TWENTY-FIVE YEARS OF RADIO PROGRESS

Practical and Amateur Wireless

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

a GEORGE NEWNES *Publication*

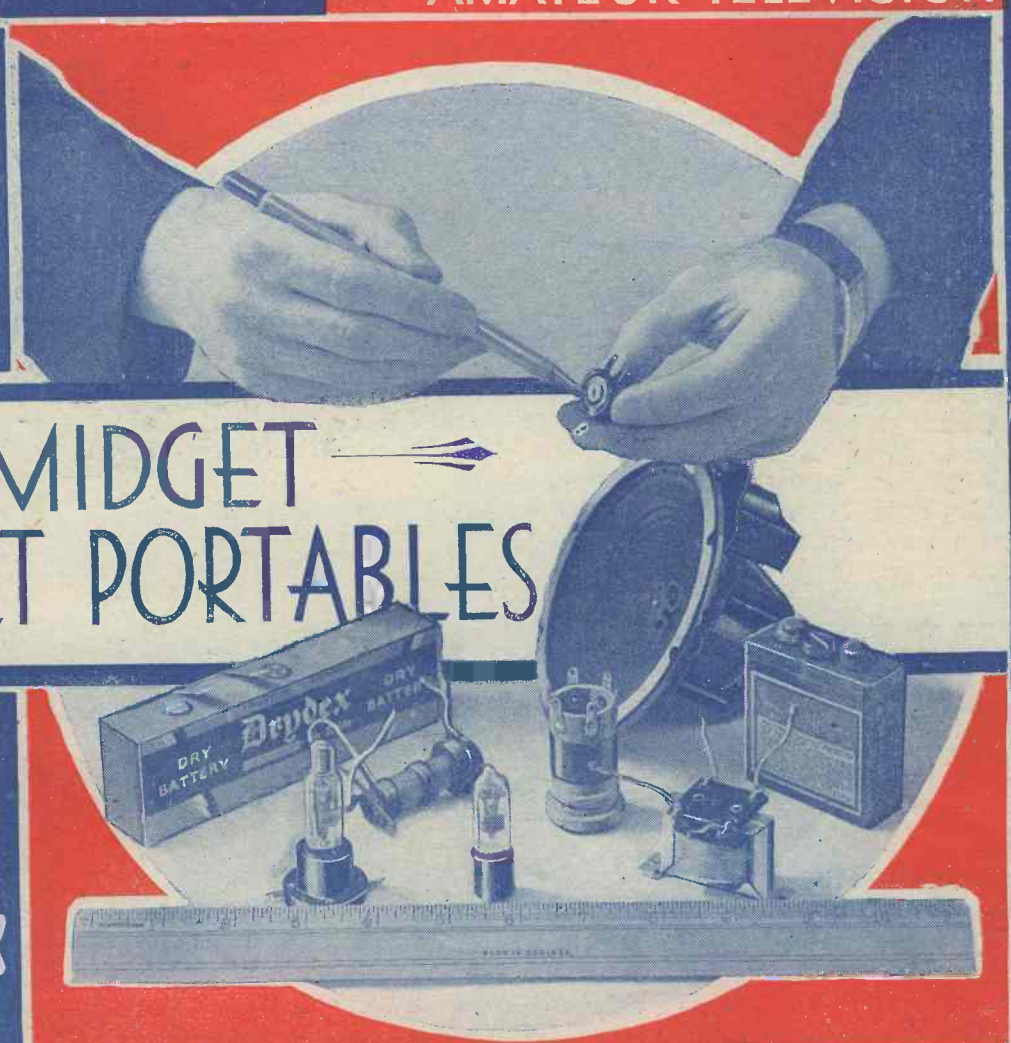
Vol. 6. No. 141.
June 1st, 1935.

AND AMATEUR TELEVISION

Our New Series of

MIDGET POCKET PORTABLES

for all Purposes



OUR NEW MIDGET PORTABLES—THE CAMEO SERIES.

SEE PAGE 324

Practical and Amateur Wireless

Edited by F. J. CAMM

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

VOL. VI. No. 141. June 1st, 1935.

ROUND *the* WORLD *of* WIRELESS

Stand by for Radio Nice

THE new 100-kilowatt transmitter which the French PTT has had under construction at La Brague, near Nice, is now nearing completion, and it is fully expected that tests will be undertaken within the next week or so. Should these prove satisfactory, the station will take over its duties in July. Although, according to a recent report that the Toulouse-Muret 120-kilowatt station is now completely built, experiments with this plant cannot yet be made as the electric cable from the generating station at Toulouse has not been entirely laid. The date of its opening is yet unknown.

Local *versus* Distant Listeners

IT is interesting to note from the result of a plebiscite taken among Austrian radio listeners, that of these the majority tuned in to the local stations for periods up to thirty hours per week. Of these some twenty-five per cent. devoted almost the same quantity of hours to the reception of foreign broadcasts.

No More Records in German Broadcasts

IN view of complaints made by the gramophone industries in Germany, the authorities have decreed that no more records in future are to be broadcast from the stations, and as a substitute more orchestral music is to be given in the programmes.

China Hears European Broadcasts

FROM a report received from West China, it would appear that under favourable conditions the following European transmitters can be fairly well received: Moscow, Prague, Milan, Breslau, West Regional, Stuttgart, and Vienna.

Round the World by Radio

ON April 25th last an interesting experiment was carried out by the American Telegraph and Telephone Company. From his office the President decided to ring up the Chairman of the Company who was sitting in a neighbouring room. The connection was made by cable *via* London, Amsterdam, then by wireless to Java, San Francisco, and finally over his own network to New York. Communication was held for a period of fifteen minutes in a perfectly satisfactory manner.

New Czecho-Slovakian Station

WORK has already been started on the new high-power station at Banska Bystrica, which is to relay the Prague programmes for the Western portion of the country. The power of the station will be 30 kilowatts by day, but this will be reduced by fifty per cent. for the night transmissions. Although most of the programmes will be taken from the capital, it is expected that a certain portion of the entertainments will be provided locally in order to satisfy the Slovak population.

