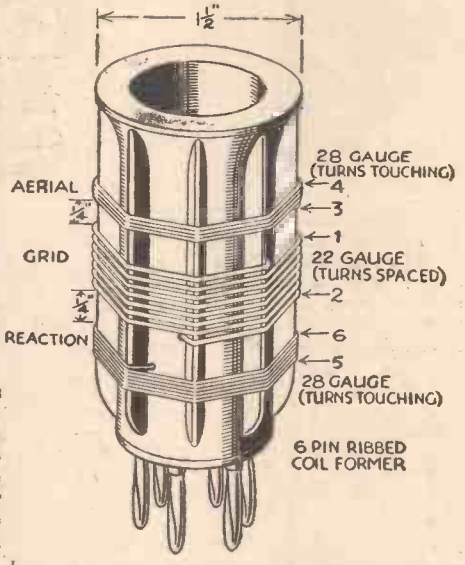


Fig. 5.—The above drawing gives details of short-wave coils suitable for use in carrying out the experiments described. Appropriate numbers of turns for the aerial, grid, and reaction windings for 12-22, 20-50, and 48-90 metres respectively are: 3, 4, and 5; 5, 7, and 10; and 4, 6, and 8.

numbers shown for the connections in Fig. 4 correspond with those in Fig. 2.

The wire used for winding the coils may be enamelled, 22-gauge being used for the grid winding, and 28-gauge for the aerial and reaction coils. It will be seen that the turns of the grid coil are shown as being slightly spaced; this spacing can most easily be arranged by winding on the former a length of string about the same thickness as the wire at the same time as the coils are wound. The string can be removed afterwards, and the turns of wire kept rigidly in place by applying a few spots of sealing wax where they pass over the ribs.

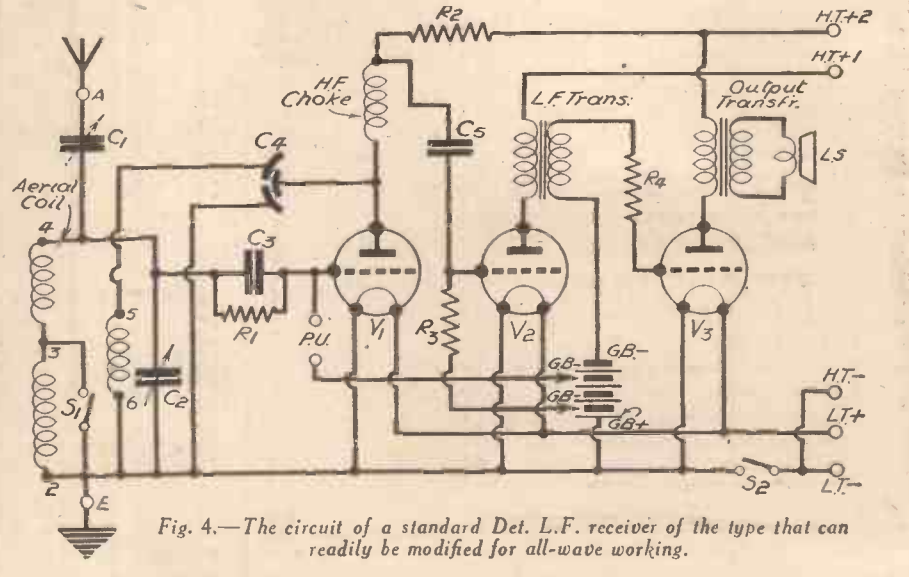


Fig. 4.—The circuit of a standard Det. L.F. receiver of the type that can readily be modified for all-wave working.

On Your Wavelength

by Thermion

Signature Tunes

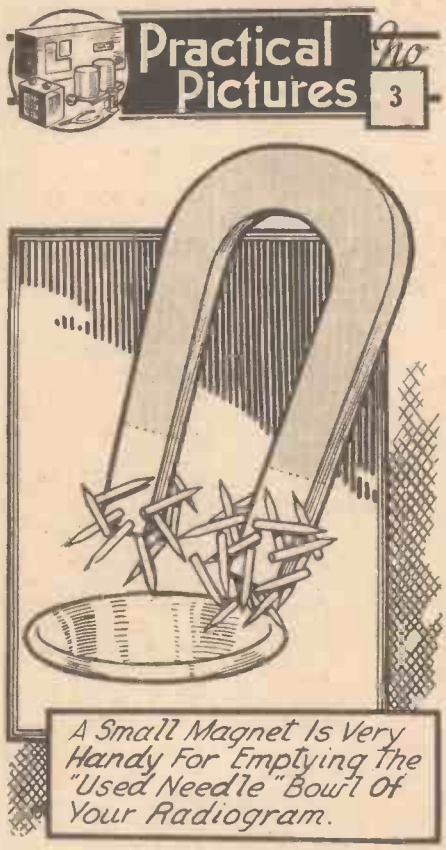
FOLLOWING my recent par. about crooners, it just occurs to me that this signature-tune business is all wrong. Is not a signature tune adopted by band leaders to convey at once to the listening public in a musical way that it is Bill Brown or Tom Jones, or Jack Smith and his "boys" (particularly the "boys"!) who are about to broadcast? As it is, these bands make a sort of triumphant entry on to the listening stage as if they were a victorious army returning from foreign parts after vanquishing the foe. Not content with a signature tune, they take the trouble also to say: "This is Bill Brown and his boys," or "This is the blankety-blank orchestra conducted by Tom Smith," in addition to announcing themselves in musical language! Moreover, they tell you both before and after playing their jazz trifle. This, I suggest, is altogether wrong. It is giving undue importance to nigger music. Having given their half-an-hour's entertainment, they go off the air in a blare of triumphant music, playing their signature tune just as if they had just won the Battle of Waterloo all over again. Unfortunately, the disease has spread, and every sponsored programme is prefaced and concluded by a piece of musical tripe. If the signature tune is necessary and satisfies its purpose, no further announcement is necessary. Most conductors of a group of tired-eyed knights of the cat-gut now regard themselves somewhat in the nature of monarchs, and have created their own anthem. I hope the various broadcasting bodies will stop it. It is blatant advertising of one of the lowest forms of music, which has enjoyed, if I may say so, an inflated, spurious, and certainly artificial degree of popularity. I visit many homes and have never yet discovered people dancing to dance music, very little of which is played to dance time. Nor have I ever observed people listening to dance music. Most of them take an almost fiendish delight in placing the switch to the off position directly a signature tune is played. Please stop this signature-tune nonsense! From this you will gather that I do not like crooners, that I do not like signature tunes, and that I think undue importance is placed on dance music. Any of these so-called collaborative musical compositions are almost insulting to British intelligence. Even if you rule out the "boo, boo, boo, boo," business to which I referred last week, the lyrics are unworthy of a child of ten.

There are some good dance bands, of course, and I know that many readers enjoy the programmes they supply. But if the various dance bands are so different, a signature tune should not be necessary. One should recognise a band by its superlative music!

All-wave Reception

I WONDER how many of my readers who are 'true' experimenters have given their attention to the design of an all-wave set. On the face of things it is a perfectly simple matter to modify the design of an ordinary broadcast set to enable the short-wave stations to be received, but when the time comes to put one's ideas into practice the position is not so straightforward. Many receiver manufacturers have, at different times, attempted the construction of a high-grade set for tuning from about 10 to 2,000 metres, but comparatively few of the designs that have been evolved have proved completely successful. I do not say that those few all-wave sets which are now on the market are not entirely satisfactory—all of those which I have had the opportunity of testing have proved to be—but these form only a very small proportion of the total number that have passed from the drawing-board to the test bench.

Quite apart from considerations of design I still wonder if all-wave reception is really needed, or if it is a passing phase. There



seems to be little doubt that short waves will be used more and more in the course of time, but the point to decide is whether we shall find it better, and perhaps cheaper, to have two entirely different sets for the present broadcast and short-wave bands, or whether a single receiver will adequately meet our needs.

Television Receivers

ALREADY I see that at least one firm has issued a statement to the effect that, when the high-definition television broadcasts commence, they will place on the market a complete receiver for both sound and vision at a price between £25 and £30. This certainly sounds more promising than the figures up to £80 which were previously suggested by the Television Committee' and if the necessary television equipment can be obtained for little more than the price of a modern radiogram interest in television should certainly be given the stimulus which it deserves. Besides, if television instruments can be bought for such a figure, at a time when they will be comparatively rare, it should augur well for the future. And, no matter what the price of the ready-made instrument turns out to be, the constructor should be able to make his own for a still lower expenditure.

Ultra-short-wave Work

IF you have carried out much experimental work in connection with ultra-short-wave reception you must have found the same difficulty as I have—that of choosing the most suitable circuit. The "straight" detector—L.F. still takes some beating when we get down below 80 metres or so, but the superhet seems to give excellent reception provided that a high intermediate frequency (465 kilocycles seems to be very suitable) is used. On the other hand there is much to be said for the Armstrong super-regenerative circuit for receiving on these very high frequencies, and I believe that this arrangement is still worthy of experiment.

Home Construction Pays

I HAVE often stressed the advantage to be gained by the home constructor, not only in reliability, but in the ability which he is afforded to put right anything which goes wrong. During the past week I have heard of several cases of commercial receivers going wrong within a week or so of delivery, and of the trouble which has been caused to the listener. My own newsagent bought a set by one of the largest makers in the country, and within two days it had developed a fault. He sent to the agent from whom the set was purchased, the set was examined, and as no trace of the fault was obtained, a second model was supplied. This developed a similar fault in three days, and he again sent for the dealer. After some delay the set was returned to the makers (he was without the set for a week), and on its return it developed precisely the same trouble. When I last saw him he said that the firm were nonplussed and were sending one of their engineers down to see the set. Not being a constructor, he is unable to put the matter right, and cannot listen in on a set which he has bought and which over a period of about one month has only given him about three programmes.

This is not by any means the only case I have heard of, and some of the excuses made by the dealers are really laughable.

Television Censorship

A DAILY newspaper recently published a letter from a reader raising a very interesting point regarding the forthcoming television programmes. He asks whether it will be possible to censor the programmes from abroad. We all know that the standards of humour of our European neighbours are not the same as ours, and it will certainly be interesting to see whether any International Board of Censors will be set up to prevent the English listener from being

(Continued overleaf)

(Continued from previous page)

supplied with continental performances which do not meet our ideas of entertainment. There has been considerable ink spilt regarding the broadcasting of advertising matter, and, no doubt, things will be considerably more complicated when television broadcasts become regular entertainment features. Censorship is a very delicate task, and I should like to know how censors will be able to tackle a matter of this nature.

Colour-coded Resistances

I SEEM to be tilting at manufacturers more than ever this week, but I hope that they will realise that my criticism is constructive and certainly in no way vindictive. In common with nearly everybody, I think the colour-coding adopted for fixed resistances a most excellent scheme. There are, however, two small grouses. Using certain makes of these resistors, I find it very difficult to distinguish between "orange" and "yellow" or between "orange" and "brown" and sometimes between "orange" and "red." No, I am *not* colour-blind, and the difference is easily recognisable when a full range of resistors of different colours is available for comparison. But if you have only one or two resistors on hand you cannot always be sure.

I feel very strongly on this point because I recently spent valuable hours looking for a fault which finally turned out to be due to the use of a 50,000-ohm resistor instead of a 5,000 ohm. If, however, the makers supplied a little paper strip printed with a specimen of all the colours used, comparison and check would be easy. As an alternative, the actual resistance in ohms might be printed somewhere on the resistor. Many makers do this already, but not all.

Another Use for H.F. Valve

IN the majority of cases the H.F. metal rectifier can be used to replace a diode without affecting results to any noticeable extent. There are minor exceptions, however, the two principal ones being the following: The maximum input voltage and maximum rectified output current of the "cold" diode are somewhat lower than those of a valve-type diode, so that the rectifier could not so satisfactorily be used in circuits where there was a phenomenal amount of intermediate-frequency amplification, or where only a single super-power valve was used in the output circuit. The "Westector" is more efficient at lower frequencies (long waves), and is, therefore, most suitable for use in the second detection circuit of a superhet; the valve-type diode is better for use as detector in a "straight" circuit which is designed to tune down to, say, 150 metres or less.

Tightening Screws

IF the screws securing earthing wires to metallised baseboards are tightened with the fingers it will be found that sufficient pressure may be exerted to lock the wire firmly, but if a screwdriver is employed, and the screws are turned to the limit, there will be a danger of shearing the wire inside the hole, and troubles might arise at a later stage due to the wire coming out of the hole.

Anchoring Battery Leads

THE battery cords should be anchored to ensure that an unexpected tug does not disconnect the ends with a possibility of a short-circuit. The anchoring may be accomplished by using one of the insulated bell-staples driven into the top surface of the chassis or by means of a small strip of ebonite. Do not use a metallic strip in case the edges cut into the insulation of the wire and thus cause trouble. Alternatively, the cords may be knotted before passing them through the hold in the chassis, and the knot will prevent the ends from receiving any strain.

Notes from the Test Bench

Mains Unit for the Hall-Mark Four

A READER recently inquired whether he could use his mains unit, having an output of approximately 200 volts at 60 m.a., for supplying the H.T. to the valves of the Hall-Mark A.C. Four as he had noticed that this receiver required a voltage supply of approximately 200. A unit of this type is quite unsuitable, as an energised moving-coil speaker having a field winding resistance of 2,000 ohms is employed. A mains unit having an output of approximately 300 volts at 60 m.a. is required. The consumption of the valves is approximately 50 m.a. and therefore a voltage drop of 100 takes place across the 2,000-ohm field winding, leaving the necessary 200 volts for the anodes of the valves. There seem to be many constructors who are not quite clear concerning the use of energised speakers, and think that one of these instruments can be substituted for any of the permanent-magnet models. It is emphasised, however, that this is not so; when an energised speaker is used, care must be taken in the choice of a mains unit, and constructors who have not the necessary knowledge to make the required calculations should consult our Advice Bureau before making a substitution of this kind.

Stabilising Push-Pull Circuits

IT is a commonly accepted fact that a well-designed push-pull output stage gives better quality reproduction than the normal single-valve type, as with valves connected in push-pull harmonic distortion is almost non-existent. If the push-pull stage is not well designed, however, distortion caused by the self-oscillation of the valves is often experienced. There are several methods of correcting this form of instability, however, and one of these is effectively used in our Hall-Mark receivers. The three most effective methods we have found are as follows: the connection of a low capacity condenser (*e.g.*, .0001-mfd.) across each half of the input-transformer secondary—*i.e.*, between G. and G.B. terminals; the connection of a 50,000-ohm resistance between G.B. terminal of the input transformer and the common negative line; or the connection of 10,000-ohm resistances between the G. terminals of the input transformer and the grids of the output valves.

Improving Superhet. Selectivity

SUPERHETS using a pentagrid valve sa a frequency changer, followed by a second detector and one or two L.F. stages have become popular during recent months. Most superhets of this type employ one I.F. transformer, however, and therefore they are often lacking in selectivity.

Fortunately, this low selectivity can usually be corrected by adding an extra I.F. transformer. The secondary of the existing I.F. transformer should be disconnected from the second detector grid circuit and connected through a very low capacity semi-variable condenser to the primary of the extra I.F. transformer, the secondary of this being then connected to the second detector grid in the usual manner.

The Language of Scots

Herewith a kick in the pants:

SIR,—I am afraid I must reply to "Thermion," whose articles I have read for the first time. I must admit they are extremely interesting, but I disliked his references to anything Scots—notice "Scots," *not* "Scotch." I am Scots myself—three-quarters anyhow—although I prefer to call myself British. If he examined the family tree of the British nation he would find that we in Lowland Scotland are more entitled to call our language "English" than an Englishman is. Personally, I am of the opinion that English as spoken by people of Inverness and of Lowland Scotland is correct English, and that spoken by teachers who graduate from such places as Oxford and Cambridge is *not* correct. It is as much a dialect as the so-called "Scotch." I would suggest that a committee formed by Englishmen, Scotsmen, Welshmen, and Irishmen with a British chairman might be able to deal with the subject.

In passing, let me add my support to the 2 H.F. Det. Pen. (A.C.-D.C.) with A.V.C. type of receiver.—ERIC M. BROWN (Leith, N.B.).

The Prince as Radio Expert

DURING the Prince of Wales's recent visit to the H.M.V. factories he heard a demonstration of high fidelity reproduction in the H.M.V. Research Laboratories, and was most successful in identifying the sounds of some special records in which everyday noises had been recorded at unusual volume. He also listened to the private records made by H.M.V. for the B.B.C. of the Royal Wedding Ceremony, which had been broadcast the previous evening. Mr. Clark said afterwards that he had been amazed by the Prince's technical interest in the various processes, and that his four-mile tour over the H.M.V. factories was, he believed, the longest that had ever been made by a Royal visitor.

Exide Going to Eastbourne

DELEGATES from many countries will attend the Fifteenth Annual Exide Convention to be held on May 28th, 29th, and 30th, at Eastbourne.

The Convention Headquarters will be at the Grand Hotel, where the morning sessions devoted to business discussions will be held, and the Convention will be opened with an address by the Chairman, Mr. D. P. Dunne, Managing Director of the Company.

An informal Reception and Dance will take place at Convention Headquarters on Monday, May 27, and on Tuesday, Wednesday and Thursday delegates will be entertained to luncheon by the Company and to dinner on Tuesday and the Banquet on Wednesday in the Winter Gardens.

A number of functions of a social and recreative nature are being organised, including the Annual Exide Golf Challenge Cup Competition, which will be played on the Willingdon Golf Course by kind permission of Mr. Cruickshank, Secretary of the Club.

SEND THAT DODGE OF YOURS!

SUBMIT YOUR IDEA

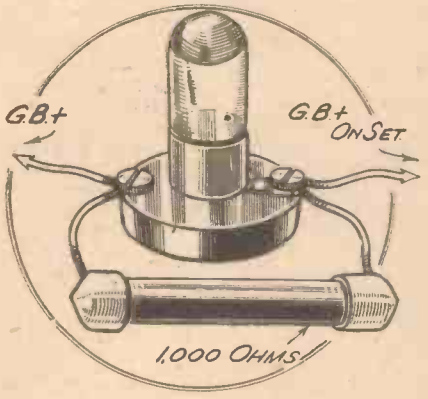
READERS WRINKLES

THE HALF-GUINEA PAGE

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.

A Grid Battery Fuse

IT is the usual custom to insert a fuse in the H.T.—lead of battery sets to protect the filaments in event of accidental

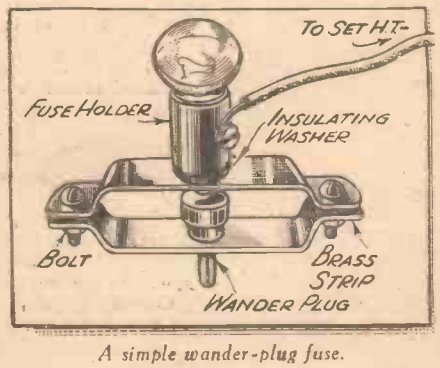


A useful grid battery fuse.

contact with high potential circuits. Many cases of burnt out filaments can, however, be traced to the use of fairly high potentials for grid bias. Unfortunately, a plain fuse in the grid battery circuit is inadvisable, because when this fuse is blown, the grids of L.F. and output valves are left free, with resultant depreciation in emission. To prevent this, a fixed resistance of 1,000-5,000 ohms should be connected in parallel with the usual fuse bulb. Should the fuse blow, bias is still applied through the resistance and, although, in some cases, distortion may result, no harm to the valves can possibly take place.—E. FISHER (Oldbury).

A Wander-plug Fuse

THIS fuse is intended for replacing the negative H.T. wander plug in any battery set. For its construction only two small nuts and bolts, a strip of brass, and a flashlamp bulb holder with base-board mounting, are required, in addition to the existing wander plug. The holder will have a small brass mounting strip insulated from its barrel. A piece of brass of similar width and thickness is bent to the shape shown in the sketch and a hole

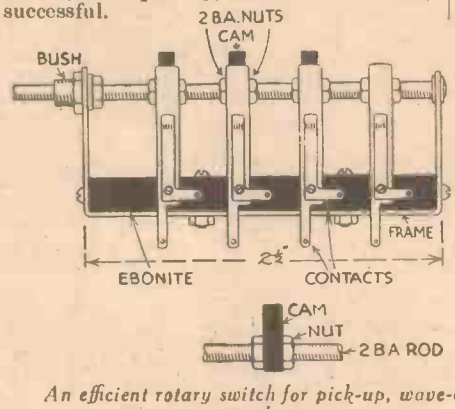


A simple wander-plug fuse.

large enough to take the screwed portion of the wander plug is drilled in the centre. Two small holes are also drilled at each end of the strip, and the wander plug is then inserted through the larger hole and the knurled upper portion is screwed on. The bulb holder mounting is then bolted to the ends of the brass strip. The wire to the set is taken from the small screw on the side, and a suitable fuse bulb is inserted in the holder.—G. WYATT (Burton-on-Trent).

An Experimental Rotary Switch

THE accompanying sketches illustrate a rotary switch of novel design. It has been used in a four-valve superhet for wave-changing and for switching in the gramophone pick-up, and has been very successful.



An efficient rotary switch for pick-up, wave-changing, and other purposes.

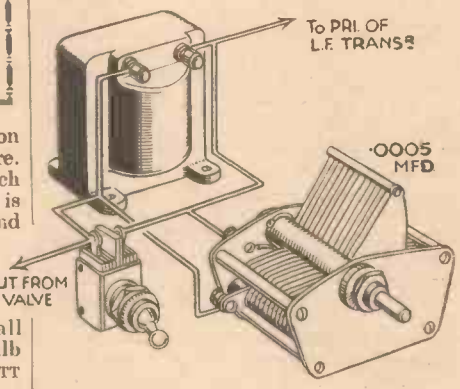
The sketches are self-explanatory, but a few remarks concerning the construction of the cam action are here given.

This consists of separate cams bolted to a 2 B.A. rod, the cams being cut from ¼in. sheet ebonite. The working end of the cam is left flat to obviate the use of separate springs to keep the rotor in the position required.

It will be observed that a switch of this description can be readily enlarged by placing contacts on the other side of the ebonite base and adjusting the cams to suit requirements. In a certain experiment, the switch was found to work satisfactorily in six different positions of the rotor.—G. S. FINCH (Surbiton).

A Tone Control Unit

THE simple tone control unit shown in the accompanying sketch is extremely efficient and is also inexpensive. The parts required are: a small L.F. choke, or



Using a choke and a variable condenser as a tone control unit.

an old transformer; a .0005, or larger, variable condenser, and a two-point switch. The secondary of the transformer (or the choke) is inserted in the lead from the plate of the L.T. valve to the intervalve transformer for the power valve. The tuning condenser is put in parallel with the choke, and the switch is connected up so that it short-circuits both choke and condenser when in the "on" position. With the switch in the "off" position, the H.T. supply to the valve flows through the choke windings. This tends to smooth out the vibrations, the damping being very much more marked for high notes than for low notes. This has the effect of reducing the treble response and gives a predominance to the bass. The function of the condenser is to allow a certain amount of the upper register through. With the condenser set at minimum the choke takes off the high notes. With the condenser set at maximum the high notes pass through the condenser and reach the intervalve transformer.

The switch is included to allow the whole unit to be cut out for reception of very weak stations, since the unit tends to slight reduction in volume.—M. How (Cumberland).

A COLD-CATHODE "VALVE"

Considerable Interest has been Aroused in Scientific Circles by the Introduction Some Months Ago of a Cold-Cathode "Valve" by the Television Laboratories of Philadelphia and San Francisco. The Article Gives the Most Recent Information on the Cold-Cathode "Valve," Early Details of which were Published Herein Some Months Ago

AT the onset let it be understood that this device, while of great importance and interest, seems to have its use limited to the field of television as far as the man in the street is concerned. Speaking bluntly, it is not a device for doing away with either valves or filaments as they are generally understood.

The cold-cathode tube consists essentially of an anode and two cathodes. The cathodes may conveniently take the form of flat plates, while the anode may conveniently take the form of a very short cylindrical tube having a hole in its centre greater than the size of the cathodes. While it is claimed that some sort of effect may be obtained with cathodes of pure metal, for practical purposes cathodes must be coated with some substance which will freely emit secondary electrons, as is the case with a photo-electric cell, where cæsium is often used.

Secondary Electrons

Before proceeding further with a description of the cold-cathode tube it will be necessary to clear up the meaning of the term "secondary electrons," otherwise the subsequent explanation will not readily be understood.

The ordinary electron with which the reader will be familiar is a primary electron such as that thrown off a filament when heated. A secondary electron is an electron knocked out of the surface by bombardment of a primary electron. To take a case in point, secondary emission may occur in a screen-grid valve due to collision between primary electrons and screening grid. It is interesting to note that if the speed of the primary electron is sufficient when it collides with a suitable surface it may knock out a number of secondary electrons, the interesting point being that these secondary electrons are themselves exactly the same as primary electrons, the only difference being in the manner of their creation. Thus, if only a single electron is hurled at a metal plate it may knock off, say, ten other electrons.

Fig. 1 gives a diagrammatic illustration of a cold-cathode tube. This diagram is not in itself quite complete, but will better serve the purpose of explanation than the more complete diagram at Fig. 2.

In Fig. 1 cathodes are referred to as "A" and "B," and the anode as "X"; the anode battery as "Y." Now if a light is allowed to fall on, say, the cathode "A" it will cause secondary emission to take place as in a photo-electric cell, and if only a single secondary electron is liberated from "A" it will be attracted by the ring anode "X" and will travel until it impinges upon the cathode "B," which might give up, say, five secondary electrons which, in turn attracted by the anode, will fly back and impinge on the cathode "A." These electrons in turn knock out five each and the twenty-five electrons thus produced will fly back against "B" and in an incredibly small space of time a current of several milliamps. may be made up. As a matter of fact, a resistance has to be imposed in one or other of the cathode leads, otherwise the current will build itself up until it burns the tube out.

Focusing the Electron Stream

So far the explanation of the function of the cold-cathode tube has been purely of an explanatory nature, and in practice

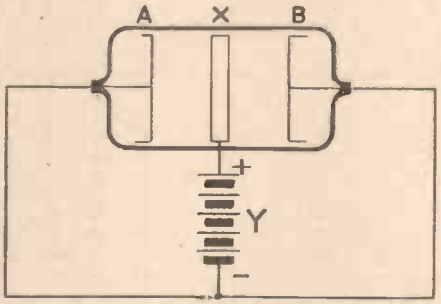


Fig. 1.—A simple diagram of a cold-cathode tube.

it could not function in the simple way outlined above, the reason being that the initial electrons set off as a result of the light falling on the first cathode would be unduly attracted by the anode and flow to it in a normal manner. Consequently, the stream of electrons has to be focused or diverted through the anode by means of a focus coil surrounding the anode (see Fig. 2). By means of a small current supplied by a battery, a field is set up round the focus coil which directs the path of the electron from cathode to cathode. The field coil has no further influence upon the functioning of the tube.

Once more reverting to the initial secondary emission, it is now clear how the electron is attracted to the second cathode, but it will be understood that inasmuch as the electron will speed up as it approaches the anode, it will slow down after it has passed it, and to overcome this slowing down a split tuned circuit is interposed between the two cathodes, tuned to the order of 50 megacycles, which imparts sufficient energy to the electron on its way from one cathode to the other to ensure that its collision occurs at an appropriate speed to bring about efficient secondary emission. It should be understood that the frequency of the tuned circuit is chosen with respect to the dimensions of the tube, the idea being to get a change of phase as the electron is in flight.

Certain modifications of this tube have been produced where the oscillation is maintained by the tube itself once it has been excited, while it is understood that a third type of tube is able to produce oscillations entirely on its own without even the initial excitation.

The Use for Television

It is claimed that it is possible for this tube to rectify, by virtue of a non-linear relationship between the voltage obtaining across it, for various values of current passing through it, and it is interesting to note that an anode current up to 45 m.a. may be obtained with an anode potential of some 200 volts. As already intimated, there is no limit to the anode current, except that imposed by consideration of the tube burning out. Its application is, of course, in the field of television, where it becomes automatically the basis of a television camera, the projected image being thrown on to the cathode with some scanning means, so that the image falls on to the cathode point by point, causing secondary emission to build up currents appropriate to the light intensity, and without the usual limitations of minute current imposed by the normal photo-electric cell. It would seem that the time lag between the initial secondary emission and some predetermined maximum current would be such that a current of several milliamps. could be produced while scanning at 200 lines; thus much of the complicated initial amplification is avoided.

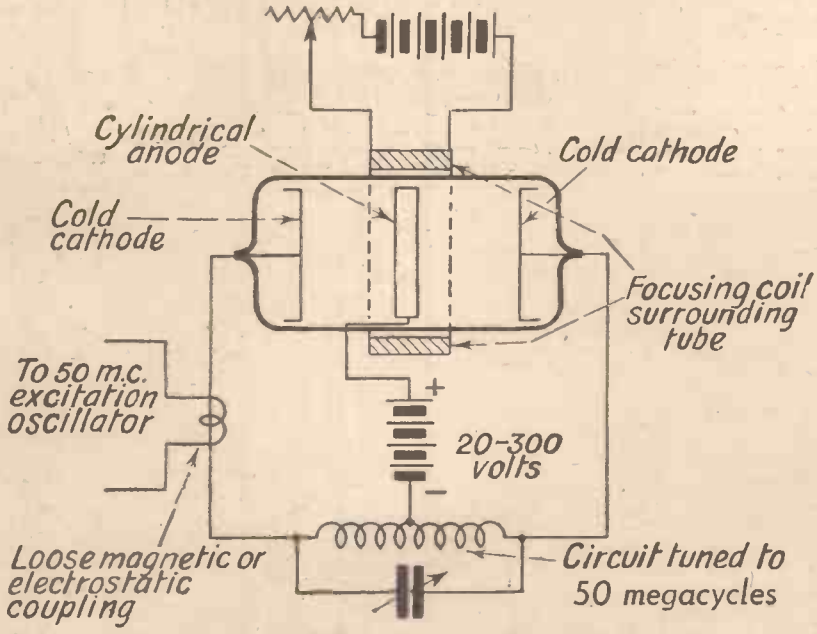


Fig. 2.—The complete circuit for a cold-cathode "valve."

VALVE COUPLINGS—3

In this Third Article of a Popular Series, Push-pull, Q.P.-P. and Class B Methods of Coupling are Explained

THE previous article in this series was concerned with the more usual methods of coupling together the detector and first L.F. valves, or even two L.F. stages. To continue with this theme, it is appropriate this week that we should consider the less-usual methods of coupling that have come into prominence during the past year or two. These methods are known as push-pull, class B, and quiescent push-pull, and doubtless the methods of applying these systems are known to most readers, although the underlying principles are not so well understood.

It should be made perfectly clear at the outset that all three systems of coupling that have been mentioned are fundamentally the same, although they differ in detail. All three could be referred to as push-pull with fair accuracy, and the different names replaced by letters, such as A, B, and C. The reasons for this will more clearly be understood as we proceed to consider the different arrangements, starting with push-pull, which is the basis of the systems.

Push-pull Efficiency

Push-pull amplification provides a ready means of obtaining an increased low-frequency output from a single stage of amplification, and its efficiency is actually so great that the output from a pair of valves connected in this manner is equal to nearly two and a half times the output of one of the valves wired in a normal transformer-coupled circuit. Push-pull is therefore better in many respects than a circuit consisting of two valves in "cascade" (one following the other and coupled together by one of the methods described last week). Not only does the push-pull stage give more output, but it gives better quality than can generally be obtained by other means. The reason for this can best be understood by considering the connections shown in Fig. 1, where it will be seen that a "double" L.F. transformer, having a single primary winding and a secondary with two halves and a centre tapping, is used to feed the grids of the two output valves. The centre tapping is connected to negative G.B. or earth—both of which are the same theoretically—so that a voltage is developed across both halves of the secondary and therefore applied to the two grids.

Full-wave Working

The most important point to bear in mind is that when one grid is made negative with respect to earth, the other is made positive. In other words, the two valves operate by virtue of the two halves of the audio-frequency "wave." In many respects the behaviour can be compared with that of a full-wave rectifier, which is known to be more efficient than a half-wave one. As the rated ratio of the push-pull transformer is the ratio of the primary turns to each half of the turns on the secondary winding, the input to the two valves is equivalent to twice the input to a single valve fed by an ordinary transformer. As previously stated, however, the output is more than doubled due to the greater efficiency that is secured.

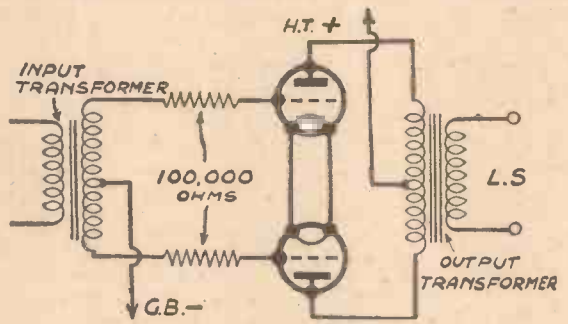


Fig. 1.—A standard push-pull circuit.

A still more important advantage of push-pull, however, is that any tendency toward distortion is minimised, due to the "cancelling" effect of the two valves. The same thing applies to hum in the case of a mains-operated amplifier, since the hum tends to be cancelled out by the two valves working in opposition. One advantage of this is that a supply of A.C. can be employed to feed the filaments of directly-heated valves, the reason being that an increase in grid voltage produced due to the filament being positive in respect to the earth line in one valve is accompanied by a corresponding reduction in additional bias in the case of the other.

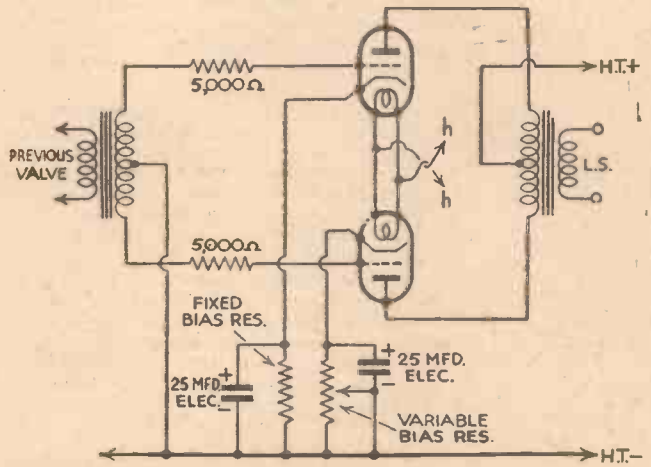


Fig. 2.—When using two indirectly-heated valves in push-pull it is a simple matter to obtain accurate matching by using a variable bias resistance for one valve, as shown here.

Matched Valves

In making a push-pull amplifier there is an important point that must be considered, which is that the two valves must be as nearly identical as possible. If this were not so, it is clear that proper balance could not be maintained. In practice it is not always easy to obtain a pair of perfectly-matched valves, and therefore it is necessary to take some precaution that will prevent slight differences from exerting any appreciable effect. One precaution is to insert a "stopper" resistance in the grid lead to each valve as shown in Fig. 1, and another is to bias the valves separately. The latter can be done in one of two ways, depending upon whether the valves are of the directly- or indirectly-heated type. Where they are directly heated a push-pull transformer may be employed that has a double centre tap, or in other words, that has two separate secondary windings; a separate G.B. connection can then be made to each, and the two G.B. voltages adjusted individually. When the valves have indirectly-heated cathodes the matter is simplified, because the G.B. voltage for each would normally be obtained by means of a dropping resistance inserted in each cathode lead, as shown in Fig. 2. In this case it is a good plan to use a fixed resistance of correct value in circuit with one valve, making the other one variable, and of maximum value equal to about one and a half times the calculated value. Thus, if the two valves shown normally require a bias resistance of 500 ohms, a fixed resistance of this value could be used with one valve and a variable resistance of 750 ohms maximum with the other. When this was done the variable resistance could be set until the greatest output was obtained. In some instances it is desirable to employ both the "stopper" resistances and the separate G.B. supplies.

A considerable output can be obtained from a single push-pull stage in which a pair of pentodes are employed, and in this case balance can be maintained between the valves by feeding the auxiliary grids from separate H.T. sources.

(Continued overleaf)

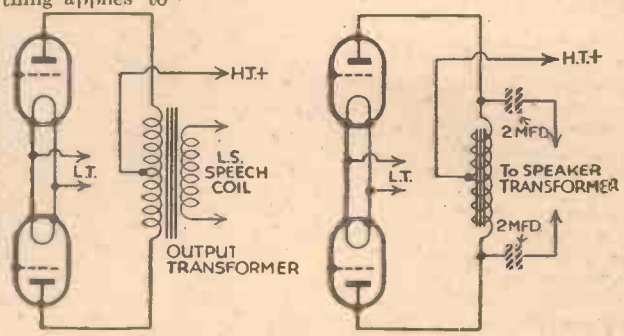


Fig. 3.—Two different methods of feeding the speaker from a push-pull amplifier. The transformer method on the left is best when the speaker is not fitted with its own transformer; that on the right is suitable for use with a speaker provided with an ordinary (not centre tapped) transformer. The two condensers shown in broken lines are optional, but to be preferred in the case of a mains receiver.

(*Continued from previous page*)

The Output Feed

Just as the input to a push-pull stage is "split" to feed both grids, so must the output from both be "collected" so that it can be fed to a single loud-speaker. For this reason the anodes of the two valves must be connected to the ends of centre-tapped choke or transformer primary, as shown in Fig. 1. The H.T. lead for both valves is taken to the centre tapping, and speaker leads taken either from the two ends of the choke or from the secondary of the output transformer; the two methods are shown in Fig. 3.

In calculating the correct ratio for the output transformer the usual formula

$$\text{(Ratio} = \sqrt{\frac{\text{Optimum load of output valve)}}{\text{Speaker Impedance}}}$$

is employed, but the optimum load in this case is equal to the sum of the optimum loads of the two valves employed. This is because the valves are actually wired in series, and the primary winding of the output transformer is equivalent to two primaries, of which one is used for each valve. When automatic grid bias is used to feed two directly-heated valves the reverse condition applies, since, so far as anode current is concerned, the valves are in parallel; that is, twice the anode current of one valve passes through the resistance. Thus, when using the formula: Value of resistance (in ohms) equals the grid-bias voltage required, divided by the anode current (in amps.), the anode current must be taken as twice that of one valve.

"Push-push" Amplification

Quiescent push-pull (Q.P.P.) is a direct development of the normal method of push-pull amplification, but possesses the great advantage of being particularly economical of high-tension current. This is because the two valves in the push-pull circuit are so biased that they do not pass any appreciable amount of anode current when there is no signal voltage applied to their grids. When a signal voltage is applied, it is only the positive half-cycle of this that actuates each valve. Thus, instead of both valves working together, and in oppositive phase, as in normal push-pull, they work "in turns." During the positive half cycle one valve functions due to the positive signal voltage reducing the standing G.B. voltage, and during the negative half-cycle the other valve comes into operation. The latter explanation might seem to be a contradiction, but it should be mentioned that when one grid is made positive the other is made more negative, and *vice versa*. It is for the reason just explained that Q.P.P. has often been referred to as "push-push," because both valves operate one after the other on each half-cycle.

A Q.P.P. circuit is almost identical with that used for normal push-pull, as can be seen by looking at Fig. 4, but it is customary to use high-efficiency pentodes in this case, although triodes may be employed; they are not so efficient, however, and they are not so responsive when heavily biased. It is not generally necessary to employ two "stopper" resistances with Q.P.P., but it is usually better to have a single resistance of about 150,000 ohms in the G.B. lead, as shown. Accurate matching and balancing of the two valves can be obtained by varying the auxiliary-grid voltage.

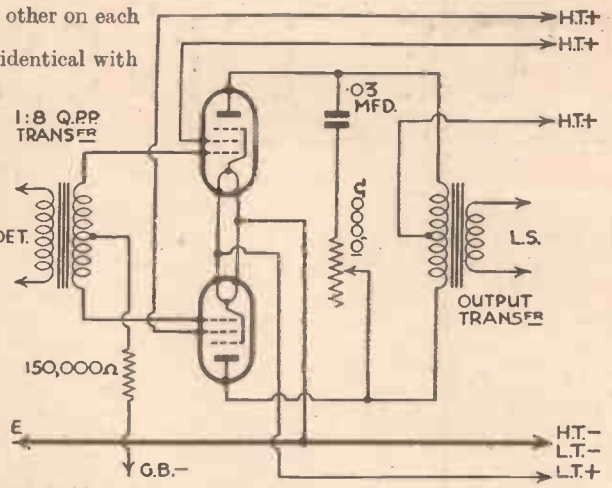


Fig. 4.—A Q.P.P. circuit showing the tone-control components referred to in the text.

Q.P.-P. Transformer Ratio

The degree of amplification given by Q.P.P. is very great, the result being that an output of well over 1 watt can be obtained from a pair of pentodes connected in this circuit, and when they follow immediately after a normal grid-leak detector. In order to load the valves fully it is usual to employ a push-pull input transformer with a ratio of about 1 : 9, instead of the 1 : 3 or 1 : 5 ratio normally specified for push-pull. The output transformer or choke is an extremely important component with Q.P.P., because the current flowing through the primary winding is constantly varying according to the strength of the signals being received, and according to the type of music being listened to. It will be seen that if the resistance of the winding were high the voltage-drop would constantly vary and so cause the anode voltage to vary. Generally speaking, the resistance should not exceed 400 ohms, and it is even an advantage to have a lower resistance than this where possible.

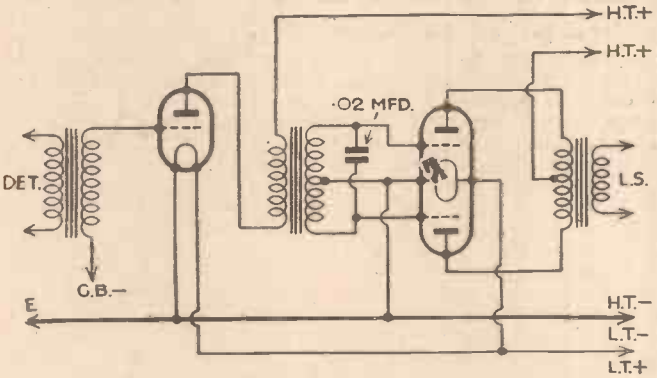


Fig 5.—This circuit is for a complete driver—class B stage. Note the inclusion of a .02 mfd. condenser across the secondary windings of the driver transformer for preventing undue high note response.

One slight disadvantage of Q.P.P. (and also with class B for that matter) is that it has a tendency to give over-amplification to the higher notes, and so to make reproduction rather screechy.

This can be overcome by connecting a fixed condenser of about .02mfd. in parallel with the primary of the output transformer, but it is generally better to use a .03 mfd. condenser in series with a 10,000-ohm variable resistance as shown in Fig. 4. By adjusting the resistance a smooth variation in pitch can be obtained.

Class B

Class B is similar to Q.P.P. in principle, but has many points of difference, the most obvious of which is that the two valves (there is actually only one valve, of course, but this contains two filaments, two grids and two anodes) are triodes. Another obvious difference (see Fig. 5) is that the grids are not biased at all. This is because the double valve is designed so that the anode current at zero grid volts is almost nil. When signal voltages are applied to the grids the positive half-cycles again cause the anode current to vary, the maximum anode current depending entirely upon the signal voltage applied. Thus, the current consumption is always proportional to the volume of sound emitted by the loud-speaker.

It has been explained that the grids of the valve are actually made positive, and it is known that when the grid of a valve is positively biased there must be a flow of current in the grid circuit. This is always avoided in other methods of amplification, but it is an essential of class B. And since the valve is dependent for its correct working upon the flow of grid current it may be considered as a current-operated device, whereas all other valves are purely voltage operated. Where current is involved there must be a supply of *power*, and this is why a class B valve must always be preceded by a driver. The high-voltage and low-current output of the driver valve is transformed to a low voltage at a comparatively heavy current by means of the driver transformer, which usually has a *step-down* ratio of about 2 : 1. The secondary of this transformer must have a very low resistance or else it would "absorb" the voltages that should be applied to the grids; the resistance is generally kept down to about 250 ohms.

In most details other than those mentioned the class B valve may be considered as similar to the Q.P.P. arrangement, since the necessary output transformer is similar and the valve tends to give undue prominence to the higher frequencies. The latter tendency may be corrected in the same manner as that employed in the case of class B, but an additional or alternative corrective measure is to connect a .02 mfd. fixed condenser between the two grids of the valve as shown in Fig. 5.

SIDE-LINES IN RADIO

How Wireless is Used as a Safety Device. Owing to the Patent Position, only a Bare Outline of the Various Applications is given. Actual Practical Apparatus will, of course, Differ in Certain Respects

By W. J. DELANEY

THE average listener has become so used to the reception of the broadcast programmes that he has rather overlooked the very remarkable uses to which it is possible to put the radiated oscillations commonly referred to as "wireless." The peculiarities of these radiated oscillations have been made use of in many directions for purposes quite unrelated to the carrying of music or speech, and although some of these cannot interest the ordinary listener (I have in mind the medical uses of H.F. currents and also the various forms of H.F. furnaces, etc.), there are certainly some transmissions which are very interesting, indeed, both on account of their value in the saving or safeguarding of life, and in the interesting manner in which the transmissions are used or controlled.

Wireless and Ships

Every user of a portable receiver knows how a signal is only received at its maximum volume when the frame aerial is turned so that it is in the plane of the particular transmission being received. When a frame aerial is turned at right angles to the direction from which a transmission is coming, the signal is either inaudible or extremely weak. This fact has enabled many a ship to travel across the sea in perfect safety, although a special form of frame aerial is used (Fig. 1). In this, a small coil is mounted at one end of the frame, and, to complete the arrangement, an exactly similar frame and coil is mounted rigidly at right angles. Mounted inside the smaller coils is a single, small, rotatable coil, and it will be obvious that as this coil is turned about, whilst permitting the remaining structure to be kept rigid, it will be possible to obtain a signal only when a certain relationship exists between the direction of the signal and the position of the moving coil.

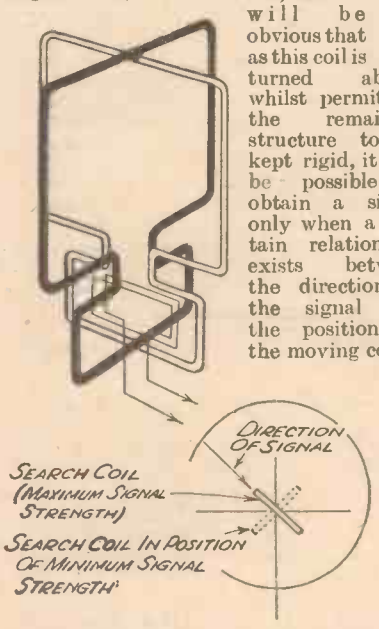


Fig. 1.—Explanatory diagram of a direction-finder (generally referred to as a radio-goniometer), together with a sketch showing how the rotatable coil gives the direction of a transmitter.

Situated round the coast, certain stations radiate a given signal at regular intervals, and it is a simple matter for the navigator on board ship to ascertain the direction of the transmitter, and the signal which he hears tells him the name of the station. Consequently, he can travel through fog when an ordinary lighthouse would be rendered invisible.

Fig. 2.—The Marchese Marconi and a micro-wave transmitter showing a reflector for an aerial.

Radio Beacons

Short-wave "fans" know how the ultra-short waves have very peculiar characteristics, such as have resulted in their receiving the name "quasi-optical" waves. That is to say, they behave almost like light rays, and in that manner may be dealt with, in some respects, as though they were light rays. For instance, if a bulb is removed from a motor-car headlamp, and is illuminated, the light spreads around and illuminates a certain area. If, however, it is placed at the focal point of a parabolic reflector, all the rays of light are concentrated and directed forward in a beam, which has much greater power than the lamp itself seems to possess. It also reaches to a very much greater distance. Now the ultra-short wavelengths act almost in the same manner. If permitted to radiate from a normal aerial, they will be found to spread only over a very small area. (It will be remembered that it is stated that the proposed television broadcasts from the Crystal Palace cover a radius of approximately twenty-five miles.)

If now we arrange a reflector behind the small aerial, we can direct the radiation in a long narrow beam, and this will cover a tremendous distance, provided the design of the reflector and aerial is correct. A metal plate will act as a reflector, or a number of wires or metal rods may be fitted to a wooden framework (as shown in Fig. 2) and used for the purpose. Great distances may be covered in this way, using only a very small power, and a modification of the wireless lighthouse is thus rendered possible.

The reflector is built on a revolving base, and this turns slowly in the same manner as the ordinary lighthouse lamp. When it is facing definite compass points, a particular form of signal is radiated, and whilst it is passing through the remainder of its travel, a different signal is transmitted. Thus, a ship not fitted with a direction-finder as previously mentioned, will hear a signal at regular intervals (in the same manner as the light becomes visible as the lighthouse mechanism revolves), and when he is in certain positions the character of the particular signal will change, thus enabling him to know his position with certainty. Various beacons could use different signals so as to render them easily identifiable.

Depth-sounders

It is also necessary for a ship to know the depth of the ocean bed, and in the olden days this was ascertained by a process known as "Heaving the Lead." A weighted line was marked in fathoms, and was dropped overboard. When the weight touched bottom the depth was read off from the markings on the line. It is obvious that such a system could not give a continuous reading as it would be impossible continually to draw the line in and pay it out to cope with irregularities of the ocean bed.

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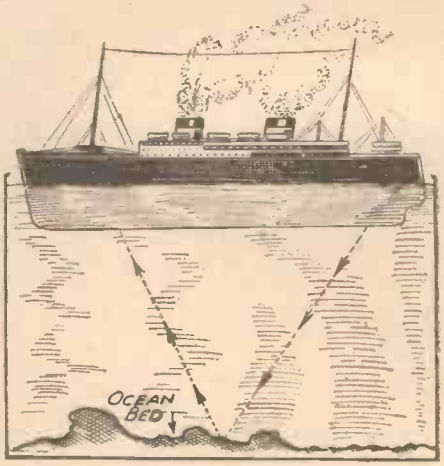


Fig. 3.—The depth of the ocean may be ascertained by means of the reflection of the radio signal. This illustration gives an idea of the method employed.

PLANNING THE OUTPUT STAGE—2

In this Article Details of the Various Types of Output Valve Available are Dealt With, and also the Circuit Conditions which must be Provided in Order to Produce an Efficient Complete Output Stage.

WE can now turn our attention to the so-called Class "A" valves, in which category are two main types—triodes and pentodes. It will be remembered that a Class "A" valve is defined as one taking a steady mean drain from the high-tension battery all the time that the set is switched on, the *instantaneous* values of this current, however, being varied above and below according to the audio-frequency signal voltage applied to the grid.

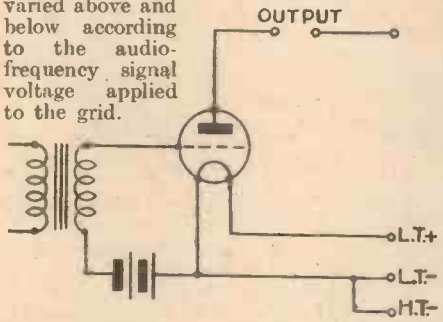


Fig. 1.—A battery-operated Class "A" output stage (triode).

Triode and Pentode Compared

In the case of a triode valve the amplification is not great; that is, the valves are, in general, of comparatively low sensitivity, so that a fairly large grid input is necessary in order to obtain the full rated output.

For this reason, a considerable degree of voltage amplification is necessary before the output stage. In a way, the comparative insensitivity of a triode is an advantage, because a valve of this class is less liable to be overloaded by strong signals than a more sensitive value. It is mainly on this account that triodes are usually preferred for use in receivers and amplifiers designed for high-quality amplification.

Pentode output valves, on the other hand, are very much more sensitive and require a much smaller grid-excitation voltage for a given output. Thus, the usual small battery pentode can be fully loaded with a signal only one-third as powerful as that required to load a battery triode of comparable output.

A pentode, therefore, can be used in receivers having less voltage amplification than that necessary for a triode output valve, and this, in many instances, means that a complete low-frequency stage may be saved: for a pentode may usually be placed immediately following the detector valve. Alternatively, the higher sensitivity of the pentode can be utilised to obtain stronger reception of the less-powerful stations, but in any case it is advisable to fit some form of volume control and to use it intelligently when powerful signals are being received. Only thus will overloading and the consequent distortion and "blasting" be avoided.

Harmonic Distortion

In this connection, it should be mentioned that the effect of overloading a pentode is far more distressing to the ear than an equivalent amount of overloading with a triode. This is due to the fact that in the case of a triode the bulk of the distortion consists in the introduction of false second harmonics (that is to say, notes one octave higher than the actual notes transmitted) and, to a smaller extent, of fourth and other *even* harmonics. With a pentode, on the other hand, overloading results in the production of a much greater proportion of third and other *odd* harmonics which are far more unpleasant.

Another point concerning the pentode is that its frequency response—that is to say, the degree to which it reproduces notes of different pitch—is quite different from that of the triode, the higher notes being considerably more prominent. The reproduction therefore appears to be unduly shrill to many people, and it is often an advantage to install some form of tone-corrector to reduce top-note response, and thus to give a more pleasant balance of tone.

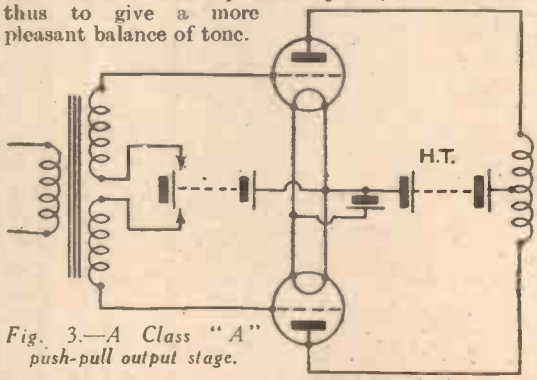


Fig. 3.—A Class "A" push-pull output stage.

It is now necessary to see roughly what valves in these two classes are available. For battery-operated sets there are two types of triode at least in every manufacturer's range. One of these, the "power" valve usually has a maximum output of about 150 milliwatts, allowing for approximately 5 per-cent. second harmonic distortion. The high-tension current drain is in the neighbourhood of 6 milliamps., and the valve is therefore suitable for use in sets operated from dry high-tension batteries.

The second valve of the triode class is described as a super-power valve, and most commercial types have a maximum output of about 350 milliwatts. On the other hand, they require a grid voltage input approximately twice that required by a power valve, which means that they will not give greater power unless the correspondingly-increased signal voltage is available.

Moreover, the high-tension current required by a valve of this type generally lies between 12 and 14 milliamps. which is beyond the economic discharge rate of all but the largest and most expensive size of high-tension batteries, so that their use is practically restricted to sets operated from an eliminator. The normal battery output pentode yields an output of 400 milliwatts or more when operated under optimum conditions, and takes about 9 milliamps. H.T. With a lower high-tension voltage the H.T. drain can be reduced below 6 milliamps., but the output is then only comparable with that of a small power triode.

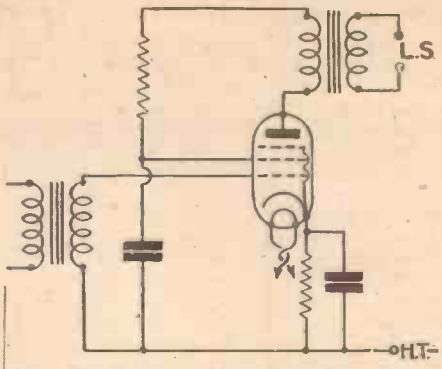


Fig. 2.—Using a mains-operated pentode valve for Class "A" output.

Mains Output Valves

Dealing now with mains output valves, the normal 200-volt output triode will give something like 3 watts output, and the normal corresponding mains pentode up to 3½ watts. There is, in addition, a range of still larger directly-heated triodes for A.C. mains operation, working with high-tension voltages of 400 and giving 5, 7 and even more watts of output, but requiring of course correspondingly larger grid inputs.

Figs. 1 and 2 show respectively the theoretical circuits for Class "A" output stages using battery and A.C. mains valves of both triode and pentode types. Similar circuits giving more practical details will be discussed in the concluding article, but the diagrams reproduced here are shown in order that they may be compared with Fig. 3, which shows an alternative arrangement for obtaining increased output by using two output valves connected in what is known as "push-pull."

It will be observed that the intervalve coupling transformer has two secondaries, one feeding each valve grid, and so connected that one valve amplifies a positive half cycle, while the other valve is amplifying a negative half cycle and vice versa. The anodes of the two valves are, however, connected to

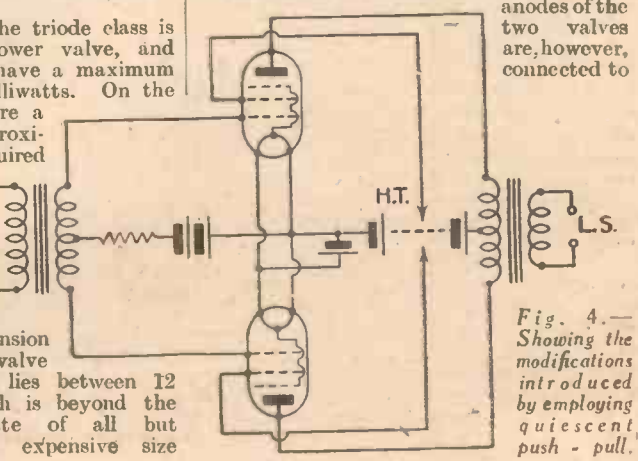


Fig. 4.—Showing the modifications introduced by employing quiescent push-pull.

a special output transformer with centre-tapped primary, which combines the outputs of the two valves in such a way that they do not cancel each other out as might be expected from a casual glance at the circuit. This diagram should be studied carefully because it contains the clue to the operation of the second main class of output valves; namely, those working on the quiescent principle.

Quiescent Principles

In the case of a Class "A" valve, negative bias is applied to the grid to an extent which reduces the mean anode current to the correct rated value, and at the same time permits anode current swings above and below this value. The same arrangement is adopted with ordinary push-pull. If, however, a pair of valves connected in push-pull is severely over-biased so that the mean anode current is extremely small, it will be clear that when each valve is dealing with a positive half cycle there will be a rise of anode current, but that when it is dealing with a negative half cycle the signal will be suppressed. This is actually what happens in quiescent push-pull, a practical circuit for which is shown in Fig. 4. Each valve only deals fully with alternate half cycles, the reverse half cycles being practically suppressed, the small and badly distorted residues of these half cycles cancelling each other out. By this means two comparatively small triode or pentode valves give an output very much larger than that obtainable from a single valve, and for a very much smaller high-tension consumption, because when no signal is being received the H.T. current is negligible, and when a signal is being received current is drawn proportionate to the volume obtained.

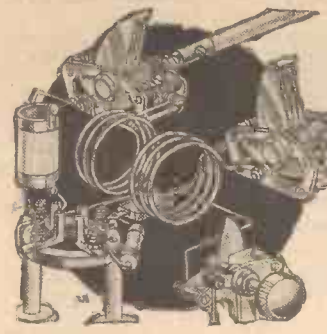
SIDE-LINES IN RADIO

(*Continued from page 907*)

Again using the directional beam, a small transmitting system is arranged at one end of a ship and this directs its ray downwards at a slight angle. The beam is reflected again by the ocean bed and returns to the ship (Fig. 3). Knowing the speed with which the wireless signal travels, it is a fairly simple matter to calculate how far it has travelled before it returns to the ship, and by arranging that the transmission of the signal sets into action a small revolving pointer, and that the echo or reflected beam from the ocean bed has a similar action on another pointer, the difference between the two pointers may be made to read in fathoms. The navigator may thus see at a glance at any moment just how deep the water is, and a much more accurate map of the ocean bed is therefore obtainable.

Aircraft

We have already mentioned in these pages how an aeroplane may be guided into an aerodrome and landed in the densest fog by means of special transmissions, and by employing a buried wire an aeroplane may be conducted across country which is completely obscured from view. A high-frequency radiation is conducted along the cable or wire, and the listener in the machine will hear the signal at its strongest when he is directly over it. A special directional receiving aerial is employed, and by the use of an indicator his deviation to one side or the other may be seen, and the machine thus kept directly over the cable and so guided from one place to another.



Short Wave Section

THE BEST SHORT-WAVE CIRCUIT

An Interesting Explanation of the Chief Advantages of the Various Popular Kinds of Circuit Used for Short-Wave Reception.

By FRANK PRESTON

IF you were to ask twelve short-wave experimenters what, in their opinion, was the best type of short-wave circuit you would be almost certain to receive at least six different replies. The fact is that there is no "best" circuit—all have points of merit, and all have drawbacks for certain purposes. For this reason the choice of circuit is very largely a matter for the individual to decide for himself, and the decision must depend upon the amount of use the short-waver will receive (and this must govern the expenditure), the experience of the operator, and whether the receiver is intended to be used as a source of musical entertainment or for more experimental purposes.

The Simplest of All

There are very many experienced amateurs—both those who transmit and those who receive only—who prefer the perfectly "straight" single-valver to anything else. These people will tell you that they can bring in every station that is worth listening to with a set of this nature, but they may omit to tell you that reception is limited to 'phones. They will also explain that the absence of amplifying stages makes for complete absence of background noises, so that signals that are really quite weak can be listened to in comfort. Those keen experimenters who employ a simple set of this nature generally go to considerable trouble to "hot it up" to the greatest possible degree by careful experiment with different types of coil, various detector valves, and with special reaction arrangements, and claim that this "hotting-up" gives far better useful amplification than all the H.F. and L.F. valves in the world. At the conclusion of the experiments a circuit of this type will certainly give a remarkable performance, and the user has the satisfaction of knowing that he is getting an extremely high degree of efficiency for a very modest outlay.

A circuit of the type just referred to, and which was described in detail in the issue of PRACTICAL WIRELESS dated April 14th, 1934, is shown in Fig. 1, where the simplicity is obvious. That this circuit is capable of providing extremely good reception in the hands of the average constructor is borne out by the many letters which we have received from readers in various parts of the world who have adopted it. A great advantage of a simple set of this nature is that it can be used in its simplest form for 'phone reception (which the short-wave enthusiast still seems to prefer), whilst it can be employed in conjunction with the L.F. stages of the normal broadcast set when "the family" wishes to listen to a short-wave programme.

The Advantages of the H.F. Stage

There are many short-wave "fans" who have now given up the single-valver in favour of a receiver having an H.F. stage. They know perfectly well that there is no appreciable amount of amplification provided by the additional valve, but they have also found that the high-frequency stage has a "stabilising" effect by eliminating "dead-spots" that are often found at certain points of the tuning scale, especially when the aerial is of the normal broadcast pattern, instead of being of one of the many special types that have been described in these pages for short-wave work. The H.F. stage acts as a "buffer" and so simplifies reaction control—making it more uniform and smooth over the complete wavelength range—and at the same time minimises troublesome hand-capacity effects. It is not generally recommended that the aerial circuit of the H.F. valve should be tuned, because on short waves tuning is so critical that it becomes almost impossible to operate two tuning condensers simultaneously. Instead, the aerial circuit is usually of the aperiodic type, and consists of a fixed non-inductive resistance of between 100,000 and 250,000 ohms, or a good short-wave H.F. choke, the circuit being as shown in Fig. 2. Coupling between the H.F. and detector valves is by means of a tuned transformer, of which the normal aerial-coupling coil provides the primary, and the grid coil the secondary. From this it will be seen that very few components are required for the H.F. "amplifier," and that the cost, apart from that of the valve, is practically nil.

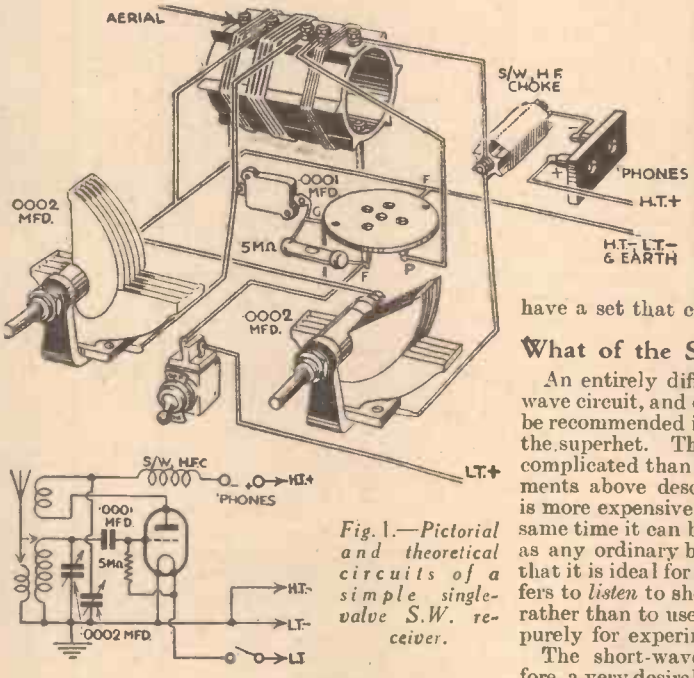


Fig. 1.—Pictorial and theoretical circuits of a simple single-valve S.W. receiver.

From what has been written above it will be clear that the H.F. valve has important points in its favour when a special short-wave aerial cannot be erected, or when the user has little experience of short-wave work and, therefore, desires to have a set that can easily be tuned.

What of the Superhet?

An entirely different type of short-wave circuit, and one that can strongly be recommended in many instances, is the superhet. This is obviously more complicated than either of the arrangements above described, and naturally is more expensive to construct. At the same time it can be operated as easily as any ordinary broadcast receiver, so that it is ideal for the person who prefers to *listen* to short-wave broadcasts, rather than to use these transmissions purely for experimental purposes.

The short-wave superhet is, therefore, a very desirable circuit for Empire listeners to the special B.B.C. Empire programmes, and a suitable circuit is given in Fig. 3. This circuit employs an S.G. valve as combined first detector and oscillator, acting on the autodyne principle, whilst a single intermediate frequency amplifying stage is used, this being followed by a normal leaky-grid detector and a pentode output stage. The tuning coil employed may be a normal short-wave

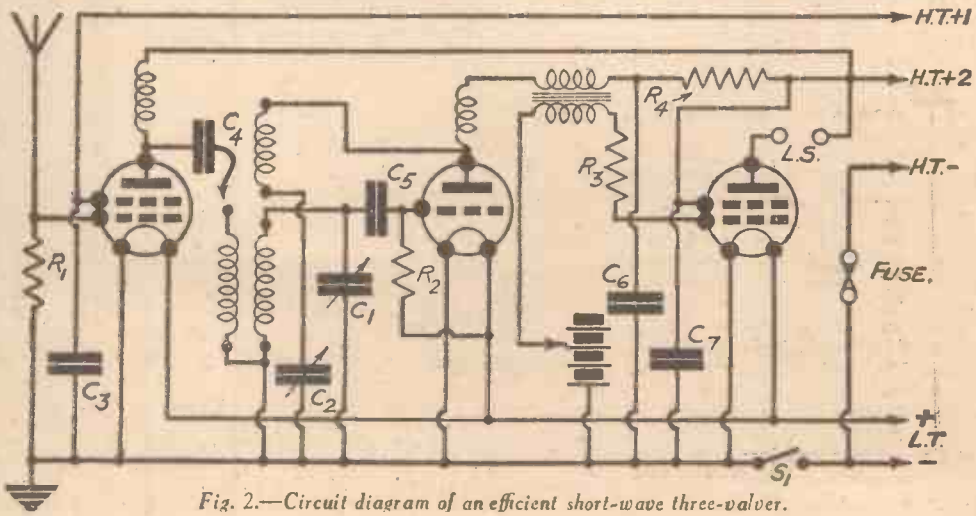


Fig. 2.—Circuit diagram of an efficient short-wave three-valver.

component, whilst the I.F. transformers operate at 150 kilocycles, this frequency generally proving best for short-wave work.

Values of all the principal components are indicated, and it will be obvious that the tuning condenser should be provided with a good slow-motion drive. The reaction condenser may be of a standard type, although it is sometimes preferable to provide a vernier control for this also. In any case, fine control of reaction can be provided by means of the variable potentiometer used for controlling the voltage on the screening grid of the first valve. Anode-bend first detection is illustrated, but this can be changed to leaky-grid without altering the constants of the circuit to any appreciable extent.

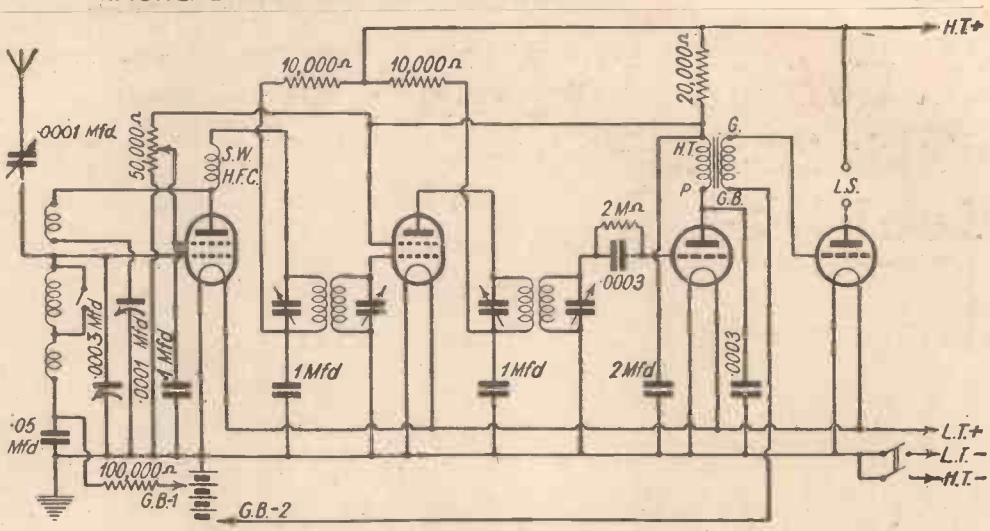


Fig. 3.—Circuit diagram of a short-wave superhet.

Adapters and Converters

In this short article reference has been made only to a few main types of short-wave circuit, and there are dozens of slight modifications, all of which have their own advantages and disadvantages. It might also be mentioned that a single-valver of the kind shown in Fig. 1 may be used as an adapter or converter in conjunction with an existing broadcast receiver. When used as an adapter the valve simply replaces the detector valve in the complete set, but when used as a converter (and this is only possible when the receiver has at least one H.F. stage) the single valve precedes the receiver, making the complete circuit rather like that shown in Fig. 3, with the exception that the normal tuned-grid, tuned-anode, or tuned-transformer coupling used between the H.F. and detector stages take the place of the intermediate-frequency transformers. The inter-stage tuning circuits must be tuned to approximately 150 kilocycles (2,000 metres) in the normal manner, but once this has been done all short-wave tuning can be carried out on the converter alone.

Modernising Short-Wave Receivers

Such Subjects as Adding a Converter Unit, H.F. Amplification, and Curing Hum, are Dealt with in this Article

ALTHOUGH for many years past transmission and reception have been effected on wavelengths below 100 metres, spanning the entire globe and achieving results in broadcast and communication service with transmitters using only fractional power of that which is used on the normal wavebands, the short-wave set has made little strides.

Reception apparatus, when the short waves first became popular, had a fearsome and laboratory appearance—large diameter coils of heavy gauge wire, extension handles at least a foot long, components mounted high above the baseboard to prevent any possible capacity leak to earth—practically all parts being made by the amateur himself specially for the purpose.

The passing of time, however, bringing with it progress in radio generally, and scientific design of components coupled with manufacturing efficiency, the broadcast receiver for 200 to 2,000 metres went through countless changes until the up-to-the-minute set can be said to have reached finality (almost) in design and results.

The short-wave set, though being somewhat improved in appearance since the early days, remains the same in essential design, nine out of ten used by the enthusiasts consisting of an oscillating detector and one or two L.F. stages, with 2-volt battery valves and headphone reception.

There are certain obvious reasons for this; first, there is the caprice of reception conditions, changing, as they do, from day to day, or, for that matter, from hour to hour. The amateur never knows how much the Appleton and Heaviside layers will allow him to receive. Also, the general idea seems to be that it is not possible to make use of modern mains valves and their applied developments, such as automatic gain control; again, it is thought that high-frequency amplification is useless below that of 100 metres.

While there is a good deal of truth in all this, and difficulties do crop up which are absent on the broadcast bands, let it be said now that all modern receiving devices can be used on the short waves with advantage, giving, shall we say, a greater factor of signal strength combined with ease of listening on the moving-coil speaker.

For those who have a good broadcast receiver with not less than one H.F. stage, of the "straight" type, either commercial or home built, they have the nucleus for a first-class short-wave receiver.

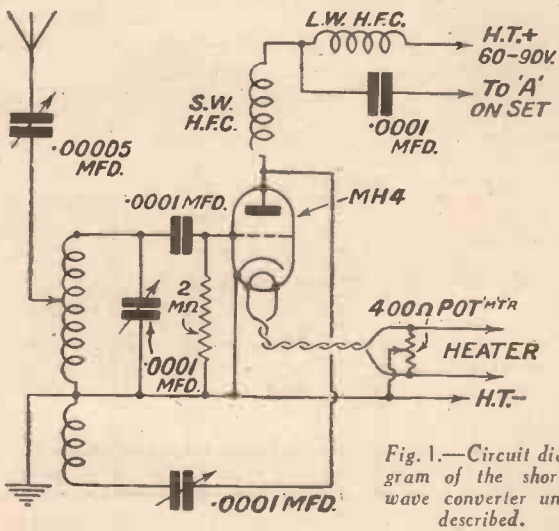


Fig. 1.—Circuit diagram of the short-wave converter unit described.

Adding a Converter

Assuming the set to be an all A.C. one, all that is necessary is to add an external converter unit, deriving its filament and H.T. currents from the receiver proper, as shown in Fig. 1. Any H.F. type valve may be used, though the Osram Catkin M.H.4 has been found excellent for this purpose.

The converter unit is an oscillator detector combined, the H.F. stage of the receiver acting as the intermediate frequency amplifier, as previously explained in the article "Reception on 5 to 10 Metres," published in the February 16th issue. In changing over a battery short-wave set for all-mains valves, the experimenter generally experiences bad hum of many different forms; some of these will be discussed and devices for their removal will be explained.

In Fig. 2 it will be seen that the centre tap on the transformer supplying heater current to the valves is not used; instead, a 400-ohm potentiometer is connected across the secondary, the moving arm forming the artificial centre. This will be found very useful in helping to cure mains hum due to incorrect electrical tapping of the secondary. Leads from the filament transformer to the valves should preferably be screened, with the screening material at earth potential, and at all events any

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mains wires should be kept well away from grid circuits. Hum due to inadequate attention to the points just mentioned will be in the nature of a deep 50-cycle ripple.

The power unit supplying high-tension current to the receiver also should be above reproach, particularly in regard to smoothing. Two filter sections should be used by-passed at least by 4-microfarads condensers, though rectified 100-cycle hum may not make itself so objectionable as that of the mains ripple type, which spoils any signals completely.

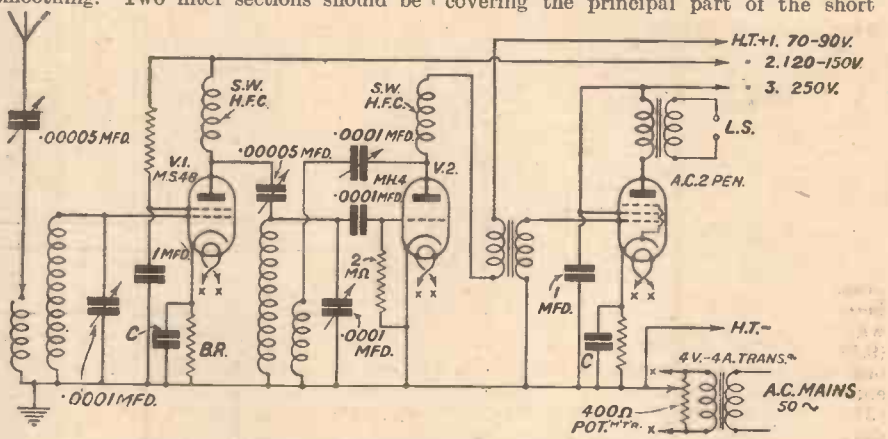

Fig. 2.—Theoretical diagram of a three-valve A.C. short-waver.

Causes of Hum

The above mentioned types of hum and their cure is perfectly straightforward, but it is frequently found that a more subtle kind of hum is noticeable. If, when tuning the receiver, it is noticed that hum only occurs at a certain portion of the dial for a matter of perhaps twenty or thirty degrees, or even more defined than that, the source of the trouble will most likely be due to some induction effect or other external to the set. Proximity of the receiver to mains wiring of any kind, the leads to the electric light or to wall plugs, or to any other type of electrical apparatus, will give rise to the "bump" hum effect. The obvious cure, of course, is to see that the short-wave receiver is well away from the sources of trouble just mentioned. Actual load on the mains, such as switching on other electric lights in the house, may be the cause of this peculiar hum; a good earth, of course, is essential, though in the majority of cases a tuned circuit in the earth lead will effect a complete cure. Fig. 3 gives the values of the circuit and the number of turns on the coil covering the principal part of the short wavelengths; the circuit has to be tuned to the particular frequency at which the hum is making itself felt.

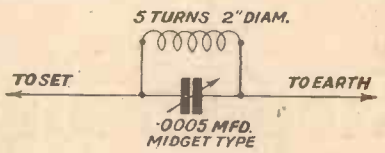

Fig. 3.—A filter for preventing induced hum.

Complete Screening

A good short-wave set should be completely screened, and the best way to do this is to build the whole of the set into an aluminium can, the bottom of which can be a wood baseboard covered with aluminium foil. The set can be assembled in the usual way, the screening can be fitted over the baseboard later, making sure that the foil makes good contact with the metal sides. The tuning controls can be fitted last of all.

LEAVES FROM A SHORT-WAVE LOG

THE recent gales had little adverse effect on the reception of distant signals, and some nights when the weather was extraordinarily rough, broadcasts were logged peculiarly free of disturbing atmospherics. It is wise, however, to make sure that a high wind does not cause the aerial lead-in to sway to and from the house as the movement produces an alteration in capacity, and consequently affects the tuning of the receiver.

South American stations have been very active during the past ten days, and although transmissions from across the Atlantic have not been so strong as hitherto, signals from Colombia, Venezuela, and Brazil have been exceptionally good.

PRA8, Pernambuco (Brazil) on 49.67 metres (6,040 kc/s) may be tuned in on most nights from about G.M.T. 21.30; you will recognise the studio by the fact that it uses a siren as interval signal, and if you pick up the call you may notice a reference to the Voice of the North (Brazil), *A Voz do Norte*. By the way, the language used is Portuguese and not Spanish. If you hear a time signal at the hour, it will be *three hours behind* G.M.T.

A Question of Language

The question of language is an important one, as on a slightly lower dial reading you may find Barranquilla (HJ1ABB) on 49.65 metres (6,042 kc/s) of which the call in Spanish includes the words: *Emisora Atlantico* (Atlantic broadcast). The station usually works between G.M.T. 23.30-03.00 (ex. Sundays) and as an interval signal uses a chime of four notes. (It has been logged on 49.57 metres, namely, just below GSA, Daventry.) A further "pointer": a clock strikes every hour.

Another Brazilian recently logged is PSK, Marapicu, on 36.65 metres (1,185 kc/s) which not only relays programmes from PRF5, Rio de Janeiro (31.58 metres), but also transmissions from Buenos Aires (Argentine Republic), on special occasions. As it is a 12-kilowatter it is, as the Americans say, a fairly sure bet.

Make a special note that CT1AA, Lisbon

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(31.25 metres) has been experimenting lately on a longer channel, namely, 50.17 metres (5,980 kc/s); the transmissions have been simultaneously broadcast. In the call it was made clear that the station was testing out this wavelength. There need be no doubt in your mind as to identity if you hear the cuckoo calls.

Alternative Channels

This question of additional or alternative channels is one which the listener must bear in mind and, where such exist, on the off chance of their being used without notice being given, I have inserted them in their correct sequence in my lists. Mention has already been made in previous issues of such transmitters as Zeesen, Rome, Skamlebaek, and so on, which, with the increase in their activities, are gradually taking up the extra channels at their disposal. Reference, therefore, must be made here to VK3LR, Lyndhurst (Victoria) which, so far working on 31.315 metres (9,580 kc/s) or as VK2XX when carrying out experimental transmissions, is also entitled to use the following: 13.927 metres (21,540 kc/s); 19.697 metres (15,230 kc/s); (25.253 metres (11,880 kc/s) and 48.86 metres (6,140 kc/s).

Although they are now seldom mentioned, both PCJ, Huizen, and PHI, Eindhoven Holland) are working to a regular schedule. The former is still in an experimental stage although one of the oldest short-wavers, as it was opened in 1927, and on 19.71 metres (15,220 kc/s) broadcasts simultaneously with PHI on Sundays only. The Eindhoven transmitter on 25.57 metres (11,730 kc/s) sends out on its own a programme on Monday, Thursday, Friday, and Saturday of each week between G.M.T. 13.00-15.00 or 15.30, with an extended transmission on Sundays to 16.00. The programmes open with the Dutch National Anthem.

I have not yet had any definite information regarding any short-wave broadcasts from Cairo, but understand that these may be carried out this year. The wavelengths to be used are 25.46 metres (11,780 kc/s) and 49.92 metres (6,010 kc/s). Reference is seldom made to Radio Maroc (CNR) on 23.38 metres (12,830 kc/s) and on 37.33 metres (8,035 kc/s), but the station regularly broadcasts the Rabat programmes every Sunday between G.M.T. 20.00-23.30 (37.33 m.). Announcements are usually made in the French language only, but the call is also given out in English.

Transmissions from Java

If you care to turn to the higher frequencies on any day between G.M.T. 11.00-13.00 you should pick up without difficulty PMA, Bandoeng (Java) on 15.50 metres (19,350 kc/s), a 60-kilowatter which, when free from the wireless telephony service with Holland, usually maintains communication by reeling off a gramophone record or so. On 15.92 metres (18,830 kc/s) PLE, Bandoeng, carries out a similar service, but with the difference that it usually makes use of an interval signal of three notes: A flat, E, D flat.

Finally, add to your list: XGOX, Nanking (China) which now has under construction a short-wave station to which the following channels have been allotted: 16.84 metres (17,800 kc/s); 25.11 metres (11,900 kc/s); 31.56 metres (9,500 kc/s) and 49.97 metres (6,000 kc/s). I am told that we may shortly expect it to carry out tests.

Berlin on 6 metres

I understand that Berlin, with a view to testing out the 5- and 6-metre band for local broadcasts of both speech and television, is now carrying out daily transmissions with a power of 2½ kilowatts on roughly 6 metres from G.M.T. 15.00-23.00. The programmes used are those of the high-power long-wave Deutschlandsender (Zeesen), and also those broadcast from the site of the old Witzleben transmitter and for which the aerial on the famous Funkturm has been specially adapted.

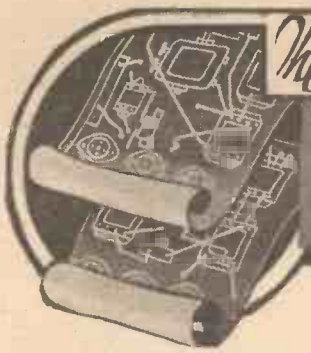
LKJ1, Jelöy, through which you listen to the Oslo (Norway) broadcasts, is still using in the morning 31.45 metres (9,540 kc/s), but for the afternoon and evening transmissions switch over to 48.94 metres (6,128 kc/s). On the lower wavelength you will be given an opportunity of logging the station on Sunday and Sunday week between G.M.T. 15.00—16.00, but the call will be put out in morse. As it takes its programmes from the Norwegian capital, it is the Oslo opening and interval signal which will help identification. The same dial position, within a hair's breadth, should bring you DJN, Zeesen, which transmits a special programme for Southern Asia daily between G.M.T. 08.45—16.30, and one for Central America between G.M.T. 02.15—03.30 daily.

Variety from Halifax

EXCERPTS from a variety bill arranged by Billy Merrin will be relayed to Northern listeners from the Palace Theatre, Halifax, on March 6th. Billy Merrin's famous Commanders Dance Band will provide a musical background to the show.

Leeds Symphony Concert

THE first part of the Leeds Symphony Concert will be relayed to Northern listeners from the Town Hall, Leeds, on March 16th. The orchestra will be conducted by John Barbirolli, and the soloist is to be Gaspar Cassado, Catalonian 'cellist.



The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

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

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AMATEUR WIRELESS AND WIRELESS MAGAZINE.

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Blueprints, 6d. each.

Four-station Crystal Set ..	31.3.34	AW427
1934 Crystal Set	4.8.34	AW444
150-mile Crystal Set ..	Out of print	AW450

STRAIGHT SETS. Battery Operated.

One-valvers: Blueprints, 1s. each.

B.B.C. One-valver ..	Out of print	AW344
B.B.C. Special One-valver	Out of print	AW387
Twenty-station Loud-speaker One-valver (Class B) ..	Out of print	AW449

Two-valvers: Blueprints, 1s. each.

Melody Ranger Two (D, Trans)	Out of print	AW388
Full-volume Two (SG.-Det, Pen)	17.6.33	AW392
Iron-core Two (D, Trans)	Out of print	AW395
Iron-core Two (D, QPP)	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D, Trans)	Out of print	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans)	Out of print	AW338A
Lucerne Minor (D, Pen) ..	Out of print	AW426
Family Two (D, Trans)	*Apr.* '32	WM278

Three-valvers: Blueprints, 1s. each.

£8 Radiogram (D, RC, Trans)	Out of print	AW343
New Regional Three (D, RC, Trans)	25.6.32	AW349
Class-B Three (D, Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D. Trans, Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans. Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans) ..	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher: Chassis Model (SG, D, Pen)	3.2.34	AW419
Lucerne Ranger (SG, D, Trans)	Out of print	AW422
Cossor Melody Maker with Lucerne Coils	Out of print	AW423
P.W.H. Mascot with Lucerne Coils (Det. R.C, Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	Out of print	AW424
Pentaquester (HF, Pen, D, Pen)	14.4.34	AW431
£5 5s. Three: De-luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	9.6.34	AW437
All-Britain Three (HF Pen, D, Pen)	Out of print	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.1.34	AW451
Transportable Three (SG, D, Pen)	*Feb.* '32	WM271
Multi-Mag Three (D, 2 Trans) ..	*June* '32	WM288
Percy Harris Radiogram (HF, D, Trans)	*Aug.* '32	WM294
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple-tune Three (SG, D, Pen)..	*June* '33	WM327
Tyers Iron-core Three (SG, D, Pen)	*July* '33	WM330
C.-B. Three (D, LF, Class B)	Out of print	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
All-wave Three (D, 2LF) ..	*Jan.* '34	WM348
"W.M." 1934 Standard Three (SG, D, Pen)	*Feb.* '34	WM351
£3 3s. Three (SG, D, Trans) ..	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	*Oct.* '34	WM371

Four-valvers: Blueprints, 1s. 6d. each.

