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THE LEADING, AUTHORITATIVE, TWO-IN-ONE WIRELESS WEEKLY

Practical and Amateur Wireless

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 6. No. 132.
March 30th, 1935.

AND AMATEUR TELEVISION

The A.B.C. OF Valve Pin Connections

THE SILVER SOUVENIR ! See Below

Practical and Amateur Wireless

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Technical Staff:
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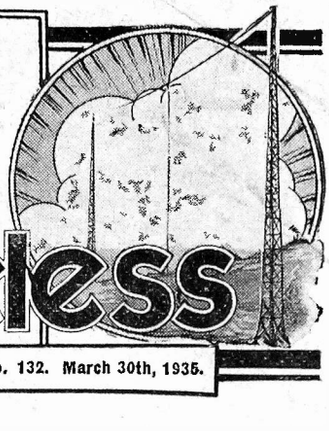


ROUND *the* WORLD *of* WIRELESS

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 Colunio 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.

INTERESTING and TOPICAL PARAGRAPHS

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. 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.

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.

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.

"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.

MAKING A CALIBRATION CHART

An Article Explaining the Simple Method Adopted

By W. H. DELLER

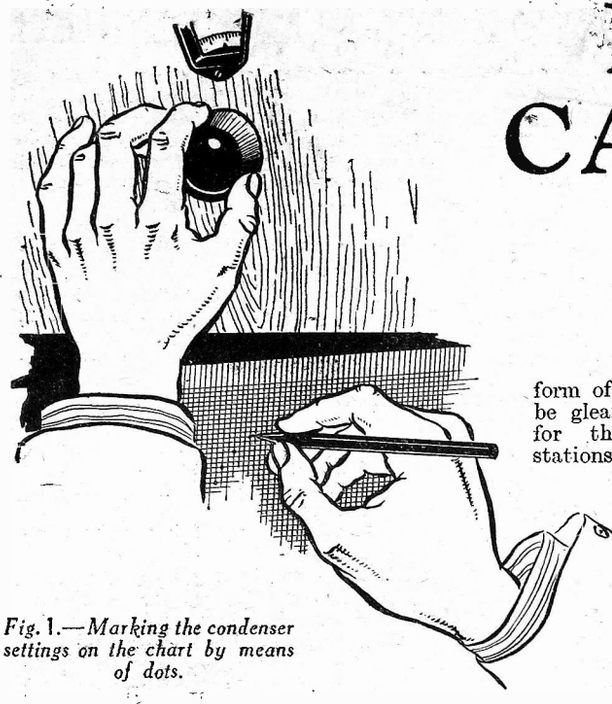


Fig. 1.—Marking the condenser settings on the chart by means of dots.

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 only 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.

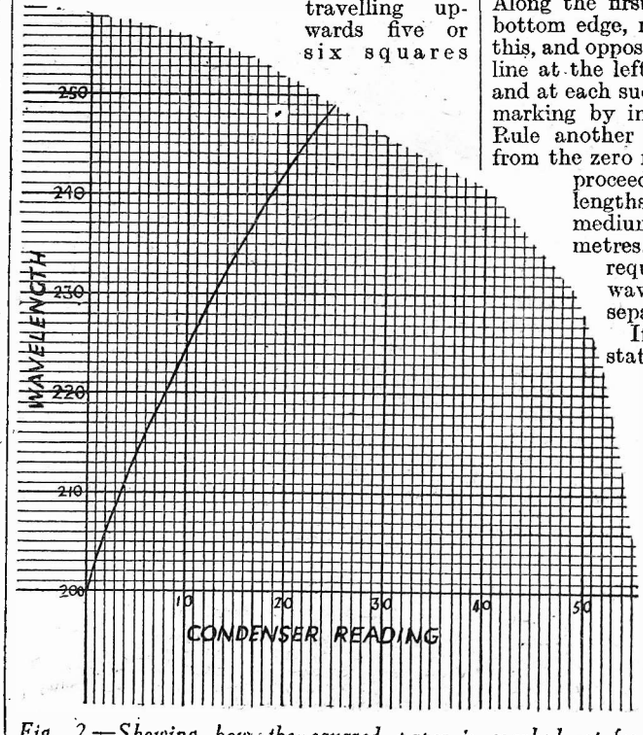


Fig. 2.—Showing how the squared paper is marked out for condenser and wavelength readings.

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.