NEXT WEEK!

FULL CONSTRUCTIONAL DETAILS OF THE FIRST OF OUR

CAMEO MIDGET PORTABLES

New Additional Italian Relay

IN order to provide an alternative programme to Bari listeners, a small station is to be erected in this Italian city. As it is only desired to supply local listeners, the power will be limited to 500 watts and the wavelength selected in the neighbourhood of 200 metres. When installed, Bari (2) will take its programmes from alternately Milan, Florence, and Turin.

Time Signals from the Continent

IN addition to the signals given out at stated periods throughout the day by the B.B.C. stations, it is also possible to secure the exact time from some of the Continental transmitters. The six pips have been adopted by Radio-Paris and Brussels; these may be heard from both at B.S.T. 13.00. At other times, such as 08.00 and 20.00, Radio-Paris marks the hour by means of a carillon. Prague puts out a morse signal consisting of one dash and several dots at 21.00 nightly, and Hamburg a somewhat similar signal at 23.00.

Television in Italy

THE first Italian television transmitter has now been installed at Turin. Wavelengths to be used for vision and sound are respectively 5.05 and 8 metres. The receivers which are being placed on the market for the purpose of capturing these transmissions are all equipped with the Zworykin cathode tube.

Listen to Radio Nimes

ALTHOUGH one of the smallest of Europe's broadcasters, it is often possible to pick up Radio Nimes, a 200-watt French station on 201.1 metres (1,492 kc/s). The call, given out by a man on week-days and a woman announcer on Sundays, is *Ici Radio Nimes de la Radiodiffusion Meridionale.* Interval signal: One stroke on a gong between items. Opens and closes with gramophone record of a choir singing an old folk song in local dialect.

French Bagpipes!

RADIO BRETAGNE, or PTT Rennes, on 288.6 metres, of which the broadcasts are so well heard in the United Kingdom, is the one French station which may be stated to possess an original interval signal. Scorning the conventional gong, carillon, or musical box, it has adopted a Breton tune played on the *biniou*, the French conception of Scottish bagpipes. As this instrument is never played alone, the accompaniment is provided by the old *bombarde*, a species of hautbois of very ancient origin. Listeners may find it of interest to tune in this station when it closes down at night.

Range of a 1-Kilowatter

AMONGST the better-known stations of the United States which can still be tuned in after 1 a.m., will be found WIOD, Miami Beach (Fla.) on 230.6 metres (1,300 kc/s). Although the distance (from London) is roughly 4,500 miles, this medium-wave transmitter has been picked up in many parts of the British Isles.

ROUND the WORLD of WIRELESS (Continued)

Scottish Summer Resort Broadcasts

HARRY GORDON and his Beach Pavilion Company will make the Scottish air ring with merriment on May 29th. This is the first of the summer resort entertainments which will be broadcast during the next few months.

Bath and West Show

THIS year's Bath and West Show will be held at Taunton from May 29th to June 1st, and a microphone will be taken to the Show, for the benefit of Western listeners who cannot be present, on May 31st. The Bath and West, or, to give it its full title, the Bath and West and Southern Counties Society, was started in 1777 for the encouragement of agriculture, arts, manufactures, and commerce.

Choral Concert from Bristol

A CONCERT by the Bristol University Choir and Orchestra will be relayed from the Colston Hall, Bristol, for Western listeners on June 1st. The conductors will be R. Vaughan Williams, Reginald Redman, and Arthur Warrell. Vaughan Williams will conduct his own composition of The Hundredth Psalm; Reginald Redman will conduct his own setting of "Sheba's Captain," and Arthur Warrell will conduct his own work for double chorus, "A Lyke-Wake Dirge." The soloist at the concert will be Leslie Bennett (baritone).

Variety from Blackpool

DANCE music by Bertini's and Larry Brennan's Bands precedes on May 30th a relay from the Palace Theatre, Blackpool, when Northern listeners will hear an excerpt from a variety bill which includes Bob and Alf Pearson (in songs at the piano) and Archie's Juvenile Band.

Gounod's "Faust"

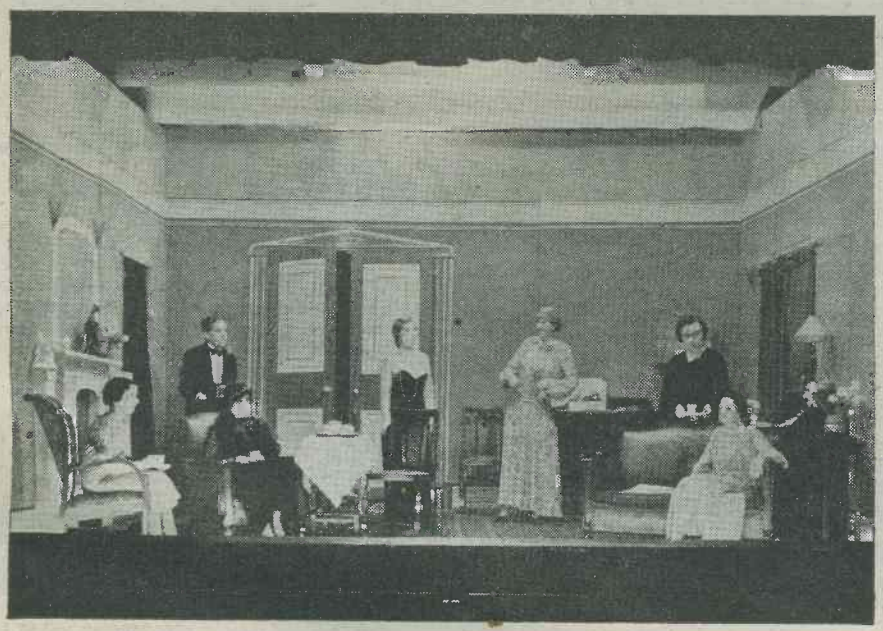
A CONCERT version of Gounod's opera "Faust" will be broadcast to Northern listeners on June 1st, by members of the Stoke-on-Trent Choral Society, supported by the B.B.C. Northern Orchestra.