65/- Four (SG, D, RC, Trans)	Out of print	AW370
"A.W." Ideal Four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D, Pen)	Out of print	AW421
Crusaders' A.V.C. 4 (2 H.F., D, QP21)	18.8.34	AW445
(Pentode and Class-B outputs for above: blueprints 6d. each) ..	25.8.34	AW445A
Quadradyne (2SG, D, Pen) ..	*Feb.* '32	WM273
Calibrator (SG, D, RC, Trans) ..	*Oct.* '32	WM300
Table Quad (SG, D, RC, Trans)	*Nov.* '32	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
Self-contained Four (SG, D, LF, Class-B)	*Aug.* '33	WM331
Lucerne-Straight Four (SG, D, LF, Trans)	*Feb.* '34	WM350

Five-valvers: Blueprints, 1s. 6d. each.

Super-quality Five (2 HF, D, RC, Trans)	*May* '33	WM320
New Class-B Five (SG, D, LF, Class B)	*Nov.* '33	WM340
Class-B Quadradyne (2 SG, D, LF, Class B)	*Dec.* '33	WM344

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Consoelectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C. Two (D, Trans) A.C.	*June* '32	WM286

Three-valvers: Blueprints, 1s. each.

Home-lover's New All-electric Three (SG, D, Trans) A.C. ..	25.8.33	AW383
S.G. Three (SG, D, Pen) A.C. ..	3.6.33	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen) A.C.	23.6.34	AW430
D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July* '33	WM323
Simplicity A.C. Radiogram (SG, D, Pen) AC.	*Oct.* '33	WM333
Six-guinea AC/DC Three (HF Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF Pen, D Pen) A.C.	*Nov.* '34	WM374

Four-valvers: Blueprints, 1s. 6d. each.

A.C. Melody Ranger (SG, DC, RC, Trans) A.C.	Out of print	AW380
AC/DC Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C.	8.9.34	AW446
A.C. Quadradyne (2SG, D, Trans) A.C.	*Apr.* '32	WM279
All Metal Four (2SG, D, Pen) A.C.	*July* '33	WM329

SUPERHETS.

Battery Sets: Blueprints, 1s. 6d. each.

1934 Century Super	9.12.33	AW413
Super Senior	*Oct.* '31	WM250
1932 Super 60	*Jan.* '32	WM269
Q.P.P. Super 60	*Apr.* '33	WM319
"W.M." Stenode	*Oct.* '34	WM373
Modern Super Senior	*Nov.* '34	WM375

Mains Sets: Blueprints, 1s. 6d. each.

1934 A.C. Century Super, A.C. ..	10.3.34	AW425
1932 A.C. Super 60, A.C. ..	*Feb.* '32	WM272
Seventy-seven Super A.C. ..	*Dec.* '32	WM305
"W.M." D.C. Super, D.C. ..	*May* '33	WM321
Merrymaker Super, A.C. ..	*Dec.* '33	WM345
Heptode Super Three, A.C. ..	*May* '34	WM359
"W.M." Radiogram Super, A.C.	*July* '34	WM366
"W.M." Stenode, A.C.	*Sep.* '34	WM370

PORTABLES.

Four-valvers: Blueprints, 1s. 6d. each.

General-purpose Portable (SG, D, R.C, Trans)	Out of print	AW351
Midget Class-B Portable (SG, D, LF, Class-B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW417
Town and Country Four (SG, D, RC, Trans)	*May* '32	WM237
Two H.F. Portable (2SG, D, QP21)	*June* '34	WM362
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM363

SHORT-WAVERS. Battery Operated.

One-valvers: Blueprints, 1s. each.

S.W. One-valve	Out of print	AW329
S.W. One-valver for America	Out of print	AW429
Roma Short-waver	10.11.34	AW452

Two-valvers: Blueprints, 1s. each.

Home-made Coil Two (D, Pen) ..	14.7.34	AW440

Three-valvers: Blueprints, 1s. each.

World-ranger Short-wave 3 (D, R.C, Trans)	Out of print	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver ..	*Jan.* 19, '35	AW463
Short-wave Adapter	*Dec.* 1, '34	AW456
Superhet. Converter	*Dec.* 1, '34	AW457

Four-valvers: Blueprints, 1s. 6d. each.

"A.W." Short-wave World Beater (HF Pen, D, RC, Trans) ..	2.6.34	AW436
Empire Short-waver (SG, D, RC, Trans)	*Mar.* '33	WM318

Super-hets: Blueprints, 1s. 6d. each.

Quartz-crystal Super	*Oct.* '34	WM372

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Two-valve Mains Short-waver (D, Pen) A.C.	10.11.34	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	*Aug.* '34	WM368

Three-valvers: Blueprints, 1s. each.

Emigrator (SG, D, Pen), A.C. ..	*Feb.* '34	WM352

Four-valvers: Blueprints, 1s. 6d. each.

Gold Coaster (SG, D, RC, Trans) A.C.	*Aug.* '32	WM263
Trickle Charger:	*Jan.* 5, '35	AW462

THE EASY ROAD TO RADIO.

THE BEGINNER'S SUPPLEMENT

DUAL-PURPOSE COMPONENTS

In this Interesting Article, Written in Non-Technical Language, it is Explained How and Why Certain Components Perform Two Different and Opposite Functions.

THE beginner in wireless construction who tries to understand the "whys and wherefores" is often nonplussed, due to the fact that there are several components which serve one particular purpose when used in certain parts of the circuit and, apparently, the very opposite purpose when used differently. Examples of components to which this applies are resistances, condensers, and chokes. Thus, the very same resistance may be used in the anode circuit of a valve for coupling the valve to that following it, or for *de*coupling the valve from others. In

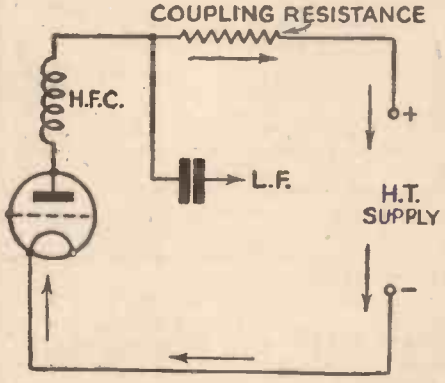


Fig. 2.—A theoretical circuit showing how the coupling resistance is virtually in parallel with the valve, the H.T. supply completing the circuit.

exactly the same manner a fixed condenser may be used for coupling or decoupling, whilst it may be used for "by-passing" or for "stopping"—the terms by-pass condenser and stopper condenser are common enough. An H.F. choke is used to prevent the passage of high-frequency current, but whilst performing this function it also carries the direct current which comprises the anode current of the valve.

Coupling and Decoupling

The difficulty mentioned above does not occur when the constructor has a theoretical knowledge of the behaviour of the various parts of a receiver, but there are comparatively few who are sufficiently interested in the theoretical side to delve very far into it. The points in question must therefore be explained without making very much reference to theory. Let us start by considering the resistances included in the anode circuit of the typical detector valve and wired in series as shown in Fig. 1. The resistance nearest the anode terminal of the valve-holder is for coupling purposes, and its object is to "collect" the output signal voltage from the detector and to pass it along to the following low-frequency stage. It is known that the output from the detector is actually developed between the filament and anode, and it is this voltage which must be utilised. Therefore it would appear that the anode of the valve should be joined to the grid of the following one, the filaments of the two valves being joined together. This would be all very well if it were not for the fact that the detector anode voltage would then be applied to the grid in the form of bias, and this would prevent the valve from functioning.

Instead of doing this, therefore, the coupling resistance is used, and the output voltage from the detector must be developed across it. If it is realised that there is a complete circuit through the H.T. supply it will be seen that the coupling resistance is virtually in parallel with the detector valve, as shown diagrammatically in Fig. 2. Provided that the resistance of the H.T. supply to the low-frequency currents made to pass through it were sufficiently low, this arrangement would be quite satisfactory. Actually, however, the resistance is *not* low, except in the rare instance where a new large-capacity battery is used.

The Effect of H.T.-Supply Resistance

When the resistance is any other than low it will be clear that a portion of the voltage which should be developed across the coupling resistance is developed across the battery or H.T. unit. And as the same source of supply is used for the detector and also the other valves in the receiver the audio voltage variations occurring across the H.T. supply would be applied to the other valves, where it would cause distortion and various other troubles. This is where decoupling comes in; if the decoupling resistance and condenser shown in Fig. 3 are included in the circuit conditions are changed. The 2-mfd. by-pass condenser has negligible resistance to audio, or low-frequency, currents, but the decoupling resistance offers great opposition to the flow of such currents. As an example of the point involved it might be stated that the resistance offered by a 2-mfd. condenser to frequencies of 1,000 ohms

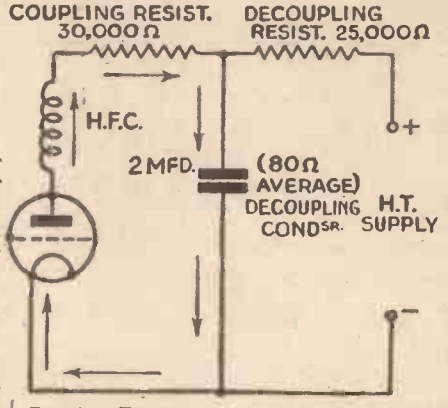


Fig. 3.—This circuit shows how the use of decoupling components prevents the audio-frequency currents from passing through the H.T. battery or unit.

(which is a fair average between the highest and lowest frequencies representing the audio range) is only about 80 ohms. It is therefore evident that the low-frequency currents will take the "return" path through the condenser rather than pass through the fixed decoupling resistance, the resistance of which is very considerably greater.

By-pass or Stopper?

That clears the question of coupling and decoupling resistances, and also of by-pass condensers. We can now consider the matter of coupling and stopper

(Continued overleaf)

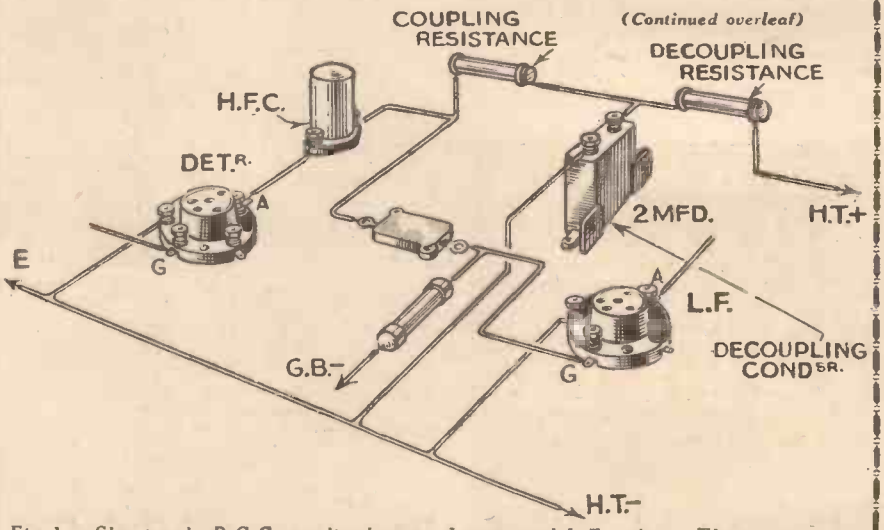


Fig. 1.—Showing the R.C.C. coupling between detector and L.F. valves. The various parts are referred to in the text.

THE BEGINNER'S SUPPLEMENT

(*Continued from previous page*)

condensers: generally a single condenser acts in both of these capacities. This is shown in Fig. 4, which is the intervalve circuit between a high-frequency and a detector valve. The .0003-mfd. fixed condenser between the anode of the H.F. valve and the tuned-grid coil serves to pass on the amplified high-frequency currents from the first valve and at the same time to prevent the high-tension supply from being short-circuited through the tuned grid coil. The condenser also, in cases where anode-bend detection is employed, prevents the high positive anode potential of the first valve from being applied as grid bias to the detector.

A Complete Insulator

The reason for the condenser providing the two different functions is that it is a complete insulator so far as direct current is concerned, but an excellent conductor of high-frequency currents. Actually, the resistance offered by a condenser is inversely proportional to the frequency of the current applied to it. Thus, the resistance shown by the .0003-mfd. condenser to a frequency of 1,000,000 cycles per second (corresponding to a wavelength of 300 metres) is just about 500 ohms, its resistance at 600 metres (500 kilocycles) being approximately 1,000 ohms.

What the Choke Does

The function of an H.F. choke is quite comparable with that of a condenser, and which has just been described, with the exception that its behaviour is exactly the opposite. As an example of this we might consider the purpose of the H.F. choke connected in the anode lead of the high-frequency valve in Fig. 4. Its purpose is like that of the coupling resistance mentioned above, for it has to carry the direct anode current to the valve and at the same time to provide the greatest possible opposition to the high-frequency currents applied to it, so that the (H.F.) voltage between its ends, and which is applied to the following valve, is as great as possible. The average high-frequency choke used in the position shown has an inductance of about 400,000 microhenries. Such a choke offers a resistance equivalent to 2,500,000 ohms to frequencies corresponding to 300 metres, or only 400,000 ohms

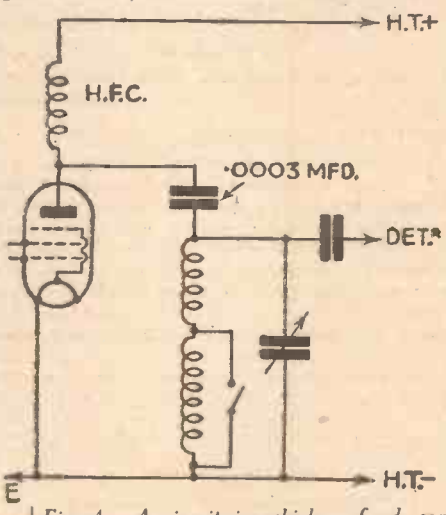


Fig. 4.—A circuit in which a fixed condenser is used as a stopper and also for H.F. coupling.

at 1,800 metres. At all normal wavelengths the resistance is very high compared with that of the coupling condenser, so that the H.F. currents have no hesitation in flowing through the condenser rather than through the choke into the H.T. supply, and hence to earth.

MAKING A LAPEL MICROPHONE

A Simple and Easily-made Instrument for the Experimenter

A MICROPHONE which may be carried about without impeding the work of the hands is a useful thing to possess, both to the home experimenter and the amateur transmitter. It is also a decided asset in public-address work; and, of course, in the case of home-built deaf-aid systems it becomes a necessity.

Showing constructional details and method of fixing the microphone to the lapel of a coat.

Any small carbon microphone having a detachable cap—the "trench" type with the carbon inset, or the earpiece with a button mounted to the diaphragm—can be easily adapted for carrying in the manner described with the addition of the special clip shown in the accompanying illustration.

The clip is a strip of fairly stout, springy brass, roughly ¾in. wide and 2in. long. A short distance from one end drill two small holes, about ¼in. apart; and at the other end drop on a blob of solder, smoothing-off afterwards with emery-cloth. With pliers, bend the clip to the shape shown, and carefully unscrew the cap and remove the diaphragm from the microphone. Using holes in the clip as a template, mark off and drill similar holes in the aluminium back. Fix the clip with short round-headed bolts and replace the diaphragm and cap. The completed microphone is clipped in the lapel button-hole or breast pocket, as shown in the accompanying sketch.—F. J. G. (Ellesmere).

RADIO CLUBS AND SOCIETIES

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

THE CROYDON RADIO SOCIETY

AN interesting evening was spent on Tuesday, February 19th, when the Vice-Chairman, Mr. W. J. Bird, lectured on Electrical Condensers, and gave a brief survey of their theory, manufacture, and application to modern circuits.

Mr. Bird considered that condensers did not get the attention they deserved, merely lying unnoticed on our baseboards. If of foreign manufacture they were indeed noticed when they broke down, and then British ones were substituted. He dealt with the theory of the atom very lucidly in leading to the theory of condensers, and discussed how different materials gave varying dielectric constants. The subject of winding of paper or roll type condensers and the assembly of standard models proved particularly interesting. With a special home-made model producing A.C. of varying frequencies, the action of A.C. with a condenser in circuit was very easily understood.

Mr. F. J. Camm, Editor of PRACTICAL AND AMATEUR WIRELESS, is lecturing on "The Constructor and the Press" in St. Peter's Hall, on Tuesday, March 12th. It is felt that readers would like to hear their Editor, and all are asked to come along to hear what is likely to be a novel and illuminating talk.—Hon. Secretary. E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

SHORT-WAVE RADIO AND TELEVISION SOCIETY (THORNTON HEATH)

THE principles of television were outlined by Mr. Jas. T. Webber, hon. secretary of this Society, in a talk at the Thornton Heath Library on Thursday, February 21st.

Mr. Webber said that at present television was in its infancy, but there was no doubt that it would ultimately reach the efficiency of present-day wireless, and this end could be helped to a great extent by amateurs who experimented solely for the pleasure they got out of it. He then went on to explain the manner in which the televised image was transmitted and received. The construction of the "artificial eye" was explained, and also the main features of the scanning disc, with the aid of lantern slides. Various types of apparatus used were also illustrated, from the first televisor, which is at present in the Museum at South Kensington, up to present-day apparatus.—Hon. Secretary, Jas. T. Webber, 368, Brigstock Road, Thornton Heath.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

A VERY interesting lecture, entitled "The British Polar Expedition to Tromso," was given before the meeting of the London Chapter, held on Friday, February 22nd, by Mr. R. Naismith, A.M.I.E.E., of the National Physical Laboratory. The objects of the expedition were fully explained, and by an electrical experiment he was able to illustrate the work carried out in the Polar regions. The apparatus used for this demonstration consisted of a signal generator and a loud-speaker, by means of which the signals were directed against a cover which represented the ionised layer above the earth, the echoes from which were picked up by a microphone and measured on a cathode-ray tube. His lecture was concluded by a description of the life in Tromso, which was illustrated by some very fine slides.—A. E. Bear, Secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

THE STAFFORD RADIO SOCIETY

THE above society, though founded only a few months ago, has already proved itself beneficial to its members. On Friday nights lectures are given by some of the leading members. On February 8th two short lectures were given, one, "The Measuring of the Performance of a Receiver," was given by Mr. R. J. Billingsley. The second one, "Twelve Years of Radio Progress," was given by Mr. W. P. Rowley, who made it particularly interesting by illustrating the various stages with several pieces of apparatus. Both lectures were enjoyed by the members present.—Hon. Sec., R. J. Billingsley, 109, St. Georges Road, Stafford.

A RADIO CLUB IN THE POTTERIES

ANYONE interested in the formation of a Radio Club in the Potteries is invited to communicate with Mr. H. Churton, 26, Victoria Street, Smallthorne, Stoke-on-Trent.

PRACTICAL LETTERS FROM READERS

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

An Equivalent-circuit Diagram

SIR,—I have been interested in a diagram in the article on Valve Sensitivity, in the February 16th issue, and must admit that it constitutes a lucid explanation of stage gain. However, one might imagine that a new reader would visualise a kind of grid leak, whereas, of course, the load is truly between CB but by way of A on the diagram, R (CB) being theoretically infinite resistance in one direction.—G. SAYER (Ware).

Visual-t ning Indicators

SIR,—I saw a suggestion in a recent issue which I welcome, namely, for a visual-tuning indicator for attachment to the panel of a receiver. I should also like to see details for the construction of the same in one of your future issues.—R. I. (Oxford).

[*An article on visual-tuning indicators appeared in* PRACTICAL WIRELESS *dated November 25th*, 1933.—ED.]

A Quality Set

SIR,—I suggest the design of an A.C. receiver on these lines: a straight circuit with iron-core coils; two H.F. stages; a double-diode-triode detector; L.F. with push-pull; and amplified delayed A.V.C. with valve. I think you will agree that this would be a "quality set."—A. G. GOBELL (N. W. 10).

A Boon at Sea

SIR,—As most of my time is spent at sea, I want to take this opportunity whilst I am on shore of thanking you for your excellent publication PRACTICAL AND AMATEUR WIRELESS. I have had the paper sent to me in all parts of the world since the first issue, and consider it a great boon, particularly to us seafarers who do not have many opportunities of keeping abreast with the everyday developments of wireless. I have taken particular interest in your "Radio Wrinkles" section. Wishing you long and continuous success.—G. MCGAHAN (Sunderland).

Powerful Short-wave Transmissions

SIR,—Perhaps it would be of interest to your readers to note that the short-wave station CY1AA (Lisbon) has recently been testing on a new wavelength of 50.17 metres. It is a very powerful signal.—W. L. (Gordon, Berwickshire).

Our Short-wave Section

SIR,—As a new reader, I would like to say how I appreciate your short-wave section, and hope it will become still larger! May I suggest that you publish a simple short-wave battery receiver with provision for adding to it in succeeding editions?—H. C. G. (Birkenhead).

From a Reader in Norway

SIR,—I find your magazine very interesting and would like to see an A.C. four-valver described.—ERIK KR. GRAVDAHL (Oslo).

A Short-wave Four-valver

SIR,—A circuit which I favour is a short-wave superhet with a valve arrangement as follows: (1) H.F. pentode, (2) heptode, (3) double-diode-triode, (4) output pentode. The set should be for battery operation, and I think that with reasonable care and attention in design a really efficient receiver would result.—R. J. S. (W.3).

A Typical Circuit

SIR,—There must be a considerable number of F. J. CAMM'S three-valve supers in use, it would be helpful to the owners of such sets if you published a typical theoretical circuit showing component values, and voltage and current ratings at different points along the circuit, particularly for the use of mains users. This would help one to find faults quickly.—S. G. MATTOCKS (Southsea).

A Range of Receivers

SIR,—I was very glad to learn that you had decided to enlarge the short-wave section in PRACTICAL AND AMATEUR WIRELESS. I am sure it will prove very popular. Might I suggest that a series of receivers be described starting with a heptode superhet converter, and working up to large multi-valve sets so as to cater for all tastes and pockets.—R. S. DARLING (Chislehurst).

Trimmers and Calibration

SIR,—I am very interested in your remarks concerning station marked dials in the February 16th issue of PRACTICAL AND AMATEUR WIRELESS. I offer the following suggestion as to the reason why the calibration of these dials, or any other for that matter, does not hold good. It is the practice of the majority of wireless manufacturers, after calibrating a set, to dab a little adhesive composition on the trimmers to prevent them working loose, and it is this practice which is definitely the cause of the calibration altering. What happens is that as the seccotine hardens it has a tendency to tighten the trimmer up, thereby increasing the capacity and throwing the ganging out. This is more noticeable when the oscillator trimmers are so treated, and needs little imagination to realise what effect this will have on calibration. Even if this was allowed for, the heat generated during the working of the set would soften the composition, causing the ganging to alter once more.

I write from practical experience of this fault, being employed on the testing boards of one of the largest manufacturers of receivers.—F. G. BOWLES (Westcliff-on-Sea).

Calibrating a Milliammeter

SIR,—Some time ago I was very interested in the various methods of calibrating a milliammeter for various ranges, but the resistance of the meter was unknown.

I have used the following method with success, for calculating the R of the meter.

(1) Take a "good" 2-volt accumulator—properly charged and which has been in use about 1 hour—it can then be taken as having an E.M.F. of 2 volts and a negligible internal resistance (this is impossible with dry or inert cells).

(2) Taking the meter, say, as 10 m.a. for a full scale deflection, calculate a resistance that will give about 10 m.a., which equals

$$R = \frac{E}{I} = \frac{2 \times 1{,}000}{10} = 200 \text{ ohms.}$$

(3) Connect up the milliammeter, the resistance, and the accumulator in series.

(4) Read the current in m.a. flowing in the circuit—say 8 m.a.

(5) Calculate the voltage drop across the known resistance.

$$E = I \times R = \frac{200 \times 8}{1{,}000} = 1.6 \text{ v.}$$

$\therefore$ 2 v. — 1.6 v. = voltage drop across meter = .4v.

$$\therefore \text{R of meter} = R = \frac{E}{I} = \frac{.4 \times 1{,}000}{8} = 50 \text{ ohms.}$$

(6) The final resistance must be fairly accurate, but it actually depends upon the accuracy of the resistance used.

This method can now be substituted for any resistance, but the unknown resistance placed in series with the meter and the accumulator. From the equation $R = \frac{E}{I}$ the unknown resistance will be the resistance calculated, less the resistance of the meter.—W. P. HAMLYN (Charlton).

A Quality Set

SIR,—I have been very interested in the letters published recently concerning a set which is a little "different." Most of your correspondents are in favour of a 2 H.F. arrangement, and I should like to add my plea to theirs for a circuit of this type.

Personally, my opinion leans towards 2 V.M.H.F. Det., and push-pull output with A.V.C. incorporated.—H. J. TURNER (Pontypridd).

[*The Famous Fury Four incorporates 2 H.F. stages.*—ED.]

Club for Barking

SIR,—I am interested in wireless and wish to become a member of a Radio Club. Will local readers get into touch with me with the object of forming club to Barking.—G. F. GODDARD (137, Beccles Drive, Barking).

CUT THIS OUT EACH WEEK.

Do you know

—THAT a station-calibrated dial may in many cases be made up by reversing the present celluloid scale and writing the actual names on the reverse side.

—THAT the fuse is the most important safeguard which can be used in a mains receiver.

—THAT the position of the fuse in a Universal receiver should be chosen with care.

—THAT in the case of a powerful near-by station causing selectivity troubles, the importance of a vertical aerial should not be overlooked.

—THAT a metallized valve is not a cure for instability, although the screening of the electrodes is sometimes an advantage.

—THAT in view of the above the importance of layout should be just as carefully studied even when that type of valve is employed.

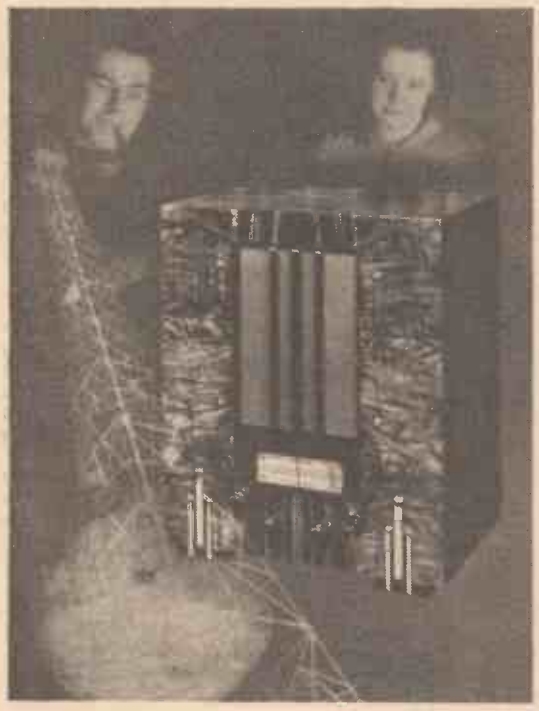
—THAT an output filter circuit should be fitted as a matter of course to every receiver.

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.

MARCONIPHONE JUBILEE RECEIVERS

MANY months of research, considerable sums of money, and much human energy have gone to the design and manufacture of the three Marconiphone "Jubilee" receivers recently released. The basic idea behind these releases was conceived about the middle of 1934, and from that time until the present day, their design and manufacture have proceeded with the utmost despatch. They consist of: Model "264"—a 5-valve (including rectifier) table superhet at 12½ guineas, for A.C. mains; Model "297"—a 5-valve (including rectifier) console superhet receiver at 17 guineas, for A.C. mains; and Model "287"—a 5-valve (including rectifier) superhet radio-gramophone at 22 guineas, for A.C. mains.



The new Marconiphone Jubilee Table Grand, Model 264.

The new "electron-trigger" device which is incorporated in all three models is a very ingenious arrangement. It is justly named "robot," as it fulfils a most important function in the working of the instrument entirely automatically.

"Electron-trigger" Action

As its name implies, it makes use of "electrons"—those elusive little bodies which are the playthings of scientists. Travelling at a speed of almost 200,000 miles a second, they form an invaluable and infallible means of control to thousands of oscillations which take place in the interior of the set.

Briefly, their function is closely allied to the Q.A.V.C. action. As everyone knows by now, this Q.A.V.C. action makes for silent tuning between stations, that is, absolute freedom from atmospherics and other extraneous noise whilst searching for stations, and also ensures that programmes of a satisfactory volume remain constant and do not vary in the slightest degree. Once the listener has decided upon the volume level he requires for the particular room in which he will be listening, which he does by turning the volume control to the desired position, then he can be absolutely certain that when he turns the tuning knob, only those stations which result in the same volume level will be allowed to come through the loud-speaker.

This state of affairs is looked after by the "electron trigger." Once the tuning scale reaches a programme of the desired level, the incoming signal "pulls the trigger" and releases the stream of electrons which couples the circuits instantaneously, and allows the reproduction to come through.

Two of these new sets are shown in the accompanying illustrations, which show the pleasing lines of the highly-finished cabinets. Readers interested in either of these receivers will find full particulars in a leaflet which can be obtained on application to The Marconiphone Company, Ltd., 210-212, Tottenham Court Road, London, W.1.

This illustration shows the attractive appearance of the Marconiphone Jubilee Model 287 Radio-gramophone.

FACTS & FIGURES

New Mullard Transmitting Valve

FOR several years screened grid receiving valves for H.F. amplification have been standard practice, but for transmission purposes, except in a few special instances, the triode is still generally used. A few years ago screened tetrodes for use in transmitters were developed, and we now learn that the Mullard Company have produced a type, known as QZ05-15 having a maximum continuous anode dissipation of 15 watts, and capable of giving an output of 15 watts at 45 metres, 10 watts at 15 metres, and of operating at further reduced output down to 5 metres.

A Wearite unscreened iron-core coil.

In addition to avoiding the neutralisation difficulties associated with operation on several wavelengths (the anode-grid capacity of the QZ05-15 is as low as 0.001 micro-micro-farads), this valve requires a very low grid excitation power which can be derived from a crystal-drive stage operated under conditions of good frequency stability.

The filament is of the high-emission oxide-coated type which, while robust, consumes only 1.1 amp. at 4 volts. The total emission is 400 m.a., the maximum anode voltage 500v. and the maximum screen voltage 125v. The maximum screen dissipation is 3 watts.

It is very important that the screen dissipation be carefully checked by the following formula :—

Screen dissipation=0.6 (watts) (Screen Current (amps.) + Anode Current) (amps.) × Screen (volts).

The anode dissipation can be checked from the following expression :—

Anode dissipation (watts)=(Va Ia + Vs Is) —(Ws + W)

Where Ws=Screen dissipation
W =Output Power.

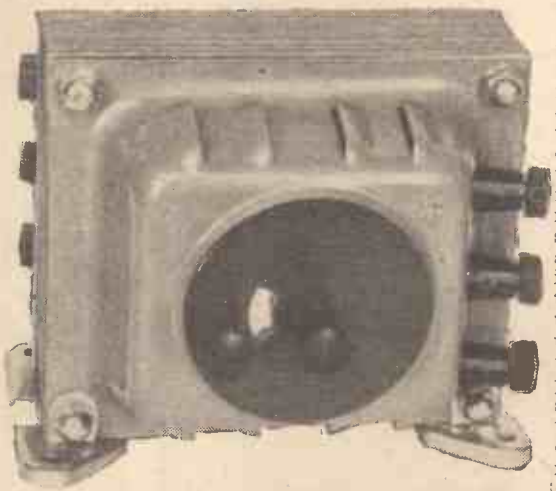
The list price of the QZ05-15 is £5 17s. 6d.

Wearite Components

THE small iron-core coil (I.C.6) illustrated on this page is a later addition to the "Wearite" range of Nucleon-cored coils, and its small size makes it particularly suitable for portable sets. Due to the iron-dust core, these coils have a high efficiency and selectivity, which permits of their use in simple circuits with excellent results. The coil is the outcome of careful design and research work and, although unscreened, is capable of giving a very good account of itself.

For those who desire the coil for use in a receiver of a compact nature where more than one will be required, a special screened model is obtainable. This is identical in all respects, but is provided with a screening case, and an extra 2s. 6d. is charged for it. The unscreened coil is 5s., and the screened coil 7s. 6d. The latter model is distinguished by its reference No. I.C.S.6.

The mains transformer illustrated at the foot of the page is Type A, and its most novel feature is the protected input circuit. It is usual to provide a terminal strip on a mains transformer with a number of terminals or sockets to suit different mains voltages. There is always a risk with this type of transformer that the terminals might be touched whilst the receiver is switched on, and thus a nasty shock might be obtained. In this Wearite model a rotatable insulated disc is attached at its centre, the point of attachment forming one end of the primary, and thus one connecting point for the mains lead. A hole is drilled near the edge of this disc and a small window is cut between it and the centre point. A plug-in insulated terminal is inserted in the hole, and if this is removed the disc may be rotated to uncover various holes, each of which represents a tapping on the primary, and the exact voltage suitable is then indicated through the window. Thus the process of connecting this transformer to the mains is exceedingly simple, and at the same time the transformer is perfectly safe. There are five models, each designed to suit a special need and the prices range from 17s. 6d. to 25s. The actual model illustrated is T.21-A, having outputs of 250-0-250 at 60 m.a.; 2-0-2 at 1 amp. and 2-0-2 at 3-4 amps., and this costs 25s.



The Wearite power transformer referred to on this page.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

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

SPECIAL NOTE

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

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

Please note also, that all sketches and drawings which are sent to us should bear the name and address of the sender.

Ultra-short-wave Aerials

"Can you definitely state the best aerial for really ultra-short wavelengths? I want to erect such an aerial, so that I can experiment with reception without having to worry as to whether the aerial is O.K. or not."—J. T. (Feltham).

Unfortunately we cannot state definitely just what aerial is best. We are, however, carrying out very exhaustive experiments in this connection, especially in view of the forthcoming television transmissions. The whole subject of ultra-short-wave work is rather delicate and much conflicting evidence is available. You may take it, as a general standpoint, however, that an aerial of half the wavelength will prove satisfactory. A metre is 3.28ft., and this will probably help you. Remember capacity losses between the aerial and walls; try a counterpoise; use heavy gauge metal rod for lengths less that 15ft.; copper and brass tubes have been found very good; insulation is highly important, and the actual position of the receiver with respect to the aerial also seems to have its effect. These details will probably be of assistance to you until more definite information has been obtained.

A Low-pass Filter

"Whilst reading a book recently I came across the term 'low-pass filter.' Could you please explain what this is, and its use in a normal wireless receiver?"—U. A. S. (Wellingboro.)

A low-pass filter is a circuit made up from impedances connected in series and parallel. Its object is to impede the progress of high frequencies, but to permit low frequencies to pass, and it is from this latter that its name is derived. A typical example is to be found in the H.F. choke and by-pass condenser in the detector anode circuit. Here the impedances in question are the choke and the condenser, and the choke stops the H.F. from passing, whilst the by-pass condenser allows them to leak away to earth. Similar arrangements are used for tone-control purposes.

Maintenance Costs

"I have just bought an all-mains A.C. radiogramophone, and should like to know how to work out the cost of running this. It has five valves, types of which are not known. The loud-speaker is a permanent-magnet type, and the turntable is synchronous. Will these details enable you to tell me how much it costs to run?"—B. R. (Bradford).

We are sorry we cannot tell you the actual cost, but you can work it out from the following details. Examine the rectifier, whether of metal type or valve, and ascertain its total output in volts and milliamps. Expressing the current as the decimal fraction of an amp. (1 milliamp. is .001 amps.) multiply it by the volts. Next multiply the number of volts supplying the filaments or heaters by the current. If the valves are of the standard A.C. type they are fed with a 4-volt 1-amp. supply, and the five valves will, therefore, take 5 amps., which is 20 watts (5 by 4). Add this to the H.T. figure just obtained, and you will have the total secondary load on the mains transformer. The efficiency of the latter is not better than 75 per cent., so that the actual primary load is easily found. Allow a further 5 watts for the synchronous motor, and you have the total load on the mains.

Improving the Bass

"My set is rather old, employing detector and two L.F.s. R.C. coupling is used between detector and first stage, with a transformer between second and third. Speaker is M.C. but bass is rather lacking. What is the simplest manner of putting up the bass response in the cheapest possible way? I do not want to spend much on it, as I hope to get a better set before very long."—S. W. (Hampstead).

We presume from your last remark that you would not wish to obtain a new valve and therefore the cost of any alteration must be kept below that level. Probably the simplest scheme would be to buy a 1s. 1 watt resistance of about 10,000 to 20,000 ohms, and also a one- or a two-mfd. fixed condenser. These should then be used to parallel-feed the L.F. transformer. In case this method is not familiar to you, connect the resistance in place of the primary of the transformer, and join the condenser between the anode and the anode terminal of the transformer. The H.T. terminal of the transformer, as well as the G.B. terminal, are then joined together and connected to grid bias, whilst the grid terminal is left as it is at present.

Rejuvenating the H.T.

"Is it possible to rejuvenate a high-tension battery? Mine run down very quickly, and it seems such a waste of money to throw them away."—W. R. T. (Peckham).

It is possible to slightly increase the useful life of a battery but it is not worth it. A battery which has run out may be made to serve a few hours longer by warming it up slightly by placing it in a moderate oven. Such a scheme should only be resorted to in an emergency, such as when the shops are shut, etc. A scheme which has also been suggested and found to work is to stand the battery in a sal-ammoniac solution. Some amateurs have actually taken a battery down and pierced small holes through the zinc containers in order to allow a similar solution to soak into the sacs. This is, of course, of no use if the zincs have become eaten away. In general, however, it will pay you much better to get a larger capacity battery.

Speaker Position

"I have been trying some positions for the loud-speaker, and it seems very difficult to decide upon the best place. Is there any data regarding this point, or is it unimportant?"—W. E. (Birmingham).

The fact that you cannot decide upon the best place rather points to the fact that with your particular equipment the speaker position is unimportant. When a really first-class speaker and receiver are in use, the actual method of mounting the speaker and its position are all important, and the quality may be completely spoiled by the method in which it is carried out. If too low down, high notes will not be heard clearly. If the baffle is of the wrong size the frequency response will be affected.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face type and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. Radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," 8, Southampton Street, Strand, London.

PREMIER SUPPLY STORES

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

OFFER the Following Manufacturers' Surplus New Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra, I.F.S. and abroad, carriage extra. Orders under 5/- cannot be sent c.o.d. Please send for Illustrated catalogue, post free.

ALL-ELECTRIC 3-stage Amplifiers, 200-250v., 40-60 cycles, 10 watts undistorted output, complete with 5 valves and Magnavox Super 66 energised speaker, £12/10/0.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, condensers, resistances, and diagram, 120v. 20 m.a., 20/-; trickle charger, 8/- extra; 150v. 30 milliamps with 4v. 2-4 amps. C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps., with 4v. 3-5 amps. C.T., L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps. L.T., 27/6.

PREMIER Chokes, 40 milliamps, 25 hys., 4/-; 65 milliamps, 30 hys., 5/6; 150 milliamps, 30 hys., 10/6; 60 milliamps, 80 hys., 2,500 ohms, 5/6; 25 milliamps, 20 hys., 2/9; 250 milliamps, 30 hys., 20/-.

ALL Premier Mains Transformers have engraved panels, terminal connections, all low-tension windings centre tapped, tapped and screened primaries 200-250 volts.

PREMIER 250-0-250 60 milliamps, 4 volts 1-2 amps, 4 volts, 2-3 amps, 4 volts 3-4 amps, 10/-

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

PREMIER combined HT8 and HT9 transformer rectified output 250 or 300 volts 60 milliamps, 4 volts 1-2 amps, 4 volts 3-5 amps, 10/-, or with Westinghouse Rectifier, either type, 18/6.

PREMIER HT10 transformer rectified output 200 volts, 100 milliamps, 4 volts 1-2 amps, 4 volts 3-5 amps, 10/-, or with Westinghouse Rectifier, 19/6.

PREMIER HT11 transformer 500 volts 120 milliamps rectified output, 4 volts 2 amps, 4 volts 2 amps, 4 volts 3-5 amps, 22/6; with Westinghouse Rectifier, 42/6.

SPECIAL offer Western Electric mains transformers input 200-250 volts, output 350-0-350 volts, 120 milliamps screened primary 4 volts 1-2 amps, 4 volts 2-3 amps, 4 volts 3-5 amps, 9/6. Input 100/250 volts, 300-0-300 volts 60 milliamps 4 volts 1-2 amps, 4 volts 2-3 amps, 6/6. Input 200/250 volts screen primary output 500-0-500 volts 150 milliamps 4 volts 3-5 amps, 4 volts 2-3 amps, 4 volts 2-3 amps, 4 volts 1 amp, 4 volts, 1 amp, 19/6.

MAINS transformer with Westinghouse Rectifier output 150 volts, 30 milliamps and 4 volts, 2 amps L.T., 15/- the pair.

USA. 3-gang condenser with trimmers, 3/11; a really solid job.

PREMIER L.T. Charger Kits, consisting of Premier transformer and Westinghouse rectifier, input 200-250v. A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 15v. 1 amp, 19/-; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2 v. ½ amp., 11/-.

B.T.H. Truspeed Induction Type (A.C. Only), Electric Gramophone Motors, 100-250v., 30/- complete. D.C. model Truspeed, 100/250v., 42/6.

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

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

SPECIAL Offer of Wire-Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

CENTRALAB Potentiometers, 400 ohms, 1/-; 50,000, 100,000, ½ meg., any value, 2/-; 200 ohms, wire-wound, 1/-.

RELIABLE Canned Coils with Circuit accurately matched, dual range, iron cored, 2/11.

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

SPECIAL offer .00015 brass short-wave tuning condensers with slow-motion and complete dial, 3/9. Short-wave chokes 10-200 metres, 9d.

DUBILIER electrolytic condensers, 12 microfarads, 20 volts 6d., 8 plus 4 microfarads 500 volts 4/-, 50 mf. 50 volts, 1/9.

AMERICAN G.E.C. auto-transformers 450 watts, one side 110 volts, other 90/240 volts in 5 volt steps, 30/-.

(Continued at top of column three)

(Continued from foot of column one)

BRITISH Radiophone fully screened 3-gang .0005 top trimmers with complete, slow-motion drive, 7/6.

MAINS transformer input, 200/250 volts, 6 volts 1 amp, 4/6. 10 volts .5 amp., 4/6.

SPECIAL OFFER. Kolster-Brandes (shop-soiled) Receivers, 2-valve Battery Pup, with self-contained Speaker, Valves and Batteries, 27/6.

POLAR Star Manufacturers' model, 3-gang condensers, fully screened, 7/6, with trimmers; unscreened, 5/-.

RELIABLE Intervalve Transformers, 2/-; multi-ratio output transformers, 2/6; Microphone transformers, 50-1 and 100-1, 2/6; 1-1 or 2-1 Output Transformers, 2/6.

UTILITY 3-gang Condensers. 0.0005, fully screened, with trimmers, ball bearing straight or superhet, 6/9, complete; with illuminated disc drive, 7/11; the best 3-gang available.

T.C.C. Condensers, 4mf. 450v. working, 4/-; 4mf. 750v. working, 6/-.

VARLEY Constant Square Peak Coils, bandpass type B.P.7 brand new, in maker's cartons, with instructions and diagram, 2/4.

VARLEY H.F. Intervalve Coils, B.P.8, band-pass, complete with instruction, in original cartons, 2/6.

PREMIER British-made Meters, moving iron, flush mounting accurate, 0-10, 0-15, 0-50 m.a., 0-100. 0-250 ma., 0-1, 0-5 amps.; all at 6/-.

WESTERN Electric Condensers, 250v. working, 1 mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 400v. working, 1 mf., 1/-; 2 mf., 1/6.

WIRE-WOUND Potentiometers, 1,000, 2,500, 50,000, 500,000, 2/- each; 1,000 ohms, semi-variable, carry 150 m.a., 2/-.

A LARGE Selection of Pedestal, Table and Radio-gram cabinets, by best manufacturers at a fraction of original cost. Send for list.

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SUPER-MOVING Coil Speakers, handle 10 watts, energised directly from A.C. mains, manufactured by world-famous radio and gramophone company. 40/-

T.C.C. Electrolytic condensers, 8 mfd. 440v. working, 3/-; 4 mf. 440v. working, 3/-; 15 mf. 50v. working 1/-; 50 mf. 12v. working, 1/-; 15 mf. 100v. working, 1/3.

CONDENSER Blocks, H.M.V. 400v. working. 4+2+1+1+1+.5, 3/9; 2+2+1+1+1+.5, 3/-; Phillips 6+4+2+1+1, 4/6.

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10,000, 12,000, 15,000 ohm wire-wound potentiometers with mains switch, 1/6.

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SPECIAL OFFER. Guaranteed U.S.A. Electrolytics. 4 mf. 1/9; 8 mf. 1/9; 12 mf. 1/9, all 550 v. Peak Working.

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The Following Types, 5/6 each: 350v. 120 m.a., full-wave rectifier, 500v. 120 m.a., full-wave rectifier, 2½ watt indirectly-heated Pentode.

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The Following Types, 6/6 each: 42, 25Z5, 36, 38, 83, 39, 44, 53, 6B7, 2A6, 267, 5Z3, 6C6, 6A4, 6D6, 6F7, 43, 59. Send for Complete Valve List.

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RADIOMART. Free shortwave three blueprint and magazine with all 5/- shortwave orders.
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RADIOMART. Telsen 100 Hy Chokes 1/11; Telsen 100 ma Fuses 2d. Telsen preset condensers 9d.
RADIOMART. British Radiophones fully screened 2-gang, .0005, top trimmers, latest compact type, 5/11.
RADIOMART. Radiophone 3-gang straight or superhet 7/6. Radiophone 4-gang superhet, 9/6, all boxed.
RADIOMART. British Radiophone 2-gang as above, but fitted Uniknob trimming; wavelength moving-scale dials, 8/3.
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RADIOMART. Utility super 2-gang .0005, ball-bearing, fully screened, with trimmers, 5/11; with disc dial 6/11.
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RADIOMART. Variable condensers. Lotus .0003, 1/-; Utility .0005, 1/3; Ready Radio, .00075, .0003, .0005, 1/-. Telsen, .0001, .00015, 10d.
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RADIOMART. Special offer dozen assorted wire-ended resistances, all different, most famous makes, our selection only, 2/6.
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THANKS

We have this season received over 300 letters of appreciation. It is, of course, impossible to reply to these individually, and we now take this opportunity to publish a few, and to convey to all these good friends our thanks.

A. McD., St. Martins Square, Scarborough.
"I am delighted with your prompt service and the value of the goods I received safely this morning Your ad. is correct, you do not sell junk. As I was badly done with a firm of Cut Price Specialists recently, I appreciate your courteous business methods all the more."

H. W. S., Chapel Street, King's Lynn.
"I would advise you that Mr. C., of High Street, King's Lynn, is not only a very satisfied customer of yours, but a very good advertiser, never failing to speak of your square dealing and prompt attention."

H. J. B., Inhurst Road, North End, Portsmouth.
"I feel I must write and thank you for the very prompt attention given to my recent orders. In the course of some 12 years in the industry, I have only struck one other firm to compare with you in this essential detail."

D. A. S., Holdenhurst Road, Kingswood, Bristol.
"The goods came to hand safely on Wednesday, and I wish to take this opportunity of thanking you for the prompt despatch and for the quality of the goods. It is something to-day, to receive goods exactly as advertised, and in addition to find them in good condition. I assure you of my purchasing further in the future from you. I shall not hesitate to recommend your methods."

J. J. M., St. Albans Crescent, Bournemouth.
"May I compliment you on the fact that you seem to be the only firm from whom I am able to get delivery practically by return, and goods strictly as advertised."

A. J. S., Palmerston Road, Chatham.
"This is my fourth order from your present list, and your firm is the best I have dealt with over a period of eight years in radio."

W. E. S., North Park Street, Dewsbury.
"I realise how many pounds I might have saved had I made your acquaintance years ago."

C. L. G., Eccleshall Road, Stafford.
"I may say I have made many purchases with complete satisfaction, and never been 'had.'"

Miss H., Alnmouth.
"Your consideration was very much appreciated, and shows you are truly 'The Square Dealers'."

M. I. F. G., Berks.
"I was delighted with the purchase from you. Usually at these 'cut-price' places, especially transactions by post are a failure. With you they are a certain success."

G. L., Duke Street, Southport.
"I have been recommended to you by my brother-in-law. Not that this was necessary, as I have dealt with you before and was well satisfied."

J. C. Milton, Cambridge.
"Many thanks for those condensers I received from you. You certainly are honest."

J. N., Groathill Road, So. Edinburgh.
"Many thanks for the expedition with which you executed my small order the other day. London would have taken three weeks, and many apologies to do the job!"

F. H., Highfields, Dursley.
"The goods you sent recently were extremely satisfactory and I was pleased with them and you will be interested to know that I worked a W2 (American) station with the first kick from my new TX."

A. H. C., Bellshouston Drive, Mosspark, Glasgow.
"I should like to take this opportunity of thanking you for the remarkably swift service and the consideration shown to my order, and it will be a pleasure to deal with you again."

J. H. D., Leek Road, Norton, Stoke-on-Trent.
"I might add that I am very pleased with the prompt delivery of my order—neatly packed and exact to order. The goods also being new and modern have pleased me very much. Shall recommend you to my friends."

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RADIO CLEARANCE, 280, High Holborn, W.C.1, offer the following stupendous bargains, limited quantities only, all orders over 5/- post free.—'Phone: Holborn 4631.

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RADIO CLEARANCE Makes Special Offer of a Limited quantity S.T.600 Dorchester Kits to Designers' Specification, including Colvern coils, Polar condensers, T.C.C. fixed condensers, R.1 Hypermite transformer, ready drilled panel and terminal strip, list price £5/17; our price, £3/10.

RADIO CLEARANCE.—Dorchester 3-valve service grid, detector, power or pentode battery, chassis including all first-class components, brand new, completely wired; at 30/- each, less valves.

RADIO CLEARANCE.—Earl permanent magnet moving-coil speakers, 7½in. cone, brand new, boxed; list price 29/6; our price 10/11.

RADIO CLEARANCE.—Plessey mains transformers, primary input 200-250 volts, secondaries 350-0-350 at 120 m.a., 4 volts 2½ amps., 4 volts 6½ amps., screened primary, exceptional value; 7/6 each.

RADIO CLEARANCE.—Standard Telephones and Cables mains transformers, shrouded type, for H.T.8 rectifier with 4v. 4 amp. C.T., L.T. winding; exceptional value at 6/- each.

RADIO CLEARANCE.—British Radiophone 3-gang Midget type superhet. condensers, fully screened with trimmers 2 0.0005 sections and 110 kc. oscillator section; 7/6 each.

RADIO CLEARANCE.—British Radiophone 3-gang Midget type straight condensers, fully screened with trimmers, 3 0.0005 sections, 7/6 each.

RADIO CLEARANCE.—British Radiophone 3-gang superhet, condensers, unscreened, 2 0.0005 sections and 110 kc. section, 4/11.

RADIO CLEARANCE.—British Radiophone 110 kcs. intermediate frequency transformers; 3/- each.

RADIO CLEARANCE.—British Radiophone set of band-pass coils, manufacturer's type, with circuit diagram, suitable for tuned grid or tuned anode; set of 3 coils, 4/-.

RADIO CLEARANCE.—British Radiophone set of superhet. coils, manufacturers' type, with circuit diagram, suitable for use with above advertised condenser; 5/6 per set of 3.

RADIO CLEARANCE.—5-pin chassis mounting valve holders; 3d. each.

RADIO CLEARANCE.—British Radiophone volume controls, 10,000 ohm, 25,000 ohm, 50,000 ohm, 200,000 ohm, 500,000 ohm, 1 meg., at 1/6; volume controls, with switch, 1 meg., 1/9.

RADIO CLEARANCE.—8 mfd. dry electrolytics 500v. working, well-known make; 2/6 each.

RADIO CLEARANCE.—8,000 ohms volume controls log type, with Q.M.B. switch, by G.E.C., 2/- each.

RADIO CLEARANCE.—1 watt resistances, well-known make, all sizes; 6d. each.

RADIO CLEARANCE.—1¼mm. white sleeving; 9d. per doz. lengths.

RADIO CLEARANCE.—Telsen 0.0001 and 0.00015 reaction condensers; 5d. each.

RADIO CLEARANCE.—Steel chassis, cadmium plated, drilled ready for use; 4 valve, 1/6 each.

RADIO CLEARANCE.—4 mfd. Post Office Condensers, 250 v. D.C. working; 1/6 each.

RADIO CLEARANCE, 280, High Holborn, W.C.1. 'Phone: Holborn 4631.

UNIVERSITY RADIO.—We have thousands of guaranteed modern second-hand radio parts. From 50% to 75% under list prices. Please call or write stating requirements.—142, Drummond St., N.W.1. Nr. Euston Station (L.M.S.).

SPECIAL easy terms offer on new receivers. We make the highest possible allowance on used wireless goods in exchange for new sets, such as Ekco, Marconi, Ultra, G.E.C., Ferranti, etc. We pay the deposit and the first monthly payments according to the allowance on your goods. You may have nothing to pay for four months. Components and Peto-Scott kits supplied for cash, or in part exchange. Highest allowances. Write to-day.—R. Wigfield, Furlong Road, Goldthorpe, Yorks.

WEEDON P.L.R. Co., SPEAKER and REWINDING SERVICE. Mains transformers, etc. Cones, Coils and Centres fitted all M/C speakers, 5/-. Receiver repairs, including American and Midgets. Trade invited.—Dept. C, 80, Lonsdale Avenue London, E.6. Maryland 1782.

WANTED, good modern wireless parts, sets, eliminators, meters, valves, speakers, etc. Spot cash waiting. Exchanges. Send or bring. We pay more than any other dealer. Open 9-8.—University Radio, 142, Drummond St., Euston, N.W.1.

ADVERTISEMENT INDEX

★ THIS MONTH'S BIG FEATURE

Wonders of the Underground Railway

THERE is a particular fascination about Underground Railways. What, for instance, is the Dead Man's Handle? How can engineers, boring in the bowels of the earth towards each other, be certain that their tunnels will meet? How do escalators and electric signals work? These, and many other most interesting questions, are all answered in "Wonders of the Underground Railway" which appears in the March issue of "Practical Mechanics" now on sale.

Special Contents of the March "PRACTICAL MECHANICS"

- How the Automatic Pistol Works.
- Escaping from the Earth—Inter-Planetary Travel.
- Television for Beginners.
- Marvels of Modern Canals.
- Power of the Tides.
- Making a Scale Model D.H. Gypsy Moth.
- Weighing the Electron.
- A Steam-driven Model Boat.
- A Moderately Priced Three-Valve Wireless Receiver.
- An ABC of Engineering Tools.
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★ THE MARCH

PRACTICAL MECHANICS

M.W.A.7

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Practical and Amateur Wireless

3d. EVERY WEDNESDAY

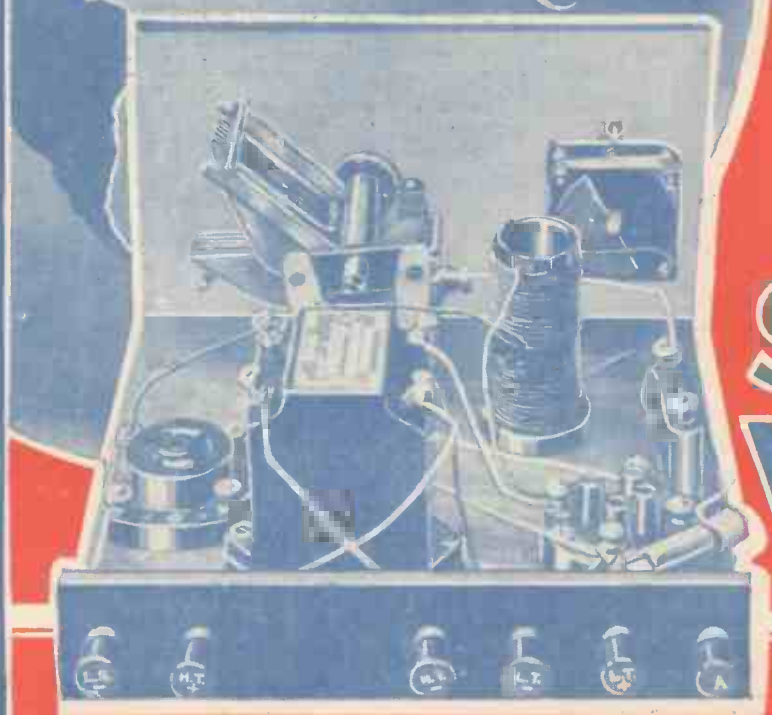
Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 5. No. 130. March 16th, 1935.

AND AMATEUR TELEVISION

The BEGINNER'S Easy-to-Build SHORT WAVER



BUILDING THE HALL-MARK CADET!

See Page 942

Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff: W. J. Delaney, H. J. Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.

VOL. V. No. 130. March 16th, 1935.

ROUND *the* WORLD *of* WIRELESS

Listen to South America

CONDITIONS have been exceptionally favourable for the reception of South American stations, and in particular transmitters from the Argentine Republic. Try between midnight and 1 a.m. for the following, situated in and around Buenos Aires: Radio del Pueblo (LS6), 222.2 metres; Radio Stentor (LS8), 243.9 metres; Radio Prieto (LS2), 252.1 metres; Radio Paris (LR8), 260.9 metres; Radio Splendid (LR4), 303 metres; Radio Belgrano (LR3), 315.8 metres; Radio Argentina (LR2), 329.7 metres; La Nacion (LR6) 344.8 metres, and Excelsior (LR5), 361.4 metres. The last station as an interval signal uses three musical notes somewhat similar to those broadcast by the N.B.C. Radio Splendid may be identified by its two chords on a vibraphone. Most announcements from Buenos Aires are made in both Spanish and English.

Is this a Record?

ACCORDING to recent statistics there are now twenty million wireless receivers in the United States of America. Of this number one and a half million are installed in automobiles. The total figure shows an increase of over two million radio sets over the preceding year.

A Belated Children's Hour

APPARENTLY in Portugal, the household nursery is still wide awake at 9 p.m. G.M.T., for the Parede station features at that hour a special half-hour's broadcast for the youngsters. Part of the time is devoted to calling up naughty children to whom a wicked uncle addresses a few words. Seemingly, remonstrance *via* ether is more effective than the homely slipper.

Late (Mid)night Special

IN order to give listeners dwelling in the more remote parts of Hungary a late summary of the day's news, Budapest broadcasts a special bulletin daily at midnight local time (G.M.T. 23.00) as a fitting end to the radio entertainments.

Prague's Second Station

TO provide an alternative programme, the Prague studio broadcasts on 249.2 metres (1,204 kc/s) with a power of 5 kilowatts. The interval signal is a different one from that used by the main transmitter and consists of the first bar of the Sokol March, a phrase of six notes, repeated at intervals.

Norway's Seven-year Plan

THE Norwegian Government is planning a thorough reorganisation of its broadcasting system which may be completed within seven years. To give the country an adequate service it will be necessary to install nine main transmitters and ten relays in addition to which the network will include one powerful short-wave station. Geographical conditions are such that of the nineteen transmitters, twelve or thirteen must work on channels *above* 300 metres. The scheme includes stations at Oslo, Stavanger, Vigra (Aalesund), Bodo, Finmark, Bergen, Trondelag (Trondheim), Tromso, and Flekkeroj (Kristiansand), with relays at Rjukan, Hammerfest, Narvik, Frederiksstad, Tromso, Hamar, Vega, Notodden, Progrunn, and Kristiansund. In order to cut down expenses the power of the present Oslo transmitter will remain at 60 kilowatts, but a small regional transmitter will be built in the capital to provide an alternative programme. Flekkeroj (Kristiansand) and Bergen will both possess 20 kilowatt stations, and although Norway was only allotted one "long-wave" channel, the latter station will take another wavelength between 1,000 and 2,000 metres. At Lamberseter, near Oslo, work is to be started shortly on a 25 kilowatt short-waver.

Calling All Cars!

ON and around 150 metres, if your receiver will tune down to these channels, you may hear a number of police transmissions. The calls consist of three letters of which, in the majority of cases, the prefix is GT, such as GTM, Liverpool, GTN, Brighton, GTT, Newcastle-on-Tyne, and so on.

Kosice (Czecho-Slovakia) on Higher Power

TO counteract the broadcasts of the Nyiregyhaza (Hungary) broadcasts to the Magyar-speaking communities on the Czech border, work has begun on the reconstruction of the Kosice station; by the late spring it should be working on 10 kilowatts.

Radio in Iran

IN view of the popularity achieved by broadcasting in the Ottoman Republic, the "Persian" Government is considering proposals to effect a similar service at Teheran, Schiraz, and possibly at another important centre of the country. (Iran is now the official name adopted by Persia.)

Radio in Paris Streets

PARISIANS are complaining that the "noise level" of their streets has been raised by the introduction of taxicabs equipped with radio receivers. Several of them are already plying for hire and within the next few weeks arrangements have been made for three hundred to be put into service.

ROUND the WORLD of WIRELESS (Continued)

Accordion Music from Blackpool

NORTHERN listeners will hear Emile Zigano's Apache Accordion Orchestra and Jack Herbert and Cyril Hutton (comedians) in the variety excerpt which is to be relayed from the Palace Theatre, Blackpool, on March 15th.

"Quayside Nights"

THIS is the title of a new series of programmes dealing with ports in the West. The first of these nights will be given on March 20th, and will take the form of a visit to Bristol's docks, arranged by Ewart S. Brookes, who was responsible for the series of programmes entitled "Cargoes" broadcast last year.

"Workaday World"

THE eighth talk in the series "Workaday World" is entitled "Pros and Cons," and will be given on March 20th for listeners in the West by H. A. Marquand.

Symphony Concert from Birmingham

THE City of Birmingham Orchestra's Symphony Concert will be relayed from Birmingham Town Hall on March 21st. The symphony is Beethoven's No. 6 (The Pastoral). Lisa Minghetti is the violinist for the Brahms Concerto in D. Leslie Heward is the conductor.

Broadcast from the White City

ON March 23rd the Outside Broadcast Department of the B.B.C. has arranged to broadcast from the White City at 4.15 a running commentary by H. M. Abrahams, the famous Oxford 100yds. sprinter. He will describe the last two events of the Varsity Sports, the "Mile" and "Quarter Mile." This will be good news to the many athletes scattered all over the country who cannot attend the White City.

The B.B.C. Empire Orchestra

THIS recently-formed orchestra, which has been broadcasting regularly from the Empire Station at Daventry since last December, will make its début in home programmes on March 15th. On that date listeners to the Regional programme will hear a concert by the B.B.C. Empire Orchestra, which will simultaneously be broadcast in Transmission 4 of Empire programmes. This is primarily intended for reception in East and South Africa and Mediterranean countries. It is receivable by listeners whose local time is within a few hours of Greenwich time.

The Regional "Pool"

MIDLAND contributions to the Regional "pool" on March 22nd include a symphony concert by the B.B.C. Midland Orchestra, which gives the Brahms and Elgar Variations, Leslie Heward conducting.

"Merry-go-Round"

A REVUE entitled "Merry-go-Round," by Herbert Sidney and Ernie Gower, is to be produced by Martyn C. Webster on March 23rd. It had its first appearance when Mr. Webster was producer at the Glasgow station; and Ernie Gower, who composed the music, was pianist with the "Radioptimists" concert party there. The chief characters in the revue are a millionaire, who becomes a chorus boy at a theatre, and his bride, who takes a good deal of convincing that this is a sound idea.

INTERESTING and TOPICAL PARAGRAPHS

Relay from Theatre Royal, Lincoln

ON March 22nd the first relay will be given from the Theatre Royal, Lincoln. This is an independent theatre, which serves a large area in the East Midlands. Listeners will hear a variety bill.

"Off the Beaten Track"

ON March 21st J. E. Cowper presents one of his "Off the Beaten Track" programmes of gramophone records. It is to consist of Portuguese Fados and Folk Songs from Palestine.

B.B.C. Variety "Drive"

THE B.B.C. is to make a variety "drive" during the coming spring season and Jubilee festivities which will place the B.B.C. variety hours among the highest peaks of broadcast entertainment. The groundwork has already begun, and John Watt, showman of "Songs from the Films," who has discovered many "stars" for radio, is reviewing artists who can supply suitable material themselves and those who are adaptable to variety work if supplied with the right kind of material. A new territory was tapped when several artists were introduced direct from the sets of film-producing companies. It has now been arranged with various executives in the film studios to report the names of artists who may be suitable for broadcasting.

FERRANTI RADIO HUSTLE

The popularity of the new Ferranti AC/DC receivers is evidenced by the display of activity seen in the above illustration, which shows a large batch of cabinets in the Hollinwood Factory being delivered from the cabinet-making shop to the receiver-assembly department.

Van Dieren's "Chinese Symphony"

MARCH 15th is an important musical broadcast date, as for its first performance Constant Lambert is conducting the London Symphony Orchestra in Van Dieren's "Chinese Symphony." In a talk with Constant Lambert he described the work as one for orchestra, chorus and five soloists. It plays, he said, without a break for forty-five minutes. The symphony is based on a translation from the Chinese by Hans Bethge. In this broadcast the words will be sung in English. This, Constant Lambert added, is probably Van Dieren's most complicated work. It was composed in 1913, and is definitely not Oriental, but could be described as the opposite to what might be termed a "chinoise" composition.

Plethora of Spanish 100 Watters

PENDING the reorganisation of the Spanish broadcasting system for which plans have already been drawn up, the country has been sprinkled with over fifty private 100-watt transmitters for the broadcast of local programmes. The majority of these stations are working on a common channel, namely, 201.1 metres (1,492 kilocycles). Although their power is low, reception of some of these transmissions, in particular from those situated near the Franco-Spanish border, is reported in the British Isles.

SOLVE THIS!

PROBLEM No. 130.

The signals from Barker's S.G., detector and pentode receiver were very good and a fair number of stations were heard at loudspeaker strength. Unfortunately, some of the foreign stations which he particularly wished to hear were not quite loud enough and he therefore decided to fit an extra L.F. amplifying stage. This was built on a separate baseboard and consisted of a 3 to 1 transformer and a 4-pin valveholder. It was connected to his existing set, bias was applied to the valve in the correct manner, as also was the H.T. He fitted a super-power valve in the socket but found that in addition to severe distortion, no increase in volume was obtained on many stations. Why was this? Three books will be awarded for the first three correct solutions opened. Mark your envelopes Problem No. 130 and address them to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received not later than the first post Monday, March 18th.

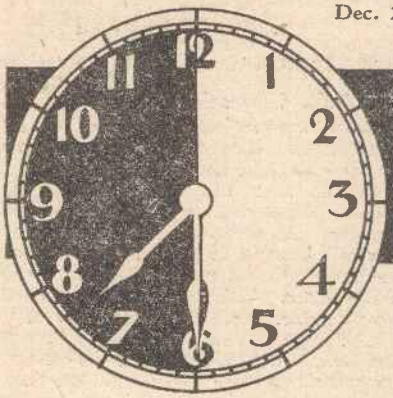
Solution to Problem No. 129.

When Rawlins connected his spare speaker *without* transformer across his remaining speaker he was, of course, short-circuiting the latter, owing to the low resistance of the speaker without transformer.

The first three correct solutions opened in respect of Problem No. 128 were from the undermentioned readers, and books are being forwarded to them:—

R. T. Lewis, 74, Green Way, Maidstone, Kent.
G. Milton, 18, Nield Road, Denton, Manchester.
F. Oliver, 36, Wenallt Road, Abernant, Aberdare, Glam.

Previous articles in this series appeared in issues dated Dec. 15th, Dec. 22nd, Dec. 29th, Jan. 5th, Jan. 12th, Jan. 19th, Jan. 26th, Feb. 2nd, Feb. 9th, Feb. 16th, Feb. 23rd, March 2nd, and March 9th.



Half-Hour Experiments

Following the Experiments described last week, those detailed below are in connection with the Modification of a Normal Superhet for All-wave Reception.

By FRANK PRESTON

IN the last article of this series the question of converting an ordinary broadcast receiver was discussed, and methods of carrying out the modification in simple cases were described. The subject was by no means exhausted, however, since the modification of a superhet for all-wave reception was not considered at all. In many respects, however, the superhet lends itself to the alteration more readily than does a "straight" receiver of average type. The reason for this is that a considerable amount of amplification can be carried out at intermediate frequency, although normal high-frequency amplification on short waves is practically impossible.

The Simplest System

Where the superhet is of a comparatively old type and employs separate tuning condensers for the aerial and oscillator circuits it is possible to devise a switching system similar to that described last week for bringing short-wave coils into circuit in place of those which cover the broadcast bands, but great care must be taken to ensure that the coils are adequately screened; for this reason it is better to employ short-wave coils of the pattern described in the issue of PRACTICAL WIRELESS dated December 23rd, 1933, under the title of "Making Your Own Screened Coils." The general arrangement of the modified circuit for all-wave tuning will then we as shown in Fig. 1, where the coil number connections are those given in the article just referred to.

This system is by no means ideal, due to the fact that, as pointed out last week, it is a very difficult matter to tune two short-wave circuits simultaneously. When the idea is tried out, however, it will generally be found that the tuning of the aerial circuit is not very critical, so that stations can be tuned in first of all on the oscillator condenser, after which the aerial tuner can be brought into "line."

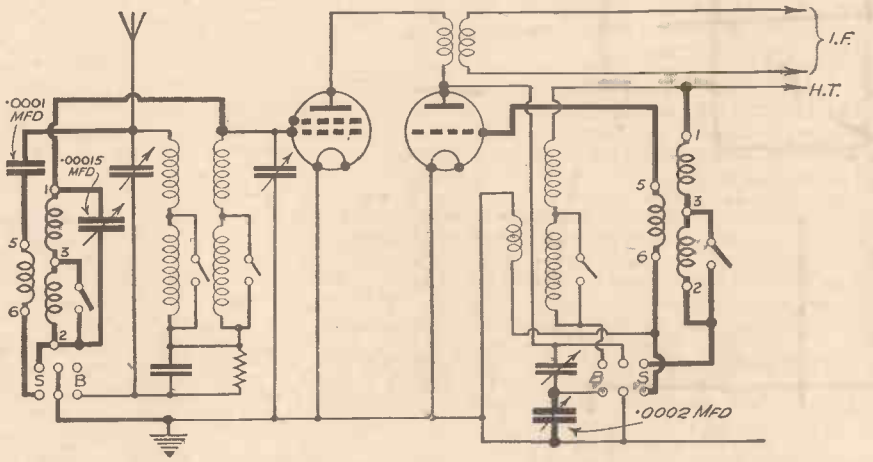


Fig. 1.—A skeleton circuit, showing how short-wave coils and waveband switches can be added to a superhet with separate first-detector and oscillator valves to permit of all-wave tuning. The short-wave circuits are shown by heavier lines for clarity.

The Intermediate Frequency

There is another objection to this circuit arrangement, which is that the frequency of the intermediate-frequency amplifier is generally rather low for use on the short waves, where 465 kc/s is better than the customary (for broadcast bands) 110 kc/s. There is no simple method of overcoming this difficulty, and so the lower frequency must be employed. It is not intended to imply that 110 kc/s will not prove reasonably satisfactory—it will on wavelengths down to 19 metres or so, and sometimes on even lower wavelengths than this.

A Separate Short-wave Frequency Changer

A better method than that dealt with above, and one that is used by a number of manufacturers of all-wave superheterodynes, is to employ a separate short-wave first-detector-oscillator which may be switched into circuit to replace the corresponding portion of the circuit which is used for the broadcast bands. The separate unit is actually a short-wave converter such as is often used in conjunction with a "straight" receiver of the H.F.-det.-L.F. type, the difference being that it is arranged so that it can be switched in quite easily, the converter being, in fact, part of the complete receiver.

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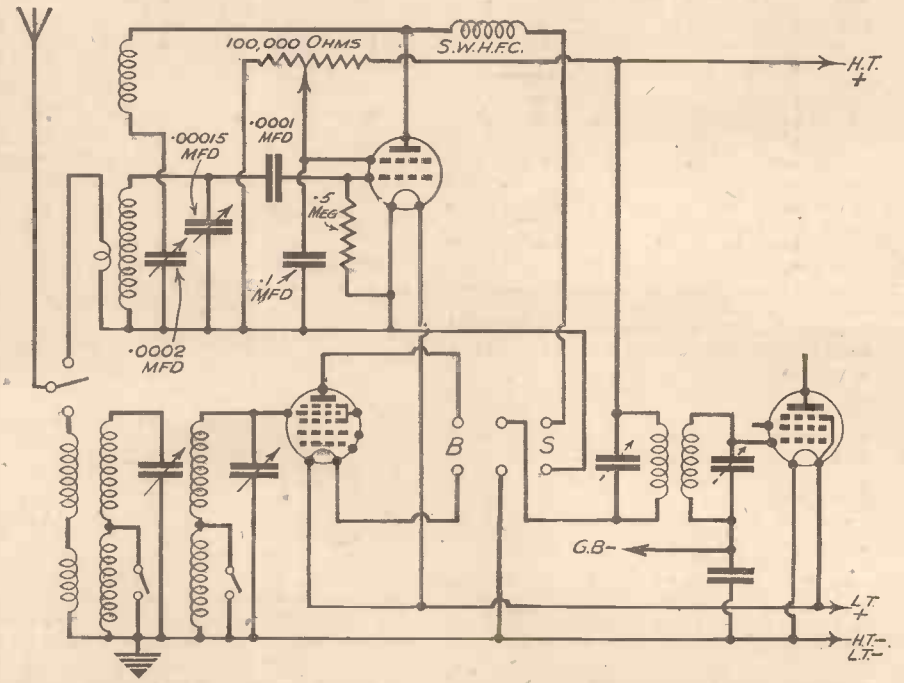


Fig. 2.—Showing how a short-wave converter can be used in conjunction with a modern superhet, a switch causing the broadcast frequency changer to be replaced by the short-wave unit.

(Continued from previous page)

In the case of a battery set the switching arrangement is perfectly simple and is as shown in Fig. 2. In this circuit the frequency-changing and intermediate-amplifying circuits are shown in skeleton form only, since they will vary according to the particular receiver with which the experiments are being carried out. The circuit of the short-wave converter is shown complete, and it will be seen that this follows standard practice in every respect. A screen-grid or H.F. pentode valve is employed as an autodyne frequency changer, and this has a short-wave high-frequency choke connected in its anode circuit. When the two-pole change-over switch is turned to the short-wave position the primary winding of the I.F. transformer is joined in series between the short-wave choke and high-tension positive, and thus completes the anode circuit of the autodyne valve.

Transferring the L.T. Connections

The other pole of the change-over switch is used for breaking the L.T. lead to either of the frequency-changing valves and completing the circuit to the other one. Thus, when the switch is set for normal broadcast reception, both the H.T. and L.T. circuits of the S.G. valve used in the converter are broken; when short-wave reception is being carried out the corresponding circuits of the pentagrid (or whatever valve or combination of valves is used in the original receiver) are broken.

In Fig. 2 a second switch is also shown for transferring the aerial from the broadcast coil to that used for short waves. If this switch is employed, care must be taken to see that the leads to it are short and direct, but the switch can well be dispensed with by fitting two sockets for the two aerial connections and providing the lead-in wire with a plug which can be transferred from one to the other. Alternatively, it might often be better to use separate aerials for short-wave and broadcast reception, in which case it may be found that both can be left connected to their respective terminals regardless of the waveband in use.

Making the Converter

A few notes regarding the short-wave converter may prove helpful to the less-experienced constructor, although the details will be obvious to those with previous experience of short-wave work. In the first place it should be explained that the tuner may be exactly as described last week, or it may be of any other type—some readers will no doubt prefer to employ a tuner of the type which covers various short-wave ranges and fitted with a multiple wave-change switch. It will be evident that the tuning and reaction condensers are entirely separate from those used in the original receiver, and that they are used only when short-wave reception is desired, during which time the broadcast tuning condensers need not be touched at all. Suitable values for the condensers, as well as for the other components, are indicated on the circuit. The purpose of the 100,000-ohm potentiometer is to adjust the screening-grid voltage to the most suitable figure, and this will also be found very useful for securing a fine variation in reaction coupling.

All the parts for the converter should be mounted on a small metal chassis, and it is desirable that the whole should be enclosed by a screening box to prevent interaction with the rest of the receiver. The converter can then be fitted into the same cabinet as the original set, the controls being arranged in some convenient position and away from the others.

For A.C. Operation

When the superhet receiver is A.C. operated the connections will be almost the same as those shown in Fig. 2, with the exception that the cathode leads will replace those shown for the common negative. A second single-pole change-over switch may also be used for transferring the heater-current supply from one valve to the other. This switch, as well as the two-pole one, should preferably be of the Q.M.B. type. Where separate valves are used for first detection and for the oscillator it will be best to arrange that the heater of the oscillator remains in circuit so that the load on the L.T. winding of the mains transformer remains constant regardless of the wavelength to which the set is tuned. There will almost certainly be a slight variation in H.T. current consumption when the switch is turned from one waveband to another, but it is unlikely that this will be sufficient to alter the anode voltages to any appreciable extent.

It is just possible that, in some cases, the oscillator, remaining in circuit, will cause interference at certain settings of the tuning condenser, but this can generally be avoided by giving a movement to the knob of the broadcast tuning condenser, or by improving the screening of the converter.

Readers are asked to note that the modifications described have, of necessity, been of a general nature and may call for slight amendment in certain cases. They will, nevertheless, provide the experimenter with material for interesting experiment.

BRINGING YOUR LOUD-SPEAKER TO LIFE

A Simple Experiment for Obtaining Realistic Reproduction

TO obtain the realistic effect, or a sense of solidity and movement of sound issuing from your loud-speaker, just as one would experience if facing the orchestra at the broadcasting studio, is at present impossible.

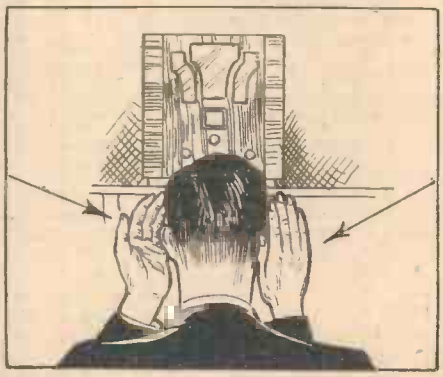
It is, no doubt, within reason to get natural results, using two transmitters and receivers together with two earphones, not forgetting the two microphones side by side facing the orchestra or item to be broadcast. The microphones, of course, represent the ears of the listener. This double channel transmission, as it is called, is found to be expensive and altogether out of the question, especially as television takes first place in utilising any twin transmission.

Steriophonic Effect

However, a very interesting substitute, or artificial steriophonic sensation, can be experienced by the listener, wherein the sound issuing from the loud-speaker is made to appear as if it comes from the various parts of the room, as is the effect when one is listening direct to a concert or play. This effect is controlled by the listener. Although with the method to be described it is difficult to separate, and place each instrument of an orchestra, which is, of course, possible when one is actually listening in front of the performers, good results can be obtained of a band marching past, or a conversation between two people when broadcast.

Manipulation of Hands

It will be thought that to do all this some elaborate apparatus would be required, but this is not the case. On the contrary, all the listener needs is his own hands! The listener manipulates his hands, first as shown in the accompanying illustration and then in the reverse position.



A simple method of obtaining a stereophonic effect from a loud-speaker.

Facing the loud-speaker, the two hands are brought into position, one immediately in front of the left ear and the other behind the right ear, held closely in contact with the head, thus making cups round the ears. The position of the loud-speaker or source of sound will then be found to move right or left as the hands are manipulated. By reversing the hands—just twisting the hands round from the wrist, and without moving them from the head—the sound travels right across the room. It can easily be seen, therefore, that by this simple means, two people, broadcasting, can be made to speak from opposite sides of the room. Move the hands as each speaker takes his or her turn, and the conversation will become infinitely more realistic.

The reason of this phenomenon is not just the fact of the hands acting as an ear-trumpet would, but to the fact that the sound waves are put out of phase on reception by the ears, owing to the position of the hands. The ear with the hand in front of it receives a sound wave slightly after the time at which the other ear with the hand behind receives it.

This minute difference in the arrival of the wave is summed up mentally to indicate the position or source of the sound. No doubt this sense of steriophony is brought about from continual practice from infancy of the coupling together of sight and hearing. A simple example of this "sense" is that a person in a completely darkened room can, almost infallibly, tell the spot from which a voice comes, or any other sound, without being able to see and without moving the head. This example, too, goes to show that reception from a loud-speaker in the ordinary way cannot be quite perfect, as all the sounds emanate from one position, thus differing completely from actuality.

The Pick-up and Instability

Various Forms of Instability and Hum may be Introduced when a Gramophone Pick-up is Used, and the Reasons and Cures are Given Here

By W. J. DELANEY

PRACTICALLY every modern commercial receiver is fitted with pick-up terminals, and it will generally be found that the connection of the pick-up to these receivers introduces no ill-effects. On the other hand, users of rather old commercial receivers often wish to use a pick-up, and therefore modify the receiver (either by fitting pick-up terminals or by the use of an adaptor), and find that the performance of the receiver is marred, and

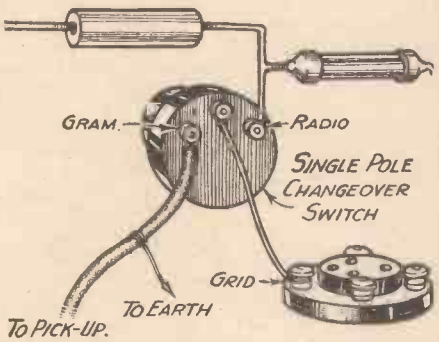


Fig. 1.—A change-over switch to control the pick-up. Note where the screening is employed.

in some cases the pick-up cannnot be used, simply because serious hum or whistling is introduced. This very often happens also in the case of a home-constructed receiver, even although a published constructional design is being faithfully followed and provision has been made for the use of record reproduction.

Why the Pick-up is Troublesome

The pick-up is joined, in practically every receiver, to the most vital lead in the set, namely, the grid lead of the detector valve. You have only to place a finger on this point in any receiver to cause a violent hum or howl, and it is therefore obvious that the connection of a long lead to this point will generally result in some sort of trouble. As a rule a change-over switch will be fitted, and, in the radio position, the pick-up will be out of circuit (Fig. 1). In this case, our troubles will be confined to record reproduction only, and no ill-effects will result on radio. On the other hand, if no switch is provided, or if one of the arrangements shown in Fig. 2 is in use, there will be one lead always joined to the grid, and this may cause trouble when radio reception is required. In general, it will be found undesirable to screen this lead, as the introduction of the capacity between the grid and the earthed screening might result not only in instability, but also in loss of signal strength. On the other hand, one side of the pick-up (or pick-up and switch circuit) is joined to earth—direct in the case of most mains receivers, and through a grid battery in battery-operated receivers, and, therefore, no ill-effects will result from an earthed and screened lead at this point.

The pick-up may also introduce trouble on account of induction from a gramophone motor, by induction with one or more L.F. components in the receiver, or even, in remote cases, by induction from a speaker field or speech coil. We must, therefore, deal with these points in order, and we will imagine that a receiver is in use in which serious hum or instability is taking place.

Tracing the Cause

The first thing to do is to ascertain the exact cause, and this is not a difficult task. First, entirely disconnect the leads to the gramophone motor, and then remove the pick-up and any associated leads from the receiver, disconnecting them, if possible, at the point where they make contact with the actual receiver wiring. Now try the set on radio if whistling has been present, and it should be found that it is now absent. Similarly, any hum which was previously obtained, and which disappears when the leads are removed, will obviously be traced to the pick-up circuit. Now with a thick piece of wire short-circuit the pick-up terminals, or the points to which the pick-up wiring was joined, and switch the set on to the gramo. position. *It should be perfectly quiet.* Any form of trouble which arises with this connection is due to a faulty receiver, and the usual steps should be taken to effect a cure. As this article is concerned with the pick-up circuit, the usual causes and cures of L.F. troubles are not given.

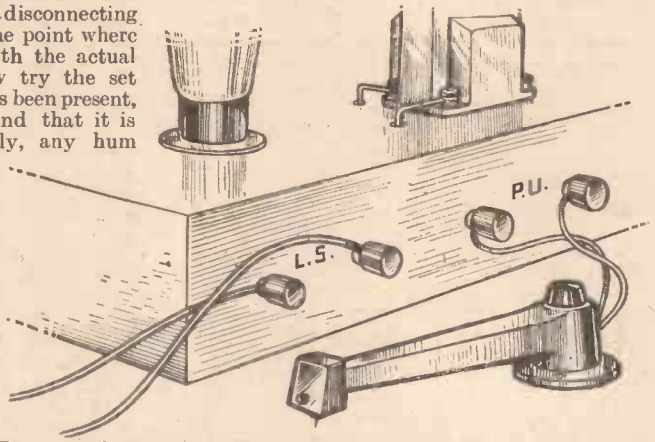


Fig. 3.—The first step in tracing the cause of trouble is to join the pick-up direct to the P.U. terminals, excluding all long (and screened) leads and switches, etc.

Assuming, therefore, that the receiver is quite in order, and that perfect quiet is obtained with the pick-up terminals short-circuited, we may now join the two leads of the pick-up itself (without any form of switching or long leads) direct to the pick-up terminals (Fig. 3). Again, the set should be perfectly quiet.

If in this position hum is introduced, remove the pick-up and carefully test the two leads for continuity. The usual battery and 'phones may be used, or a sensitive meter and a small voltage. If a volume-control is built into the pick-up mount, this should be tested for a break or leak to the casing. If the pick-up is quite in order, no hum should be introduced when it is connected directly as just mentioned, and, therefore, we may replace the usual leads, which are generally of some length in order to enable the pick-up to be mounted on the motor-board, or to enable a switch to be mounted on the panel. If, on replacing these leads hum is introduced, then there will be one or two reasons for it. Either the leads themselves are causing trouble, or the coils inside the pick-up are coupling with some component. To eliminate the latter possibility, disconnect the two leads at the pick-up head (which is usually fairly simple and generally only necessitates the removal of the cover, or the unscrewing of the head) and join the two leads together. If hum continues, the leads are at fault, whilst if it ceases, the magnet windings are the cause.

Inductive Coupling

In the latter case the simplest method of finding the component which is coupling and causing the hum is to replace the pick-up and, with the mounting unscrewed from the board, but leaving the same length of wiring, to place the pick-up near the receiver and move it about near various coils, etc. In this way it will be found that the hum is greatly strengthened when nearer to the component causing the trouble, whilst when well removed from it, the hum is weakened or ceases entirely. To effect a cure, the component itself must be screened, and in this connection it must be remembered that we are dealing with L.F. and, therefore, iron must be used

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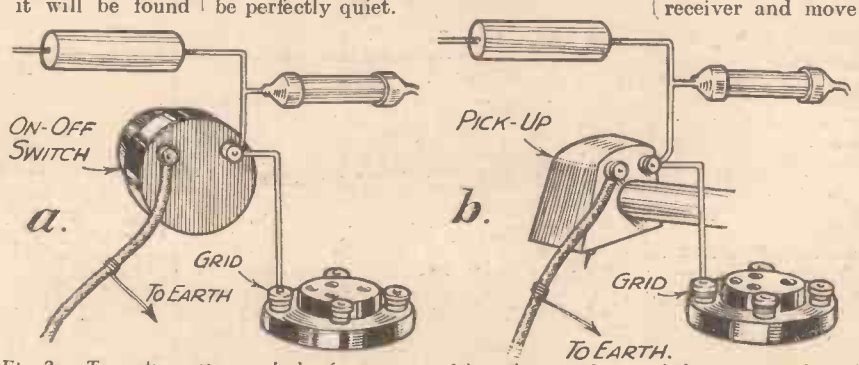


Fig. 2.—Two alternative methods of connection, (a) with a simple on-off shorting switch, and (b) without any switch at all. With this latter connection it is necessary to detune the radio circuits when record reproduction is required.