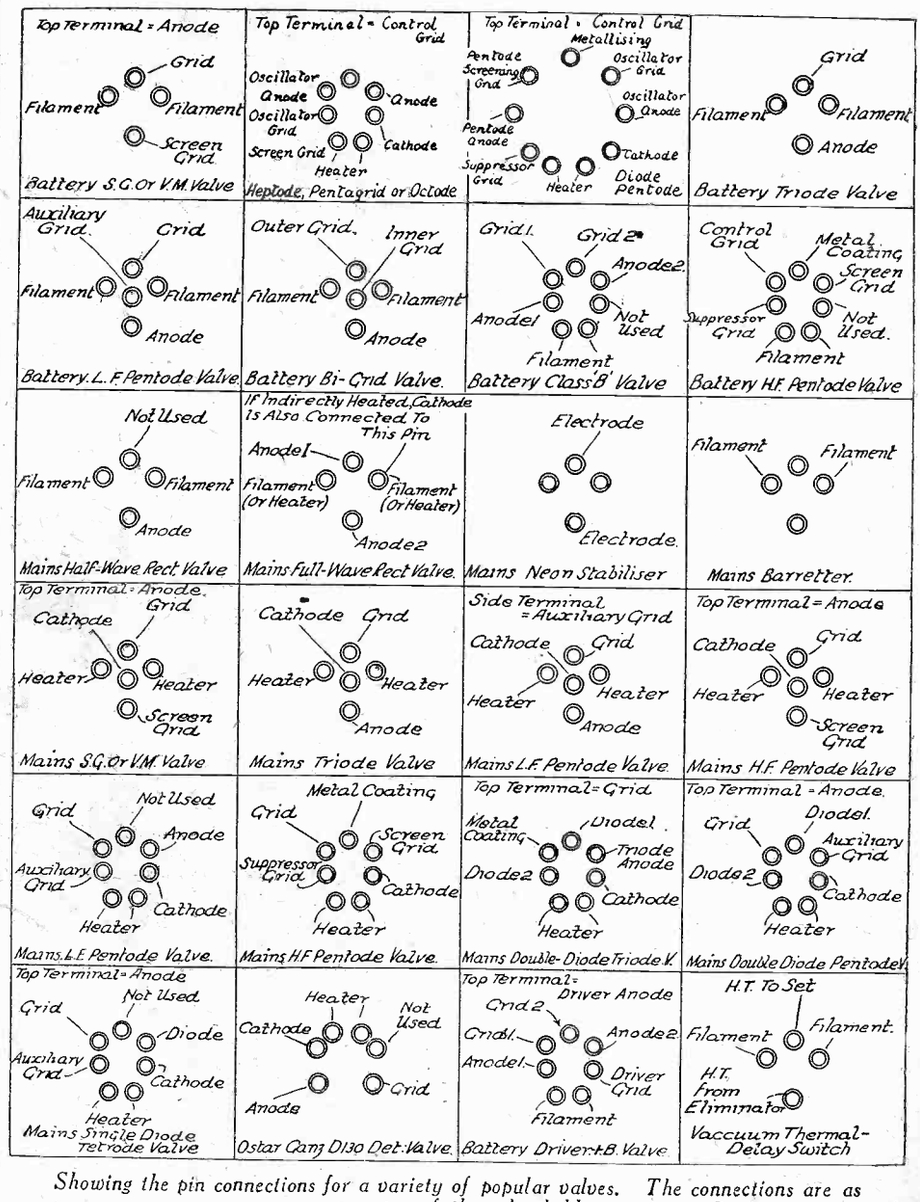
Battery Pentodes

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.

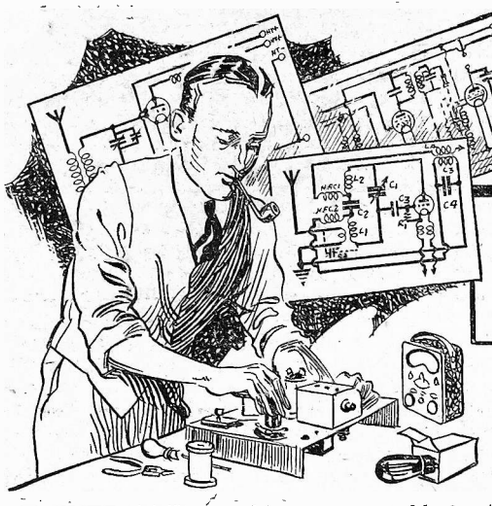
A few of the valves represented in the diagrams below are not now used very widely, but they have been included to make the reference more comprehensive. For example, the bi-grid valve which was formerly employed as first detector in certain types of super-heterodyne (chiefly in conjunction with a frame 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.

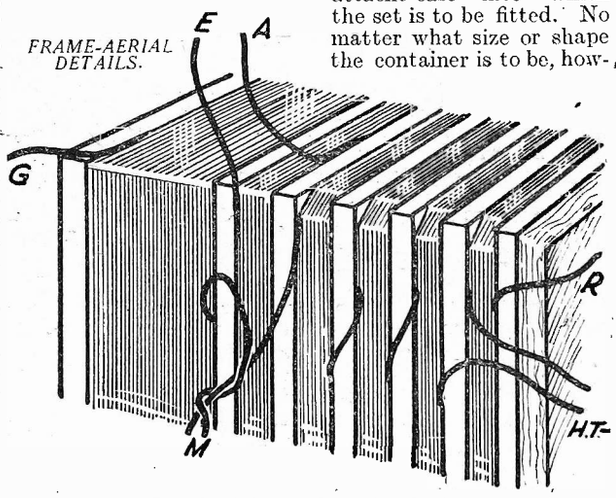
The Frame Aerial

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.



FRAME-AERIAL DETAILS.

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)

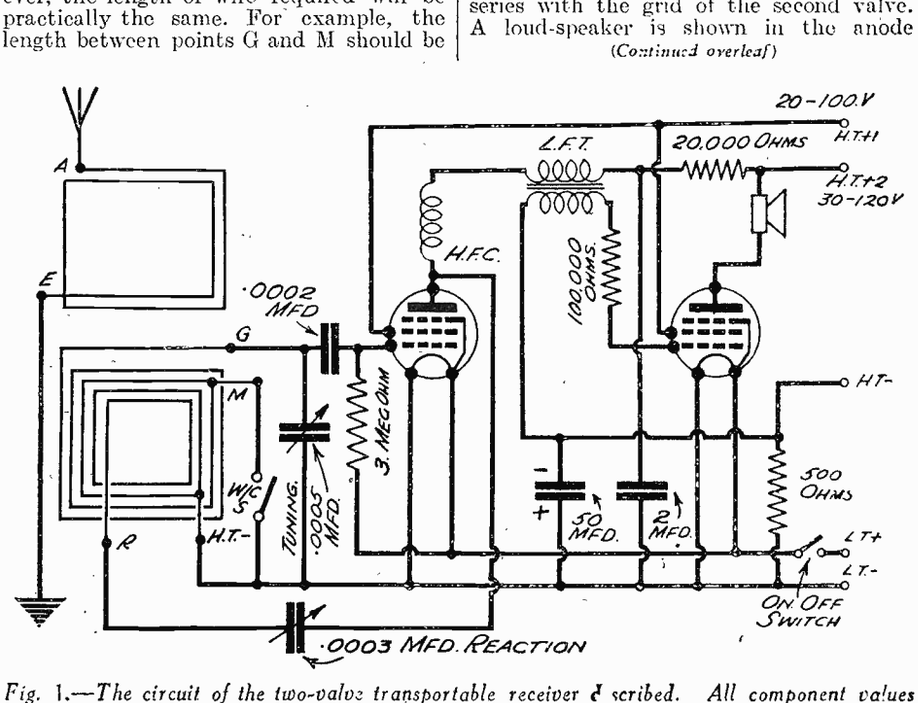


Fig. 1.—The circuit of the two-valve transportable receiver described. All component values are indicated.

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.