INTERESTING and TOPICAL PARAGRAPHS

"Music Out of School"

UNDER the general title, "Music out of School," part of the Oswestry, Shropshire, Schools' Musical Festival will be relayed to Northern listeners from the Powis Hall, Oswestry, on May 31st.

FERRANTI'S EMPLOYÉS' DRAMATIC ACTIVITIES



A scene in the play "Fresh Fields," by Ivor Novello, recently produced in the Works Theatre by the Ferranti Amateur Dramatic Society.

Military Band Concert

THE Scottish Military Band will broadcast the Overture, "Rienzi," by Wagner; incidental music to "Henry VIII," by Sullivan; Dramatic Legend, "The Erl King," by Schubert; Spanish Caprice, "Moraima," by Espinosa; and excerpts from "Aida," by Verdi; on May 31st.

The Radio Follies

RICHARD SPENCER presents in the Midland programme a concert party entertainment by the Radio Follies on June 6th. Another light feature will be the variety bill relayed from the Empire Theatre, Peterborough, on June 7th.

B.B.C. Midland Orchestra

NOTABLE musical programmes will be a concert by the B.B.C. Midland Orchestra, conducted by Leslie Heward, on June 3rd; the second of the series of Shakespeare songs in different settings on June 6th, when the three singers will be Mary Pollock, Geoffrey Dams, and Cuthbert Ford; and the fourth of the Midland Chamber Concerts, on Saturday night, June 8th, when the Alfred Cave Quintet and the B.B.C. Midland Singers, conducted by Edgar Morgan, give an Elgar programme.

Broadcast of the Derby

THE great annual racing festival of the Derby will be broadcast on June 5th. Mr. R. C. Lyle will again describe the race from a box on the top tier of the new stand. There is only one commentator in this broadcast. In the National, owing to the usual obscurity, there are two. This year the new B.B.C. recording van will be going to the course to pick up sound records of the crowds, the racing, and the festivities which may give added colour to the news bulletins of the day.

"Bitter Sweet"

THE services of Serge Abranovic have been secured to play opposite Evelyn Laye in "Bitter Sweet." He will sing in the part created by the Rumanian tenor, George Metaxa, in the broadcasts which are taking place on the Regional wavelength on May 31st and the National wavelength on June 1st. Serge Abranovic, who for long deputised for Richard Tauber in the Lehár operettas, sprang to fame in the name part of "The Prince of Schiraz." This operetta was produced in Vienna and Zürich.

Empire Broadcasting Service: New Transmitters

IN view of the success achieved by the Empire Service the B.B.C. has decided to extend the station at Daventry by the addition of two short-wave transmitters, which will be of higher power than the two now in use. There will also be extensions to the aerial system, based on the data collected in the experimental work which has been carried out at Daventry by the B.B.C. during the past two and a half years. When the two new transmitters are in operation the two existing transmitters will be combined to form one transmitter of higher power, making available three transmitters in all. Constructional work on the building to accommodate the additional transmitters will begin shortly.

"Souvenirs"

THE third edition of "Souvenirs," a non-stop medley of song memories compiled by Mai Jones, will be presented by Francis Worsley for Western listeners on June 4. The memories revived will be song hits through the last twenty-five years.

SOLVE THIS!

PROBLEM No. 141.

Harvey obtained some manufacturers' surplus goods, and from them constructed an A.C. mains five-valver. When tested out results were very poor, and he accordingly decided to buy a really good voltmeter in order to make the necessary tests. He checked through each stage and found that all components were in order, of the correct value, and correctly wired. The valves he could not test satisfactorily, and therefore decided that the mains section was faulty. He disconnected the receiver from the mains section and measured the output with his meter. He found it was just 250 volts, and assumed that it was in order. Where was he wrong? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 141 in the bottom left-hand corner and must be posted to reach here not later than the first post Monday, June 3rd, 1935.

Solution to Problem No. 140.

The grid resistance used in Peters' R.C.-coupled stage was faulty, and after being in use for a short time became partially disconnected. Thus the grid of the L.F. valve choked, the condenser charge dissipating when the set was switched off.

The following three readers successfully solved Problem No. 139, and books are accordingly being forwarded to them:—

S. G. Acton, 47, Fairholme Road, Ashford, Middlesex: K. L. Mortlock, Bartle Frere, Haileybury, Herts: J. Coupe, 92, Low Moor Road, East Kirby, Notts.

The Experimenters Explain

Automatic Grid Bias and its Application to Battery Receivers

by The Experimenters

IN explaining other technical refinements and modifications we have prefaced our more practical remarks with a brief discussion of the advantages and disadvantages of the systems in question. If we were to attempt to do this in the present instance, however, we should find a good deal of difficulty in stating the disadvantages of automatic grid bias—in respect of either mains or battery-operated receivers. In fact, so far as mains sets are concerned, automatic grid bias is a practical essential. In the cases of battery-fed receivers, however, the position is somewhat different, and although automatic bias is extremely desirable and certainly worth while, it is not used to anything like the extent to which it should be. Many manufacturers of successful commercial battery receivers have employed this form of bias for a number of seasons, but the average constructor has not, we believe, recognised its many advantages. It is for this reason that automatic bias has not been used more often in PRACTICAL AND AMATEUR WIRELESS receivers which have, generally speaking, been designed on the simplest possible lines at the request of readers. Nevertheless, there are doubtless hundreds of constructors of these sets who would now—after obtaining satisfactory results with the original design—like to add the refinement, especially after realising its advantages. We shall therefore describe the simple modifications in respect of various popular sets after explaining the broad principles.

How the Bias is Provided

First of all, let us see how automatic bias "works" in a battery set. The main idea is that a resistance is included in the negative high-tension lead, so that all of the H.T. current consumed by the set has to pass through it. Fig. 1 shows a skeleton circuit where the simple wiring alterations required in the average type of non-variable-mu receiver are indicated. As current flows through the resistance a voltage-drop occurs, this voltage being proportional to the current flowing and the value of the resistance in ohms. The actual voltage is equal to the current in amps. multiplied by the resistance in ohms, or, more simply for our present purpose, to the current in milliamps multiplied by the resistance in thousands of ohms. The figures indicated in Fig. 1 serve as an example of the simple calculation.