The Pick-up and Instability

(Continued from previous page)

for screening, not copper or aluminium. In general a transformer or L.F. choke will be found at the root of the trouble and, therefore, the screening will in no way affect the radio performance of the receiver.

Arranging the Leads

If the leads are causing the trouble, it may be advisable to alter the method of wiring the circuit so as to agree with Fig. 4. It will be seen that the lead from the grid should go direct to the switch, preferably without screening, and the pick-up should then be wired to the switch, and to earth. Screen the leads from the pick-up as shown in this sketch, and make quite certain that a good earth connection is made to the screening. Furthermore, earth the pick-up casing and carrier arm (if of metal).

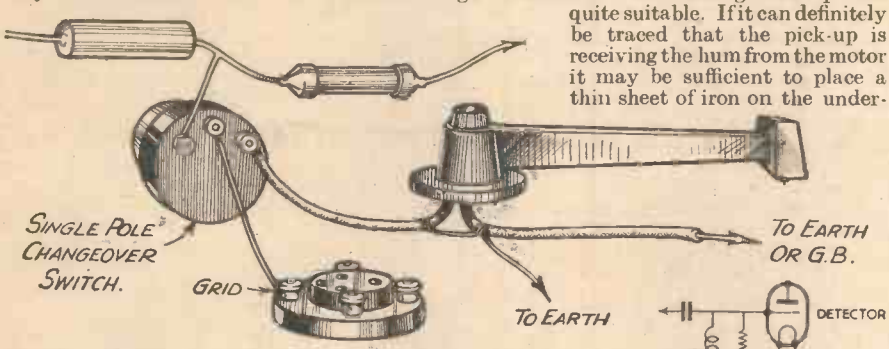


Fig. 4.—The correct way of arranging the pick-up and switch. Note that, as a general rule, screening should be confined to the pick-up lead only, the grid connection, being unscreened, as screening here will be part of the radio circuit and may thus cause other troubles.

If at this stage, that is, with the pick-up in its correct position, and all wiring complete, no hum is introduced, we may connect up the motor. If hum now arises, even with the motor switched off, then the actual leads to the motor are responsible, and the ordinary *lead* cased electric cable should be employed for this part of the wiring. Earth the lead covering, but take care regarding short-circuits.

With no hum at this point, the motor should be switched on, and the introduction of the trouble will thus be directly traceable to the motor itself. In the case of the ordinary type of motor, the only cure will be to screen it entirely, and again we must remember that iron must be used. Precautions regarding short-circuits must again be taken, and to facilitate the construction of the screening box, the thinnest sheet iron may be employed. Fine mesh galvanised-iron wire netting often proves quite suitable. If it can definitely be traced that the pick-up is receiving the hum from the motor it may be sufficient to place a thin sheet of iron on the underside of the motor board, but if the motor is introducing the hum to the components in the receiver, then the complete box will be required.

With the synchronous type of motor, if hum is induced from this to the pick-up, the simplest cure will be to place a disc of thin sheet iron (of the same dimensions as justify the felt disc) on the turntable, with a disc of felt glued to it. It will not be difficult to trace whether hum is induced from a turntable of this type, as it will probably be found that by holding the pick-up and swinging it from the position coinciding with the beginning of a record towards the centre, the hum will be found to vary as the angle of the pick-up varies. The Columbia pick-up is provided with a special coil to avoid this type of hum, but the iron disc will be found quite satisfactory with the ordinary type of pick-up.

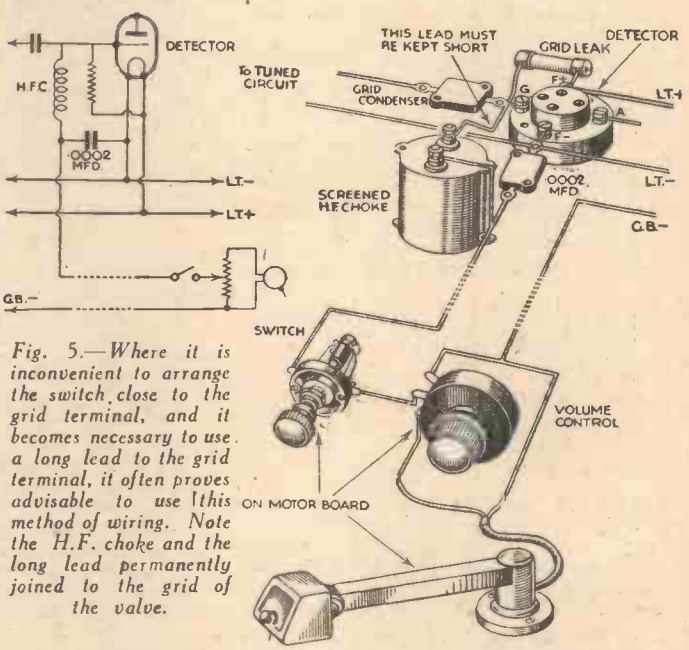


Fig. 5.—Where it is inconvenient to arrange the switch close to the grid terminal, and it becomes necessary to use a long lead to the grid terminal, it often proves advisable to use this method of wiring. Note the H.F. choke and the long lead permanently joined to the grid of the valve.

Finally, it may often be found necessary to include an H.F. choke in the pick-up circuit as shown in Fig. 5. This, of course, is only necessary where H.F. instability is caused by the introduction of the pick-up leads, and this is a certain cure for whistling when a pick-up is used. As will be seen from the illustration, the lead to the switch may be quite long, and no break to the actual grid need be included. Where it is found necessary for some reason to use the switch on the motor board, or at some distance, this method should be adopted.

HERE AND THERE

Munich's New Relays

FOLLOWING the closing down of Augsburg, the German *Reichsrundfunk* has decided to open two further relays in Eastern Bavaria; the stations will work on a channel common to Nurnberg.

Ever Heard of Sortavala?

IT is a small 200-watt Finnish relay taking the Helsinki programmes on 400.5 metres in common with a 500-watter, Pori. But Sortavala in Eastern Finland is required to give a broadcasting service to a large area and will be provided this year with a 20-kilowatt station operating on an exclusive channel. The new Lahti transmitter which is being built will be one of the most powerful in Europe, namely, 220 kilowatts. Contrary to the custom which has hitherto prevailed, when completed it will only broadcast in the Finnish language.

French High-power Stations Soon on the Air

THE new Lyons-Tramoyes 90-kilowatt station may be ready at the end of April when it is anticipated Toulouse-Muret (120 kilowatts) and Little-Camphin (60 kilowatts) may also start testing. Nice-La Brague (60 kilowatts) will follow in June, and Marseilles-Realtor (100 kilowatts) in September. It is not expected that the Rennes-Thourie (120 kilowatts) station will be ready before the end of 1935. Paris P.T.T. (120 kilowatts) as regional transmitter, is down for its official opening in June. Bordeaux-Lafayette and Strasbourg-Brumath will be raised to 100 kilowatts during 1935, and next year France proposes to erect a new 100-kilowatt station at Limoges.

Heilsberg Temporarily Signs Off

WITH a view to a complete overhaul and reconstruction of the plant, the Heilsberg station will remain closed until approximately the end of March, when it will re-open as a 100-kilowatter. It is also to be equipped with an anti-fading aerial system.

Radio Sao Paulo

A TEN-KILOWATT broadcasting station has been installed on the summit of Mount Sumare, overlooking the city of Sao Paulo (Brazil). It is the first of a number of powerful transmitters to be erected in that country.

Cable and Wireless Limited

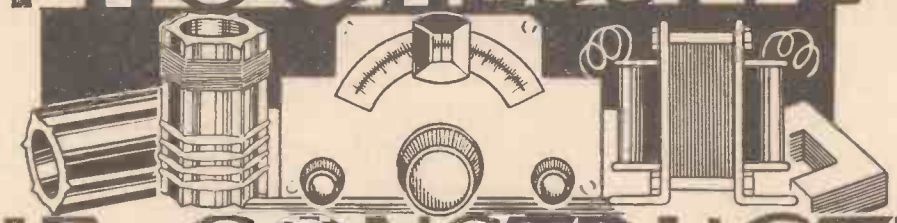
AN important change in the administration of Cable and Wireless Limited was announced recently by the appointment of Mr. Edward Wilshaw, J.P., F.C.I.S., as joint managing-director. The appointment comes as a climax to the recent far-reaching managerial changes, and will be welcomed in the City as well as throughout the Company.

Mr. Wilshaw brings to his new appointment over forty years' experience of the science of communications in general, and cable working in particular. For thirty-five years he was closely associated with the old Eastern Telegraph Company (now merged into Cable and Wireless Limited), and in the later years of that company he acted as general manager and secretary. After the merger and the formation of Cable and Wireless Limited, he was appointed chief general manager and a director. His knowledge of cable and wireless communications in its many aspects is probably unrivalled. Among the many qualifications to his new appointment is his close association with the City.

His joint managing-directors are Mr. J. C. Denison-Pender, chairman of the Company, and Wing-Commander Sir Norman Leslie, Bart., C.M.G., C.B.E.

Previous articles in this series were published in the issues for Jan. 26th, Feb. 2nd, Feb. 9th, Feb. 16th, Mar. 2nd, and Mar. 9th.

PROGRESSIVE HOME CONSTRUCTION



The subjects already dealt with include Home-made Components, Making an L.F. Transformer, a Single-valver, an H.T. Battery Eliminator, and an H.T. Rectifier.

This Week the Experimenters Describe the Construction of an H.F. Amplifier using a Number of Home-made Components, for which Full Details are Given

by The Experimenters

IN the last two articles we have devoted our attention to the construction of an H.T.-battery eliminator, so we had better now return to the receiver itself. Up to now we have dealt with the construction of a single-valve receiver and of a simple L.F. amplifier, in both instances using home-made components. From our

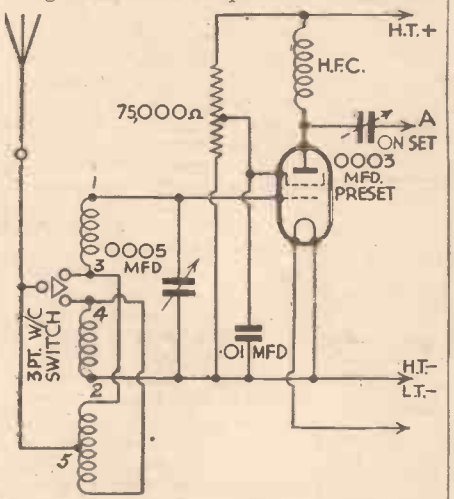


Fig. 1.—The circuit of the H.F. amplifier unit for which constructional details are given.

correspondence we have been very pleased indeed to learn how popular our new series (which commenced in the issue of PRACTICAL AND AMATEUR WIRELESS dated January 26th) has become, and to know that readers of our weekly articles have not experienced any difficulty in following the constructional details. A few readers, however, have written to ask where they could buy the wire and ribbed former for the tuning coil, whilst one or two have asked how the diameter of the former is measured—outside the ribs, outside the cylindrical portion, or inside the tube. We have replied to these queries by post, but it might be well to repeat the information here, especially as the parts in question will be required again for the constructional work to be described this week. In the first place, we would say that the materials should be obtainable from any good local dealer, but in case of difficulty they are certainly obtainable, along with any other parts, from the Peto-Scott Co., whose address will be found in the advertisement pages. With regard to the diameter of the former, this is always measured *outside* the ribs. It is evident that this should be so when it is pointed out that the number of turns is based upon the diameter of the coil, which is wound over the ribs.

Simple S.G. Circuit

And now for further constructional work. Following the sequence of valve stages, we now come to the high-frequency amplifier, a circuit for which is given in Fig. 1. It will be seen that this is of the simplest possible type, employing a screen-grid valve and a coil almost identical with that used for the single-valver, and which was described in our first article in this series; the only difference is that we do not require the reaction winding in the present instance. Nevertheless, the reaction winding can be included, even though it is not required, so that the coil may later be used in practically any other circuit arrangement.

Components Required

It is not necessary to repeat the details of construction here, but these are illustrated in Fig. 2 to save readers the trouble of referring to the previous issue. The other components required are the 3-point wave-change switch, tuning con-

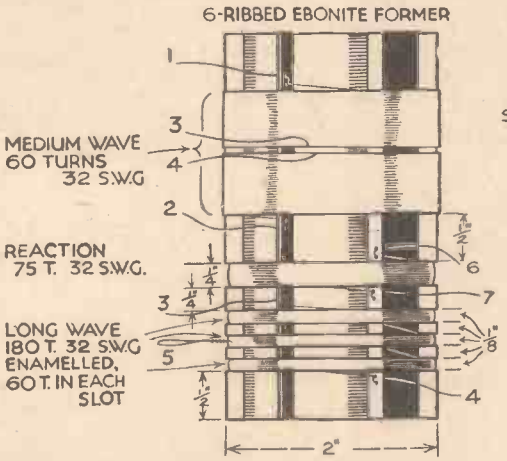


Fig. 2.—This drawing, reproduced from a previous article of this series, gives constructional details of the coil employed for the H.F. amplifier.

denser, .01-mfd. non-inductive fixed condenser, high-frequency choke, 75,000-ohm potentiometer, 4-pin valve-holder and a pre-set condenser (if this was not made previously). Of these it will be most convenient to obtain the tuning condenser and valve-holder ready made, whilst many readers will probably

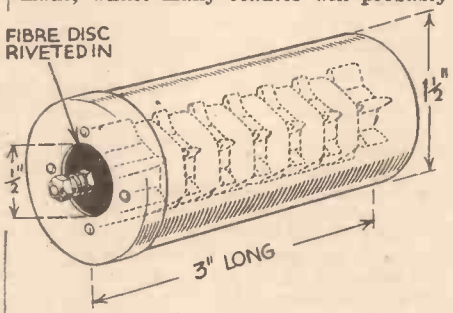


Fig. 4.—Showing a simple method of screening the choke shown in Fig. 3 by means of a cylindrical tin canister.

also prefer to buy the non-inductive by-pass condenser. The H.F. choke can be made exactly as described in the issue dated February 2nd, and, as shown in Fig 3, although in this case it will be better to fit a screen. One simple and effective method of doing this is as shown in Fig. 4, where it

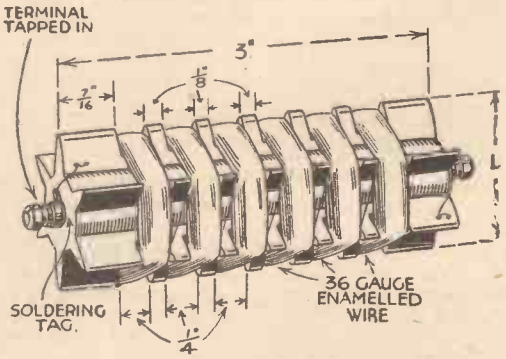
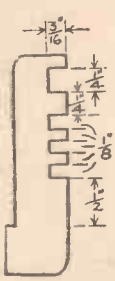


Fig. 3.—Winding data for the choke are given in this drawing.



may be seen that a cylindrical canister 3in. long and 1½in. in diameter forms the screening box. Holes ⅛in. in diameter are made in the two ends, and these are covered with discs of thin fibre which are riveted or bolted in place; the terminals fitted to the ends of the choke are passed through the centres of the fibre discs so that connections can be made in the usual manner. To ensure proper screening, the lid of the canister must be a good

fit, whilst, if desired, it may be soldered in place after the choke has been placed in position. The screen must be earth connected, and this can be arranged either by fitting a small terminal to the metal, or and mounting the complete choke on a metallised chassis or baseboard by means of a tightly-fitting brass strap.

If it is proposed to make the fixed condenser, this can be done by following the

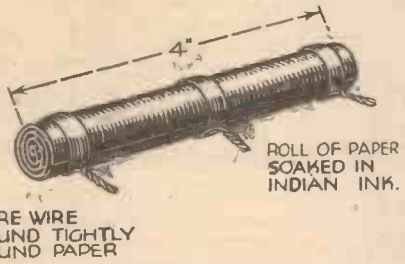


Fig. 5.—This sketch shows how the fixed screening-grid potentiometer can be made.

method described in the second article of this series and using forty strips of foil separated by sheets of mica .002in. thick. Alternatively, the size of the foils can be increased to 1½in. by 1in., when twenty electrodes will give approximately the required capacity.

Making the Potentiometer

It will not be found to be a difficult matter to make the potentiometer by following a similar method to that employed in making the fixed resistances used for coupling and decoupling in the anode circuit of the detector valve. A strip of fairly porous paper, about the thickness of this page, and measuring 8in. by 4in., will be required, and this should be soaked in Indian ink, after which it can be made into a tight roll, as shown in Fig. 5. Connections are made to the two ends by binding tightly with bare copper wire, and a third connection can be made in the centre by following the same idea. After completion the position of the central connection can be varied until the best results are obtained.

The method of making a wave-change switch was described in the first of these articles, and the switch now required is exactly the same as the previous one.

Arranging the Components

That completes the construction of the various components, and the next step is to mount them on a suitable chassis or baseboard. You can decide for yourself which form of construction is to be employed, but in any case it will be the same as that used previously. The coil is not screened, and it will therefore be desirable to fit a vertical aluminium plate between it and the coil used in the detector stage. An idea of a suitable arrangement for the parts is given by the sketch, Fig. 6, but the exact layout may, of course, be varied within limits.

It is assumed that the H.F. valve employed is of the metallised type, but if it is not it should be mounted in a vertical holder, the bulb passing through a hole in the screen in the manner that used to be common before metallised valves were introduced. There will be three flexible leads—for H.T.+, H.T.— and L.T.—, and for L.T.+, and the first of these should be provided with a wander plug which can be inserted into the maximum-voltage tapping on the H.T. battery or eliminator, whilst the other two may be joined to the corresponding terminals on the detector valve-holder. If desired, the two latter flexible leads may be dispensed with and the connections made to terminals fitted on the right-hand side of the H.F. unit, as shown in Fig. 7. When that is done, corresponding terminals should be fitted to the chassis of the detector portion so that direct connections can be made by means of short connecting wires. This is a convenient arrangement which many readers will remember as being widely employed several years ago when the "unit" form of wireless-set construction was employed. This method has many points in its favour for experimental purposes, and that is why it is being suggested in the present instance. At the same time, however, there is no reason why our readers should not rebuild the detector and L.F. amplifier previously described, as well as the present H.F. amplifier, on a new chassis. Nevertheless, it will in most cases be found better to leave this until we have dealt with the construction of a Class B output stage so that any particular type of "straight" receiver having from one to four valves can be made as a final set.

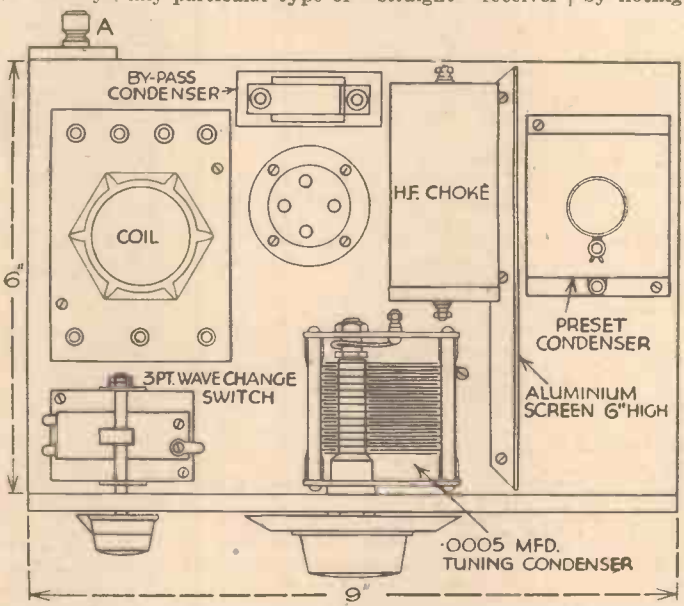


Fig. 6.—This drawing shows a suitable layout for the components of the H.F. amplifier.

Connecting and Operating

When using the H.F. unit, the aerial lead-in must be transferred to the appropriate terminal on the amplifier, but the earth lead can be left in its former position. In tuning it will, naturally, be necessary to operate both the condenser of the amplifier and that of the detector stage more or less simultaneously This will not present any difficulty after a few stations have been tuned in, because the two dials can then be rotated together and kept "in step." The reaction condenser will be operated exactly as before, and both wave-change switches must be used when changing from one waveband to another.

Those who build the H.F. unit and detector on the same chassis may consider it desirable to employ a two-gang condenser, but it must be remembered that there will be some little difficulty in doing this, because it is unlikely that the two coils will have been made so extremely accurately that they have identical values of inductance. This point can be checked fairly easily if the same make and type of tuning condenser is used for both circuits, by noting if the dial positions of the two are practically the same for every station. If they are nearly alike, it will be permissible to use a gang condenser of the type having an external-trimmer knob mounted concentric with the main tuning knob. In this case the two circuits can always be "balanced" after any particular transmission has been tuned in roughly.

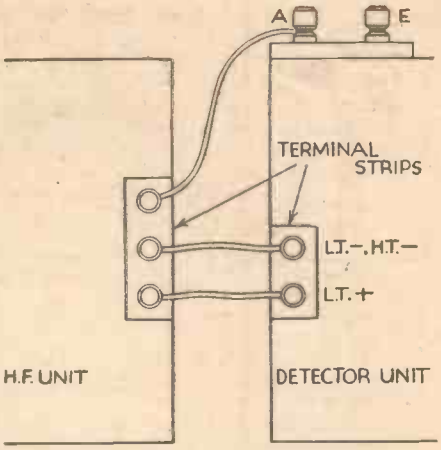
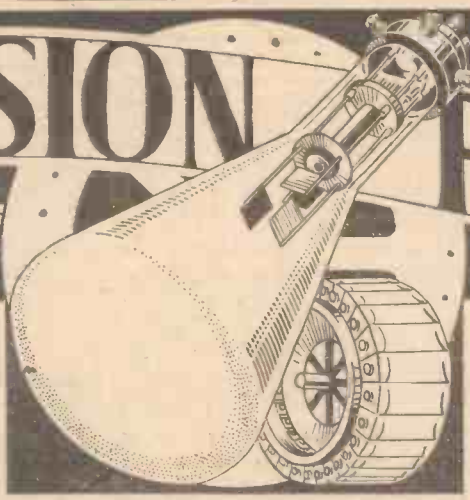


Fig. 7.—When the separate receiver stages are made as units it will be found convenient to fit terminal strips for inter-unit connection as shown here.

Should it be found that the dial readings of the two condensers differ by more than a few degrees when tuned to any particular transmission, the coils will require to be modified before attempting to use a gang condenser. If it is noticed, for example, that the setting of the condenser on the H.F. unit is 85 degrees when that on the detector portion is, say, 75 degrees, it will be known that the inductance of the coil associated with the second condenser is greater than that of the other. This can be corrected by removing a few turns—one at a time—until the readings correspond.

It will probably be observed that the coils have to be balanced separately for long and medium waves.

TELEVISION FOR ALL



TIME BASE REFINEMENTS

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

IN our detailed analysis of the action of cathode-ray tube receivers, the stage has been reached where a simple double-acting electrical circuit has been found capable of imparting to the beam of electrons an ordered movement, which has had the effect of making the bright spot on the fluorescent screen trace out the required picture area in a series of horizontal straight lines, and repeating this process at a predetermined number of times per second.

Non-linearity Effects

The simple circuit shown last week is not capable of carrying out this action with the degree of accuracy required in high-definition television reception. First of all, there is the liability of non-linearity, that is to say the relationship between the rise in voltage across the condenser and the time factor is not strictly represented by a straight line as was shown in last week's graph. Generally, what happens is that the condenser charge is more rapid at the start of the cycle of changes than it is when it is approaching its full charge. In an actual television picture, therefore, this would have the effect of crowding the resultant image towards the side of the light area which is the end of the line trace. Since the line trace direction is not yet standardised, this can be either on the left- or right-hand side of the picture, while in the case of the picture repetitive time base it causes the picture to be crowded or squeezed up at the bottom (line repetition appears to be generally accepted as top to bottom).

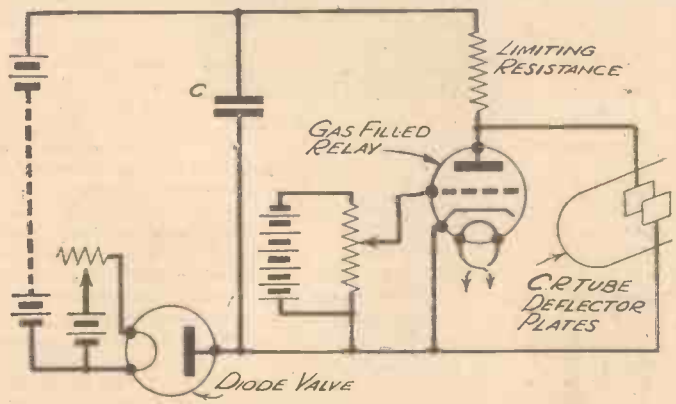


Fig. 1.—The simple single-time-base connections using a gas-filled relay.

Certain adaptations of the simple neon-gas-tube time-base circuit can be undertaken to minimise this effect, but it is preferable to use a gas-discharge valve, or relay of the mercury or neon-gas type, with an additional electrode in the form of a grid. Actually, the type of control exercised by this grid is distinct from that associated with the grid electrode in an ordinary thermionic valve.

Ionisation

The effect utilised in this gas-filled relay—often called thyratrons, but this is the registered name of the relays marketed by the Edison Swan Co.—is the discharge between an anode to which is applied a positive potential and an ordinary heated cathode (directly or indirectly heated according to type). Ionisation occurs in this relay, for the electrons emitted from the cathode surface collide with the gas molecules within the glass envelope and strike an electron from each. This molecule without an electron is referred to as an ion, and the collision effects inside the bulb are cumulative.

In designing this relay it is arranged that a definite minimum voltage must be exceeded before the arc discharge commences, and this is governed amongst other things by the gas pressure and the separation distances between electrodes.

Now, whereas in an ordinary valve grid voltage variations cause a corresponding alteration in the anode current, with the gas-filled relay the voltage applied to the grid electrode does not cause a variation in anode current, but alters the value of the anode voltage at which the arc discharge will commence.

Grid-Control Ratio

There is thus a degree of control of the operating conditions which is important, and this is known as the grid-control ratio,

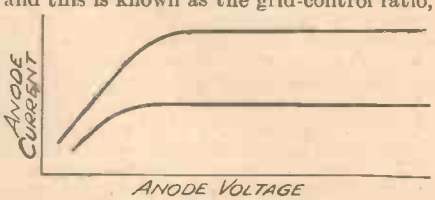


Fig. 2.—Showing how with a screened pentode valve the anode current is constant after a certain minimum anode voltage is reached.

having its counterpart in the amplification factor with ordinary valves. To take a simple concrete example, if a negative grid potential of 10 volts was applied to a tube having a grid-control ratio of 20, then it would require a voltage of $10 \times 20 = 200$ volts in excess of normal before the arc discharge would start.

Once this control effect has been overcome, however, and current starts to flow as a result of the arc discharge and consequent ionisation, the grid has no further control, and the only way to stop the discharge is to interrupt the anode circuit and so remove the anode voltage. The grid then regains control and the cycle can only be repeated by once more furnishing the anode with a voltage in excess of normal, as indicated in the previous paragraph.

Before seeing how to apply these relays in time-base circuits there is one other point which readers should note, and that is the fact that the internal resistance of the tube is comparatively low when the discharge has started. A voltage drop of

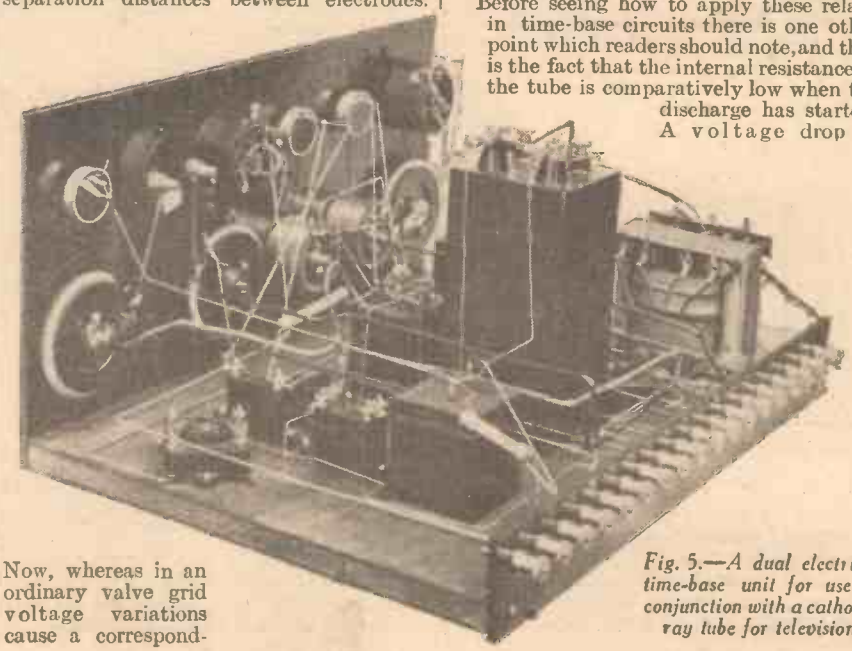


Fig. 5.—A dual electrical time-base unit for use in conjunction with a cathode-ray tube for television.

some 15 volts only is accounted for at the maximum anode current, and in consequence the value of the anode current is dependent only on the external load impedance. Steps have to be taken therefore to include some form of limiting resistance so that the maker's current rating is not exceeded.

Using the Relay

It is quite a simple matter to substitute this relay for the ordinary neon-gas tube shown in last week's circuit, and the scheme is indicated in Fig. 1. The saturated diode is still employed in this case, but by means of a potentiometer and battery the appropriate negative bias can be applied to the relay and a control of the actual voltage required for the gas discharge to commence secured. As before, the condenser C is charged steadily until a voltage value is reached, when the gas discharge commences (evidenced as a bright blue glow for mercury filling or a red glow for neon filling in the relay itself) and the condenser is discharged.

Whereas in the case of the simple neon gas tube the voltage change obtained for the purpose of giving the spot movement in the cathode-ray tube—generally termed the voltage "sweep"—was limited by the striking and extinguishing voltage difference (generally of the order of 30 volts, which is insufficient to make the spot move across the total available space on the fluorescent screen), with this relay in circuit the sweep voltage secured is equal to the full value to which the condenser C is charged by the circuit arrangements.

As a concrete example one can take the case of the Osram mercury vapour discharge tubes (G.T.I.) shown in Fig. 1. Here the grid-control ratio is rated at between 20 to 25 according to the temperature of the relay. Taking the latter figure, and assuming that a negative bias of 12 volts is applied to the grid, then the current will not flow in the relay until the voltage across the condenser C has reached a value of 300 volts. Within the anode-voltage limits of the relays, therefore, it is possible to obtain any voltage sweep that may be required to give the full line scan across the cathode-ray tube. It will be noted that in Fig. 1 a limiting resistance has been included to prevent the relay current from rising to such a value that the tube may be damaged when the gas discharge occurs. A convenient value for this is 500 ohms.

television receivers has brought about the introduction of further refinements. First of all, the diode valve is prone to show the effects of any changes in filament temperature, especially in those cases where the feed to the filament is obtained from a mains transformer and the mains are not steady. If this happens, the constancy of frequency so essential for C.R.-tube time bases no longer applies, and the variations upset the picture formation. Again, the characteristics of a saturated diode are such that it is not truly linear until a certain minimum anode voltage is reached.

These factors represented rather awkward difficulties in the early days of cathode-ray tube working, but the development of screen-grid and screen-pentode valves has presented time base users with quite a straightforward solution. If characteristic curves for either of these valves are plotted with anode volts against anode current, it will be found that the curve is horizontal, as in Fig. 2, after a certain minimum anode voltage is reached. The saturation current and the voltage condition for this depends on the magnitude of the filament current, the higher the filament current the greater the saturation current.

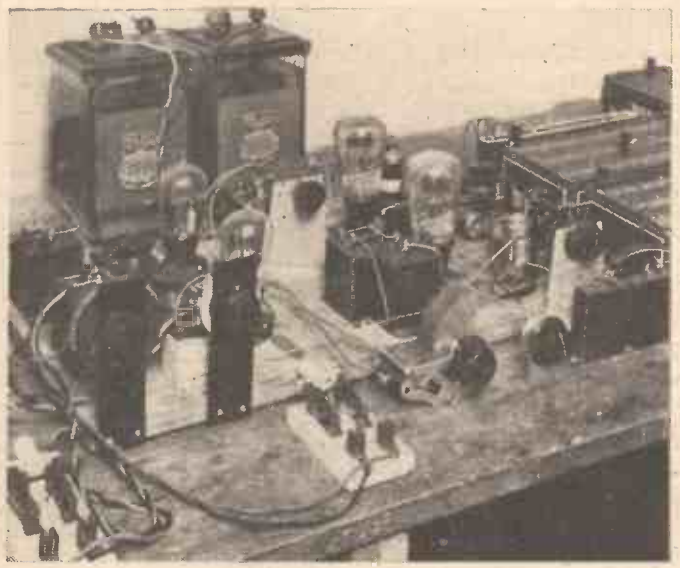


Fig. 3.—A temporary layout for a double time-base in order to become familiar with its main functions.

Using Pentode Valves

A screened pentode of this nature can, therefore, replace the saturated diode, and many interesting experiments can be conducted by the reader in order to become thoroughly familiar with the principles of working. For the first tests, connections and layout can be of quite a temporary character, and in Fig. 3 is shown an actual example of this scheme. Battery and accumulator feeds are used throughout, and various combinations of fixed and variable condensers may be employed as indicated in order to vary the frequency of the scan.

The arrangement shown in Fig. 3 is actually a double time-base giving both frequency pulses; one relay and pentode valve giving the line traverse periodicity (H.F. scan), while the other pair takes charge of the picture periodicity (L.F. scan).

In Fig. 4 is furnished an actual theoretical circuit for a double time base of this nature, together with the values of the various components employed. Across the points AB and CD are connected the two separate pairs of deflector plates in the cathode-ray tube, so that the electron beam which passes through them can be made to perform the required line trace at the predetermined frequency of picture repetitions. Even when the double time bases include a large number of variable quantities for the purpose of experimenting, they can be built up into quite a neat unit. This is evidenced by a reference to Fig. 5, which shows the finished model made up from information derived from the "hook up" illustrated in Fig. 3.

It will be noticed in Fig. 4 that the points A and C are labelled "shift." These points are connected to the movable arm of a potentiometer right across the full available voltage. In this way a polarising voltage is applied to the deflector plates in order to move or "shift" (hence the reason for employing this term) the spot on the fluorescent screen caused by the electron-beam impingement on the inner surface to its correct position, so that the scanning area is disposed centrally within the total area. This shifting or polarising effect is a control which is quite independent of the sweep voltages used to move the spot in its proper scanning sequence.

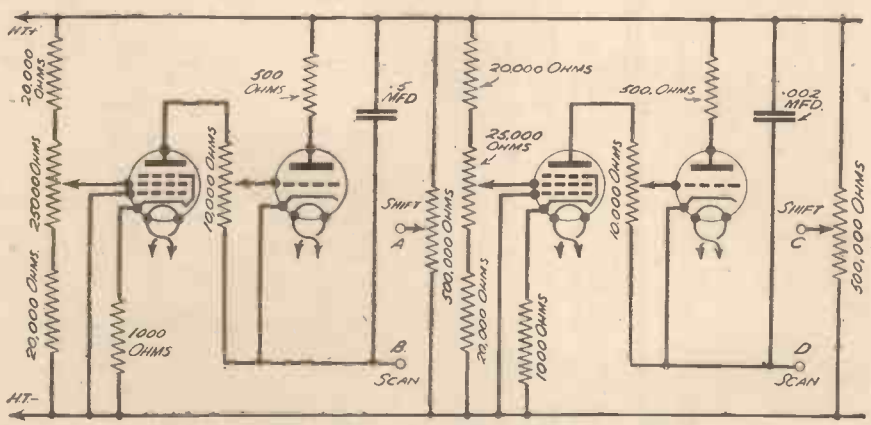


Fig. 4.—A double time-base circuit using gas-filled relays and screened-pentode valve.

Further Improvements

Now although the circuit shown in Fig. 1 can produce a true linear voltage sweep on the *assumption* that the saturated diode is a constant current charging arrangement, there are one or two drawbacks to the use of a diode which for modern high-definition

Distance Traversed

Mention of spot movement brings to mind the question of the distance travelled by a spot in carrying out the scanning action. Taking a concrete case of a television image area size of 8in. horizontal by 6in. vertical divided into a 240-line picture, the total distance travelled in one complete scan is 240 x 8 x 2in. (remember the spot has to travel across the screen and then "fly back") which is equal to 320ft. But since there are twenty-five complete explorations in one second this gives a travelled distance of 320 x 25 = 8,000ft. in one second, which works out an average speed of over 5,500 miles per hour.

On Your Wavelength

by Thermion

Television for the Deaf and Dumb

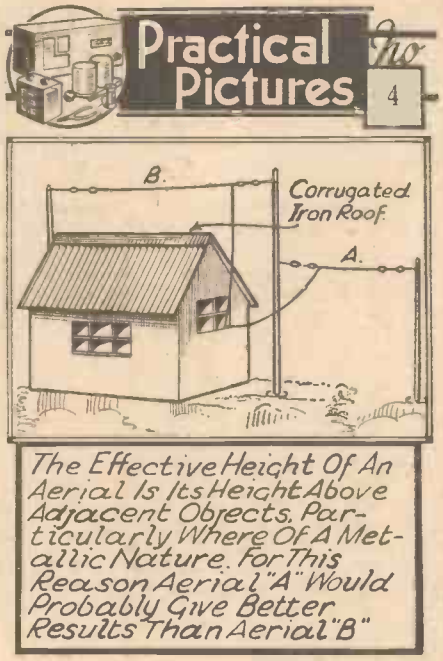
WIRELESS telephony has benefited no section of the community so much as the blind. It is one of the greatest boons to the sick and bedridden, and has been responsible for more cures than any medicine or any Harley Street physician. The deaf and dumb, however, have been unable except in a few cases to enjoy this marvel of modern science. There are, I know, many excellent deaf aids on the market, but it is my impression that the deaf and dumb have not received national sympathy or the blessing of many associations apparently because they are in possession of that one most blessed faculty—the sight. Television will assuredly do for the deaf and dumb what radio telephony has done for the blind. I make the early suggestion that a national movement should be formed at once to provide free television sets and licences for the deaf and dumb at such a time as television is practicable. Free licences are issued to the blind; free looking-in licences should, therefore, be accorded to the deaf and dumb. Mr. Fred W. Edwards, F.T.S., of Castle Gresley, Derbyshire, recently made the suggestion that he would offer the Derbyshire School for the Deaf and Dumb a television installation as soon as the Midland Regional television programmes are on the air.

Queries and Enquiries

I HAD occasion to stroll into the Technical Queries and Enquiries Department the other afternoon. I was not received exactly with open arms. In fact, it would be more accurate to say that I was nearly thrown out. After the "great white chief" had cooled down somewhat he showed me some specimen letters which he received from readers. Here is a specimen: A reader, evidently writing on some odd pieces of wallpaper with the blunt end of a matchstick dipped in ink, proceeded to unwrap his harrowing story which was that he was out of work, had some odds and ends of components by him. Did we issue a cheap blueprint? Have we ever published an article on A.V.C.? How could he connect a pick-up? Did we think that his idea for a new tuning scale (accompanied by a long description and many unintelligible diagrams) had any commercial value, and if so, could we put him into touch with manufacturers who would buy the idea? How much was it worth? Could we please reply by return of post? Would we consider two wrinkles; if we accepted them would we please buy him some wireless parts? He enclosed a coupon intended for our Presentation Dept., sent requests for the catalogues of every component manufacturer, appended a letter for publication, asked us to identify three short-wave stations which he had picked up, and ended by omitting to enclose the query coupon or a stamped and addressed envelope. This is laying it on with a trowel, but I can assure you that it is by no means an isolated instance. I do think readers should be a little more reasonable, and limit their queries to a few at a time. Wrinkles should be sent separately; catalogue applications should be sent separately; queries should be brief and not enclosed with any other correspondence. I am all on the side of the hard-pressed Technical Staff. Whilst I am on this topic they have asked me to point out that under no circumstances can they grant interviews. I learn that quite a number of readers have made personal calls, evidently with the idea of getting immediate attention. This is taking an unfair advantage of other readers whose questions are just as important and just as urgent. If you want a prompt reply enclose a stamped and addressed envelope and the coupon; there is extreme pressure on the space allotted in this periodical to the answering of queries. I hope readers will take this friendly tip.

Broadcast Effects

I MUST confess that I do not normally spend very much time listening to the broadcast programmes, but I do enjoy a good play or a vaudeville. A few days ago,



however, I was most disappointed when listening to a short play which I had hoped to enjoy; it was *The Lottery Ticket*, and after suffering for about ten minutes I was obliged to switch over to another station. It was not the players who were responsible for the ruined performance but, apparently, the men in the "Effects" department. After about every three spoken words there were loud guffaws and unmusical laughter that made one think of the noises one is inclined to hear at a country football match, or at an unruly parliamentary-election meeting.

During the comparatively short time that I listened I was unable to assure myself whether the "noises off" were supposed to suggest an audience that was not present, or the yokels in the village in which the scene was supposed to be enacted. In any case they were intensely annoying, not only to myself but to others, for a lady in the family party remarked that if someone did not switch off the set before long she would scream. Is it really necessary to indulge in this sort of thing? This is not the first time it has taken place, and I much prefer to hear a broadcast without "audience effects" unless these are natural, due to the concert taking place in a public hall.

[*We do not agree with these sentiments.*—ED.]

Multiple Reaction Circuits

I READ that a Continental experimenter has recently carried out a number of interesting experiments in connection with a variety of reaction circuits, and he claims to have obtained much improved results from a standard "straight" receiver by applying reaction, not only to the detector circuit, but also to the circuits of the H.F. amplifying valves. That, in itself, is by no means new, but the main point in this instance is that the experimenter in question has been including the reaction coil in the *cathode* circuit of the valve instead of, as is usual, in the anode circuit. It would appear that the idea merits further attention, and many of my readers may care to try the system for themselves. There are a variety of methods of actually connecting the reaction winding, but the simplest is to wire an H.F. choke between the cathode terminal of the detector valve and H.T. negative, and to connect one side of the reaction coil to the cathode of the valve, and the other, through the reaction condenser, to earth.

"High-tension" Voltage

THE term "high tension" as applied to the voltage of the usual H.T. battery is somewhat of a misnomer, and is, in any case, only a comparative term. For example, the high-tension voltage used in the ignition system of a motor car runs into thousands of volts, whilst the electrical engineer does not usually call a supply "high tension" unless the voltage is at least 1,000. But it would appear that wireless users, or at least lookers-in, will soon have to consider methods of obtaining real high tension—up to something like 5,000 volts—for some of the new cathode-ray tubes require such a voltage to be applied to their shielding anode. Fortunately, however, it is only a *potential* that is required, the current being negligible. Thus, the voltage can be developed by means of a mains transformer of modest dimensions, but comprising tens of thousands of turns on the secondary winding.

Camouflaging the Speaker

I CALLED on a sick friend the other day, and was surprised when I arrived in his bedroom to hear strains of music, obviously from a broadcast programme, but which seemed to fill the air without having any direction. After years of listening, and set and speaker testing, it was most delightful to enter a room and to find music filling the air, as it were, without any apparent source. I looked round the room and no speaker was visible. I walked about the room, and it was most pleasing to find that no matter where I went the volume remained unaltered, and it was impossible to trace its source. The volume

(*Continued overleaf*)

(Continued from previous page)

which was being delivered was only just sufficient to be comfortably audible, and in the sick-room this was most soothing. After a fruitless search for the speaker I had to ask where it was, and was surprised to learn that it was simply attached to the back of a wardrobe. This was standing across one corner, and the speaker was actually emitting the sounds from the rear of the cone, no hole having been cut in the wardrobe to provide the customary baffle effect.

On asking how this idea had been hit upon I was told that music was wanted in the room, and a spare speaker happened to be available. On looking round for somewhere to put it, my friend thought of putting it in one corner out of the way, but in view of dust, etc., he finally decided to screw it on the back of the wardrobe. A little adjustment of volume was required, and when the best position had been found, the results were really remarkable. It seems that there is a lot of room for experiments in loud-speaker positions, and perhaps some of my readers have found unusual schemes which are worthy of note and could be passed on to others.

Television Test Cards

THE keen wireless amateur has often felt the necessity for the broadcasting of the well-known constant-frequency records. These have, from time to time, been radiated by various concerns. and they give the amateur a wonderful indication of the response of the receiver and enable defects to be found very easily. Now in television the need for such testing apparatus is very much more marked, and it is interesting to note that the B.B.C. have developed some very interesting patterns which enable a receiver to be tested for its response in all directions. These cards are normally used by the B.B.C. Television engineers, but "lookers-in" were recently greatly pleased to find that these were broadcast during an interesting transmission, and, no doubt, many amplifiers were forthwith reconstructed. The present transmissions often open with a sort of "frontispiece" portraying an eye and the letters B.B.C., and this in itself is a very useful test. The lines should be quite clearly defined, and there should not be deep grey shadows between the various lines of the pattern. The letters B.B.C. should be clean cut, and not with jagged edges, and users of disc apparatus may clean up the alignment of the holes with the aid of this particular test card.

With or Without Pigtails

I HAVE recently been looking at some short-wave condensers for tuning purposes, and I have noticed some interesting developments of the pigtail connection. In the earlier days the connection to the moving plates of a variable condenser was of the friction type, a cone bearing being provided with a terminal, and the end of the moving spindle provided with a point. Wear was taken up by tightening the terminal, and although this was not too bad from some points of view, unknowing amateurs often spoilt things by oiling the bearing to stop squeak. Owing to the insulation properties of the oil, the connection became very intermittent. Later, some condensers were provided with a miniature watch-spring, which coiled round and round, and finally found anchorage at a terminal attached to a piece of insulating material arranged out of the field of the fixed plates. This seemed all right until it was used on the short waves, when weird scratching noises were finally traced to the effects of adjacent turns of the springs touching. In a condenser I have by my side I see that the spindle projects through the end plate, and it is drilled out to accommodate a piece of plaited copper wire. This is perfectly flexible, and is soldered just inside the hollow spindle. It projects straight up to a terminal on the end plate, and is no longer than ¼in. The rotation of the plates twists the wire, but does not damage it owing to the plaited formation, and this appears one of the soundest connections I have yet seen. It will be possible to use this type of connection right down to 5 metres without noises or other troubles such as would be caused by a coiled connection.

Notes from the Test Bench

Using S.G. Valve as Detector

RECEIVERS of the straight type employing a triode detector can usually be made more sensitive by substituting an S.G. or H.F. Pen. valve for the triode. Most valves of this type do not work well when followed by straight transformer coupling, however, and therefore if the receiver employs a transformer of this type it is advisable to parallel-feed it, using a coupling condenser of approximately .5 mfd. and an anode resistance of approximately 75,000 ohms. The leads connected to the anode terminal of the valve-holder should be transferred to the cap terminal of the S.G. valve, and the anode terminal should then be joined to H.T. battery 30 volts, approximately, by means of a flexible lead. When this substitution is made reaction trouble is sometimes experienced, but when this is the case a remedy may be effected by varying the voltage on the screening grid—i.e., by trying various sockets between approximately 24 volts and 60 volts for the lead connected to the anode terminal of the valve-holder.

Checking A.V.C.

IT seems that many constructors find it difficult to decide whether the automatic volume control in their receiver is functioning effectively. The best method of checking this is by connecting a milliammeter in the anode circuit of the controlled valve. If the automatic control is operating satisfactorily, the anode current registered on the meter will fluctuate in sympathy with the received signal. When no transmission is being received, the controlled valve will be working at maximum sensitivity, as A.V.C. only reduces the sensitivity when a strong carrier wave is being picked up. It is therefore also possible roughly to check the efficiency of the automatic control by noting whether background noise is greatly reduced when a strong carrier wave is being received. It should be noted, however, that this rough method cannot satisfactorily be made use of when Quiet Automatic Control (Q.A.V.C.) is employed, as the receiver is de-sensitised between stations when this system of control is functioning effectively.

Improving Selectivity

RECEIVERS having only one or two tuned stages are sometimes insufficiently selective for reception under modern conditions if a long aerial is used. Fortunately, however, it is a fairly easy matter to improve the selectivity of this type of set. It is sometimes possible to improve results sufficiently by connecting a pre-set condenser having a capacity of approximately .0003 mfd. in the aerial lead, but in most cases the addition of an extra tuned stage will be found necessary. This should consist of a screened coil and tuning condenser of the same types as those incorporated in the receiver. The aerial lead should be transferred to the aerial terminal of the new coil, and the fixed vanes of the new condenser (to which the grid terminal of the new coil has been connected) should be joined *via* a very small condenser (approximately 20 m.mfd.) to the fixed vanes of the first tuning condenser of the receiver.

Cathode Glow Lamps

THE use of cathode glow lamps for television receivers is a well-known practice, especially where low-definition pictures are concerned. Unfortunately, in many cases they are found to suffer from the disadvantage that the walls of the glass envelope become opaque as a result of the "sputtering" of the cathode material. A French company is now stated to have produced a lamp which overcomes this defect in a very satisfactory manner. Their invention describes a lamp in which the cathode is seen through the anode, this latter electrode being provided with a special aperture for this purpose. In addition, a mirror is arranged above the aperture at some pre-determined angle so that light is reflected from its surface. By making the cathode from a form of white metal, such as palladium or silver, the sputtered particles do not affect the reflective properties of the mirror, but on the contrary tend to maintain it, and so lengthen the life of the lamp which previously suffered an early demise through opacity.

Keeping Mirrors Clean

APPARENTLY the short article dealing with the question of keeping mirrors bright and clean in all television apparatus, which appeared in PRACTICAL AND AMATEUR WIRELESS, dated Feb. 16th, aroused quite a lot of interest. Not only do the remarks apply to mirrors but also to all forms of lenses or glass that are included in receivers of this type. I was therefore very glad to have brought to my notice a compound which when rubbed over glass, mirrors, lenses, etc., has the property of preventing dampness or steam from affecting the surface. I put it to a very rigid test and found it admirable for the purpose. In one case after treatment, I went so far as to breathe on the mirrors but they showed not the slightest signs of becoming misty during condensation. Readers will therefore be well advised to keep a small tin of this compound handy, for after applying a small quantity the glass only requires polishing.

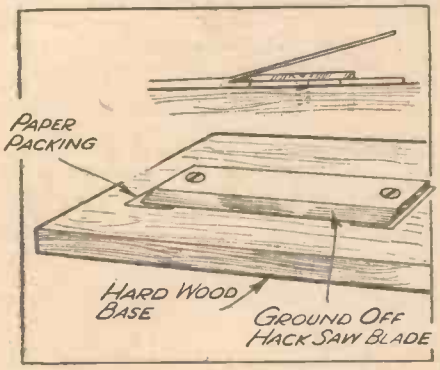
THAT DODGE OF YOURS!

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

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.

Splitting Mica

WHEN making fixed condensers it is often desirable to split up the mica sheet, as purchased, into much thinner sheets. By using the thinner sheets, not only is the capacity of the condenser increased, or, inversely, a fewer number of sheets required, but the complete con-

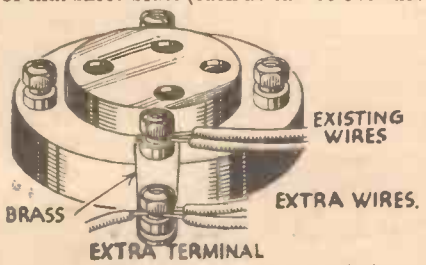


A simple method of splitting mica sheets.

denser is, of course, very much cheaper. Mica is easily split with a knife, but some difficulty may be experienced in getting all the separated sheets of the same thickness unless some device is used for gauging them. An easy way of doing this is shown in the sketch. The blade is a piece of hack-saw blade ground off on one side to a knife edge, and drilled through (it will be necessary to soften the ends of the blade to do this) so that it can be fixed to a piece of hard flat wood with two wood screws. The blade is packed away from the wood with pieces of paper, the thickness of the paper deciding the thickness of the split mica sheet. As a guide, the thickness of an inside page of PRACTICAL AND AMATEUR WIRELESS is about .003in., and an outside cover .005in. The corner of a piece of thick mica is pressed against the edge of the blade and pushed through, by pressing the fingers on top, the lower piece emerging from the underside of the knife of the correct thickness.—W.H.F. (Middlesex).

A Wire-connecting Link

WHEN building a set constructors often find that three or four wires have to go under one terminal, which leaves no room for the terminal nut to screw on. A simple remedy is as follows. Cut a piece of thin sheet brass (such as can be obtained

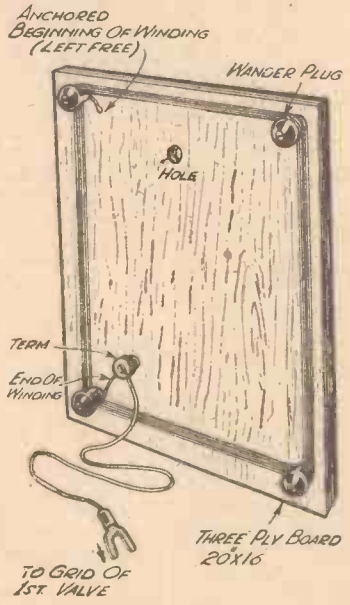


An easily-made wire-connecting link.

from an old condenser vane) about ¼in. long and ¼in. wide. Pierce two holes, one at each end, slip one end on to the present valveholder terminal screw, or any other component which is carrying wires, and fix an extra terminal in the other hole, as shown in the sketch. This will enable two or three additional wires conveniently to be connected to the same point.—A. BARRON (Sunderland).

A Simple Frame Aerial

I FOUND that by using an aerial of the type shown in the accompanying sketch, and connecting it to the grid of

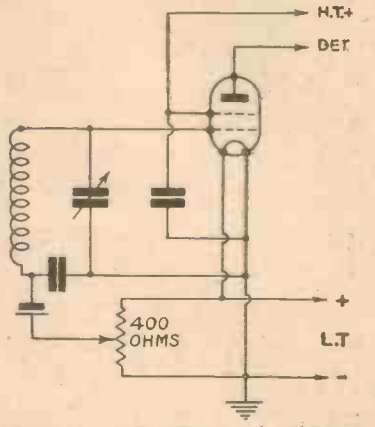


A handy and efficient frame aerial can be made as shown.

the first valve direct, it enabled me to use a simple det.-2 L.F. set in any room as a portable set. To vary the amount of "capacity" to earth, and thereby control selectivity, I placed the aerial either on the floor or on a chair.—F. JACKSON (Holywood).

Accurate Grid Bias

THE accompanying circuit diagram shows a method of obtaining accurate grid bias, instead of using 1½-volt tappings. Grid bias being measured from the negative end of the filament, the slider enables a variation of 0-2 volts below the grid

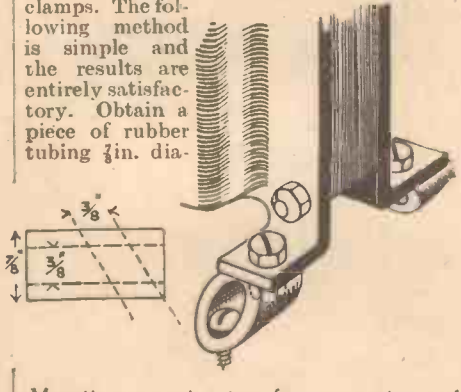


Using a variable resistance for obtaining accurate grid bias.

bias battery voltage to be obtained. This is especially useful for screen-grid valves and "economy pentodes," and results in economy in current and better quality. A resistance of about 400 ohms is suggested, and this imposes the negligible load of 5 mA. on the low-tension battery.—B. A. BURGESS (Sheffield).

Mounting Mains Transformers

IT is sometimes recommended that a noisy mains transformer should be mounted on rubber blocks after failing to effect a cure by further tightening the core clamps. The following method is simple and the results are entirely satisfactory. Obtain a piece of rubber tubing ⅜in. dia-



Mounting a mains transformer on pieces of stout rubber tubing to eliminate noise.

meter and ⅜in. bore, and instead of cutting off the pieces squarely, slant the knife and make each piece about ⅜in. wide, as shown in the sketch. The cutting will be easier if tube and knife are held under water.

By slanting the knife the pieces will be of a shape which allows of easy insertion of the bolting-down screws, or nuts, and the screwdriver can also be held right over the screw head.—J. EVANS (Hoole).

THE HALL-MA

A New Low-priced Receiver Designed for Quality and to Operate and has Surprisi

The Hall-Mark Cadet and its Stentorian Baby Speaker.

IT is because of the extreme popularity achieved by the battery-operated Hall-Mark Three, described in the issues of PRACTICAL WIRELESS, dated December 15th and December 22nd, 1934, that the present receiver has been designed. The Hall-Mark Three has been made up in tremendous numbers, and constructors have obtained excellent results and entirely trouble-free reception. Readers will remember that low price was a particular feature of the previous receiver, and several inquiries have been received for an even cheaper set. At first it appeared that it would be practically impossible to produce an efficient receiver which would cost less than the Hall-Mark Three, but such a remarkable result has, in fact, been achieved in the case of the present receiver.

Thanks to Readers

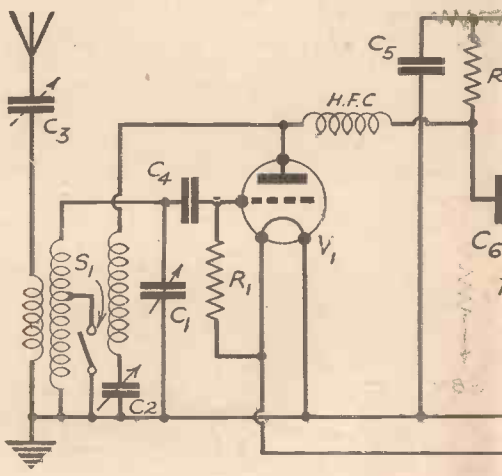
In designing the little Cadet we have been mindful of many excellent suggestions made by those thousands of readers who regularly write and tell us of their needs, and who frequently make valuable suggestions. Of these, many have asked for a receiver of the two-L.F. type which could be made by the veriest novice, and which would give a really good output for a modest consumption of high-tension and low-tension current. We have also been requested to produce a receiver employing resistance-capacity coupling, for, as most experimenters are aware, this form of coupling ensures good quality reproduction in the most inexpensive manner. It may be thought by some readers that R.C.C. is out of date, but the fact that it is still used for many high-class "quality" amplifiers immediately negatives this suggestion, and serves as proof of its worth. This explains why the Hall-Mark Cadet has been designed to incorporate two resistance-capacity coupled stages, the second of which feeds into a power pentode. This arrangement has been found to produce surprisingly good results—far better, in fact, than we had expected. In consequence of this, the receiver gives an excellent output which is certainly adequate for all normal requirements.

NOTE THE SIMPLE AND STRAIGHTFORWARD WIRING CONNECTIONS

Sub-chassis view of the Hall-Mark Cadet. Examine this in conjunction with the diagram on the next page when wiring the receiver.

Selective Tuning Circuit

The tuning circuit of the receiver is similar to that used between the H.F. and detector stages of the original Hall-Mark, and consists of the excellent Hall-Mark H.F. coil used as an H.F. transformer and a low-priced, though perfectly sound, variable condenser. This transformer has a separate primary winding, and this provides loose coupling between the aerial and grid circuits, thus ensuring a fairly high degree of selectivity. Still further to improve selectivity, however, a pre-set condenser is included in the aerial lead, and this can be adjusted to suit all local conditions. Due to the fact that there is only a single tuned circuit one cannot expect quite the



Theoretical diagram of

LIST OF C

COIL

B.T.S. Hall-Mark Cadet.

CONDENSERS

Variable .0005 mfd. with slow-motion drive (Jackson Bros. Nugang).
Fixed .0002, .01, .02, 2mfd. (T.M.C.).
Reaction .0003 mfd. (Polar).
Preset .0003 mfd. (Formo).

H. F. CHOKE

Bulgin H.F.8.

FIXED RESISTANCES

2 meg., ½ meg., ¼ meg., 75,000 ohms, 30,000 ohms, 20,000 ohms (Erie, one watt).

ON-OFF SWITCH

Bulgin S.22.

WAVE

Bulgin S.22.

VALVE

Two 4 pin, one 5 pi

TERMI

One A.E., one L.S.

WAND

H.T. +, H.T.—, G. (Belling Lee).

SPADE

L.T.+, L.T.— (Bel

COMPONE

Three (B.R.G.).

A High-quality, Cheap and Simple Re

ARK CADET

Reception. It is Remarkably Easy to Build
ng Reach and Selectivity

same degree of selectivity as in the original Hall-Mark, but it is remarkably good.

Trimming Adjustments Obviated

The absence of an H.F. stage obviates all matching and trimming difficulties, so that any constructor, or prospective constructor, need do no more than build the receiver, connect up to batteries, speaker, aerial and earth to obtain good reception of, at least, the local stations. But, although the Cadet was originally intended as a local station set it has proved to be far more than this, especially when used in conjunction with a reasonably good outdoor aerial. Fully twenty stations have been received after dark on the loud-speaker, with very little interference. Despite this, we do not claim that the Cadet will "circle the world"—it will not, and it is not supposed to do so—but we do say that it will permit of a fair choice of programmes, and that it will give good "quality" reproduction of those programmes. We should say, in passing, that the Stentorian "Baby" loud-speaker employed does much towards improving reception, for it is particularly sensitive, and capable of really good reproduction when fed from the receiver under discussion. It is also worthy of mention that the detector valve is adequately decoupled, and that there is only a single high-tension positive lead.

Note the clean appearance of the upper side of the chassis.

Rear view of the Hall-Mark Cadet.

Preparing the Chassis

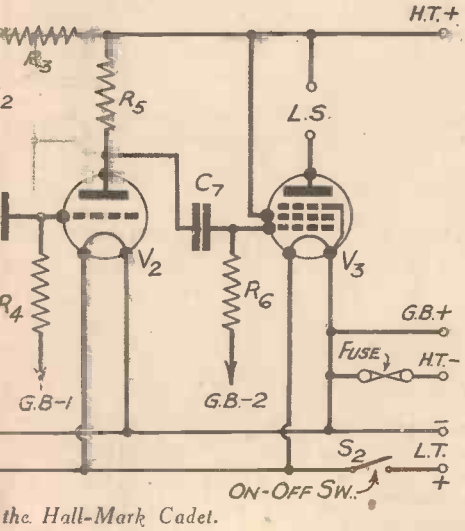
With regard to the construction of the receiver, it will be noticed from the wiring plans that this is extremely straightforward and simple. The chassis is very small indeed, but the parts are well spaced to make them accessible for wiring, and also to ensure that there shall be no interaction between them. The first step is to prepare the chassis by drilling the holes for the valve holders and coil, although it may be obtained ready drilled if desired. The hole for the coil is 1½in. in diameter, and the three for the valve holders are 1in. in diameter; all four can easily be made by using a centre bit and brace.

Insulate One Component Bracket

Next, the mounting of the components brackets must be undertaken. These are attached to the upper surface of the chassis at equal distances from the ends to maintain symmetry. The point to watch, however, is that the bracket for the on-off switch is insulated from the metallised surface of the chassis, although that for the wave-change switch makes contact with the metallising. The reason for insulating the former bracket is that the switch attached to it is in the low-tension positive lead, so that if the bracket were in contact with the metal the accumulator would be short-circuited, since the switch-mounting bush is in electrical contact with the spring arms. The method of insulating is to scrape the metallised surface away over a square about ¼in. greater than that of the base of the bracket, and this can be done by scribing lines with the edge of a knife blade, and then scraping away the metallising. Care should be taken that this job is done thoroughly, otherwise trouble will occur at a later stage.

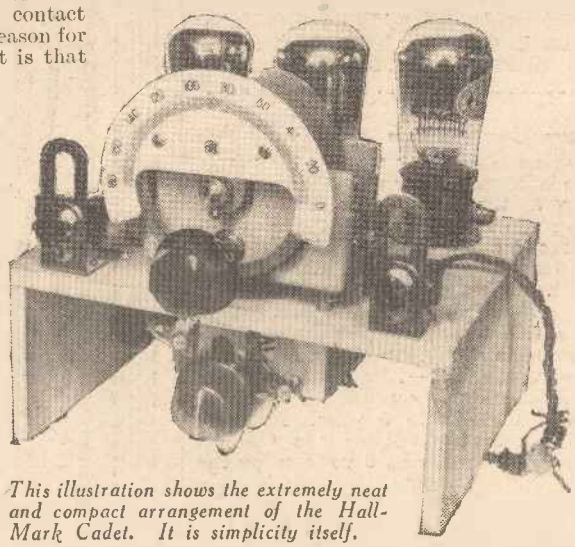
Before mounting any of the components two rectangular slots must be cut in the rear edge of the chassis to receive the terminal-socket strips for aerial, earth, and loud-speaker leads. These two slots can be made with a fretsaw, or by carving down at the two ends, and removing the wood

(*Continued overleaf*)



the Hall-Mark Cadet.

COMPACTNESS AND EFFICIENCY ARE KEYNOTES OF THIS REMARKABLE RECEIVER



This illustration shows the extremely neat and compact arrangement of the Hall-Mark Cadet. It is simplicity itself.

COMPONENTS

-SWITCH

HOLDERS
n (Clix).

AL STRIPS
(Belling Lee).

ER PLUGS
B.+, G.B.—1, G.B.—2

TERMINALS
ling Lee).

T BRACKETS

FUSE
100 m.a. (Microfuse).

VALVES
H2, HL2, ME2 (362 Valve Co. Ltd.).

CHASSIS
Metaplex 8in. by 6½in. with 3in. runners (Peto-Scott).

SPEAKER
W. B. Stentorian Baby.

BATTERIES
120 volt H.T. (Drydex).
9 volt G.B. (Drydex).
2 volt L.T. accumulator (Exide).

ceiver with the Hall-Mark Heritage!

between the saw cuts with a chisel. As an alternative, the strips may be mounted a little farther towards the centre of the chassis, when the metal contacts can be passed through ⅜in. holes.

It will be found most convenient to mount first of all the components on the underside of the chassis; this avoids the possibility of damaging the coil or variable condenser, and allows the chassis to be handled rather more easily. It will also be found that a few of the connecting wires can also be fixed in position before work is commenced on the upper surface.

Mounting the Tuning Condenser

It is unnecessary to describe the method of mounting the coil and tuning condenser, since this will be evident from the photographs which are reproduced. We will mention, however, that the coil is attached to the chassis by means of a small angle-bracket with which it is supplied, whilst the condenser has its own fixing feet. There is just one point to be observed in mounting the condenser, which is that the screws which pass through the chassis into the feet must not be tightened unduly or else the metallised surface will be broken, and the earth-return from the condenser frame will be imperfect. At the same time, the screws must be reasonably tight to ensure that the condenser is not loose, for that also would result in imperfect connection.

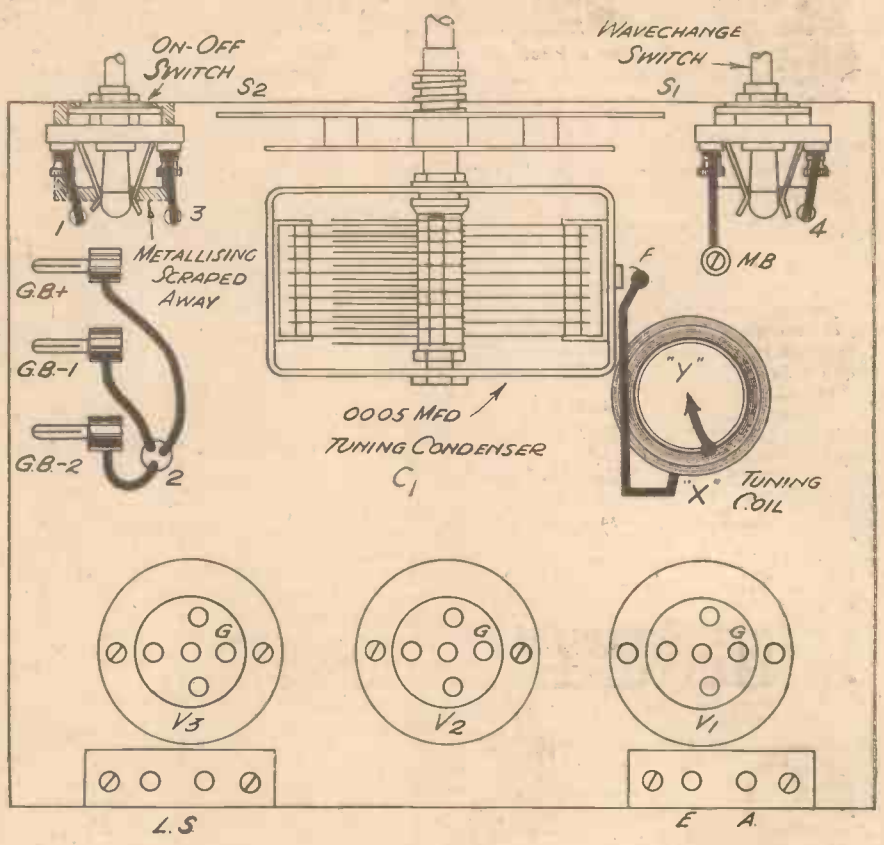
Flexible leads are used for the battery connections in the usual manner, and the exact positions of these will be clear from the wiring plans. A number of earth-return connections are made to the metallised surface of the chassis through the bolt, which is used to secure the mounting bracket for the coil, and it is therefore desirable that a washer should be placed under the head of the bolt to ensure ample area of contact.

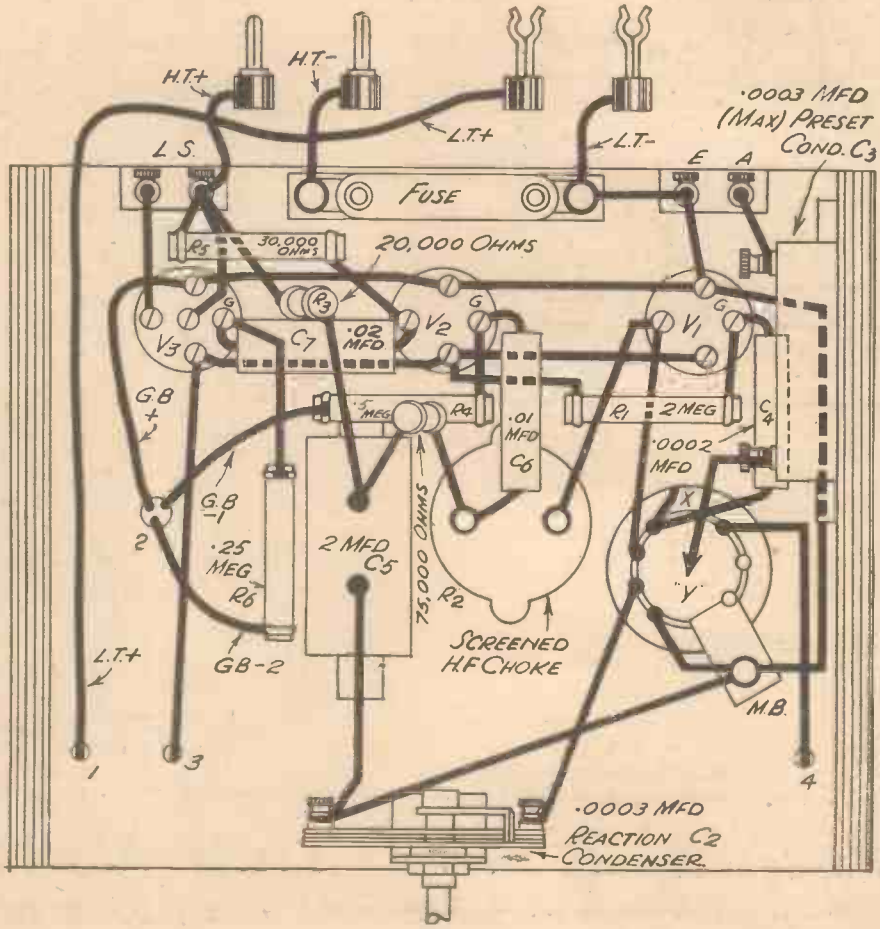
Battery Connections

After completing the receiver the valves can be inserted in their respective holders; looking at the front of the receiver and reading from left to right, the valve positions are as follow: H2 (detector), HL2 (first L.F.), and ME2 (pentode output). The flexible battery leads can then be attached, taking the H.T.+ lead to the full voltage of the high-tension battery (this should be between 100 and 120 volts), the G.B.—1 lead to a socket on the grid-bias battery providing about 1½ volt and G.B.—2 to 6 volts. Actually, it is well to try varying the G.B.—2 voltage between 4½ and 9 volts, using the highest voltage that proves satisfactory. It should be mentioned that the set should be switched off before making any alteration to the G.B. voltage, otherwise there will be a danger of damaging the pentode.

Complete operating instructions will be given next week, whilst the method of using a pick-up, when desired, will also be explained.

TOP AND SUB-CHASSIS WIRING DIAGRAMS OF THE HALL-MARK CADET





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EXACT TO SPECIFICATION

Build with a Pilot Author Kit and make a 100% success certain. Since 1919 the most popular Kits with Home Constructors the whole world over because they are exact to the designer's specification and are complete down to the last screw and piece of wire.

The GRAMADAPTOR

CONVERTS your PRESENT SET to a MAGNIFICENT 1935 *Radiogram!*

5/- DOWN

STAND your Mains or Battery Set on this remarkable unit . . . give it all the qualities of a costly 1935 Radiogram. Connected in an instant . . . plays with front open or closed. Sensitive Pick-up. Volume Control. 2 needle cups. Walnut polished Cabinet.

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Overall dimensions: 38½ in. high by 22½ 17½ in. deep.

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1 J. B. Nugang type "A" .0005 mfd. condenser with disc drive		9	6
1 Polar Compax condenser, .0003 mfd.		2	6
1 Bulgin H.F. choke, type H.F.8		2	3
1 Formo .0003 mfd. preset condenser		1	6
3 T.M.C. tubular condensers		2	3
1 T.M.C. Hydra type 25 condenser, 2 mfd.		3	0
1 Bulgin on/off switch, type S.22		1	3
3 Clix sub-baseboard valveholders		2	1
2 Belling-Lee socket strips		1	6
3 Peto-Scott component brackets		1	0
5 Belling-Lee plugs			10
2 Belling-Lee spade terminals			4
1 Microfuse, 100 m.a. fuse			6
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3 Amplion 1 watt resistances		3	0
Connecting wire, screws, flex		1	6
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KIT "B" As for Kit "A" but including set of 3 specified valves, less cabinet and speaker. Cash or C.O.D. Carriage Paid, £2/19/6, or 12 monthly payments of 5/6.

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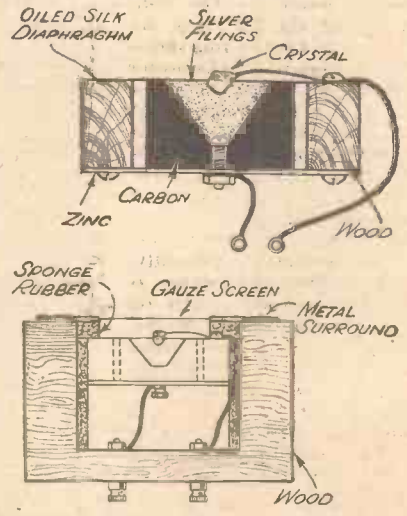
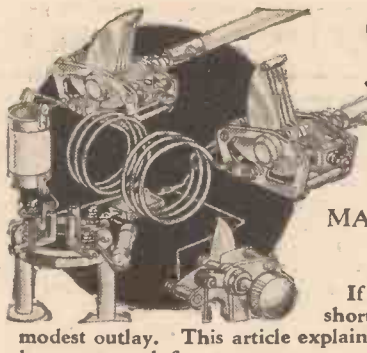
A CRYSTAL MICROPHONE

THE materials needed to construct this efficient microphone are a block of wood, 4in. by 3½in., cut to an octagonal shape, Reiss-carbon mike type, and 2in. deep; A square piece of hardwood, 1¾in. by ½in. deep; a piece of sheet zinc, 1¾in. square; one piece of oiled silk, not less than 2in. square; a block of carbon 1¼in. square by ⅜in. thick; some silver filings; a flat piece of sponge rubber; a small piece of galena or silicon crystal; two terminals; ⅜in. screws (9); a 6in. length of fine copper wire; a ¼in. nut and bolt; a 3in. square of gauze or linen; a 6in. length of twin flex; and a small tube of adhesive. Take the large block and cut a 2in. square out of one side to a depth of 1⅜in. Drill two holes in the bottom for the two terminals, then line the inside of the cut-out square in the large block with sponge rubber, sticking it in place with adhesive. Obtain another piece of thin zinc 2½in square, with the centre cut out leaving a ⅜in. surround which, when laid on the face of the block will give an inside overlap of just under ¼in. Drill 4 holes for screwing it to the block face.



Constructional details of the microphone.

To make the actual "mike," scoop out the centre of the carbon block to the shape shown, and drill a hole to take the bolt fastening it to the zinc square. Drill the same size hole in the zinc, marking diagonally from corner to corner to get the exact centre. On the top edge of the carbon block, glue a sponge rubber washer to press against the oiled silk diaphragm. Next take the oiled silk and in the centre make two very fine cross-cuts, just enough to allow the piece of crystal to be pushed half through. Then glue the diaphragm on to the hardwood block, keeping the piece of crystal exactly central, stretch taut till dry. Bolt the carbon to the zinc, and lock one end of a piece of twin flex under this centre bolt. Fill the cup in the carbon block with silver filings, press up against the diaphragm, and screw the zinc plate to the bottom of the block. Before placing the "mike" in the large block, fill the hole to a depth of just over an inch with the odd scraps of rubber, lay in the "mike," cut a washer of rubber 2in. square, with a ¼in. surround, lay the gauze or linen over the face of the block, and screw on the metal surround, which will leave the "mike" entirely suspended in the sponge rubber. A. B. (Liverpool).



Short Wave Section

MAKING A SHORT-WAVE SET FROM SPARE COMPONENTS

If you have not had previous experience with the short waves it is possible to make a start for a very modest outlay. This article explains how an experimental "initiation" receiver can be constructed from spare parts such as the average constructor already possesses.

THERE must be many a reader possessing the usual broadcast receiver covering the medium and long waves who is deterred from exploring below 200 metres simply because of the cost of building and running a separate receiver. However, contrary to what many listeners believe, it is not necessary to go to the expense of an elaborate receiver just to listen to the short waves.

Important Pointers

Before describing the construction of the set there are one or two facts regarding short-wave reception which the reader should know. First of all, a large aerial is not essential, but it is important that it does not sway in the wind or it will cause fluctuations in the tuning. For this reason a well-insulated indoor aerial, although not quite so sensitive as an outdoor one, is often preferable. Secondly, tuning on the short waves is much more selective than on the medium and long waves, so much so that the tuning condenser must be much smaller than the usual .0005 mfd., and should be fitted with a good slow-motion dial, otherwise it is quite possible to tune right past a station without noticing that it is there.

Another point which must be mentioned is the importance of the reaction control, for with a simple straight set it is essential to employ reaction. By bringing the set to the verge of oscillation it becomes very sensitive, but as soon as the reaction is reduced it loses its sensitivity and appears to be practically "dead," so that even the most powerful transmissions cause hardly a sound in the ear-'phones. For this reason it is highly desirable that the reaction control be as smooth as possible so that the receiver can be brought up to its most sensitive condition without fear of its suddenly bursting into oscillation. Incidentally, one peculiarity of the short waves is that it is often quite difficult to make the receiver oscillate, especially on the very short waves. This is in marked contrast with the conditions found on the medium waves, where elaborate precautions in the way of screening the coils and tuning condensers, etc., is often necessary to prevent self-oscillation.

Since the resources of individual readers in the way of spare components must vary considerably it is useless to lay down hard and fast rules regarding components and lay-out. The original design, as shown here, can be taken as the basis of your own lay-out, but provided that one or two particular points are noted, as will be explained later on, it is not necessary to follow it slavishly in every detail.

Circuit Details

From a study of Fig. 1 it will be seen that the circuit is made as simple as possible. Any little refinements which may be found desirable after the first try-out can easily be added later.

From Fig. 1 it will be seen that the aerial is connected to the grid coil through a variable condenser C1. This condenser is important, since it not only enables the selectivity to be varied in the usual way, but also plays an important part in reducing the damping effect of the aerial on the grid circuit, thus enabling the set to oscillate more readily.

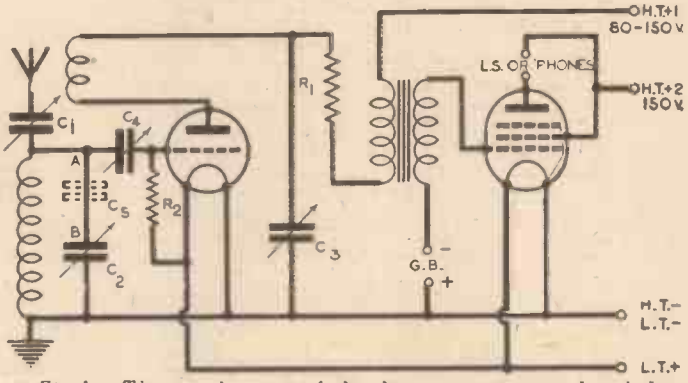


Fig. 1.—Theoretical circuit of the short-wave receiver described.

The use of the resistance R1 in place of an H.F. choke is perhaps somewhat unusual. The accepted practice is, of course, to employ a good quality short-wave choke, but as the reader is unlikely to have such a component already in his possession, and as a resistance answers the purpose quite well, the latter is specified here. To make up for the drop in anode voltage caused by the resistance the high-tension lead H.T.+1 is plugged in at a slightly higher tapping on the H.T. battery than would otherwise be used. Incidentally, an ordinary H.F. choke is of little or no use in this position.

The only other point calling for comment is the fixed condenser C5 (shown in dotted lines). This is only employed when a small tuning condenser is not available and the constructor is compelled to resort to the use of one of the usual size. C5 is then connected in series with C2 in order to reduce the effective capacity of the latter, but more will be said later concerning this.

Using Ordinary Components

Now for the constructional details! Suitable sizes for the panel and baseboard are 10in. by 6in., and 10in. by 8in., respectively. The components must be well spaced and the wiring kept short and direct. In this connection there are one or two points which should receive particular attention. For instance, the grid condenser is mounted close to the detector valve-holder so as to reduce the length of the connecting wire to the grid. Connecting wires running parallel to one another are avoided wherever possible, and a minimum number of terminals is used so that greater space can be allowed between them, thus reducing insulation leakage and simplifying the lay-out. Wiring is further simplified, and uncertain contact avoided by leaving out the usual filament switch. With an experimental set of this nature it is quite easy to disconnect one of the accumulator leads when switching off.

The experimenter who has no previous experience of short-wave work will be unlikely to have any special short-wave components on hand, and here his ingenuity will be called in play to modify those components which he already possesses. First of all, it is essential to have a good-quality air-spaced tuning condenser with a maximum capacity not greater than .00025 mfd. Fortunately, the writer had such a component available when constructing the set shown in Fig. 3, but in many cases a .0005 or .0003 mfd. condenser will be the only type the constructor possesses. However, if this is so, it can be modified by connecting a good-quality fixed condenser in series with it. The fixed condenser is connected in the lead marked A B in Figs. 1 and 2. If the tuning condenser to be used has a capacity of .0005 mfd., then a .0003 mfd. mica condenser should be connected in series with it. This will reduce its capacity to just under .0002 mfd. In the case of a .0003 mfd. tuning condenser a .0003 mfd. fixed condenser would also be suitable and would give a resultant figure of .00015 mfd. Of course, this arrangement is not put forward as taking the place of a really good short-wave tuning condenser, but it will serve its purpose quite well, providing the condenser is of the highest quality.

Regarding the tuning condenser itself, one with a pigtail connection to the moving vanes and with brass vanes well spaced should be selected if possible. Any good slow-motion dial can be used, but one

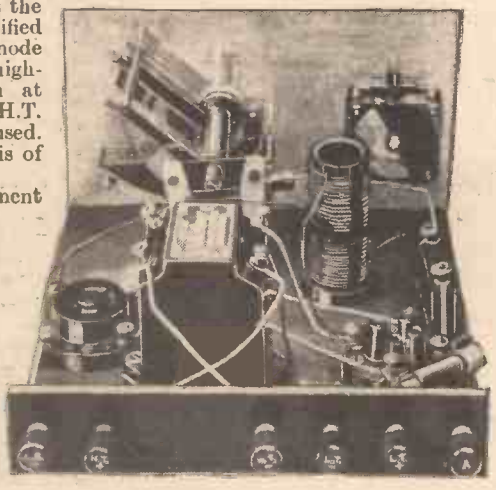


Fig. 3.—Rear view of the short-wave two-valver, showing the layout of components and simple wiring connections.

with a high ratio will make for easier tuning. For the reaction condenser an air dielectric instrument is preferable, but it is not absolutely essential.

Modifying the Valve-holders

Other components beside the tuning condenser which must have low-loss characteristics are the detector valve-holder, and the tuning coil. An ordinary valve-holder may be used for the output valve, but one of the special skeleton type is preferable for the detector. However, an ordinary holder can often be modified to make it suitable in this position. Fig. 4 shows how the bakelite can be sawn away from between the sockets, thus reducing the self-capacity of the holder and increasing the leakage path between the sockets.

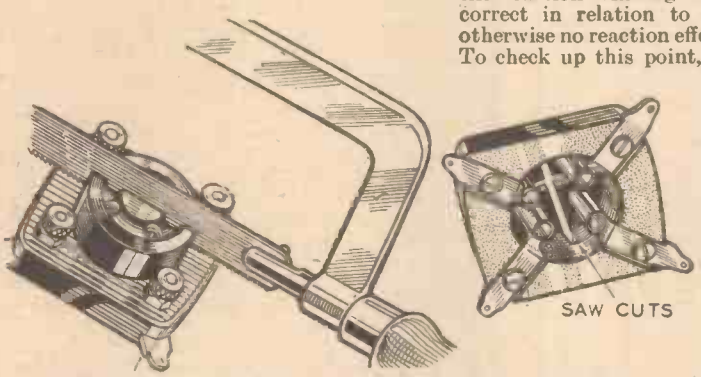


Fig. 4.—Showing the method of modifying an ordinary valve-holder for use in the short-wave set. The bakelite is sawn away between the sockets.

Coil Windings

The tuning coil consists of a 1in. ribbed bakelite former, and is wound with ordinary single lighting flex from which the outer cotton braid is removed. The turns are spaced fairly closely but not actually touching. Of course, there is no objection to the use of the conventional bare copper wire of 20 or 22 gauge, but with an experimental hook-up of this nature flex is quite suitable, and has the added advantage that it is easy to handle. It can be threaded through small holes made in the former, and the ends brought out for connecting purposes.