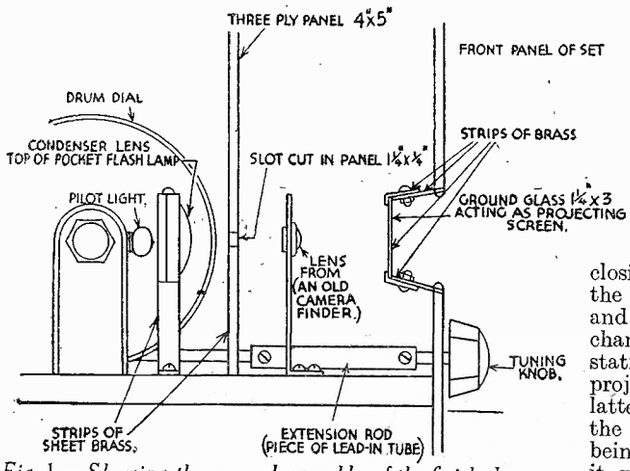


Fig. 1.—Showing the general assembly of the finished parts.

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).

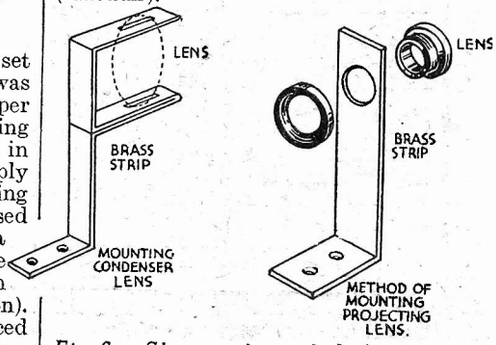


Fig. 3.—Showing the method of mounting the lenses.

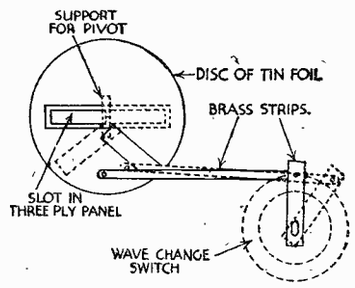


Fig. 2.—Details of the shutter.

MAKING A CALIBRATION CHART

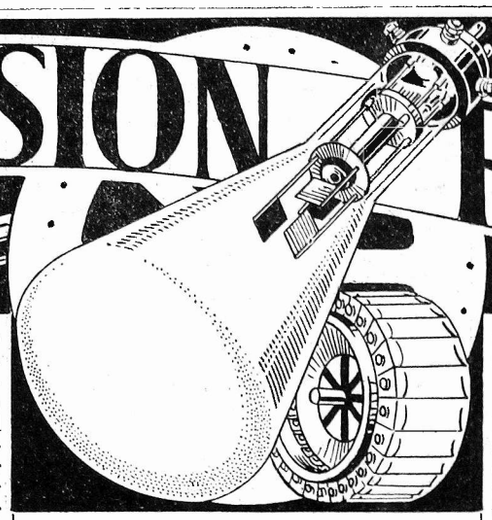
(*Continued from page 35*)

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.

TELEVISION FOR ALL



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

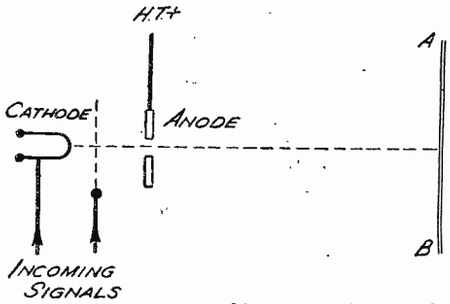


Fig. 1.—Inserting an additional mesh electrode between cathode and anode for modulation purposes.

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

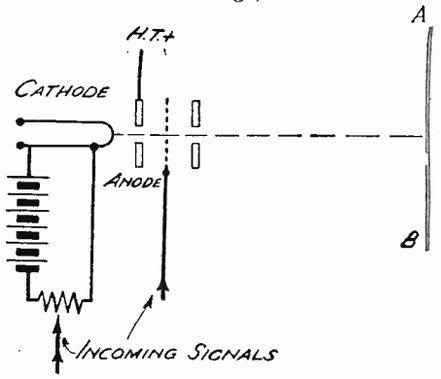


Fig. 2.—Another suggestion for intensity modulation which included a potentiometer control.

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 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.

Fig. 4.—An imperfect image resulting partly from misfocusing and over-modulation.

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

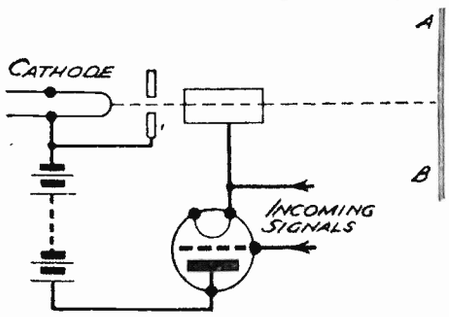


Fig. 3.—Including an amplifying valve in an anode modulation circuit.

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

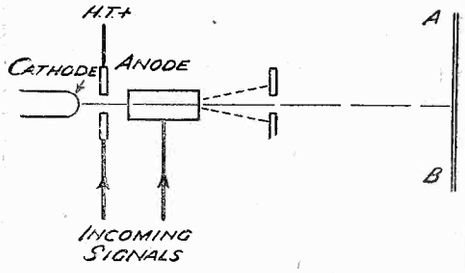


Fig. 5.—Interposing an apertured mask to cut off the electron beam in accordance with incoming signal intensity.

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 *vid* 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.

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. 7.—Showing the result of over-correction, and slight over-modulation.

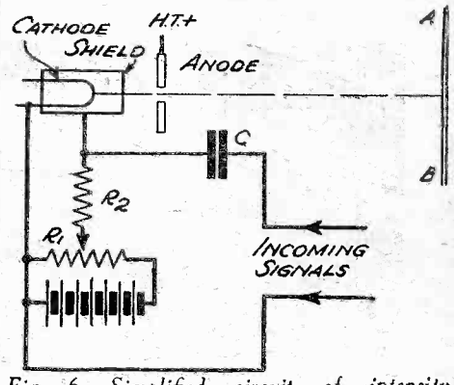


Fig. 6.—Simplified circuit of intensity modulation on the C.-R. tube shield.

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 emphasised 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.