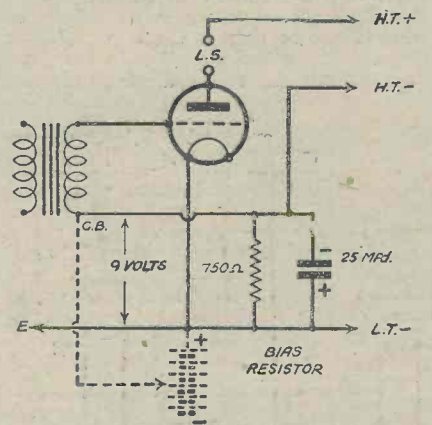


Fig. 1.—This skeleton circuit serves to explain the principal points in connection with automatic bias for a battery set. New connections are shown by heavy lines, and those they replace, by broken lines.

The actual effect of the bias resistance can be seen by comparing the two sets of connections in Fig. 1, and it will be seen that the resistance takes the place of the bias battery, this being more evident when one considers a battery of the combined H.T. and G.B. type. In modifying an existing receiver it is only necessary to connect the G.B.— lead from the secondary of the L.F. transformer to the H.T.— lead, connect one side of the resistance to the earth line, and to transfer the H.T.— lead from its usual terminal to another joined to the second connection of the resistance. In practice, a large-capacity fixed condenser —generally a 25-mfd. electrolytic—is wired in parallel with the resistance to act as a by-pass to the audio-frequency currents. An electrolytic condenser of this type is quite inexpensive, since it need have a working voltage of only 20 or so.

We have found from our correspondence, and from several of the queries addressed

(Continued overleaf)

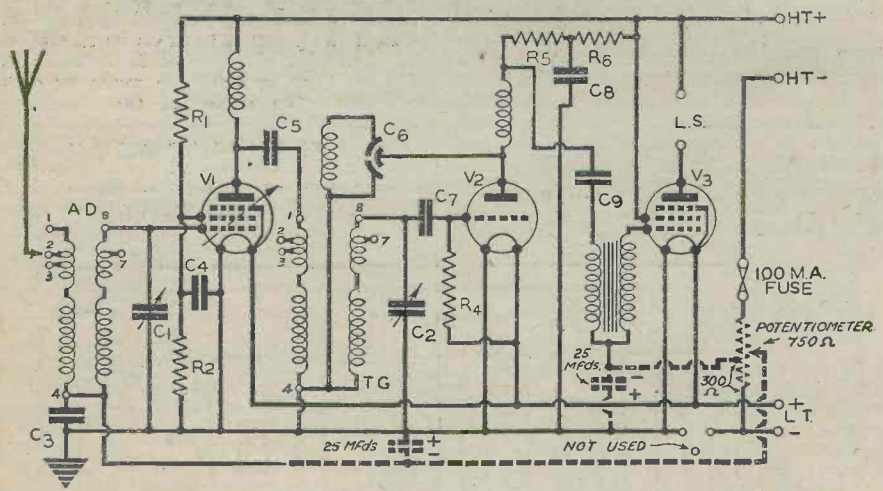


Fig. 3.—Showing how automatic grid bias can be provided in a set with a v.m. valve. The circuit shown is that of the "Summit."

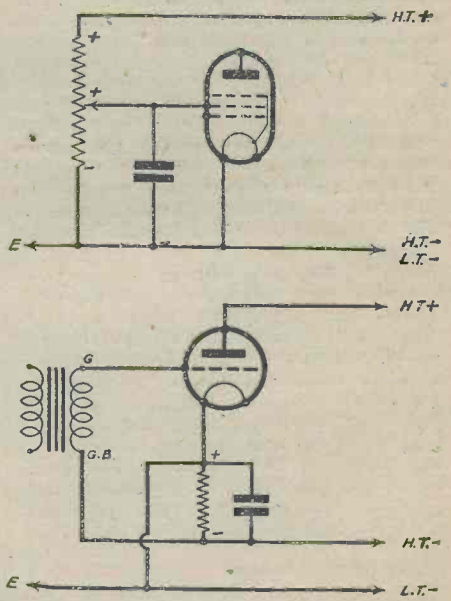


Fig. 2.—A comparison of these two circuits will reveal how one end of the bias resistance (connected to the grid) becomes negative with respect to the other (connected to the filament).

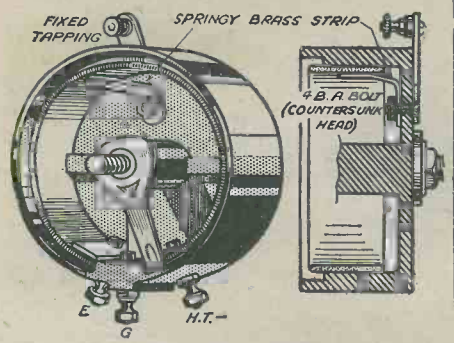


Fig. 4.—Showing how a fixed tapping can generally be arranged on the usual type of wire-wound potentiometer.

(Continued from previous page)

to the Free Advice Bureau, that the main difficulty which readers have in understanding automatic grid bias is that they fail to understand how one end of the resistance can be positive and the other negative; this is best understood by considering the bias resistance as a portion of a potentiometer such as that used to supply the screening grid of an S.G. valve. The second "arm" of the potentiometer is the valve, as will be seen by examining the two skeleton circuits in Fig. 2.

Advantages of Automatic Bias—

Having grasped the general principles of automatic G.B., we are in a better position to appreciate the advantages which it confers. It is obvious that it enables a G.B. battery to be saved, but this alone is of little importance because this component costs only about a shilling and need not be replaced more frequently than twice a year. A more important point, however, is that the resistance regulates the G.B. voltage according to the H.T. voltage; that is, as the H.T. voltage falls off (due to the battery running down, for example) the G.B. voltage is automatically reduced in proportion. This is because the anode current passed by the valves becomes less with a reduction in H.T. voltage, and thus the product of current and resistance—the G.B. voltage, in other words—also becomes less.