It is suggested that the first coil be wound with twelve and fourteen turns with a space of about ¼in. between the grid and reaction windings. This should cover approximately 20 to 40 metres, but the actual range will depend on the setting of the aerial series condenser, the size of the tuning condenser, and the spacing between the turns of the coil, etc. Later on other coils to cover the whole waveband from 10 to 180 metres can be constructed, and if these are fitted with valve-pin bases coil changing will be simplified.

Regarding the valves, a good, lively detector valve is necessary, such as a PM2DX or one of the HL type. An old valve which has lost its emission is quite unsuitable, and will most likely fail to oscillate. An economy pentode is used in the output stage because of its high magnification, but a high-magnification small power valve is also suitable. A super-power valve is not recommended.

Operating Notes

When connecting up the receiver for the first time it is recommended that the 'phones be used rather than the speaker, as transmissions of full speaker strength are unlikely to be secured right away. Start operations with the grid condenser screwed down to the position of maximum capacity, and the aerial series condenser in about the half-way position. It should now be possible by advancing the reaction to make the set oscillate over any part of the tuning range, but if it fails to oscillate try reducing the capacity of the aerial condenser. If this fails, try a higher anode voltage on the detector valve, or substitute another valve. Of course, the direction of the reaction winding on the coil must be correct in relation to the grid winding, otherwise no reaction effect will be obtained. To check up this point, see that the path of the reaction current from the anode of the valve through the reaction coil is in the same direction as the current from earth to aerial in the grid coil. There can be no mistaking when the set is oscillating, as a loud click will be heard when touching the aerial terminal, while "swinging" the tuning condenser will produce whistles and squeaks when passing stations. For the best operating conditions, the reaction control should be set so that the valve is just on the verge of oscillation, as denoted by a rushing sound in the 'phones. If the reaction, instead of building up, slowly goes in with a plop, try adjusting the value of the grid condenser and also reducing the anode voltage on the detector valve by plugging the lead from H.T.+1 into a lower socket on the H.T. battery. Alternatively, the value of R1 may be increased to 30,000 or 40,000 ohms.

It is worth while spending some time getting reaction to work properly, as much depends on its correct adjustment. The receiver is most sensitive when on the threshold of oscillation, but if the reaction is ploppy it is impossible to maintain it in this condition, and the set either remains comparatively insensitive or, if the reaction be advanced, it bursts into oscillation.

Short-wave Broadcasts

Probably the listener's first impression of the short waves will be rather disappointing, consisting of the reception of a seemingly endless number of morse stations. But by patiently following round the dial one or two telephony transmissions are almost certain to be picked up. The apparent scarcity of broadcasting stations is due to the fact that most of these stations are confined to certain wavebands. Between these bands there are large areas in the frequency spectrum given over almost exclusively to commercial stations. The times of the broadcast transmissions are also not so regular as on the medium and long waves. However, once a station is located it will be possible by waiting for its call sign to find exactly on what waveband one is working. Reference to published lists will then show where and when to continue the search. Generally speaking, short-wave broadcast stations are limited to six main bands in the region of 49, 31, 25, 19, 16, and 14 metres, while amateur transmissions can be picked up round about 20 and 40 metres.

Final Adjustments

After the first explorations, using the fourteen-turn winding as the tuning coil and the twelve turns as the reaction coil, the connections can be reversed and the twelve-turn coil used for tuning. If the set oscillates too violently a few turns may be removed from the reaction winding. On the other hand, if all the expedients so far mentioned fail to make the set oscillate then more turns may be added. Generally speaking, however, the fewer the turns, consistent with making the set oscillate, the smoother will be the reaction.

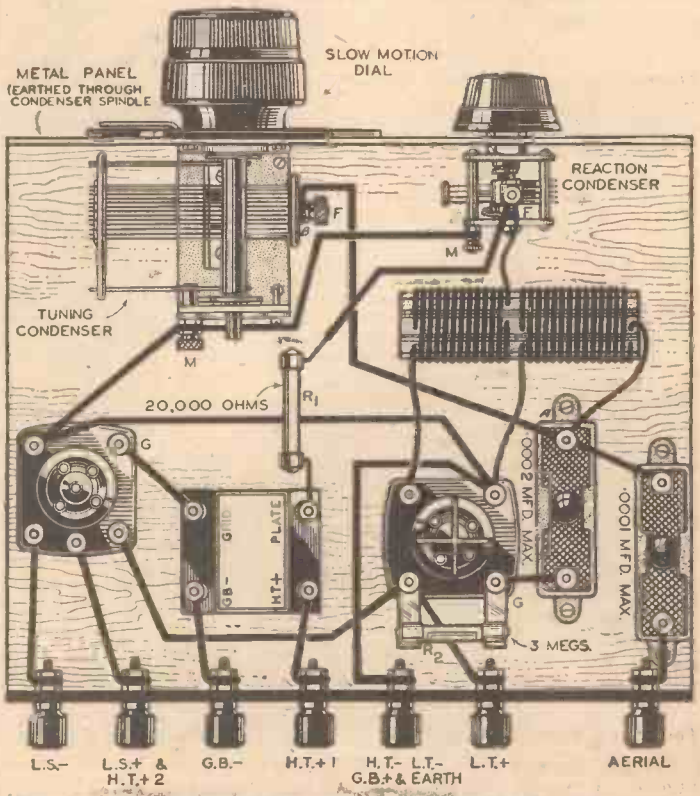


Fig. 2.—Plan of the receiver showing the suggested layout and wiring. The coil is shown in a horizontal position to clarify the connections.

LEAVES FROM A SHORT-WAVE LOG

By E. THURWAY

CT1AA, Lisbon, to which I referred in these columns recently, without doubt is seeking a more favourable channel than the one at present used, namely, 31.25 metres. It has been trying out 50.17 metres, 25.08 metres (announced), and 25.2 metres (11,960 kc/s).

With the rapid increase in the number of short-wave broadcasting stations it is necessary to use great care when endeavouring to identify the nationality of the station. Bear in mind that many countries now broadcast programmes for the benefit of others, and consequently a foreign tongue and *not* the native language is used. A case in point is that of W2XAF, Schenectady (New York), on 31.48 metres, which transmits a radio entertainment in Spanish for listeners in South American States on Wednesdays, from G.M.T. 23.35-00.30, and again on Saturdays between midnight and 00.30.

As there are so many Venezuelans and Colombians now on the air, it would be easy to jump to the wrong conclusion or even to confuse it with one of the DJN transmissions for Central America.

CT2AJ, Ponta Delgada, Sao Miguel (Azores), which has been licensed by the Portuguese Authorities as a private broadcasting station, has been recently heard on various occasions in Great Britain. Although advertised to work on 83.3 metres it has been reported on several channels varying from about 75 to 85.7 metres. Its schedule is G.M.T. 22.00-00.00 on Wednesdays and Saturdays, and power nearly 500 watts. Personally, I have picked up a broadcast from this transmitter somewhat mixed up with the Dutch amateurs on the 80-metre band.

International Prefixes

Talking of amateurs reminds me that three International prefixes have been altered. It would be wise to make a note of them. Romania now uses YR instead of YP; Malta ZB in lieu of VP3, and Cuba has replaced CM by CO throughout the list. Now for the stations which are more easily captured.

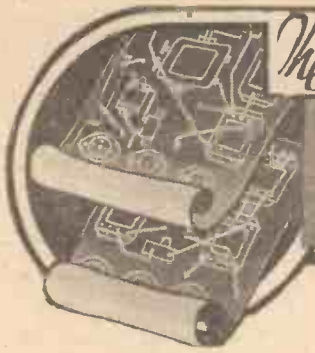
Nightly at G.M.T. 22.30, EAQ, on 30.43 metres (9,860 kc/s), the short-wave Madrid (Spain) station, comes on the air with calls in both Spanish and English. Here they are: *Aqui Estacion (Ay-ah-coo) Radiodifusion Ibero-Americana*, and, *Good Evening Everybody, this is station EAQ, Madrid, Spain, calling you.* In addition to the Spanish transmissions which are destined to listeners in South America, you may hear English concerts three or four times weekly between G.M.T. 01.00-01.30; they are welcomed not only by Europe and North Africa, but also by the United States and Canada. Nightly, however, for the benefit of all listeners the station broadcasts a special news bulletin in the English language. EAQ (Madrid) is worth logging, as it is a good, strong, steady signal; its unvarying wavelength is useful for calibration purposes, and in addition the broadcasts always include interesting musical items.

German Transmissions

Another station which provides a large number of broadcasts throughout the day and night is Zeesen (Germany) on a number of wavelengths. The principal transmitters in actual use are DJQ, 19.63 metres (15,280 kc/s); DJB, 19.74 metres (15,200 kc/s); DJD, 25.49 metres (11,789 kc/s); DJA, 31.38 metres (9,560 kc/s); DJN, 31.45 metres (9,540 kc/s), and DJC, 49.83 metres (6,020 kc/s). In addition, on 16.89 metres (17,760 kc/s) you may hear DJE testing shortly; it has not yet been brought into regular operation. As in the case of our Daventry Empire Service, the Germans frequently transmit simultaneously on two channels. The daily schedule is as under: G.M.T. 05.30-07.00 (DJQ, DJB); 08.45-12.15 (DJB, DJN); 17.00-21.30 (DJD); 13.00-16.30 and 22.15-02.15 (DJA, DJN); 17.00-21.30 and 22.30-03.30 (DJC). Barring the DJA G.M.T. 22.15-02.15 broadcasts, which are made for South America and for which Portuguese is used as the secondary language, all announcements for the other transmissions are made in German and English. Here again, English news bulletins are broadcast to the world at G.M.T. 09.30, midday, 16.15, 19.00, 21.00, and 01.15.

French Colonial Station

Another series of overseas transmissions to which you might also tune in is that provided by the French Colonial station FYA, at Pontoise, near Paris. Although the bulk of the broadcasts is mainly of interest to the French-speaking races, a news summary in English is provided at G.M.T. 13.30 (12.30 Sundays), and at 01.00 daily. The station works at the following times: G.M.T. 12.00-16.00 (19.68 metres. 15,243 kc/s); 16.15-19.15 and 20.00-23.00 (25.23 metres, 11,885 kc/s); and again between midnight and 03.00 and from 04.00-06.00 on 25.6 metres (11,705 kc/s). Generally speaking, the French programmes will be found to contain a considerable proportion of relays.



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

PRACTICAL WIRELESS.

Blueprints, 1s. each.

Long-Range Express Three	24.9.32	PW2
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Radiopax Class B Four	27.5.33	PW21
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Double-Diode Triode Three	10.6.33	PW23
Three-Star Nicore	24.6.33	PW24
Class B Detector Two-Valver	17.6.33	PW24A
D.C. Ace	15.7.33	PW25
Superset	19.8.33	PW26
Auto-B Three	19.8.33	PW27
All-Wave Two	19.8.33	PW28
A.C. Three	16.9.33	PW29
Premier Super	23.9.33	PW30
Experimenter's Short-Wave Three	23.9.33	PW30A
A.C.-D.C. Two	7.10.33	PW31
All-Wave Unipen	14.10.33	PW31A
F.J.C. 3-valve A.V.C. (Transfer Print)	4.11.33	PW32
Luxus A.C. Superhet	14.10.33	PW33
A.C. Quadpak	2.12.33	PW34
Sixty-Shilling Three	2.12.33	PW34A
Nucicon Class B. Four	6.1.34	PW34B
Fury Four Super	27.1.34	PW34C
A.C. Fury Four Super	10.2.34	PW34D
Leader Three	10.3.34	PW35
D.C. Premier	31.3.34	PW35B
A.C. Leader	7.4.34	PW35C
Prima Mains Three	5.4.34	PW35D
Master Midget Two	12.5.34	PW35E
Atom Lightweight Portable	2.6.34	PW36
Ubique	28.7.34	PW36A
Four-Range Super-Mag. Two	11.8.34	PW36B
Summit Three	18.8.34	PW37
Armada Mains Three	18.8.34	PW38
Midget Short-Wave Two	15.9.34	PW38A
All-Pentode Three	22.9.34	PW39
£5 Superhet Three	27.10.34	PW40
A.C. £5 Superhet Three	24.11.34	PW43
D.C. £5 Superhet Three	1.12.34	PW42
Hall-Mark Three	8.12.34	PW41
F. J. Camm's Universal £5 Superhet	15.12.34	PW44
A.C. Hall-Mark	26.1.35	PW45
Battery Hall-Mark 4	2.2.35	PW46
Universal Hall-Mark	9.2.35	PW47

AMATEUR WIRELESS AND WIRELESS MAGAZINE.

CRYSTAL SETS.

Blueprints, 6d. each.

Four-station Crystal Set	31.3.34	AW427
1934 Crystal Set	4.8.34	AW444
150-mile Crystal Set	Out of print	AW450

STRAIGHT SETS. Battery Operated.

One-valvers: Blueprints, 1s. each.

B.B.C. One-valver	Out of print	AW344
B.B.C. Special One-valver	Out of print	AW387
Twenty-station Loud-speaker One-valver (Class B)	Out of print	AW449

Two-valvers: Blueprints, 1s. each.

Melody Ranger Two (D, Trans)	Out of print	AW388
Full-volume Two (SG.-Det, Pen)	17.6.33	AW392
Iron-core Two (D, Trans)	Out of print	AW395
Iron-core Two (D, QPP)	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D, Trans)	Out of print	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans)	Out of print	AW338A
Lucerne Minor (D, Pen)	Out of print	AW426
Family Two (D, Trans)	*Apr.* '32	WM278

Three-valvers: Blueprints, 1s. each.

£8 Radiogram (D, RC, Trans)	Out of print	AW343
New Regional Three (D, RC, Trans)	25.6.32	AW349
Class-B Three (D, Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D. Trans, Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans. Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher: Chassis Model (SG, D, Pen)	3.2.34	AW419
Lucerne Ranger (SG, D, Trans)	Out of print	AW422
Cossor Melody Maker with Lucerne Coils	Out of print	AW423
P.W.H. Mascot with Lucerne Coils (Det. R.C, Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	Out of print	AW424
Pentaquester (HF, Pen, D, Pen)	14.4.34	AW431
£5 5s. Three: De-luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	9.6.34	AW437
All-Britain Three (HF Pen, D, Pen)	Out of print	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.1.34	AW451
Transportable Three (SG, D, Pen)	*Feb.* '32	WM271
Multi-Mag Three (D, 2 Trans)	*June* '32	WM288
Percy Harris Radiogram (HF, D, Trans)	*Aug.* '32	WM294
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Tyers Iron-core Three (SG, D, Pen)	*July* '33	WM330
C.-B. Three (D, LF, Class B)	Out of print	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
All-wave Three (D, 2LF)	*Jan.* '34	WM348
"W.M." 1934 Standard Three (SG, D, Pen)	*Feb.* '34	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	*Oct.* '34	WM371
Graduating to a Low-frequency Stage (D, 2LF)	*Jan'* 35	WM378

Four-valvers: Blueprints, 1s. 6d. each.

65/- Four (SG, D, RC, Trans)	Out of print	AW370
"A.W." Ideal Four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D, Pen)	Out of print	AW421
Crusaders' A.V.C. 4 (2 H.F., D, QP21)	18.8.34	AW445
(Pentode and Class-B outputs for above: blueprints 6d. each)	25.8.34	AW445A
Quadradyne (2SG, D, Pen)	*Feb.* '32	WM273
Calibrator (SG, D, RC, Trans)	*Oct.* '32	WM300
Table Quad (SG, D, RC, Trans)	*Nov.* '32	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
Self-contained Four (SG, D, LF, Class-B)	*Aug.* '33	WM331
Lucerne-Straight Four (SG, D, LF, Trans)	*Feb.* '34	WM350
£5 5s. Battery Four (H.F, D, 2LF)	*Feb.* '35	WM381

Five-valvers: Blueprints, 1s. 6d. each.

Super-quality Five (2 HF, D, RC, Trans)	*May* '33	WM320
New Class-B Five (SG, D, LF, Class B)	*Nov.* '33	WM340
Class-B Quadradyne (2 SG, D, LF, Class B)	*Dec.* '33	WM344
1935 Super Five (Battery Superhet)	*Jan.* '35	WM379

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Consoelectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C. Two (D, Trans) A.C.	*June* '32	WM286

Three-valvers: Blueprints, 1s. each.

Home-lover's New All-electric Three (SG, D, Trans) A.C.	25.3.33	AW383
S.G. Three (SG, D, Pen) A.C.	3.6.33	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen) A.C.	23.6.34	AW439
D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July* '33	WM328
Simplicity A.C. Radiogram (SG, D, Pen) AC.	*Oct.* '33	WM338
Six-guinea AC/DC Three (HF Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF Pen, D Pen) A.C.	*Nov.* '34	WM374

Four-valvers: Blueprints, 1s. 6d. each.

A.C. Melody Ranger (SG, DC, RC, Trans) A.C.	Out of print	AW380
AC/DC Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C.	8.9.34	AW446
A.C. Quadradyne (2SG, D, Trans) A.C.	*Apr.* '32	WM279
All Metal Four (2SG. D. Pen) A.C.	*July* '33	WM329
"W.M." A.C./D.C. Super Four	*Feb.* '35	WM382

SUPERHETS.

Battery Sets: Blueprints, 1s. 6d. each.

1934 Century Super	9.12.33	AW413
Super Senior	*Oct.* '34	WM256
1932 Super 60	*Jan.* '32	WM269
Q.P.P. Super 60	*Apr.* '33	WM319
"W.M." Stenode	*Oct.* '34	WM373
Modern Super Senior	*Nov.* '34	WM375

Mains Sets: Blueprints, 1s. 6d. each.

1934 A.C. Century Super, A.C.	10.3.34	AW425
1932 A.C. Super 60, A.C.	*Feb.* '32	WM272
Seventy-seven Super A.C.	*Dec.* '32	WM305
"W.M." D.C. Super, D.C.	*May* '33	WM321
Merrymaker Super, A.C.	*Dec.* '33	WM345
Heptode Super Three, A.C.	*May* '34	WM359
"W.M." Radiogram Super, A.C.	*July* '34	WM366
"W.M." Stenode, A.C.	*Sep.* '34	WM370

PORTABLES.

Four-valvers: Blueprints, 1s. 6d. each.

General-purpose Portable (SG, D, R.C, Trans)	Out of print	AW361
Midget Class-B Portable (SG, D, LF, Class-B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	*May* '32	WM287
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM362
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM363

[SHORT-WAVERS. Battery Operated.

One-valvers: Blueprints, 1s. each.

S.W. One-valve	Out of print	AW329
S.W. One-valver for America	Out of print	AW429
Roma Short-waver	10.11.34	AW452

Two-valvers: Blueprints, 1s. each.

Home-made Coil Two (D, Pen)	14.7.34	AW440

Three-valvers: Blueprints, 1s. each.

World-ranger Short-wave 3 (D, R.C, Trans)	Out of print	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver	*Jan.* 19, '35	AW463
Short-wave Adapter	*Dec.* 1, '34	AW456
Superhet. Converter	*Dec.* 1, '34	AW457

Four-valvers: Blueprints, 1s. 6d. each.

"A.W." Short-wave World Beater (HF Pen, D, RC, Trans)	2.6.34	AW436
Empire Short-waver (SG, D, RC, Trans)	*Mar.* '33	WM318

Super-hets: Blueprints, 1s. 6d. each.

Quartz-crystal Super	*Oct.* '34	WM372

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Two-valve Mains Short-waver (D, Pen) A.C.	10.11.34	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	*Aug.* '34	WM368

Three-valvers: Blueprints, 1s. each.

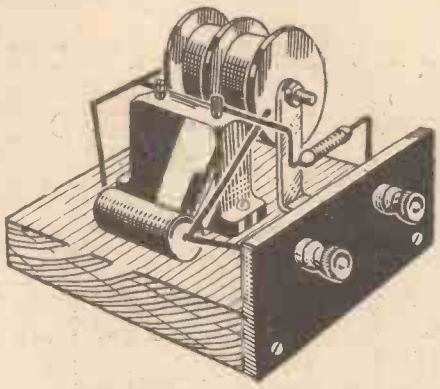
Emigrator (SG, D, Pen), A.C.	*Feb.* '34	WM352

Four-valvers: Blueprints, 1s. 6d. each.

Gold Coaster (SG, D, RC, Trans) A.C.	*Aug.* '32	WM292
Trickle Charger:	*Jan.* 5. '35	AW462

THE EASY ROAD TO RADIO.

THE BEGINNER'S SUPPLEMENT



AUTOMATIC TONE COMPENSATION

An Article Describing the Construction of a Simple Unit for Improving the Quality of Reproduction.

IT is well known that the human ear fails to respond to all sound frequencies at different volumes. This aural defect occurs in different individual cases to a varying extent, but, generally speaking, everyone suffers from the inability to hear speech or music at low volume with the proper relation between the frequencies contained in the reproduced item. The reader may probably have noticed that when one turns the volume control of one's receiver to the minimum position the music or speech appears to sound "thin." This effect occurs because the human ear attenuates the upper and lower frequencies to a greater extent than the middle ones at low volume.

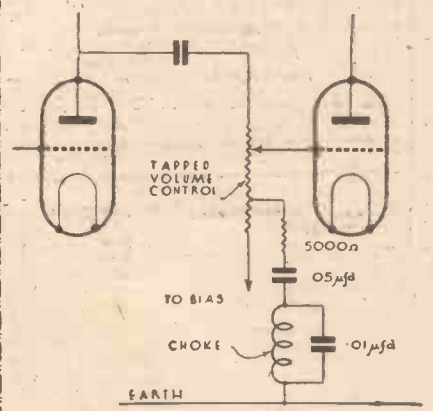


Fig. 1.—The theoretical circuit.

Over-amplification

It will be apparent that there are two courses open for correcting this deficiency. Firstly, the high and low frequencies could be over-amplified as the volume is decreased, or, secondly, the middle frequencies could be attenuated so that the response would remain uniform at low volume. The first of these methods would be comparatively difficult to realise, as two separate systems would have to be designed to amplify the upper and lower frequencies. By the judicious use of a manual tone control it is possible to attain a fairly satisfactory state of affairs aurally, as the tone control can be set in such a position as to give apparently an over-accentuation of the bass notes, thus giving a more "rounded" tone to the reproduced item. While this will be a pleasing form of reproduction to the majority of listeners, and will no doubt be fairly satisfactory, it usually happens that after listening to a receiver fitted with a good system of automatic tone compensation this kind of "quality" will not be tolerated.

Attenuating the Middle Frequencies

The only other course open to us is to design a system which, at a position towards minimum on the volume control, will resonate at round about 1,000 cycles per second. This system, to put it simply, will absorb a portion of the middle frequencies at low volume without affecting the upper and lower frequencies. Thus the ear will attenuate these latter frequencies through its inherent deficiency, while our system will attenuate the middle frequencies automatically to maintain the correct tonal balance.

The particular method adopted is illustrated theoretically in Fig. 1, and pictorially in Fig. 2. It will be seen that a tapped volume control is used, this tapping point being arranged at a position approximately two-thirds of the way round the resistance element from the maximum end. The resistance of the volume control should be fairly high to allow of a very gradual attenuation of volume. The circuit itself consists of a choke (which can be home-constructed), a ½-watt resistance of 5,000 ohms, a fixed condenser with a value of .05 mfd., and another with a valuc of .01 mfd.

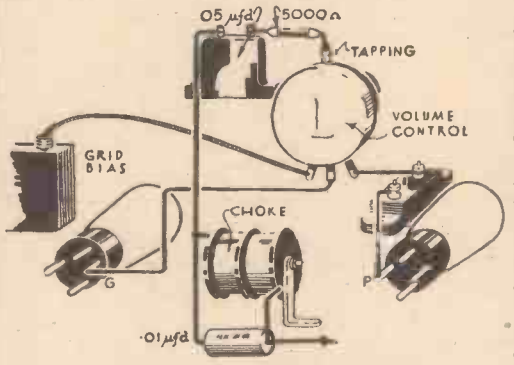


Fig. 2.—The circuit shown pictorially.

The construction of the choke is illustrated in Fig. 3. The double section bobbin may be built up from cardboard, or one of the many insulating materials manufactured for this purpose, and as shown, the winding consists of 4,000 turns of 44 gauge D.S.C. wire to each section. Great care must be exercised in the winding of the choke to ensure that the wire is not broken, as it is exceedingly fine. The connections of the two sections of the choke will be seen in the inset drawing in Fig. 3. The mounting of the choke may be effected by means of a bracket, the fixing screw of which, running as it does through the centre of the choke, must be of non-ferrous metal.

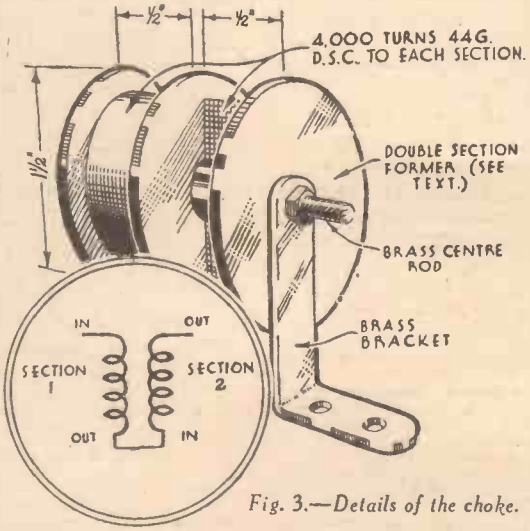


Fig. 3.—Details of the choke.

Fig. 4.—The components made up into a compact unit.

A Simple Unit

It will perhaps be found convenient to make up the choke and condensers into a unit, as shown in Fig. 4, and this can be mounted in a suitable position to the volume control in the receiver. This positioning will not be found to be at all critical, as the components in the unit, connected as they are between the low potential end of the volume control and earth, should in no way affect the stability of the finished receiver.

No difficulty should be experienced in making the tapping point to your existing volume control. In the case of one with a solid element a thin spring could be arranged to press against the element, to which your connection to the unit should be taken, while a volume control with a wire element would allow of a soldered connection to the element itself.

In conclusion, it may be stated that the construction of this piece of apparatus will be found well worth while, as the improved reproduction of your receiver, after its incorporation, will be immediately apparent, particularly in the case of listeners who employ radio as a musical background to their normal activities, and consequently operate their receivers at low volume for considerable periods.

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.

GLASGOW AND DISTRICT RADIO CLUB

UNDER a new management committee this club is taking up television and ultra-short-wave work on a progressive scale. The 56 M.C. section has been consistently active, during the last few months, experimenting and testing with a local enthusiast, super-regenerative and straight circuits being used. An eight-watt amplifier has been constructed and has been of considerable use in experiments. Double-diode-triodes, Class B, and push-pull are being tried out as short-wave detectors. Novices are well catered for with a series of lectures on elementary theory, and new members are welcomed.—Hon. Sec., Mr. J. Hair, 42, Maryland Drive, Glasgow, S.W.2.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

THE meeting of the London Chapter, held on Friday, March 1st, was well attended for the Lecture on Television given by Mr. W. J. Nobbs, F.T.S., Television Advisor to the Chapter. He dealt with the subject from the beginner's point of view and from that of the advanced experimenter, and by the aid of the blackboard illustrated the various systems in use. Some very interesting apparatus was used for demonstrating reception of television in the hall, and the image was reproduced from special gramophone records. This was the first of a series of television lectures, and as this subject will be featured at many meetings, all readers of PRACTICAL AND AMATEUR WIRELESS are invited to attend.—A. E. Bear, Secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

SHORT-WAVE RADIO AND TELEVISION SOCIETY

THE weekly meeting of this society was held at St. Paul's Hall, Norfolk Road, on Tuesday, February 26th, under the chairmanship of Mr. R. E. Dabbs (2BUS). Mr. S. J. Meares gave a talk and description of his disc scanning television receiver. The receiver was housed in a cabinet in the front of which was a small aperture for viewing the picture. The apparatus consisted of a Baird disc driven by a small motor taken from a vacuum cleaner. By employing resistances in series with the motor it was possible to attain the correct speed. Behind the disc was a neon tube of the flat plate type which was connected to the output of the television receiver, and to achieve synchronisation with the transmitter two electro-magnets and a thirty-toothed wheel were fitted in the usual manner. Mr. Meares used this television receiver in conjunction with a receiver employing a PX4 valve in the output stage. This was found to give quite good pictures.—Secretary: Mr. J. T. Webber, 368, Brigstock Road, Thornton Heath.

SLADE RADIO

THE subject of the address on February 21st was a lantern lecture upon Modern Wireless Valves, by Mr. Valentine, of the Mullard Wireless Service Co., Ltd. The speaker dealt principally with the A.C./D.C. 13v. universal valves and the octode frequency changer. Slides were thrown on the screen showing the manufacture of valves to the final testing before despatch, while other slides showed in detail the apparatus used for the carrying out of the various tests. The audience were informed that one of the tests consisted of applying 350 volts between heater and cathode. These new universal valves had the Mullard new type base which was explained in detail. They also have the grid brought out at the top of the valve.

The second portion of the address dealt with the frequency changer, and this was again very thoroughly demonstrated by means of slides of graphs showing how the beat note is produced, and diagrams of circuits were also shown.—Hon. Secretary: Chas. Game, 40, West Drive, Heathfield Park, Handsworth, Birmingham.

INSTITUTE OF SCIENTIFIC RESEARCH

A GENERAL meeting of this society was held recently, and the following officers were elected: President, D. W. F. Mayer; Vice-President, J. P. P. Tyndall; Treasurer, P. W. Berry; and Secretary, R. Nathan.

In connection with this meeting, readers are asked to note that all future correspondence should be sent to the Secretary, at 118, Spencer Place, Potternewton, Leeds, 7.

A visit to the Distribution Department of the Leeds Gas Works took place on Friday, February 22nd, and the party of eleven members who turned up spent an interesting and enjoyable afternoon.

REPLIES IN BRIEF

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

A. V. O. (Needham). Tapping No. 1 on the coil will obviously be less selective than No. 7. The latter is a centre-tap, whilst the former is the top of the coil and this accounts for the increase of volume when it is used. Ganging will also be upset if you use No. 1.

A. G. D. (N.18). To avoid tampering with the wiring of your commercial set obtain a gramophone pick-up adaptor and use this according to the maker's instructions.

H. W. (Stockport). We regret that the coils in question could not be used in the Universal Superhet.

J. S. (Edinburgh). If you are certain that aerial and earth are O.K. in the new house, the set must have been damaged in the change-over, and it should therefore be carefully checked.

H. E. D. (Wrexham). We regret that we have no blueprint of a receiver using the coils which you have by you.

R. W. (Bruton). The variable-mu valve will give of its best when used with a volume-control circuit. As yours is a portable we would advise the ordinary H.F. pentode and not the variable-mu type.

R. E. B. (Isleworth). You do not give the type of coil which you have. We can supply several blue prints, but it is necessary to know the particular make of coil.

A. C. M. (Pennymoor). It would appear that one of the coils is not switching when you change over to long waves, and thus one circuit is set for medium whilst the other is set to long. This would account for the medium wave stations being heard as a background throughout the long-wave tuning.

H. W. (Bolton). Trouble may be due to the fact that you are using D.C. mains supply. Touching earth to aerial might short the mains, but method of connection in set and source of supply are necessary in order to state for certain. Static charges on the aerial might be prevented from leaking to earth if an air-spaced condenser is used in aerial circuit, and this might spark when the static discharges.

N. P. (Leigh-on-Sea). We regret that we cannot supply complete circuit diagrams to suit individual requirements. This is emphatically stated in the panel on the Queries and Enquiries page.

E. L. (Grimsby). We would not recommend the supply of the valves you mention from D.C. mains. Short-wave components for your needs may be obtained from Messrs. Stratton & Co., Bromsgrove Street, Birmingham, or from A. F. Bulgin & Co., Abbey Road, Barking, Essex.

J. B. (New Malden). What do you mean by "It will only go half-way"? Does the set burst into oscillation at that point, or does it fail to oscillate? In the former case probably too much H.T. is being applied to the detector, and, in the latter, the capacity of the reaction condenser is too small, or the reaction winding is defective.

N. N. (Forest Hill). It is impossible to describe the type of the rectifier merely from the dimensions. It is essential to know the input and output ratings.

W. R. (New Washington). If you are certain the trouble is not due to instability arising from bad circuit design, it may be traced to interference coming through the mains, and the usual interference circuit consisting of H. F. chokes and condensers should be fitted to the mains-input circuit.

J. S. (S.E.5). Presumably the padding condenser is not large enough, and we would recommend the addition of a .001 mfd. fixed condenser in parallel with it in order to adjust the oscillator circuit for long waves.

G. W. D. (Buckingham). It is not advisable to recommend one particular make, and you should therefore obtain one or two sets on approval from a good local dealer, in order to test them under the actual conditions which are to be found in the school. This is better than all the recommendation, and it is possible that the Universal type of receiver will be found most suitable.

S. C. (Market Rasen). You should not put the extra resistance in the bias circuit as this increases the bias on the output stage and thus reduces the volume. Try a 100-ohm resistance in each anode circuit of the push-pull valves, or, alternatively, a high resistance between centre-tap of input transformer and earth, with a 2-mfd. condenser across it.

M. G. S. (Blaydon-on-Tyne). Insertion of decoupling resistance will hardly affect anode current of total circuits. A triple-capacity battery should give good service on this particular receiver.

B. H. (E.8). We are sorry we have not used these particular coils and, therefore, cannot supply you with a blueprint for them.

A. M. (Liverpool). If hum is not noticeable on gramophone, it points to H.F. pick-up and more care should be used in screening the H.F. side. Is the detector valve microphonic? Try a screened-aerial lead-in and a screened earth lead, and make quite certain that the pick-up leads are well screened and the screening earthed.

A. H. M. (Wolverhampton). In view of your difficulty we would suggest the inclusion of a Droitwich wave trap in the aerial circuit. Your local dealer should be able to supply one of these or get one for you.

PRACTICAL 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).

"Radiogramme"

SIR,—There seems to be some confusion in the use of the word "radiogramme." It is neither an instrument nor a metric unit, but a message transmitted by radio from ship to shore and given to the person concerned in worded form. It is so spelt in order to avoid confusion with "radiogram," the instrument as we know it. I believe this results from an agreement originally come to by the American postal and radio authorities.—H. W. FOWLING (S.E.14).

"Stal" Rectifier

SIR,—With regard to the query of B. M. J., of Swansea, about building a trickle charger, I think he will find that the rectifier is of French manufacture under the trade name of "Stal."—BERNARD HORTON (West Melton).

Undistorted Output

SIR,—Can you please supply any method for determining the undistorted output of a valve. If this is impossible for the ordinary amateur, why do valve manufacturers not supply this information on their data sheets. What will the output of receivers employing the following valves be :—(1) Cossor 220 P; (2) Two Cossor 220 P's in push-pull ?—ERIC M. BROWN (Leith).

[The formula for ascertaining undistorted output is rather complicated, but a rough approximation may be obtained by multiplying the amplification factor squared by the normal grid bias squared, and dividing this by eight times the normal impedance. In the case of super-power valves, most manufacturers do supply the output figures. The undistorted output of the 220P is 170 milliwatts, but with two of these valves in push-pull the output will be in the neighbourhood of 420 milliwatts, as it is possible to tolerate 25 per cent. overload with a push-pull stage, owing to its particular characteristics.—ED.]

"Atom" Lightweight Portable

SIR,—I have been a regular reader of PRACTICAL WIRELESS since No. 80, and I must express my very great appreciation of it. I am a newcomer to wireless, and until I began to take your paper, I knew nothing whatever about it. Since then, however, my knowledge has increased by leaps and bounds, and wireless is now my principal hobby.

A short while ago I constructed your "Atom" lightweight portable, and I am obtaining every satisfaction from it.

I feel I must reiterate other reader's congratulations on the amalgamation of *Amateur Wireless* with your paper, and I wish the paper, which I think is now better than ever, every success.

I qualified last summer for the Coronet camera presented in connection with your paper, and I take this opportunity of thanking you for it. It is undoubtedly a very fine piece of work, and I have taken some excellent "snaps" with it.—ROBERT S. BRATHERTON (Putney).

Dutch Time

SIR,—In your paragraph on Holland's time problem in "Round the World of Wireless" you say that Dutch time is twenty minutes *behind* G.M.T. Actually the reverse is correct, Holland being twenty minutes *ahead* of G.M.T. In other words, at 9.40 here it is 10 o'clock in Holland.—C. HERBERT (London, W.7).

[Thanks for pointing out the slip.—ED].

Starting in Radio

SIR,—I am a novice in wireless matters—but have decided to study and learn *thoroughly*.

I should be grateful if you can recommend a book, or books, which would suit me. In these days of mains sets—mention of H.T., L.T., grid-bias batteries, etc., only serves to confuse me, when apparently all these particular batteries and accumulators are now contained in the transformer of the mains set.—T. E. H. BROOKER (N.W.6).

[You could not do better than obtain the "Wireless Constructors' Encyclopædia" and study this in conjunction with the articles which are published weekly in these pages. The Encyclopædia is arranged alphabetically and is lavishly illustrated, and you should soon have a good grasp of modern wireless practice. Obtain also our list of wireless books.—ED.]

More-powerful Sets Wanted

SIR,—Upon reading the correspondence columns in the February 23rd issue, I noticed that a reader wants sets with more valves and punch. I heartily agree with him.

I am using a home-constructed super-het 7, and while admitting that it was rather expensive to build, it is certainly worth it to feel the great reserve of power at your control, when required.

Originally this set had a Class-B output stage, but I discarded it in favour of a super-power valve.

The valve is a 362 P.2, and it gives 800 m.w. undistorted output for 18 m.a. input. The combined PRACTICAL AND AMATEUR WIRELESS is far superior to anything else on the market, and I wish it every success.—D. E. MORGAN (Stafford).

Our Class B Unit

SIR,—I have built your Class B adapter and am using it with a screen-grid det., power set. I have been more than pleased with the results I have obtained.

I have been working it on batteries but now I wish to use it with D.C. eliminator which gives an output of 15 milliamps at 120 volts. Will you please tell me what alterations are necessary for this.—C. E. CROSBY (Ilford).

[It should be possible to connect the unit direct to the receiver in place of the dry battery. In the event of any instability, it will be necessary to decouple the anode circuits, but it will be necessary to try the unit first, as it may work quite well without any further alteration.—ED.]

Amateur Transmitting Licence

SIR,—Could you possibly give me any information concerning simple transmitting or give me any names of books on that subject.—D. H. KING (Framlingham).

[No experiments may be undertaken in transmission until the licence issued by the P.M.G. is obtained. If you are keen on actual transmitting work we would advise you to attend one of the colleges or take a correspondence course from one of our advertisers in order to grasp the principles thoroughly and thus be enabled to qualify for the licence.—ED.]

Changing Resistances

SIR,—As I am constructing the Short-wave World Beater, in which four fixed resistances are used, ½ watt type, I beg to inquire if it would be suitable to use 1 watt type of the same values.—D. A. STEWARD (King's Langley).

[It may be taken, as a general rule, that it is always possible to use resistances of higher rating, but never of lower rating. In some cases, of course, the physical dimensions may render it essential to adhere to a specified type, but in this particular case you may use your 1 watt resistances without trouble.—ED.]

A Good S.-W. Log

SIR,—For the past seven months I have been hearing a Brazilian station on the 49-metre band, and just recently I have been able to trace the source of this transmission. In answer to my report I have received a QSL card of unusual design. The call-sign of this station is PRA8, and is owned by the Radio Club of Pernambuco. It uses the slogan "A Voz do Norte," which is, of course, "The Voice of the North."

The official wavelength given is 49.67 m. 6,040 kc/s, but at the time of writing they are on about 49.45 m. and transmit daily from 19 to 20.00 and 21 to 01.30 G.M.T. Strength with a 3-valve receiver is excellent, sometimes peaking at R9 with headphones. Quality is usually good, but it is subject to severe heterodyning at times.

I am very surprised to find that very few S.-W. listeners report this station, particularly as PRA8 is one of the most consistent South American S.-W. stations.

I would like to mention reception here also of the following short-wave stations :—

HI4D, Santo Domingo, 45.5 m.; ZTJ, Johannesburg, 49.01 m.; HJ1ABB, Barranquilla, 46.51 m.: HJ4ABB, Manizales, 42 m.; HJ4ABH, Manizales, 49.15 m.; YV6RV, Valencia, 49.75 m.; YV2RC, Caracas, 49.08 m.; YV3RC, Caracas, 48.78 m.; YV4RC, Caracas, 47.10 m.; YV5RMO, Maracay, 51.28 m.; VUB, Bombay, 31.36 m.; XEBT, Mexico City, 50 m.; COC, Havana, 49.96 m.; HJ4ABE, Medellin, 50.42 m.; PRF5, Rio de Janeiro, 31.56 m., and VK2ME, VK3LR, VE9GW, VE9AS (46.67 m.). I have 148 verifications and QSL cards in which are included many of the above stations. In conclusion, I hope that more space will be given to this fascinating side of radio in future issues of PRACTICAL AND AMATEUR WIRELESS.—F. A. BEANE (Ridgewell).

CUT THIS OUT EACH WEEK.

Do you know

—THAT instability in H.F. receivers may generally be cured by isolating the grid and anode circuits.

—THAT great care is needed in choosing the intermediate frequency for a short-wave superheterodyne.

—THAT brass screws or bolts should always be employed when making up experimental chokes, coils, etc., to avoid modifications in inductance which might be obtained with iron screws.

—THAT the former upon which ultra-short wave chokes is wound must be selected with care, and should preferably be dispensed with entirely.

—THAT D.C. receivers of commercial design which cannot easily be modified may now be operated from A.C. mains by means of a simple device known as an inverter.

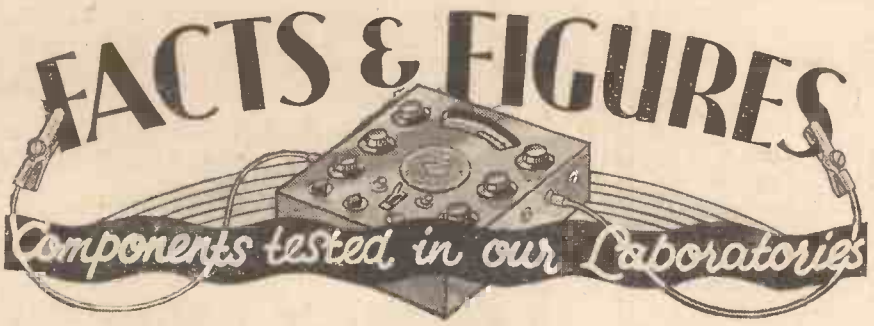
—THAT the above device is just the opposite to a converter, and thus generates D.C. from an A.C. source.

—THAT for the average cathode-ray tube a voltage of very high value has to be used—generally of the order of 1,000 volts.

—THAT it is not essential to use sal-ammoniac in the construction of an H.T. battery or dry cell.

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.

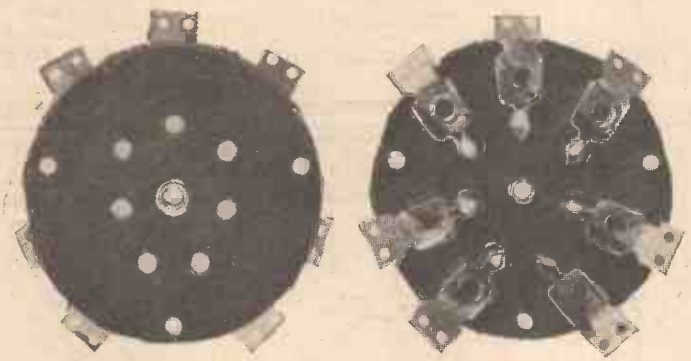


Wearite Valve-holders

AN interesting new type of valve-holder has been developed by Messrs. Wright and Weaire, and is the subject of the illustration below. Its original design will at once be apparent, and there are one or two points about the design of this holder which will instantly appeal to every constructor. Firstly, the method of mounting, and secondly the highly-efficient type of contact. With the majority of chassis type valve-holders, it is necessary to cut a hole in the wooden or metal chassis and then pass the contacts down through the chassis, mounting the holder itself on the upper surface. There is a risk in some cases of a contact between the chassis and the contacts, and although by careful mounting this may be avoided, the risk is there. With these new Wearite holders it is only necessary to cut a hole in the chassis to accommodate the base of the valve, and thus the hole may be very roughly cut (in the case of those who have not a large enough drill), provided that it leaves sufficient material for the attachment of the screws. The holder is then attached to the underside of the chassis and thus the bakelite discs forming the holder are interposed between the contacts and the chassis.

The contacts are extremely efficient and are built up from steel and brass. The material actually in contact with the valve legs is brass, and it is to the same piece of material that connecting wires are soldered, thus ensuring sound electrical connection. To ensure that a secure grip is obtained on the valve leg, and that this grip will remain efficient throughout the life of a receiver in spite of repeated insertion and removal of the valve, a second similar structure is made up from spring steel and fastened outside the brass contacts. The double arrangement of these may be seen in the right-hand illustration. The spring steel gives a very efficient form of contact, and is a novel development of this type of holder. It is impossible to damage a valve owing to accidental contact as the upper discs are sufficiently thick to prevent the valve legs being forced into contact with the sockets unless the valve is in its correct position.

The holders are obtainable for 4-pin, 5-pin, 7-pin, and 9-pin valves, and the prices are 8d., 8d., 1s., and 1s. 3d., respectively.



The efficient Wearite chassis-mounting valve-holder, showing, on the right, the interesting double contact which utilises both spring steel and brass.

New Drydex Battery Prices

READERS should note that the prices of certain Exide H.T. batteries have been reduced in price. The new prices are as follow :—

Drydex "Texet" Series.

Type T.T. 60	(60	volts),	3s.
„ T.T.100	(100	„),	5s.
„ T.T.120	(120	„),	6s.

Drydex "Red Triangle" Series

Type H.1,003	60	volts	3s. 9d.
„ H.1,004	66	„	4s. 3d.
„ H.1,005	99	„	6s. 3d.
„ H.1,006	120	„	7s. 6d.
„ H.1,044	108	„	6s. 9d.

At these new prices, Drydex batteries become more attractive than ever, and, with the name Exide behind them, they can be relied upon to give every possible satisfaction.

New Mullard Transmitting Valve

A NEW valve is announced from the Mullard factory, and this is of particular interest in view of the ultra-short-wave developments which are taking place to-day. The characteristics of this new valve, which is known as the type TZ1-75 are :—

Filament Voltage	10.0 v.
Filament Current	1.6 a.
Total Emission	1.5 a. approx.
Maximum Anode Voltage	1,500 v.
Maximum Continuous Anode Dissipation	75 w.
Amplification Factor	25

Mutual Conductance :
(At Anode Volts 1,000 Anode Current 75 m.a.) 5 m.a./v.

Anode Impedance :
(At Anode Volts 1,000, Anode Current 75 m.a.) 5,000 ohms.

The mean anode current must not exceed a maximum value of 120 m.a. and for short-wave working the applied anode voltage must be limited according to the following table :—

Wavelengths (metres)	Maximum Anode Voltage (volts)
45 and above	1,500
25	1,200
14	1,000
5	800

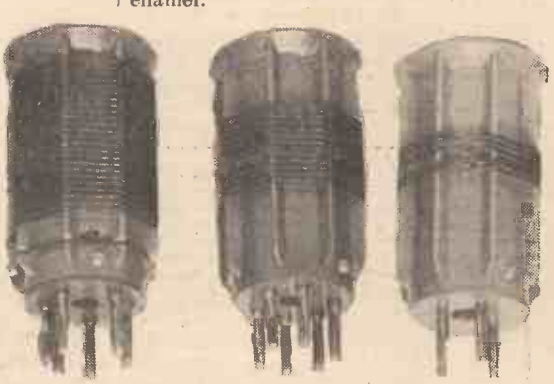
The list price of the TZ1–75 has been fixed at £14.

New Magnum Switches

SOME time ago we announced the introduction of some multi-contact switches by Messrs. Burne-Jones and Co., Ltd., in which the contacts were of gold and silver. These switches are obtainable in several patterns and provide for most intricate switching without difficulty. A demand has arisen for this type of switch in a slightly lower price, and Messrs. Burne-Jones have now introduced an exactly similar style of switch in which the contacts are of nickel silver, instead of the former higher-priced metals. The switches are, of course, quite as efficient, although naturally the same reliability will not be obtained at the actual contact points. In many circuits this will not be found a great disadvantage and, therefore, this cheaper switch may be employed. The switches are made with 5, 6, 7, 8, or 9 pairs of contacts, and the prices range from 4s. to 5s. 6d. The rotating contacting member may be arranged to provide 2, 3, 4, or 5 separate positions at the same price. Owing to the novel method of constructing the switch it may be obtained with any desired arrangement up to thirty-two pairs of contacts to special order, and if necessary a Q.M.B. switch may be incorporated at an extra price of 1s. 6d. each.

Eddystone Short-wave Coils

FOR the construction of a short-wave receiver, the Eddystone coils will be found extremely useful. They are obtainable with four- and six-pin bases, the former being suitable for plugging into an ordinary low-loss valve-holder, whilst the latter are intended for use with a special six-pin coil base made by Messrs. Stratton and Co. The coils cover all ranges from 12 metres up to 2,000, and each is identified with a coloured spot on the upper surface of the coil former. Heavy gauge enamelled wire is used for the short-wave ranges, and the losses are reduced to a minimum. Threaded ribs on the formers prevent the turns of wire from moving and thus a receiver may be calibrated and, in spite of coil changing, the calibration will hold. The coils cost from 4s. to 6s., according to the range. To enable the coils to be stored without damage a neat metal box is obtainable from the same firm for 1s. 8d. This has six divisions and is neatly finished in crystalline enamel.



Six- and four-pin interchangeable short-wave coils from the Eddystone range.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

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

SPECIAL NOTE

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

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

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.

Soldering Troubles

"Although I prefer to solder connections, I find the following troubles: I use an electric iron and commercial paste-flux. When the iron is ready, I wipe it and dip it in the paste, but it dirties the iron. Generally, it gives good results at a joint, provided I can keep the iron clean and tinned. Can you state whether the fluid flux is better and will prevent this trouble?"—L. P. (Dewsbury).

If your iron is really hot it should not become dirty when used with paste-flux. Either your flux is in a dirty condition and contains impurities, or your iron is not quite hot enough. This could result from the use of an incorrect voltage. Your iron may, for instance, be designed for use on 250-volt mains and be used at present on 200 volts. The fluid flux is quite good for cleaning the iron and for tinning purposes, but is not recommended for use in a receiver owing to the risk of corrosion. A block of sal-ammoniac, or a heap of crystals may be used to clean the iron, and the paste-flux retained for wiring-up purposes.

A Comprehensive Circuit

"Would it be possible for you to publish a circuit in the near future which will cover the normal broadcast band as well as the 6- or 7-metre band which is to be used for the television transmission? I want to build such a set so that I can receive the television pictures and also the ordinary broadcast programmes."—J. U. E. (Sydenham).

There are several things to be considered before such a circuit is developed. First and foremost, when the transmissions are introduced, will they form complete programmes through the normal broadcasting hours, so that the necessity for listening on the broadcast band will be unnecessary? In that case, of course, it will not be necessary to cover the wide band, and the design of the circuit will be simplified and improvement in efficiency obtained. We are, naturally, carrying out experiments here, and as soon as all broadcasting arrangements are finally settled, suitable circuits will be given.

The Universal Hall-Mark

"In the list of components for the Universal Hall-Mark Four you specify four 7-pin valve-holders. I think you will find that three of these should be 6-pin holders. Also the suppressor grid in the output valves is connected to the control grid and not to cathode as depicted in the diagram. These points may be considered of sufficient importance to you to call for correction."—J. R. Sweeney (Baldwin Avenue, Glasgow).

There are no 6-pin valve-holders on the market, and the fact that there are only six connections to the valve itself is of no importance. A 7-pin holder is used, and one pin is left blank. With regard to your second point, the suppressor grid is joined to the control grid in these particular valves.

Long Waves and the Aerial Condenser

"The receiver I am using has a small pre-set condenser fitted in the aerial lead (inside the set). Whilst trying the long-wave stations recently I found that the value required for this condenser on long waves was different from the value which is best on medium waves. Does this show that the winding of the coils for the two bands is not matched? If so, how can I modify the coil to get it matched?"—R. E. (Hull).

The series aerial condenser is generally found to be unnecessary on long waves. Try short-circuiting the condenser and you will probably find that results are better in that way. If so, fit a small push-pull switch on the set so that it may be pulled out when long-wave listening is indulged in. Alternatively, fit a second aerial terminal joined to the other side of the condenser, and change the aerial connection for long waves.

A Peculiar Effect

"I have a three-valve receiver—detector and two L.F. stages, the H.T. for which is obtained from the mains. After disconnecting the H.T. the set still works faintly. I should be glad if you could explain this."—S. W. W. (Co. Cork).

We presume you wish to infer that the set keeps on working for an indefinite period after the H.T. has been disconnected. Most sets will work for a short time, due to the condensers discharging, but if it keeps on it would appear that there is some leakage and that the H.T. is not in fact disconnected although the switch is operated. Remove the H.T. section or positive and negative leads entirely, and then see if it keeps working.

Some Points on the Hall-Mark Three

"With regard to the Hall-Mark Three, has the lead to valve V1 (the cap) to be screened? What other valves are suitable? What is the capacity of each section of the tuning condenser? Is the baseboard metallised over wood?"—S. E. (Newtown).

The lead to the cap of V1 need not be screened, but in the event of instability this precaution should be taken. The screening sleeving should, of course, be earthed if such a lead is employed. We do not advise any change from the valves specified. Each section of the condenser has a maximum capacity of .0005 mfd. The chassis is made from plywood, and this is specially prepared by the makers to provide a metal surface.

An Old D.C. Fault

"I built a set using a D.C. eliminator. This works all right in a friend's house, but when I use a two-way adapter I find that the fuse and lamp blow. The lamp is 40-watt. What is the cause of this? I always understood that a lamp and set could be run from a two-way adapter. Must I earth the eliminator on D.C. or not?"—M. I. (Hackney).

The eliminator should be provided with an earthing terminal to its metal case. If no case is provided, then the H.T. negative lead should be found and joined to the receiver in the ordinary way. The earth terminal on your receiver must then be joined to earth through a 2-mfd. condenser. If you are using a direct earth to the set you are probably shorting your mains. If a metal case is fitted to the unit, the earthing terminal on this should also be joined direct to earth, and if this blows the fuse it points to a short-circuit inside the unit and the wire should not be used.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face type and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. Radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," 8, Southampton Street, Strand, London.

PREMIER SUPPLY STORES

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

OFFER the Following Manufacturers' Surplus New Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra, I.F.S. and abroad, carriage extra. Orders under 5/- cannot be sent c.o.d. Please send for Illustrated catalogue, post free.

ALL-ELECTRIC 3-stage Amplifiers, 200-250v., 40-60 cycles, 10 watts undistorted output, complete with 5 valves and Magnavox Super 66 energised speaker, £12/10/0.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, condensers, resistances, and diagram, 120v. 20 m.a., 20/-; trickle charger, 8/- extra; 150v. 30 milliamps with 4v. 2-4 amps. C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps., with 4v. 3-5 amps. C.T., L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps. L.T., 27/6.

PREMIER Chokes, 40 milliamps, 25 hys., 4/-; 65 milliamps, 30 hys., 5/6; 150 milliamps, 30 hys., 10/6; 60 milliamps, 80 hys., 2,500 ohms, 5/6; 25 milliamps, 20 hys., 2/9.

ALL Premier Mains Transformers have engraved panels, terminal connections, all low-tension windings centre tapped, tapped and screened primaries 200-250 volts.

PREMIER 250-0-250 60 milliamps, 4 volts 1-2 amps, 4 volts, 2-3 amps, 4 volts 3-4 amps, 10/-

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

PREMIER combined HT8 and H10 transformer rectified output 250 or 300 volts 60 milliamps, 4 volts 1-2 amps, 4 volts 3-5 amps, 10/-, or with Westinghouse Rectifier, either type, 18/6.

PREMIER HT10 transformer rectified output 200 volts, 100 milliamps, 4 volts 1-2 amps, 4 volts 3-5 amps, 10/-, or with Westinghouse Rectifier, 19/6.

PREMIER HT11 transformer 500 volts 120 milliamps rectified output, 4 volts 2 amps, 4 volts 2 amps, 4 volts 3-5 amps, 22/6; with Westinghouse Rectifier, 42/6.

SPECIAL offer Western Electric mains transformers input 200-250 volts, output 350-0-350 volts, 120 milliamps screened primary 4 volts 1-2 amps, 4 volts 2-3 amps, 4 volts 3-5 amps, 9/6. Input 100/250 volts, 300-0-300 volts 60 milliamps 4 volts 1-2 amps, 4 volts 2-3 amps, 6/6. Input 200/250 volts screen primary output 500-0-500 volts 150 milliamps 4 volts 3-5 amps, 4 volts 2-3 amps, 4 volts 2-3 amps, 4 volts 1 amp, 4 volts, 1 amp, 19/6.

USA. 3-gang condenser with trimmers, 3/11; a really solid job.

PREMIER L.T. Charger Kits, consisting of Premier transformer and Westinghouse rectifier, input 200-250v. A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 15v. 1 amp, 19/-; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2 v. ½ amp., 11/-.

B.T.H. Truspeed Induction Type (A.C. Only), Electric Gramophone Motors, 100-250v., 30/- complete. D.C. model Truspeed, 100/250v., 42/6.

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

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

SPECIAL Offer of Wire-Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

CENTRALAB Potentiometers, 400 ohms, 1/-; 50,000, 100,000, ½ meg., any value, 2/-.

RELIABLE Canned Coils with Circuit accurately matched, dual range, iron cored, 2/11.

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SPECIAL offer .00015 brass short-wave tuning condensers with slow-motion and complete dial, 3/9. Short-wave chokes 10-200 metres, 9d.

DUBILIER electrolytic condensers, 12 microfarads, 20 volts 6d., 8 plus 4 microfarads 500 volts 4/-, 50 mf. 50 volts, 1/9.

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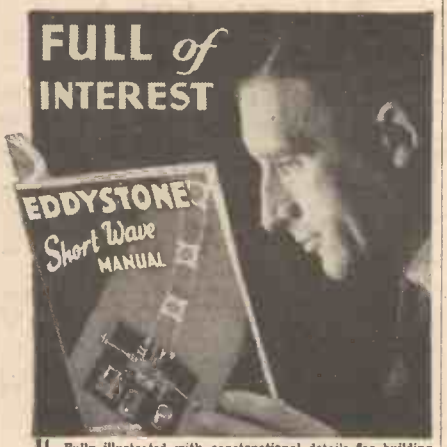
T.C.C. Condensers, 4mf. 450v. working, 4/-: 4mf. 750v. working, 6/-.

Continued at top of column three



Fully illustrated with constructional details for building Battery and Mains S.W. Receivers—6v. S.W. Super-het with A.V.C.—All-Wave Wavemeter—5-metre Receiver—Simple 5-metre Transmitter—Crossfeeder Aerial System—Battery and Mains S.W. Converters—Amateur Bands Receiver—100 watt Transmitter—Eliminators, etc. COMPILED BY THE LEADING SHORT WAVE SPECIALISTS. Obtainable from your radio dealer, W. H. Smith, or in case of difficulty, STRATTON & CO., LTD. (Dept.25), Bromsgrove Street, Birmingham. London Service Depot:—Webb's Radio, 14, Soho St., W.1. Glasgow Service: J. R. Hunter, 138, West Nile St. PRICE 1/6

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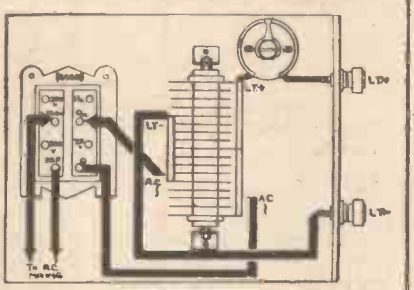

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(Continued from foot of column one)

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G.M. SERVICE Dual aperture slow-motion drives, with escutcheon plates. List 8/6. Each 1/11.

G.M. SERVICE. T.C.C. block condensers, fully tapped. Surplus at fraction of cost. .1 + .1 mfd., 8d.; .5 + .5 mfd., 9d.; 2 mfd., 1/1; 2.3 mfd., 1/1; 3.1 mfd., 1/4; 4 mfd., 1/11; 4 + 2 mfd., 2/4; 6.5 mfd., 2/11; 8 mfd., 3/11; 9 mfd., 4/3; 12 mfd., 5/10; 13 mfd., 6/3; 14 mfd., 6/10.

G.M. SERVICE. P.M. Speakers, Magnavox-12/6; Earl (list 29/6) 10/11. Rola 19/6d. Selectun 4-pole bal.-armature units, 4/11.

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TELSEN Grid Leaks, ½, ½, 3, 4, 5 meg., 4d. each, 3/- per dozen; Telsen Tag condensers, all values, 3d. each, 2/6 per dozen.

TELSEN Power Pentode Output Chokes, type W172, 15-30 henries, 40 m./amps., 4/6 each.

TELSEN Radiogrand Transformers, 5-1 3/6, 3-1 3/6, 1.75-1 5/-; Telsen coupling units, 1-1; 2/6 each.

TELSEN Output Transformers, 1-1 ratio, 3/- each; Telsen valve holders, 4-pin, 5-pin universal screen grid type, 6d. each, 5/- per dozen; 7-pin, 10d. each, 7/6 per dozen.

TELSEN Screened All-wave H.F. Chokes, 2/9 each; Standard screened H.F. chokes, 1/9 each; short-wave H.F. chokes, 2/- each.

TELSEN Tapped Pentode Output Chokes, type W72, 50-25 henries, 20 m./amps., 4/6 each; Telsen 15 henry, 50 m./amps., L.F. chokes, 3/- each; Telsen L.F. chokes, 18 henries, 50 m./amps., 3/6 each.

TELSEN 40-henry L.F. Chokes, 1/6 each, limited number; Telsen variable condensers, 0.00025 and 0.00035, 1/6 each.

TELSEN Electrolytic Condensers, 4 mf., 6 mf., 500-volt, 3/- each; 4 mf., 6 mf., 275 volt, 2/6 each; 25 mf., 25 volt, 50 mf., 25 volt, 50 mf., 50 volt, 25 mf., 50 volt, 1/3 each.

TELSEN Reaction Condensers, 0.0001, type W356, 1/3 each; Telsen reaction condensers, 0.0003, type 194, 1/3 each; Telsen type W136, 1/3 each.

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IRON-CORE Screened dual-wave coil, matched for S.G. with diagrams, 2/6.

MICROPHONES. Western Electric, Hanging Model, 2/6; Table model, transformer in base, 8/6, full instructions.

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PRACTICAL AND AMATEUR WIRELESS, 16/3/35.

RADIO CLEARANCE, 280, High Holborn, W.C.1, offer the following stupendous bargains, limited quantities only, all orders over 5/- post free.—'Phone: Holborn 4631.

RADIO CLEARANCE First Bargain List is now Available, send 1½d. stamp to cover cost and postage.

RADIO CLEARANCE Makes Special Offer of a Limited quantity S.T.600 Dorchester Kits to Designers' Specification, including Colvern coils, Polar condensers, T.C.C. fixed condensers, R.I Hypermite transformer, ready drilled panel and terminal strip, list price £5/17; our price £3/10.

RADIO CLEARANCE.—Dorchester 3-valve service grid, detector, power or pentode battery, chassis including all first-class components, brand new, completely wired; at 20/- each, less valves.

RADIO CLEARANCE.—Earl permanent magnet moving coil speakers, 7½in. cone, brand new, boxed; list price 29/6; our price 10/11.

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RADIO CLEARANCE.—British Radiophone 3-gang Midget type straight condensers, fully screened with trimmers, 3 0.0005 sections, 7/6 each.

RADIO CLEARANCE.—British Radiophone 3-gang superhet, condensers, unscreened, 2 0.0005 sections and 110 kc. section, 4/11.

RADIO CLEARANCE.—British Radiophone 110 kcs. intermediate frequency transformers; 3/- each.

RADIO CLEARANCE.—British Radiophone set of superhet. coils, manufacturers' type, with circuit diagram, suitable for use with above advertised condenser; 5/6 per set of 3.

RADIO CLEARANCE.—5-pin chassis mounting valve holders; 3d. each.

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HULBERT for Quality Surplus Speakers.

ALL speakers listed below are brand new and made by one of the best known British makers of high grade moving coil speakers. Repeat orders coming in daily.

10/6 ONLY. Original price 30/-. Energised. 8in. cone, 6,500 ohms field for direct use on 200/240 volts D.C. mains. Also 1,800, 2,000, 2,200, or 2,500 ohms field. Price includes power, pentode, or universal transformer as required.

14/- ONLY. Usual price 45/-. As above, but with 10in. cone. A very powerful quality speaker capable of handling large outputs.

15/6 ONLY. Usual price 35/-. Permanent magnet model with cobalt steel magnet of high efficiency. 8in. cone. Power, pentode, or universal transformer.

18/6 ONLY. Usual price, 39/6. As above but with 10in. cone. Powerful quality speaker giving large output with given input.

19/6 ONLY. Usual price 41/-. Permanent magnet model with the new Alni magnet, high flux density and wide frequency response. 8in. cone. Power, pentode, or universal transformer.

24/- ONLY. Usual price 70/-. As above, but with 10in. cone. Ideal for use with quality receivers.

2/9 ONLY. Brand new cabinets suitable for any of above.

59/6 ONLY. Brand new Auditorium speakers suitable for P.A. or Quality receivers and amplifiers for use on D.C. or A.C. mains. Rectifying equipment for latter, 17/6. Usual price for these speakers, £9. Purchaser writes: "I have had considerable experience with high quality reproduction but must admit that the speaker you supplied surpasses anything I have so far heard." Field resistance 1,000, 1,250, 1,500, or 2,000 ohms. Speech coil 7, 10, or 15 ohms.

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M.W.A. 8

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STATION NAMES OR NUMBERS?

SEE PAGE 3

Practical and Amateur Wireless

3D EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 6. No. 131. March 23rd, 1935.

AND AMATEUR TELEVISION

TUNING & ADJUSTING The HALL-MARK CADET

BRITAIN'S LEADING AND AUTHORITATIVE RADIO WEEKLY!

Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff: W. J. Delaney, H. J. Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.

VOL. VI. No. 131. March 23rd, 1935.

ROUND *the* WORLD *of* WIRELESS

Smallest Orchestra in the World

THE Columbia Broadcasting Company of America can well claim this title for the Sherman-Thompson Baby Orchestra invited to play before the microphone. Its members ranged from three to six years of age, and made music with toy instruments.

Poland's Projected New Stations

WITH the bringing into operation of the Torun transmitter to serve the western part of the country, the Polish authorities are considering the closing down of Katowice and Cracow, and will erect in their stead a high-power station on a site roughly midway between these two centres. In addition, to provide an alternative programme for Warsaw listeners, a new station will be installed in the neighbourhood of the capital.

Iceland's New Broadcasters

THE Marconi Chelmsford works are building a modern 100-kilowatt transmitter which is to be installed at Reykjavik during the summer months; it will work on the channel at present used by the 16-kilowatt station.

Holland's Big Surprise

RECENTLY between G.M.T. 02.00-04.00 on 301.5 metres, listeners have heard tests with gramophone records carried out by a very powerful foreign station. This would appear to be the 120-kilowatt transmitter which Holland may shortly bring into operation on that channel for the Huizen programmes. Announcements during the testing period are given out in Dutch, English, French, German, and Spanish.

Radio and the Water Supply

IN Vienna rumours having been spread to the effect that drinking water drawn from lead composition pipes to which radio receivers were earthed contained a greater proportion of lead particles, the question was seriously considered by the public health authorities. Tests were officially carried out in various parts of the city, and although traces of lead were found in the drinking water, a statement was broadcast reassuring the general public that the earthing of wireless sets could not be held responsible for any injury to health.

Do You Hear Brasov?

REPORTS have been received from readers stating that tests from the new high-power Romanian National transmitter are being heard in the morning hours on roughly 1,840 metres. The official wavelength allotted to this station by the Lucerne Plan is 1,875 metres, namely, the channel on which Kootwijk (Holland) is broadcasting.

'Ware Sharks!

THIS is a new kind of warning put out by VK2UW, a Sydney broadcasting station. In view of the frequent visits paid by sharks to the coastal resorts in the neighbourhood of the city, the station has hired an aeroplane to circle over the sea during bathing hours. When a shark is sighted making for the shore the aviator warns the station, which in its turn puts out the above call. Loud-speakers on the beach broadcast the message to the bathers and thus ensure a speedy return to the beach and safety.

Spanish Three-year Plan

SPAIN'S Director of Telecommunications is now planning a start on the reorganisation of the existing broadcasting network. The construction of the new stations will be spread over a period of three years. The following transmitters are to be built; Madrid (Nacional), 150 kilowatts (1,639 metres); Madrid (Centro), 50 kilowatts (293.5 metres); Barcelona (Nordeste), 50 kilowatts (274 metres); Valencia (Este), 20 kilowatts (352.9 metres); Sevilla (Sur), 60 kilowatts (410 metres); Corunna (Nordouest), 30 kilowatts (377.4 metres); Vizcaya (Norte), 30 kilowatts (238.5 metres); Tenerife (Canaries), 10 kilowatts (207.3 metres) and two 5-kilowatt relays at Murcia and Oviedo to work on the same channel, 207.3 metres. Madrid (Nacional) on the long wave is to be the first to be brought into operation.

Taking Time by the Forelock

ALTHOUGH the Rennes-Thourie (France) high-power station is not expected to be ready to work for another eighteen months or so, a largish inn situated in the village near which the transmitter is being erected already bears the sign: *à l'Hôtel de la T.S.F.* (Broadcasting Hotel!)

Proposed Saar Transmitter

ALTHOUGH, at the outset, the authorities had only planned the installation of a studio at Saarbruecken, it is now suggested that a relay station should be opened for the broadcast of local entertainments as well as radio entertainments transmitted over the National network. It is probable that the station will operate on a channel common to either Frankfurt-am-Main or Stuttgart.

Round the World of Wireless

AT 7 p.m. G.M.T. every evening the entire South African broadcasting system relays the chimes of a clock installed in the Union Buildings at Pretoria. It is the newly adopted time signal, and has been christened South Africa's Big Ben.

ROUND the WORLD of WIRELESS (Continued)

Free H.M.V. Records

IN order to popularise classical music, albums of H.M.V. records will be given away with "His Master's Voice" radiograms during the present Jubilee Year. A department is kept busy packing the albums, as shown in the illustration on this page.

"Pleasure on Parade"

FRANK A. TERRY'S Winter Concert Party, "Pleasure on Parade," is to broadcast from the Manchester studios to Regional listeners on the afternoon of March 28th, and to repeat the same show in the Northern programme only on the evening of March 30th.

Penzance Orchestral Society

A CONCERT by this well-known Orchestral Society will be relayed from St. John's Hall, Penzance, on March 27th, for listeners in the West. Gaby Valle (soprano) will be the vocalist. This Orchestral Society was formed in 1906, and still has the same President and the same Hon. Conductor. The members come from all parts of Cornwall to rehearse, some having to make a journey of twenty-five miles each way.

"Physics in Industry"

THE application of physics to industry will be discussed in March at the Conference of the Institute of Physics—held in Manchester in recognition of the city's enterprise in starting the first local branch of the Institute. The President of the Conference, Professor W. L. Bragg, Director of the Physical Laboratories at Manchester University, is to broadcast a talk about "Physics in Industry," with particular reference to the Conference, on March 29th.

"Yeoman's English"

THE second talk in the series, "Yeoman's English," will be given by H. C. Wyld, Merton Professor of English Language and Literature in the University of Oxford, under the title, "What Dialects Are," on March 28th. Professor Wyld has published twelve books and has further published over forty monographs and articles on philological, literary and educational subjects.

"Hearts and Harmony"

MAX KESTER is at the moment engaged in writing the story for a little musical comedy called "Hearts and Harmony," which will be broadcast on March 29th. The music and lyrics are by Peter Mendoza. The story is of a really "peppy" song writer who comes to live in a small town and falls in love with the daughter of the owner of a music shop. This is really too bad, but actually the romance, owing to the musical numbers coming from our "peppy" gentleman, puts the shop on its feet and eventually makes the whole of Little Muddleton jazz-conscious.

Radio Follies

RADIO Follies Concert Party have an amusing show on March 30th. It is a burlesque of "1066 and all that," and has the title "1935 and before that." Michael North and Richard Spencer are the pianists and organisers of the Radio Follies.

INTERESTING and TOPICAL PARAGRAPHS

"Microphone Tours"

THE fifth of the North's "Microphone Tours" is to be made on March 30th, and will take the form of a visit to a famous Staffordshire pottery—probably the oldest in the country. Microphones established at points of vantage all over the premises will enable listeners to follow the whole process of making china, earthenware and stoneware; and pottery workers—some of whom are descended from long generations of potters—will be interviewed in front of the microphone.

H.M.V.'S GIFT OFFER OF RECORDS

Packing presentation albums with H.M.V. records at the "His Master's Voice" factories.

"Joe Gutteridge"

A BLACK Country programme, again featuring a typical local character—"Joe Gutteridge," will be broadcast on March 26th. Many letters containing reminiscences of Black Country life of the 'sixties and 'seventies have been evoked by this series.

"Midland Parliament"

ON March 27th "Midland Parliament" will hold a session to discuss the question, "Can new industries cure unemployment?" One of the speakers will be Lieutenant-Colonel H. Jarrett-Kerr, of Cheltenham, who is a representative in this country of the Rural Reconstruction League of India.

Parodies in Song and Verse

ON March 26th, John Morley, who was the joint author of "Princess of Paraphernalia," presents a programme of parody in song and verse. He has devised it himself, and a number of the parodies are original. His general scheme is a beanfeast given by Hiawatha (with apologies to Longfellow and Coleridge-Taylor) to which modern poets and song-writers are invited. Those to be parodied include Masefield, Chesterton, Belloc and Kipling, John Ireland and Liza Lehmann.

SOLVE THIS!

Problem No. 131

Willand had a simple battery-operated receiver which functioned satisfactorily, but the output was not quite sufficient for his requirements. He therefore built a push-pull amplifying unit (to his own design), and although this certainly gave increased volume, reproduction was accompanied by a high-pitched background whistle. What point had he overlooked, and how could the trouble be eliminated?

Three books will be awarded for the first three correct solutions opened. Mark your envelopes Problem No. 131 and address them to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received not later than the first post Monday, March 25th.

Solution to Problem No. 130

In adding the super-power amplifier, Barker had overlooked the fact that his small accumulator was incapable of supplying the higher L.T. current required when the additional valve was in use.

The first three correct solutions opened in respect of Problem No. 129 were from the undermentioned readers, and books are being forwarded to them:—

P. Chinchen, 11, Forest Street, Collyhurst, Manchester, 9; T. H. Bigg, 54, Ferndale Road, Gravesend, Kent; W. A. Lucas, The Hut, Dudley Road, Hastings.

Variety from Northampton

AN item of special interest on March 27th will be a relay of a variety bill from the New Theatre, Northampton, with Pickard's Chinese Syncopators as the chief attraction. This company of eight, all Chinese, had a very successful season at the London Coliseum some years ago, when they came over from New York. That was their last previous visit to this country.

"Spring is in the Air"

THIS is the title of a programme drawn from musical comedies which is to be given by the B.B.C. Midland Orchestra and the Midland Wireless Singers on March 28th. H. Foster Clark will conduct. The soloists are Marjorie Westbury (soprano), Cuthbert Ford (baritone) and a young Birmingham tenor, Harry Porter, who had his first broadcast in a Birmingham Philharmonic Concert last month.

"Dic Penderyn"

A PROGRAMME which will take Welsh listeners back to the period of depression following the Napoleonic wars will be broadcast on March 25th under the title, "Dic Penderyn." There was a pitched battle, with hand-to-hand fighting between soldiers and workmen, in the High Street at Merthyr and one of the workers, Richard Lewis, was sentenced to death. He was reprieved, but a fortnight later he was publicly hanged.

STATION NAMES OR NUMBERS?

A Practical Article Pointing Out the Advantage of Using Station Names on Tuning Dials, and Describing a Method of Adapting Dials Marked in Degrees

THE old controversy of station names versus degrees or wavelength readings on the tuning dials is one that cannot be even broadly defined, because so much depends upon the likes and dislikes of each individual constructor.

Although station names are obviously convenient, it is nevertheless doubtful if many constructors go to the slight trouble necessary to achieve this assistance in tuning. Let us take some of the major objections against station names and analyse them to find out if they are really as serious as they seem.

First, it may be argued that it is not possible to print anything like the number of stations on the average dial that is in any wavelength list. But is it necessary to crowd the dial with names of stations which can only be received at entertainment strength on odd occasions? By entertainment strength is meant at sufficient volume with negligible fading, and interference, to provide good listening fare without the necessity of straining to appreciate the programme.

Actually, if the average set is analysed, in the majority of cases it will be found that the total number of stations to which the set is regularly tuned does not exceed fifteen. It must be a very small dial if fifteen names cannot be printed without crowding, so point number one is settled.

Point number two. Supposing the set *is* used on odd occasions by a "fan," who is keen on distant stations, how would he identify the stations which did not happen to be listed? First, it is necessary to settle the question of what he would do in the event of the dial being marked in degrees or wavelengths. In the first event—well, the only solution is to judge the positions

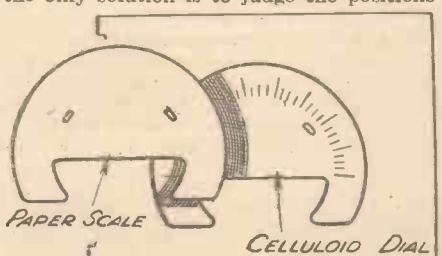


Fig. 2.—After the paper scale is cut to shape it is fixed to the celluloid dial.

in relation to known points, *i.e.*, if an unknown station is about half-way between London Regional and London National the wavelength would be approximately 300 metres, reference to a list of stations would then give an idea of the possible station.

Location of Stations

It will be noted that it is necessary to know the locations of various stations when this method is used, and as it is difficult to remember the exact location of more than a few of the "stand-by" stations, the "fan" would in all probability have a separate list of stations, and the corresponding dial readings. How much handier it would be if this list was transposed on to the dial, giving direct reference.

Theoretically, in the case of a wavelength scale it should be quite simple to read off the wavelength indicated on the dial, and

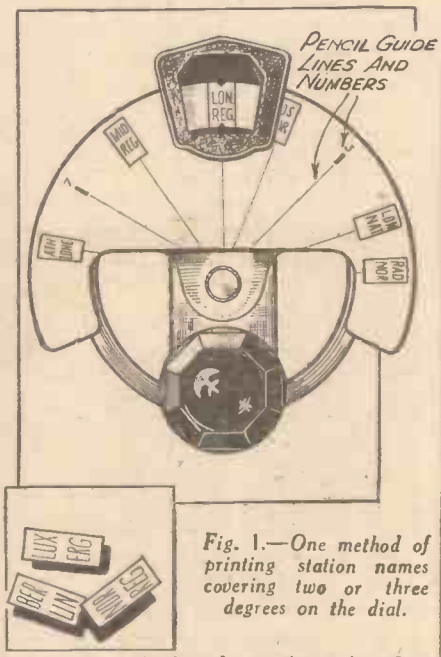


Fig. 1.—One method of printing station names covering two or three degrees on the dial.

find out from the list the station using that wavelength. Unfortunately it is very rarely as simple as this. It must be remembered that to attain the accuracy aimed at in a scale so marked there are three components which must be in accordance with one another—the tuning condenser, the coils, and the dial. The condenser manufacturer naturally makes a slow-motion dial which agrees with his condenser, but it does not follow that if that dial is used on a condenser of another manufacturer the wavelength markings would be accurate at various tuning positions; on the contrary it would possibly be several metres out. Again, the wavelength depends directly on the inductance of the coils, and in marking the wavelength scales a standard coil inductance has to be taken on a basis (usually 157 mh. for medium waves and 2,200 mh. for long waves).

If the coils used in a set do not adhere accurately to this particular standard it is obvious that the dial cannot be depended upon to indicate the exact wavelengths to which the receiver is tuned. It will be seen, then, that unless care is taken in the association of various dials, coils, and condensers it is very improbable that the dial could be depended upon to indicate wavelengths with greater accuracy than + 6 metres on the medium waves with possibly greater error on the long waves.

Definite Advantages

Summarising these points, if we have a dial with about fifteen station names, it is just as easy to find any unknown stations by the method which is used with the degrees dial, and it must be agreed that a named dial is no detriment to long-distance work; on the contrary, it would score on the point of convenience.

Point number three. It is not always easy to print on celluloid or to crowd station names into a dial which is already marked in degrees or wavelengths. This point will be fully dealt with later on, but it is not so formidable as it may seem.

Point number four. Is there any easy method of indicating the exact position of the pointer necessary to ensure the set being exactly tuned to the station indicated by the name? The method is one of personal choice, if an accurate point is needed a short vertical line can be marked on the dial under the name when it is finally calibrated, the name being arranged in a manner to be described so that it will be in approximately the correct position.

If the set is not particularly selective, and the stations received cover two or three degrees on the dial there will scarcely be any need for accurate indication if the type of printing illustrated in Fig. 1 is adopted. Alternatively a line can be drawn right through the name in the required position.

From these points, it will not be difficult to see that there are definite advantages in using station names on a dial instead of the indications usually found on the home-constructor's set, not the least of which is the assistance given to non-technical members of the household who do not happen to be so conversant with the intricacies of tuning, and who wish to receive a definite station. It remains then to deal with the various methods of substituting these names for the degrees or wavelength readings.

Printing the Names

It has already been mentioned that some difficulty may be experienced in printing on celluloid, and the best method of overcoming this is to print the names on good quality note-paper, the paper then being stuck over the original dial with any good quality adhesive.

For appearance and clarity the names should be printed in block letters with indian ink, and if the constructor's ability in this direction does not come up to his own exacting standard, possibly a friend would lend a hand to improve matters.

With the first method, the first step is to remove the celluloid dial, reverse it and refix it in position. This leaves a plain surface to be viewed through the escutcheon. The set is then tuned in to the various known stations and a mark made with a

(Continued overleaf)

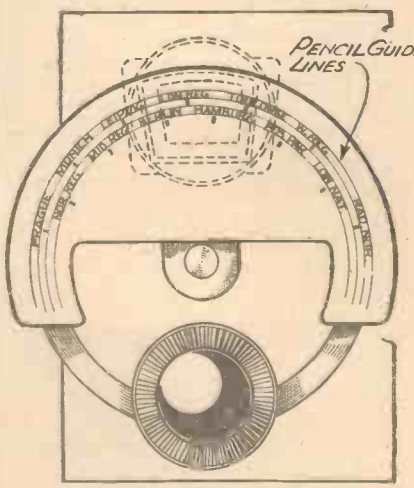


Fig. 3.—An alternative method of lettering the scale.

(Continued from previous page)

pencil in the exact tuning spot for each station. A note should be kept to ensure that these tuning points do not get confused, it would be as well to number each of them and make a list on an odd scrap of paper.

When the desired stations have been located, the dial is removed and thin pencil lines drawn from the centre outwards through the various points. These thin lines serve as guides on which to stick the station names, these being first printed on note-paper, after which they are cut out and stuck in position. Fig. 1 shows the method and partly finished result much more clearly than could be explained in several paragraphs.

In the dial illustration the various named stations happen to be a reasonable distance apart, but it may happen that two (or more) named stations happen to be too close to be printed in this particular style. Under these circumstances the best method of lettering is shown in Figs. 3 and 4, and this style will undoubtedly be the one that is most popular, the actual indication being made by a short line under the name, as already suggested.

Duplicate Celluloid Dial

To carry out this method a duplicate of the celluloid dial should first be made by placing the latter on a piece of plain note-paper, and marking round the edge with a sharp pencil, afterwards cutting out the shape. This paper scale should be securely fixed to the celluloid dial, the assembly being re-fixed to the dial mechanism when ready (Fig. 2).

The various stations should be recorded with a light pencil line in the manner already explained, the dial then being removed ready for printing.

As a guide for the names, semicircular lines can be drawn on the dial with a compass the names then being inserted and being so arranged that they come central over the associated pencil marks. These marks can also be inked in and the dial cleaned with a pencil rubber, the result being a neat clear dial which can be replaced on the receiver, ready for use.

Various abbreviations can be used, for instance—LON. REG., LON. NAT., NOR. REG., DROIT., LUX., and POS. PARIS, appear on the author's own dial, and save a great deal of space whilst giving clear indication of the station intended.

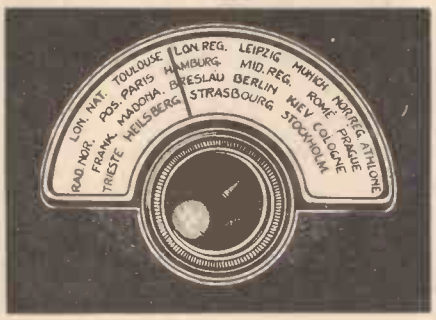


Fig. 4.—A dial printed with four rows of station names.

Providing that the dial can be removed, any type of slow motion can be treated in this manner, whether it be moving dial or full-vision moving pointer style; the Polar V.P. horizontal drive and the Utility W.346 are ideal types. On one of the former dials 42 names have been printed in capital letters ⅛in. high without undue crowding.

Typewriting the Names

Another advantage with this type of dial is that if a typewriter is available the names could be typed in instead of being hand lettered. With a reasonably good ribbon and a little patience, an extremely pleasing dial can be produced, the long-wave stations or, alternatively, all the English stations being typed in red, for still easier identification.

There remains the problem of a dial illuminated from the back, and in this case the original scale markings would be superimposed on the station names. Perhaps the constructor would be quite satisfied with this state of affairs; if not, it is a comparatively simple matter to cut a new dial from opaque white celluloid. Clear celluloid would serve, but the opaque material tends to spread the light, giving a more evenly lit dial. The newly introduced white bicycle "flaps" supply a sufficient amount of this material for normal purposes. Any printing on these can be removed with turpentine, leaving a clean surface.

NEW HIVAC MIDGET VALVE

THE new Hivac "Midget" valve, though extremely small, has a performance comparable with its larger standard counterpart. It was designed by Mr. Stephen P. de Laszlo, managing director of the High Vacuum Valve Co., Ltd., and is available in three forms, the most remarkable of which is the screen-grid, since this is the first miniature screen-grid valve to be placed on the market. Hivac "Midget" valves require an exceptionally low filament and anode current.