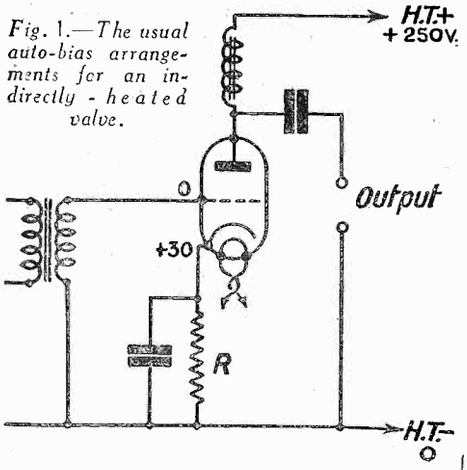


Fig. 1.—The usual auto-bias arrangements for an indirectly-heated valve.

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,

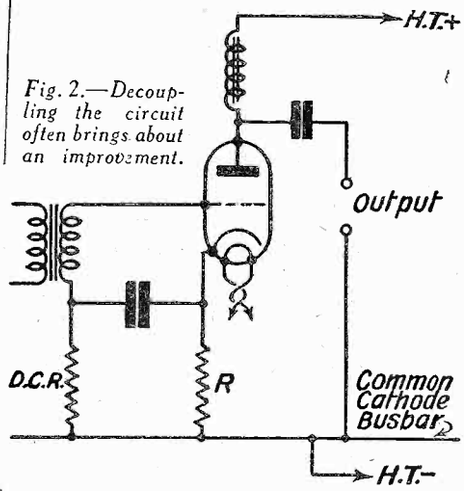


Fig. 2.—Decoupling the circuit often brings about an improvement.

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 as the resistances sometimes connected in the anode feed to reduce the anode voltage.

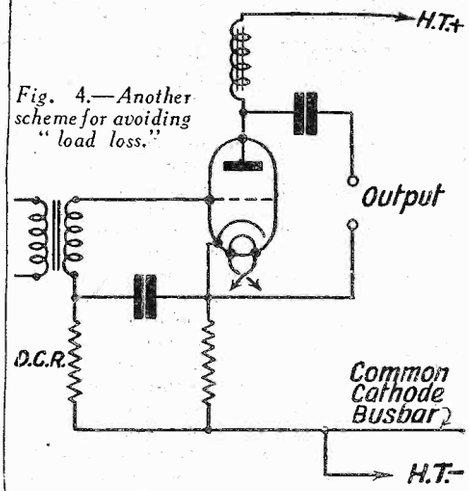


Fig. 4.—Another scheme for avoiding "load loss."

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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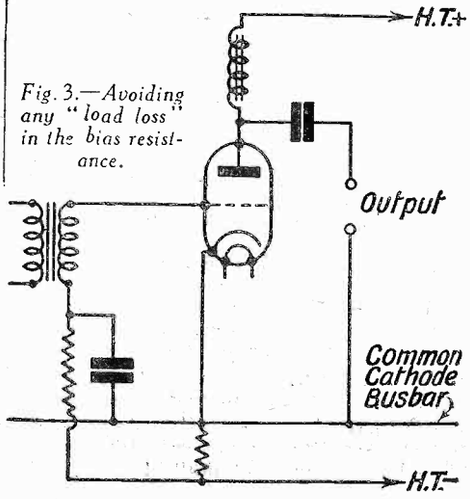
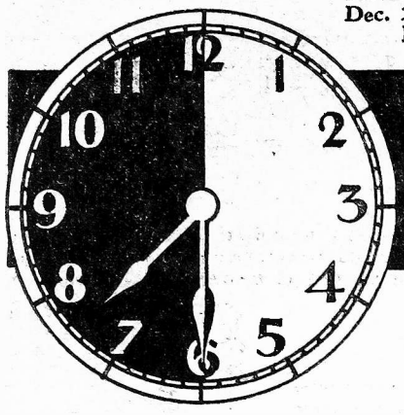


Fig. 3.—Avoiding any "load loss" in the bias resistance.

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,

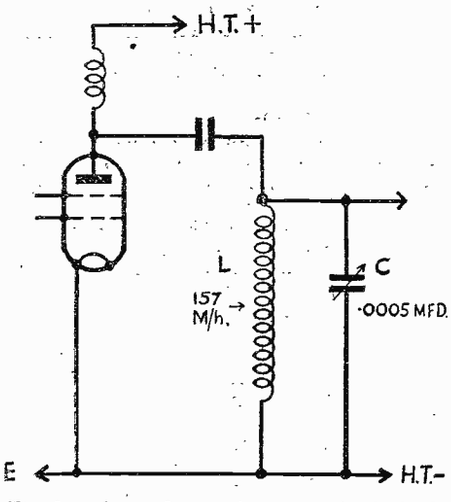


Fig. 1.—A simple tuning circuit of which the resonant wavelength can be found by applying the formula: wavelength = 1,884 $\sqrt{LC}$.

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) $= 1{,}884 \sqrt{L \text{ (inductance)} \times C \text{ (capacity)}}$. 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

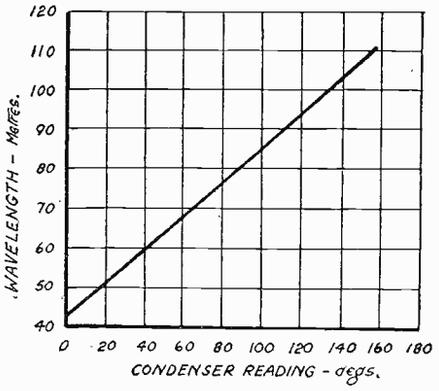


Fig. 3.—A typical calibration graph for the wavemeter. When using the components mentioned in the text the line will be practically straight.

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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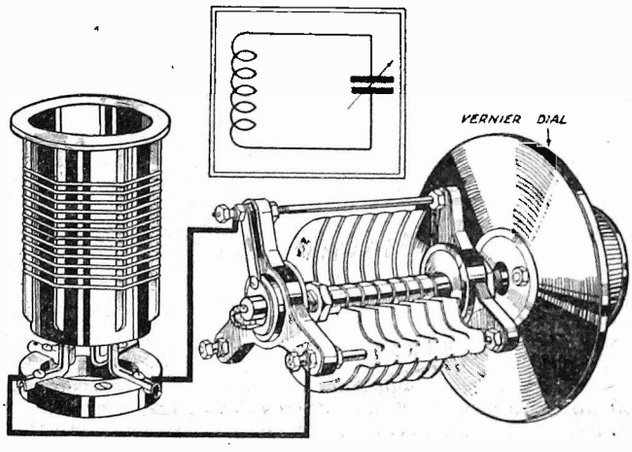

Fig. 2.—Theoretical and pictorial circuits for the simplest type of wavemeter—the absorption type

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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

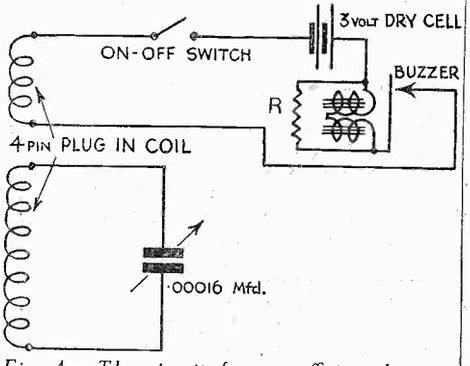


Fig. 4.—The circuit for an efficient buzzer wavemeter of the type described.