The importance of this cannot be overstressed, since we all know that if the G.B. voltage remains constant while the H.T. voltage falls off distortion and overloading inevitably occur. This can be compensated for, to a certain extent, by altering the position of the G.B. tapping, but it is possible to vary the voltage only in stages of 1½ volts by this method, and such a large variation may often be too great. For this reason, it will be appreciated that automatic bias often prolongs the useful life of the high-tension battery and at the same time causes an improvement in the quality of reproduction.

—and a Few Disadvantages

A minor objection to the system is that the value of the bias resistance may have to be changed when replacing a valve in the set by a new one, if this is of different type from the original. This applies, not only to the output valve, but to every valve in the set because, as we have pointed out, the value of the resistance is determined by the total H.T. current passed by all the valves in the receiver. Another minor disadvantage is that the H.T. voltage supplied to the anodes is reduced by the amount used for grid bias and "lost" in the resistance. This is generally of little importance in the case of a receiver of the usual type, although it may attain importance in a set using variable-mu valves of a type which require a large maximum G.B. voltage. Even then, however, the "lost" voltage could be compensated for by increasing the voltage of the H.T. battery by connecting an 18-volt G.B. battery in series with it.

It will also be evident that it may often be rather difficult to provide automatic bias in a receiver having variable-mu valves, due to the fact that the H.T. current varies according to the setting of the variable-bias volume control. In practice, this factor can generally be overlooked when there is only a single variable-mu stage, because the variation in current is so small that, as a percentage of the total current consumption, it is negligible. As an example of this point we may consider a three-valve receiver such as the "Summit" (PRACTICAL WIRELESS, Aug. 18th and 25th, 1934), which uses a combination of Cossor valves comprising the 210V.P., 210H.L., and 220H.P.T. The maximum current passed by these valves (volume control full on) with correct bias and maximum anode voltage, is approximately 3.5, 1.5 and 8 milliamps respectively, giving a total of 13 milliamps. When the full (low-volume) bias is applied to the variable-mu H.F. pentode the current passed by this valve falls to about 1.5 milliamps, although the current passed by the other two remains constant. Thus, the variation in current which would be passed through an automatic bias resistance would be 2 milliamps, which is equivalent to about 16 per cent. Generally, however, the variation in current over the range of volume normally required would be even less than this, so that an automatic bias arrangement would function satisfactorily.

With Variable-Mu

There is a slight practical difficulty in applying automatic bias to a receiver having a variable-mu stage though, due to the fact that there are two different bias voltages required, one of which remains constant whilst the other has to be varied. Nevertheless, this can be done, as shown in Fig. 3, which is the modified circuit of the "Summit," by using a potentiometer with a fixed tapping in addition to the slider. There is no potentiometer of the exactly correct type on the market, but an ordinary wire-wound one can easily be modified as shown in Fig. 4 by making a connection to the winding at the correct point. This can be done by fitting a strip of springy brass and a connection as shown. It is obvious that this exact method cannot be applied to all potentiometers, but in most instances a modification of the idea will suggest itself.

The correct position for the tapping may be found by measuring the resistance between it and the end of the winding or, in the case of a potentiometer which is not of the "graded" type, by taking the resistance in circuit as being proportional to the distance of the tapping from the end of the winding and the total resistance. Thus, if the potentiometer to be employed had a total resistance of 1,000 ohms, a 500-ohm tapping could be made by connecting to the centre of the resistance element.

Details concerning the other circuits shown in this article, and information regarding the application of more than one grid bias voltage will be given next week.

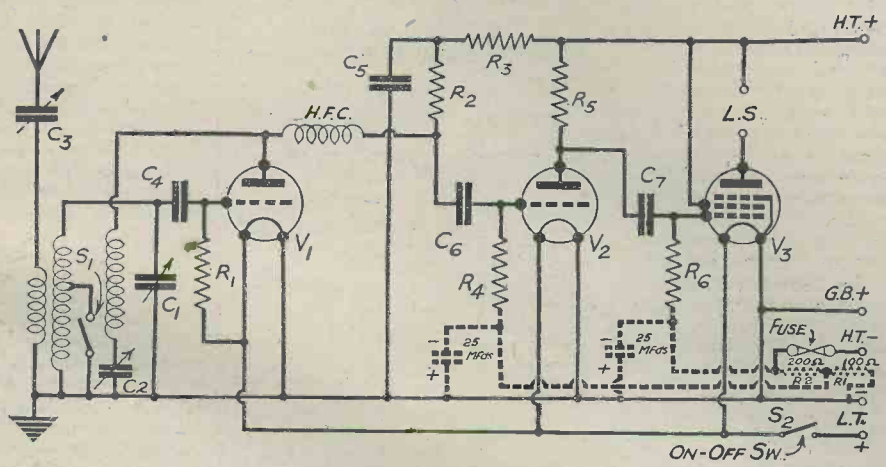


Fig. 5.—Connection for automatic grid bias in the "Hall-Mark Cadet" are here shown in broken lines.

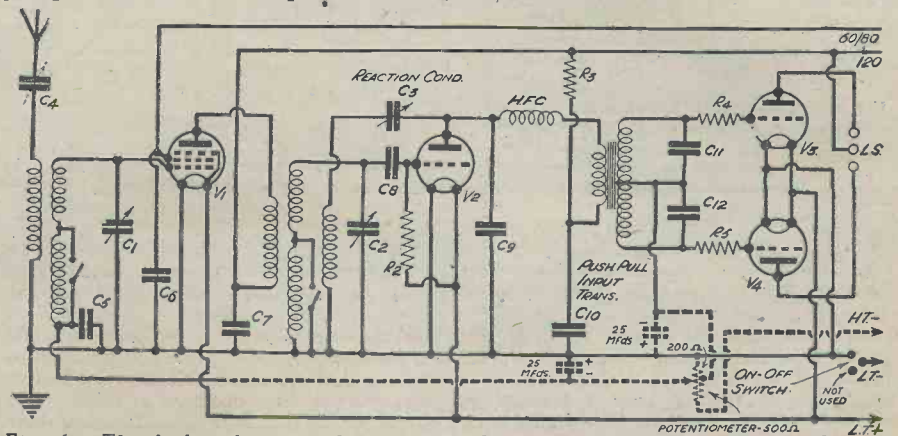


Fig. 6.—The broken lines in this circuit indicate the modifications required when adding automatic bias to the "Battery Hall-Mark Four."