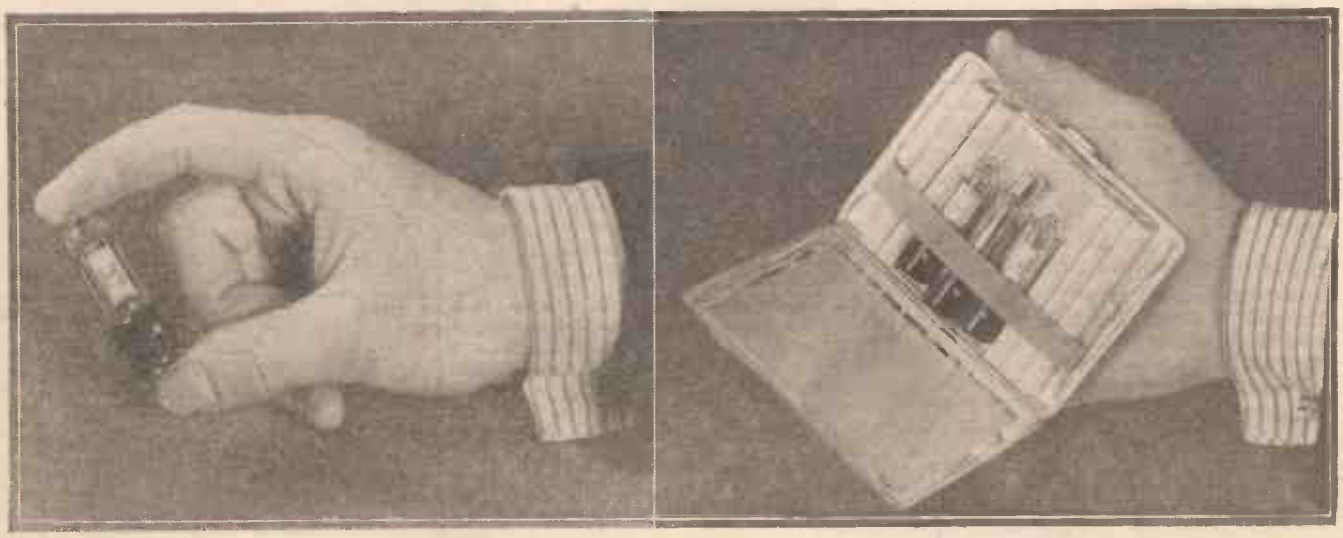
These valves undoubtedly open up a new field of possibilities for amateur constructors, who will now be able to build "pocket" sets, and small three, four, and five-valve "portables" capable of long-range reception hitherto out of the question. Though other midget components have been available, there were no correspondingly small screen-grid valves which could be operated adequately with miniature batteries.

During the past few months these valves have been subjected to severe tests by a Government department and it is understood that they have given every satisfaction. Their sturdy construction renders them capable of withstanding the rough treatment that is inevitable with a portable receiver, and the tests have shown that the life of the valves is so long that it was decided that they could be soldered into the sets. Believed to be the smallest valves on the market, having an extremely low current consumption, they are yet remarkably robust, and these qualities being coupled with long life and excellent performance, they will undoubtedly appeal strongly to many constructors.

The illustrations show the really miniature proportions of these new valves, which are to be marketed at 10/6 for type XD (a triode for detector purposes), type XL (a triode for L.F. purposes), and 15/6 for type XSG (a screened-grid valve for use in H.F. amplifiers). They are, of course, of the 2-volt type taking a filament current of .06 amps, anode volts required being 100 maximum for the triodes and 120 maximum for the screen-grid.

The amplification factor is 16, 12, and 360 respectively, impedance being 27,000 ohms, 14,000 ohms and 600,000 ohms.

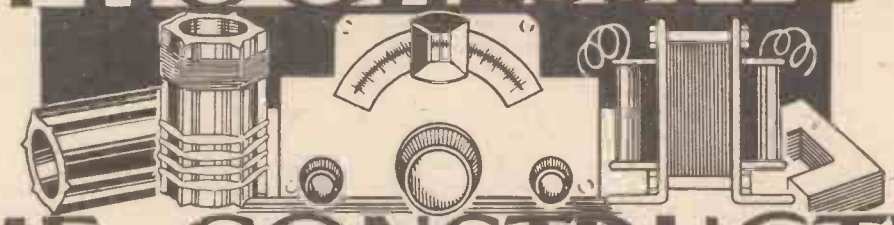
Samples have not yet been received for test.



These illustrations clearly show the diminutive size of the new Hivac valve.

Previous articles in this series were published in the issues for Jan. 26th, Feb. 2nd, Feb. 9th, Feb. 16th, Mar. 2nd, Mar. 9th, and Mar. 16th.

PROGRESSIVE HOME CONSTRUCTION



The subjects already dealt with include Home-made Components, Making an L.F. Transformer, a Single-valver, an H.T. Battery Eliminator, H.T. Rectifier, and an H.F. Amplifier.

The Principal Points to Bear in Mind when Converting a Battery Receiver for A.C. Operation are Explained in this Eighth Article of the Series

by The Experimenters

ALL of our articles in the present series have been in connection with battery-operated receivers, although we have devoted space to constructional information concerning the building of a battery eliminator. So that the simple receiver units which we have described may be of interest to a wider section of readers, however, it is decided this week to explain how the units may be

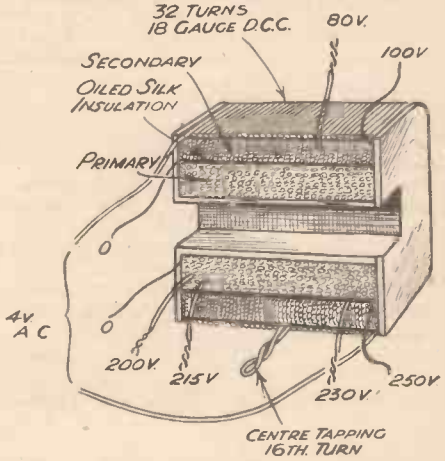


Fig. 1.—Showing how the 4-volt L.T. A.C. winding can be added to the mains transformer previously described.

modified to make them suitable for all-mains operation. The details will be presented in such a form that they will be of interest, not only to those who have been following the "Progressive Home Construction" series, but also to all other readers who wish to convert a battery-operated receiver for operation from the A.C. mains.

The L.T. Supply

In the first place it will be evident that a power-supply unit of some kind is essential, and this may be a ready-made one, or a unit such as that described in the issues of PRACTICAL AND AMATEUR WIRELESS dated March 2nd and March 9th. In the latter case, however, an additional supply will be needed, this being the 4 volts A.C. for heating the cathodes of the indirectly-heated valves, which must be used when working from A.C. mains. The 4-volts supply can be obtained by placing an extra winding on the existing mains transformer, or by making a new transformer for L.T. only. The first method will generally be preferred, due to the saving in expense, and the winding can simply be placed on top of those already in place, as shown in Fig. 1. As was the case with the other windings, 8 turns per volt will be required, thus making 32 turns in all, whilst a tapping must be taken after the 16th turn. The gauge of wire that should be used depends upon the maximum current required, and hence, upon the number of valves in use. If there are only two valves, 22-gauge d.c.c.

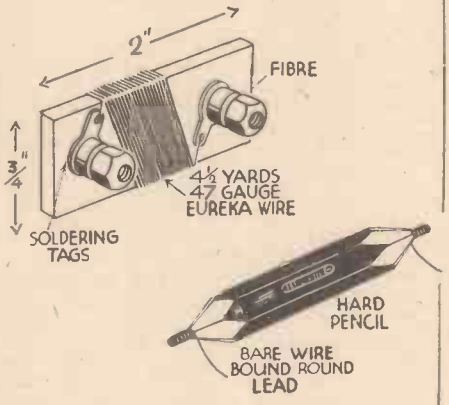


Fig. 3.—Two different methods of making the fixed bias resistance are illustrated above.

wire will be satisfactory, but in the case of a three- or four-valve set it is better to use 20- or even 18-gauge wire (again d.c.c.). Actually, the stouter wire can generally be used perfectly well regardless of the number of valves, provided that the core is amply large—as it is in the case of the transformer previously described—since the output current will automatically regulate itself to the needs of the receiver. When the heavier gauge wire is used it is well to be on the safe side by measuring the voltage output when the transformer is feeding the valves; if the voltage is in excess of about 4.1, a shunt resistance can be used to increase the "load."

If it is preferred to make a separate L.T. transformer the construction will be exactly as described for the H.T. one, and the primary will be identical with that of the latter. The secondary, on the other hand, will consist of only 32 turns, tapped at 16 turns.

High-tension Current

With regard to the high-tension side of the equipment, we are again governed by the number and types of valves in use. When there are only two valves a maximum current of about 30 milliamps will generally be sufficient, but for three or more valves (and when a super-power or power-pentode valve is used in the output stage) an output of 60 milliamps. will be about right. These considerations will govern the type of rectifier to be used, this point being dealt with three weeks ago.

We can now consider the modifications required in the receiver itself, and it will be best to do this by referring to the separate units which we have described, so that the necessary alterations in each stage can be detailed separately. The detector stage is obviously the one that should be studied first, and the chief alterations are shown diagrammatically in Fig. 2. It will be seen, in the first place, that the two leads which were previously marked L.T. + and L.T. — are now marked 4v. A.C., and that neither of them is connected to earth nor to the grid leak. Instead, the cathode of the valve is used for the earth return, being joined to the lower end of the tuning coil, high-tension negative, the centre tapping of the L.T. winding, and to the grid leak.

Provision for Pick-up

The grid circuit remains unaltered, and the anode circuit is only slightly changed—

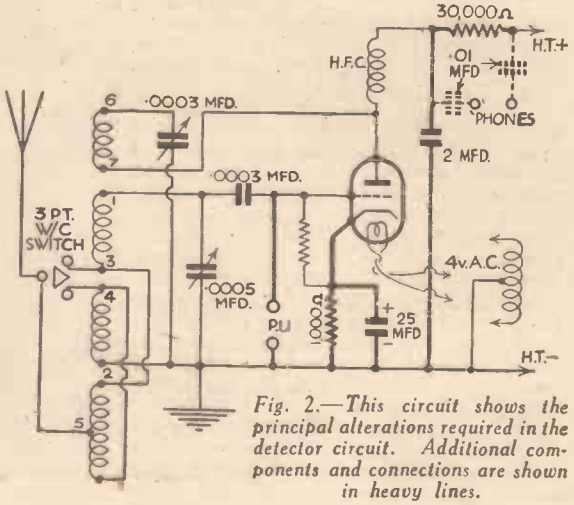


Fig. 2.—This circuit shows the principal alterations required in the detector circuit. Additional components and connections are shown in heavy lines.

by the addition of a voltage-dropping resistance and 2-mfd. by-pass condenser. These components are the same as we described for decoupling when using an L.F. amplifier. We have added, in the grid and cathode circuits of the detector, the components and connections required when it is wished to employ a pick-up, and it will be seen that the cathode is earthed through a 1,000-ohm fixed resistance shunted by a 25-mfd. electrolytic condenser. When the valve is being used for rectifying radio signals the grid does not receive any bias voltage because the grid and cathode are kept at the same potential by the leak, but when a pick-up is connected to the points indicated, the grid is made negative with respect to the cathode due to the voltage drop across the 1,000-ohm resistance, and this bias enables the valve to function as an efficient L.F. amplifier. The correct value for the bias resistance depends upon the actual valve used as detector, but the value mentioned is suitable for most general-purpose or detector valves. The resistance can, of course, be bought very cheaply in ready-made form, but those who wish to make it themselves can do so by winding about 4½ yards of enamelled Eureka resistance wire on a strip of fibre, as shown in Fig. 3. Another method is to use the "lead" from a very hard pencil, by binding bare wire round the ends, as also shown in Fig. 3. It will be evident that the latter method cannot be accurate, because the resistance will

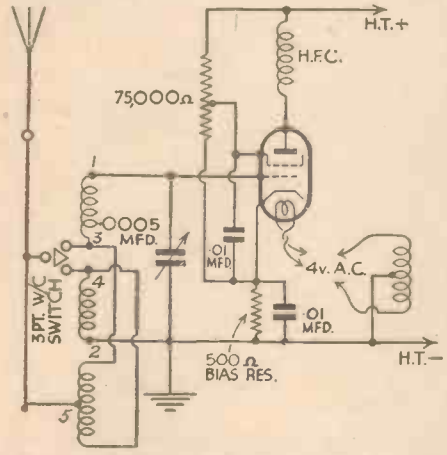


Fig. 5.—The altered connections in the cathode circuit of the H.F. valve are shown here.

vary considerably with the hardness of the lead and with the make of pencil; those who are in possession of a good meter, however, can easily measure the resistance of a few odd pencils for themselves.

Automatic Bias for the L.F. Valve

In passing, it should be mentioned that if 'phones are to be used with a mains-operated receiver it is desirable that they should be isolated from the mains supply so as to avoid any danger of the wearer receiving a shock. This can be arranged, in the case of the single-valve receiver represented by Fig. 1, simply by connecting the 'phones through a pair of .01-mfd. fixed condensers (made as described last week) to the two ends of the voltage-dropping resistance. This is shown by broken lines in Fig. 1.

The modification of the L.F. stage for A.C. operation is just as simple as that of the detector stage, and the points involved are illustrated in Fig. 4. Here again the heater leads are disconnected from the earth line and joined to the 4-volt A.C. supply, whilst the earth return is taken from the cathode, through the usual biasing resistance and by-pass condenser. As the high-tension current for the valve must pass through the resistance in the cathode circuit a voltage-drop occurs across that resistance, and this is used to bias the valve. All readers are well aware that the bias voltage must be of a rather

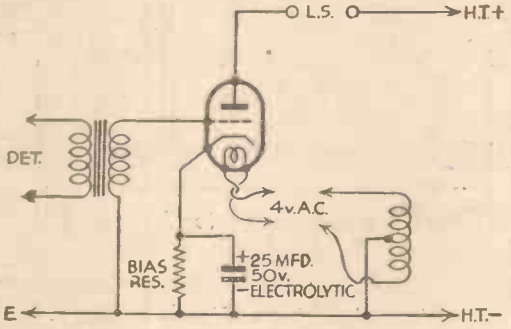


Fig. 4.—Showing the simple modifications required in the L.F. circuit.

critical value, and therefore the resistance must be chosen with more care than was given to that used with the detector valve. Moreover, the value will differ widely according to the make and type of indirectly-heated output valve employed. The method of determining the resistance value is simple, though, and pre-supposes a knowledge of the anode current and grid-bias voltage requirements of the valve. For example, if the valve is rated to pass 25 milliamps. high-tension current at a particular anode voltage (generally 200) and to require a G.B. voltage of 10 volts, the resistance value is found by multiplying the voltage by a thousand and dividing the result by the anode current in milliamps. In the case quoted the resistance would be 10,000/25, or 400 ohms. Such a resistance could be made as described before by winding 5 feet of 47-gauge enamelled Eureka resistance wire on a strip of fibre, or by using a suitable length of HB pencil. For the benefit of those who wish to make wire-wound resistances to other values than those mentioned, it may be pointed out that Eureka resistance wire of 47 gauge has a resistance of approximately 214 ohms per yard; in 40-gauge the resistance is about 37 ohms per yard. The current carrying capacity of the finer gauge wire

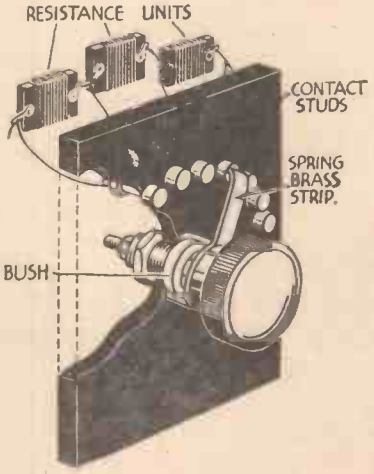


Fig. 6.—Showing one method of making a reliable, though rather cumbersome, variable resistance.

is 50 milliamps., and of the stouter gauge, 150 milliamps., both at 100 degrees C.

The H.F. Amplifier

The modifications required in the high-frequency portion of the receiver are shown in Fig. 5, where it will be seen that they are practically the same as in the L.F. amplifier. A fixed 500-ohm bias resistance is shown in the cathode lead, and this is a suitable value for nearly all S.G. valves. Where a variable-mu valve is to be employed, however, it will be necessary to replace the fixed resistance by a variable one having a maximum value of about 2,500 ohms. It is not generally worth while to make this resistance, but a reliable component can be made at home if desired by using ten wire-wound resistances of 250 ohms each (made as described above) and connecting these between adjacent contact studs mounted round a circle drawn on a sheet of ebonite. A contact arm, with knob and spindle, can then be made and fitted, the complete arrangement being as shown in Fig. 6. A component made in this manner will prove to be fairly "silent" in action, although there is bound to be a certain amount of noise as the arm moves from one stud to another. Almost complete silence of operation can be secured by increasing the number of contact studs, and thus of resistance elements, to twenty, but this rather complicates the constructional work.

One little point to be observed in connection with the modified circuit is that the "earth" end of the screening-grid potentiometer, and also of the S.G. by-pass condenser, is connected to the cathode terminal of the H.F. valve-holder instead of straight to earth. If this is not done the S.G. voltage will vary a good deal as the bias voltage is altered, and this will lead to distortion and, possibly, to a certain amount of instability at particular settings of the control.

PROGRAMME NOTES

Orchestral Concert from Torquay

THE artists in the weekly concert of the Torquay Municipal Orchestra on March 26th will be Emelie Hooke (soprano) and Albert Voorsanger (violin), by permission of the Folkestone Corporation. This programme will be relayed from the Pavilion, Torquay, to Western listeners.

Concert from Manchester

THE Manchester Tuesday Midday Society's Concert, which, relayed from the Houldsworth Hall, Manchester, is available to North and Regional listeners on March 26th, will consist of a recital by Bratza, the well-known Serbian violinist. Bratza's real name is Milan Yovanovitch. He was trained in Vienna, but has since toured every part of Europe, and now lives in London. His broadcast programme will include Tartini's "Concerto in D minor" and Tchaikovsky's "Sérénade Mélancolique."

Good Friday Concert

THE British Broadcasting Corporation announces that on Good Friday (April 19), at 7.30 p.m., a performance of the Bach St. John Passion will be given at Queen's Hall by the B.B.C. Symphony Orchestra and the Philharmonic Choir under the direction of Sir Henry Wood. The soloists on this occasion will be Elsie Suddaby, Astra Desmond, Margaret Godley, Eric Greene, Arthur Cranmer, William Parsons, Roy Henderson and Jan van der Gucht.

TELEVISION FOR ALL

IMPORTANT C.R. TUBE OPERATING DETAILS

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

READERS who have been following this series of articles, dealing with the use of cathode-ray tubes for the portrayal of television pictures on the fluorescent screen, will have appreciated that several "new" principles are involved in the different processes that have to be employed in making the electrons emitted from the cathode follow a predetermined course of action. The term "new" is not used in the sense that the ideas have just been found out, but rather to indicate that since cathode-ray tubes are to most readers something which they have never before handled, they are meeting for the first time principles and practice which need very careful study before they can be applied with the hope of securing really satisfactory results.

Sweep Voltages

The methods used to make the light spot on the screen traverse a rectangular area in the form of distinct lines of light by means of time bases is by now quite plain, but there are still other factors which merit close attention. First of all, depending upon the type of tube employed, so the sweep voltages applied to the two pairs of deflector plates must be of sufficient magnitude to make the area covered fill the space available to the limits set by the slight curvature at the screen's circular extremities.

In this way the size of picture watched will be brought to the full economical limits set by the screen's diameter. Remembering last week's remarks, this factor is controlled by the value of the anode voltage used in the gas-filled relays, together with the grid-control ratio and applied negative bias. For example, if both the vertical and horizontal sweeps are insufficient, the picture area would be as in Fig. 1, and would not do justice to the tube's capabilities.

Another Feature

In addition, one must see that *both* these sweep voltages receive attention, otherwise the results obtained may resemble those shown in Figs. 2 and 3. In the former the horizontal sweep is too great (derived from the vertical plates) and the vertical sweep too small (derived from horizontal plates) while the latter figure shows the conditions reversed. In any case, these conditions are completely under the control of the user, and a potentiometer bias on the gas-filled relays is capable of giving the limits desired. These same controls will set the picture to the right ratio, which in the case of the low-definition transmissions is 7 vertical to 3 horizontal, and in the case of the proposed high-definition signals appears to be of the order of 6 horizontal to 5 vertical, that is, of a similar standard to ordinary talking films.

When such a course is felt desirable, the user of this apparatus is at liberty to "magnify" any particular section of the picture by increasing the sweep voltages, and so enlarging the total area that the extremities are lost in the limits of the screen size, but the centre section of the picture is magnified to fill the space available. Mechanical receiving apparatus, of course, does not possess a feature of this nature, and this is sometimes cited as an advantage of cathode-ray tube working.

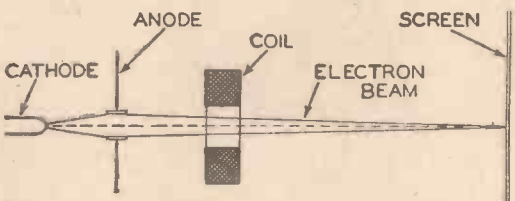


Fig. 4.—Method of bringing the electron beam under the influence of a magnetic field.

While on the subject of deflector plates, it is well to mention here that they are very frequently referred to as the "X" and "Y" plates. The reason for this should be quite apparent, and arises from the relation to ordinary graphical expression which we use so often to show effects which would otherwise be difficult to explain in words only. With every graph there are the X and Y ordinates (horizontal and vertical respectively) at right angles to one another, and this is the condition featured by the plates in the neck of the cathode-ray tube.

Hard or Soft Tubes

Although gas-filled cathode-ray tubes have certain advantages arising from the ionisation conditions associated with their action, the general tendency at the moment for high-definition television reception is to use "hard" tubes, that is, those from which any form of gas has been pumped so that they work in an evacuated state. This means that the anode with the hole in its centre—so frequently referred to as the "gun," because its purpose is to accelerate the electrons (bullets) and propel them at very high velocity towards the fluorescent screen or "target"—have to be furnished with higher operating voltages than would be the case with gas-filled or soft tubes.

This does not present any prime difficulty, however, for there is infinitesimal power expended in this part of the circuit owing to the extremely small gun currents which flow. It is for this reason that batteries of small capacity, but high voltages, can be used if desired at this part of the apparatus, and many manufacturers, anticipating this requirement, have produced high-tension batteries solely for this particular purpose. Their compact form and special design make them ideal for this purpose, and readers not desiring to make up a power unit for the "gun" volts can use these with every confidence.

"Origin" Distortion

Very frequently, when the unmodulated light field scan of a cathode-ray tube is examined it will be noticed that there are two bright arms, like rectangular axes, positioned within the scan. This could be seen very clearly in the Fig. 2 diagram published in the issue for March 2nd, and the effect is very often referred to as "origin" distortion or the "white cross" effect. It arises in the case of hard tubes from a slight lack of proportionality in the deflector plate action, especially when these are worked at low voltages. With soft tubes it is caused from a secondary

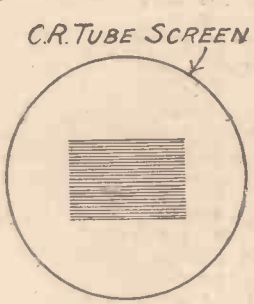


Fig. 1.—A picture area made too small by insufficient sweep voltages on each pair of deflector plates.

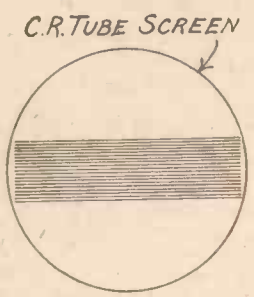


Fig. 2.—Using too large a voltage sweep on the vertical deflector plates, and too little on the horizontal deflector plates.

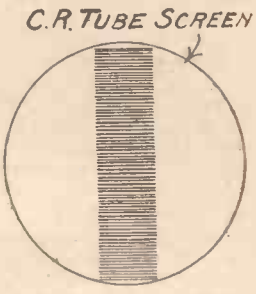


Fig. 3.—The picture area shape with the reverse conditions shown by Fig. 2.

ionisation action owing to the presence of positive ions within the field of the deflector plates.

To overcome this it is possible to make the electrode system asymmetrical inside the tube, and thus deflect the axial centre of the scan either off or near the edge of the screen. Picture-centring devices are then able to bring the image back to its appropriate position on the tube. In some tubes certain electrode refinements, such as an electrostatic shield, are introduced to overcome the slight defect.

Focusing

In any optical lens system used for photography, light experiments and so on, means are provided for mechanically positioning the lenses so that the emergent light beam can be focused into a sharp spot or area on any object or screen with which it is used. With cathode-ray tube working, a similar focusing effect of the spot on the screen has to be produced, otherwise the resultant fluffy-edged or misfocused spot will bring about an imperfect television picture. This process of beam concentration is often referred to as fasciculation, and in practice it can be carried into effect in a number of ways. With soft tubes a small trace of inert gas is capable of giving the electrical "focus" effect required in conjunction with an adjustment of filament current.

Then, again, there is the simple expedient of bringing the electron beam under the influence of a magnetic field as shown in Fig. 4. The coil surrounds the beam and has a steady direct current passed through it capable of being varied at will. The strength of the resultant field produced, together with the mechanical dimensions of the electrode system and accelerating potentials used, enable a balance to be struck where the spot appears in sharp focus on the screen. Remember that the size of this spot is very small under practical conditions, and unless this is so, there will be overlap between the scanning lines, and a blurred image will result. In the case of a 240-line image giving a picture depth of 6 inches, the separation between each line is only one-fortieth of an inch.

Using the Shield

A more common electrostatic method now in use employs the Wehnelt cylinder, or shield, to which reference has been made earlier in this series. When the potential of this cylindrical electrode, seen very clearly in Fig. 5, is varied in relation to the cathode, the field of force between these two electrodes is modified. In practice this is given a negative bias, sometimes approaching a figure up to as much as one-tenth of the operating anode voltage—and the electrons leaving the cathode surface and tending to move in a divergent direction come under the influence of the repelling negative field (remember the electrons are minute negative particles of electricity) and are forced back into the centre of the beam.

In this way the forward electron movement is confined to a narrow cross section, and the concentrated beam not only passes through the small orifice of the gun, or accelerating anode, but reaches the screen and evidences itself as a bright, sharp-edged spot. The only real drawback to this arrangement is that, as in the action of the grid of an ordinary thermionic valve, the application of the negative potential places a limit on the number of electrons which actually "escape" from the filament (or cathode). In consequence, this shield bias has to be very carefully adjusted, and must not exceed a certain rated figure for each particular tube.

Modulation

So far our prime attention has been directed towards imparting a regular movement to the screen spot, and seeing that this is correctly focused, as well as eschewing minor defects (such as origin distortion) in building up the observed field. To build up the picture in terms of light and shade with these lines, the incoming television signals, amplified by the radio receiver to a sufficient strength, must be made to modulate the beam, as this is the only source of light, replacing, say, the neon lamp in a disc receiver or the Kerr cell of a mirror-drum projection set.

The light intensity of the observed spot at any position of its motion, when only under the influence of the accelerating potentials and time base circuit voltages, is constant, being due to the actual number of electrons which reach the screen while the whole beam undergoes its constant velocity motion. A form of modulation has to be devised which is quite independent of these earlier constant and varying potentials. If this is not done then an incorrect image will result. For example, suppose it is desired to vary the actual number of electrons which reach the screen. This will cause the spot to alter in brightness throughout its travel, and due to the rapidity of movement coupled with the phenomena of visual persistence which every normal eye possesses, a picture can be traced out which "shows" on the screen a replica in light of the actual scene radiated from the transmitting station.

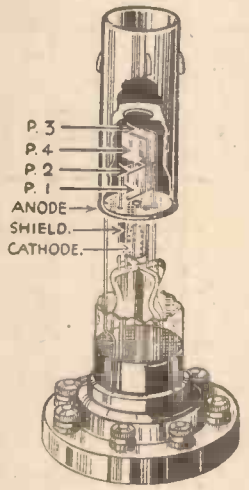


Fig. 5.—The electrode system of a cathode-ray tube in which the Wehnelt cylinder is indicated as a shield.

If this signal voltage variation was applied, say, to the shield or cylinder, then not only would the number of electrons vary but the spot of light would alter in focus due to the variations in the static negative field between cathode and shield.

(To be continued)

ADAPTING A COMMERCIAL RECEIVER FOR TELEVISION

A Simple Method for Obtaining Television Signals with a Commercial Receiver not Specifically Designed for the Purpose

MANY readers and amateurs are anxious to try out television reception, but are in possession of a commercial receiver, in which either the method of assembly is too complex, or the screening is so complete, that it is not an easy matter to obtain access to the appropriate leads. Furthermore, it is often felt undesirable that such a receiver should be interfered with in view of the fact that the guarantee might be rendered void. The following hints will be found of use in such cases, and the information is that which Messrs. Mervyn give to their clients who wish to employ their kits, etc. with such receivers.

First of all, a split-anode adapter is required. This is in the form of a valve base, with the grid and filament pins continued to form sockets on the opposite side. The anode pin is short, however, and terminates in a small screw terminal at the side of the base. Immediately above this is a further terminal which is fixed to the anode socket on the top of the base, and thus, if the adapter is plugged into a valve-holder, and a valve inserted in the adapter, the electrodes are continued through the adapter with the exception of the anode. A meter or other device may then be joined across the two terminals to complete the anode circuit and enable the valve to function. To use the neon lamp, plug the adapter into one of the valve-holders in the receiver (preferably the output valve), and connect the top of the two terminals to the neon lamp. The other side of the lamp is then joined to H.T. maximum. This may be found by means of a voltmeter, or with the aid of the following hint. Tune to a station, and then connect the free lead from the lamp to each terminal on the transformer fitted to the loud-speaker. Music will only be heard when one point is touched. The H.T. lead is that where no music is obtained.

TELEVISION PROGRAMMES

THE action of the Television Committee in recommending that the B.B.C. be the authority responsible for high-definition television developments has undoubtedly had its repercussion in the work now being done by them in furnishing the low-definition service. The programmes which they are presenting to those in the happy possession of receiving apparatus for looking-in have made a still greater improvement of late, and, frankly, I am amazed at the quality of the pictures and the amount of entertainment value which they furnish.

I switched on my mirror-drum receiver the other day with the ostensible reason of carrying out one or two alterations which I felt would improve matters, but the programme was of such an inviting character that I sat down and thoroughly enjoyed the full three-quarters of an hour transmission. Eustace Robb had compèred a programme in which there were twelve distinct turns, including different types of acrobatic, ballroom, and Spanish dancing, singing, and humorous patter; the pictures being distinct and clear with an ingenious painted background scenery. Some friends who happened to call in at the time were so impressed with the results that they there and then resolved to build up receiving apparatus for themselves, and join the band of people which the Television Committee's report so aptly described as "pioneers." The only fault one could find with the transmission was that the Midland Regional station, which provides the sound, does not now come over so well in the London district on its new wavelength. This is a small matter, however, and one easily rectified by using a more powerful set, and in any case, it is the vision that is of prime importance. More power to your arm, Mr. Robb, and a hope that your programmes will continue for a very long time and maintain their high standard.

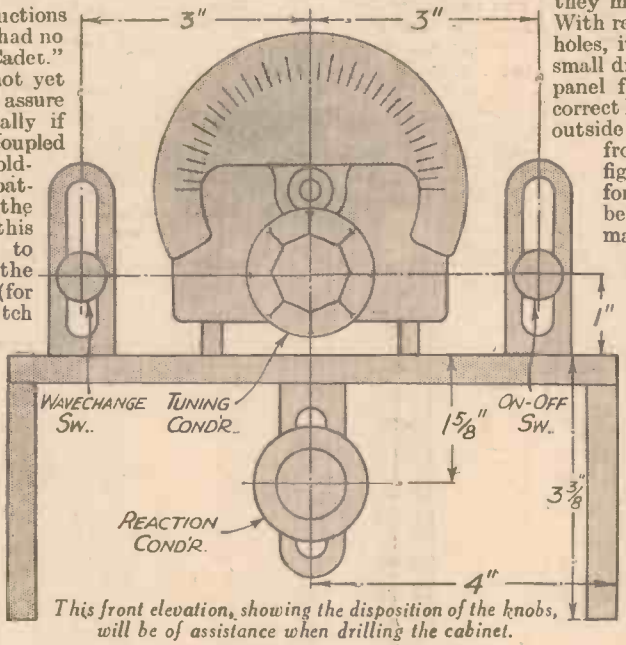
A rear view of the complete receiver chassis.

ADJUSTING AND OPERATING

THE HALL-MARK CADET

Further Details Concerning the Fascinating Little Receiver which was Fully Described Last Week

IF you have followed the instructions given last week you should have had no difficulty in building the little "Cadet." If the set has been adjusted but not yet given its preliminary test we can assure you of a pleasant surprise, especially if you look upon the resistance-coupled Det.-2 L.F. set as somewhat old-fashioned. After connecting the batteries, etc., as described last week, the set can be tried out, and to do this the reaction control should be set to zero (anti-clockwise), the knob of the wave-change switch pulled out (for medium waves) and the battery switch set to the "on" position. By rotating the slow-motion knob of the condenser drive it should be an easy matter to tune in the local station at reasonably good strength. After that, advance the reaction setting slowly and note the increase in signal strength; there is no need to turn the knob so far that the receiver is set into oscillation, and it should be turned back a little as soon as a point is reached at which the first trace of distortion sets in.



This front elevation, showing the disposition of the knobs, will be of assistance when drilling the cabinet.

Tuning In

When this has been done it should be possible to bring in a number of other stations by turning the tuning knob and occasionally readjusting the reaction control slightly. In all cases care should be taken not to advance reaction up to the oscillation point, because if that is done there will be a danger of causing interference with nearby receivers. After becoming satisfied that the set is functioning correctly on medium waves, the long-wave band should be tried by pushing in the wave-change switch-knob.

Adjusting the Pre-set

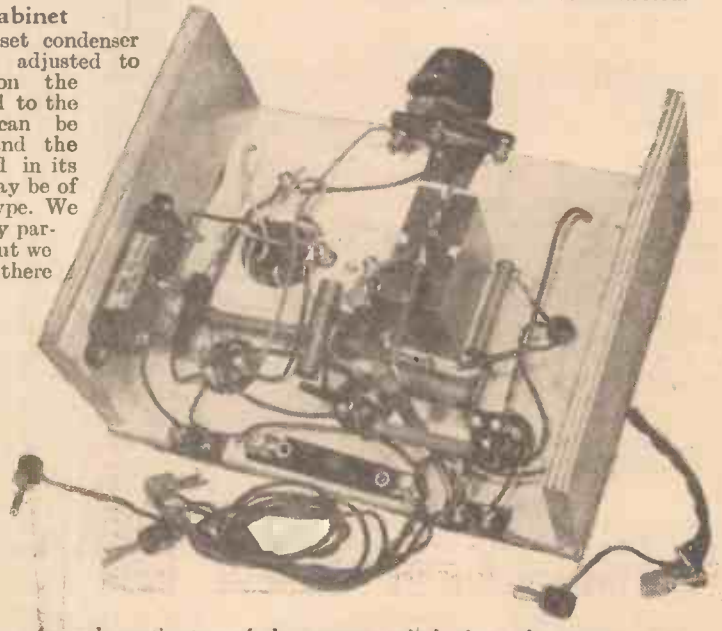
Finally, the pre-set condenser mounted on the chassis runner can be adjusted to the most suitable capacity for the prevailing conditions. The chief object of this condenser is to sharpen up the tuning, and the degree of selectivity is increased, as the capacity is reduced, by screwing out the knob. It will, however, be found that as selectivity is increased in this manner there will be a certain diminution in volume, although this will not be great if the aerial is fairly long. It will be found that when a short or indoor aerial is employed selectivity is amply good with the pre-set condenser adjusted to its maximum capacity, but where a particularly long outdoor aerial is used it may be found that best results are obtained by screwing out the knob as far as possible. Somewhere between these two extremes will be the position which will suit the majority of requirements, and it can easily be found by trial, tuning the receiver to three or four stations as a check on various separate settings.

Drilling the Cabinet

After the pre-set condenser has finally been adjusted to its best position the locking nut fitted to the control spindle can be tightened up and the receiver mounted in its cabinet, which may be of any convenient type. We do not specify any particular cabinet, but we might say that there is ample choice in the Peto-Scott range, and any reader is sure to find one to suit his requirements. The four control knobs are intended to pass through the front of the cabinet, which means that this must not be more than about 5/16in. thick. The exact position of the hole centres are shown in the drawing in the centre of this page, and a full-size template may, if desired, be made from this. An alternative method is to slip the complete chassis into the cabinet and mark the position of the centre of the longest—tuning condenser—spindle. A ⅜in. hole can then be made for this spindle, and the receiver again inserted to locate the positions of the other three holes, after which they may be made with a ¼in. twist drill. With regard to the method of boring the holes, it will be found best to run a very small drill, or even a bradawl, through the panel from the inside, later drilling the correct holes with the proper drill from the outside; this will prevent the polished front of the cabinet from being disfigured. After having made the holes for the spindle, the escutcheon can be fitted, using the condenser itself in making a paper template.

Gramophone Reproduction

Should any readers wish to use the "Cadet" in conjunction with a pick-up for record reproduction, they can easily do so by joining one pick-up lead to the grid terminal of the detector valve, and the other to a tapping at about 1½ volts on the G.B. battery. If desired, a terminal socket strip, like those used for the aerial, earth, and loud-speaker connections, may be fitted in the centre of the rear edge of the chassis by slightly altering the position of the microfuse. There will be no need to fit a radio-gram. switch since the pick-up can quickly be connected or disconnected.



An underneath view of the receiver, which shows the position of the pre-set condenser.

On Your Wavelength

by Thermion

Don't Do It!

I AM often amused at the organised attacks (I am quite certain that they *are* organised attacks) which cyclists make on any newspaper which happens to touch upon the rear light problem, or roads, or motor-cars, or cyclists. I derive the amusement from the somewhat obnoxious phraseology which cyclists use. Further amusement accrues from my reflection that editorial waste-paper baskets must be pretty full, and that the letters, when they do appear in print, must be well watered down. Unfortunately, there are still half-witted creatures who waste their time writing rude letters to their favourite papers when an opinion is expressed which does not coincide with theirs. Every paper has a small following of these demented individuals, and wireless papers are no exception. Regularly I receive letters from people who claim to have invented everything. They write letters of at least twelve pages in the most vehement language accusing some firm, or even some writer, of having filched their ideas. If you happen to be one of this ilk please remember that we destroy such letters and that you are merely wasting your time. This paragraph has been invoked by a letter I received bearing an Ashford, Kent, address, from a reader who is certain that he is a miniature Marconi.

And Others

FORTUNATELY, only a very small percentage of such letters are received. In my omnifarious journalistic connections I find that all editors receive them, and have the standard practice of throwing them away. Other letters are written in a more friendly strain, but sometimes with an axe to grind. After saying how much they enjoy reading a particular feature, they enclose a wrinkle! Such wrinkles are similarly destroyed, for it is the rule that no other correspondence should be enclosed.

Television Nomènclature

I HEARTILY agree with the views expressed by Sir Ambrose Fleming, K.T., F.R.S., in a letter from him recently published in the *Telegraph*, and which I print below.

"Now that television has been taken under the control of the General Post Office and its practical working committed to the B.B.C., certain fairly short words will be required for general use to describe the process or act of transmitting images of objects by television, and names for the instruments employed and users of them.

"Such verbs as 'Televise' or 'Televisionise' are not very expressive, and the words 'Looker-in' or 'Lookers-in' are inelegant.

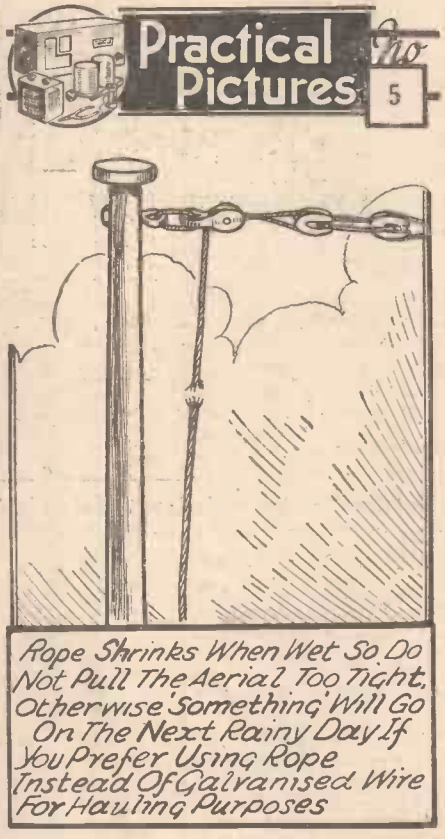
"I have suggested elsewhere the word 'Telise' for the process or act, as it 'tells our eyes' what is taking place at a distance. Some may prefer to spell it, as my wife suggests, 'Telleyes.'

"The term 'Television receiver' is too long. It might be abbreviated to 'Teliser,' and for 'Looker-in' we might use the word 'Telisor.' These terms are merely suggested with diffidence, unless any better can be found.—AMBROSE FLEMING."

Sir Ambrose Fleming is the famous inventor of the thermionic valve which has made wireless telephony possible, and has revolutionised wireless telegraphy.

Keeping in Touch

IT is remarkable how radio sometimes provides the link with missing friends, or distant friends, in more ways than one. The particular link to which I refer is not the ether link, but the printed word. I received a technical query the other day from an old friend of mine, an aircraft designer, who, the last time I heard of him, was in Japan. He did not disclose his identity until the end of his letter. PRACTICAL AND AMATEUR WIRELESS was the link which re-established us.



Another Link

CONSTRUCTOR Crusader 2,578, Mr. Maurice E. C. Jones, of Raynes Park, tells me that he would like to join issue with me regarding my comments on the cost of home construction as compared with commercial sets. He thinks that it is still cheaper to buy a set than to make one. Well, there is nothing to stop him. There have been dozens of receivers described in PRACTICAL WIRELESS, the nearest commercial counterpart to which would cost five times their prices. I am glad to know, however, that this reader agrees with me about crooners. Some readers prescribe a packet of new safety razor blades for their throats!

Readers with Short Memories

ANOTHER bold reader sent me a cutting of the cover of Volume I No. 1 of PRACTICAL WIRELESS. He also sends me a cutting of page 855 of our late contemporary *Amateur Wireless*. This particular page is headed "On Your Wavelength" and on it is reproduced a piece of script lettering from a Holland radio journal which *Amateur Wireless* thought was similar to its own titling. This reader apparently sent me these two cuttings to infer that since we are now using "On Your Wavelength" we have lifted the title. He is apparently in ignorance of the fact that *Amateur Wireless* has been amalgamated with PRACTICAL WIRELESS, and that this present feature has been continued in the new combined journal. Might I suggest that this reader peruses the first paragraph of my notes this week?

Whilst I am dealing with this point, it may not be remiss for me to point out that I have been on the staff of both papers. In fact, I edited for several years the original *Amateur Wireless* supplement to *Everyday Science*. I am quite well acquainted with the history of both papers. By the way, the reader who sent me the cuttings referred to has evidently been misled by the fact that Thermion did not sign the feature he enclosed.

Television Prices

IT appears that there is still a good deal of speculation going on regarding the supply of television receivers when the high-definition broadcasts commence. I remarked a week or two ago that some firms have suggested marketing a television receiver for about £25, and I now see that another firm proposes to put out a receiver giving a projected picture measuring approximately 10½in. by 7½in. and costing about twenty pounds. I am afraid that there are too many approximations here, and I doubt if the firm is really able to estimate the probable cost at present. Meanwhile it will be interesting to watch the market, but I certainly doubt whether there will be a really efficient apparatus at the low prices that have been mentioned. My contention is rather borne out by the fact that a well-known firm has actually produced a combined sound and vision receiver to sell at 75 guineas; in this instance there is no guess work for the firm in question has prepared a descriptive folder giving complete details. The matter is being kept secret at the moment, so I am unable to give any further particulars, except that the instrument appears to be a thoroughly sound job.

Gas-driven Radio Sets

I SEE that the old story about operating the wireless set from the gas mains has again cropped up in the lay press. Only the other day I read that it is now practically certain that gas-driven sets will be available within a comparatively short time. The write-up in question went on to point out what a great blessing the gas-operated receiver would be to the many thousands of people whose homes are not yet wired for electric lighting and

(*Continued on page* 14)

(Continued from page 12)

to explain that the gas set of the future would be as trouble-free as the all-mains receiver of to-day.

It may be that I have overlooked some very important development, but I certainly cannot see how it will be possible—at least in my generation—to obtain sufficient electric current to operate a set from the device which the lay press describes as consisting of two strips of different metals heated at their junction. We all remember the thermopile and similar apparatus from our schooldays, and we also remember that when several of these metal junctions were joined together and placed near to a strong source of heat the current generated was only sufficient to move the pointer of an extremely sensitive galvanometer through a small arc. If there has been some recent development whereby a reasonable collection of thermo-couples can be made to generate a power of, say, 30 watts, I should very much like to have further details concerning the arrangement. In the meantime I very much doubt whether there will ever be a satisfactory receiver for operation from gas.

Radio on Coaches

RADIO receivers have successfully been installed in long-distance trains, and I now learn that a company owning a large fleet of motor coaches proposes shortly to fit receivers in all of their vehicles. Successful tests have been carried out with one of the firm's cars, and the announcement now made is confirmation of the satisfactory nature of the experiments.

Bravo, Nottingham!

I LEARN that a number of important tests have recently been carried out by the Nottingham Passenger Transport Board, in conjunction with the Post Office and the B.B.C., with regard to the elimination of interference by the trolley buses with radio reception. The Droitwich and Midland Regional transmitters both radiated special transmissions during the early hours of the morning with a view to noting the effect of a new type of suppressor device fitted to the buses. I gather that the new device proved entirely satisfactory in reducing the interference to negligible proportions. I only hope that many other local authorities will follow the example of Nottingham.

Radio-gram. Advantages

THERE is no doubt about it that a radio-gram. is a very worth-while proposition. Its main object, of course, is to provide programmes of your own selection when the broadcast items are not to your liking. But it has other advantages, particularly for the home constructor and the experimenter. In the first place, it makes possible the use of a really effective speaker baffle, in a form which does not offend the lady of the house. Then it offers ample storage space for batteries (if used), and for those additional gadgets which we so often want to add to our sets after they have been completed.

Moreover, since there is usually ample shelf room in a radio-gram cabinet, there is every encouragement to the constructor to arrange his receiver in several separate units—H.F. unit, L.F. amplifier, power pack, etc.—so that, in the event of his wishing to experiment with a new circuit, which usually involves only one unit, the new arrangement can be made up and substituted for the original unit without having to rebuild the whole set.

The H.F. Pentode

IT is sometimes mentioned in articles concerning the H.F. pentode that this type of valve does not require a by-pass condenser between its screening-grid pin and its cathode. The necessity for this condenser was very forcibly brought to our notice the other day, however. We were experimenting with a three-valve receiver of the S.G., detector, L.F. type using pentodes in each stage. For the preliminary test a by-pass condenser was not connected between the screening grid of the detector and its cathode, and on connecting the aerial and earth to the receiver-volume was very much lower than one would expect from a set of this type. When a .5 mfd. non-inductive condenser was joined across screening grid and cathode of the H.F. pentode detector, however, volume was doubled but instability was experienced between stations. Further tests were then conducted and the instability was entirely eliminated by screening the leads to the cap terminals.

Using a Superhet Converter

A READER who had constructed the Adapter-Converter Unit described in a recent issue of PRACTICAL AND AMATEUR WIRELESS wrote to us complaining that results were not very satisfactory when the unit was used as a converter in conjunction with his two S.G., detector, pentode receiver. On making further inquiries, however, we were told that the receiver in question did not function very satisfactorily on the long-wave band, and this, of course, was the reason for the unsatisfactory short-wave reception. When the unit is used as a converter the H.F. stages of the receiver have to be accurately tuned to a wavelength of approximately 2,000 metres if satisfactory results are to be obtained. It is therefore very essential that the tuned circuits be accurately ganged at the particular dial setting used when the short-wave converter is being operated, and it is emphasised that bad reception is often due to inaccurate ganging.

Parallel Feeding

WITH some of the cheap L.F. transformers at present on the market bass response is conspicuous by its absence. In most cases this is due to insufficient primary inductance. It is possible, however, to greatly increase this inductance by preventing direct current from passing through the primary winding. This is done by connecting the preceding valve anode via a fixed condenser of approximately .5 mfd. to the P terminal of the transformer, the H.T. terminal being then connected to H.T.— and the anode terminal of the .5 mfd. condenser via a suitable resistance (chosen to match the impedance of the preceding valve) to H.T.+.

Speaker Rattle

WE sometimes receive complaints from readers concerning so-called speaker rattle, and we are asked to suggest a reliable make of speaker to substitute for their existing type. It is very often found, that what seems to be speaker rattle is really due to valve amplitude distortion, and may be cured by using an output valve having a higher undistorted output.

Also, think how handy it is to have a gramo. section always available to enable you to carry out response tests with some of those excellent constant-frequency records which can now be purchased so inexpensively.

Pentode or Triode?

ONE sees very few commercial receivers at the present time which use anything but a pentode in the output stage. This, in a way, is a pity, because so many listeners are quite content with a lot of volume and little quality, and are entirely without qualms about seriously overloading a sensitive output stage. Please do not infer that I accuse the pentode of bad reproduction, but its great sensitivity makes it very easy to overload, and so many listeners will keep advancing the volume control.

Maximum output for minimum input is all the cry nowadays, but there are also many listeners who are willing to sacrifice a little in sensitivity for the sake of the undoubted ability of the triode to handle the louder passages of music without distortion.

Among A.C. valves, there are, of course, some excellent output triodes, and I now see that one enterprising valve maker, at least, has produced an A.C.-D.C. output triode having very useful characteristics. In a push-pull arrangement this valve should make possible a powerful universal set giving very fine reproduction.

Automatic Loud-speaker Warning

IN view of the fact that several accidents have been caused at the Porte de la Villette, Paris, by motor lorries colliding with the roof of one of the arches, a new warning signal has been installed. By means of a photo-electric cell, should a car on its approach cut the beam of light, a stentorian voice shouts, "Pass to the right," namely, through a larger subway. The system has proved very successful as most of the drivers ignored the printed warnings.

The Vagaries of Television

AMONGST the many eccentric people calling at the Berlin studio, it is reported that one of the most excited visitors was a woman who stated that since television programmes had been started she was afraid to undress before retiring for the night as she had been told that the television transmitter was directed towards her room. One of the studio officials sent her away fully satisfied that the instrument in future would be turned towards another part of the capital!

High Power in the Far East

THE Japanese Broadcasting Corporation of Japan is planning the erection of a 150-kilowatt transmitter which is to be ready to work by the end of 1935. Its site will be in the neighbourhood of Tokyo.

THAT DODGE OF YOURS!

SUBMIT YOUR IDEA

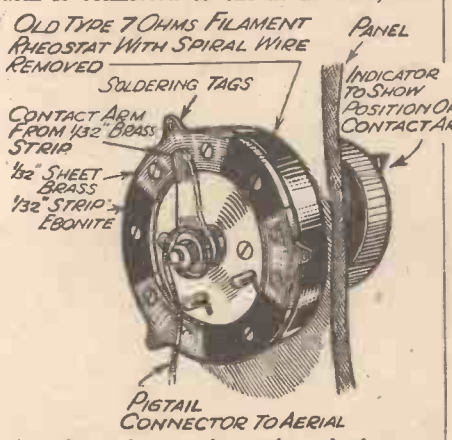
READERS WRINKLES

THE HALF-GUINEA PAGE

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.

A Multi-contact Switch

HERE is a multi-contact switch made from an old 7-ohm filament rheostat. This is quite a simple adaptation which can be used with convenience in the aerial lead to a multi-tapped aerial coil, and operated from the front of panel. Three or more contact segments can be fitted, as shown in the accompanying sketch, which is self explanatory. The switch arm is connected to the aerial lead, and



A useful multi-control switch made from an old filament rheostat.

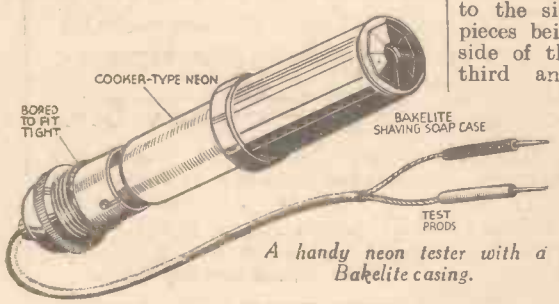
each of the brass segments to a tapping on the coil.—W. MURRELL (Purfleet).

A Simple Neon Tester

HOW often have you, when diving into the "innards" of a radio-gram installed in a dark corner, wished for some speedy means of testing as to the presence of necessary current at vital points?

Here is a very cheap device which enables various tests to be carried out quickly, without fear of short circuits, wrong polarity, or fear of incorrect type of current. The tester is quickly and easily made with one of the small type neon tube lamps as used for pilot lights in cooker controls. These are usually readily obtained from most electrical stores, together with a bakelite lamp-holder, some twin flex, and insulated wire for the test prods.

Mounted, as shown, in an old bakelite shaving soap case by any convenient



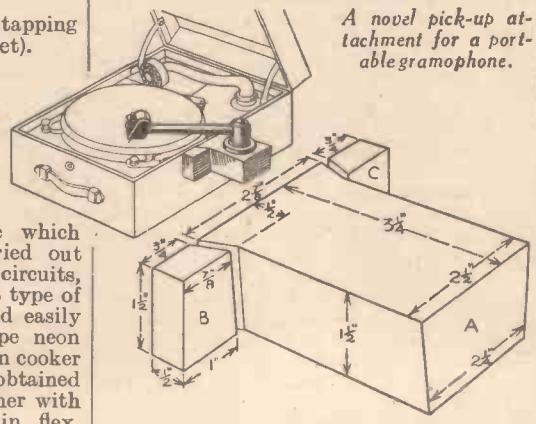
A handy neon tester with a Bakelite casing.

method of fixing that suggests itself, it should prove a useful addition to the experimenter's kit. Additionally, it provides a rapid means of testing the continuity of windings if used in series with a source of H.T. current, or for fixed condenser tests in the same way. Its greatest feature lies in the extremely small amount of current used.

The diagram, which is self explanatory, shows the peep-hole at the end for providing visual indication without exposing the lamp to any risk of damage.—W. F. CLARK (Ealing).

A Pick-up Attachment

BEING desirous of using a pick-up on a portable gramophone, and not wishing



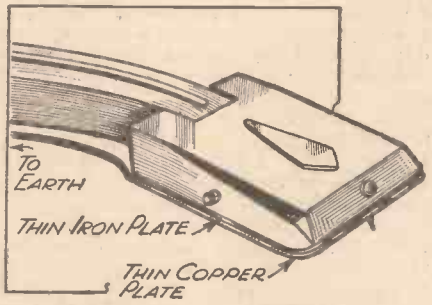
A novel pick-up attachment for a portable gramophone.

to disturb the existing tone-arm, I made the device shown in the accompanying drawing.

It consists of three pieces of wood cut to the sizes indicated, the two smaller pieces being permanently screwed to the side of the gramophone case, while the third and larger piece is a neat fit between them. The pieces of wood fit together dovetail fashion, thus preventing any movement; the pick-up being screwed to this block, is thus easily removable. It should be noted that the position of the pick-up must be fixed by the template usually supplied by the makers.—C. EMERY (Liverpool).

Preventing Motor Noise in Pick-ups

IT is sometimes found that brush noise from the motor driving the gramophone turntable, more particularly on D.C. mains, is still present, even after various condensers have been fitted across the mains or motor terminals. The interference can then be put down to direct pick-up of

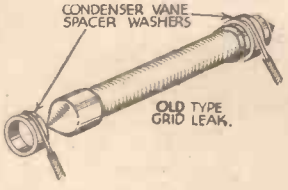


Method of fitting a metal shield to a pick-up for preventing noise.

the motor field by the coils, and the iron in the pick-up itself. This can often be stopped by securing a thin iron plate, backed by a copper plate, secured to the underside of the pick-up. This double shield is connected by means of a third lead through the pick-up arm direct to earth, or to a point which may vary with different types of pick-up. The metal plates should not be too thick owing to the weight causing record wear.—W. H. F. (Middlesex).

Grid-leak or Resistance Fitting

PRESENT-DAY resistances and grid-leaks are well designed for easy fixing, but many constructors possess perfectly good components of this kind of the older glass type with tagless metal ends. The writer discovered that the vane-spacing washers off an old tuning condenser were a nice push fit on the ends of most of the resistances in his possession, and since



A simple but efficient grid-leak or resistance fitting.

then many have been used as shown in the accompanying sketch. A piece of wire is soldered to the washer before it is pushed over the metal end of the resistance or grid-leak.—D. M. STEWART (Stranraer).

MUST WE START AGAIN?

Will the Introduction of High-definition Television on Short Waves Revolutionise the Design of Broadcast Receivers? Some Interesting Problems Which Might Arise are Here Discussed by W. J. DELANEY

THE news that high-definition television transmissions are to begin this year has been received by the majority of wireless amateurs with great enthusiasm. It is, however, a propitious moment to ponder as to whether the introduction of this form of television will not completely revolutionise our present system of broadcast receiver design, and with it the principles of sound reproduction. At first sight this might seem a rather exaggerated suggestion, but let us analyse the position carefully.

The Wavelength Range of Receivers

The first point about the forthcoming transmissions is that the wavelengths to be used will be in the neighbourhood of 5 or 7 metres. Those who have already experimented on these ultra-short wavelengths know the care which is needed in receiver design, and the great care which has to be taken to avoid losses. The technique is totally different from that required in the design of a normal broadcast receiver intended for use on wavelengths from 200 metres upwards. It is, furthermore, quite reasonable to state that the present B.B.C. transmissions, together with all the European broadcasts, will remain at their present allocations (except, perhaps, for minor slight changes to avoid jamming, etc.). It is feasible to suggest that the purchaser or constructor of a television receiver (which, it must be remembered, will consist of a "double" receiver to enable both sound and vision to be obtained) will only be able to pick up the television transmissions. These will obviously be rather few to commence with, and it cannot be expected that the user of the television receiver will be restricted to a few transmissions.

From this it is clear that new receivers will have to cover the present bands of 200 to 600 and 1,000 to 2,000 or thereabouts in addition to the 5-metre band. This is no small matter. At present there are only two or three "all-wave" receivers on the market, and these do not go down to 5 metres, but take as their minimum a wavelength somewhere about 10 metres.

Tuning Problems

The degree of selectivity required for 5-metre transmissions is infinitely greater than for any higher ranges, and thus difficulties of tuning to suit both bands have to be contended with. True, a superheterodyne circuit can be devised to cover the entire bands, but will this suffice to provide the quality which is needed for high-definition pictures? We cannot imagine that it will be necessary to have three complete receivers in one cabinet, one for broadcasting on the present bands, and the other two for the sound and vision on ultra-short wavelengths.

Will a new type of circuit be evolved which will answer the purpose? In other words, must we start again to design circuit principles for use on the H.F. side of a receiver?

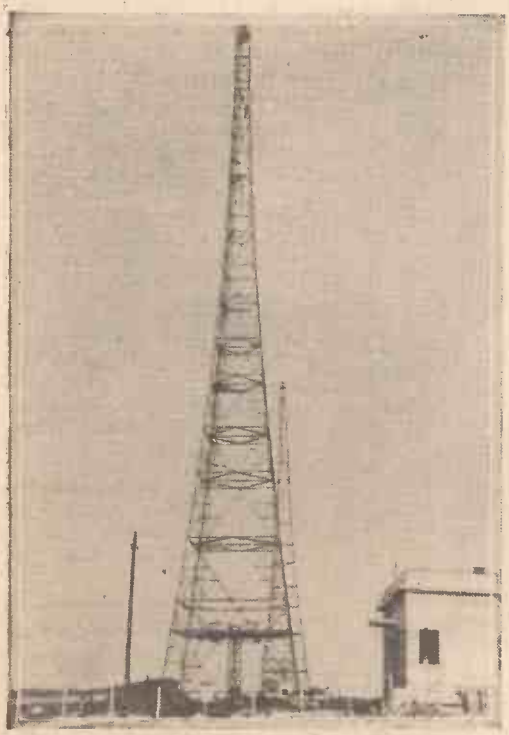
Compare this view of the ultra-short-wave aerial. It may just be seen on the framework projecting from the side of the Crystal Palace Tower. Very little power is required to cover immense ranges on the short waves.

Frequency Response

We next come to a much more vital point, and this concerns the overall frequency response, or, in other words, the efficiency of the audio-frequency (L.F.) side of the receiver. For the present 30-line transmissions it is necessary to use an L.F. amplifier which is far more efficient than is normally required for broadcast reception with loud-speakers as at present designed. When we come to high-definition pictures, however, we must obviously be even more careful in L.F. circuit design, and the frequency response required is infinitely greater than at present realised by the ordinary listener.

If, therefore, we use such an L.F. amplifier with a circuit for normal broadcast reception what would we find? Firstly, side-band splash and station heterodyning would absolutely ruin any programme we picked up, and to avoid this it would be necessary to fit special high-note filters to come into operation on the broadcast band. Many commercial receivers of the present day incorporate such devices to reduce noises on the present band, and in these the L.F. design is only worked out for sound broadcasting as at present known.

What about loud-speaker design for such a high-efficiency amplifier? Is there a loud-speaker at present obtainable which would respond to an amplifier of the type which will probably be needed? If not, then we must start again on loud-speaker design, and this will, in turn, lead to a general improvement in cabinet design, etc., in order to take full advantage of the improved response.



Towering masts and tremendous power characterise the medium- and long-wave stations

All Down to the Ultra-shorts

Is it too much to imagine that all good-quality stations (by which, of course, is meant such stations as the B.B.C. main stations and the better Continentals) will go down to the ultra-shorts in order to take full advantage of the much better quality which will be obtainable?

One of the greatest bugbears of present broadcasting would be removed if such a move took place. Side-band splash, heterodyne whistles, and all similar objectionable noises would not be known if such a move took place, as there is ample room in a small band for double the number of stations at present transmitting. Figures are never pleasant and can be made to prove anything, but the following particulars are interesting to those who have not previously considered the position.

The normal broadcast band extends, roughly, from 200 to 600 metres, or from 1,500 kilocycles to 500 kilocycles. The separation required for "ether comfort" is 10 kc/s. Therefore, in the normal band above referred to we can squeeze 100 stations, and the frequency covered by each station will be 10,000 cycles.

Five metres represents a frequency of

(Continued on page 21)

VALVE TYPES AND USES—8

The Subject of This Article is the Special Type of Valve Used for Frequency Changing in Modern Superheterodynes

IT is very largely due to the efforts of the valve manufacturers that the superheterodyne receiver has achieved such a large measure of success and popularity during the last couple of years or so. In the past it was generally found to be necessary to employ two separate valves for frequency changing—one acting as first detector and another as a local oscillator, and this system had other disadvantages than that of adding to the total number of valves required. One difficulty was that of maintaining a comparatively uniform intensity of oscillation over the complete band of wavelengths covered by the receiver, and another was that of ensuring efficient "mixing" of the received and locally-generated oscillations.

Combining the Oscillations

Until special frequency-changing valves were introduced the two sets of oscillations had to be combined in the grid, anode, or cathode circuit of the first detector; none of these systems proved ideal, although each had certain advantages in particular circumstances. It was later found that better "mixing" could often be obtained by combining the two different frequencies *inside* the first detector, and the bi-grid valve was employed for this purpose. Even this did not prove entirely satisfactory, whilst the method was quite unsuitable for use when it was intended to employ an outside aerial, due to the fact that oscillations were radiated in the form of interference. This latter trouble was overcome by employing a screen-grid or pentode valve as first detector, but then many of the old difficulties reappeared.

In recent years it has become almost a craze to reduce to the greatest possible extent the number of valves in the receiver, and because of this many multiple-purpose valves have been introduced. An important instance of the combination of two valves (or, at least, two valve functions) in a single valve is to be found in the various types of first-detector-oscillator valves that are now available. Multiple valves in some cases are [not favoured by the writer, as was pointed out when dealing with diodes, but any objection of this sort certainly does not apply to the modern frequency changer, for in this case the combination is not merely a result of an attempt to bring about a numerical reduction in the valves required, but of successful efforts that have been made to increase the efficiency of the modern superheterodyne receiver.

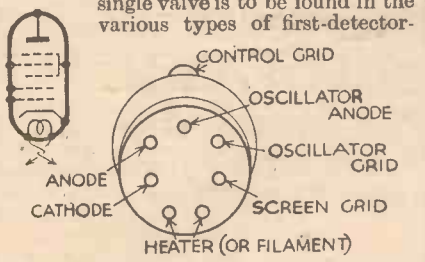


Fig. 2.—Showing the valve base connections and diagram of an indirectly-heated pentagrid or heptode. The base connections are the same for an octode.

Three Main Types

There are actually three main types of frequency-changing valves made in this country and extensively used to-day, these being in addition to the bi-grid valve, which is still available, but used principally for replacement purposes in older patterns of receivers. The types are the heptode or pentagrid, the triode-pentode, and the octode. There is one other type, however, but this is used principally on the Continent, and is a triode-hexode. It is scarcely necessary to mention that, in most cases, the valves are available in both battery and A.C. types, whilst in the majority of instances universal models are also available. An exception to this rule is the octode which at present is made only in A.C. mains and universal types by members of the B.V.A., although a battery model will shortly be available.

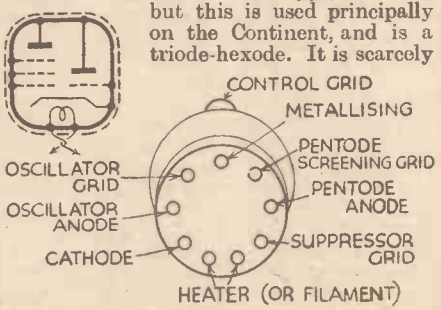


Fig. 1.—The connections and theoretical diagram for a triode-pentode frequency changer.

Of the three types of frequency-changer mentioned, it will be simplest to commence by studying the triode-pentode, since this is identical in principle with two separate valves—a pentode first detector and a triode oscillator. There is a common cathode or filament, but otherwise the connections are exactly the same as when two separate valves are employed. It will be understood from this that external "mixing" arrangements must be provided. This type of valve has proved very successful in both mains and battery form, and is to be found in a number of commercial receivers of popular type. The valve is fitted with a nine-pin base and a top-cap connection, the terminal points being as shown in Fig. 1, where a diagrammatic view of the electrodes is also given. The connections shown are those for an indirectly-heated valve, but they are the same for the battery counterpart with the simple exception that the pin marked cathode is left blank. Two typical triode-pentode valves are the Mazda types TP 22 and ACTP, of which the principal characteristics are set out in one of the panels on this page. It will be seen that two sets of characteristics are given, due to the fact that the valves are composed of two complete sets of electrodes.

MAZDA TP 22

Chief Characteristics:

	Pentode	Oscillator
Filament Volts	2	
Filament Current	.25 amp.	
Max. Anode Volts	150	150
Average Screen Volts	60	—
Average Anode Current	1.2 m.a.	.7 m.a.
Average Screen Current	.4 m.a.	—
Min. and Max. G.B. Volts	1.5—20	—
Base	9-pin.	

MAZDA ACTP

Chief Characteristics:

	Pentode	Oscillator
Heater Volts	4	
Heater Current	1.25 amp.	
Max. Anode Volts	250	200
Max. Screen Volts	200	—
Average Anode Current	6.5 m.a.	1.5 m.a.
Average Screen Current	2.5 m.a.	—
Min. and Max. G.B. Volts	5—41	—
Base	9-pin.	

COSSOR 210 PG

Chief Characteristics:

	S.G.	Oscillator
Filament Voltage		2
Filament Current		.1 amp.
Max. Anode Volts	150	150
Average Screen Volts	55	—
Min. and Max. G.B. Volts	0—9	—
Base	7-pin.	

COSSOR 41 MPG

Chief Characteristics:

	S.G.	Oscillator
Heater Voltage		4
Heater Current		1 amp.
Max. Anode Volts	250	100
Average Screen Volts	80	—
Average Anode Current	1 m.a.	6 m.a.
Average Screen Current	3 m.a.	—
Min. and Max. G.B. Volts	1.5—10	
Base	7-pin.	

MULLARD FC 13

Chief Characteristics:

	Pentode	Oscillator
Heater Volts		13
Heater Current		.2 amp.
Max. Anode Volts	250	90
Average Screen Volts	90	—
Average Anode Current	.8 m.a.	1.6 m.a.
Average Screen Current	3 m.a.	—
Min. and Max. G.B. Volts	1.5—20	—
Base	8-pin side contact.	

"Electron Mixing"

The pentagrid and octode valves are entirely different from the triode-pentode, although they are used for the same purpose. The main point of difference is that no external coupling between the detector and oscillator sections is required, because the "mixing" takes place within the valve itself, and is known as "electronic mixing." Consisting of screen-grid and triode valve in series, the pentagrid valve is shown diagrammatically in Fig. 2, where the pin connections are also indicated. Principal characteristics of the Cossor pentagrids, types 210 PG and 41 MPG, are given in panels on this page, details of the tetrode (S.G.) and triode (oscillator) portions being stated separately. It will be remembered by regular readers that these two valves were used and specified for the now-famous £5 Superhet, which was—so far as we are aware—the first modern superheterodyne employing only three valves to be described for home construction. The circuits of the battery and A.C. versions of this receiver were reproduced on pages 198 and 360 of PRACTICAL WIRELESS dated October 27th and November 24th, 1934, and readers desiring further information concerning the use of this type of valve are asked to refer back to these issues.

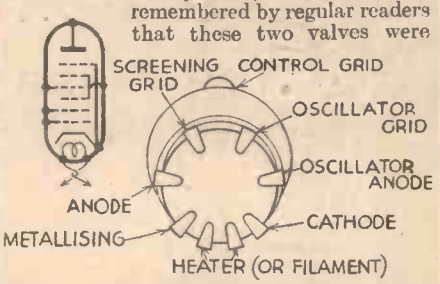


Fig. 3.—Valve base connections and theoretical diagram are here shown for the Mullard Octode FC 13.

The Octode

Octode valves do not differ greatly from heptodes or pentagrids, but have, as the

(*Continued on page 20*)

IMPRESSIONS ON THE WAX

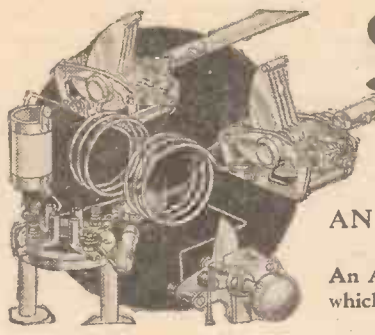
By T. Onearm

SERGE KOUSSEVITSKY, who is sharing with Toscanini the honour of conducting the London Music Festival in May and June, is universally acknowledged to be one of the three greatest conductors in the world—the rival of Toscanini and our own Sir Thomas Beecham. Koussevitsky, who has a life contract with the Boston Symphony Orchestra, spent a fortnight in London last autumn making records for "His Master's Voice," and as a result we have his performance of Beethoven's great "Eroica" Symphony (*H.M.V. DB*2346-51). When Beethoven first conceived this Symphony he planned to dedicate it to Napoleon, who was at that time the great apostle of freedom. By the time the symphony was finished Napoleon had taken the title of First Consul of France, and Beethoven, who regarded the action as a betrayal of Napoleon's republican ideals, tore up the title page of his symphony which bore the dedication to Napoleon and exclaimed: "So he is only as other men. Now he will trample other men under his heel!" From that day in 1804 until seventeen years later, when he heard the news of the death of Napoleon, Beethoven did not mention the great Frenchman's name, and then all he said was, "I have already written music for this catastrophe"—referring to the slow movement, the Funeral March of this Symphony.

The H.M.V. March list is rich in light music. At the head of it all stand three records from "Jill, Darling," the musical comedy success that is drawing all London to the Saville Theatre, made by the artists, orchestra, and conductor who take part in the show. (*H.M.V. B*8277–9). The lead is played by Frances Day, and with her she has those delightful artists, Louise Brown, Arthur Roscoe, and John Mills. The gay, catchy tunes, the witty verses, the piquant instrumentation, and the high spirits of these records are more infectious than 'flu. Cole Porter, the famous American composer of "Night and Day" and "Miss Otis Regrets," appears as a singer of his latest numbers, "Thank you so much, Mrs. Lowsborough Goodby!" and "Two little Babes in the Wood"—this is modern, snappy, sophisticated America at its most delightful (*H.M.V. B*8284). Belle Baker is the high priestess of rhythm, her curious, husky voice and her extraordinary vitality are reminiscent of Sophie Tucker, and she sings "The Continental" and "Stay as Sweet as you are" (*H.M.V. B*8288) with rhythmic verve that sweeps you off your feet. Eric Coates is well represented this month. John McCormack has made an exquisite record of his song, "A house, love, made for you and me" (*H.M.V. DA*1393), and the Light Symphony Orchestra has made two charming records (*H.M.V. C*2722-3) of his new "Three Men" Suite—a series of clever character sketches that will be as popular as the London Suite. Four novelty records deserve special mention.

The Walt Disney Silly Symphony Selection (*H.M.V. B*8283) is ideal for children of all ages. It is a selection of all the popular Silly Symphony tunes: "See the funny little bunnies," "You're nothin' but a nothin'," "Pied Piper of Hamelin," "The Penguin is a very funny creature," "Lullaby" (Brahms), "Lullaby Land," "Rock-a-bye, Baby," all played with authentic effects and funny noises. "Saint Patrick's Night" (*H.M.V. C*2726) is a cameo of life—we find ourselves listening in to a real Irish party, reels, songs, high spirits and all. "Toad of Toad Hall" Selection (*H.M.V. C*2724) is a charming record of the music of the only children's play to rival Peter Pan. To complete the quartet of novelties there is Ken Harvey (*H.M.V. B*8289), America's greatest banjoist, playing more notes in less time on a banjo than many a famous pianist. For slickness and verve Harvey has no equal.

Other records deserving special mention are Backhaus' sensitive and beautifully recorded performance of Beethoven's "Moonlight" Sonata (*H.M.V. DB*2405-6) and Horowitz, dazzling as ever, in a rarely heard work by the same composer, the Thirty-Two Variations in C minor (*H.M.V. DA*1387-8). Mozartians are well served; Fritz Busch, the brother of Adolf Busch, the violinist, has conducted a sensitive performance of Mozart's "Linz" Symphony (*H.M.V. DB*2191-3), and the Pro Arte Quartet and Alfred Hobday play exquisitely the Quintet in C major (*H.M.V. DB*2383–6).



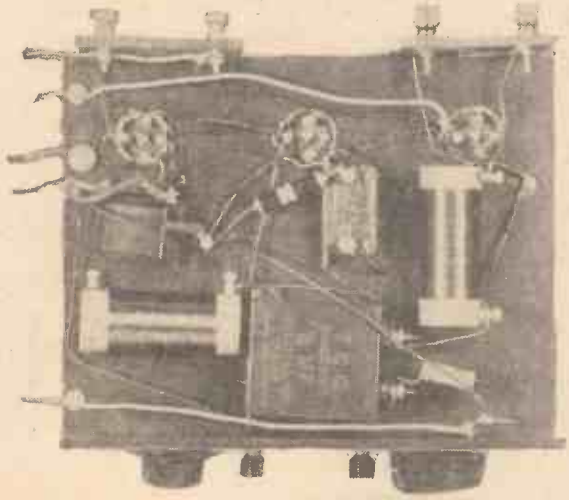
Short Wave Section

AN ALL-MAINS SHORT-WAVE THREE-VALVER

An Article Describing a Simple but Efficient Receiver which Tunes from 13-85 metres with Wavechange Switching.

THIS receiver has been designed for loud-speaker reception of all the worth-while short-wave transmissions, a function which it fulfils admirably, but added to which it has been found a very useful standard receiver for general work, being sensitive, and particularly free from the generally distressing features possessed by some all-mains sets. Even when using 'phones, hum is negligible, and the set is perfectly stable on all wavebands.

When considering the design, the following three important points were given preference: (1) efficiency, (2) simplicity, both of construction and operation, and (3) low cost. The set fulfils these requirements, and America has been received regularly nightly. Fig. 1 shows the theoretical circuit, that part to the left of the dotted line being the set proper, and that on the right the power pack. This latter has not been described, as it is a standard arrangement with which most constructors will be familiar. Those who have not already got the necessary parts on hand will find that similar units are easily obtainable commercially, or will be able to buy components of kits of parts to make them. In the writer's case a power pack and "filter compact" which were made by Regent one a few years ago were used. The building of the set is not described minutely as all the information the constructor requires is easily obtained from the accompanying illustrations. Therefore, in the following notes it is proposed to examine the circuit, comment on the set generally, and point out any "tricky" or unusual arrangements in the construction.



Sub-baseboard view showing the simple wiring connections.

LIST OF COMPONENTS REQUIRED.

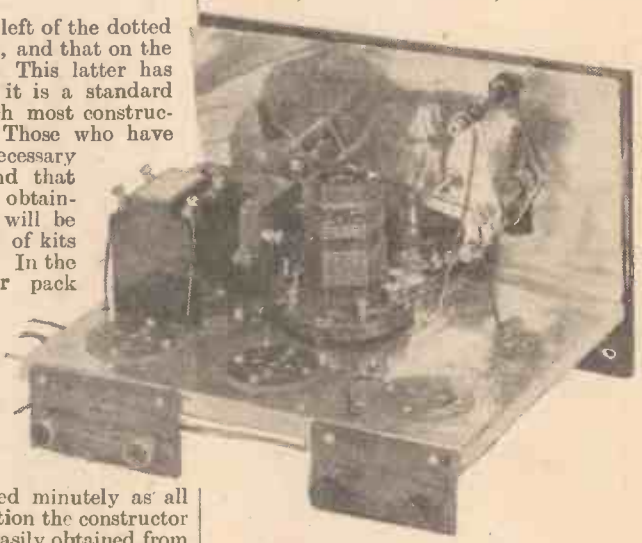
Plywood baseboard, 9in. x 7in.
Ebonite panel, 9in. x 6in.
Copper foil, 9in. x 11in.
One Lissen triple-range short-wave coil.
One Premier Supply Stores .00015-mfd. short-wave variable condenser, complete with slow-motion dial.
One Polar "No. 4" .0001-mfd. reaction condenser.
Three Clix chassis-mounting valve-holders.
One Varley Niclet L.F. transformer, ratio 5:1.
One 1-mfd. non-inductive condenser.
One .002-mfd. fixed condenser.
Two Bulgin 2-point push-pull switches.
One .0001-mfd. fixed condenser.
One 1-mfd. gridleak.
Two Premier Supply Stores short-wave H.F. chokes.
One Dubilier 25-mfd. 25-v. electrolytic condenser.
One Lissen 600-ohm resistance.
One T.C.C. 2-mfd. fixed condenser.
One Amplion 30,000-ohm fixed resistance.
Four terminals.
Ebonite for terminal strips.
Wire, screws, flex, etc.
Valves: 1 Tungsram H.P.4100 (H. F. Pentode)
1 Tungsram A.R.495 (detector).
1 Tungsram A.P.495 (power) *or* A.P.P.4130 (pentode).

The Circuit

The aerial is choke-coupled to the first valve in a normal manner; no condenser is shown in the aerial circuit, but with certain long aerials it may be found that the medium-wave programmes break through. If this happens, it will be found that a neutralising condenser in series with the aerial may be adjusted to tune out the interference. The first valve is an H.F. pentode, and it is incorporated for the following reasons: it acts as a "buffer" for the aerial—no matter how the aerial swings, it has no effect on reception, nor does the aerial affect calibration of the receiver as it is completely isolated from the tuning circuit. By virtue of the H.F. valve the set cannot re-radiate, and tuning-in "on the squeal" will not worry other listeners. A final word in its favour is that it definitely gives a certain amount of amplification, and here it is helped by the fact that tuned-anode coupling is used between it and the detector valve.

A tuned circuit gives a much greater impedance than an H.F. choke in the anode circuit of the valve, so enabling it to give much better amplification. The 1-mfd. condenser in this tuned circuit must, therefore, be non-inductive, and this is probably the most important point to watch in the whole construction. It will be noticed that a .002-mfd. condenser is in series with the reaction variable, as this improves reaction control to a certain extent. If, however, it is found to be unnecessary it can, of course, be left out, but, at all events, it acts as a safeguard should the reaction condenser develop a short. The remainder of the circuit is normal and straightforward. Although a power output valve is specified, a pentode can, of course, be used. No transformer or choke is shown in the output-valve anode circuit, as the set is designed for speaker reception, and it was presumed that a moving-coil speaker incorporating its own transformer would be used. A sensitive moving-coil speaker with a large magnet system is the best, for it makes the utmost of a weak signal, but should the use of

(*Continued overleaf*)



A three-quarter rear view of the receiver, showing the layout of components.

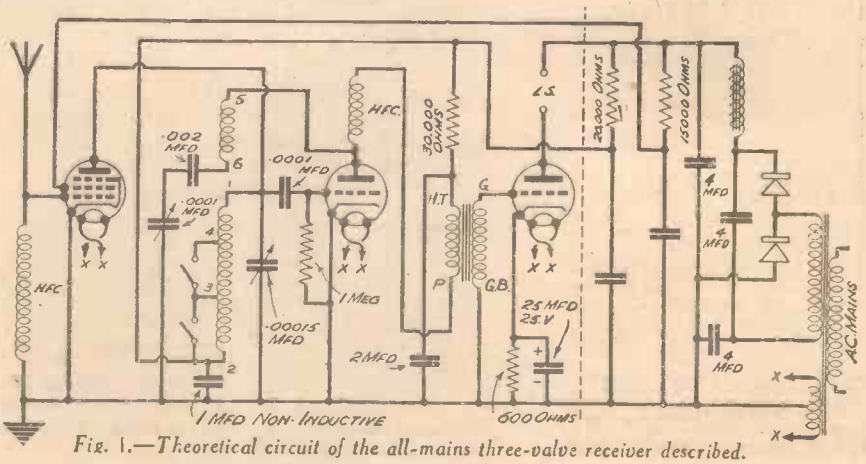
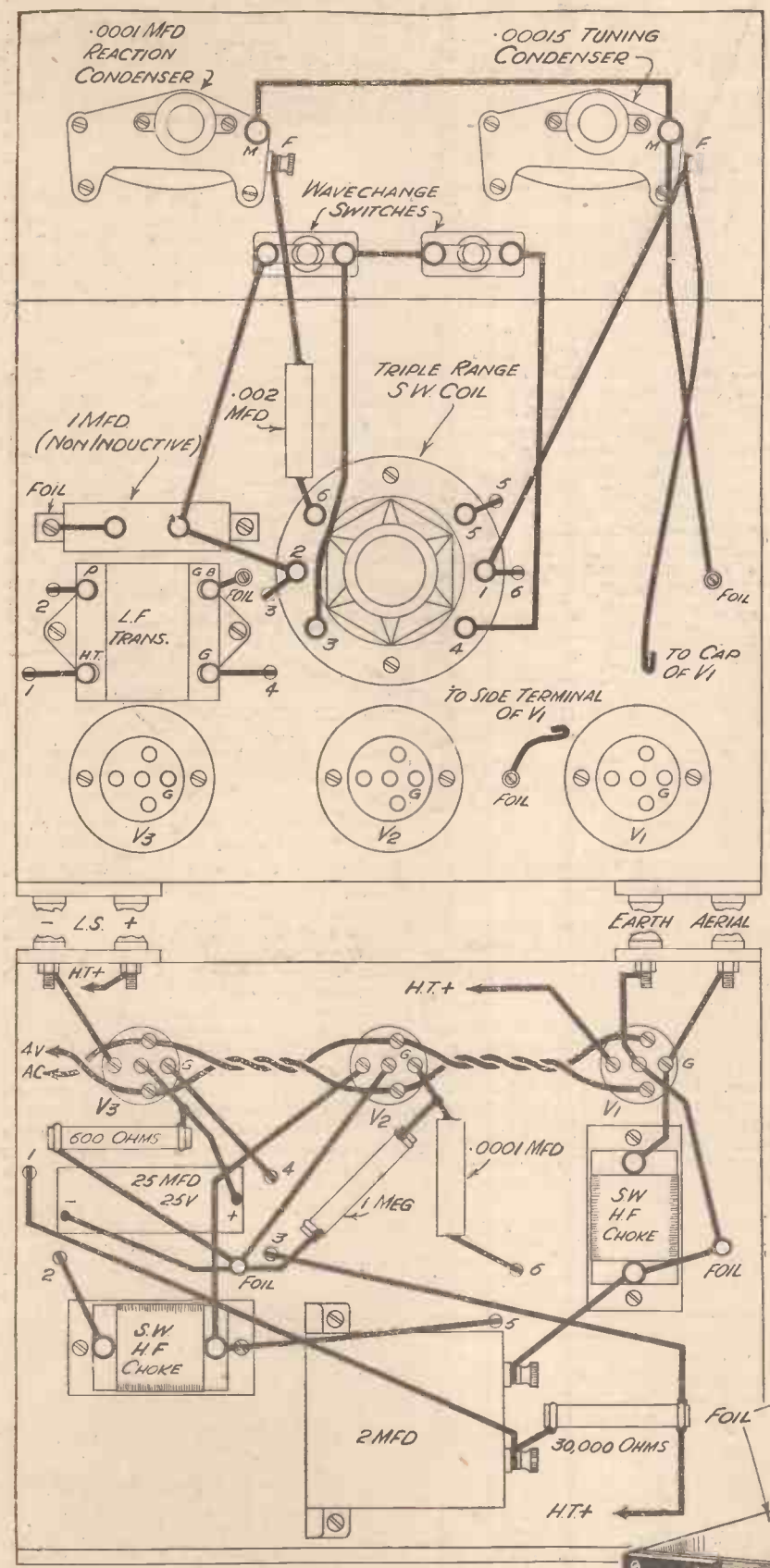


Fig. 1.—Theoretical circuit of the all-mains three-valve receiver described.



Top and Sub-chassis Wiring Diagrams of the All-Mains Three-valve Receiver

(Continued from previous page)

'phones be desired, an external output filter circuit should definitely be used.

Constructional Details

The receiver is built above and below the baseboard, which is covered with copper foil. This foil is carried right up behind the panel, and as a consequence the whole set is quite free from hand capacity. Holes must be cut so that the two switches do not make contact with the foil, as otherwise a short-circuit of the H.T. would result. A small tag is left on the foil and clamped under the earthing terminal. Mention of this reminds me that an earth was quite unnecessary and, in fact, made signals weaker on the original receiver. The set is raised by means of the front panel, and the two terminal strips at the rear as shown in Fig. 2. The components specified are those used in the original set, but some of the minor ones, such as fixed condensers, may be of any good make.

The operation of the set is simple. The chief point to bear in mind is—turn the dial very slowly, and do not use too much reaction.

VALVE TYPES AND USES

(Continued from page 17)

name suggests, an additional electrode. The effect of this electrode—an auxiliary grid—is to convert the screen-grid first-detector portion into an H.F. pentode. This gives the very same advantages that the H.F. pentode shows over the screen-grid valve, and which have been described in many previous articles in these pages. The auxiliary grid is internally connected to the cathode or filament, with the result that the external connections to the valve are the same as those shown in Fig. 2, for a pentagrid. One of the best-known octode valves available is the Mullard, type FC 13, which is a universal valve, having a side-contact base, the connections to which are shown in Fig. 3, whilst the principal characteristics are given in another panel.

Although not mentioned in the foregoing paragraphs, it should be pointed out that all of the valves referred to possess variable-mu properties, and can, therefore, be employed to provide a control of volume either by means of manual or automatic operation. Generally it is found best to combine the volume control with that operating on the intermediate-frequency valve, as was done in the case of the £5 Superhet above mentioned.