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 electric 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 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.

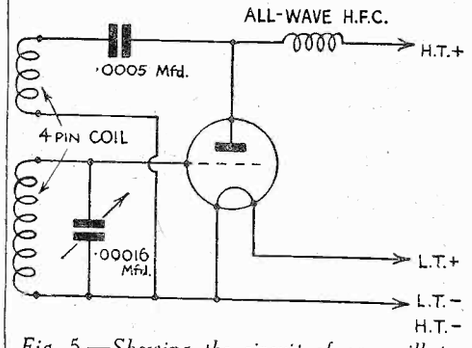
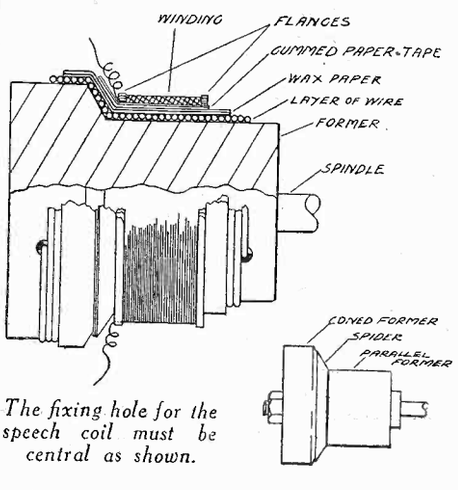


Fig. 5.—Showing the circuit of an oscillator suitable for use as a heterodyne wavemeter.

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 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.



The fixing hole for the speech coil must be central as shown.

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 (ye 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:

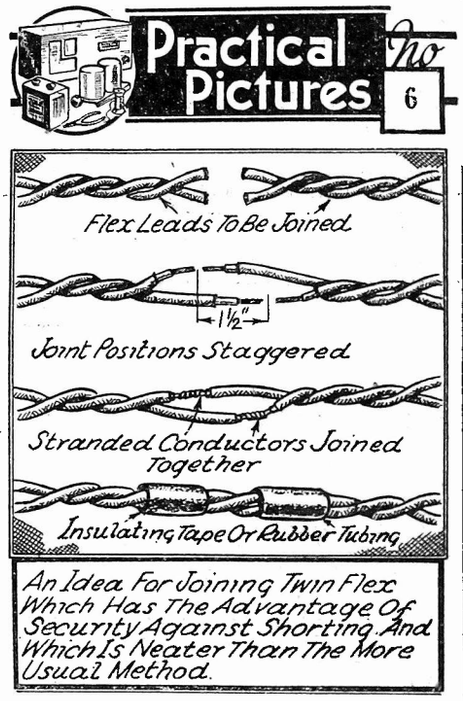
"DEAR THERMION,

"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

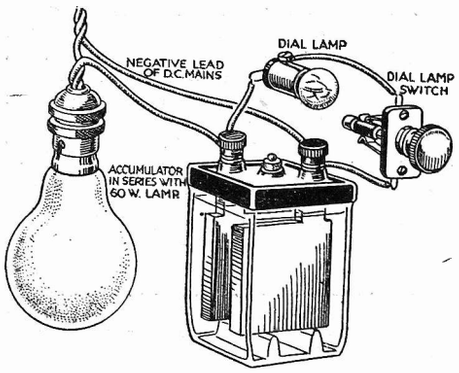
ONE of the most popular announcers in the Mexico broadcasting world who, having offended the station director, had not been paid for some months, instituted a hunger strike as a protest. In view of his reputation with listeners he continued to carry out his duties, and daily, flanked by two hospital 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

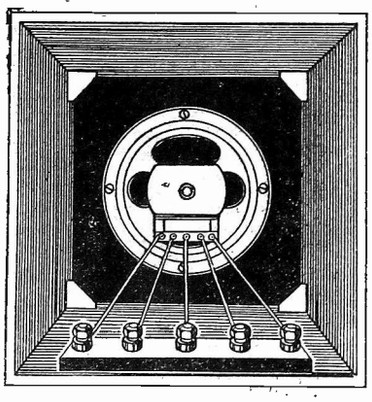


An economical method of using a dial lamp.

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.

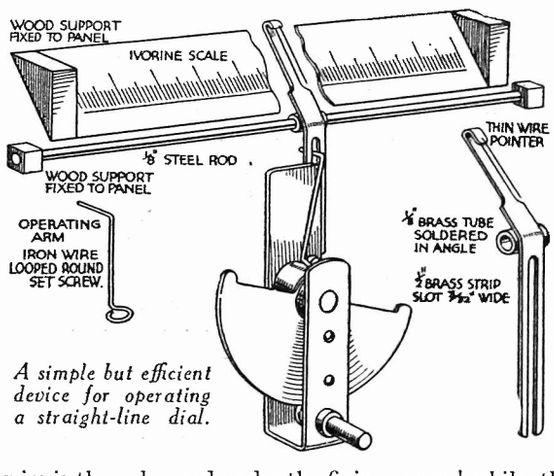
THAT DODGE OF YOURS!

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.

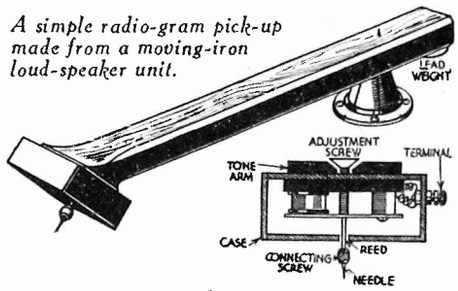
wire is then clamped under the fixing screw on the collar, as shown in the sketch. The length of this arm can be made to suit a scale of any length; it is half the scale length minus ½in. The slow-motion gear should be placed a short distance from the panel to allow for free passage of pointer carriage.