COMPONENTS

Their Action, Principle & Purpose

The Output Circuit Between the Last Valve and the Loud-speaker is Dealt With in this Sixth Article of the Series, and the Easy Calculations Involved are Simply Explained.

WE have now traced through our typical three-valve receiver from the aerial to the output circuit of the pentode low-frequency valve. It now only remains to consider the loud-speaker and the device used to feed it. The latter may take the form of a step-down transformer, an L.F. choke, and a condenser, or a resistance and a condenser. No matter which of these coupling devices is employed it is essential that the impedance of the component, or part of a component, included between the anode of the valve and the H.T.— lead should have an impedance of a fairly definite value. The position is not unlike that which we observed in connection with the output circuit of the detector valve, for the object is to obtain the greatest possible transference of energy from the output valve to the loud-speaker. In the case of the detector valve it was explained that the anode-circuit component should have an average impedance equivalent to twice the impedance of the valve; the same idea applies in the L.S.-feed circuit, except that instead of considering the impedance of the last valve we take into account its *optimum load*. This is generally stated by the makers in ohms, and is usually equal to about twice the impedance in the case of triodes, although there is not always a definite relationship so far as pentodes are concerned.

The Step-down Transformer

In the first place we will assume the use of a step-down transformer for feeding the speech coil of the moving-coil loud-speaker, the connections being as shown

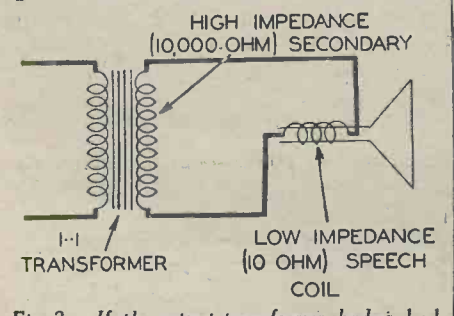


Fig. 2.—If the output transformer had a 1 : 1 ratio there would be very little power transferred to the speech coil. This may more readily be understood by referring to a similar D.C. circuit in Fig. 3.

in Fig. 1. It is hardly necessary to remind readers that the transformer is nearly always fitted to the speaker, and that makers will supply the correct type on being advised of the ratio required or of the make and type of output valve in the receiver. The average battery pentode valve has an optimum load in the region of 10,000 ohms, and so the transformer primary should offer an impedance equal to this figure at average audio frequencies. To ensure good response to the lower notes it is best in this case to work on a frequency of, say, 100 cycles, and the formula is: Z (impedance) $=2\pi fL$, where $\pi=3.14$, f is the frequency, and L is the inductance in henries. For our present purpose this formula might well be re-written: $L=\frac{Z}{2\pi f}$. Using this formula and working on the figures already mentioned, we find that the correct inductance for the primary winding of our transformer is $\frac{10,000}{6.28\times 100}$, which is equal to approximately 16 henries. The primary winding of the transformer must, therefore, be designed

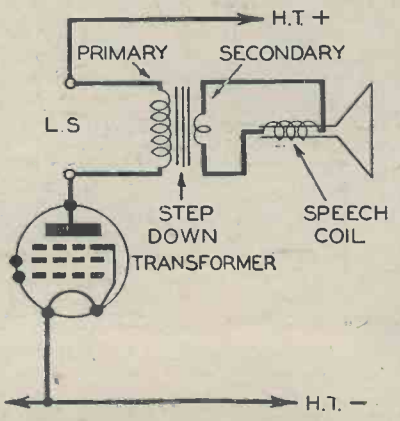


Fig. 1.—Showing the usual method of feeding the moving-coil speaker. A step-down transformer is connected between the anode circuit and the speech coil.

to have an inductance of not less than this value when carrying the full current passed by the last valve. It is important that this latter point should be observed, since there are on the market many transformers rated at 50 henries or so which may possess scarcely any inductance at all when carrying, say, 20 milliamps, because their inductance rating is arrived at without considering the D.C. current passing through them. Better-class manufacturers, however, generally state the inductance at "No. D.C." and at "x milliamps D.C."

Alternative Ratios

When the transformer is supplied as an integral part of the speaker the makers will generally say what is the maximum current-carrying capacity of the primary. It is usual to provide speakers with tapped transformers, the primary windings of these having three tappings which provide alternative inductances to suit the impedances of different types of valve. The lowest tapping is suitable for super-power valves (low value of optimum load); the second matches ordinary power valves (medium optimum load), and the third is for pentodes, which have a comparatively high optimum load. There are, of course, other speakers which are provided with multiple-tapped transformers so that a value of any particular optimum load may be matched accurately; a well-known and popular example is the W.B. "Stentorian."

In addition to the impedance of the transformer primary winding it is necessary to consider the correct ratio between primary and secondary windings. This is because the impedance of the speech coil is generally considerably smaller in ohmic value than the optimum load of the valve, and hence, than the impedance of the primary winding; a fairly average value for the impedance (at, say, 100 cycles) of a speaker speech coil is 10 ohms, and if this were connected in parallel with the secondary winding of a 1 : 1 transformer—in which the secondary and primary impedances are similar—there would be very little power passed on to the speaker. The reason is that, of the total power developed in the secondary circuit (see Fig. 2) only a fraction would be developed across the speech coil. This point might more easily be understood by considering a similar D.C. circuit, such as that shown in Fig. 3. In this case two resistances are shown as being in series, one having a value of 10,000 ohms and the other of 10 ohms. If a current of 10 milliamps were passed through the two resistances the wattage "absorbed" by the 10,000-ohm resistance would be just 1 watt, whilst the 10-ohm resistance would "absorb" only 1/1,000 watt. In the case of the transformer best results can be obtained by making the impedance of the secondary equal to the impedance of the speech coil, and this suggests the method of determining the correct ratio. The ratio is proportional to the optimum load of the valve divided by the impedance of the speech coil, but we cannot find the ratio between the numbers of primary and secondary turns by this simple ratio, because the impedance, or inductance, of a coil is proportional to the *square* of the number of turns. Because of this we have to take the square root of the ratio of optimum load to speech coil impedance, so that we obtain the formula: $\text{ratio}=\sqrt{\frac{\text{optimum load of valve}}{\text{speech coil impedance}}}$