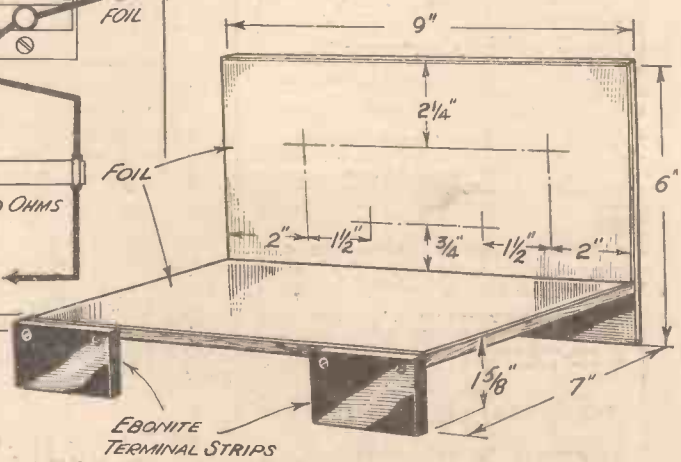
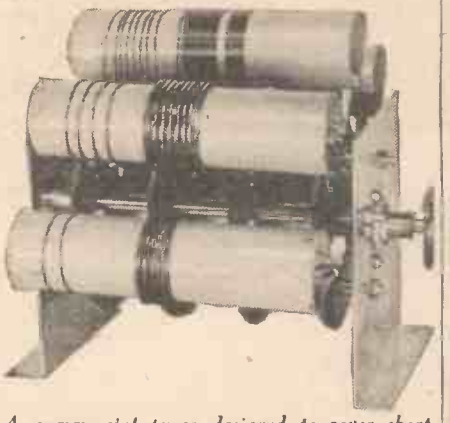


Fig. 2.—Rear view of the panel and baseboard, showing the terminal strips.

(Continued from page 16)

30,000 kilocycles, and therefore using the 10,000-cycles limit our normal 100 stations would only occupy the band from 5 to less than 6 metres (6 metres represents a frequency of 50,000 kc/s, a difference of 10,000 kc/s). Obviously, therefore, we



A commercial tuner designed to cover short waves as well as the medium and long.

could have many more stations, get them all into a band occupying, say, from 5 to 15 metres, and the musical quality which could be radiated by the stations would be immensely superior to that at present known.

The present cone type of speaker cannot go up really high in the musical scale, and no one wants it to as things are at present. But if we run up to the 30,000 cycles point (and thus obtain the really high harmonics, which are really essential to obtain *perfect* reproduction) will the horn-type speaker have to come back?

There are, unfortunately, one or two fallacies in the above arguments, and these will be dealt with as receivers are brought out for the new bands, but they give food for thought and may, indeed, result in a very much needed clean-up of the ether conditions in Europe.

This massive cabinet houses only a loud-speaker, but it is of the exponential horn type. Will this supersede the cone type of speaker?

The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

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

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A.C. Fury Four Super	10.2.34	PW34D
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A.C. £5 Superhet Three	24.11.34	PW43
D.C. £5 Superhet Three	1.12.34	PW42
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£8 Radiogram (D, RC, Trans)	Out of print	AW343
New Regional Three (D, RC, Trans)	25.6.32	AW349
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Home-built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher, Chassis Model (SG, D, Pen)	3.2.34	AW419
Lucerne Ranger (SG, D, Trans)	Out of print	AW422
Cossor Melody Maker with Lucerne Coils	Out of print	AW423
P.W.H. Mascot with Lucerne Coils (Det. R.C, Trans)	17.3.34	AW337A
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£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
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All-wave Three (D, 2LF)	*Jan.* '34	WM348
"W.M." 1934 Standard Three (SG, D, Pen)	*Feb.* '34	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
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"A.W." Ideal Four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D, Pen)	Out of print	AW421
Crusaders' A.V.C. 4 (2 H.F., D, QP21)	18.8.34	AW445
(Pentode and Class-B outputs for above: blueprints 6d. each)	25.8.34	AW445A
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Five-valvers: Blueprints, 1s. 6d. each.

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Class-B Quadradyne (2 SG, D, LF, Class-B)	*Dec.* '33	WM344
1935 Super Five (Battery Superhet)	*Jan.* '35	WM379

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Consoelectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C. Two (D, Trans) A.C.	*June* '32	WM286

Three-valvers: Blueprints, 1s. each.

Home-lover's New All-electric Three (SG, D, Trans) A.C.	25.3.33	AW383
S.G. Three (SG, D, Pen) A.C.	3.6.33	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen) A.C.	23.6.34	AW439
D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July* '33	WM328
Simplicity A.C.-Radiogram (SG, D, Pen) A.C.	*Oct.* '33	WM338
Six-guinea AC/DC Three (HF Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF, Pen, D Pen) A.C.	*Nov.* '34	WM374

Four-valvers: Blueprints, 1s. 6d. each.

A.C. Melody Ranger (SG, DC, RC, Trans) A.C.	Out of print	AW380
AC/DC Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C.	8.9.34	AW446
A.C. Quadradyne (2SG, D, Trans) A.C.	*Apr.* '32	WM279
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Battery Sets: Blueprints, 1s. 6d. each.

1934 Century Super	9.12.33	AW 413
Super Senior	*Oct.* '31	WM256
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Q.P.P. Super 60	*Apr.* '33	WM319
"W.M." Stenode	*Oct.* '34	WM373
Modern Super Senior	*Nov.* '34	WM375

Mains Sets: Blueprints, 1s. 6d. each.

1934 A.C. Century Super, A.C.	10.3.34	AW425
1932 A.C. Super 60, A.C.	*Feb.* '32	WM272
Seventy-seven Super A.C.	*Dec.* '32	WM305
"W.M." D.C. Super D.C.	*May* '33	WM321
Merrymaker Super A.C.	*Dec.* '33	WM345
Heptode Super Three, A.C.	*May* '34	WM359
"W.M." Radiogram Super, A.C.	*July* '34	WM366
"W.M." Stenode, A.C.	*Sep.* '34	WM370

PORTABLES.

Four-valvers: Blueprints, 1s. 6d. each.

General-purpose Portable (SG, D, R.C., Trans)	Out of print	AW351
Midget Class-B Portable (SG, D, LF, Class-B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	*May* '32	WM287
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM362
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM363

SHORT-WAVERS. Battery Operated.

One-valvers: Blueprints, 1s. each.

S.W. One-valve	Out of print	AW329
S.W. One-valve for America	Out of print	AW429
Roma Short-waver	10.11.34	AW452

Two-valvers: Blueprints, 1s. each.

Home-made Coil Two (D, Pen)	14.7.34	AW440

Three-valvers: Blueprints, 1s. each.

World-ranger Short-wave 3 (D, R.C, Trans)	Out of print	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver	*Jan.* 19, '35	AW463
Short-wave Adapter	*Dec.* 1, '34	AW456
Superhet. Converter	*Dec.* 1, '34	AW457

Four-valvers: Blueprints, 1s. 6d. each.

"A.W." Short-wave World Beater (HF Pen, D, RC, Trans)	2.6.34	AW436
Empire Short-waver (SG, D, RC, Trans)	*Mar.* '33	WM318

Superhets: Blueprints, 1s. 6d. each.

Quartz-crystal Super	*Oct.* '34	WM372

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Two-valve Mains Short-waver (D, Pen) A.C.	10.11.34	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	*Aug.* '34	WM368

Three-valvers: Blueprints, 1s. each.

Emigrator (SG, D, Pen), A.C.	*Feb.* '34	WM352

Four-valvers: Blueprints, 1s. 6d. each.

Gold Coaster (SG, D, RC, Trans) A.C.	*Aug.* '32	WM292
Trickle Charger (Old Series)	*Jan.* 5, '35	AW462

THE EASY ROAD TO RADIO.

THE BEGINNER'S SUPPLEMENT

WHAT IS MODULATION?

An Instructive Article in Which are Examined the Various Ways in which Modulation, in One Form or Another, Occurs in Radio Reception.

IN the radio sense, "modulation" is the name given to the process whereby the audio-frequency currents, obtained from the microphone and its associated amplifiers, are combined with radio-frequency oscillations, prior to being led to the aerial from which their power is radiated as a "modulated carrier wave." Concurrently with this, corresponding modulated high-frequency currents are produced in the aerial circuit at the receiving end; and it is the modulation which is, so to speak, sorted out by the detector and passed on to the low-frequency stages, and speaker, for reproduction as sound.

But while this is a correct definition of the specialised meaning of the word "modulation," the term is also, and quite properly, applied to all cases in which an alternating current impulse is superimposed upon another current which may be either an alternating current of a different frequency, or a direct current.

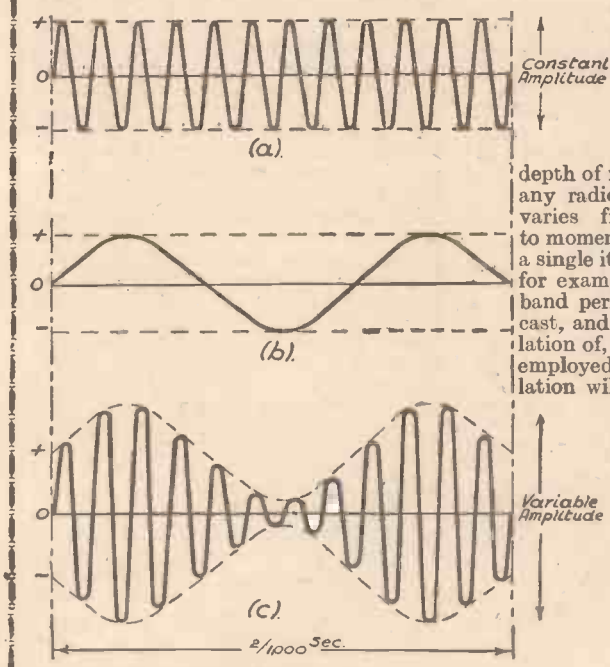

Fig. 1.—Showing how L.F. and H.F. waves are combined to give a modulated H.F. wave.

The Scheme Explained

Fig. 1 shows, in the centre diagram, a conventional audio-frequency wave, and above it an unmodulated carrier of constant amplitude. At (c) is shown the resultant wave which would be produced by the modulation of (a) by (b) Half the distance between the upper and lower crests is called the "depth of modulation," and is usually expressed as a percentage of the carrier amplitude. Two points in connection with the depth of modulation call for comment. In the first place it is clear that it is impossible to modulate a carrier wave to an extent greater than 100 per cent. without distortion, and in Fig. 2 is shown how 25, 50, and 100 per cent. modulation is expressed diagrammatically.

Next, it must be understood that the depth of modulation for any radio transmission varies from moment to moment even during a single item. Suppose, for example, a military band performance is being broadcast, and that an average modulation of, say, 25 per cent. is being employed. This degree of modulation will be obtained over the bulk of the programme, but for particularly soft passages the percentage modulation will be less, and for specially loud passages it will be considerably more.

Possible Overloading

Now for a radio-frequency signal of a given strength (that is, a carrier of a given amplitude) and for a given degree of voltage amplification in the H.F. and detector stages of the radio receiver, the audio-frequency signal applied to the grid of the output valve is proportional to the depth of modulation. If, then, the percentage modulation ranges, as it does, from a very small value up to 80 per cent. or more, it is necessary to use an output valve which will handle, without distortion, grid voltages corresponding to the strongest signal, and the fullest modulation likely to be received.

This indicates that there are two forms of valve overloading which must be guarded against. Overloading due to a carrier of excessive amplitude can be avoided by a volume control acting on the aerial circuit, or by the use of variable-mu valves whose signal-handling capacity can be increased by increasing the grid bias. On the other hand, overloading of the low-frequency valves during periods of deep modulation calls for a conservatively-rated amplifier which, while giving adequate volume with signals of average modulation, can also handle audio-frequency signals of three or four times average amplitude. This explains why, as has been pointed out many times before in these pages, a valve having a maximum output rating much greater than the normal required output must be used in the last stage if really good reproduction is to be obtained.

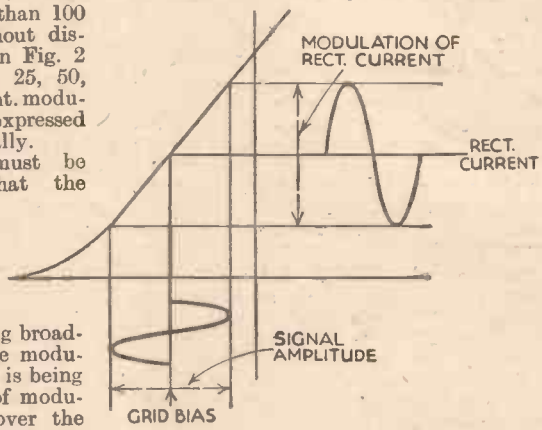

Fig. 3.—Showing the effect of modulating the rectified current in the anode circuit with a grid-voltage variation.

Whenever we begin to talk about exact quantities, such as percentages, the

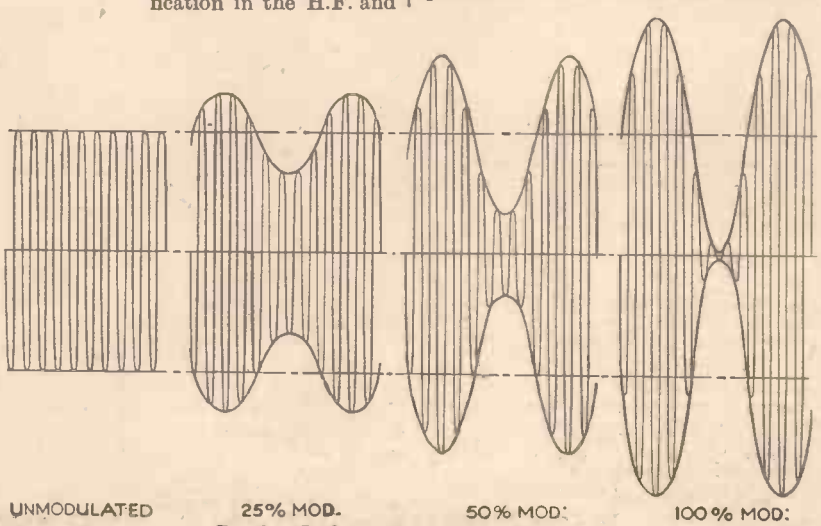

Fig. 2.—Different degrees of modulation.

question of measurement arises, and it is reasonable to ask whether it is possible to make exact measurements of the depth of modulation. It is not an impossibility, but an accurate modulation meter is rather beyond the resources of most amateurs, and the measurement itself involves the use of a valve voltmeter as well as other instruments. Moreover, it necessitates various circuit changes, and certainly could not be employed during the reception of a programme in the ordinary way.

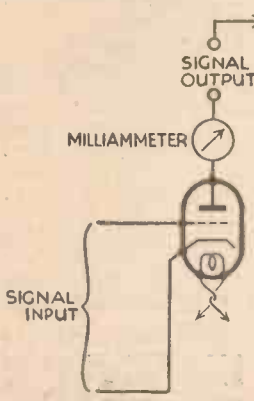

Fig. 4.—Checking modulation with an anode circuit milliammeter.

It is, however, not only possible, but very helpful, to employ a simplified system of measurement which, while not giving a definite reading of modulation depth, serves as a comparative indication, and assists the listener in operating his set under optimum conditions.

Before dealing with this point, however, it is necessary to consider other forms of "modulation." A receiving valve, when no signal is applied to the grid, passes a steady anode current, the value of which depends upon the rate at which the electrons are emitted by the filament or cathode, the voltage applied to the anode, and the bias voltage, if any, applied to the grid. When, however, a signal is applied to the grid, the value of the anode current will vary in sympathy with the signal variations, and the anode current may thus be said to be "modulated" at the frequency of the applied signal. The anode currents of the H.F. valves will be modulated at radio-frequency, the R.F. modulation being itself modulated at audio-frequency. The anode currents of low-frequency valves will, of course, be modulated at audio-frequency; and the anode current of a detector valve will be modulated mainly at audio-frequency but with a certain R.F. component. Part of the R.F. energy component, in this case, may be returned to the grid circuit by means of the reaction arrangement, and the remainder may be—and should be—filtered out by one method or another in order to avoid its transference to the low-frequency stages.

Anode Current Modulation

Consider, now, the effect of this modulation of the anode current. In the case of an amplifying valve, the anode current will swing above and below the mean or average value, as indicated in Fig. 3. Note, however, that owing to the curvature at the bottom end of the grid volts/anode current graph, distortion will occur if the swing overlaps this region. Similarly, distortion will occur if the positive swings overlap the region in which grid current can flow.

It will thus be seen that any over-modulation of the anode current produces distortion, and is, therefore, similar in its results to over-modulation of the carrier wave. An effect of this type can be avoided if care is taken to (1) bias the valve correctly, that is, to the mid point of the straight portion of its characteristic; (2) limit the grid-input signal to a value (at maximum modulation) which the valve can handle without distortion.

Here, then, is one point at which a rudimentary form of modulation meter might be of service. Such a method is, in fact, often used by wise listeners. It consists merely of a milliammeter of suitable range included in the anode circuit of the output valve, as shown in Fig. 4. Its function is two-fold. In the first place, its steady reading when no signal is being received gives an indication that the grid-bias is of approximately the correct value. When a signal is being received, the instrument should, theoretically, give a pulsating reading corresponding to the fluctuations of the anode current. But a milliammeter of the ordinary type cannot follow the rapid changes of an audio-frequency current. What it can do, however, is to give a general indication of the state of affairs. Thus, if the kicks are mainly in an upward direction, so that the mean value of the anode current appears, on the whole, to be increased, it shows that the incoming signal is overlapping the bottom bend, with resultant distortion. The remedy is, of course, to *decrease* the grid-bias slightly and/or to reduce the input by means of the volume control. On the other hand, a general tendency for the kicks to be downward, or an impression that the mean-anode current is reduced, indicates grid-current distortion. In these circumstances the grid-bias voltage should be increased slightly, and if this fails to produce the desired result, or introduces bottom-bend distortion, the input should also be reduced.

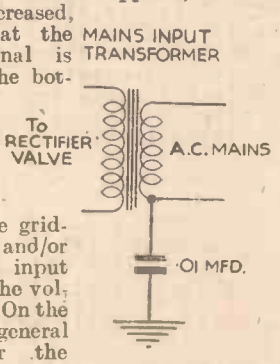

Fig. 6.—Removing modulation hum with a fixed condenser.

The Detector Stage

In the case of a detector valve, the modulation of the anode current quite properly produces just the results we have to avoid in an amplifier. In a leaky-grid detector the application of a signal produces an effective reduction of mean anode current depending upon the strength of the incoming radio-frequency signal and its modulation depth. An anode-bend detector sustains a net increase in the anode current when receiving a signal.

Here again, the effective change of anode current depends jointly upon the strength of the incoming R.F. signal and upon its depth of modulation, and advantage can be taken of these changes to ensure that the set is operated in the most efficient manner. With a leaky-grid detector, for example, in which the anode current is depressed by a signal, the anode current will be a minimum when the receiver is accurately tuned to a station, and will rise as the set is brought off tune either above or below the correct tuning point.

If, therefore, a milliammeter of suitable range is connected in the anode circuit of a leaky-grid detector, it will indicate when the set is correctly tuned, because at that moment the anode current will be depressed to its lowest value. Quite a cheap instrument will do, and it need not be very accurate.

Another Case

It should be remarked that a device of this sort is not very sensitive in the case of feeble signals, but is perfectly satisfactory when dealing with the more powerful transmissions. The same idea is also of great service in adjusting the trimming of ganged-tuning circuits. The method is to tune in to the optimum point for one station (that is, minimum reading of the milliammeter in the detector circuit), and then make any adjustments to the trimmers with the object of obtaining a further drop in the reading.

In sets fitted with A.V.C. another version of this simple modulation meter should be employed. It will be understood that the amount of additional bias fed back to the H.F. and/or I.F. stages by the A.V.C. valve depends upon the strength of the received carrier. Also that the application of this controlling bias results in a decrease in the anode current of the variable-mu valves. Therefore, a milliammeter in the anode circuit of one of the H.F. or I.F. valves will again give the lowest reading when a signal is accurately tuned in.

Most visual tuning indicators fitted to modern sets work more or less on the principles described above. Not all of them, however, are plain milliammeters. Some are simple instruments of this type, having a shutter or reflector device to vary a spot or band of light or shadow, as indicated in Fig. 5, thus giving the desired indication. Others make use of the voltage drop in some component included in the anode circuit to modify the glow from a small neon discharge tube, and in others the anode current is passed through one winding of a special differential transformer, thus varying the voltage applied to a small lamp bulb.

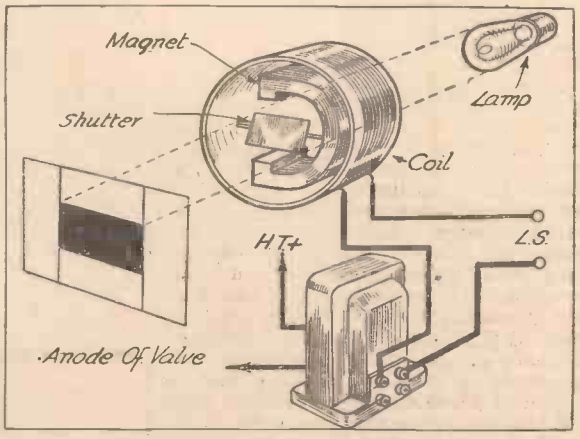

Fig. 5.—A visual tuning indicator in which a shutter is used to vary a band of light for giving the desired indication.

LEAVES FROM A SHORT-WAVE LOG

By E. THURWAY

THIS week we register a few alterations and additions to our time schedules. The B.B.C., for instance, are now testing out a new series of experimental transmissions destined to Western Canada; they are made simultaneously through GSL, 49.1 metres (6,110 kc/s) and GSC, 31.32 metres (9,580 kc/s), but there is a possibility that these frequencies, if found unfavourable, may be changed. These test programmes are limited to Sundays, Mondays, Wednesdays, and Fridays between G.M.T. 02.30 and 03.30.

W8XK, Saxonburg (Pa.), also advises a new daily time-table which, if disappointment is to be avoided, it would be wise to note. On 13.93 metres (21,540 kc/s) from G.M.T. midday to 19.00; on 19.72 metres (15,210 kc/s) from G.M.T. 15.00-21.15; on 25.27 metres (11,870 kc/s) from 21.30-03.00, and finally on 48.86 metres (6,140 kc/s) from G.M.T. 21.30 until 05.30. It is useful to tune in to this last frequency on Saturday mornings between 05.30-06.00, as during these thirty minutes much information is broadcast regarding the short-wave activities of the following week.

Havana

COC, Havana (Cuba), on 49.92 metres (6,010 kc/s), has been well heard in the British Isles since the new transmitter has been installed. The broadcast can be identified by the bugle call interval signal. The station is now on the air daily from G.M.T. 14.30-17.30; from 21.00-23.00 and again from 01.00-03.00. On Saturday nights an additional programme is put out so that you may still find the transmitter working on Sunday morning between G.M.T. 04.30 and 06.30.

If, as I see from reports, the "Yanks" secure good reception of ZTJ, Johannesburg, on 49.2 metres (6,097 kc/s) I fail to see any reason why we, in these isles, should not make a search for it. It is a 5-kilowatter as against VQ7LO, Nairobi, which is only rated at 500 watts, and the latter is frequently picked up in the early part of the evening. The difference in distance, namely, 4,230 miles for Kenya Colony as against 5,630 miles for the South African signifies considerably less on short than on medium waves. Probably the best times for trying for ZTJ, in view of its comparatively high channel, will be G.M.T. 04.30-05.30 daily, except Sundays, and between 18.00-21.45 on Saturdays.

N.B.S. of Lisbon

From the call heard it is now definitely proved that the Portuguese station on 48.78 metres (6,150 kc/s) is CSL, the National Broadcasting Station at Lisbon. This is the wavelength on which it has been found most frequently, although on two occasions it announced that it operated on 49.7 metres. Apparently neither frequency nor time schedule are yet definitely fixed as the station is still experimenting, but so far the times adopted have been from G.M.T. midday to 13.30 and more regularly from G.M.T. 19.00-23.00 or midnight. On many nights it takes part of its entertainments from the medium-wave National station at Barcarena (476.9 metres) when a woman announcer officiates in the studio. I2RO, Rome, on 49.30 metres (6,085 kc/s) is a station which should prove "three star" in our logs, not only for the power of its signals but in view of its entertainment value. The E.I.A.R. propose, via this transmitter, to offer to the U.S.A. the finest radio programmes Italy can provide; the broadcasts will include concerts by the best symphony orchestras and soloists and choruses from the foremost opera houses. Two of these A1 entertainments are to be given weekly until the summer months. I2RO is on the air on Mondays, Wednesdays, and Fridays between G.M.T. 23.00-00.30 or even later.

The 25.4 metre (11,810 kc/s) channel which I2RO used for a long period has been put to another use, namely, tests on directional aerial towards the Far East—mainly with Japan. On the other hand, JYR, Tokyo, on 38.07 metres (7,880 kc/s) has been logged relaying JQAK in the same city at G.M.T. 10.00; JVT, Nazaki, on 44.44 metres (6,750 kc/s) is also used irregularly for these relays between G.M.T. 09.00-12.40.

Some time ago I mentioned the possibility of listening to the Reykjavik (Iceland) concerts on short waves; the scheme is now rapidly taking shape, as I am now informed that a 7-kilowatt transmitter is to be erected immediately for use not only for a public telephony service with Lyngby (Copenhagen) but also as a broadcast relay. The channels and call signs adopted are as under: TFL, 21.48 metres (13,965 kc/s); TFK, 33.11 metres (9,060 kc/s), and 59.31 metres (5,058 kc/s). The station should be working by this summer.

Another short wave projected is one which the Czech authorities want to install at Podebrady, near Prague, to take the capital programmes for the benefit of their nationals overseas. Although planned to work on wavelengths between 13 and 100 metres for telegraphy, it will use for broadcasts a channel in the 31-metre band.

PRACTICAL LETTERS FROM READERS

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

An Eliminator Hum

SIR,—I wonder if you can give me any explanation of the following:—

A friend of mine recently purchased an eliminator working on 250 v. 50 ~ A.C. It worked very well for a time, then developed a hum. I mean the actual eliminator, the hum was not coming through the speaker.

I was called in to examine the set, but could not find the cause of the hum, then when moving the eliminator while the set was on, I turned it up on its side and the hum stopped.

I tried this again and the same thing happened, so I left it like that and it is hum-free now.

I also have an eliminator and the same thing happened after a year's use, so I turned the eliminator on its side and once again the hum stopped.

Also, I would like to get into touch with any Radio Club in or near my district and would be obliged to you or any of your readers who could let me have particulars.—T. S. FERGUSON (Glasgow).

[*The explanation may be quite simple, namely that the bolts which clamp the laminations of the mains transformer have become loosened after the year's use, and thus the eliminator is giving off a hum caused by the vibration of the laminations at the periodicity of the mains. When turned on its side the weight of the transformer pulls on the holding-down bolts and thus pulls the laminations together and prevents them from vibrating.*—ED.]

Let's Get Down to Earth

SIR,—The ideal earth, in my humble opinion, is one entirely devoid of the baser metals (copper and lead). On it there should be no foothold for canker, cat-burglars, corrosion or (heaven forbid!) crooners, whatever the latter may really be. Says Meadgargler, the post-cocktail poet, in expressing a similar sentiment:—

Two beacons of Belisha—
Copper wire, a length,
Works my 10-valve "Tippler"
Back to pre-war strength.

But of the earth
Nothing is heard;
Nor of the crooner
Who here was lured.
They two are
Very close . . .

So it all goes to prove something or other, doesn't it? And in conclusion I would say this: The *best* earths are never blown out of trees! That's worth knowing. Even the humble fox can teach some of us a lesson; he has his little "earth."—LYNDA LEATHERJACKET (Irongates).

Short-wave Reception

SIR,—I was very interested in Mr. Miller's report on short waves in the North of Scotland in your issue for March 2nd. Daylight reception here is much better than at night. Mr. Miller says he can hear the 49 m. Americans quite plainly—lucky fellow! I can only hear them when conditions are very good, and that is sometimes months apart. He also says that he has logged such stations as VUB, India, and Lindhurst, Australia. Well, I haven't even heard them, although I do my searching at scheduled times. I have, however, logged VK2ME, Sydney, at 2.30 p.m. consistently for four Sundays, and on the L.S. at that, with a o-2-v Reinartz home-made receiver. The question of inefficiency on the part of my set can be ruled out. But really, Mr. Editor, they are elusive beggars, these short-wavers.—JAMES WILLIAMS (Kirkintilloch, Scotland).

Congratulations from Egypt

SIR,—I must first of all congratulate you on the excellence of your combined paper. Never before has there been such value as this. I have purposely put off writing this letter, as I thought you could not possibly keep up the quality of your paper.

I must add my name to the list of your overseas readers who want a good S.W. high-powered battery receiver with medium waves, or at least a S.W. adapter for battery sets.

In conclusion, kindly let me know the full price of "Newnes Television and S.W. Handbook," as I will not under any circumstances mutilate my PRACTICAL AND AMATEUR WIRELESS to get something cheaply.—H. HELBAWY (The Pyramids, Egypt).

[*Thanks for your kind remarks. The retail price of "Newnes' Television and Short-wave Handbook" is 4s. post free.*—ED.]

Our £5 Superhet Three

SIR,—I shall be very grateful if builders of your £5 Superhet three set would write to me, giving their experiences with this type of circuit. In return I am willing to give any information I can to such readers regarding reception of stations, H.T. supply, and length and position of aerial and earth systems, etc., for this receiver. I may state that this district is not very good for the reception of long-distance stations, but I am able to receive a fair number on favourable evenings. The selectivity of this set is all that could be desired without the risk of high-note cut-off, and it is the best set I have yet built, or heard, for purity of tone.—J. C. (Wareham).

Long-wave Coil for the Push-pull Detector Set

SIR,—In your issue of March 4th, 1933, you published a push-pull detector circuit, Is it possible to include a long-wave coil as well as a medium-wave coil, and, if so, how can this be constructed?—H. O. (Skegby).

[*The long-wave windings for the push-pull detector receiver should be wound on the same size formers as those specified for medium waves. The grid winding should consist of 200 turns, the reaction winding 40 turns (centre tapped), and the aerial winding approximately 30 turns. The number of turns on the aerial winding may be slightly varied, however, to suit the length of aerial, and the degree of selectivity desired.*—ED.]

Alternative Coils for £5 Superhet

SIR,—With reference to the article concerning alternative coils for the £5 Superhet, on page 682 of PRACTICAL AND AMATEUR WIRELESS, I should be glad if you would advise me what connections are made to terminals 7 and 8 of the Varley coils, and whether condenser C4 is essential with these coils.—H. L. (London, S.E.3).

[*If the Varley coils are wired as shown on page 682, top capacity band-pass coupling will be obtained. If*

inductive coupling is desired, terminal 7 of the first BP50 coil should be joined to terminal 8 of the second BP50, and terminal 8 of the former to terminal 7 of the latter. The home-constructed condenser C4 should then be omitted.—ED.]

An Experience with Earths

SIR,—Some elderly friends of mine recently had presented to them a discarded crystal set. The location being somewhat badly shielded with tall trees, I decided (though not without a few qualms) to see what could be done with an indoor aerial slung in the attic. The only available thing at the moment for an earth tube was the centre of a broken cycle inflator, which was not particularly effective. Seeking then to improve matters, a piece of galvanized angle-iron about 2ft. long was driven home and connected up, with obvious benefit to signal strength. Next a strip of copper tape (a remnant of lightning conductor) was pressed into service. And again with obvious advantage—so much so that every word of a service in Canterbury Cathedral could be distinctly heard. But only for a few minutes, and then signals faded to the merest whisper. And nothing would restore them. It seemed as if the grid had become choked with electrons that could not escape—only I didn't know where the "grid" was.

After a little consideration it occurred to me that I had, without thinking, rigged up an electric couple with my earths. Putting the matter to the test, I found that as between the galvanized angle and the copper strip, with but 6in. of separation, a current was flowing which on first contact measured 12 milliamps, quickly falling to 10, and then more slowly to 9, at which it remained steady over five minutes. The voltage was found to be approximately 0.75. Between angle-iron and inflator tube (10in. apart) the current flowing was 8 m.a. falling to and remaining constant at 6 m.a., while between the angle and the other two combined a steady current of 11 m.a. was measured. There was also a slight current between the inflator tube and the copper strip, and it seems to me as if this comparatively hefty current had the effect of choking the passage of the minute current passing between aerial and earth. I wonder if any reader has ever experienced this effect or can throw any light on the phenomenon? Anyway, the moral would seem to be that if you install a multiple earth, don't mix the metals.—H. C. E. (Reading).

Fitting A.V.C.

SIR,—*Re* your correspondent's remarks (B. J., Watford) regarding A.V.C. In not fitting A.V.C. to the average "P. and A.W." receiver you are, of course, perfectly correct. A.V.C. would *not* operate really satisfactorily on these small receivers. This, however, is certainly no reason for condemning A.V.C. itself. On a large and powerful receiver A.V.C. is not only desirable but almost a necessity. One must, however, bear in mind its limitations, and the fact that it must be applied to more than one stage to be really effective. The fact that A.V.C. is fitted by manufacturers on certain small superhets is to be regretted, as it may bring this system into disrepute. The great difficulty is that A.V.C. requires a powerful receiver and a really good aerial. Unless the signal reaches a certain strength it will fail to operate the A.V.C., and fading will be experienced.—F. SMITH (London, S.E.).

RADIO CLUBS AND SOCIETIES

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

SHORT-WAVE RADIO CLUB FOR TOTTENHAM!

READERS residing in the district, and who may be interested in the formation of a short wave radio club, are invited to get in touch with Mr. L. Woodhouse, 57, Pembury Road, London, E.5.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

TO commemorate the fifth anniversary of this society, Radio-Normandie is broadcasting a special commemorative concert between midnight and 12.30 a.m. on March 31st. Reports of reception are welcome, and may be addressed to the society at the address given below, or to Radio-Normandie.

The "Surprise Meeting" held by the West Middlesex and East Buckinghamshire Branch of this society on March 6th was a great success. It was attended by members from Stoke Newington, Wembley, Hayes, Eastcote, Ruislip, Feltham, and Reading.

The next meeting of the society will be held on April 17th, and all members and readers are welcome. Notification should be sent to Mr. Leslie W. Orton, 11, Hawthorn Drive, Willowbank, Uxbridge.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

THE London Chapter held its Annual Dinner on Saturday, March 9th, at Maison Lyons, Shaftesbury Avenue, W.1. It was attended by many prominent people, including the American Consul, Charles C. Broy, and Watson Davis, the editor of *Science Service*, of Washington, and representatives of the B.B.C., the Radio Research Station, Slough, and the Radio Manufacturers, etc. Points from the speeches dealt with the world friendship brought about by short-wave radio, and the many advantages of membership of the club. The event concluded with dancing until midnight to music furnished by Howard Baker's "Carlton" Dance Orchestra.—A. E. Bear, Secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

SLADE RADIO

AT a meeting of this Society, on Thursday, February 28th, Mr. J. L. Miller gave a lantern lecture on electric welding. He described and illustrated the various methods, and also the different systems of time control of the current; both mechanical devices and the thyratron valve method were described.

The lecture, which was a deviation from the usual type of radio talk, proved of unusual interest, as the lecturer did not consider 10,000 amps. to be a large current to deal with; in fact, currents of 100,000 amps. were not unusual for welding processes.—Hon. Secretary, Chas. Game, 40, West Drive, Heathfield Park, Handsworth, Birmingham.

INTERNATIONAL DX'ERS ALLIANCE (MANCHESTER CHAPTER)

A NEW chapter of the International Dx'ers Alliance has now been opened in Manchester, and meetings are at present held once a month. The I.D.A. is an all-wave organisation, and consists of "DX" fans of all wavebands. There have already been three meetings of this Manchester Chapter, all being quite successful and interesting. At the last meeting members had the opportunity of trying out an American 7-tube all-wave receiver, and about seven American short-wave broadcasting stations were heard at good strength. The next meeting will be held on Monday, April 1st, 1935, at 8 p.m., at 19, Devonport Avenue, Withington, Manchester. Any PRACTICAL AND AMATEUR WIRELESS readers desiring further information should write direct to the local Manager, Mr. R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, near Manchester.

INTERNATIONAL SHORT-WAVE CLUB (MANCHESTER CHAPTER)

ON February 5th, at the British Legion, Middleton, a meeting of the above Chapter was held, at which further announcements were made with regard to members attending the mass short-wave meeting of the International Short-wave Club, to be held in Leicester, on March 31st. Visits will be made to amateur transmitting stations, etc., and any member requiring further information about this gathering may obtain same from the secretary of this, or any other Chapter of the I.S.W.C. The meeting concluded with a very interesting talk by the Technical Adviser, Mr. H. Andrews, entitled "Snags in Short-wave Receivers."

A further meeting was held on February 19th at the same place, when a general discussion took place on short-wave reception.

The next meeting will be held on April 2nd, at which a special lecture, entitled "Short-wave Radio Communication" will be given by Mr. D. R. Parsons, of Messrs. Stratton & Co., Ltd. A cordial invitation is extended to all radio enthusiasts in the Manchester district. The meetings are held at the British Legion, Long Street, Middleton, near Manchester, and further information can be obtained from the Secretary, Mr. R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, near Manchester.

THE CROYDON RADIO SOCIETY

OVER fifty people attended the Croydon Radio Society's loud-speaker night on Tuesday, March 5th, in St. Peter's Hall, Ledbury Road, S. Croydon, and the members had brought fourteen loud-speakers for comparison on the Technical Adviser's quality receiver. He reminded his audience what to listen for in judging quality as, for instance, "s's," "t's" and "th's" were important indications on speech. The organ was ideal for bass note testing, as low notes were uttered at good volume, and a good speaker must have no trouble in distinguishing such instruments as the flute, euphonium, oboe, and clarinet.

The multi-speakers included the hon. librarian's triple Magnavox combination, Mr. Ménage's piezo coil and P.M. moving-coil outfit, as well as Mr. M. G. Finnin's two Magnavox moving coils associated with a piezo high-note tweeter. Indeed it was Mr. Finnin's triple speaker which ultimately won the verdict with its remarkably wide frequency range and level response.

Experts figured in the Croydon Radio Society's programme of "High Quality Sound Reproduction" on Tuesday, February 26th, at St. Peter's Hall, S. Croydon. Each dealt with his particular section of the apparatus, as for instance, Mr. P. G. A. H. Voigt, the eminent loud-speaker designer, Mr. L. H. Irvine, designer of the special H.F. unit in the receiver, and Mr. N. C. Mordaunt, A.I.R.E., who is responsible for the Purley Radio Paraphrase Amplifier.

The loud-speaker was Mr. Voigt's domestic horn model, and he thoroughly described its unique arrangement of high note reflector and other features, while many a problem he had encountered in its design was well ventilated. Of no less interest was Mr. Irvine's account of the H.F. unit, in which he used a four-gang Varley permeability tuner.—Hon. Sec.: E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

THE RADIO, PHYSICAL AND TELEVISION SOCIETY

A MEETING of the above Society was held on Friday, February 8th, at 72a, North End Road, West Kensington. The lecture, which was on the C.O.P.A. transmitter, was given by Mr. E. G. Nurse (GSNR), and was of particular interest to all members, especially to those who held transmitting licences.

Readers of PRACTICAL AND AMATEUR WIRELESS will be very welcome to any of the Society's meetings, which are now held at least once a month, on an informal basis. The entrance fee is 1s. 0d., with 3d. payable at each meeting attended.—Hon. Sec.: M. E. Arnold, 12, Nassau Road, Barnes, S.W.

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.

INTERESTING TRADE MAGAZINE

APPEARING in a new and attractive form, *Philco News* is not, strictly speaking, a catalogue at all, though for the sake of convenience we mention it in this column. Admittedly, in any event its object is primarily to bring to the notice of its readers the excellence of the wares produced by the firm which also sponsors its publication, and to append prices of the various receiving sets, etc., of which mention is made here and there in the course of many interesting and informative articles on various topics. It appears, for instance, that recently the firm put at the disposal of Mr. Hore-Belisha, Minister of Transport, data which they had accumulated over a long period regarding car-radio. In America rather more than fifteen per cent. of cars on the road are fitted with radio. Less than two per cent. of all cars involved in accidents during 1932 were equipped with radio, and in no case was the presence of radio brought forward as being a possible cause of accident. Other interesting facts are revealed in an article on the subject, and in other articles. In short, this 28-page journal, brightly written, and neat and business-like in appearance, is full of matter which will appeal to radio dealer and listener alike.

STRIKING MARCONIPHONE RECEIVERS

FINELY produced in photogravure, a large and gengrously illustrated folder, recently issued by the Marconiphone company, deals comprehensively, as far as appearance and essential specifications are concerned, with their wide range of newest models, including the various "Jubilee" five-valve seven-stage superhet models, ranging in price from 12½ guineas for the table grand model to 22 guineas for the radiogram. Photogravure is an admirable medium for suggesting the beauty of grain of the various woods used in cabinet construction, and in glancing through the leaflet one is immediately struck with the imposing and gracefully-proportioned appearance of the various models, realising that they may well grace even the most luxuriously furnished homes. What is claimed to be the world's finest radiogram is Model 292—a nine-valve twelve-stage superhet, with automatic record changer, multi-functional speaker, variable selectivity, and every other conceivable refinement. For A.C. mains operation only, its price is 52 guineas.

REPLIES IN BRIEF

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

H. M. D. (Eltham). We regret that you could not obtain an energised speaker with a sufficiently low D.C. resistance to use in the Armada in place of the smoothing choke. You should, therefore, adhere to the specified speaker.

A. C. (Highgate). An H.F. pentode may be substituted for the S.G. valve without any alteration. Obtain one of the 5-pin pentodes and simply plug it in in place of the present valve.

L. F. (Carshalton). A valve may be the cause of the trouble, or a resistance may have become faulty, and the switching on and off causes an arc which restores the circuit. Therefore check all valves and resistances.

H. A. (Queenboro). The set would not give very good results from an indoor aerial in your district. The cost of the parts alone would be about 18/- to 20/-.

J. M. (Shoreham). The counterpoise is your only way out. Arrange a wire beneath the aerial well insulated and roughly equal to the aerial in length. If possible keep it about three feet from the walls and floor. Connect to the earth terminal in the ordinary way.

D. G. (Manor Park). We would not recommend the feeding of the valves from the D.C. mains. A simpler scheme would be to arrange a simple charger, using a 100-watt lamp in series with the mains and your accumulator, and thus giving it a slow charge about once a week.

F. J. R. (Watford). Microphony is responsible for the trouble. You will have to completely screen the detector valve, preferably wrapping it with thick felt and placing a metal box over it to keep all firm. Beware of short circuits when placing the box in position.

J. M. (Malta). Ordinary drawing paper could be used for the cone, although you will probably find that Two-sheet bristol board will produce the most satisfactory reproductiou with that particular method of construction.

H. C. (No Address). We do not like the tuning arrangements of the proposed all-range receiver. What precautions are you taking to avoid interaction between the fifteen coils? Very careful screening would be required and the losses introduced on the 12-metre band would probably render the set useless. An untuned aerial circuit would undoubtedly prove superior on this band.

R. H. (Pendelbury). The wires may be bared and clamped between the metal surface of the baseboard and the lower end of the electrolytic condenser. This not only ensures that the condenser case will be effectively earthed, but also acts as a return earth connection to the chassis.

F. G. (Ossett). A theoretical diagram of the Radiopax Class B Four was given on page 364 of PRACTICAL WIRELESS dated May 27th, 1933.

D. G. (No Address). The Bandaptor will be quite suitable for use under modern conditions.

B. D. (Woodford Green). The circuit was only given to illustrate the article and was not a definite arrangement. It will, of course, work quite satisfactorily, and the additional values you require are: C6—any value from .1 to 2 mfds.; C2—any value from .0001 to .0005 mfds., and R1—from 20,000 to 40,000 ohms. The tuning coil sizes you mention are correct.

W. G. F. (Watford). No, your unit would not be suitable for the push-pull circuit as the total current is then double that of the single valve. A Q.P.-P. circuit might be tried, although you would have to be careful in your choice of valves.

G. P. (Isle of Coll). We cannot state why those effects occur, as you do not state the particular arrangement of the circuit. It is possible that the two coils are not of the type suitable for an S.G.-detector circuit, or that the capacities of the two condensers are not accurate throughout the tuning range. Interstage wiring might also upset the ganging of coils and condensers.

I. R. C. J. (St. Austell). Your difficulties probably arise from the fact that the oscillator circuit is not designed for use with the I.F. transformers you are using. These two parts of a superhet must match. There is no book on the subject of accumulators at the price you mention. Messrs. Heayberd can supply the charger.

A. L. (Bedminster). Field coil is joined in the H.T. positive lead. To use permanent-magnet speaker a smoothing choke of equivalent characteristic must be used. There is no suitable choke on the market, and you must therefore use the correct speaker.

W. H. A. (Watford). The H.T. negative lead should, of course, be returned to the other side of the bias resistance.

E. R. (Sheffield). Either a resistance or transformer or choke winding is at fault. Simplest check is with a milliammeter in each anode circuit. Current will probably vary as the fading takes place in the appropriate stage.

F. G. (Darnall). A series resistance will be most suitable. In your particular instance obtain a wire-wound resistance having a total value of 12 ohms, with tappings at 4 and 8 ohms. A 10-watts resistance will be required to avoid over-heating. Tappings will allow output to be regulated for 2 or 4 volts, and an ammeter should be inserted in series to check the charging rate, if desired.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on Page 32 must be attached to every query.

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

SPECIAL NOTE

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

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

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.

Coupler Coils for the Signal Generator

"I have your July 14th, 1934, issue of 'Practical Wireless,' and would like to make my own signal generator as shown on page 480. Please tell me the number of turns and gauge of wire on each former of the coils, as I wish to construct my own."—J. O. (Doncaster).

The coupler coils should be constructed as follows: Long-wave oscillator coil; 170 turns of 32 s.w.g. d.c.c. copper wire in 7 slots, 1/16in. wide, and 3/16in. deep, with a distance of 1/16in. between adjacent slots. Each slot except the last one should contain 24 turns, and the former should be 2½in. in diameter. Long-wave coupler coil: This should be constructed in the same manner as the oscillator coil, but using 76 turns, wound in three slots containing 25, 25, and 26 turns respectively. Medium-wave oscillator coil: 60 turns of 26 s.w.g. d.c.c. copper wire on a 2in. diameter paxolin former. Medium-wave coupler coil: This should be constructed in the same manner as the M.W. oscillator coil, but using 20 turns instead of 60.

Instability on Short-wave Sets

"I have made a short-wave adapter, but am troubled with howling as soon as I touch the controls. I am using it in conjunction with an S.G. Three receiver. I should also like to know where I can get a list of amateur broadcasters."—J. E. J. (Lampeter).

The trouble you are experiencing tends to indicate that the earth connection is ineffective, or that the spindles of the tuning and reaction condensers are not at earth potential. After the earth connections have been attended to it is suggested that the adapter be enclosed in an aluminium screening box. It is probable that the Radio Amateurs Call Book may be obtained from F. L. Postlethwaite, 41, Kinfauns Road, Goodmayes, Essex.

G.B. Battery Connections

"I have a Lissen set which has a G.B.— and a G.B.+ lead, the former being connected to G.B. battery —15 volts, and the latter to G.B. battery+. I wish to operate the set from a mains unit but am not quite certain concerning the required connections for the G.B. leads."—P. E. B. (Macclesfield).

It is assumed that G.B.+ lead is connected to H.T.— and L.T.— at present, and therefore no alteration will be necessary to the G.B. wiring when the mains unit is substituted for the H.T. battery. If the mains supply is of a D.C. nature, however, the earth lead should be transferred from the existing earth terminal of the receiver to the earth terminal of the unit.

R.C. Coupling Values

"I should like to couple my detector (PM1HL) to my first L.F. valve (PM2DX) by means of resistances and condensers. Can you please tell me the values of the components required? I want straight-line response and as high a degree of amplification as can be obtained."—H. H. (Southport).

It is suggested that you use a 50,000-ohm anode resistance, a 10,000-ohm decoupling resistance, a 500,000-ohm grid-leak, a .01 mfd. coupling condenser, and a 2 mfd. decoupling condenser.

Improving the Leader Three

"I have built a Leader Three, but find that signals are very weak, especially on the medium-wave band. I also notice that when I short-circuit the G.B. — and G.B.+ leads the volume is increased."—S. G. (Ireland).

The fact that volume increases when the G.B. leads are short-circuited tends to indicate that the output valve has a low emission, that the G.B. battery is defective, or that the H.T. battery is run down. These components should therefore be tested, and it is also suggested that you try the effect of connecting the aerial terminal to terminal 6 or 7 of coil 1 instead of to terminal 4; this slight modification should improve medium-wave sensitivity.

Dropping Voltage of Mains Unit

"I have a three-valve battery set working from a D.C. mains unit. I have connected the detector H.T. lead to the 100-volt tapping, but find that this voltage is rather in excess of the requirements of the valve. Can I connect a 500,000-ohm potentiometer in the detector H.T. lead in order to drop the voltage and also to control the volume?"—L. G. R. (Dalston).

The use of the 500,000-ohm potentiometer is not recommended in the position referred to, and it is suggested that a 20,000-ohm fixed resistance be connected between the detector H.T. lead and the mains unit tapping, and a 2 mfd. condenser between the receiver end of this resistance and H.T.—. Volume may then be controlled by connecting the 500,000-ohm potentiometer across the G. and G.B. terminals of the L.F. transformer.

Oscillation Control on the Hall-Mark Four

"In the article describing the A.C. Hall-Mark Four, you say that with some push-pull valves it may be necessary to fit condensers across the two halves of the push-pull transformer secondary. May I ask what the symptoms are that determine whether these are necessary or not?"—T. C. (Stoke-on-Trent).

If condensers are not connected across the transformer secondary winding or a resistance of approximately 50,000 ohms is not connected between the centre tap of the transformer and the common negative line, self-oscillation, usually in the form of a high-pitched whistle, may be experienced.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face type and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. Radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," 8, Southampton Street, Strand, London.

PREMIER SUPPLY STORES

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

OFFER the Following Manufacturers' Surplus New Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra, I.F.S. and abroad, carriage extra. Orders under 5/- cannot be sent c.o.d. Please send for Illustrated catalogue, post free.

ALL-ELECTRIC 3-stage Amplifiers, 200-250v., 40-60 cycles, 10 watts undistorted output, complete with 5 valves and Magnavox Super 66 energised speaker, £12/10/0.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, condensers, resistances, and diagram, 120v. 20 m.a., 20/-; trickle charger, 8/- extra; 150v. 30 milliamps with 4v. 2-4 amps. C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v. 60 milliamps., with 4v. 3-5 amps. C.T., L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps. L.T., 27/6.

PREMIER Chokes, 40 milliamps, 25 hys., 4/-; 65 milliamps, 30 hys., 5/6; 150 milliamps, 30 hys., 10/6; 60 milliamps, 80 hys., 2,500 ohms, 5/6; 25 milliamps, 20 hys., 2/9.

ALL Premier Mains Transformers have engraved panels, terminal connections, all low-tension windings centre tapped, tapped and screened primaries 200-250 volts.

PREMIER 250-0-250 60 milliamps, 4 volts 1-2 amps, 4 volts, 2-3 amps, 4 volts 3-4 amps, 10/-

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

PREMIER combined HT8 and H T9 transformer rectified output 250 or 300 volts 60 milliamps, 4 volts 1-2 amps, 4 volts 3-5 amps, 10/-, or with Westinghouse Rectifier, either type, 18/6.

PREMIER HT10 transformer rectified output 200 volts, 100 milliamps, 4 volts 1-2 amps, 4 volts 3-5 amps, 10/-, or with Westinghouse Rectifier, 19/6.

PREMIER HT11 transformer 500 volts 120 milliamps rectified output, 4 volts 2 amps, 4 volts 2 amps, 4 volts 3-5 amps, 22/6; with Westinghouse Rectifier, 42/6.

SPECIAL offer Western Electric mains transformers input 200-250 volts, output 350-0-350 volts, 120 milliamps screened primary 4 volts 1-2 amps, 4 volts 2-3 amps, 4 volts 3-5 amps, 9/6. Input 100/250 volts, 300-0-300 volts 60 milliamps 4 volts 1-2 amps, 4 volts 2-3 amps, 6/6. Input 200/250 volts screen primary output 500-0-500 volts 150 milliamps 4 volts 3-5 amps, 4 volts 2-3 amps, 4 volts 2-3 amps, 4 volts 1 amp, 4 volts, 1 amp, 19/6.

USA. 3-gang condenser with trimmers, .0005, 3/11; a really solid job.

PREMIER L.T. Charger Kits, consisting of Premier transformer and Westinghouse rectifier, input 200-250v. A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 15v. 1 amp, 19/-; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2 v. ½ amp., 11/-.

B.T.H. Truspeed Induction Type (A.C. Only), Electric Gramophone Motors, 100-250v., 30/- complete. D.C. model Truspeed, 100/250v., 42/6.

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

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

SPECIAL Offer of Wire-Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

CENTRALAB Potentiometers, 400 ohms, 1/-; 50,000, 100,000, ½ meg., any value, 2/-.

RELIABLE Canned Coils with Circuit accurately matched, dual range, iron cored, 2/11.

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

SPECIAL offer .00015 brass short-wave tuning condensers with slow-motion and complete dial, 8/9. Short-wave chokes 10-200 metres, 9d.

DUBILIER electrolytic condensers, 12 microfarads, 20 volts 6d., 8 plus 4 microfarads 500 volts 4/-, 50 mf. 50 volts, 1/9.

BRITISH Radiophone fully screened 3-gang .0005 top trimmers with complete, slow-motion drive, 7/6.

SPECIAL OFFER. Kolster-Brandes (shop-soiled) Receivers, 2-valve Battery Pup, with self-contained Speaker, Valves and Batteries, 27/6.

T.C.C. Condensers, 4mf. 450v. working, 4/- 4mf. 750v. working, 6/-.

(Continued at top of column three)

(Continued from foot of column one)

POLAR Star Manufacturers' model, 3-gang condensers, fully screened, 7/6, with trimmers; unscreened, 5/-.

RELIABLE Intervalve Transformers, 2/-; multi-ratio output transformers, 2/6; Microphone transformers, 50-1 and 100-1, 2/6; 1-1 or 2-1 Output Transformers, 2/6.

UTILITY 3-gang Condensers. 0.0005, fully screened, with trimmers, ball bearing straight or superhet, 6/9, complete; with illuminated disc drive, 7/11; the best 3-gang available.

VARLEY Constant Square Peak Coils, bandpass type B.P.7 brand new, in maker's cartons, with instructions and diagram, 2/4.

VARLEY H.F. Intervalve Coils, B.P.8, band-pass, complete with instruction, in original cartons, 2/6.

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

WESTERN Electric Condensers, 250v. working, 1 mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 400v. working, 1 mf., 1/-; 2 mf., 1/6.

WIRE-WOUND Potentiometers, 1,000, 2,500, 50,000, 500,000, 2/- each; 1,000 ohms, semi-variable, carry 150 m.a., 2/-.

A LARGE Selection of Pedestal, Table and Radiogram cabinets, by best manufacturers at a fraction of original cost. Send for list.

0-1 Milliammeter by Best Manufacturers, bakelite cased, accurate, 18/6.

R.I. Dux Intervalve Transformers, 3/6; B.J. Push-Pull Input Transformers, 3/-.

POLAR Arcuate Slow-Motion Drives, complete, 2/11.

WILLIAMS & MOFFAT Full-Vision drives, complete 2/11.

IGRANIC Iron-Core Coils, latest type, with switching, 3/11. Lewcos Band-Pass Filter Units, 2/6.

ORMOND No. 4 Variable Condensers, .00025, O K for Beginners' Short-Waver.

LARGE Cone Units by R. & A., Ltd., 3/6.

THE following Lines 6d. each, or 5/- per dozen.—Chassis valve holders 5-, 6-, or 7-pin, screened screen-grid leads, any value 1-watt wire resistances, wire end condensers 0.0001 to 0.5, 3 amp. main switches. Cyldon double capacitors.

T.C.C. Electrolytic condensers, 8 mfd. 440v. working, 3/-; 4 mf. 440v. working, 3/-; 15 mf. 50v. working 1/-; 50 mf. 12v. working, 1/-; 15 mf. 100v. working, 1/3.

CONDENSER Blocks, H.M.V. 400v. working. 4+2+1+1+1+.5, 3/9; 2+2+1+1+1+.5, 3/-; Phillips 6+4+2+1+1, 4/6.

GRAMPIAN Permanent Magnet 9 inch Moving Coil Speakers, handles 4 watts. Universal Transformers, 18/6. Ditto Energised, handles 5 watts, 2,500 ohms, 21/-.

10,000. 12,000, 15,000 ohm wire-wound potentiometers with mains switch, 1/6.

SPECIAL OFFER. Guaranteed U.S.A. Electrolytics. 4 mf. 1/9; 8 mf. 1/9; 12 mf. 1/9. all 550 v. Peak Working. 2000 mf. 12v. working, 6/-.

DARIO directly-heated 1 watt, 200v. Mains Power Valves, 2/6.

BLUE SPOT 45 P.M. Speaker, multi-ratio transformer, handles 4 watts, listed 45/-, at 25/-, or in handsome walnut cabinet, 35/-. Blue Spot 99 P.M. Speaker, multi-ratio transformer, handles 5 watts, listed 59/6, at 31/-.

BLUE SPOT Energised Speakers 2,500 ohms type 29D.C., Power and Pentode Transformer, 9/11.

PREMIER SUPPLY STORES Announce the Purchase of the Complete Stock of a world famous Continental valve manufacturer; 2 volt Battery Valves, H.F.; Det.: L.F.: 2/3; Power: Low Consumption Power, Super Power, 2/9; Screen Grid, 4 and 5 pin Pentodes, 5/-; all the following standard mains types, fully guaranteed, 4/6 each; H.F. Pentodes, Variable-Mu H.F. Pentodes, H.L., L. Power, medium, high, low mag. and variable-mu Screen-grids, one, three, and four watt A.C. output directly-heated Pentodes; 250v. 60 m.a. full-wave rectifiers; D.C. types, 20v. .18 amp., filaments, Screen-grid V.M.: H.: H.L.: Power: Pentodes: H.F. Pentodes: Variable-Mu H.F. Pentodes.

The Following Types, 5/6 each: 350v. 120 m.a., full-wave rectifier, 500v. 120 m.a., full-wave rectifier, 2½ watt indirectly-heated Pentode.

The Following American Types, 4/6: 250, 112, 171, 210, 245, 220, 47, 40, 24, 35, 57, 58, 55, 37, 80, 6A7, 2A7, 83, 27, 2A5, 77, 78.

The Following Types, 6/6 each: 42, 25Z5, 36, 38, 83, 39, 44, 53, 6B7, 2A6, 267, 5Z3, 6C6, 6A4, 6D6, 6F7, 43, 59. Send for Complete Valve List.

PREMIER SUPPLY STORES

(Dept. G.N.), 20-22, High St., Clapham, S.W.4. 'Phone: Macaulay 2188. Nearest station: Clapham North, Underground.

MAINS Transformers, chokes, etc., to specification, repairs promptly executed. Guaranteed satisfaction. Prices on request. Henry Peace, Ltd., Wednesbury, Staffs.

L. ORMOND SPARKS, late Technical Staff AMATEUR WIRELESS and WIRELESS MAGAZINE, will attend to all your Technical and Constructional troubles. Postal Queries 1/- each question. Blueprint alterations, 2/6. Diagrams 1/- per valve. Enclose stamped envelope. Detailed replies. Prompt Service.—54, Blythe Hill Lane Catford. S.E.6.

SOUTHERN RADIO'S WIRELESS BARGAINS: SPEAKERS.—Blue Spot Permanent Magnet Speakers. Universal Transformers for Power, Super-Power, Pentode or Class B. All brand new 1935 series, Type 99P.M., 30/- (List 59/6). 45 P.M., 24/- (List 45/-). Type 62P.M., in attractive cabinet, 38/- (List 67/6); Type 32P.M., 45/- (List 87/6). All in sealed cartons. ELIMINATORS.—Regentone Eliminators, 1935 Series. Brand new and boxed. Type W.5a for A/C Mains, 200/250v. Complete with Trickle Charger for 2, 4 or 6 volt accumulators, 39/6 (List 75/-). Type WIa (less Trickle Charger) to carry 30 milliamps, 33/- (List 67/6). Type WIC (less Trickle Charger), 30/-. A few only Ekco Eliminators for 100/125 volts A/C only: Type K.25 with Trickle Charger to carry 25 milliamps, 35/- (List 92/6); Type K18 with Trickle Charger output 18 milliamps, 32/6 (List 87/6). All Eliminators in Sealed Cartons.

CONDENSERS.—Plessy Four-Gang Condensers with Oscillator Section for Superhet. Fully screened with trimmers, 7/3 each. This is the piano type of condenser and standard full size 0.0005 (not midget). Lotus 3-Gang 0.0005, 11/- (List 19/6); 2-Gang 0.0005, 7/3 (List 14/-). All Lotus Condensers are Brand New. Fully Screened with trimmers complete with Dials, escutcheons, etc. Igranic 1 mfd., 1/3; 2 mfd., 2/-. Dubilier 4 mfd. (2+1+1), 2/9—1,000 Volt Test.

COILS.—Igranic Superhet 4-Coil set (1 osc. 2 I.F. with pig tails and 1 I.F. plain), 9/- per set (List 50/-). Varley Constant Square Peak Coils B.P.5, with all accessories, 2/3. Telsen Twin-matched Coils: Type W.287, screened with switch, 7/9 (List 17/-). Triple-matched Screened Type W.288, with switch, 10/9. Telsen Twin Coil Unit, Type W.478, 12/6. Type W.477, 17/6. All Brand New and Boxed.

PICK-UPS.—Marconi Model K.25, 21/- (List 32/6).

RECEIVERS.—Burgoyne Class "B" Three-Valve Sets, complete with 3 Mullard Valves. Exide Batteries and accumulator. Magnavox Moving Coil Speaker. In modern cabinet beautifully finished in chromium plate. Brand new, in sealed cartons, £3/18/6.

OSRAM.—4-Valve (and rectifier) A.C. Receivers. Two H.F. Stages, complete with 5 Osram Valves, Moving Coil Speaker. Pedestal Cabinet. Ready for use on all Voltages A/C. In Sealed Cartons £5/10/- (List £15/15/-).

TELSEN.—3-Valve Battery Sets. Model S93, complete with three Mazda Valves, 20/- (List 75/-). Contained in exquisite Bakelite Cabinet.

MISCELLANEOUS.—Westinghouse Metal Rectifiers, Type H.T.8, 8/9. Morse Tapping Keys with flash signal and buzzer, complete with battery and bulb, 2/-. Biflo Static Cut-outs, definitely eliminate all interference, 2/3. Lewcos Spaghetti Resistances, all capacities, new and boxed, 1/6 per dozen assorted. Telsen Short-wave Chokes, H.F. Screened, 1/9. Telsen Binocular H.F. Chokes, 2/-. Telsen ACE L.F. Transformers, 3-1 and 5-1, 2/9. Deemark Dual Range Coils, complete with circuits, 2/-.

STOCK-TAKING PARCELS.—We have gathered at our Mail Order Dept. a large quantity of odd lines from our various branches. It is impossible to list these articles individually. We are, therefore, offering them in parcel lots at 5/- per parcel. Each parcel contains components to the value of at least 20/- and include Switches, Fixed Condensers, Transformers, Resistances, Coils, etc., etc. Every article is of present day use in Radio. Telsen and Ready Radio Circuits numbering 10 different circuits are included in each parcel, 5/- per parcel.

THOUSANDS OF BARGAINS AT OUR VARIOUS BRANCHES.—All Goods guaranteed and sent post paid. Branches at 46, Lisle Street, W.C.2; 271-275, High Road, Willesden Green, N.W.10. All Mail Orders to: 323, Euston Road, London, N.W.1. SOUTHERN RADIO, 323, EUSTON ROAD, LONDON, N.W.1. Near Warren Street Tube. 'Phone: Museum 6324.

THE following unused set manufacturers' Surplus; all goods guaranteed perfect; immediate delivery. MAGNAVOX speakers, complete with hum-bucking coil. output transformers, etc. DC152 (9in. cone), 22/6. DC154 (7in. cone), 16/-. All with 2,500 or 6,500 ohms fields.

WESTINGHOUSE rectifiers, HT8, 9/6. HT9, 10/- HT10, LT5, LT4, 10/9. Regentone transformers for HT8 or HT9, with 4v. 4 amp. LT winding, 7/-. Eliminators, first-class make. Outputs 150v. 25ma, SG and Detector. AC type with Westinghouse rectifier, 25/-. AC type with .5 amp. trickle-charger, 30/-. DC type, 12/6.

DUBILIER or TCC dry electrolytic condensers 8mfds. or 4mfds, 500v. working, 50mfds, 50v. 200mfds, 10v. 3/3. 50mfds, 15v, and 15mfds, 100v, 2/3. 50mfds, 12v, 2/-. TCC type "M" condensers, any value up to .001 mfds, 6d. Eric resistances. 1 watt type, 7d., 2 watt, 1/2, 3 watt, 1/9. Send for comprehensive list.

WARD, 45, Farringdon Street, London, E.C.4. Telephone: Holborn 9703.

HALL-MARK THREE Superhet Three, ST600 Guaranteed First Specified Kits—Lowest Prices —Easiest Terms—Lists Free—Melfo-rad, Queen's Place, Hove. (Trade supplied.)

REPAIRS to Moving Coil Speakers, Cones and Coils fitted, or rewound. Fields Altered. Prices Quoted Including Eliminators. Loud-Speakers Repaired, 4/- L.F. and Speech Transformers, 4/- Post Free. Trade Invited. Guaranteed Satisfaction. Prompt Service. Estimates Free. L.S. Repair Service.—5, Balham Grove, London, S.W.12. Battersea 1321.

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When radio frequency gain is difficult to obtain, as is the case on ultra-short wavelengths, it is most desirable to offset this loss by the use of a very efficient output stage; a high-slope pentode output valve is the obvious choice for this position. General performance will be controlled to a large extent by the gain here, and consequently a type giving an exceptionally large milliampere saving for a small voltage output from the detector is called for. Marconi N41 fulfils the requirement admirably for those using A.C. circuits. Not only is the conductance unusually high; it also provides ample undistorted output for domestic purposes and can be fed directly from a sensitive pick-up for gramophone work.

WRITE TO THE VALVE DEPARTMENT, MARCONIPHONE COMPANY LIMITED, 210 TOTTENHAM COURT ROAD, LONDON, W.1, MENTIONING THIS PAPER.

MARCONI VALVES

THE CHOICE OF THE EXPERTS

RADIO CLEARANCE, 280, High Holborn, W.C.1 offer the following stupendous bargains, limited quantities only, all orders over 5/- post free. 'Phone: Holborn 4631.

RADIO CLEARANCE. First Bargain List is now available, send 1½d. to cover cost and postage.

RADIO CLEARANCE. Aerodyne 5 Valve Battery Superhet Chassis, Class B output, complete with Mullard Valves, £4/5/- each; chassis, complete in cabinet with Rola P.M. Speaker, £5/5/-.

RADIO CLEARANCE. Makes Special Offer of a Limited quantity S.T.600 Dorchester Kits to Designers' Specification, including Colvern Coils, Polar Condensers, T.C.C. fixed Condensers, R.I. Hypermite Transformer, ready drilled panel and terminal strip, list price £5/17/-; our price £3/10/-.

RADIO CLEARANCE. Dorchester 3 Valve screen grid, detector, power or pentode battery, chassis including all first-class components, brand new, completely wired at 30/- each, less Valves.

RADIO CLEARANCE. Earl permanent magnet moving-coil Speakers, 7½in. cone, brand new, boxed; list price 29/6; our price 10/11.

RADIO CLEARANCE. Magnavox Permanent Magnet moving-coil Speakers, 6in. cone, fitted Pentode Transformers. List price 27/6; our price 11/-.

RADIO CLEARANCE. Standard Telephones and Cables Mains Transformers, shrouded type, for H.T.8 rectifier with 4v. 4 amp. C.T., L.T. winding; exceptional value at 6/- each.

RADIO CLEARANCE. British Radiophone 3-gang Superhet Condensers, screened 2.0005 sections and 110 kc. oscillator section, 7/6 each.

RADIO CLEARANCE. British Radiophone 3-gang Superhet Condensers, large type, screened 2.0005 sections and 110 kc. oscillator section, 7/6 each.

RADIO CLEARANCE. British Radiophone 3-gang Superhet Condensers, unscreened 2.0005 sections and 110 kc. oscillator section, 4/11 each.

RADIO CLEARANCE. Polar Star 3-gang straight Condensers, fully screened with Trimmers, 3.0005 sections, 6/6 each.

RADIO CLEARANCE. British Radiophone, 110 kcs. and 117 kcs. intermediate frequency Transformers, 2/6 each.

RADIO CLEARANCE. British Radiophone Short-Wave intermediate frequency Transformers, 473 kcs., 2/6 each.

RADIO CLEARANCE. British Radiophone set of Superhet Coils, manufacturers' type, suitable for use with above advertised Condenser, 5/6 per set of three.

RADIO CLEARANCE. 5-pin Chassis mounting Valve Holders, 3d. each.

RADIO CLEARANCE. British Radiophone Volume Controls, 10,000 ohm, 25,000 ohm, 50,000 ohm, 500,000 ohm, 1 meg., at 1/6; volume control, with switch, 1 meg., 2/6.

RADIO CLEARANCE, 8 mfd. and 4 mfd. dry electrolytics, 500 volt working, well-known make, 2/6 each.

RADIO CLEARANCE. 1 watt resistances well-known make, all sizes 6d. each.

RADIO CLEARANCE. 1½ mm. white sleeving, 9d. per dozen lengths.

RADIO CLEARANCE. Steel Chassis cadmium plated, drilled ready for use, 4 and 5 valve type, 1/6, 7 valve 2/-.

RADIO CLEARANCE. Valve Screens with base, 6d. each.

RADIO CLEARANCE. T.C.C. 2 mfd. Condensers, 250 volt working, 1/3 each. Block Condensers, 4 2 1 mfd., 350 volt working, 2/- each.

RADIO CLEARANCE, 280, High Holborn, W.C.1. Holborn 4631.

CLARION VALVES.—All brand new; battery types, 2-volt, HF.2, LF.2, LP.2, 1/9. Super power, PP.2, 2/6; screens and pentodes, 3/9; A.C. Mains, 4-volt, 1 amp., general purpose, 3/3; power, 4/-; screens and pentodes, 4/6; full wave rectifiers, 3/6; postage paid, cash with order, or C.O.D. over 10/-. Clarion Valves, Dept. 2, 885, Tyburn Road, Erdington, Birmingham.

SPEAKER REPAIRS—REWINDING SERVICE. New Cones, Coils, etc., fitted all makes M/c Speakers, Fields altered. Mains Transformers, etc., rewound. English/American receiver repairs. Estimates free, work guaranteed, Trade invited. Write Dept. C., Weedon P.L.R. Co., 80, Lonsdale Avenue, London, E.6. Maryland 1782.

ALL purpose MICROPHONES, W. E. Type, complete with leads and instructions, 2/- each Microphone transformers, 3/3 each. Microbuttons, 7d. each, all post free.

ELECTRIC Motors bargain, 1/12 D.C. shunt, ball bearings perfect, originally £3 15/-, only 14/- each, carriage forward. Electromicro, 34, Queen Street, Hammersmith.

ST. 600 and ST. 1.5 guaranteed components sent carriage paid. Graham Farish, Eddystone, Colvern, Wearite, T.C.C. and T.M.C. Stockists. Prompt attention to all orders. Cash or C.O.D. Experienced Exporters. **ESSELRAD ELECTRIC CO.**, Old Hall Street, **HANLEY**, Stoke-on-Trent.

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VAUXHALL.—Radiophone volume controls, all values from 5,000 to 500,000 with switch, 3/6.

VAUXHALL.—Westinghouse rectifiers set, manufacturers surplus skeleton type H.T.8, 9/6; H.T.9-10, 10/-.

VAUXHALL.—Westinghouse Westectors, W.4, W.X.6, 5/9. Regentone transformers with terminals and H.T.8, 17/6.

VAUXHALL.—Gramophone motors: Collaro 32 model, 32/6. Universal model for 110 D.C. 200/250 AC/DC, 47/6.

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VAUXHALL.—Dubilier all values, 1 watt resistances, 7d.; Clix valveholders with terminals, 5-pin, 7d.; 7-pin, 9d.; Continental 7-pin, 9d.; W.B., 4/5 pin, 4½d. Post paid, 2/6, or over or C.O.D.

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ADVERTISEMENT INDEX

M.W.A. 9

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THE LEADING, AUTHORITATIVE, TWO-IN-ONE WIRELESS WEEKLY

Practical and Amateur Wireless

AND AMATEUR TELEVISION

3d. EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 6. No. 132. March 30th, 1935.

The A.B.C. OF Valve Pin Connections

THE SILVER SOUVENIR ! See Below

Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff:
W. J. Delaney, H. J. Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.

VOL. VI. No. 132. March 30th, 1935.

ROUND *the* WORLD *of* WIRELESS

THE SILVER SOUVENIR.—
Mr. F. J. CAMM'S LATEST DESIGN

NO reader needs to be reminded that this is Jubilee Year, in which His Majesty's Silver Jubilee—twenty-five years of reign packed with scientific progress and mechanical achievement—will be celebrated. It is fitting that a journal such as PRACTICAL AND AMATEUR WIRELESS, which circulates among so many thousands of His Majesty's subjects in all parts of the world, should signalise the event. This we shall do by publication of our new "Souvenir" series of receivers which have been specially designed by Mr. F. J. Camm to cater for the needs of every listener, no matter where he resides. Our readers will agree that Mr. F. J. Camm has produced many astonishingly successful receivers in the past, but none, in our opinion, equal to his latest—the SILVER SOUVENIR. Order next week's copy now, for this issue will contain a fuller statement concerning his latest design.

Croydon Enthusiasts

THERE was an enthusiastic gathering of members of the Croydon Radio Society and the Thornton Heath Television and Short-wave Society at St. Peter's Hall, South Croydon, on Tuesday, March 12th. to hear Mr. F. J. Camm, Editor of PRACTICAL AND AMATEUR WIRELESS, lecture on the subject of "The Constructor and the Press." The interesting discussion which followed the lecture indicated the enthusiasm of the members of these two clubs. Well-organised and efficiently run clubs such as these are to be congratulated on the vast amount of work and good they do in the interests of better radio reception.

Television in Berlin

THE German *Reichsrundfunk* proposes to open its regular television service at the end of March. The transmissions will be made from the Funkturm (Broadcasting Tower) at Witzleben, which was used as an aerial for the old Berlin station. They will be given three times weekly in the evening hours for a period of ninety minutes on 6.70 metres (vision) and 6.98 metres (speech).

State Interval Signals

THE French P.T.T., in order to choose a series of interval signals for the capital and provincial stations, is recording the various suggestions put forward, and will play them before a special committee. The sounds which are considered most suitable will be adopted and introduced as soon as possible in the individual broadcasts.

The German Noise Museum

THE Berlin broadcasting station has instituted a collection of 1,500 gramophone records depicting every kind of noise which may be required in the broadcast of plays and so on. In most instances, to secure the desired effect, the sounds of several records are mixed and these "mixtures" again registered provide new combinations to be used at a future date.

Novel American Competition

A WELL-KNOWN New York magazine, having circularised its readers, was able to state from replies received that of all electrical appliances used in the households of New Jersey, the mains-fed wireless receiver only secured second place with 95.6 per cent. votes. Actually, it was beaten by the electric iron! In sequence, the electrical appliances came as under: iron, radio, sweeper, toaster, bells, and finally, the electric flapjack or waffle iron.

The Call of the Jungle

FROM British India comes the report that if an interval signal is required for the Calcutta or other broadcasting stations, it would be possible to use the trumpeting of a bull elephant or the growl of a tiger. Suitable records could be made for the various districts in which stations are to be installed.

Copying the B.B.C.

AT the International Exhibition to be held this summer at Brussels (Belgium), the I.N.R. proposes to install a large broadcasting studio with a glass enclosed gallery to which the general public will be admitted. The programmes, in this way, will be heard both by loudspeaker and direct in the hall in order that comparisons may be made.

Canned Music Preferred

DURING the run of the recent radio exhibition at Belgrade (Jugoslavia), the authorities ascertained from visitors that of the items in the programmes, gramophone records were the most popular. Of the votes collected only 20 per cent. were in favour of "live" artists performing before the microphone!

Quality Group

ALTHOUGH the majority of U.S.A. broadcasting stations are comprised in the Columbia and N.B.C. networks, WOR, Newark (New Jersey), WLW, Cincinnati (Ohio), and WGN, Chicago (Ill.) are the key-transmitters of the new system calling itself the Quality Group. They now carry out an independent interchange of programmes.

Money for Jam!

AT a certain Continental station, the local station officials were recently accused of debiting the studio accounts with copyright fees or salaries paid to Beethoven, Mozart, and Chopin! Accountants from Moscow discovered the swindle with the result that the staff was put under arrest.

ROUND the WORLD of WIRELESS (Continued)

"How Very Regional"

IN the Midland programme on April 1st is a mystery feature entitled "How Very Regional." It is to be produced by Martyn Webster, but no information has been given in advance as to its character.

Variety from Peterborough

ON April 4th a variety bill will be relayed from the Empire Theatre, Peterborough. The artists will include Ernest Shannon, in mirth, melody, and mimicry; Mr. Shannon has frequently broadcast, and his stage successes include the bandit hero in "The Maid of the Mountains" and Captain Posen in "The Little Dutch Girl."

Pre-war Musical Comedy

THE Columio Male Voice Choir—consisting of nine natives of Colne, all concerned with some aspect of the cotton industry, are to broadcast to Northern listeners a programme of pre-war musical comedy numbers on April 6th. They will be supported by the B.B.C. Northern Orchestra, conducted by T. H. Morrison, and the soloists will be Dorothy Paul (mezzo-soprano) and Wallace Irving (baritone).

Old-time Dance Music

CONDUCTED by Stanford Robinson, the B.B.C. Theatre Orchestra will give a popular programme of old-time dance music to Regional listeners on April 9th. Many B.B.C. programmes bring in a large mail, but few such an enthusiastic one as the old-time dance music broadcasts by the Theatre Orchestra. The appreciations invariably emphasise that advantage is taken of the opportunity given to the writers of being able to dance to the old tunes.

Crazy Week for Western Listeners

A CRAZY WEEK has been planned for Western listeners beginning on April 1st, and all types of programmes will be affected. One high spot will probably be a Mad Tea Party on April 3rd, when many of the people who broadcast regularly in the Western programme will come to the studio. Reginald Redman and Francis Worsley have combined in a musical programme which is described as Musical Mania, a Potty Pot-pourri, to be given on April 4th, and a parody on the feature For Western Farmers in Particular, entitled "Whither Sprouts," will be given on April 5th.

Weather Talk

"WANTED—the right weather" is the title of the third of the "Northern Cockpit" series of talks features which is to be broadcast to Northern listeners on April 1st. Northerners drawn from every walk of life—fishermen, a farmer, a schoolboy, a shop-girl, unemployed man, a woman organiser of charity fêtes, a street cleaner, a landscape painter—will review this all-important question of the weather, each making a statement of precisely what kind of weather he or she desires on the following day.

Workington Town Prize Band

UNDER the direction of Reginald Hutchinson, the Workington (Cumberland) Town Prize Band will broadcast from the Newcastle studios on April 6th. The band has won many contests locally, and since its first appearance at the Crystal Palace in 1928 it has worked its way up from the Junior Cup to the Championship section.

Chamber Music from Manchester

THREE members of the B.B.C. Northern Orchestra—Frank Park (viola), Pat Ryan (clarinet), and Charles Kelly (pianoforte)—will give a chamber music concert from the Manchester studios on April 5th.

INTERESTING and TOPICAL PARAGRAPHS

Broadcast of the Launching of the *Strathmore*

THE Duchess of York is to christen the *Strathmore* in her father's name, when this 24,000-ton liner is launched at Barrow-in-Furness on April 4th. The ceremony will be covered in an outside broadcast included in the main Regional programme. Microphones installed along the slipway will "pick up" the sounds as the vessel takes the water; and there will be a running commentary on the proceedings by Commander D. A. Stride. The *Strathmore* was in course of construction when the Orient liner *Orion* was launched from the same dockyard (Vickers-Armstrongs Naval Construction Works) in December last. Like the *Orion* the *Strathmore* is equipped with the most recent type of anti-fire apparatus.

"The Mystery of the Seven Cafés"

ERIC MASCHWITZ, variety director, and A. W. Hanson, producer, who directs the "In Town To-night" feature, are preparing a new series of programmes provisionally entitled "The Mystery of the Seven Cafés." Continental music and melodrama will be blended in an unusual way. The main story concerns the adventures of a Secret Service man in pursuit of clues to an international mystery. The clues lie in cafés in seven capitals. In each of the seven instalments music by the café band is interwoven with thrilling drama. Sydney Horler will be responsible for the script and Walford Hyden and the Café Colette Orchestra will provide the music. The series is likely to start about the end of June.

Lilian Cooper

Lilian Cooper (who comes from a country village near Crewe and who was apprenticed to a dispensing chemist before winning the rose bowl at Blackpool decided her to take up singing as a profession), will give songs by Brahms, Schumann, and Schubert, in connection with this concert.

MUSIC AND CHARM

Nora Williams, the popular American stage and radio star, is also a keen radio fan, and the above illustration shows her listening to her new Cossor receiver.

SOLVE THIS!

PROBLEM No. 132

Pycroft built a modern four-valve receiver, using completely screened coils, and assembled the parts on a metal chassis. The set was used in conjunction with an aerial system in which was included an interference suppression device consisting of two balanced transformers with the usual screened inter-connector. Upon completion it was desired to calibrate the receiver by means of a heterodyne wavemeter. It was found, however, that the heterodyne note could not be heard, no matter how close the wavemeter was placed to the set. What important point had Pycroft overlooked, it being known that the wavemeter was functioning correctly?

Three books will be awarded for the first three correct solutions opened. Mark your envelopes Problem No. 132 and address them to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received not later than the first post Monday, April 1st.

Solution to Problem No. 131

Willand had omitted to include any stabilising arrangement in the grid circuits of the push-pull valves. If he had inserted a fixed resistance of about 5,000 ohms in series with each grid, the instability would not have been present.

No correct solution was received of Problem No. 131, therefore no books have been awarded.

MAKING A CALIBRATION CHART

An Article Explaining the Simple Method Adopted

By W. H. DELLER

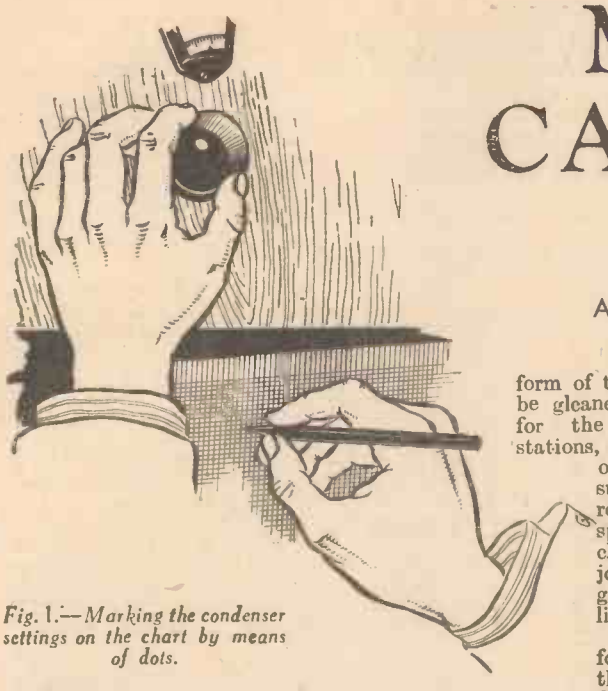


Fig. 1.—Marking the condenser settings on the chart by means of dots.

WHEN handling a new receiver there is always an element of uncertainty regarding correct condenser settings for different stations, more particularly for "foreigners."

The preparation and completion of a calibration chart will, however, provide a ready means of identifying unknown stations, and for that matter will also indicate the required condenser reading to obtain a wanted station. Beyond this, such a chart provides by far the simplest method of recording the various tuning positions.

Briefly, the operation consists of constructing a curve on a sheet of squared paper. This particular paper is faintly ruled in both horizontal and vertical directions to subdivide the surface into small squares. In the ruling most readily obtainable these squares measure one-tenth of an inch, which for the present purpose, on account of clarity, is eminently suitable. It does not matter if the ruling is in millimeters, but where such is employed it is better, unless a very small chart is needed, to allow more than one square for each degree or division on the condenser scale.

Marking Off the Squared Paper

The bottom edge of the paper is marked off to represent the condenser scale, commencing with zero at the left-hand corner, and progressing in numerical value towards the right. The line immediately above represents the lowest wavelength, or frequency, in kilocycles to which the condenser will tune, and the succeeding horizontal lines representing wavelengths. This explanation will be made clear by referring to Fig. 2.

To obtain the approximate outline of the curve, first carefully tune in the local station, note the condenser reading, and at the corresponding position on the scale at the bottom of the paper extend an imaginary vertical line until it crosses a similar horizontal line corresponding with the wavelength of the station. At the point where these two lines intersect mark a dot. Tune in the remaining B.B.C. stations, and also mark the readings, as before, by dots. These dots will extend roughly in a diagonal direction from left to right, and a line drawn through them will give an idea as to the form of the curve. From this may be gleaned the likely dial readings for the higher-powered foreign stations, which, as found, are noted on the chart as before. When sufficient stations have been received to make an evenly-spaced chain of dots, the chart is finally filled in by joining all the marks together by means of a clean line.

Thus it is evident that by following a line representing the wavelength of a required station outwards until it touches the curve, and from that point dropping vertically, the appropriate condenser setting will be read off on the bottom scale.

Using the Chart

Apart from providing a most interesting occupation for several evenings, the completed chart may reveal the reason for the failure to receive certain stations clearly, if at all. For instance, it may be found that the curve is "humpy," due to the condenser being faulty either on account of design or something wrong mechanically. Perhaps it should be explained what is meant by "humpy." This is where the curve suddenly flattens out in one part so that it rises perhaps only two squares over a distance of, say, eight squares, and rises again just in the same manner, travelling upwards five or six squares while moving towards the right-hand two squares. Therefore, it may be that while on the flat part of the curve ouly two stations are represented by eight degrees on the condenser dial, the steep portion may cover five or six stations with a relative condenser movement of two degrees, and are consequently impossible of entire separation. It is, however, pointed out that where the design of the condenser is responsible, the probability is that it is not one of modern manufacture. In such a case, considerable improvement could be effected by the substitution of another condenser.

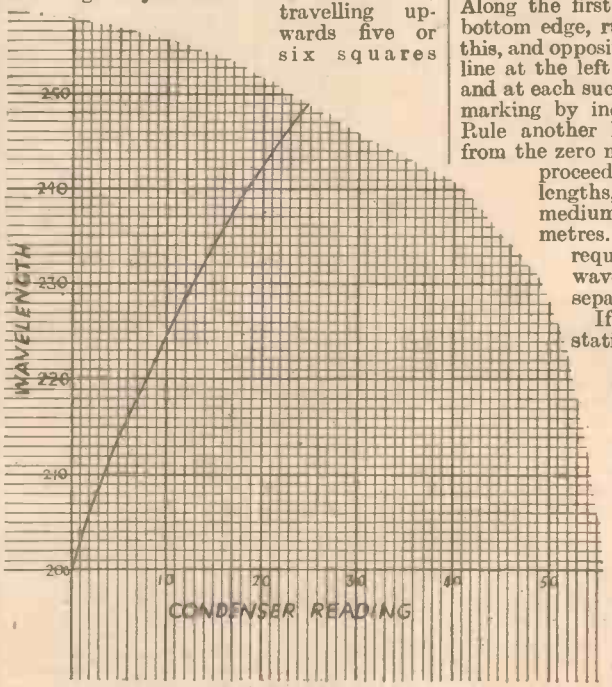


Fig. 2.—Showing how the squared paper is marked out for condenser and wavelength readings.