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 1¼in. 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).

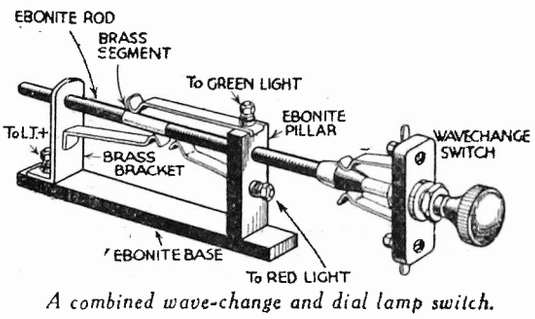
A Wave-change Indicator

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).

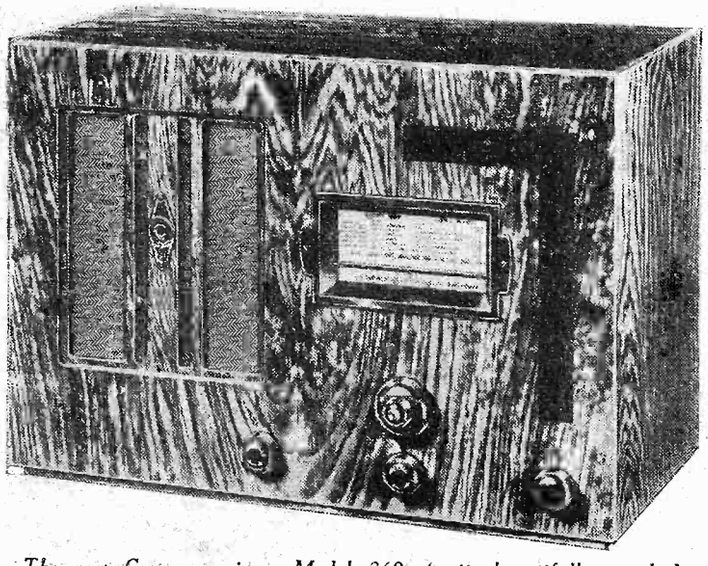


A combined wave-change and dial lamp switch.

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, 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 new Cossor receiver, Model 369, in its beautifully marked walnut cabinet, showing the full-vision tuning scale and neat arrangement of control knobs.

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.

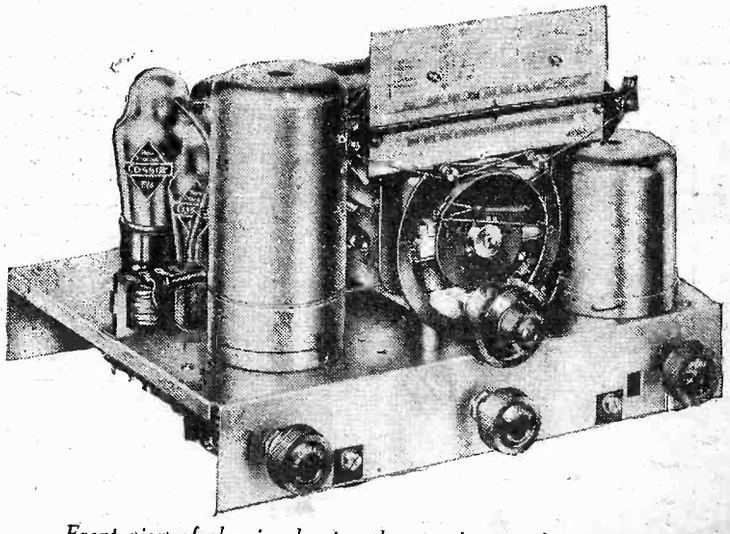
SPECIFICATION IN BRIEF

Receiver: Cossor 4-valve Universal All-Electric Receiver, Model 369.

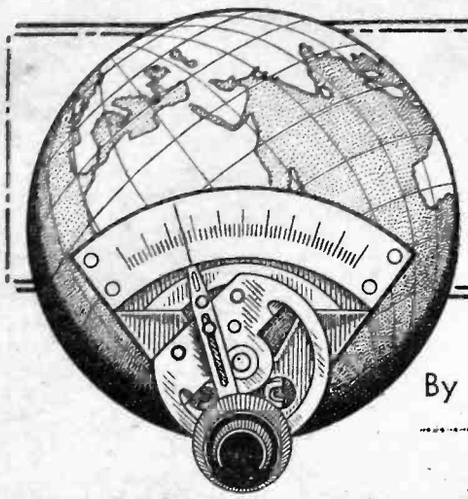
Makers: A. C. Cossor, Ltd.

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, 13¼ins. 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 so 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.

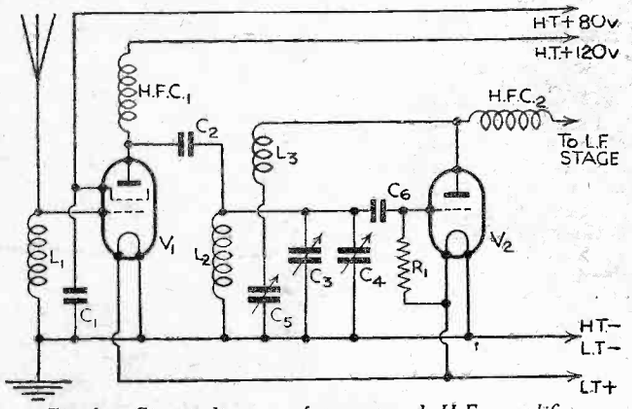


Fig. 1.—Circuit diagram of an untuned H.F. amplifier.

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

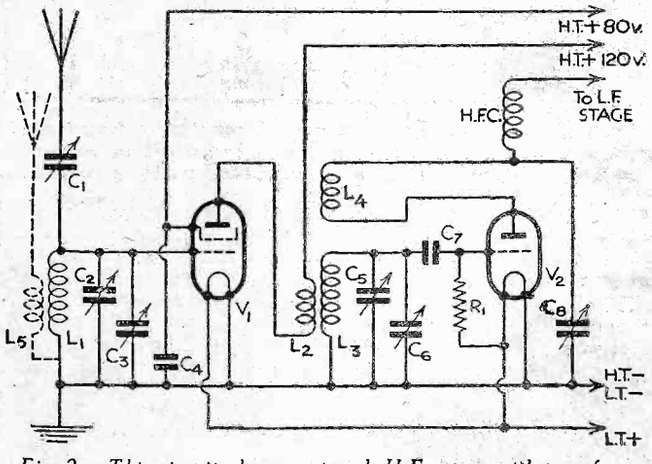


Fig. 2.—This circuit shows a tuned H.F. stage with transformer coupling to the detector valve, and throttle control of reaction.