(Continued overleaf)

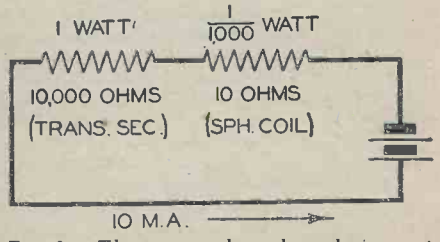


Fig. 3.—This circuit shows how the power is distributed in a circuit consisting of two resistances in series with a battery.

(*Continued from previous page*)

If we apply the figures mentioned above to this formula we find that the ratio in our hypothetical example is $\sqrt{\frac{10,000}{10}}$ which can be simplified to the square root of 1,000, or just about 33:1.

Choke-capacity Feed

In some instances it would be inconvenient to connect the transformer directly in the anode circuit of the output valve as shown in Fig. 1, and we might find it better to feed the speaker through a choke-capacity filter as shown in Fig. 4. This would be the case if the transformer fitted to the speaker were unsuitable for carrying the full anode current required by the output valve, or if the speaker were to be used some distance away from the receiver, especially in the case of a mains set. The position is not greatly changed, however, for the transformer ratio and primary impedance may be as calculated above, whilst the choke should be chosen to have the inductance we found for the transformer primary. With regard to the transformer, however, there is the difference that it has not to carry any D.C. current, the result being that the primary inductance may be determined on this basis. The L.F. choke performs the same function as the feed-resistance considered last week in connection with the parallel-fed L.F. transformer, and the coupling condenser may have a capacity between .5 and 4 mfd. The tone can be varied by altering the capacity of the condenser, and it is sometimes worth while to experiment with different values, although 2 mfd. is a good average.

By employing the circuit shown in Fig. 4 it is possible to use a transformer the ratio of which is actually lower than that found by the calculation above by connecting the coupling condenser to a tapping on the choke. As an example of this it may be explained that the effective ratio of the transformer could be doubled by joining the coupling condenser to a centre tapping on the choke, or quadrupled by using a tapping one-quarter of the way down the choke from the "H.T.+" end. The principle is similar to that dealt with last week in connection with the auto-choke method of L.F. coupling, and the step-down ratio provided by the tapped choke is equivalent to the ratio of the total "length" of the choke to the fractional distance of the tapping employed from the "H.T.+" end.

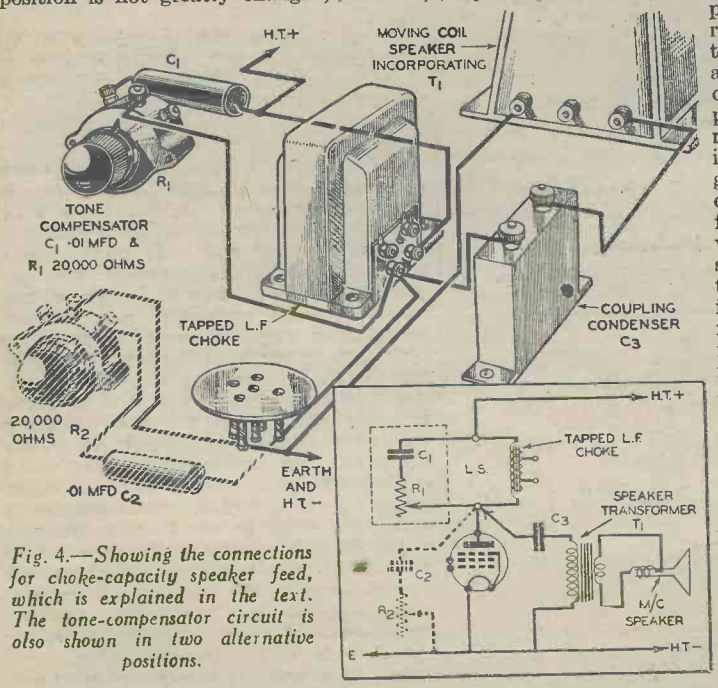


Fig. 4.—Showing the connections for choke-capacity speaker feed, which is explained in the text. The tone-compensator circuit is also shown in two alternative positions.

Resistance-Capacity Output

Yet another arrangement for feeding the speaker is that shown in Fig. 5, where the L.F. choke is replaced by a resistance (non-inductive) having a value in ohms equal to the optimum load of the valve. This arrangement is not often used because the resistance has the effect of reducing the H.T. voltage to a fairly considerable extent. Nevertheless, the scheme is useful when the mains unit supplies a voltage a good deal in excess of that actually required, and where quality of reproduction is an important feature. We do not necessarily say that the resistance-feed method will provide better reproduction than that given when a high-grade choke is employed, but a resistance (which is cheap) is as good as the most expensive transformer. The value of the resistance lies in the fact that its impedance remains constant regardless of the frequency of the audio currents passed through it.

Tone Correction

There is one more point, in connection with the output circuit from the last valve, which we have not considered. It is common knowledge that a pentode—and also a class B valve for that matter—almost invariably gives rather more amplification to the higher audio frequencies, the result being that reproduction is inclined to be rather shrill. It is for this reason that it has become fairly standard practice to include a correction device in the anode circuit of a pentode, the device consisting of a fixed condenser and variable resistance wired in series between the ends of the output transformer, choke or resistance, as shown in Fig. 4; as an alternative these components may be connected between the anode and earth, as indicated by broken lines. Both forms of connection produce the same effect, but the second has the advantage that the variable resistance is at "earth potential," so that there is no danger of receiving a shock if the grub screw on the knob is in contact with the slider, as it usually is.