Method of Calibration

Reverting to the actual chart and calibration, obtain a sheet of squared paper 18in. by 23in., and paste it on a sheet of stiff card 4in. wider than the narrow way of the paper. Should the card be other than white, paste a strip of drawing paper at each side to cover the face of the card so that it comes flush with the edge of the squared paper. The size of the paper mentioned is a standard one, but where it is undesirable to use a card, a larger sheet can be utilised. The purpose of the added blank margins is for marking the names of the stations on, but where considered unnecessary, the marginal strips may be dispensed with.

It will be noticed that the paper is divided into 1in. squares with heavy lines. Along the first of these lines near to the bottom edge, rule a line with ink. Below this, and opposite to the first similar vertical line at the left-hand side mark a figure 0, and at each succeeding heavy line continue marking by increments of 10 up to 180. Rule another line up the left-hand side from the zero mark, and to the left of this proceed to mark off the wavelengths, commencing with the medium waves from 200 to 600 metres. On account of the space required, the medium and long wavelengths are dealt with separately.

If it is intended to log the stations at the side of the chart more space must be left at the lower end of the scale between 200 and 300 metres. Therefore, it is suggested that an inch be devoted to each ten metres up to 300 metres, marking accordingly at the base line of each of the first ten large squares up from the bottom, Allow 3in. for the next 50 metres, and 2in. each for each 50 up to 450 metres, while 1½in. of space will be enough to record the stations up to 500, and again up to 550

(Continued on page 38)

The ABC of Valve Pin Connections

A Brief Explanation of the Connections Employed for Multi-electrode Valves, which should be Read in Conjunction with the Diagrams on this Page

WE are constantly receiving enquiries from readers asking how a particular valve should be wired up in the receiver. The difficulty arises in most cases due to the rapid introduction of new types of multi-purpose valves, most of which have a seven- or nine-pin base, in addition to the connection mounted on top of the valve envelope. With a view to saving readers trouble in writing to us, or to the makers, with regard to the various points which are raised, we have recently published a series of articles under the title of "Valve Types and Uses," in which all the more popular valves have been dealt with in various groups, such as power valves, pentodes, high-frequency amplifiers, frequency changers, and so on. This series has proved very popular, and we learn that many readers are cutting out the various articles and keeping them together in a file for future reference. No doubt many other readers will have their copies of PRACTICAL AND AMATEUR WIRELESS bound, so that they will always have the articles ready to hand.

Under-chassis Connections

In order to provide an even simpler method of reference to the valve-base connections alone, however, we have had the illustration on this page specially prepared, and it will be seen that all the main types of British valves are represented. It should be made perfectly clear that the various drawings show the valve holders as seen from the top. When the connections to the terminals of a chassis-mounting valve holder are required it will not be a difficult matter to reverse the connections, whilst, if desired, a tracing of the particular connections required could be made and the connections obtained directly by holding the tracing up to the light and looking at it from the reverse side.

Frequency Changers

In examining the drawings it will be seen that the same connections are used for both pentagrid and octode valves; this is because the two screening grids in the latter are internally connected together. Another point which calls for an explanation is that H.F. pentodes are now available in two different types, having five-pin and seven-pin bases. Both types are in general use, but the seven-pin one is becoming increasingly popular because of the separate connection for the priming grid and metallising (where provided). Thus, these two connections can be joined to different parts of the circuit—the cathode of the valve and directly to earth, principally—and in this manner various forms of mains hum and instability may be overcome. It is often advisable to try both of the connections mentioned when any form of instability is experienced, since definite rules cannot be laid down as to which is the better.

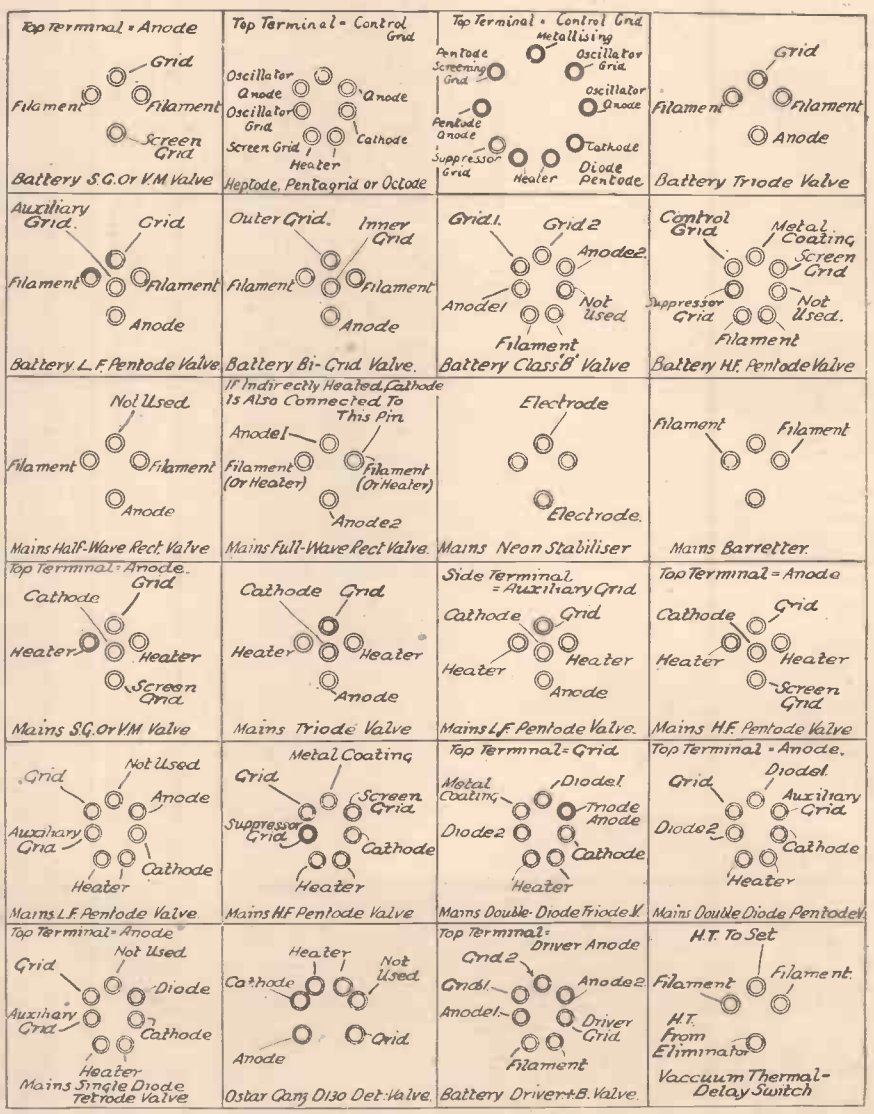
Battery Pentodes

It will be seen that, in the case of battery-operated output pentodes, connections are only given for valves having five-pin bases. This is because the four-pin base and side terminal connection is becoming obsolete. Where old valves are in use, however, the side terminal corresponds with the centre pin, so that a second H.T. positive lead should be provided for joining to this terminal. All of the other diagrams are self explanatory and do not call for any explanation.

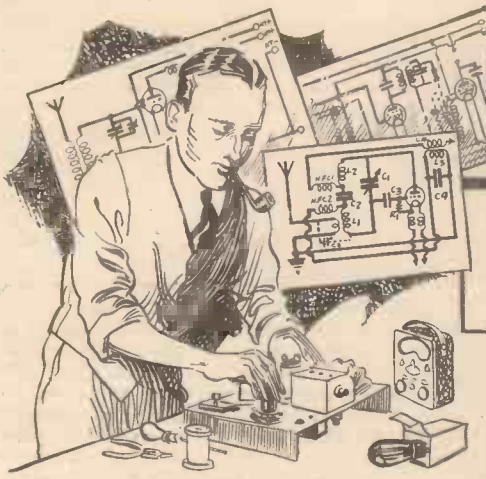
A few of the valves represented in the diagrams below are not now used very widely, but they have been included to make the reference more comprehensive. For example, the bi-grid valve which was formerly employed as first detector in certain types of super-heterodyne (chiefly in conjunction with a frame aerial) is practically obsolete, although still found in some of the older receivers.

Also included are diagrams of connections for such components as the neon stabiliser, barretter and vacuum-type thermal-delay switch. These are not wireless valves in the strict sense of the term, but are contained in glass bulbs and fitted with pin bases which fit standard valve holders.

Connections for rectifying valves are also included, and these apply equally to both directly- and indirectly-heated types. The reason for this is that the cathode in the latter types is internally connected to one of the filament, or heater, terminal pins.



Showing the pin connections for a variety of popular valves. The connections are as seen on top of the valve holder.



CIRCUITS AND SETS FOR ALL

The Circuit dealt with this Week is for a Sensitive Two-valve Transportable Receiver of Simple Design and Inexpensive Construction.

GENERALLY speaking, a portable receiver calls for a fairly intricate circuit and requires to have at least four valves. There are, however, many occasions on which a much simpler type of set will easily provide the results normally required, especially if reception of only two or three stations is insisted on and if the user is satisfied with a modest volume level. The circuit reproduced on this page illustrates the essentials of a set of the latter type, and one that can satisfactorily be used as an ordinary portable, as a stationary receiver, or as a transportable. Only two valves are employed, but these are both of the high-amplification pentode type, so that they are able to deliver quite a good output. The set represented by this theoretical diagram is not supposed to be an extremely sensitive one having a marvellously long range or giving an output sufficient to fill a small hall; on the contrary, it is intended to be used for reception of comparatively near-by stations on a small loud-speaker when an aerial is not available, or for receiving four or five programmes when attached to an outside aerial. When greater range of reception is required and a good aerial cannot be provided, the little set will prove quite capable of bringing in at least a dozen transmissions on 'phones.

The Frame Aerial

It can be seen from the circuit that a frame aerial is provided, and that this has windings for medium- and long-wave tuning as well as for reaction on either waveband. In addition there is a separate winding, loosely coupled to the tuned windings, which is required only when external aerial and earth leads are to be employed. By making use of this form of coupling there is no great loss of selectivity when the external leads are employed, and no need to employ a condenser in series with the aerial in order to reduce the "damping" effect on the tuned circuit.

Although the main windings are continuous, they actually consist of three parts: medium-wave tuning, long-wave tuning, and reaction. This arrangement makes for simplicity in winding the frame, and has proved eminently satisfactory in practice. Assuming that the end marked G is the commencement of the winding, the portion between G and M is the medium-wave tuning section; the portion between G and H.T.—is for long-wave tuning, and that between H.T.—and R serves for reaction coupling in conjunction with the .0003 mfd. reaction condenser shown.

Positions of the Windings

With regard to the question of constructing the frame aerial it will be evident that the practical details must, of necessity, largely be governed by the cabinet or attaché-case into which the set is to be fitted. No matter what size or shape the container is to be, however, the length of wire required will be practically the same. For example, the length between points G and M should be approximately 70ft., between M and H.T.—200 ft., and between H.T.—and R, 20 ft. The length of wire required for the aerial-coupling winding (between points A and E) should be about 10ft., but this is best determined by experiment.

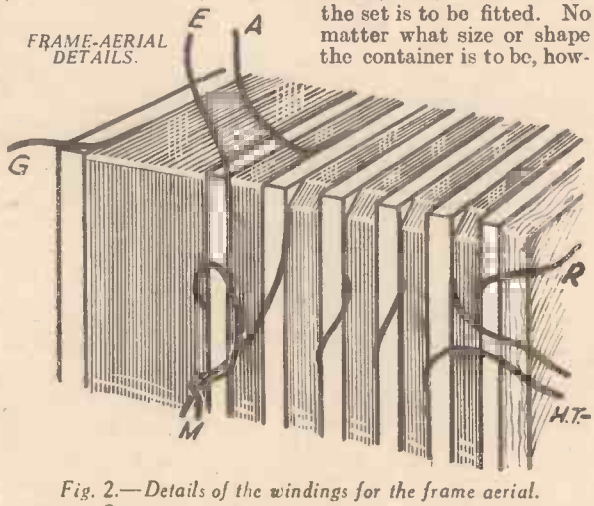


Fig. 2.—Details of the windings for the frame aerial.

The windings can be made entirely with 26-gauge d.c.c. wire, the medium-wave and aerial-coupling sections being arranged with side-by-side turns (to present the greatest possible surface area) and the others pile wound. The long-wave portion should be divided into three or four sections to reduce self-capacity, and the reaction winding can be in a single section following the others. The coupling winding can be placed between the long- and medium-wave portions, the general disposition being as shown in Fig. 2.

Apart from the tuning circuits of the receiver, there are a few other points which differ to some extent from normal practice. For example, the detector valve, as well as the L.F. amplifier, is of the pentode type; this is to ensure the greatest possible degree of amplification in the detector stage. Actually, both valves are alike, and should be Cossors, type 220 H.P.T.

Prevention Against L.F. Instability

Coupling between the two valves is by means of a plain 1 : 5 L.F. transformer—which should be of good make, since it has to carry the anode current to the detector—whilst detector decoupling is provided in the conventional manner by means of a 20,000-ohm resistance and a 2-mfd. fixed condenser. To prevent interaction and to avoid L.F. instability a 100,000-ohm fixed resistance is included in series with the grid of the second valve. A loud-speaker is shown in the anode

(Continued overleaf)

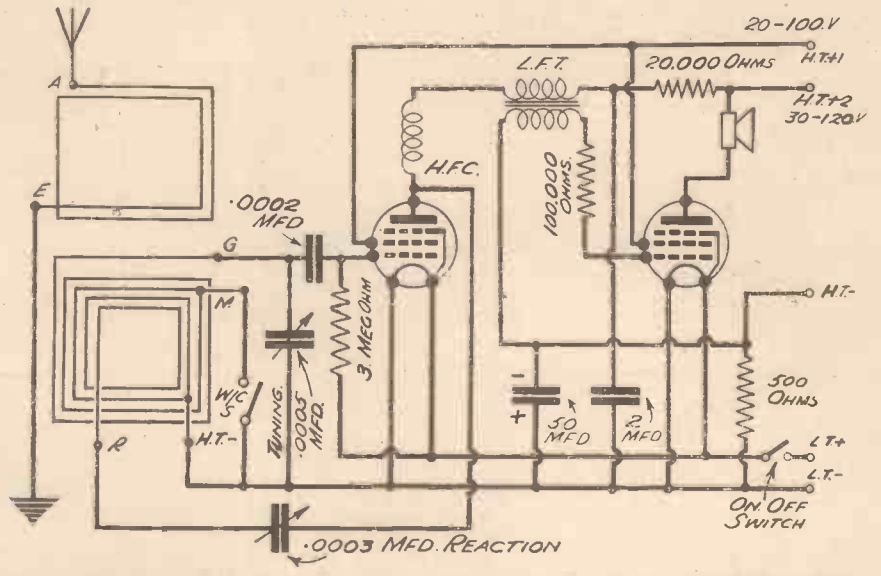


Fig. 1.—The circuit of the two-valve transportable receiver described. All component values are indicated.

CIRCUITS AND SETS FOR ALL

(Continued from previous page)

circuit of the output valve, but this may be replaced by a pair of 'phones when desired. The speaker should, for preference, be of a very sensitive type, an older type of balanced-armature unit being best. This will not give perfect reproduction, of course, but the best moving-coil unit would not do this with the circuit under discussion. By this it is not intended to imply that the set will produce very poor reproduction, but it is no use expecting too much and then being disappointed.

Automatic Grid Bias

An interesting feature which is very desirable in a portable receiver, or in practically any set for that matter, is the provision of automatic grid bias for the output valve. The bias is provided by the 500-ohm fixed resistance shown in series between the H.T.— and L.T.— leads; this resistance will give the approximately correct bias for the valve mentioned above regardless of the high-tension voltage applied. As can be seen, the bias resistance is by-passed by a 50-mfd. electrolytic condenser, such as the Dubilier type 402. It is appropriate at this point to mention that the receiver will function satisfactorily with a high-tension voltage as low as 30 or so, although satisfactory loud-speaker reception can scarcely be expected if the voltage is less than 100. Nevertheless, a low voltage will prove perfectly satisfactory when 'phones are to be employed, and this is an important point if the set is to be made up as a lightweight portable.

The Components

In this particular instance it is not proposed to give a detailed list of components, since there are so few required and these can easily be identified by examination of the circuit. Apart from the valves, the exact makes are not important, and most constructors will be able to build the receiver from spares that have accumulated when building various different types of receiver. It will be convenient, from the viewpoint of compactness, to use bakelite-dielectric condensers for both tuning and reaction, but where space is not so important ordinary air-dielectric components can be used in either or both of these positions.

It does not seem necessary to describe a lay-out for the components, since this will be dependent entirely on the container to be employed. At the same time it should be mentioned that the speaker leads should be kept as far as possible away from the frame aerial windings, and that all the usual precautions concerning the separation of the leads in the grid and anode circuits of the detector valve should be observed.

A Novel Projection Dial

A Simple Device for Illuminating Station Names as They are Tuned In

WHEN a good programme is tuned in on the radio it is a very common and aggravating thing to be asked "which station is that?" after you have settled down to listen in a comfortable chair; having paid little or no attention to the tuning dial, and not wishing to be discourteous, up you have to get and peer into the dial. In view of this the writer has contrived a dial arrangement (shown in Fig. 1), which projects the name of the station on to a ground glass screen, enabling a person with normal sight to see at a glance, and at a considerable distance from the receiver, the name of the station to which it is tuned.

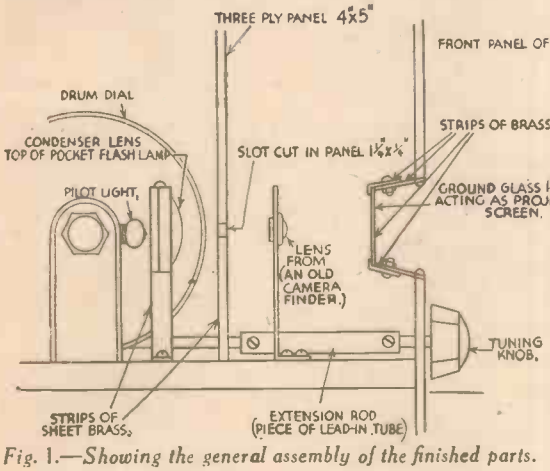


Fig. 1.—Showing the general assembly of the finished parts.

Details of Construction

Before constructing this device the set must be accurately calibrated, and this was accomplished by fixing a strip of paper over the scale on the drum dial and writing the name of the station as it was tuned in behind the narrow slot in the three-ply panel immediately in front of the tuning condenser. I then took a piece of unexposed photographic film and fixed it in a solution of hyposulphite (taking care not to allow any light to reach the film before putting it in the fixing solution). Having dried this strip of film I placed the piece of paper, on which I had written the names of the stations, over it (the emulsion, or matt side up) and at each name I made a small perforation with a pin; then at each perforation on the film I printed the name of the corresponding station *upside down* with a mapping pen and indian ink. I removed the celluloid scale from the drum, and fixed this printed strip of film in exactly the same position as occupied by the strip of paper.

The medium-wave stations are printed on one side of the strip, and the long-wave stations on the other, and by means of a shutter (Fig. 2), closing alternately one half of the slot in the three-ply panel, and operated by the wave-change switch, the name of one station at a time can be projected on the screen. The latter is set slightly back from the panel of the receiver and, being in comparative darkness, it will show clearly what is projected on the screen.

The general assembly of the various parts is clearly shown in Fig. 1, while Fig. 3 shows the method of mounting the lenses. The constructional details illustrated are those which applied in my particular case, but they may require slightly to be modified in certain instances according to the tuning condenser employed, and its position in relation to the panel.—F. W. R. (Macduff).

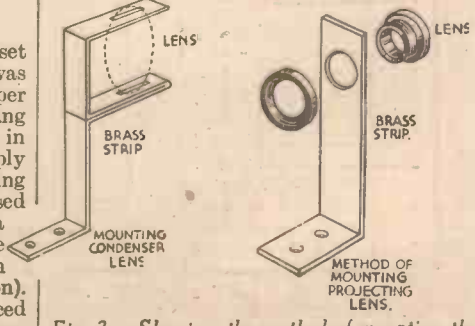


Fig. 3.—Showing the method of mounting the lenses.

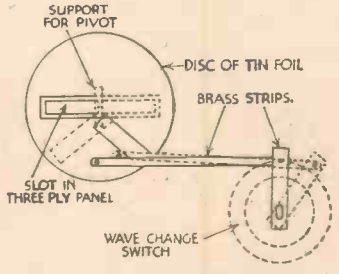


Fig. 2.—Details of the shutter.

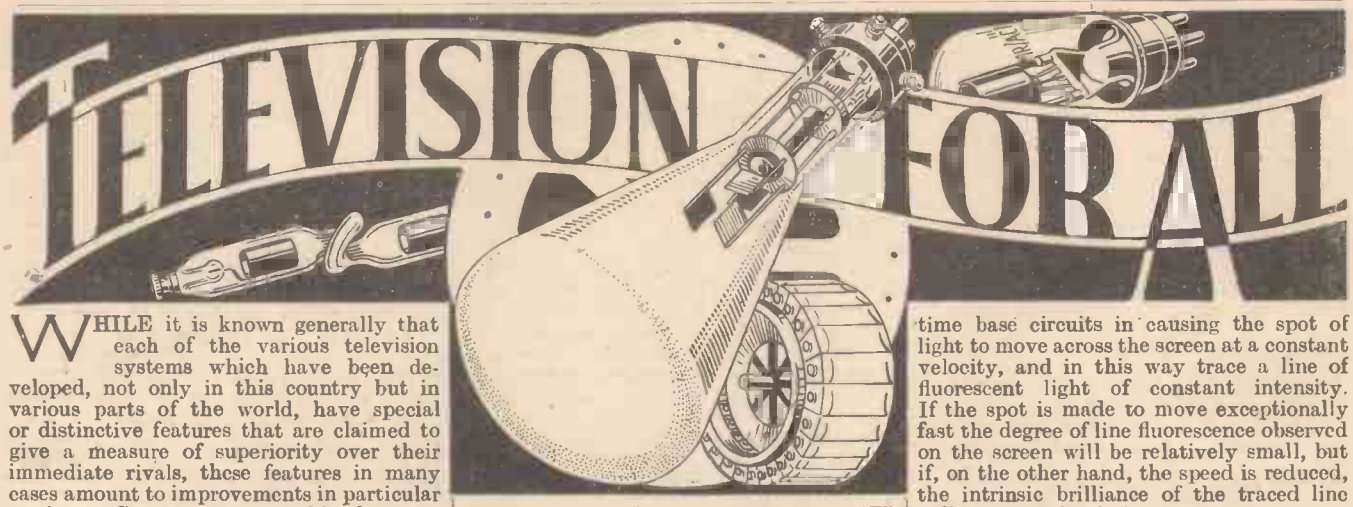
MAKING A CALIBRATION CHART

(Continued from page 35)

metres. This allows 1in. for the last 50 metres.

To commence the actual calibration, tune in first of all the local station, and take a point on the bottom scale to exactly coincide with the condenser setting. From this point follow the line upwards until level with the line of the wavelength of the station received, and at this point make a pencil dot. An easy way of following up from the condenser reading to the required wavelength without fear of error is by means of the squared edges of a sheet of card, the corner of which indicates the position of the dot. Proceed carefully to find the positions of the other B.B.C. stations, by linking the chain of dots with the higher-powered foreign stations, after making certain of their identity by signal or programme. When enough stations have been found to make a line of dots fairly close together they can be lightly pencilled through to form a continuous line. After the positions of the intervening stations have been found the line may be inked in.

Instead of making dots, pins may be stuck in the chart and a black cotton passed across the pins on the surface of the paper to indicate the initial curve. This method permits of slight positional adjustment of the line where necessary without the use of a rubber. The long waves are dealt with in the same way, after turning the chart upside down, and re-marking for condenser readings along what was the top, and the wavelengths on the remaining blank side.



CATHODE-RAY TUBE MODULATION

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

WHILE it is known generally that each of the various television systems which have been developed, not only in this country but in various parts of the world, have special or distinctive features that are claimed to give a measure of superiority over their immediate rivals, these features in many cases amount to improvements in particular sections. Consequent upon this there are many factors which are common, and in the

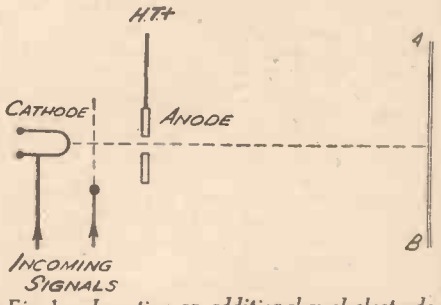


Fig. 1.—Inserting an additional mesh electrode between cathode and anode for modulation purposes.

provision of any public service of television it is essential that the type employed shall include features which enable it to be received on sets of differing design.

This is the case with the high-definition television service promised to be ready for public use towards the end of this year. Here, the signal which is propagated from the ultra-short-wave radio transmitter is generated, as a result of the equipment producing voltage variations that are a direct function of the brightness (or dullness) of successive picture areas explored in an ordered and consecutive manner. These areas are scanned at a rate which is quite independent of the nature of the subject being televised. At the receiving end, therefore, it is essential for the light intensity of the picture-reproducing device to be modulated in an identical manner, this being known as "intensity modulation."

Present Examples

With the disc receiving machine, the size of the scanning spot is kept constant since it is a finite sized aperture in a rotating disc passing over the glowing area of the cathode in the neon lamp. The incoming signals vary the intensity of this glow continuously, and so the picture is built up from light and shade intensity.

Then, again, the same principle holds good with a mirror-drum machine using a Kerr cell. The size of the beam of light emerging from the Kerr cell nicol prism combination is governed by the rectangular-apertured mask fixed to the glass envelope of the cell. The beam of light collected by the condenser lens and passed through the cell plates is altered in intensity, by applying the incoming television signals to these plates, but no attempt is made to vary the spot size, and this spot, through the medium of the rotating drum, builds up the resultant picture by moving at a constant speed over the translucent screen.

A Variant

When it comes to using the beam of cathode rays in a C.R. tube for the purpose of showing television pictures, the same principles must hold good. In other words, the intensity of the beam must be modulated, but in so doing the fasciculation or focusing of the spot on the fluorescent screen must not change, while the mean

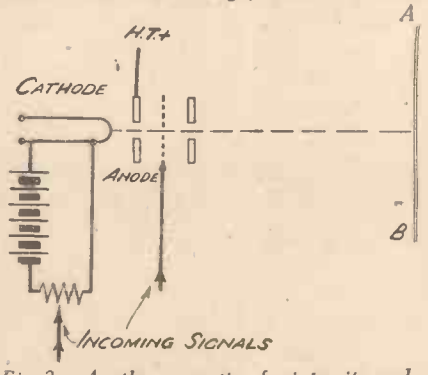


Fig. 2.—Another suggestion for intensity modulation which included a potentiometer control.

velocity of the electrons themselves, strictly speaking, must not alter.

As a variant to this, reference must be made to the television system sponsored and developed by the Cossor Co., from the original work carried out by Thun. This is known as velocity modulation. In previous articles of this series descriptions have been furnished of the action of the

Fig. 4.—An imperfect image resulting partly from misfocusing and over-modulation.

time base circuits in causing the spot of light to move across the screen at a constant velocity, and in this way trace a line of fluorescent light of constant intensity. If the spot is made to move exceptionally fast the degree of line fluorescence observed on the screen will be relatively small, but if, on the other hand, the speed is reduced, the intrinsic brilliance of the traced line will correspondingly increase.

This is termed velocity modulation, and the various light and shade details in the televised scenes are reproduced at the receiving end by adapting the velocity of the electron trace across the screen to high and low values, and thus give dark and bright sections of the picture. The scheme is a very ingenious one, but since intensity modulation is the method proposed by the Television Committee as a result of adopting the Baird and E.M.I. systems, attention will be directed here to a consideration of the different schemes of intensity modulation which have been proposed from time to time with varying degrees of success.

The First Schemes

It is actually necessary to alter the number of electrons which reach the screen in the constant sized beam and so adjust the light intensity. The first proposal for effecting this was by means of the interposition of an additional electrode at some point between the cathode and orificed anode, the electrode, of course, being actually in the path of the beam. This is shown in Fig. 1, where AB represents the tube screen, and the orificed anode is indicated with its positive potential applied for the purpose of effecting acceleration to the electrons emitted from the cathode.

Placed between the anode and the cathode is the modulating electrode, the

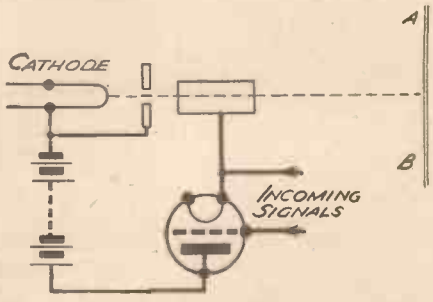


Fig. 3.—Including an amplifying valve in an anode modulation circuit.

incoming signals being applied between this electrode and the cathode in order to produce the required variations. This electrode first of all took the form of a fine mesh grid, and was then modified to a circle or loop of wire. Other alternatives were the proposals to place the grid mesh relatively close to the fluorescent screen after the ray had been influenced by both the accelerating electrode, and also the deflector plates, and the inclusion of two grids instead of one.

As far back as 1924 an idea was patented which in some respects is rather similar

to present-day practice, inasmuch as it introduced a form of potentiometer control. The scheme is shown in Fig. 2, the control grid being positioned after the orificed anode, while between this grid and the screen was fixed in the beam path a second anode. This was also orificed, but not connected to any potential or part of the circuit, being included with the object of assisting in the focusing of the beam. The incoming signals were applied between the grid mesh and the moving arm of a potentiometer, which effectively altered the mean potential of the grid.

Drawbacks

At first sight schemes of this character would seem to be quite satisfactory. Their object is to affect only the electron density of the cathode beam, and not to alter the

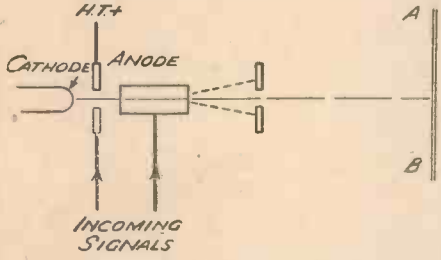


Fig. 5.—Interposing an apertured mask to cut off the electron beam in accordance with incoming signal intensity.

electronic acceleration to a degree which will manifest itself in the picture built up on the screen. This did not materialise in practice, however, and it was found that the beam focus was changed quite materially by alterations in the potential of this modulation grid by the applied incoming signals. The same remarks applied when the control grid was placed remote from the cathode, for then the modulation potentials have to be amplified very considerably to be in any way effective.

Yet another idea propounded was to modulate the anode, and this is shown in Fig. 3. Actually, the television signals were applied between the grid and the filament (cathode) of a three-electrode thermionic valve, the cathode of which was connected to a hollow cylinder in the beam path. Not only was the scanning velocity altered quite materially, but "misfocusing" of the screen spot occurred, this resulting in a very material blurring of the fine detail and structure in the reproduced picture. Effects of this character are shown quite clearly in Fig. 4, where the resultant television picture that is illustrated is not only harsh, due to a measure of over-modulation (often referred to as "soot and whitewash" in modern television parlance and being synonymous with the overloading effects in a loudspeaker), but the measure of misfocusing has removed the detail from the face and hair and given a relatively coarse appearance.

Cylinder Modulation

A more workable scheme was first suggested some twelve years ago, and consisted in including a hollow cylinder in the beam path, but on the screen side of the orificed anode, as shown in Fig. 5. Between this and the screen AB was interposed a mask having a small aperture in the direct electron path, and the potentials were adjusted during the quiescent condition, so that the beam was focused on the screen. The effect of the incoming signals was such that the rays were made to diverge somewhat (shown by the dotted lines), and in this way a number of the electrons were cut off and prevented from passing through the mask aperture. This variation in the diameter of the bundle of rays impinging on the mask in the neighbourhood of the aperture was sufficient to give the modulation desired by adjusting the intensity of the ray passing through the hole.

Modern Practice

With modern cathode-ray tubes used for television purposes, however, the Wehnelt cylinder actually surrounds the cathode (or filament), and this is supplied with a negative biasing potential to assist in the necessary process of fasciculation or beam concentration to a sharply focused spot on the screen. In addition the incoming television signals vary the potential difference of this cylinder with respect to the cathode, this serving to alter the intensity of the beam reaching the screen in conformity to the scanning potentials originally generated.

In Fig. 6 is shown the simplified scheme of connections for work of this nature. The initial negative bias is applied to the cylinder from the moving arm of the potentiometer R_1. The modulating signal voltages are passed from the radio receiver to the cathode and cylinder *via* the fixed condenser C. In addition, however, a stopper resistance R_2 is included between the potentiometer arm and the cylinder for the purpose of preventing these modulation signals taking the relatively low impedance path provided by the potentiometer winding itself.

Fig. 7.—Showing the result of over-correction, and slight over-modulation.

Results obtained by this method of intensity modulation are, in practice, very satisfactory, but as a general rule the nature of the electrode assembly is modified somewhat to prevent any of the picture defects (such as defocusing) detailed earlier from materialising. To give the reader an impression of the results which have been obtained under conditions simulating those of an actual service, reference can be made to Fig. 7. This is a radio-

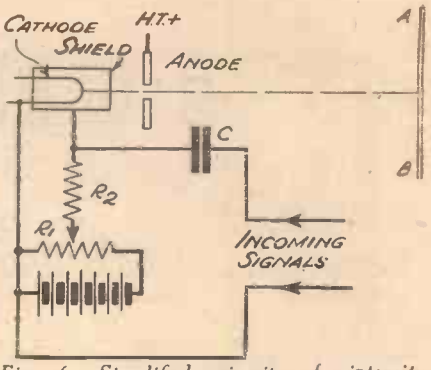


Fig. 6.—Simplified circuit of intensity modulation on the C.-R. tube shield.

received picture obtained about eight months ago. A measure of over-correction and slight over-modulation is evident by the "shadows" thrown off from the face contour, but even so it proves very conclusively that a correct intensity modulated picture is replete with very minute detail.

This is empnasised even more when the difficulties associated with photographing pictures directly from the cathode-ray tube fluorescent screen are appreciated. First of all, there is the relatively small amount of light available coupled with the short time exposure required in order not to take cognisance of the normal artist movement consequent upon performing her actions before the television scanner. Then, again, under actual "looking-in" conditions there is the accompanying sound and the eye's visual persistence, which together impart a more natural effect to the pictures watched as compared to the signal picture photographed and reproduced as evidence of television's capabilities. It must be conceded, however, that the results are more than promising and, subsequent to this picture being taken, very material improvements have been effected.

C.-R. TUBE ADVANTAGES

WHENEVER a discussion arises concerning television, one question crops up with unfailing regularity: "What advantages accrue from the use of the cathode-ray tube in the receiving apparatus to portray the radiated picture signals?" While some of the advantages may not be immediately apparent it is generally conceded that the most important are the following:

(1) The complete absence of mechanical moving parts.
(2) The noiseless operation of the apparatus as a result of advantage (1).
(3) The greater ease with which the picture can be truly synchronised, especially in the matter of eliminating the floating or hunting action which so often characterises an image produced by a disc or mirror drum.
(4) The adequate brightness of the pictures on the tube's fluorescent screen, making visibility possible even when natural or artificial room illumination is present, provided this illumination is not directed at the screen.
(5) The persistence of fluorescence of the screen supplements persistence of vision, and in this way removes partially the effects of flicker brought about by too low a picture repetitive frequency.
(6) The ease with which changes can be effected, such as horizontal to vertical scan, picture ratio, picture enlargement, alteration in number of scanning lines or picture frequency.

Auto-Bias Problems

In this Article a Few Practical Circuits are Examined, with a View to Clearing Up any Difficulty

By the Technical Staff

THE principle underlying the application of automatic grid bias is now thoroughly well known, for it is universally employed in all mains-operated receivers and occasionally in battery sets, especially when an eliminator is used for the high-tension supply. There are, however, right and wrong ways of arranging automatic grid-bias circuits, more particularly in connection with the output stage.

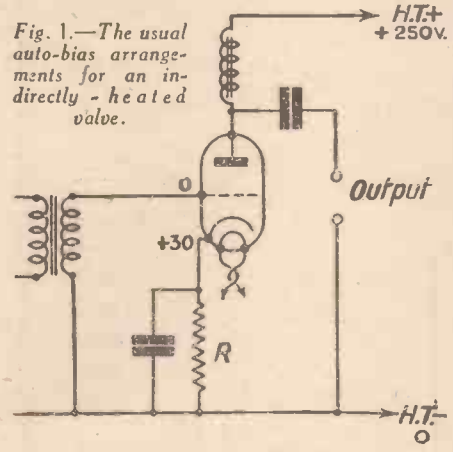


Fig. 1.—The usual auto-bias arrangements for an indirectly-heated valve.

Concerning the basic principle, it will suffice to remind readers that by making the anode current pass through a resistance connected in the cathode circuit, a voltage drop is produced which can be utilised to provide the necessary steady difference of mean potential between the grid and the cathode.

A Case Illustrated

In Fig. 1 is shown the usual arrangement for an indirectly-heated valve; the circuit is the same (except for differences in the values of resistances and condensers) for screen-grid valves, screened pentodes, triode amplifiers, and also for indirectly-heated valves of the output type. For the sake of simplicity, however, the diagram is drawn for an indirectly-heated triode having a choke-capacity output circuit. Also, for the sake of argument, it will be supposed that 250 volts of high tension are available, and that the valve requires a negative grid bias of 30 volts, and takes an anode current of 30 milliamperes.

A simple Ohm's Law calculation will show readers that in order to obtain a voltage drop of 30 ohms and 30 milliamperes, the bias resistance, R, will have to be of 1,000 ohms. If, then, we call the potential at H.T. positive +250 and at H.T. negative, zero, the potential at the cathode will be +30, and at the grid zero. This means that the cathode is 30 volts positive with respect to the grid, which is the same thing as saying that the grid is 30 volts negative with respect to the cathode.

The condenser connected across the bias resistance may be as small as 0.1 microfarad in the case of a high-frequency valve, and up to 25 or even 50 microfarads (low-voltage electrolytic type) for an output valve. It is often desirable to decouple the grid circuit, and this can be done by means of a decoupling resistance as shown in Fig. 2. The modified position of the by-pass condenser in this arrangement should be noted.

Power Loss

It must now be considered whether these arrangements are really the best in all circumstances. It can be stated straight away that no fault can be found with them for high-frequency stages, or for early low-frequency stages, but there are cases where they are not ideal for output valves. Take, for example, the case of an output triode, for which the optimum load impedance is a matter of a few thousand ohms only. The output power in the circuits shown in Figs. 1 and 2 is developed in the load (that is the speaker circuit) and in the biasing resistance, and since the resistance is of comparable value with the impedance of the load, a large proportion of the output power will be lost in the bias circuit. For example, the optimum load of the valve might be 4,000 ohms—quite a common figure, while the bias resistance is 1,000 ohms. The total impedance in the output circuit, therefore, is made up of the load and the bias resistance, and the available output power will be divided between the two in the inverse ratio of their impedances,

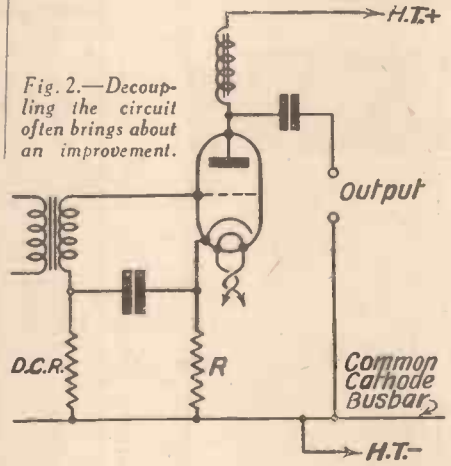


Fig. 2.—Decoupling the circuit often brings about an improvement.

so that a very substantial proportion of the power will be wasted in the bias resistance.

It is true that, in the circuit shown in Fig. 1, the by-pass condenser will prevent serious loss of the high notes, but if this condenser is only of a few microfarads capacity, the bass cut will be considerable. With a 25- or 50-microfarad condenser this loss is not so serious, but the circuit in Fig. 2, with grid decoupling, precludes any shunting of the A.C. output so far as the anode circuit of the valve is concerned, and the loss will still be noticeable.

An Alteration

Now consider the circuit of Fig. 3 and compare it with that of Fig. 2. Here it will be observed that instead of arranging the bias resistance in series with the load, so that it robs the load of a substantial part of the output of the valve, the load is taken between the anode and the cathode of the valve so that the bias resistance is not included in the output circuit. In fact, the bias resistance now acts purely as a voltage-dropping resistance, in exactly the same way

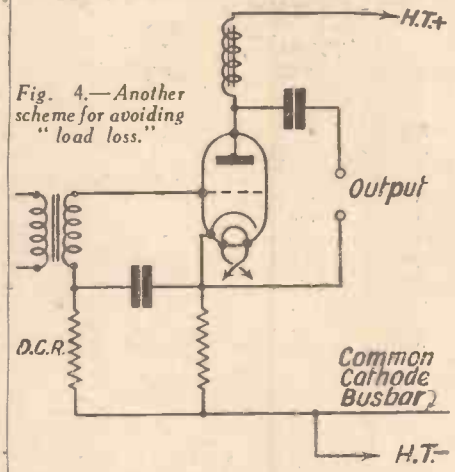


Fig. 4.—Another scheme for avoiding "load loss."

as the resistances sometimes connected in the anode feed to reduce the anode voltage.

In connection with Fig. 3, it should be remembered that this bias resistance now carries the anode currents of all the valves in the receiver, and its value should be calculated on this basis. The formula is: Bias resistance for output valve equals bias voltage required multiplied by 1,000 and divided by the total high-tension current of the set in milliamperes. This arrangement is perfectly satisfactory for receivers employing straight high-frequency stages, but when variable-mu high-frequency valves are used, either with or without A.V.C., the current in the bias resistance of the output valve will vary with the adjustment of the variable-mu valve, and the bias to the output valve will vary in proportion.

A Short Circuit

In such circumstances, therefore, it will be necessary to revert to the bias arrangement shown in Fig. 2, but the losses involved in this circuit can be avoided by the modification shown in Fig. 4. Here, the output is taken between anode and cathode and not between the anode and H.T. negative terminal. Even this arrangement

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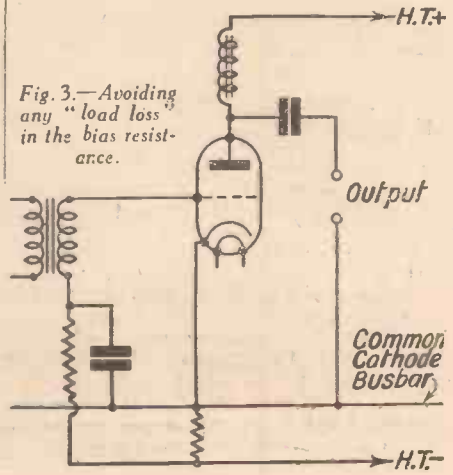

Fig. 3.—Avoiding any "load loss" in the bias resistance.

Previous articles in this series appeared in issues dated Dec. 15th, Dec. 22nd, Dec. 29th, Jan. 5th, Jan. 12th, Jan. 19th, Jan. 26th, Feb. 2nd, Feb. 9th, Feb. 16th, Feb. 23rd, March 2nd, March 9th, and March 16th.

Half-Hour Experiments

Methods of Measuring Wavelengths and of Making Different Types of Wavemeters are Explained in this Fifteenth Article of the Series.

By FRANK PRESTON

IN previous articles of this series a good deal of space was devoted to the matter of taking measurements of voltages and currents, and this evidently evoked considerable interest, judging by the large number of letters received on the subject. This week an entirely different kind of measurement—that of wavelength and frequency—is to be considered. The apparatus required for measuring wavelength is, of course, a wavemeter, and although this used to be an important part of the "stock-in-trade" of every experimenter, it is conspicuously rare at the present time. There are several very good reasons for this, not the least of which is that, since there are so many stations sending out regular transmissions, the receiver itself can very easily be calibrated in wavelengths. In addition to this, it is not now a difficult matter to obtain a set of coils and a corresponding tuning condenser fitted with a dial which is calibrated in wavelengths or frequencies.

Wavelength, Inductance and Capacity

There are, nevertheless, many occasions when a simple means of measuring wavelengths is extremely valuable, more especially when dealing with short waves,

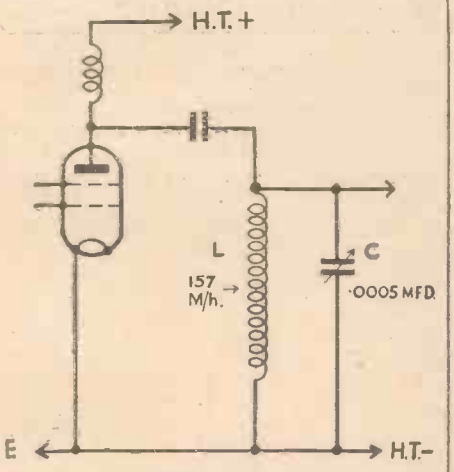

Fig. 1.—A simple tuning circuit of which the resonant wavelength can be found by applying the formula: wavelength = 1,884 $\sqrt{LC}$.

which are not so well "charted." Before proceeding to deal with the question of making wavemeters of different types it might be well to quote a very simple formula which is often valuable when considering this subject. The formula is: λ (wavelength) $= 1{,}884 \sqrt{\text{L (inductance)} \times \text{C (capacity)}}$. In words, the formula reads: wavelength equals 1,884 times the square root of the inductance of the coil multiplied by the capacity of the parallel condenser. Thus, if we consider a simple-timing circuit, such as that shown in Fig. 1, which is a tuned-grid circuit between an H.F. and detector valve, the highest wavelength to which the circuit will tune if the (medium-wave) coil

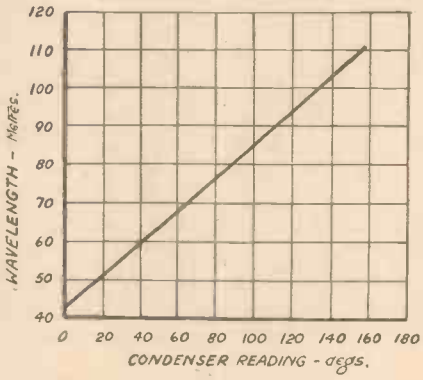

Fig. 3.—A typical calibration graph for the wavemeter. When using the components mentioned in the text the line will be practically straight.

has the standard inductance of 157 microhenries is $1{,}884 \sqrt{157 \times .0005}$, which may be re-written as $1{,}884 \times .128$, which equals 460 metres approximately. Actually, this figure would not be perfectly accurate, since the self-capacity of the coil and the capacity of the connecting leads, etc., have not been taken into consideration. It is, nevertheless, good enough for most purposes. It will be understood that the above formula can be used in several different ways to find any one of the three factors when the other two are known.

Three Types of Wavemeter

There are three general types of wavemeter, these being known as the absorption, buzzer, and heterodyne, and of these the first is by far the simplest, since it consists only of a coil and variable condenser in parallel. The arrangement of an absorption wavemeter is shown pictorially in Fig. 2 and little explanation is required. The coil may be of any unscreened type, a plug-in honeycomb coil of the two-pin type being as convenient as any. But since the meter will be required for use on all wavelengths, it is better to use a standard type of four-pin plug-in coil of the type shown. Any number of these coils can be made or bought to suit the wavelengths to be covered. Formers or complete coils are made by Eddystone, and both have been reviewed in the "Facts and Figures" section of this journal. The condenser shown has a maximum capacity of .00016 mfd., which has become a sub-standard for short-wave work. It should be added, however, that since there are no stray capacities in circuit, a condenser of this value will cover a really wide band of wavelengths on any range. As the condenser will require to be calibrated, a large circular dial marked off in degrees or other equal divisions is desirable, and a good slow-motion component is to be preferred for the sake of accuracy.

Using an Absorption Wavemeter

The method of using the absorption wavemeter is perfectly simple, and consists of placing the coil (which may be mounted on a small box containing the tuning condenser) fairly near to the aerial lead-in of the receiver. A station should then be tuned in on the set, after which the wavemeter condenser is adjusted until signal strength is reduced to a minimum. When this condition obtains the wavemeter and receiver are tuned to the same wavelength, since the former is "absorbing" the greatest amount of energy from the tuning circuit of the receiver. The wavelength of the station received being known, a note can be made of the setting of the wavemeter condenser for that wavelength. Other stations can then be tuned in and the meter calibrated on as many of these as possible. It is an advantage to prepare a graph, such as that shown in Fig. 3, so that the wavelength of the meter for any par-

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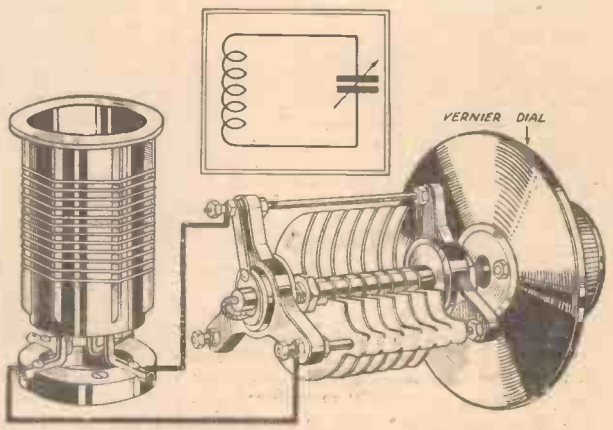

Fig. 2.—Theoretical and pictorial circuits for the simplest type of wavemeter—the absorption type.

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ticular setting of the condenser can easily be determined. It will be evident that this procedure will have to be repeated for each coil—and thus for each wavelength range—for which readings are required.

Once the meter has been calibrated the wavelengths of unknown transmissions can be found by repeating the procedure followed in calibrating the meter. Provided that sufficient and suitable coils are available, any wavelength from about 10

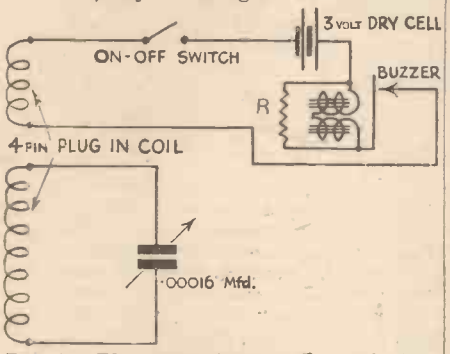


Fig. 4.—The circuit for an efficient buzzer wavemeter of the type described.

metres upwards can be determined. Lower wavelengths could, in fact, be dealt with, but readings would not be very accurate and would be rather difficult to obtain, due to the use of a comparatively large tuning condenser. A similar wavemeter for ultra-short wavelengths could be made, however, by following the arrangement illustrated and using a condenser having a maximum capacity of about 35 micro-microfarads.

Making a Buzzer Wavemeter

The buzzer wavemeter does not differ materially from the absorption type, but consists of two separate circuits inductively coupled together, as shown in Fig. 4. It will be seen from the latter diagram that the tuning circuit is the same, but that the secondary circuit contains a buzzer, battery, and switch. Again, the coil may be of the four-pin plug-in type, the secondary winding having about one-half the number of turns used on the primary and being placed about ¼in. away from it. With regard to the buzzer, this may be of any good high-note type, and there are many inexpensive instruments available from ex-Government stores. It will be seen in Fig. 4 that a 15-ohm fixed resistance is wired in parallel with the eleetric magnet winding of the buzzer, and the purpose of this is to make the note more even, and to avoid the "splashing" which is often noticeable due to back-E.M.F. A suitable resistance can be made by winding 2yds. of 36-gauge enamelled Eureka resistance wire on a small bobbin, or, alternatively, a buzzer already provided with a suitable resistance can be obtained from Eddystone. To prevent the mechanical vibration of the buzzer being transferred to the container, which would act as a sounding board, it is best to mount the component on rubber buffers which may be cut from a length of tubing.

Whereas the absorption wavemeter acts as a "receiver," the buzzer type of instrument may be considered as a "transmitter," since it does actually send out a note. Reference is not made to the audible buzz (which should be suppressed as much as possible), but to its electro-magnetic equivalent which can only be heard through a receiver after rectification. Thus, the buzzer wavemeter is simply placed some distance away from the aerial lead to the receiver, and adjusted until the transmitted note is heard at greatest strength in the speaker or 'phones. Most accurate readings are always to be obtained when the meter is so far away from the receiver that the note can only just be heard when the two circuits are exactly in tune. For this reason, when calibrating the buzzer wavemeter it may even be found necessary to place it in a different room from that in which the receiver is housed, particularly if the set is of a very sensitive type.

A Third Type of Meter

The heterodyne wavemeter is identical in principle with a miniature transmitter, and also with an oscillating detector. It consists of a tuned circuit coupled to a valve having a reaction coil in its anode circuit. For this reason it would be possible to employ an ordinary single-valve receiver as a wavemeter provided that a sufficiently-accurate dial and slow-motion drive were fitted to the tuning condenser. In practice, however, it is generally better to use a rather different arrangement in which the degree of reaction coupling is fixed, and a suitable circuit is shown in Fig. 5. A four-pin plug-in coil is again used, and tuning is carried out by means of a .00016-mfd. condenser as before. The grid coil is tuned and the coupling coil, which serves for reaction, is untuned.

Using a Heterodyne Wavemeter

The heterodyne wavemeter is used in a similar manner to the buzzer type, with the exception that the note (high-pitched) whistle heard in the speaker or 'phones indicates a tuning point slightly off resonance. The whistle is heard at two points of the wavemeter tuning scale, one of which is slightly above, and the other slightly below, the resonance point. It is the silent point between the two whistles which should be observed. Just as with the

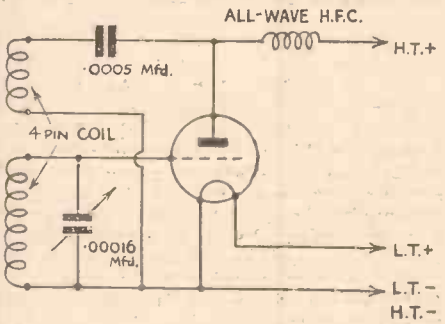


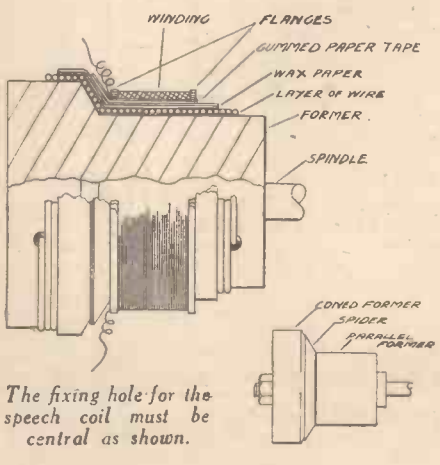
Fig. 5.—Showing the circuit of an oscillator suitable for use as a heterodyne wavemeter.

buzzer wavemeter, it is necessary to keep the instrument as far away from the receiver as possible, so that only a faint "chirp" is heard as the wavemeter tuning condenser is rotated about the resonant point.

MAKING MOVING-COIL LOUD-SPEAKER SPEECH COILS

WHEN it is necessary to rebuild a moving-coil loud-speaker; and there is difficulty in obtaining a suitable former of the correct size and thickness, a suitable job can be made from gummed paper strip. A former of brass or ebonite should first be turned some thousands of an inch smaller in diameter than the internal diameter of the former required. This is to allow for the thickness of a layer of wire which is placed on the former first, and also a layer of thick wax paper, to allow of the easy removal of the finished speech coil. One end of the former can be shaped to a cone to simplify the fitting to the large cone, and if this is required the former should be turned to allow for this. The sketch shows a section of the completed coil, and the following notes describe how this condition is reached.

A layer of enamelled wire is first wound on the former, secured at the smaller end in a hole drilled in the former and jammed there with a match stick. The wire is carefully wound on turn by turn, up the coned portion, and then for a short distance along the larger diameter, and the end secured in another hole. A layer or two of thick wax paper is then wound over the wire so that the diameter is the same as that required for the finished former. The wax paper is secured by placing a warm iron on the paper, thus melting the wax. A strip of gummed paper is then properly wetted, and stretched tightly round the former; the paper forming itself up the slope of the cone. A layer of cotton or wire is then wound on the former to press the gummed paper as tightly into position on the former and cone as possible. The



The fixing hole for the speech coil must be central as shown.

coil can be left for a few hours to dry, after which the binder is removed. Then prepare some very narrow strips of paper, and gum these on the former to form a ridge of the required height.

Winding the Coil

Now start to wind the coil proper. Secure the first end under a strip of paper near the cone end, and wind on the requisite number of turns, finishing the top layer at the cone end of the coil. The final end of the wire is secured by means of a thin strip of paper. The whole coil can be given a good coat of cellulose dope and left for a day or two to thoroughly dry and harden off. To strip the coil all that is necessary is to pull out the end of the first layer of wire, when the coil will slip off the former, and the few layers of wax paper are then removed from the inside of the former. In those cases where a spider is required in the centre of the former this can be done by separating the cone and the parallel portion of the former, clamping the spider which is previously cut to shape between them and proceeding as described above, with the exception that the first layer of wire must not be continued up the cone, but the circumference of the spider glued to the gummed paper. Made in this way the fixing hole for the speech hole must be central. This is shown in the smaller sketch. —W. H. F. (Middlesex).

On Your Wavelength

by Thermion

The Modern Tower of Babel

I HAD the temerity to state in a previous issue that we Southerners speak the best King's English. I am willing to admit this is a debatable problem—but it is my confirmed opinion, on the principle that a man convinced against his will is of the same opinion still! But ye gods and little fishes! I have been snowed under, *and* over, from readers in Lahncashire, Sco'land (yo ken!), Yorksheer, Wales (look you, whatteffer!) and Ireland (begorrah!). Each reader claims that his particular spot of country is that in which purest English is spoken. Well, well! I don't intend to settle the problem, except to say this: there are many excellent dictionaries in which will be found pronunciations. One dictionary may give one pronunciation, whilst another gives a different pronunciation. Hence, no one can lay down a hard-and-fast rule where authorities differ; but there are certain words on which *all* dictionaries are agreed, and I am yet to find a dictionary which supports, say, the Scottish pronunciation of night as *nacht*, the Irish as *Oirish*, the Yorkshire Book as *Booook*, butter as *booter*, or man as *mun*. If you go to the South West you will find Somerset pronounced as *Zummerzett*, and so on. Notwithstanding the B.B.C. pure English campaign, many vocalists seem unable to speak King's English. Here are a few vocal examples recently heard:

"*Naw rauser in arl the warld,*
Unner tiller yau camer."

I will leave you to guess the tune. Here's another:

"*Giver mee-er yawrer seemile,*
The lerver lighter inner yaw rise."

And another:

"*. . . the dyar seelvar thut shanes inner yau rer,*
. . . Yau brow tha' sall wrrrrrinkleder with kur."

I could give you many other examples, but will leave you to spend a pleasant half an hour listening for similar examples. You can make quite a hobby of it. And don't forget the *boo boo boo* folks, and the *hutcher cher cher*. Sez me!

Use the Indexes

MANY readers may be unaware that indexes for all issues of PRACTICAL AND AMATEUR WIRELESS (not *Amateur Wireless*) are available from us for 4d. each post free. I mention this because if you consult those indexes you will find many of the articles for which you ask have already appeared. It is also possible that the question you wish to ask has already been answered, which reminds me that it is always advisable to have your copies of PRACTICAL AND AMATEUR WIRELESS bound. Binding cases are supplied complete with indexes and title pages for 2s. 9d. or 3s. by post.

At the Croydon Radio Society

I WAS present as an uninvited guest at the recent lecture on the Constructor and the Press given by Mr. F. J. Camm, the Editor of PRACTICAL AND AMATEUR WIRELESS, on March 12th last, at St. Peter's Hall, South Croydon. This proved to be a most illuminating evening, for notwithstanding my lengthy association with the Press I learned a good many things which I did not know before, both from the lecturer and from the discussions and the lecturer's answers to questions which followed.

Crooners Again

APROPOS my remarks about that lowest form of life—crooning—I have just received the following letter:

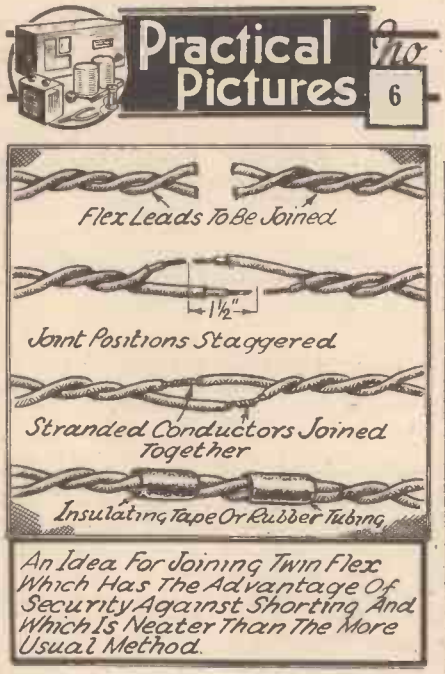
"DEAR THERMION,

"Although I did not read your article on crooners, I can easily guess the general idea of it. But I did read the article about Signature Tunes. You showed, as most writers of anti-jazz propaganda do, a narrowmindedness throughout which is typical of British people. And I find some of your statements rather strange, such as, you have never seen anyone listening to dance music, as they always turn off the switch at the first sound of the signature tune, and yet how could they know whether they would like what was to follow if they never listen to dance music? You yourself must listen to know that the bands sign off with a "triumphant blare." Don't you think it is possible for people to get so used to the announcer's voice that they can quite easily miss the name of the band; that is where the signature tune comes in.

"I agree on the lyric question, ninety per cent. are sheer tripe, apart from the people who attempt to imitate our American cousins. But I do not agree that jazz is so low (not dance music, mark you); a proper rendering of jazz can be a wonderful self expression in music which is far more natural than the stereotyped symphonic tripe which wastes the best hours of the evening on the radio, and which is only fit for over-civilised highbrows to which class you belong.

"Maybe the Editor will think you are good if you get lots of letters like this."

This reader concludes with the pious hope that I may get the sack. Apparently his argument is that all the B.B.C. programmes should be subjugated to the interests of the lower orders of intelligence to which by inference my correspondent belongs. The tenor of his letter indicates why it is that crooners can make a living and are allowed to live. I duly consign this letter to the usual undignified place accorded such documents.



Trade Apathy

MR. JACK HARVEY, a radio engineer of Cambridge, sends me the following interesting letter:

"The letter in your issue of March 2nd from a local correspondent airing his grievance against retailers is particularly interesting.

"For some time it has been very clear to me that the apathy of the trade has been the chief cause of the decline in amateur constructing, to the detriment of everyone concerned, the constructor himself, the manufacturers, the Press, and also the few dealers who would be willing to take an active interest in this side of radio.

"What seems to be required is that means be found for bringing together the constructor and the trader who is willing to help him, surely not an insurmountable difficulty.

"I have always made it a part of my policy to offer the fullest possible service to constructors, but it is difficult to get the fact known. Ordinary local advertising would be of no use; it would only result in one of two things: the constructor would expect everything he wanted in stock or to see his selected circuit working as a complete receiver, both of which are, of course, impracticable.

"The suggestion I have to offer is that a permanent list of traders be compiled and either published from time to time or be made available on application, after the fullest possible investigations have been made, and at the same time make it perfectly clear to readers not to expect the impossible, such as the two points mentioned as objections to local advertising.

"I feel sure that if this scheme were explored to the full it would do more than anything else to revive home construction, and shall be only too pleased to go further into details."

I should like to have other readers' views regarding the scheme suggested in Mr. Harvey's letter.

Pictorials or Theoreticals?

I WAS interested in the discussion at the Croydon Society lecture aforesaid, at the objections some members made regarding pictorial diagrams. Most of them were of the opinion that theoretical diagrams should suffice. Personally, I disagree. Those pictorial diagrams of which we give a generous proportion, and which are fairly costly to produce, are intended for the unconverted and for those who join the ranks of home construction

(*Continued overleaf*)

(*Continued from previous page*)

every week, and are hence making their acquaintance with radio technology and nomenclature for the first time. They are quite unacquainted with the shorthand of wireless, and anything which holds their interest and helps them to understand the technique a little better is well worth while. If every diagram in PRACTICAL AND AMATEUR WIRELESS were of a purely theoretical nature I am quite certain that the would-be constructor would be scared of attempting to make a receiver. However, perhaps you would like to express your views in the correspondence columns.

All-wave Reception

UNDER the above heading I wrote, in the issue dated March 9th: "I wonder how many . . . experimenters have given their attention to the design of an all-wave set"; and also: ". . . the point to decide is whether we shall find it better . . . to have two entirely different sets for . . . broadcast and short-wave bands, or whether a single receiver will adequately meet our needs." A reader, A. L. W., of Walthamstow, replied to my query by sending a circuit diagram of a four-valve all-wave receiver which he has built and which he claims to have proved entirely satisfactory. With regard to the receiver he writes: "Making use of a pair of all-wave coils, and using a wooden baseboard with bakelite panel, I can truthfully claim that I have had nearly two years of successful listening. Every Sunday this year between 2 and 4 p.m. I have obtained (mostly with perfect clarity) VK2ME, Sydney, and, of course, the usual bag of Americans from, say, 7.30 p.m.—moon or no moon. Now this is not a boast, but an attempt on my part to ally you to the side of the all-wave set."

He continues to write: "When you consider that I have practically no real technical knowledge and that the outlay was only a few shillings more than it would have cost to assemble an ordinary broadcast receiver, I think you will agree that all-wave listening should not frighten the newcomer." In view of these remarks I am inclined to agree.

My correspondent concludes by writing: "Why not persuade your technical staff to produce a battery model (all-wave receiver) for use with a reasonably sized eliminator? I guarantee that you will add considerably to your already large number of readers. Incidentally, I have every copy of PRACTICAL WIRELESS (except for one or two I missed while in hospital) right from Number One."

I have certainly passed on the remarks of A. L. W. to the technical staff, and I believe that they have not fallen on stony ground, if I may mix a rather inapt metaphor. Thanks very much for your interesting letter, A. L. W.!

Wireless Symbols

ANOTHER reader who is interested in short-wave work asks if it would not be possible, and desirable, to modify the conventional symbols for short-wave coils by indicating the coil by means of the same number of loops as there are turns, indicating beside the diagram the diameter of the former. I replied to the effect that I could not see how this scheme would prove worth while, since it would necessarily involve the use of somewhat different symbols for short-wave circuits from those employed in circuits for broadcast receivers. At least, I should not like to draw, say, 250 loops in a circuit diagram, would you? Nevertheless, the suggestion might prove valuable in certain instances, and the letter is appreciated. This correspondent concludes his letter by writing: "I think it is fine the way that the Short-wave Section of PRACTICAL AND AMATEUR WIRELESS has been enlarged—this is now the most interesting section in the whole mag."

Notes from the Test Bench

CONVERTING AMMETERS TO VOLTMETERS.

MOST receiver defects can be located by means of a reliable milliammeter and a voltmeter, and it is therefore rather surprising that so little use is made of these instruments by the home constructor. Perhaps this is a question of expense, however, as most readers will probably have found that the cheaper type of meter does not give an accurate reading of the output voltages of an eliminator. A reliable milliammeter having a maximum scale deflection of 5 m.a. can be obtained for approximately 25s., however, and this can easily be converted into a fairly reliable voltmeter, as a voltmeter is merely a calibrated current measuring instrument. If it is desired to measure voltages up to 500 volts—this is the highest voltage normally met with in home receivers—a resistance of 100,000 ohms should be connected in series with one of the milliammeter leads. When voltages are measured, it will only be necessary to multiply the reading registered in milliamps on the meter scale by 100. For example, if a reading of 2 m.a. is obtained the actual voltage will be 200 volts.

COST OF RUNNING MAINS SETS.

WE often receive inquiries concerning the cost of running A.C. mains receivers. The calculations involved are quite simple, however, it being only necessary to find the wattage consumption of the transformer primary. To obtain a rough estimate of this consumption the wattage consumption of the transformer secondary windings should be added together, 25 per cent. being then allowed for losses in the transformer core. For example, in a three-valve mains receiver using four-volt one amp. valves, the L.T. winding wattage will be 12 watts, and if the usual type of power pentode valve is employed in the output stage, the H.T. winding wattage will be approximately 40 watts—assuming that an H.T.8 rectifier requiring an input of 200 volts at 200 m.a. is used. The total secondary consumption will then be 52 watts and this plus 25 per cent. will give a primary consumption of 65 watts. This is equivalent to the consumption of the average electric lamp, and one unit of electricity will supply the receiver for approximately sixteen hours.

HOME-MADE COILS.

SOME constructors seem to be under the impression that very accurate inductance matching of coils is not necessary if the gang condenser is provided with trimmers. This is a fallacy, however, as the trimmers are provided merely for balancing the stray capacities in the tuned circuits, and it is essential that the coil inductances be equal. If instruments are not available for matching the coils, the easiest procedure will be to connect each one in turn in a single tuned stage receiver, varying the inductance until the local station tunes in at the same condenser dial setting for each of the coils. It will not be necessary to remove turns from the winding to obtain this correct reading, as the inductance may be lowered by increasing the distance between the turns— a few turns at the top of the winding may be pushed higher up the former until the required inductance is obtained.

HEATER WINDINGS.

IT is often found that commercial mains transformers have not been designed to provide the exact current required by the valve heaters. For example, many of these transformers have two heater windings, one rated to supply four volts at 1 amp. (for rectifier filament), and the other rated at 4 volts 5 amps. (for the receiver valve heaters). If the 4 volt 5 amp. winding is used for supplying less than five 1 amp. valves, however, the voltage will rise in excess of four volts, the actual increase being governed by the current requirements of the valves, and the regulation factor of the transformer. It is, therefore, advisable to fit a dissipating resistance across the winding in order to keep the voltage at 4 volts. The required resistance value can easily be calculated by the application of Ohms Law. Taking an example, a receiver consuming 4 volts at 2 amps. will require a dissipating resistance of 1½ ohm having a wattage rating of 12 watts, or higher. The ends of the resistance should be connected to the end terminals of the transformer winding.

IMPROVING SELECTIVITY.

SELECTIVITY is a very essential requirement for the present-day receiver owing to the congested state of the ether. There are probably many readers, however, who cannot afford to buy an expensive 1935 superhet, and wish to improve their existing straight receiver at the least possible expense. Some of the older types of straight receivers incorporate an inter-valve coupling of the tuned grid type having the S.G. coupling condenser connected to the grid end of the detector tuning coil. In such cases selectivity can be improved by converting the tuned grid coil into an H.F. transformer, this being done by winding approximately fifty turns of 34 S.W.G. wire on a former of smaller dimensions than the grid coil former and inserting this extra winding inside the existing coil. The S.G. coupling condenser and H.F. choke should then be removed, and the S.G. cap terminal connected to one end of the extra 50-turn winding, the other end of this being joined to the H.T.+ lead previously connected to the H.F. choke.

Television in Germany

I READ that high-definition television broadcasts are shortly to be made in Germany. It is proposed to broadcast the programmes three times a week between 8.30 and 10 p.m., Central European Time, and they will be sent out on ultra-short wavelengths, the system to be employed using 180 lines and 25 pictures per second. It will be recalled that similar transmissions have been made before, but these were only of an experimental nature, whilst those now proposed will be more in the nature of a public broadcasting service.

I shall be interested to see whether Germany or Britain is the first to establish a reliable high-definition service, but it rather appears that Germany will win, for the new transmissions are tentatively timed to start in a few days from the time I pen these notes, and they *may* be in operation even before you read this page.

The Status of the Radio Engineer

A SHORT time ago I commented in these columns on the many inefficient so-called wireless engineers and dealers, and pointed out that it was time that something was done to raise the status of these people in the interests of the wireless public. I am reminded of this by an advertisement which recently appeared in a certain trade journal for a fully competent man capable of taking complete charge of the technical side of a large firm of suppliers. The advertisement set out the remarkably high qualifications which an applicant must possess and then stated that the salary would be £150 per year. I do not know how many applications were received, but I certainly cannot believe that anyone who had spent sufficient time studying wireless and in gaining the necessary experience to hold such a post could afford to work for so small a remuneration. If firms cannot see their way to pay a man his due it seems that they must be content to employ inefficient men—to the disadvantage of the constructor and set buyer who want service and occasional advice.

A Matter for Congratulation?

THE Breslau station, for some months has made a feature of broadcasting felicitations to listeners who attain the anniversary of their ninetieth birthday, and to couples who celebrate their "diamond" wedding. Official congratulations are now sent to mothers who have given a family of ten children to the Fatherland.

How Many Listeners?

ACCORDING to statistics recently published in Switzerland, over forty-three million wireless receivers are switched on daily in the world. Of these, roughly 18.6 millions are used in Europe alone.

Broadcasting a Hunger Strike

ONE of the most popular announcers in the Mexico broadcasting world who, having offended the station director, had not been paid for some months, instituted a hunger strike as a protest. In view of his reputation with listeners he continued to carry out his duties, and daily, flanked by two hospital nurses, appeared before the microphone to broadcast details of his failing health. Owing to vigorous protests made by his unseen audience the station authorities paid him to date and retained his services.

THAT DODGE OF YOURS!

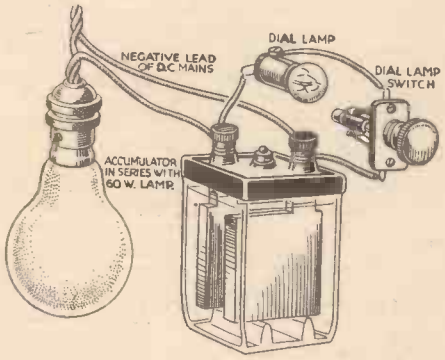
SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

An Accumulator Dodge

NO doubt, there are many readers who still have their pilot lamps connected to the filament terminals of the valve-holder, thus causing extra drain on the

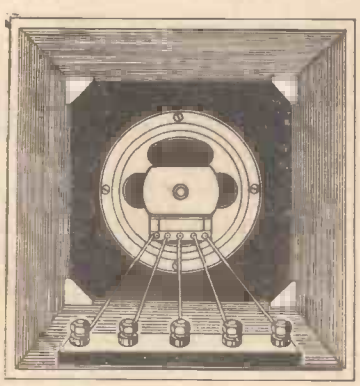


An economical method of using a dial lamp.

accumulator. A very simple method of overcoming this, and at the same time saving current, is illustrated in the accompanying sketch. An old accumulator is connected to the house lighting supply, as shown, and an extra switch incorporated on the panel for switching off the pilot lamp when not tuning. The accumulator is on charge when the house light is burning, and while the main accumulator is at the charging station, the old accumulator can be brought into service for supplying the low-tension. When used as stated, the two wires that go to the accumulator should be connected together.—H. HOSTICK (Hull).

Loud-speaker Terminal Strip

MOST loud-speakers have five terminals, two or three only of which are used. Various settings or ratios can be obtained by using alternative terminals, but once the speaker is in the cabinet, it is often very difficult to make these alterations without taking the speaker out of the cabinet. A simple method of remedying this difficulty is to fasten a strip of ebonite



A terminal strip fitted inside a loud-speaker cabinet to facilitate the adjusting of transformer ratios.

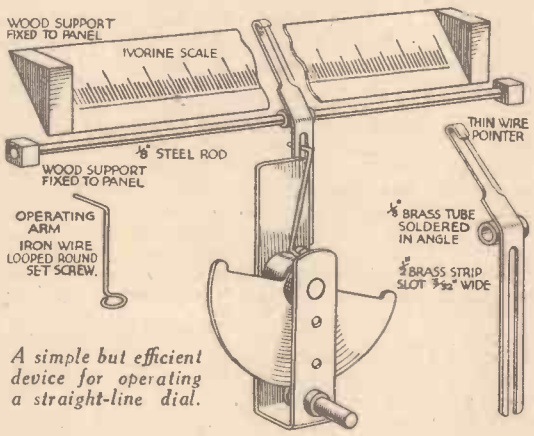
THAT DODGE OF YOURS!

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.

(or other suitable material) along the bottom of the cabinet, near the back edge, with five screw terminals placed at convenient distances apart, as shown in the sketch. Make permanent wire connections between these and the speaker terminals, and number them similarly. You can then experiment with various settings quite easily.—H. PRITCHARD (Wolverhampton).

A Straight-Line Dial

THIS handy device is made from an old slow-motion dial from which the scale has been removed. A piece of iron



A simple but efficient device for operating a straight-line dial.

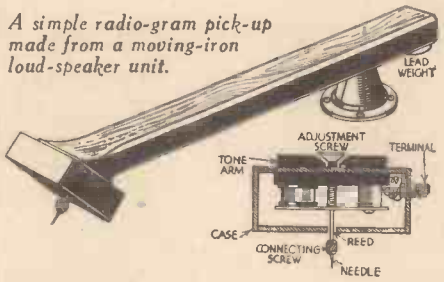
wire is then clamped under the fixing screw on the collar, as shown in the sketch. The length of this arm can be made to suit a scale of any length; it is half the scale length minus ½in. The slow-motion gear should be placed a short distance from the panel to allow for free passage of pointer carriage.

The chief feature of this dial is that it is placed at an angle, and is, therefore, more easily seen. Other details of construction are clearly shown in the accompanying sketches.—A. BOXALL (Anerley, S.E.).

An Improvised Radio-gram Pick-up

A VERY efficient radio-gram pick-up can be made by using a moving-iron loud-speaker unit in the following way. Cut the reed to within 1½in. of the moving iron, remove the cone washers from the connecting screw, and fix the screw on to the reed. A needle may now be fitted at the other end. A suitable arm, as illustrated, can be made from a piece of wood cut to shape. The unit can now be

A simple radio-gram pick-up made from a moving-iron loud-speaker unit.



mounted at an angle of 60 degrees, and the two leads connected to the set as usual.—M. PULVER (Luton).

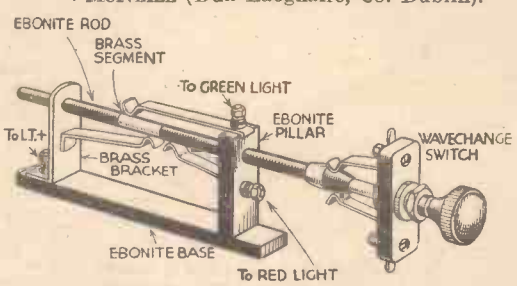
A Wave-change Indicator

A USEFUL wave-change indicator is shown in the accompanying sketch. Two lamps (red and green) are mounted close behind the dial, one terminal of each being taken to the L.T.+, while the remaining two are taken to the switch, which is shown connected to the wave-change switch.

An ebonite rod is mounted in two brackets (one of brass, and the other of ebonite) which, in turn, are mounted on an ebonite base. Three brass contact strips are made, and mounted, as shown, one on the brass bracket, and two on the ebonite bracket, terminals being fitted to each. Lastly, a strip of thin sheet brass is wrapped round the rod in such position that when the rod is moved to and fro it cannot touch both outside contacts at the same time.

To connect the two switch rods together, a thread is put on the end of the ebonite rod by heating it and screwing a nut along it, while the ebonite is still soft. The end is then screwed in the end of the plunger of the wave-change switch.

In operation, when the switch is pushed in, the green lamp is lit, and when pulled out, the red light is switched on, thus indicating the wavelength band.—R. S. MCNEILL (Dun Laoghaire, Co. Dublin).

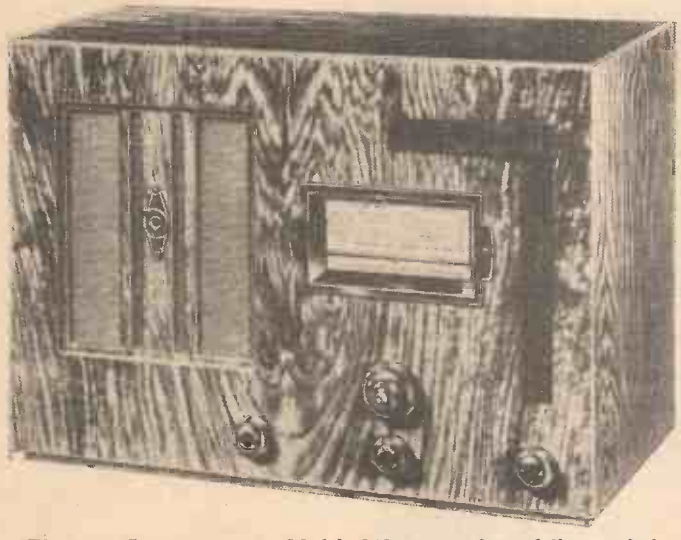


A combined wave-change and dial lamp switch.

NEW COSSOR UNIVERSAL RECEIVER

UNIVERSAL A.C./D.C. receivers have now firmly established themselves on the British market although, generally speaking, our manufacturers were reluctant to introduce them, and rightly so, as this type of receiver should be more or less equal in performance to a similar A.C. or D.C. type, and equally reliable. Until comparatively recently this has not been possible, but to-day the universal receiver can hold its own.

The Cossor universal receiver, Model 369,



The new Cossor receiver, Model 369, in its beautifully marked walnut cabinet, showing the full-vision tuning scale and neat arrangement of control knobs.

is a recent introduction and is an addition to the Cossor Super Ferrodyne range of three-valve sets; although generally similar to its A.C. brother this receiver has one or two distinct features.

The H.F. Stage

The first stage is designed round the Cossor universal H.F. pentode, working with the same iron-cored aerial and anode coupling that distinguishes this range of receivers; these coils have efficiency quite above the average, and owe their success to the particular type of iron core used, and to the use of litz wire on glass formers.

The detector is also an H.F. pentode which gives the advantage of high gain, low coil damping, and minimum high note cut; the advantage of the low coil damping is reflected in the receiver, as it allows foreign stations to be found without using reaction.

Although the first and second valves are pentodes this is not an all-pentode set, as a super-power valve is used. This choice was made for two reasons, firstly to eliminate hum which is liable to creep into the last stage as the valve must necessarily have a 40-volt heater. It is interesting to note that the control grid of this valve is brought out to a terminal on top of the bulb, like a screen-grid valve, as a precaution against hum.

The second reason for using a triode output valve is to secure adequate output with first-class quality at low anode voltages; it will be realised that since there is no transformer, the total H.T. supply is the mains voltage less the voltage lost across the smoothing choke and loud-speaker output circuit. On a 200-volt main the anode voltage would be 170 volts, or even less, but the output valve in this set—Cossor 402P—is capable of giving a really healthy output under such conditions.

The Power Pack

The power pack is designed on generous lines, and uses the Cossor 40SUA indirectly-heated rectifying valve. The whole is constructed on a thick pressed steel chassis, and is strongly made in the best possible manner. Plugs and sockets are fitted for aerial and earth, etc., thus avoiding exposure of the chassis which is undesirable on receivers that may be used on positively earthed D.C. mains.

The cabinet is finished walnut, with an inlaid panel of contrasting grain, and is fitted with bakelite knobs and escutcheon to match. The controls are simple and consist of the usual single knob tuning with a concentric pre-set trimmer knob working a travelling pointer on a horizontal full-vision wave-band illuminated scale. The other two controls are variable-mu bias and reaction, giving variable control of selectivity and volume; the wave-change switch has a position for gramophone in addition to "off," and long and short waves.

Performance

Cossor model 369 acquitted itself remarkably well on test, and was well above the standard expected from a three-valve set of the ordinary mains type; it certainly loses nothing by being universal in its application.

When used intelligently the receiver is capable of great selectivity, using the volume and reaction controls in conjunction with each other. In S.E. London only one channel was lost on each side of the local, which is a performance equal to many superhets.

Stations Received

The range is equally good, and some thirty programmes were available at good entertainment strength and clarity. The quality of reproduction is particularly pleasing, and the moving-coil loud-speaker is quite free from any signs of distress, although the volume available is considerable when working on either alternating or direct current mains.

Perhaps the most remarkable feature of this receiver is the complete absence of mains hum on either type of current supply. We were so impressed that a special test was made on some D.C. mains known to be noisy and unkind to universal receivers. Once again the precautions against hum proved adequate as the set was silent.

Provision is made for extension loud-speaker and gramophone pick-up, and the instrument, complete with a long mains lead and fitted with dual bayonet two-pin adapter, is listed at £8 18s. 6d., which is a very moderate price for such an efficient and well-built radio receiver.

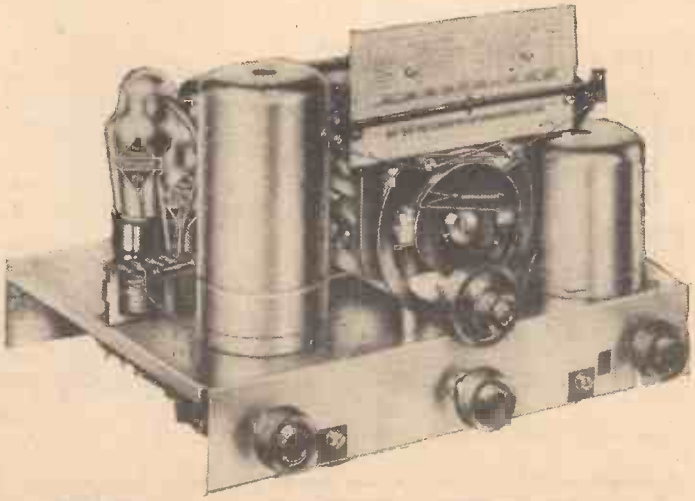
SPECIFICATION IN BRIEF

Receiver: Cossor 4-valve Universal All-Electric Receiver, Model 369.

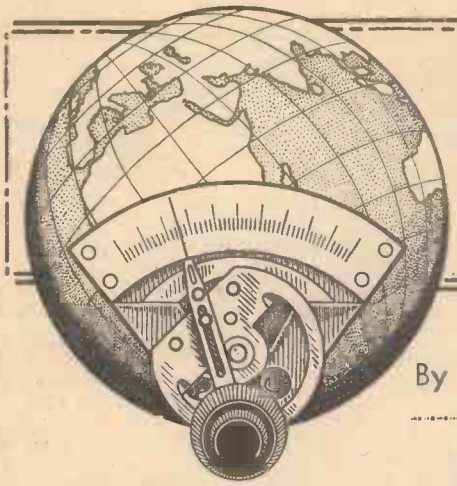
Makers: A. C. Cossor, Ltd.

Specification: Four Valves. Variable-mu H.F. screened Pentode, H.F. Pentode Detector, Super-Power Output and Indirectly-heated Rectifier. Fully screened super selective iron-cored coils. Single knob dual-pointer tuning with horizontal full-vision scale calibrated in wavelengths and illuminated according to waveband in use. Combination switch for "on-off," wavelength change and gramophone pick-up. Selectivity control and volume control. 8in. permanent magnet moving-coil loud-speaker of the latest type. Handsome walnut-finished cabinet, 13¾ins. high, 20ins. wide, 10ins. deep. Provision for extension loudspeaker.