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").

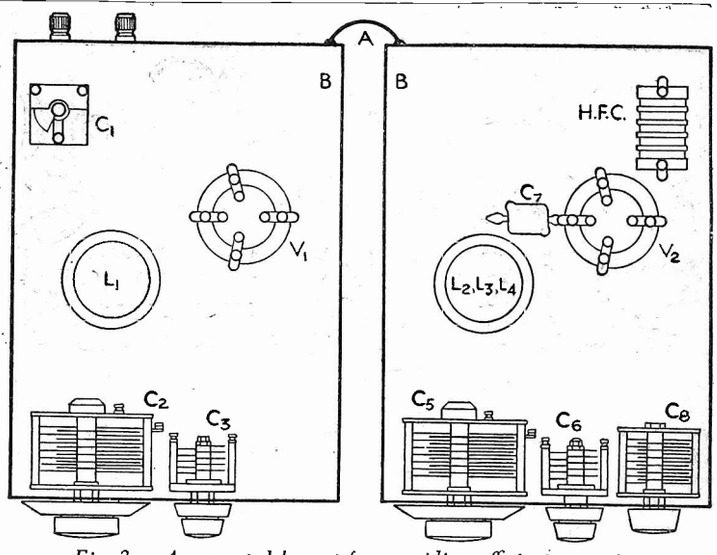


Fig. 3.—A suggested layout for providing efficient screening.

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.

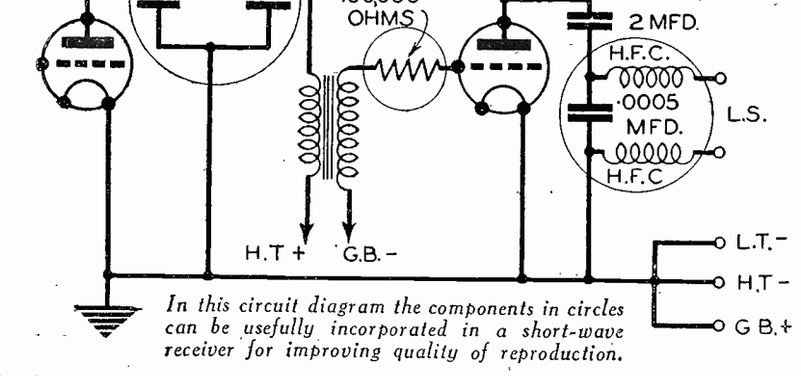
RADIO and television enthusiasts often bemoan the poor quality of the programmes received on short waves, and wonder why more information is not published with regard to improving the tone of short-wave signals received.

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.



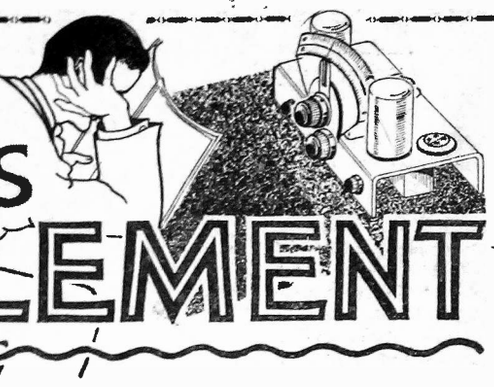
In this circuit diagram the components in circles can be usefully incorporated in a short-wave receiver for improving quality of reproduction.

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

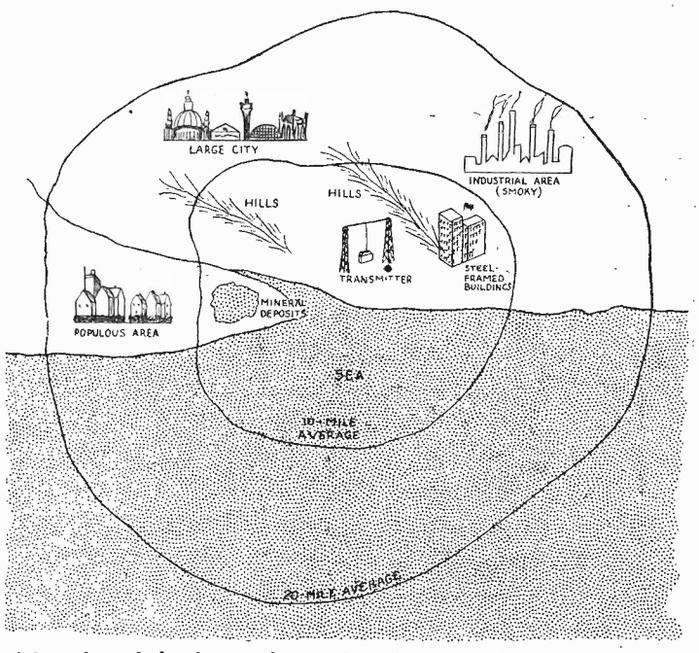
After carefully making a note of the average signal strengths from the various transmitters, a large-scale map was obtained and lines drawn from the receiver to the various transmitters. This being done, the "path" of the signals was carefully examined in an attempt to find what geographical differences 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 transmisssions 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 ★

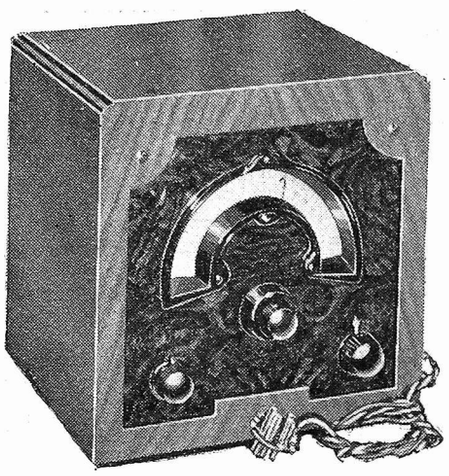
An Efficient Instrument which can be used as a Detector Unit with Battery or A.C. Receiver, or as a Superhet Unit