Price: £8 18s. 6d. For D.C. 200/250 volts (adjustable) and A.C. 200/250 volts (adjustable), 50 to 100 cycles.



Front view of chassis, showing the neat layout of components.



SHORT WAVE SECTION

H.F. Amplifiers on Short Waves

By "EXPERIMENTER"

MOST short-wave receivers use a detector valve unaided by any high-frequency amplification because it is contended that no useful amplification can be obtained from such a stage below about 150 metres. This is not true, however. Admittedly, the amplification is not as great as can be attained on ordinary broadcast waves, but at the same time it is worth while, and the amplifier gives the additional advantages of increased selectivity and stability of operation.

An Untuned Amplifier

The simplest H.F. amplifier is untuned. Such a stage would be useless on medium waves, but on short waves it isolates the detector from the aerial, and also removes dead spots in the reaction control, where the detector valve refuses to oscillate owing to high damping of its grid circuit, and eliminates the effect of a swaying aerial on the signals received. It also gives some amplification.

The circuit is given in Fig. 1. The grid circuit of the screen-grid H.F. valve V_1 consists simply of a special short-wave high-frequency choke L_1, made by winding fifty turns of 36 s.w.g. d.s.c. wire on a ½-in. diameter ebonite or paxolin tube. The screen-grid valve is coupled to the detector by means of another H.F. choke (HFC_1) and a .0001 mfd. condenser C_2. HFC_1 must have different characteristics from L_1 or there is a risk of instability in the amplifier. C_1 is a .01-mfd. mica screen-grid decoupling condenser. A non-inductive paper component may be used.

The detector circuit is standard, and the component values were given in a recent article in PRACTICAL WIRELESS. Band-spread tuning is used, C_3 being .000025 mfd., C_4 .0001 mfd. and L_2 and L_3 plug-in coils. C_5 is a .00015-mfd. reaction condenser and C_6 .0001-mfd. grid condenser, R_1 being a 5-megohm grid leak. HFC_2 is a short-wave H.F. choke; its characteristics must not be the same as those of HFC_1.

This circuit can be assembled without any screening between the H.F. and detector stages, although the components should not be crowded. No additional tuning control is introduced. In fact tuning is simplified, since there is no possibility of dead spots being troublesome.

Though not so simple to set up, the tuned H.F. amplifier offers the additional advantages of giving greater amplification and increased selectivity, as well as removing dead spots, etc. In this case the untuned choke is replaced by a tuned circuit L_1 C_2 C_3 (Fig. 2). C_2 and C_3 have the same values as C_5 and C_6 of the detector circuit, namely .000025 and .0001 mfd. The smaller condensers, C_2 and C_5 may be ganged together; the two separate .0001 mfd. condensers C_3 and C_6 are used for band setting. No difficulty need be anticipated in ganging since the H.F.-stage tuning is relatively flat.

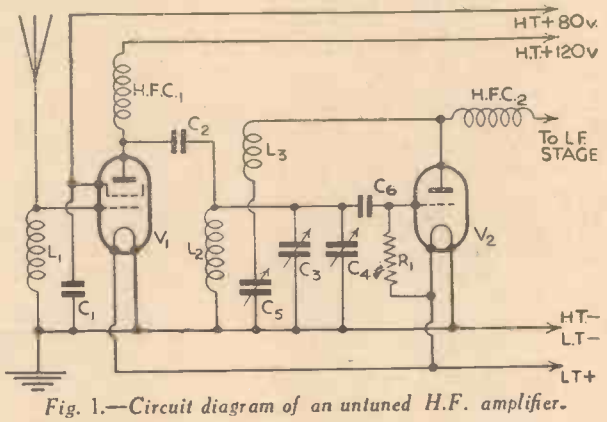


Fig. 1.—Circuit diagram of an untuned H.F. amplifier.

Flat Tuning

Owing to this flatness of tuning, however, it is comparatively easy to use the receiver without ganging, since the two dials do not have to be kept exactly in step in order to hear stations over a small band of wavelengths. Thus, having selected one of the bands containing broadcast stations by means of the band-setting condensers C_3 and C_6, initial searching is carried out on the detector band-spreading condenser C_5, and when a station is heard it is brought up to maximum strength by tuning C_2. The aerial is coupled through the .0001 mfd. semi-variable condenser C_1.

The main snags that are likely to arise are instability and "pull." If a good deal of energy is fed back from the plate circuit of the screen-grid valve to its grid circuit, the valve will oscillate, and the receiver cannot be tuned. Feedback insufficient to cause oscillation produces "pull," *i.e.* tuning the H.F. stage to the same wavelength as the detector stage upsets the tuning of the detector. These two evils are avoided by very careful screening between the two stages.

Careful Screening Necessary

As a rule, it is not sufficient merely to enclose the coils in screening cans or place a vertical sheet of metal between the stages. The whole of each stage has to be built into a separate screening box. A suggested lay-out is given in Fig. 3. Individual boxes may be used, in which case they must be connected together and to earth by a wire as at A, or the sides and ends of the boxes can be built up on a common metal base, in which case A is not necessary. It is important in both cases to have separate walls at B; a side common to both boxes often leads to instability, since it may actually couple the two stages together. The boxes need not be very large; 7in. by 5in. is a usual size.

It will be noticed that in Fig. 2 the H.F. stage is coupled to the detector by an H.F. transformer. This is merely to suggest an alternative method to that shown in Fig. 1. Either coupling may be used whether the H.F. stage is tuned or not, and experimenting with different couplings is very interesting. If the choke coupling of Fig. 1 is preferred for a tuned stage, the same component values are suitable as were given for the untuned stage. Fig. 2 also shows throttle control of reaction, again simply as an interesting alternative, both throttle and Reinartz control being equally applicable. When choke coupling is used with a tuned amplifier, the condenser C_2 and the coupling choke HFC_1 of Fig. 1 are placed in the detector stage screening box, at right angles to the reaction choke HFC_2 and as far from it as possible.

Plug-in Coils

Suitable plug-in coils for the H.F. transformer coupling are sold by various makers. Should the constructor wish to make them himself the following data will be useful. The secondary L_3 is wound

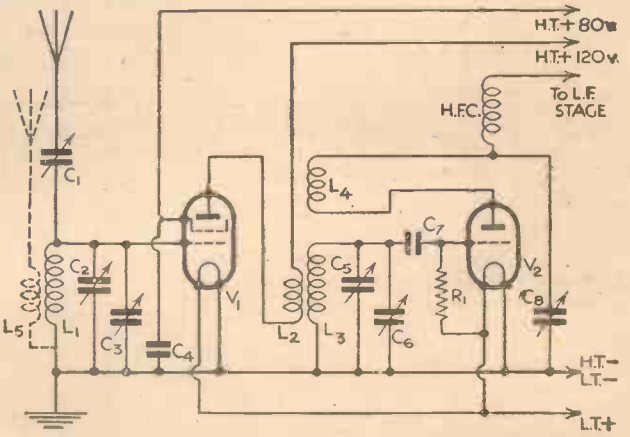


Fig. 2.—This circuit shows a tuned H.F. stage with transformer coupling to the detector valve, and throttle control of reaction.

with 22 enamelled wire, the primary L_2 and reaction coil L_4 being wound with 32 to 36 s.w.g. d.s.c. wire. The formers are 1½in. diameter ribbed ebonite tubes, unless ready-made ones of special low-loss material are used; these are preferable, since they are already fitted with six-pin base, which is necessary to accommodate three windings. The approximate number of turns is :—

Approximate wave length range.	L_2	L_3	L_4
17 to 33.5 m. ..	5	5	3
33.5 to 70 m. ..	9	11	8
70 to 135 m. ..	20	30	15

The primaries L_2 may either be wound about ⅛in. from the bottom (earthed) end of the secondaries L_3 or else interwound with the bottom turns of these windings. The reaction coils are below the primaries.

The H.F.-stage grid coil L_1 is wound exactly the same as L_3. The alternative method of coupling the aerial by means of a coil instead of the condenser C_1 is shown in Fig. 2 by the dotted coil L_5; if this method is adopted L_5 should have the same number of turns as the primary of the H.F. transformer L_2, except for the largest coil, when twelve turns will be sufficient, or standard four-pin coils may be used. These are obtainable for all wavelength ranges from Stratton & Co. ("Eddystone").

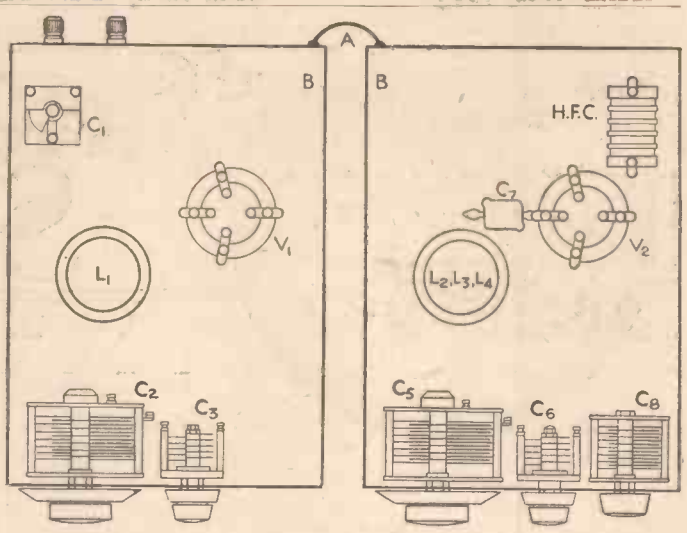


Fig. 3.—A suggested layout for providing efficient screening.

Improving Efficiency

In this Article the Author Discusses the Ways and Means of Improving the Quality of Reproduction in Short-Wave Receivers. The Effect of Choosing Suitable Components is Discussed.

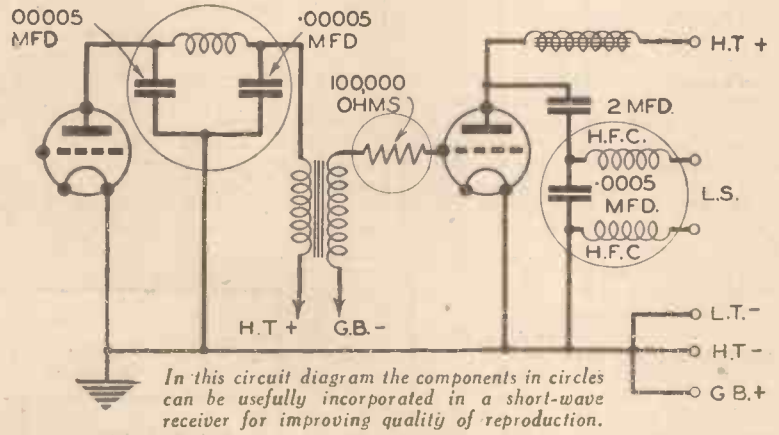
RADIO and television enthusiasts often bemoan the poor quality of the programmes received on short waves, and wonder why more information is not published with regard to improving the tone of short-wave signals received.

This question of tone is going to be a very real one when high-definition television is definitely ready for transmission, for, as is well known, the essential feature for reception of a high-definition picture giving first-class detail is a good response to high frequencies, and there has been some rumour of the necessity for a high-frequency response in the low-frequency amplifier extending as high as a megacycle! This would give the owner of the average straight short-waver much food for thought, for it is in the top-note response that the straight short-waver fails.

There are four reasons why top notes may be cut, and these are as follows: (1) use of poorly-manufactured components; (2) reaction; (3) oscillation above audio-frequency level; (4) selectivity. It is proposed to deal with these in the order given and to suggest some ways in which each can be alleviated and the quality of the output of the short-waver improved.

Use Quality Components

Firstly, the components used must be of just as good quality in the short-wave set as are used in the medium-waver, if tone is to be good. It is here that many enthusiasts seem to find trouble, for, curiously enough, in a short-waver a team of first-class components often seems to do more harm than good, causing instability, "threshold" howl, and other annoying maladies. This has been found particularly true of the L.F. transformer which, however, is the most important link in the quality chain. The only remedy the writer can suggest is one which must succeed in the end, and that is decoupling—using electrolytic condensers as lavishly as necessary. High-tension, grid-bias, and low-tension should all be by-passed and decoupled—a matter which is particularly easily carried out by means of the high-capacity electrolytic condensers. Assuming that the set is now perfectly stable, and capable of a really high-quality output, it is found that as soon as reaction is applied—and in a simple short-waver it is essential that it is applied—it is found that quality at once suffers, for reaction invariably cuts the high-note response. It is in overcoming this loss, the main cause of short-wave bad quality, that fortunately quite an amount can be done. There is at least one make of transformer on the market—by Varley—which is specially made with a rising characteristic at the top end of the scale, and this is excellent for levelling-up the response and overcoming the top cut-off caused by reaction.



In this circuit diagram the components in circles can be usefully incorporated in a short-wave receiver for improving quality of reproduction.

DANISH TRANSMISSIONS

How often do you listen to OXY Skamlebaek, which relays the Copenhagen (Denmark) radio transmissions on 49.5 metres (6,060 kc/s) from G.M.T. 18.00 until 23.00 or 23.30 every weekday, and from G.M.T. 16.00 on Sundays? Now and again on special occasions the short-waver is brought into action in the morning, and although not of regular occurrence, the 31.6-metre channel (9,493 kc/s) previously used, has not been totally abandoned. The call is one we regularly hear from the Danish long-wave station: *Kalundborg-Kobenhavn og Denmarks Kortbolgesender*, and the interval signal the familiar carillon on the musical-box. Although the aerial power is only 500 watts, OXY is one of the best stations to search for; the signals are clear and you will find its modulation excellent.

When you have logged the Dane, make a special effort to find VQ7LO, Nairobi (Kenya Colony). The search must be started in the early evening hours, as at the latest the station closes down at G.M.T. 20.00. The wavelength is the same—within a hair's-breadth—as OXY, i.e., 6,060 kc/s, but I have been able to separate them at times. As a rule, the first call is put out at G.M.T. 16.00, and as the announcer possesses a pure English accent you cannot mistake the broadcast for one from across the Atlantic. It might be worth while to give the dial a twist between 10.45-11.15 on a Monday, Wednesday, or Friday, or on a Tuesday between 08.00-09.00, or Thursday between 13.00-14.00, but the channel is not a favourable one for these daylight hours.

Range of Reception

BEGINNER'S SUPPLEMENT

A Short Article which Explains the Difficulties of Describing any Receiver in Terms of the Distance Over Which It Will Receive.

THERE is probably nothing in wireless which is more difficult to assess than the probable range (in miles) over which a receiver will be effective. It is for this reason that, in describing the results obtained with the various PRACTICAL AND AMATEUR WIRELESS receivers, we never state the distance over which the set is operative. In many instances we do say that such-and-such a station or stations has or have been received on the loud-speaker when testing the set in our laboratories, but we are always careful to point out that this does not indicate the actual capabilities of the instrument, although it does serve as a comparison with other receivers tested on the same aerial.

Transmitting Power

It used to be the custom in the very early days of wireless broadcasting to state the approximate range of a receiver, but at that time conditions were somewhat different; for one thing there were fewer stations in operation and those there were operated on similar power inputs. To-day, however, the power used by the better-known transmitters varies from less than 1 kilowatt to at least 150 kilowatts, so that, although a transmitter using the first-mentioned power might be easily receivable at 50 miles, one using the higher power would probably come in at similar strength on the same receiver at a distance of 500 miles or more.

The question of transmitter power is by no means the only point to be considered, however, and the situation of the aerials of both the receiver and transmitter can have an equally-pronounced effect. As an example of the effect of these points mention might be made of a number of tests which were carried out in the early part of 1933, when there were very few British broadcasting stations in operation. It was found that with a receiver situated at equal distances from Newcastle and Birmingham the latter station could be received at comfortable strength with a single-valve set, whilst the latter was generally inaudible. On the same receiver used in the same conditions it was observed that the signal strength from the Bournemouth and Glasgow transmitters was greater than that from either of the nearer stations mentioned, whilst the London transmissions came through at a strength somewhere between those of Newcastle and Glasgow. Despite the fact that all of the stations in question were working with approximately the same power the difference in reception was most marked, and could certainly not be accounted for by the distances separating the transmitter and receiver.

Reasons for the Differences

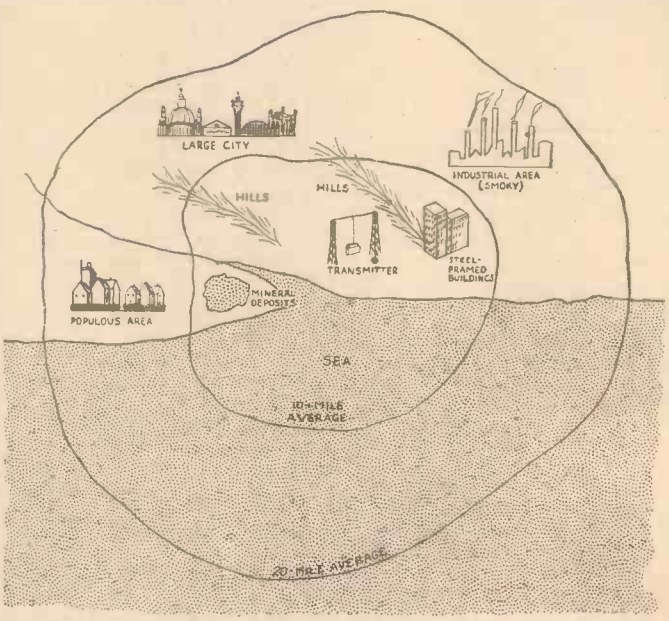
After carefully making a note of the average signal strengths from the various transmitters, a large-scale map was obtained and lines drawn from the receiver to the various transmitters. This being done, the "path" of the signals was carefully examined in an attempt to find what geographical differences existed. Unfortunately, it was not possible to pursue these experiments as far as would have been desirable, but it was definitely established that smoky towns, high hills (especially when containing mineral beds), rivers and valleys did appear to have varying effects. The reason is probably that a smoky atmosphere or a mineral bed, or even a river acts as a conductor in such a way that the electro-magnetic currents which comprise the transmitted signals are caused to leak away to earth. In the same manner it is easily conceivable that tall buildings, particularly those built around a steel framework, may act as earthed aerials and so conduct away an appreciable amount of the energy which would otherwise be available for actuating the receiver.

The above suggestion that rivers may cause signal losses may be open to challenge, since it is an accepted and proved fact that the range of wireless signals is considerably greater over the sea than over land. At the same time, however, the absence of hills and mineral deposits near the surface may have a far more pronounced effect than the conductivity of the sea water.

What Affects the Transmission?

It might be easier to appreciate the points raised above if reference is made to the illustration on this page, which is a form of sketch map showing the hypothetical range of a transmitting station. Two lines are drawn round the transmitter to join together all points at which signal strength is the same; the first one is taken at an average distance of ten miles from the transmitter, the second being at an average distance of twenty miles. It is very evident that the lines by no means follow even an approximate circle, but take a very irregular path. Hypothetical reasons for the uneven "distribution" are suggested by the towns, hills, etc., whilst it will further be seen that the range is somewhat greater along an imaginary line drawn through the transmitting aerial. This would not apply in the case of many modern aerial systems which are often arranged so as not to have such marked directional properties.

When it is considered that similar maps could be prepared to show how the range of the receiver varies in different directions there is no difficulty in appreciating the fact that range of reception can be a very variable factor. The position is made still more difficult when it is understood that the "range lines" might follow an entirely different path during hours of darkness than they do in daylight, and when the question of fading and reflection of wireless waves from the upper atmosphere is gone into.



A hypothetical sketch map showing how the range of a transmitter varies according to the surrounding country. The two roughly-circular lines join together points at which signal strength from the transmitter is approximately the same.

Rough Approximations

Having considered the more theoretical aspect of the case it is possible to give very approximate information concerning the type of receiver required for reasonably reliable reception over varying distances. In so doing an average receiving aerial must be assumed, and by an "average" aerial is meant one which is not less than about twenty feet high. In this connection, however, it must be explained that local conditions, and the position of the aerial with regard to nearby

(Continued overleaf)

(Continued from previous page)

buildings and hills is generally of far greater importance than mere height from the ground.

Generally speaking, a det.-L.F. receiver will provide satisfactory loud-speaker reception at distances up to twenty miles from a main B.B.C. station. For distances up to 100 miles a single H.F. stage is required for similar reception, and up to 200 to 250 miles two H.F. stages are necessary to ensure the same results. For greater distances a super-heterodyne receiver is a practical essential. We realise that we are treading on dangerous ground in mentioning any figures at all, and we request any reader who built, say, the Hall-Mark Three to refrain from writing to say that our figures are sadly incorrect because he regularly listens to Rome. In the same way we prefer that builders of the Fury Four Super, for example, should not point out that they are able to listen to American medium-wave stations whenever they wish.

At the other end of the scale there will probably be a number of more critical listeners who will say that although they can easily receive dozens of transmissions over distances exceeding 200 miles, it is impossible to obtain real "quality" reproduction from any station more than thirty miles from their aerials, regardless of the receiver in use. There are many points of view in connection with this question, and it is probably true that anything approaching perfect reception cannot be obtained from any other than the local station. But this is off-set by the fact that the average receiver does not give perfect reproduction in any case, so that the difference between the results obtained from the local station and from, say, Prague is so slight as to be of little importance.

MODULATION EFFECTS

THE first of these is what is known as "cross modulation." For distortionless amplification it is, of course, necessary to work on the straight portion of the characteristics of the amplifying valves, and this applies to H.F. stages as well as L.F. stages. Now it so happens that a certain amount of curvature exists in the characteristics of "straight" screen-grid and screened pentode valves, so that, particularly when strong signals are being received, there is liable to be a certain amount of rectification and distortion. If a strong interfering signal occurs on a wavelength adjacent to the "wanted" signal, the unwanted signal may be rectified owing to this curvature, and the audio-frequency portion thereof may then modulate the "wanted" carrier, giving rise to "cross talk."

The more selective circuits minimise this effect, but the most satisfactory solution is the use of a variable-mu valve, which has a long straight "tail" to its characteristic and, at the lower sensitivity adjustments, can handle quite powerful signals without rectification.

There is one particular form of hum which is definitely tunable, and occurs at its worst at certain settings of the tuning condenser. This is known as "modulation hum," and is due to the presence, in the mains supply, of a high-frequency component which, in itself, is modulated by the mains frequency.

LEAVES FROM A SHORT-WAVE LOG

By J. G. ABRAHAMS

DURING the past ten days or so there has been considerable activity in the band extending from, roughly, 40 to 50 metres, and on many nights it has been possible to listen to a number of South American transmissions. In particular, the broadcasts from Colombia, Venezuela, Ecuador, and Costa Rica have been logged at a readable strength. It will be worth while devoting a short period nightly to this portion of the wave band until British Summer Time is introduced, when some of the transmitters may be due to change over to other channels.

Moscow and Colombia

To facilitate a search, take three jumping-off points on the dial, namely, the 40-metre amateur band, then CT1GO, Parede (48.4 metres), and as a limit the Moscow transmission on 50 metres. Even above this reading you may pick up a few transmissions, as some of the South Americans are working comparatively long wavelengths. Just below the amateurs (41.1 to 42.86 metres) one station heard was HJ3ABD, Bogota, Colombia, a 100-watter, on 40.55 metres, which announces itself as "Colombia Broadcasting" and works between midnight and 03.00 G.M.T. In the band itself if amateurs are not too numerous, especially in your neighbourhood, you should manage to find Radio Manizales, also of Colombia, on 42 metres (7,140 kc/s); try for this station any Sunday before G.M.T. 22.00 or on Wednesdays or Saturdays between 00.30-03.00. In the call possibly a mention may be made of *La Voz de Caldas*, which has been adopted as a slogan. (In parentheses, I may add that a correspondent informed me that Tenerife (Las Palmas) EA8AB, is still working on Tuesdays, Thursdays, and Saturdays between G.M.T. 23.00 and midnight on 41.9 metres (7,160 kc/s), but it has not yet appeared in my log).

Another transmitter of which reception has been made in the British Isles is VP6YB, Barbados, on 42.44 metres (7,072 kc/s); the time was between G.M.T. 21.45 and 22.15. In this case all announcements were made in the English language.

On 44.71 metres (6,710 kc/s), which is immediately above a number of Rocky Point (New York) commercial transmitters, TIEP, San José, Costa Rica, now operating on 500 watts, is a "possible" between G.M.T. 00.00-03.00. Call in Spanish, including slogan: *La Voz del Tropico* (Voice of the Tropics), and repeated in English. The owner, I understand, also works the amateur station TI2EP, on 41.43 metres (7,238 kc/s).

Venezuelan Transmissions

YVQ, Maracay (Venezuela) on 44.96 metres (6,672.5 kc/s) is a 20-kilowatter, and the national short-wave station of the Venezuelan Government, but it has been heard relaying programmes broadcast by the Caracas medium-wave transmitters. The star broadcast of the past week has been, without doubt, YV6RV, Valencia (Venezuela), which, hitherto operating on 49.75 metres, has now come down to 46.1 metres, probably to avoid being jammed. Although the airline distance from London is approximately 4,800 miles, the signals are received on the loud-speaker. If you succeed in tuning in you will not fail to identify the broadcast, as the call given out every thirty minutes is always preceded by five notes on gongs. The station seems to be at its best between G.M.T. 22.45 and 23.45 or so. In its immediate neighbourhood another Colombian station has turned up, namely, HJ5ABD, Cali, on 46.22 metres (6,490 kc/s). Here we have a Spanish call only (phon): *Achay bay hota sinko ah bay day* (HJ5ABD), *La Voz del Valle*, and as an interval signal it has adopted the crowing of a rooster somewhat akin to the one used by Radio Vitus, Paris, on the lower band of the medium waves.

HJ1ABB, Barranquilla (46.53 metres) is now an old stager and its reception in London has been fairly regular. The gaps between musical items or talks are filled with the striking of four bells, alternately one high and a low note. Sometimes the call HJ1ABA is added; this denotes that a programme is being relayed from the local medium-wave broadcaster.

Caracas

If you log the above your next capture may be YV4RC, Caracas, on 47.06 metres, which is on the air nightly from G.M.T. 21.30 to 03.30. Note the call which is broadcast very slowly: *Estaçion yay vay cuatro erray say* (YV4RC), or, at times: *Essay ah erray* (S.A.R.), which stands for *Sociedad Anonima Radio Caracas*. Now this is where your exact condenser reading of CT1GO, Lisbon, will assist you, as immediately below by careful tuning you should try for CO8GC, Santiago de Cuba. Its exact channel is 48.23 metres (6,220 kc/s). Although the greater part of the broadcast is given in Spanish the call is frequently repeated in English: *The Santiago Experimental Short-wave Station*. Time to start a search, roughly G.M.T. 22.00, as Cuban local time is five hours behind ours. Within a fraction of a degree above CT1GO we may look for HJ3ABF, Bogota (48.58 metres) which, although only 50 watts, has been logged several times this winter. The chimes used between sections of the radio entertainments are reminiscent of the N.B.C. signal (three notes), but from the studio you will hear alternately a man and woman announcer.

The channel used by CSL, Lisbon (48.78 metres) having been vacated on some days by this station for 49.34 metres (although 49.7 metres was actually given out), it permitted the logging of YV3RC, Caracas, which now makes itself known to listeners by four notes of different pitch.

THE B.T.S. SHORT-WAVE ★ ADAPTER ★

An Efficient Instrument which can be used as a Detector Unit with Battery or A.C. Receiver, or as a Superhet Unit

THIS adapter converts an ordinary receiver, either battery or A.C. mains operated, to short-wave reception, and may be used either as a complete detector unit with reaction or as a superheterodyne unit. The wavelength is 13-52 metres with the two coils supplied. The red spot coil covering from 13-26 metres and the white spot coil covering 24-52 metres.

The superheterodyne method of connection is advised where possible, but this is only possible where the receiver has one or more screen-grid high-frequency stages, and providing your set covers the long waves, *i.e.*, 1,000-2,000 metres. If the receiver does not employ screen-grid high-frequency stages, the detector method of connection must be employed.

Where the receiver employs either a screen-grid, or a 7-pin type detector valve, the adapter can only be used as a superheterodyne unit, but the unit works at its greatest efficiency when employed in conjunction with receivers equipped with either two stages of L.F. amplification, or more stages of H.F., no matter whether battery or mains operated.

When used as a detector unit, in conjunction with the simplest detector and 2 L.F. receiver, the results equal those obtainable from any 3-valve set designed solely for short-wave reception.

A three-quarter front view of the adapter, showing the neat panel lay-out.

As a Detector Unit with Reaction

When using the adapter with an A.C. receiver the following adjustments must be made: Remove the back of adapter and insert the *red* wander plug in the *black* socket. (The plug is attached to the aluminium support of the tuning condenser.)

For use with battery receivers place the *red* wander plug in the *red* socket.

Next remove the detector valve from the existing receiver, and place it in the adapter valve-holder marked "Valve." Place the 5-pin plug attached to the adapter into the detector valve socket of your set from which the valve has just been removed. Should the valve-holders be of the 4-pin type, the centre pin of the plug may be removed by unscrewing with a pair of pliers. Now plug one of the coils into the coil-holder in the adapter.

In the case of battery-operated receiver, the red and black wires on the 5-pin plug should be connected in the correct order of polarity, *i.e.*, red wire to pin corresponding to L.T.+ on receiver, and black wire to L.T.— on receiver. If any difficulty in deciding the polarity is experienced, the effect of reversing the red and black wires on the 5-pin plug should be tried; it will be found that one direction gives much better results than the other. The aerial should be transferred from your receiver to the "A" socket of the adapter, and a length of rubber-covered wire connected from the "E" socket to the earth terminal on the receiver, leaving the outside earth wire connected to the receiver. The socket marked "O" is ignored when using the detector method.

Operating Details

After the adapter has been connected and the receiver switched on, only the controls on the adapter are used, the receiver controls being ignored. If the reaction knob (the right-hand knob) is rotated in a clockwise direction, a point will be reached when a rushing noise is heard, and if the main tuning dial is rotated slowly by means of the small concentric knob, signals should be heard. As the main tuning dial is rotated from zero to maximum, the reaction (right-hand knob) will have to be increased slightly in order to keep the adapter on the verge of oscillation, and it will probably be found that in certain parts of the scale the adapter will not oscillate. These dead spots are caused by the natural wavelength of the aerial, and can be overcome by adjustment of the series aerial condenser (the left-hand knob). This is at maximum when turned horizontally to the right, and minimum when turned horizontally left. In the event of difficulty in obtaining reaction this should be decreased.

Using the Adapter as a Superhet Unit

When using the B.T.S. short-wave adapter as a superhet unit with either battery or A.C. mains receivers, should the receiver be fitted with two stages of H.F. amplification, either valve may be used for inserting the plug. If the construction of the receiver does not allow the fitting of the plug to one of the H.F. valve sockets, then any valve other than the A.C. rectifier will do.

The maroon-coloured lead is used to obtain a supply of H.T. current to the valve in the adapter, and good results are usually obtained when this lead is connected to the screening grid of one of the H.F. valves, and the unit is sent out with the maroon lead connected to the screen pin

(Continued overleaf)

THE B.T.S. SHORT-WAVE ADAPTER

(*Continued from previous page*)

of the 5-pin plug, which makes this connection automatically.

In those cases where it is impossible to employ the plug in conjunction with one of the S.G. valves, and the plug is used with any other valve, then the maroon lead must be removed from the anode pin of the plug, and attached to another point where H.T. current is available. Such a point is the side terminal of the pentode valve (or where choke or transformer coupling of the output valve is not used) to the L.S.— terminal of the receiver. In some cases good results may be obtained by connecting the maroon lead to the anode terminal of the S.G. valve, but this is not always so; generally speaking any H.T. point may be used, and where an alternative point is available, it is as well to test out both, so that best results are finally obtained.

In those cases where the main receiver will not operate with lid open or back off, it is essential to provide an aperture through which the leads from the unit must pass. The main receiver should be switched on to the long-wave range and tuned to the highest wavelength possible, which, in the case of the average receiver, is in the vicinity of 1,800-2,000 metres. Should the receiver have more than one tuning control, excluding reaction or volume controls, all circuits should be tuned to maximum wavelength. The receiver should be tuned to its most sensitive condition, but must not be oscillating. Transfer the aerial lead from the main receiver to the aerial socket of the unit and connect the "O" socket to the aerial terminal of the main receiver. A length of wire must be connected between earth terminal of set and earth terminal of unit, leaving the earth wire connected to your receiver.

Reaction Control

The reaction control—which is the small knob on the right-hand side of the adapter—should be decreased until a point is reached where signals should be evident upon rotating the main tuning condenser, using the slow-motion centre knob for this purpose. The adapter is now oscillating, but the whistle usually heard when tuning signals will be absent. This adjustment should hold over a large scale. The reaction control should not be advanced beyond a point where signals are heard, or a continual howl will result. Should no signals result with the reaction control fully in, the series aerial condenser (left-hand knob) should be adjusted. This is at maximum when turned horizontally to the right and minimum when turned horizontally left. In the event of difficulty in obtaining reaction, this should be decreased.

The price of this adapter is 52s. 6d., and any further particulars concerning its operation can be obtained from the manufacturers, British Television Supplies, Limited, Bush House, London, E.C.2.

Dual-purpose Components: A Correction.

In the article under the above heading, which appeared in our issue for March 9th, it was stated the resistance offered by a 2-mfd. condenser to frequencies of 1,000 ohms is only about 80 ohms. This should, of course, read 1,000 *cycles*, and not 1,000 ohms.

AUTO-BIAS PROBLEMS

(*Continued from page 42*)

however, has one slight disadvantage, namely, that the negative side of the output circuit is at a positive potential above earth to an extent equal to the bias voltage. Should, therefore, the speaker or its transformer be inadvertently earthed, or should a fault to earth develop, such as a breakdown in the transformer insulation, this would have the effect of short circuiting the bias resistance, and the output valve would probably be ruined through running it without grid bias.

The last illustration (Fig. 5) indicates the circuit of Fig. 3 arranged for a directly-heated output valve. The centre tap of the filament transformer is connected to the common cathode bus-bar. This circuit must, of course, be used for all directly-heated output valves.

Satisfactory for Pentodes

At this point it is as well to note that the circuits given in Figs. 1 and 2 are quite satisfactory for indirectly-heated output pentodes. In such valves the load impedance is always very high compared with the bias resistance, the former being usually of the order of 8,000 ohms and the latter in the neighbourhood of 500 ohms. Thus, the loss occasioned by including the bias resistance in the output circuit is quite small and certainly not worth worrying about.

Listeners sometimes find it difficult to understand the reason for, and the operation of, the grid decoupling circuit as shown in several of the grid-bias diagrams. Referring once more to Fig. 1, it will be agreed that in addition to the D.C. voltage drop across the bias resistance, R, due to the mean value of the anode current, there is also an audio-frequency voltage drop due to the audio-frequency variations of the anode current. This audio-frequency voltage drop is also applied to the grid of the valve *via* the secondary winding of the inter-valve transformer. Now the A.C. drop across R is in opposite phase to the signal voltage, and therefore it tends to reduce the effective signal. Owing to the presence of the condenser in Fig. 1, the higher audio-frequencies are by-passed and do not affect the signal seriously; but the lower audio-frequencies are certainly badly cut. By including the decoupling resistance, D.C.R., as in Fig. 2, which is generally of 50,000 to 100,000 ohms resistance, the impedance of the path R, plus D.C.R. to all frequencies, is made greater than the shunt path represented by the condenser, so that the loss of effective signal is avoided, the A.C. component being practically confined to the resistance. In other words, the resistance D.C.R. and the condenser operate exactly as the ordinary decoupling schemes used in the anode circuits of valves.

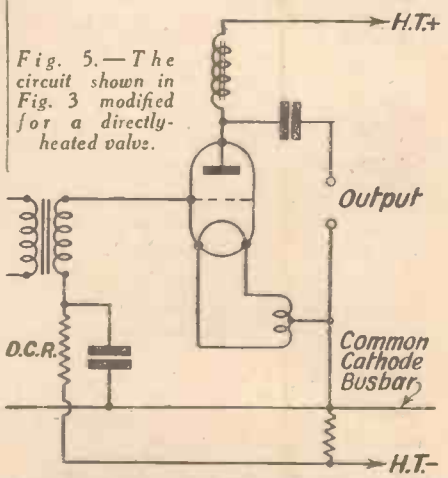


Fig. 5.—The circuit shown in Fig. 3 modified for a directly-heated valve.

RADIO CLUBS AND SOCIETIES

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

THE CROYDON RADIO SOCIETY

MR. F. J. CAMM, Editor of PRACTICAL AND AMATEUR WIRELESS, lectured on "The Constructor and the Press" to the Croydon Radio Society, and the Short-wave Radio and Television Society of Thornton Heath, in St. Peter's Hall, Croydon, on Tuesday, March 12th.

He stated that even now a revival in club and amateur interest was taking place, the great search for quality reproduction and the imminence of television being responsible. He knew as a fact that the Croydon Society's attendance was to-day three times what it was five years ago, and considerably more than at any "boom" period. There was always a thrill in making one's own receiver, and time and trouble could be spent on it which were impossible in the mass-produced article. Thus there were some very marvellous home-made receivers in existence, each incorporating a pet "whim" of its owner.

Mr. Camm urged that members of the two Societies should preach the gospel of home construction, and by so doing educate the public to appreciate how good radio reproduction could be. Not the least interesting part of the evening was the discussion on how the ideal technical wireless journal should be run, and he welcomed this opportunity of hearing views from typical readers of PRACTICAL AND AMATEUR WIRELESS. Indeed, many a hard knock was given and taken in the arguments, which showed that in Croydon and Thornton Heath at least the amateur movement was not so dead as was usually supposed. Finally, the chairman, Mr. W. J. Bird, thanked Mr. Camm for so refreshing a lecture.

Hon. Sec. the Croydon Society: Mr. E. L. Cumbers, Maycourt, Campden Road, South Croydon.

Hon. Sec. the Thornton Heath Society: Mr. J. T. Webber, 368, Brigstock Road, Thornton Heath.

SLADE RADIO

THIS Society held their first meeting in their new room at the Shakespeare and Dickens, Edmund Street. This will be their new headquarters for the future. A member, Mr. J. Wally, gave a talk about a new receiver he had just built. It could be operated by remote control, which consists of a small box having tuning, volume, and selectivity controls. It would be possible to conceal the set in a cupboard, leaving the remote control attached by means of about 6ft. of screened wires, and thus dispense with the necessity for a cabinet. Alterations to the set were not likely to prove difficult, and almost any of the parts could be home-made. There were no ganged condensers, and there appeared to be no part that an ordinary constructor could not build without difficulty.—Hon. Secretary, Chas. Game, 40, West Drive, Heathfield Park, Handsworth.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

THE members of the London Chapter were afforded another treat when at the meeting held on Friday, March 15th, Mr. S. A. Stevens, B.Sc., gave a lecture entitled "Westinghouse Metal Rectifiers." Mr. Stevens paid particular attention to Westectors, and with the aid of some very interesting lantern slides illustrated the use of these rectifiers, which included replacing the detector valve in circuits having one or more stages of H.F. amplification.—A. Bear, Secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

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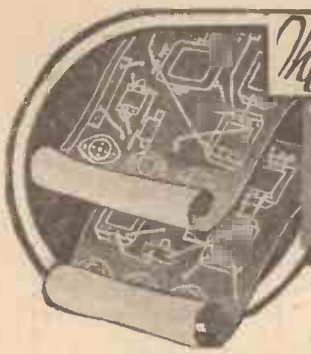
BARGAINS IN PLENTY

THE new catalogue issued by the Electradix firm consists of no fewer than seventy pages of closely-printed and well-illustrated matter, and will prove of considerable assistance to all wireless enthusiasts. The firm is able to offer numerous remarkable bargains. They have, for instance, a limited number of cæsium-type gas-filled photo-electric cells whose usual price is £5 10s. each, but which they are prepared to dispose of for £1 5s. Many experimenters will welcome this opportunity to obtain one cheaply. Also stocked is the British Talking Picture company's potassium photo-electric cell at 15s. A remarkably fine range of dynamos and motors is also listed, and, in fact, it would be hard to find any piece of electrical apparatus of the kind in which the amateur is interested that has been omitted, and even in this remote circumstance a quotation can usually be made by return of post.



The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

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

PRACTICAL WIRELESS.

Blueprints, 1s. each.

Long-Range Express Three	24.9.32	PW2
Mains Express Three	8.10.32	PW3
Sonotone Four	15.10.32	PW4
Bijou Three	29.10.32	PW5
Argus Three	12.11.32	PW6
Argus Three Mains Unit	26.11.32	PW6A
Empire Short-Wave Three	3.12.32	PW7
Solo Knob Three	10.12.32	PW8
Midget Two	17.12.32	PW9
Autokoil Pentode Two	31.12.32	PW9A
Selectone Battery Three	14.1.33	PW10
Fury Four	28.1.33	PW11
Featherweight Portable Four	6.5.33	PW12
Q.P.P. Three-Four	4.3.33	PW13
Alpha Q.P.P. Three	25.3.33	PW14
Ferrocart Q.P.P. Hi-Mag. Three	25.3.33 and 1.4.33	PW15
Supersonic Six	8.4.33	PW16
Beta Universal Four	15.4.33	PW17
A.C. Twin	22.4.33	PW18
Selectone A.C. Radiogram Two	29.4.33	PW19
A.C. Fury Four	25.2.33	PW20
Radiopax Class B Four	27.5.33	PW21
Three-Valve Push-Pull Detector Set	4.3.33	PW22
Double-Diode Triode Three	10.6.33	PW23
Three-Star Nicore	24.6.33	PW24
Class B Detector Two-Valve	17.6.33	PW24A
D.C. Ace	15.7.33	PW25
Superset	19.8.33	PW26
Auto-B Three	19.8.33	PW27
All-Wave Two	19.8.33	PW28
A.C. Three	16.9.33	PW29
Premier Super	23.9.33	PW30
Experimenter's Short-Wave Three	23.9.33	PW30A
A.C.-D.C. Two	7.10.33	PW31
All-Wave Unipen	14.10.33	PW31A
F.J.C. 3-valve A.V.C. (Transfer Print)	4.11.33	PW32
Luxus A.C. Superhet	14.10.33	PW33
A.C. Quadpak	2.12.33	PW34
Sixty-Shilling Three	2.12.33	PW34A
Nucleon Class B. Four	6.1.34	PW34B
Fury Four Super	27.1.34	PW34C
A.C. Fury Four Super	10.2.34	PW34D
Leader Three	10.3.34	PW35
D.C. Premier	31.3.34	PW35B
A.C. Leader	7.4.34	PW35C
Prima Mains Three	5.4.34	PW35D
Master Midget Two	12.5.34	PW35E
Atom Lightweight Portable	2.6.34	PW36
Ubique	28.7.34	PW36A
Four-Range Super-Mag. Two	11.8.34	PW36B
Summit Three	18.8.34	PW37
Armada Mains Three	18.8.34	PW38
Midget Short-Wave Two	15.9.34	PW38A
All-Pentode Three	22.9.34	PW39
£5 Superhet Three	27.10.34	PW40
A.C. £5 Superhet Three	24.11.34	PW43
D.C. £5 Superhet Three	1.12.34	PW42
Hall-Mark Three	8.12.34	PW41
F. J. Camm's Universal £5 Superhet	15.12.34	PW44
A.C. Hall-Mark	26.1.35	PW45
Battery Hall-Mark 4	2.2.35	PW46
Universal Hall-Mark	9.2.35	PW47
Hall-Mark Cadet	23.3.35	PW48

AMATEUR WIRELESS AND WIRELESS MAGAZINE.

CRYSTAL SETS.

Blueprints, 6d. each.

Four-station Crystal Set	31.3.34	AW427
1934 Crystal Set	4.8.34	AW444
150-mile Crystal Set	Out of print	AW450

STRAIGHT SETS. Battery Operated.

One-valvers: Blueprints, 1s. each.

B.B.C. One-valver	Out of print	AW344
B.B.C. Special One-valver	Out of print	AW387
Twenty-station Loud-speaker One-valver (Class B)	Out of print	AW449

Two-valvers: Blueprints, 1s. each.

Melody Ranger Two (D, Trans)	Out of print	AW388
Full-volume Two (SG.-Det, Pen)	17.6.33	AW392
Iron-core Two (D, Trans)	Out of print	AW395
Iron-core Two (D, QPP)	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D, Trans)	Out of print	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans)	Out of print	AW338A
Lucerne Minor (D, Pen)	Out of print	AW426
Family Two (D, Trans)	*Apr.* '32	WM278

Three-valvers: Blueprints, 1s. each.

£8 Radiogram (D, RC, Trans)	Out of print	AW343
New Regional Three (D, RC, Trans)	25.6.32	AW349
Class-B Three (D, Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher, Chassis Model (SG, D, Pen)	3.2.34	AW419
Lucerne Ranger (SG, D, Trans)	Out of print	AW422
Cossor Melody Maker with Lucerne Coils	Out of print	AW423
P.W.H. Mascot with Lucerne Coils (Det. R.C, Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	Out of print	AW424
Pentaquester (HF, Pen, D. Pen)	14.4.34	AW431
£5 5s. Three: De-luxe Version (SG, D, Trans)	10.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	9.6.34	AW437
All-Britain Three (HF Pen, D, Pen)	Out of print	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.1.34	AW451
Transportable Three (SG, D, Pen)	*Feb.* '32	WM271
Multi-Mag Three (D, 2 Trans)	*June* '32	WM288
Percy Harris Radiogram (HF, D, Trans)	*Aug.* '32	WM294
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Tyers Iron-core Three (SG, D, Pen)	*July* '33	WM330
C.-B. Three (D, LF, Class B)	Out of print	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
All-wave Three (D, 2LF)	*Jan.* '34	WM348
"W.M." 1934 Standard Three (SG, D, Pen)	*Feb.* '34	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	*Oct.* '34	WM371
Graduating to a Low-frequency Stage (D, 2LF)	*Jan.* '35	WM378

Four-valvers: Blueprints, 1s. 6d. each.

65/- Four (SG, D, RC, Trans)	Out of print	AW370
"A.W." Ideal Four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D, Pen)	Out of print	AW421
Crusaders' A.V.C. 4 (2 H.F., D, QP21)	18.8.34	AW445
(Pentode and Class-B outputs for above: blueprints 6d. each)	25.8.34	AW445A
Quadradyne (2SG, D, Pen)	*Feb.* '32	WM273
Calibrator (SG, D, RC, Trans)	*Oct.* '32	WM300
Table Quad (SG, D, RC, Trans)	*Nov.* '32	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
Self-contained Four (SG, D, LF, Class-B)	*Aug.* '33	WM331
Lucerne-Straight Four (SG, D, LF, Trans)	*Feb.* '34	WM350
£5 5s. Battery Four (H.F., D, 2LF)	*Feb.* '35	WM381

Five-valvers: Blueprints, 1s. 6d. each.

Super-quality Five (2 HF, D, RC, Trans)	*May* '33	WM320
New Class-B Five (SG, D, LF, Class-B)	*Nov.* '33	WM340
Class-B Quadradyne (2 SG, D, LF, Class-B)	*Dec.* '33	WM344
1935 Super Five (Battery Superhet)	*Jan.* '35	WM379

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Consoelectric Two (D, Pen) A.C.	23.[illegible]	[illegible]03
Economy A.C. Two (D, Trans) A.C.	*June* '32	WM286

Three-valvers: Blueprints, 1s. each.

Home-lover's New All-electric Three (SG, D, Trans) A.C.	25.3.33	AW383
S.G. Three (SG, D, Pen) A.C.	3.6.33	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen) A.C.	23.6.34	AW439
D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July* '33	WM328
Simplicity A.C. Radiogram (SG, D, Pen) A.C.	*Oct.* '33	WM338
Six-guinea AC/DC Three (HF Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF, Pen, D Pen) A.C.	*Nov.* '34	WM374

Four-valvers: Blueprints, 1s. 6d. each.

A.C. Melody Ranger (SG, DC, RC, Trans) A.C.	Out of print	AW380
AC/DC Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C.	8.9.34	AW446
A.C. Quadradyne (2SG, D, Trans) A.C.	*Apr.* '32	WM279
All Metal Four (2SG, D, Pen) A.C.	*July* '33	WM329
"W.M." A.C./D.C. Super Four	*Feb.* '35	WM382

SUPERHETS.

Battery Sets: Blueprints, 1s. 6d. each.

1934 Century Super	9.12.33	AW413
Super Senior	*Oct.* '31	WM256
1932 Super 60	*Jan.* '32	WM269
Q.P.P. Super 60	*Apr.* '33	WM319
"W.M." Stenode	*Oct.* '34	WM373
Modern Super Senior	*Nov.* '34	WM375

Mains Sets: Blueprints, 1s. 6d. each.

1934 A.C. Century Super, A.C.	10.3.34	AW425
1932 A.C. Super 60, A.C.	*Feb.* '32	WM272
Seventy-seven Super A.C.	*Dec.* '32	WM305
"W.M." D.C. Super D.C.	*May* '33	WM321
Merrymaker Super A.C.	*Dec.* '33	WM345
Heptode Super Three, A.C.	*May* '34	WM359
"W.M." Radiogram Super, A.C.	*July* '34	WM366
"W.M." Stenode, A.C.	*Sep.* '34	WM370

PORTABLES.

Four-valvers: Blueprints, 1s. 6d. each.

General-purpose Portable (SG, D, R.C., Trans)	Out of print	AW351
Midget Class-B Portable (SG, D, LF, Class-B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	*May* '32	WM287
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM362
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM363

SHORT-WAVERS. Battery Operated.

One-valvers: Blueprints, 1s. each.

S.W. One-valve	Out of print	AW329
S.W. One-valve for America	Out of print	AW429
Roma Short-waver	10.11.34	AW452

Two-valvers: Blueprints, 1s. each.

Home-made Coil Two (D, Pen)	14.7.34	AW440

Three-valvers: Blueprints, 1s. each.

World-ranger Short-wave 3 (D, RC, Trans)	Out of print	AW335
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver	*Jan.* 19, '35	AW463
Short-wave Adapter	*Dec.* 1, '34	AW456
Superhet. Converter	*Dec.* 1, '34	AW457

Four-valvers: Blueprints, 1s. 6d. each.

"A.W." Short-wave World Beater (HF Pen, D, RC, Trans)	2.6.34	AW436
Empire Short-waver (SG, D, RC, Trans)	*Mar.* '33	WM318

Superhets: Blueprints, 1s. 6d. each.

Quartz-crystal Super	*Oct.* '34	WM372

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Two-valve Mains Short-waver (D, Pen) A.C.	10.11.34	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	*Aug.* '34	WM368

Three-valvers: Blueprints, 1s. each.

Emigrator (SG, D, Pen), A.C.	*Feb.* '34	WM352

Four-valvers: Blueprints, 1s. 6d. each.

Gold Coaster (SG, D, RC, Trans) A.C.	*Aug.* '32	WM292
Trickle Charger:	*Jan.* 5, '35	AW462

IMPRESSIONS ON THE WAX

By T. Onearm

Decca Records

AMBROSE and His Orchestra offer two distinct and unusual recordings in the Decca list for this month. The first is "A Story of London Life," on *Decca F*5478, a "potted" drama which was first broadcast by him a fortnight ago, having been specially written for this great orchestra by Ray Sonin of *The Melody Maker*. "Stunt" records, such as this, are universally popular with the public, although I can't think why. When an orchestra can play dance music as Ambrose can, it seems a pity to produce sketches with a minimum of musical background. To me it is like the Berlin Philharmonic Orchestra playing at a circus. But that appears to be my own personal opinion, because the public go mad over a record like this, and I must therefore be in the minority. I am not denying that the result is amusing; that is not my point. I am sorry that Ambrose should be the orchestra that the public prefer to make such records. In fact, the sales of his other "comedy" records, such as "No, No, a Thousand Times No," and "Home James, and don't Spare the Horses," already look like becoming *record* records. They are running neck and neck into huge figures. Of course, Ambrose has, apart from his picked band of musicians, some of the finest individual comedians in the band business, with Elsie Carlisle in addition, who specialises in this form of entertainment. So Ambrose should make better comedy records than most bands. I prophesy that "A Story of London Life" will quickly move into best-selling class.

At the same time, for my own enjoyment, I am glad that Ambrose has made a recording of "Rhapsody in Blue," on both sides of *Decca F*5454. This is a great performance, and recorded in answer to a host of requests, following his recent broadcast of this classic. A very beautiful record, and quite the most outstanding of all our mid-month releases.

"When Day is Done" (*K*745)—his signature tune—which he recently recorded on a 12in. record, is another such classic as this, and I hope you will make a special point of hearing Ambrose's version of "Rhapsody in Blue."

Brunswick Records

I will give you the "Folies Bergere de Paris" records first: The Dorsey Brothers' Orchestra makes a brilliant show with "Au Revoir l'amour" and "Singing a Happy Song" on *Brunswick RL*223. This band also make another record, "Rhythm of the Rain" and "I was Lucky" on *Brunswick RL*224.

Since this band have been on the new red label (1s. 6d.) series, they seem to have enlarged their English following enormously.

I do not wonder at this. The arrangements and performance of this band are superb. I have already mentioned that the Dorseys and Ambrose often interchange their arrangements, which is a splendid move on both sides.

The Mills Brothers give us another new record: "Sweet Georgia Brown" and "Sweeter than Sugar," on *Brunswick O*1987. In two months they will be with us again with a repertoire of new songs. In the meantime, you will enjoy their mid-March offering.

Panachord Records

The Street Singer gives us a medley of the songs he has made famous on his records in England, starting with "Marta"—which must be the outstanding seller of the last four years—and including "Home," "Play to me Gipsy," "Call me Darling," "Masquerade" and "Auf Wiedersehen, my Dear." This record, *Panachord* 25702, should be very popular.

Another interesting record is a piano medley by L. Green on *Panachord* 25692. As the titles included in this new medley are outstanding favourites, this record should be very well received, especially at one shilling.

Tessie O'Shea has recorded two titles well suited to her style in "She fell for a Fellow from Oopsala" and "The Girl's Story of her Man on the Flying Trapeze" on *Panachord* 25708. As I have written before, this great music-hall artist, only just of age, has an enormous future before her. Her effervescent style, so reminiscent of the really spacious days of the old music-hall, is contagious to a degree.

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.

W. S. T. (Mitcham). The H.T. negative return was taken to the wrong side of the bias resistance, but this would not burn out valves and transformer. There must be some error in your wiring.

R. P. (Landore). What type of interference do you refer to? Other stations or static? Method of curing the trouble will depend upon the type of interference.

E. V. C. (Armley). Results are probably due to the valves you are using. We cannot say, as we have not tried them in this particular circuit. Advise use of correct valves.

I. E. M. (East Ham). Probably mains unit is unsuitable. Try a dry battery to make certain that the receiver itself is in order.

W. G. S. H. (Edinburgh). Messrs. Heayberd can supply a transformer to replace that in your eliminator. Write to them for details.

E. P. (Glasgow). Regret no details obtainable. Probable resistance in the neighbourhood of 400 or 500 ohms, and inductance round about 10 to 20 henries. Ratio of A.F.4 is 3 to 1.

J. McG. (Glasgow). Condenser you have is probably suitable.

F. C. D. (Margate). Advise you to communicate with Haynes Radio, 57, Hatton Garden, London, E.C.1.

J. C. A. (Northumberland). Arrangement you specify is quite in order, but unfortunately there is no suitable choke on the market so far as we are aware.

V. H. (Frimley). We do not advise the modification to a 1932 receiver.

S. S. (Leicester). Output with 220PA is 180 milliwatts, and with 230XP it is 450 milliwatts. With this particular circuit you would probably not notice the difference between the two transformers.

E. R. S. (Hull). We do not recommend the addition of another stage. More efficient to fit a pentode in the last stage.

F. W. T. (Castle Bromwich). Output from transformer is not great enough. You need an output of 9 or 12 volts at 1 to 2 amps.

M. B. (Leicester). If the wiring of your set is in order, the trouble you are experiencing indicates that one of the components (especially the valves) is defective, or that the aerial-earth system is inefficient.

H. C. (Laindon). The Class B unit described in PRACTICAL AND AMATEUR WIRELESS No. 119 may be added to your receiver. The W.B. Stentorian PMS.1. will be a suitable speaker.

G. W. S. (Leeds). We suggest that you obtain the booklet, "Modern Wireless Sets and How to Make Them" (obtainable from bookstalls for 6d.), and construct the "Baby Grand Three" described therein.

S. C. (Hoveringham). We suggest that you build the £5 Superhet (Blueprint PW40). This is a very selective and sensitive three-valver.

L. F. (Balham). H.T. may be supplied from the mains through an H.T. eliminator without the necessity for any wiring alterations in the receiver, but if all-mains operation is desired indirectly-heated mains valves should be fitted and the filament circuit altered to suit these.

W. A. T. (Swansea). The crackling experienced may be due to a dirty switch contact, or to bad contact between the valve pins and the valve-holder sockets.

P. D. W. (Rosyth). Although it is advisable to use 150 kc/s I.F. transformers the 110 kc/s type may be employed. 150 kc/s transformers are marketed by Colvern Ltd., Mawneys Road, Romford, Essex.

C. M. (London, W.1). A 30,000 ohms anode resistance and a .5 mfd. coupling condenser should be used in your L.F. circuit.

T. Y. (Haig Keng). As an electric gramophone is used in the transmitting studio, it is possible to get as good quality from one's own all-electric gramophone as from broadcast recitals. A reliable pick-up (such as B.T.H., or Bluespot, etc.) should be connected between the grid of the first L.F. valve and the common negative line.

S. W. (New Mills). The Class B unit described in PRACTICAL AND AMATEUR WIRELESS No. 119 may be added to the All-Pentode Three if it is desired to increase the output.

R. C. (Motherwell). We regret that we cannot supply a blueprint of the time-switch referred to.

T. W. H. (Camberwell). An H.F. choke is not essential in the anode circuit of the detector, and where economy is of paramount importance this component may be omitted.

R. S. (Helensburgh). It is not unusual to obtain reproduction after the speaker has been disconnected. This is due to loose transformer or choke laminations, or vibrating valve electrodes.

J. W. H. (Read). Your Colvern coils, Ferranti transformers, and the following of your valves may be used in a Class B unit—220V.S., L.D.210, P.M.1L.F., H.P.2. There are several Class B four-valve blueprints on our list—e.g., Radiopax Class B Four, No. PW21.

E. W. (Dundee). We recommend the use of a straight two-terminal reaction condenser in short-wave receivers, using the "throttle" circuit arrangement if wavelengths below 20 metres are to be received.

T. W. (Welwyn Garden City). We suggest that you check the wiring carefully, and if this is in order test the valves (especially the output valve), detector, grid-leak, and grid condenser.

G. B. (North Lancing). The trouble you are experiencing tends to indicate that the voltage of your H.T. battery is too low. If the coupling condenser referred to is connected to the cap of the S.G. valve, we advise you to test the S.G. valves.

H. W. (H.M.S. Renown). The address of R. Rothermel Ltd. is Rothermel House, Canterbury Road, Kilburn, London, N.W.6.

W. H. C. (Ashton-under-Lyme). The coil unit you possess incorporates H.F. transformers, whereas the specified coils are of the tuned-grid type, and therefore we cannot recommend the proposed substitution.

C. S. (Hornsey). We suggest that you use more selective coils (e.g., Wearite), with, preferably, a band-pass unit preceding the first valve. Distortion may be due to insufficient H.T. voltage, or incorrect adjustment of the G.B. voltage of the output valve.

P. O'H. (Tipperary). The PM24A may be used provided that the mains unit is suitable for supplying this valve. The bias resistance of approximately 1,000 ohms should be connected between the centre tap of the filament winding feeding the output valve and H.T.—.

N. W. S. (Harrow). We suggest that you try the effect of connecting a 4 mfd. or 8 mfd. condenser (200 volts working) between H.T.+ and H.T.— terminals of your eliminator.

A. B. (Rutherglen). We suggest that you build the Lucerne Straight Three (Blueprint AW437), as some of your components may be used in this receiver.

J. H. T. (Huddersfield). Full constructional details of a lead-aluminium charger will be found on page 641 of PRACTICAL WIRELESS dated December 17th, 1932, and chargers of the tantalum-lead and metal type are described in PRACTICAL WIRELESS dated January 21st, 1933, and November 19th, 1932.

H. W. (Tadworth). We cannot recommend the use of your old I.F. transformers in the £5 Superhet, and suggest that you build the receiver exactly to specification.

T. C. H. (Belfast). As you do not state the type number of your coil we regret that we cannot help you, and would point out that coil terminal numbering is not standardised.

A. W. (Bradford). The trouble experienced tends to indicate that the wave-change switch is defective.

J. B. (Birmingham). The one-valve low-frequency amplifier referred to in your letter should prove quite satisfactory for addition to your crystal receiver.

A. W. (South Shields). The trouble you are experiencing tends to indicate that the H.F. components in your receiver are ineffectively screened or that an S.G. valve which is more efficient than the original type is being used. Ascertain that all screening cans are connected to earth terminal and that the earth connection itself is effective.

E. T. (Dartmouth). Humbucking coils are generally internally connected to the speaker speech coil. The two coils should be wound in series with each other but in opposite directions, the humbucking coil being wound over the field winding.

F. R. (Kingston-on-Thames). It seems that the H.T. current consumption of your receiver valves exceeds the rated current output of your eliminator or that the eliminator is defective. The rated eliminator output should be slightly in excess of the normal H.T. current consumption of the receiver. A reliable high-resistance meter must be used for eliminator output tests.

H. R. P. (Cheltenham). If the dimensions of the frame are reduced it will be necessary to increase the number of turns on the various windings, keeping the total length of the windings the same as specified for the large frame. If the choke consists of approximately 750 turns of wire on a former of approximately 1in. in diameter it should prove satisfactory.

F. C. B. (Rotherhithe). We suggest that you add an extra tuned stage to your receiver. Constructional details of a suitable unit will be found in PRACTICAL WIRELESS No. 11.

P. M. (Salford). We cannot recommend valve substitutes for your receiver and think that the best procedure will be for you to wait until you can afford to obtain the specified types. The proposed modification is in order if the gram. switch is to be omitted.

P. G. (Manchester). We suggest that you connect the pick-up between the grid of the detector valve and the common negative line. As the detector valve is biased when the pick-up is in circuit satisfactory results should be obtained.

N. H. M. (Stornoway). The R.I. auto-parafeed transformer should prove satisfactory in your receiver. We do not advise you to connect each of the negative filament pins to M.B.—the filament pins should be joined together as shown in the diagram.

W. B. (Swansea). We regret that we have been unable to trace the manufacturers of your foreign speaker, but one of the advertisers in the miscellaneous columns of PRACTICAL AND AMATEUR WIRELESS will probably be prepared to undertake the necessary repair work.

P. H. (Harrow). We suggest that you add an H.F. stage to your two-valve receiver. An inexpensive S.G. H.F. unit is described in PRACTICAL WIRELESS No. 20.

J. W. H. (Rawalpindi). We have not yet published a receiver design that will meet with your requirements and therefore suggest that you obtain one of the Eddystone receivers; the makers' address is Stratton and Co., Bromsgrove St., Birmingham.

R. D. (Strabane). We do not consider that the construction of a tweeter speaker can be satisfactorily undertaken by the home-constructor.

K. B. (Battersea). Trimmer condensers are connected in parallel with the tuning sections of a gang condenser for the purpose of balancing stray circuit capacities. They usually consist of two metal plates separated by a thin sheet of mica.

PRACTICAL 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).

"Experimenter's S.W. Three" in South Africa

SIR,—As a regular reader of your paper I have noticed that many of your readers in South Africa are asking for a powerful mains and/or battery S.W. receiver. Might I recommend them your "Experimenter's Short-wave Three." Up till recently I have used this with great success here. Regarding the question of selectivity on 25 m., this particular set, when used with 150ft. aerial, had no difficulty in separating Zeesen and Daventry. As far as volume goes this set, when used with a M.C. speaker, gave large room volume on Daventry (25 m. and 31 m.), Paris, Zeesen (both 25 and 49 m.), Bombay, Buenos Ayres, Bound Brook, besides many others on 'phones.

If they desire a little more volume and selectivity without sending up the cost of batteries let them use, as I am now doing, a pentode detector and pentode L.F. This gives results equal to many of the 5-valve American sets. This I have also adapted for mains use, but it is not sufficiently hum free to allow of the use of 'phones. Sets of this type (*i.e.*, untuned S.G., det., L.F.) seem particularly suited to this country.—S. MORGAN (Johannesburg).

A Suggestion from India

SIR,—I noticed in PRACTICAL WIRELESS some time ago a suggestion from an overseas reader for a short-wave and medium-wave receiver. May I second this, and suggest a four-valve receiver—H.F., det., L.F., Q.P.P. with a 'phone jack either in the detector or low-frequency stage.

I would also like to see the short-wave feature increased in size by at least one page per week. I think that this would be appreciated by a large number of readers, as the short-wave fraternity is definitely on the increase, judging by the people out here. Your "low price" campaign is a good thing for people like myself who are blessed with more enthusiasm than money. —A. HALLIDAY STEWART (Calcutta, India).

Wireless for the Deaf

SIR,—We have read with interest the first paragraph of your article on page 937 of the issue of March 16th. It may be that you are unaware of what we are doing for the deaf, even those born deaf and consequently dumb. We enclose particulars of the Multitone Deaf Aid Radio set which may interest you. Similar instruments are in use by Schools for Deaf Children in London (including eight special schools under the London [County Council), Walthamstow, Tottenham, Bolton, Leeds, Leicester, Hull, Sunderland, Birmingham, Exeter, Edinburgh, etc. The Royal School for Deaf and Dumb Children at Margate, having had a Multitone installation for fourteen children for a month only, have informed us that they are ordering another three similar outfits. It is found that the children take the greatest delight in listening to the broadcast music and, with the aid of our instrument, they are being taught to appreciate speech sounds and, as a result of hearing their own voices, to improve their powers of speech. We could give you many instances of private purchasers born deaf who have made remarkable strides in hearing as a result of using the Multitone.

A prominent London physicist has expressed the opinion that 85 per cent. of the congenitally deaf could use the Multitone to advantage.—MULTITONE ELECTRIC CO., LTD. (Islington, London, N.1).

[*Pamphlets amplifying the points mentioned in this letter are obtainable from the firm mentioned at* 95-98, *White Lion Street, Islington, London, N.*1.—ED.]

A Suggestion from a Bombay Reader

SIR,—My hearty congratulations on the amalgamation of PRACTICAL WIRELESS and *Amateur Wireless*, and thanks for inviting readers for their suggestions.

Here is my suggestion: Every issue of PRACTICAL AND AMATEUR WIRELESS should contain a complete and up-to-date list of broadcasting stations of long, medium, and short waves, with timings and power of stations, etc. If it is not possible to give with every issue, at least once a month will do. Here in India we had only two papers giving such a list, but one of them is no longer obtainable, while the other has discontinued giving it. Now we have no reliable means of seeing a correct and up-to-date list. What we get is usually out of date and of little use; therefore, this addition to PRACTICAL AND AMATEUR WIRELESS will be greatly appreciated over here.—J. T. JARIWALA (Bombay).

CUT THIS OUT EACH WEEK.

Do you know

—THAT the length of the aerial for transmitting ultra-short waves has a very marked effect on the range of the station.
—THAT a D.C. mains receiver should be provided with a fuse in both of the input (mains) leads.
—THAT the quality from a moving-iron (cone) loud-speaker may be modified by using different materials for the cone.
—THAT if you have any gramophone records which have become warped they may be flattened by placing between sheets of glass in a warm place.
—THAT old gramophone records may be used for many purposes, first softening them by immersing them in hot water.
—THAT the earth screen between primary and secondaries of an A.C. mains transformer must be provided with an air-gap.
—THAT the valves in a receiver should be switched on when reading the voltage of the L.T. battery.

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

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

FACTS & FIGURES

The Ediswan High-vacuum Cathode-ray Tube

WE have recently received for test the new Ediswan cathode-ray tube, illustrated below, which is of the high-vacuum type, utilising an electrostatic system of "electronic lenses" to focus the electron beam to a fine point on the fluorescent screen. As it is a high-vacuum tube with no gas filling, many advantages over the original "soft" tube are present.

Firstly, better life is obtained at high accelerator voltages, as the cathode is not subject to any damaging effect due to the presence of positive ions.

The Ediswan cathode-ray tube, type B.H. It is obtainable in three types, giving the choice of blue, green, or sepia screens. The screen diameter is 5 inches.

Secondly, complete scans of the fluorescent screen do not reveal any distortion of image due to "origin" or "threshold" effect.

Thirdly, almost perfect modulation of spot intensity is obtainable, as concentration of the beam is not dependent within limits upon beam current. This property of the new tube renders it permanently suitable for the reproduction of television images up to 180 lines or more.

The grid-or negative-cylinder modulation characteristic anode current (beam current), "grid volts" curve is similar in form to the thermionic valve, beam current and intensity varying practically in a linear manner over wide limits with changes of negative cylinder voltage; also, because the tube is high vacuum, high accelerator voltages may be used attaining high electron velocities, enabling the device to record recurring and transient phenomena of extremely rapid speed. Due to the special design of deflector plates, the sensitivity is only slightly less than that of the original gas-filled cathode-ray tube. All deflector plates are brought out to terminals on the base of the tube and should be used and connected in the usual manner, care being taken to ensure that all plates have a conducting path to the final accelerator, which should be earthed. The price of the tube shown on this page is £8 8s., but the Edison Swan Electric Co., Ltd., also make a larger sized tube which costs £10 10s.

Amplion Fuses

A NEW line recently introduced by Amplion is a complete range of cartridge-type fuses in a wide variety of ratings from 60 m.a. to 3 amps. These are of standard type, and will therefore fit any standard fuse holder, fuse box, or fuse mains connector. Priced at 6d. each, these fuses will find a ready market, especially as we have found them to be extremely reliable in the course of our tests. It is often considered that a fuse is—just a fuse, and it is not fully appreciated that much depends upon its "blowing" at the appropriate overload on the circuit. We found that all of the Amplion fuses tested would readily carry the current at which they were rated, and that they "blew" with an overload of just about 50 per cent. in every case.

The ratings are 60, 100, 150, 250, 500 and 700 m.a., 1, 1½, 2 and 3 amps., whilst these are all colour coded in addition to being very clearly marked with their current ratings.

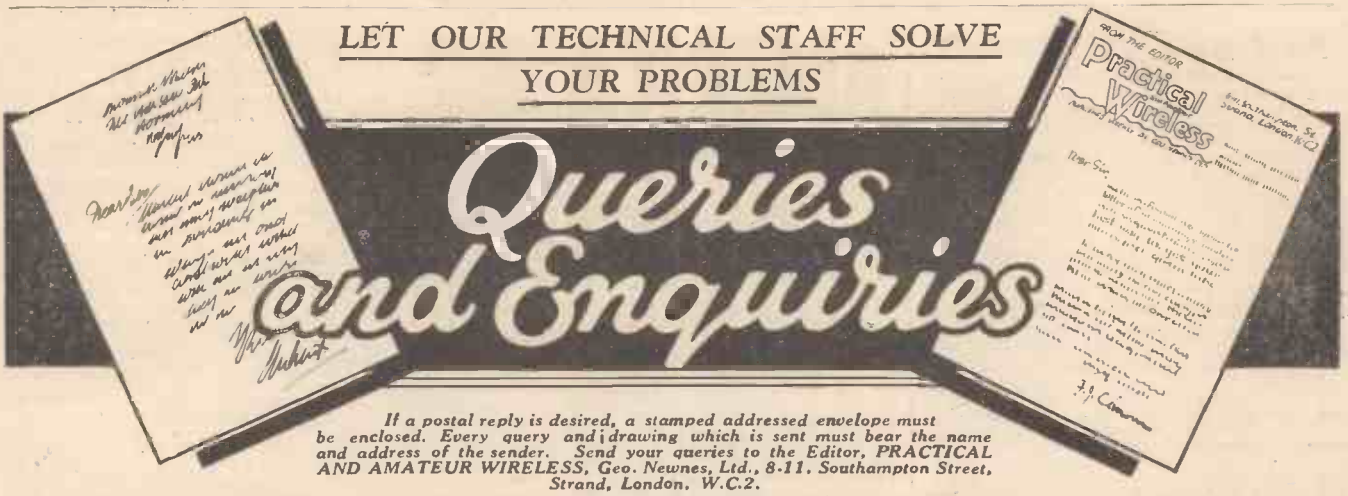
The Wearite Wave-trap Coil

AN extremely efficient type of wave-trap that will give first-class results can be made by using an "on-off" switch and a .0005 mfd. condenser in conjunction with the wave-trap coil shown on this page. This coil consists of a highly efficient iron-cored coil specially designed for use in a wave-trap. The tuning condenser may be of any type, providing it is .0005 mfd., but an air-dielectric tuning condenser will probably provide more complete elimination of the interfering station than a compression type condenser, although the latter will give quite fair results. The circuit diagram showing the connections of the coil, condenser and switch is shown on a pamphlet supplied with the coil, also the method of connecting the trap in the aerial lead. To operate the trap, the condenser should be set at zero and the interfering station tuned in on the set to give maximum volume. Next increase the trap condenser until the volume of the station is reduced to a minimum, and leave it in this position. The set can now be used in the usual manner. If the interfering station is on the long-wave it will be necessary to open the switch to bring the long-wave coil of the trap into circuit. The price of the coil is 7s. 6d. but if supplied with a cover, costs 8s. 6d.

Showing the new Wearite wave-trap coil.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

Queries and Enquiries



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

SPECIAL NOTE

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

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

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.

(5) Grant interviews to querists.

Adding a Pick-up

"Reading about gramophone pick-ups in your journal, I am desirous of fitting one to my set, but as there are no pick-up sockets provided I do not know where the leads should be connected."—F. W. (Sheffield).

Assuming that your receiver is of the battery-operated type, one of the pick-up leads should be connected to the grid terminal of the detector valve and the other to the —1½ volt socket of the G.B. battery.

60s. Three Connections

I have built the 60s. Three described in "Practical Wireless" dated December 2nd, 1933, but I am not quite certain concerning the wiring of the flex leads to the L.F. transformer and the speaker transformer.—A. M. (Burnham).

The leads referred to should be connected as follows. I.S. terminal of the L.F. transformer (or G.B.) to G.B.—3 lead, and I.P. (or H.T.) to H.T.+1 lead; P terminal of the output valve to the centre terminal of the speaker transformer, and the outside terminal of this transformer to the inside terminal of the potentiometer volume control and H.T.+2 lead.

Hall-Mark Four Transformer

I want to know if there is any difference between a Class B transformer and a Q.P.-P. transformer, and, if not, can I use the former type in the Hall-Mark Four?—C. J. H. (Woolwich).

The Class B driver transformer has a step-down ratio between its primary and secondary windings, whereas the Q.P.-P. input transformer has a very high step-up ratio. The two components are therefore not interchangeable, but it is permissible, however, to use an ordinary push-pull transformer in the Hall-Mark Four.

A Battery Microphone Amplifier

Would it be possible for you to supply me with a print or diagram of a battery-operated, power amplifier, for use in conjunction with a small microphone and two loud-speakers?—G. G. (Hednesford).

The diagram and constructional details of a battery-operated microphone amplifier will be found on page 117 of PRACTICAL WIRELESS No. 29.

L.T. Supply from the Mains

I have a two-valve set working from a D.C. mains unit, using two 2 volt .2 amp. valves. Would it be possible to supply the filament current from the mains?—F. W. L. (Birmingham).

It is permissible to supply the valve filaments from the D.C. mains, but slight hum is to be expected when this method of supply is employed. The mains + lead should be connected *via* a 40-watt 220-volt lamp to the L.T.+ terminal of the receiver, and the mains — lead direct to L.T.— terminal. An article on this subject appeared in PRACTICAL WIRELESS dated August 4th, 1934

Adjusting the Summit Three

I have built the Summit Three, but I cannot get it to take more than 3 volts grid bias on the output valve, and the potentiometer volume control has very little effect. I would also like to improve the selectivity.—A. R. A. (Bangor).

Your trouble indicates that you have interchanged the two G.B.— leads. The G.B. lead connected to the G.B. terminal of the L.F. transformer should be connected to the —3 or —4½ socket of the G.B. battery, and the G.B. lead of the potentiometer to the —9 socket. Selectivity may be improved by connecting the coupling condenser C5 to the third terminal of the second coil instead of to the first terminal, and if a very long aerial is used a .0003 pre-set condenser may be connected between the aerial terminal and terminal 3 of the first coil.

Signal Generator Details

I am building the Signal Generator described in the July 14th, 1935, issue of "Practical Wireless," but there are a few points that I am rather hazy about. Does the meter read in actual A.C. volts, or are the readings only comparative? If the former, what voltage is to be expected from, say, a set giving 2 watts output? What is the highest A.C. voltage that the meter will handle? What is the relation between the stud readings?—G. H. (Birmingham).

The output meter is an A.C. voltmeter. The paragraph "Calibrating the Meter" shows how it is adjusted by its bias to give one volt deflection. In this way it is possible to read actual microvolts because the lowest attenuator tapping gives a 100/1 ratio. The most satisfactory way of obtaining the A.C. output of a receiver is to measure the resistance of the speech coil of the loud-speaker, and then from the equation V^2/R can be obtained the wattage output. The .5 ohm stud gives a fifth of the output obtained from the second stud. The sketch of G.B. connections you enclosed is correct.

Coil Construction

"Could you tell me how many turns of 24 s.w.g. D.C.C. wire I should require to wind on a paxolin former 2½in. in diameter to tune from 200 to 500 metres, and from 1,000 to 2,000 metres, the coil to be used as an H.F. transformer? Should the aerial coil be wound in the same manner?"—D. D. (Edinburgh).

We suggest that you use 47 turns for the medium-wave secondary winding, 140 turns for the long-wave secondary winding, 20 turns for the medium-wave primary winding, 50 turns for the long-wave primary winding, and 60 turns for the common reaction winding. The coil may be used in the aerial circuit or between an S.G. valve and the detector, but it cannot be satisfactorily used as an intervalve coupler if the H.F. valve is of the triode type.

A.C. Hall-Mark Speaker

"I am at present using a receiver with Class B output and a Rola P.M. speaker. The speaker has only two leads, and is coupled to the Class B valve by means of a Class B transformer. I intend building your A.C. Hall-Mark, and would like to know whether my existing speaker and Class B output transformer can be used."—W. G. H. (Kirkcaldy).

The speaker used in the Hall-Mark Four is of the energised type, having a field-winding resistance of 2,000 ohms, and an output transformer attached suitable for matching two 41MP valves in push-pull—optimum load 6,000 ohms. Therefore, we cannot recommend the use of your existing speaker and transformer.

Choosing a Set

"I want to build an all-mains A.C. three-valve set for use on long and medium waves. Good quality is most important, but it should be as selective as possible."—J. P. L. G. (Dublin).

We suggest that you build the A.C. model of the £5 Superhet. (Blueprint No. 43), but if a straight receiver is preferred the A.C. Three (Blueprint No. 29) is recommended. The selectivity of the superhet. is superior to that of the straight set, however.

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

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face type and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. Radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," 8, Southampton Street, Strand, London.

PREMIER SUPPLY STORES

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

OFFER the Following Manufacturer's New Surplus Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra; I.F.S. and abroad carriage extra; orders under 5/- cannot be sent C.O.D.; please send for illustrated catalogue, post free.

PREMIER SUPPLY STORES Announce the Purchase of the Complete Stock of a World-Famous Continental Valve Manufacturer, all the following standard mains types, fully guaranteed, 4/6 each. HL, L, Power. High, Medium and Low Magnification Screen Grid. Variable-mu Screen Grid; 1, 3 and 4 watt A.C. output, directly heated Pentodes; 250-volt 60 ma. Full Wave Rectifiers; A.C./D.C. types, 20 volts .18 amp Filaments; Screen Grid; Variable-mu Screen Grid; H, HL, Power and Pentodes.

THE following types 5/6 each: 350v., 120 ma. full-wave Rectifiers; 500v., 120 ma. full-wave Rectifiers, 2½-watt indirectly-heated Pentodes.

2-VOLT Valves, detector, H.F., L.F., 2/3; power, low consumption power, super power, 2/9; screened grid, variable-mu screened grid 5- or 4-pin Pentodes, 5/-.

THE Following American Types, 4/6: 250, 112, 171, 210, 245, 226, 47, 46, 24, 35, 51, 57, 58, 55, 37, 80, 6A7, 2A7, 27, 77, 78, 2A5.

THE Following Types, 6/6 each: 42, 25Z5, 36, 38, 83, 39, 44, 53, 6B7, 2A6, 2B7, 5Z3, 6C6, 6A4, 6D6, 6F7, 43, 59; send for catalogue of above types.

LISSEN 3-gang Superhet Coils, with switching; listed 30/-, with circuit, 6/-.

LOTUS 3-gang Band-pass Coils; 12/6 per set; with switching.

BLUE SPOT P.M. Speaker, Multi-ratio transformer; Special offer, 16/-.

BLUE SPOT 45 P.M. Speaker, Multi-ratio transformer, handles 4 watts, listed 45/-, at 25/-; or in handsome walnut cabinet, 35/-.

BLUE SPOT 99 P.M. Speaker, Multi-ratio transformer, handles 5 watts; listed 59/6, at 31/-.

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

DARIO Valves, 4-volt battery type, H.F., R.C., L.F., power, 1/6 each; 4v. directly heated mains power, 1 watt, 2/6.

A LARGE Selection of Pedestal, table and radiogram cabinets by best manufacturers at a fraction of original cost; send for list.

BLUE SPOT 29 D.C. Moving Coil, with Multi-ratio transformer, 7in. cone, 2,500 and 7,500 ohms, 9/11.

T.C.C. Electrolytic Condensers, 15 mf., 50v. working, 1/-; 50 mf., 12v. working, 1/-; 15 mf., 100v. working, 1/3.

CONDENSER blocks, H.M.V., 400v. working, 4+2+1+1+1+0.5, 3/9; 2+2+1+1+1+1+0.5, 3/-; Philips 6+4+2+1+1, 4/6.

ALL-ELECTRIC 3-stage Amplifiers, 200-250v. 40-60 cycles, 10 watts undistorted output, complete with 5 valves, and Magnavox Super 66 energised speaker, £12/10/-.

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

PREMIER Chokes, 40 milliamps, 25 hys., 4/-; 65 milliamps., 30 hys., 5/6; 150 milliamps, 30 hys., 10/6; 60 milliamps, 80 hys., 2,500 ohms, 5/6; 25 milliamps, 20 hys., 2/9; 250 milliamps, 30 hys., 20/-.

PREMIER Auto Transformers, 100-110/200-250v. or vice versa, 100-watt, 10/-.

PREMIER L.T. Charger Kits, consisting of Premier transformers and Westinghouse rectifier, input 200-250v. A.V., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

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

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

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

WIRE End One Watt Resistors, our assortment, 2/- per dozen.

(Continued at top of column three)

(Continued from foot of column one)

SPECIAL Offer of Wire-wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 100,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

POLAR STAR, manufacturers' model, 3-gang condensers, fully screened, 7/6, with trimmer; unscreened, 5/-.

ORMOND No. 4 Variable Condensers, 0.00025, 1/6. O.K. for Short Waves.

LARGE Moving Iron Cone Units by Best Manufacturer, 3/6.

SPECIAL Offer Western Electric Mains Transformers, input 200-250 volts, output 350-0-350 volts, 120 milliamps, screened primary, 4 volts 1-2 amps., 4 volts 2-3 amps., 4 volts 3-5 amps., 9/6; input 100-250 volts, 300-0-300 volts 60 milliamps, 4 volts 1-2 amps., 4 volts 2-3 amps., 6/6; input 200-250 volts, screened primary, output 500-0-500 volts 150 milliamps, 4 volts 3-5 amps., 4 volts 2-3 amps., 4 volts 2-3 amps, 4 volts 1 amp., 4 volts 1 amp., 19/6.

MAINS Transformer, with Westinghouse rectifier, output 200v. 30 milliamps, and 4 volts 3 amps., L.T., 15/- the pair.

U.S.A. 3-gang Condenser, .0005, with trimmers, 3/11; a really solid job; Utility disc drive, 1/6.

SPECIAL Offer.—0.00015 brass short wave tuning condensers, with slow motion and complete dial 3/9; short-wave chokes, 10-200 metres, 9d.

DUBILIER Electrolytic Condensers, 12 microfarads, 20 volts, 6d.; 8 plus 4 microfarads, 500 volts, 4/-; 50 mf., 50v., 1/9; 8 mf., 3/-.

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

KOLSTER BRANDES Model 301 Pick-up with Arm; list price, 35/-; our price, 10/6.

RELIABLE Canned Coils with Circuit, accurately matched, dual range, iron core, 2/11.

UTILITY 3-gang Condenser, 0.0005, fully screened, with trimmers, ball bearing, straight or superhet, 6/9; complete with disc drive, 7/11; the best 3-gang available.

T.C.C. Condensers, 4 mf., 450v. working, 4/-; 4 mf., 750v. working, 6/-.

VARLEY Constant Square Peak Coils, band-pass, type B.P.7, brand new in makers' cartons, with instruction and diagram, 2/4.

VARLEY H.F. Intervalve Coils, B.P.8, band-pass, complete with instructions, in original cartons, 2/6.

SCREENED H.F. Chokes, by one of the largest manufacturers in the country, 1/6.

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

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

U.S.A. Electrolytic Condensers, 550v. peak working, standard tubular metal condenser, 4 mf., 8 mf., 12 mf., a real bargain, 1/9.

BRITISH Radiophone 2-gang 0.00016 Short-wave Variables, all brass with steatite insulation, 5/6.

1,000 Ohm 150 Milliamp, semi-variable resistance, 2/-; 1,000 ohm 250 milliamp., tapped, for any number, 18 valves, 3/6; 800 ohms 350 m.a., tapped, 2/-.

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

RELIABLE Smoothing Condensers, 250v. working, 1 mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 350v. working, 1 mf., 1/-; 2 mf., 1/6; 4 mf., 3/-.

ALL Premier Mains Transformers have Engraved Panels, terminal connections, all low tension, windings centre tapped, tapped and screened primaries, 200-250 volts.

PREMIER 250-0-250 60 milliamps, 4 volts 1-2 amps., 4 volts 2-3 amps., 4 volts 3-4 amps, 10/-.

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PREMIER Combined H.T.8. and H.T.9 Transformer, rectified output 250 or 300 volts 60 milliamps, 4 volts 1-2 amps., 4 volts 3.5 amps., 10/-; or with Westinghouse rectifier, either type, 18/6.

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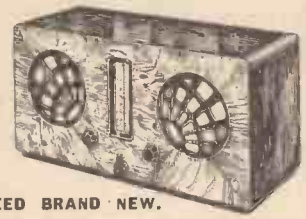

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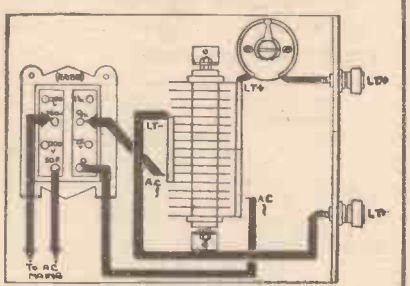

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