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

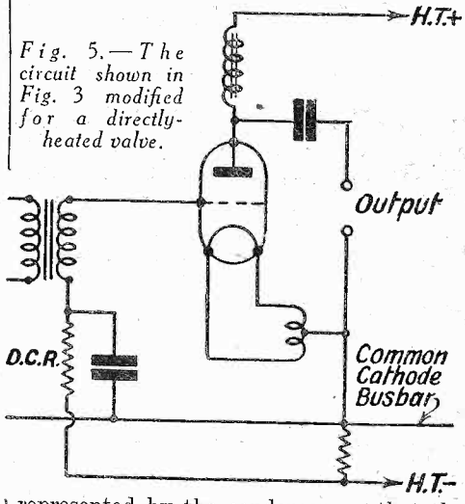


Fig. 5.—The circuit shown in Fig. 3 modified for a directly-heated valve.

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.

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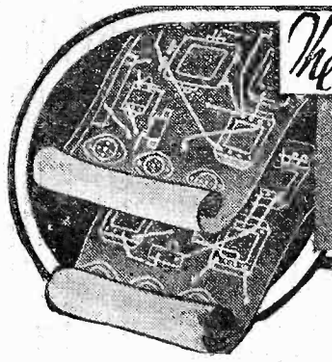
To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.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

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.

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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) 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	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:	June 6, '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* 01987. 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.

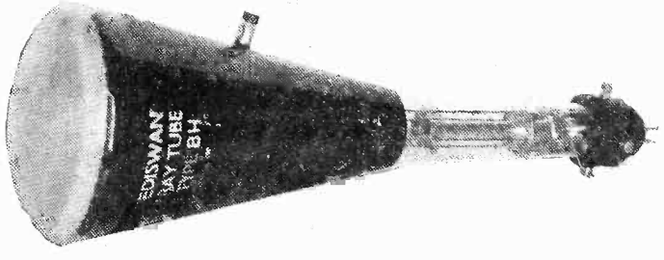
The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL AND AMATEUR WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible 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.

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.

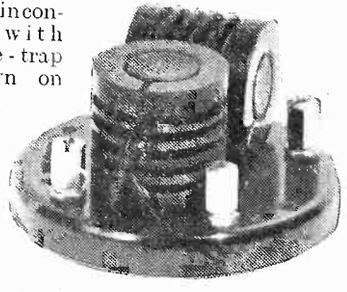
Amplion Fuses

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

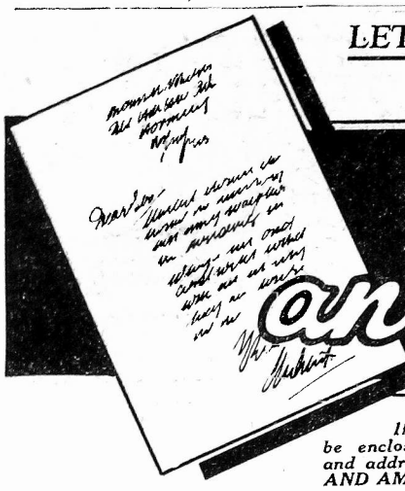
AN extremely efficient type of wave-trap that will give first-class results can be made by using an "on-off" switch and a .0005 mfd. condenser in conjunction with the wave-trap coil shown on this page. This coil consists of a highly efficient iron-cored coil specially designed for use in a wave-trap. 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.

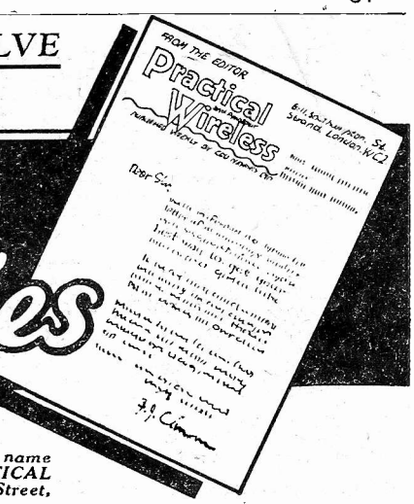


Showing the new Wearite wave-trap coil.

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 .1S 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+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)

HEAR America, hear Short Wave stations in every corner of the World. Plug the *B.T.S.* Short Wave Adaptor into your present Battery or A.C. Mains Set and instantly convert it to an efficient all-wave receiver . . . with no alterations to your set whatsoever. No other adaptor at the price incorporates *all* the *B.T.S.* features. Send coupon below to-day for descriptive leaflet.

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(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.

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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/-.

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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.

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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.

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PREMIER H.T.11 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.

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

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£50 WORTH experimenters surplus wireless components: short-wave gear, valves, coils, transformers, moving-coils, condensers, etc. Dirt cheap. Stamp for list.—H. Pitman, 8, Kinson Rd., Wallisdown, Bournemouth.

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RADIOMART. Push-back, the wire used by set-makers, ready tinned and sleeved, 6 yds., 9d.
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RADIOMART. Telsen 1-watt wire-ended resistors, 6d. Telsen cartridge resistances, tubular condensers, 6d.
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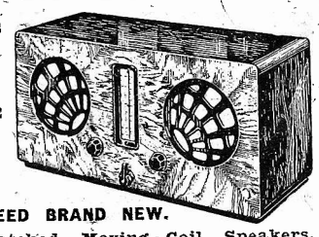

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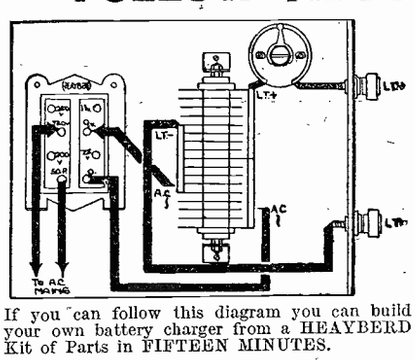

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Again thanking you,
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G.M. 3-VALVE CHASSIS. Pick-up sockets. Highly efficient straight circuit with Super Power output. Illuminated straight line tuning scale marked in wavelengths, medium and long, with handsome escutcheon for mounting on cabinet front. (5in. x 2in.) All steel chassis. **With valves, price 27/6.** (For battery operation.)

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