Of the resistance-condenser combination it is the condenser which is of major importance, and it is the purpose of this component to by-pass a proportion of the higher frequencies. We have seen before that the impedance of a condenser is less to high than to low frequencies, and it is thus evident that it can carry out the desired function.

The Effect of the Condenser

An average value for the condenser is .01 mfd., so let us see just what effect this has. If we consider a frequency of 3,000 cycles we find that the impedance of the 16-henry transformer primary or choke to it is about 300,000 ohms, whilst the impedance of the .01-mfd. condenser is only about 5,500 ohms. It will be clear from this that the condenser would by-pass a large percentage of the output at this frequency, and an even greater percentage at higher frequencies. If we consider the effect of the condenser on low audio frequencies the position is quite different. For example, let us assume now a frequency of 100 cycles, at which the choke has an impedance of about 10,000 ohms, and the condenser an impedance of approximately 165,000 ohms. In this case the condenser would have practically no effect.

The purpose of the variable resistance in series with the condenser is merely to alter the total impedance of the "by-pass" circuit according to requirements; this arrangement is much simpler than using a very large capacity variable condenser, although giving the same effect.

Inductance and Impedance

On page 277 of the issue dated May 18th it was stated that: "The impedance of the transformer primary at, say, 1,000 cycles should then be about 25,000 ohms; this would be provided if the primary had an inductance of 40 henries." The latter figure should have read "4.0 henries," but, due to a slip, the decimal point was omitted. One or two readers who calculated the value by applying the formula given in a previous article of the "Components" series have written to point out the omission of the decimal point.

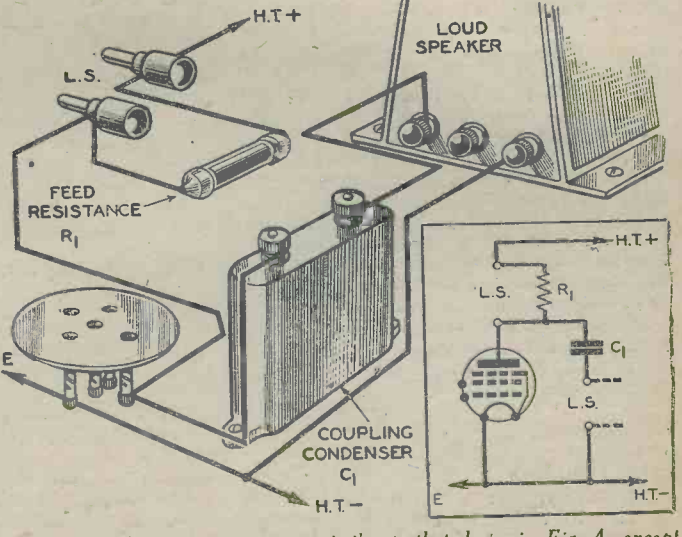


Fig. 5.—A circuit arrangement similar to that shown in Fig. 4, except that a resistance is used in place of the L.F. choke.

Improving the L.F. Amplifier

Some Suggestions are Here Given for Using Old Systems of L.F. Amplification, and for Mixing Such Systems with Modern Arrangements in Order to Obtain Better Results

By W. J. DELANEY

GENERALLY speaking, it may be stated that there are only two forms of L.F. amplification in general use to-day. These are transformer coupling and resistance-capacity coupling. Quality enthusiasts hold that the latter method is the only system worth considering, whilst manufacturers of high-class components can prove that the transformer gives a more even response than the R.C. coupling. Owing to the difficulty which arises in choosing the L.F. coupling, the majority of constructors prefer to adopt the transformer, knowing just what it will do and being aware also that there is a substantial gain in signal strength, with no voltage loss in the anode circuit of the valve with which the transformer is used.

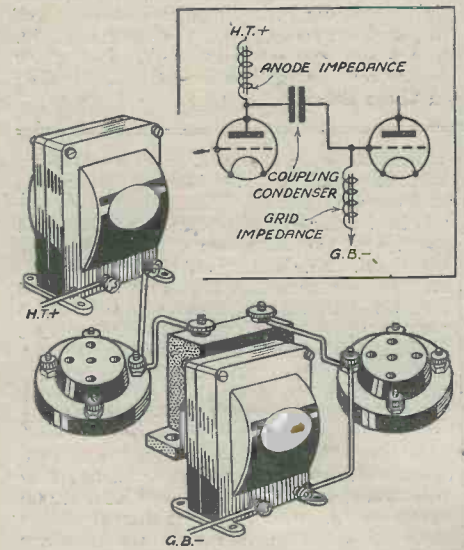


Fig. 2.—A modification of R.C. coupling. The iron-core chokes may be tapped to provide varying effects. This is known as impedance coupling.

In the search for quality in the past many novel forms of coupling have been devised, and such names as Loftin-White, Prince, etc., will no doubt recall memories of some of the ingenious circuits which have been used since broadcasting started. Why have these coupling schemes died out? One reason, of course, is that with the improvement in components, valves, and speakers it has been found that some of the old claims have not been substantiated, but there are certainly many good points in some of these old couplings which may interest the present-day experimenter, and these may be used either in the original form or in combination with more orthodox arrangements.

R.C. Coupling

The system which most people claim is the best from a quality point of view employs two resistances and a condenser, as shown in Fig. 1. It will be seen that the anode of the first valve is joined to the grid of the following through a fixed condenser. The fluctuations of current through the anode resistance cause a varying voltage drop across it, and thus there is a constant change of voltage at the anode. This is the signal which is applied to the following grid, and the condenser is used simply to prevent the application of a positive potential to the grid, whilst the purpose of the grid leak is to prevent the accumulation of grid current and consequent choking of the valve. Thus, the only component which really provides the link between the two valves is the anode resistance, and this is proved in practice by the fact that the size of the resistance governs the amplification. The object is, of course, to get the greatest possible difference in potential between the two ends of the resistance, and it is understood, from previous articles, that the impedance of a resistance is independent of the frequency.

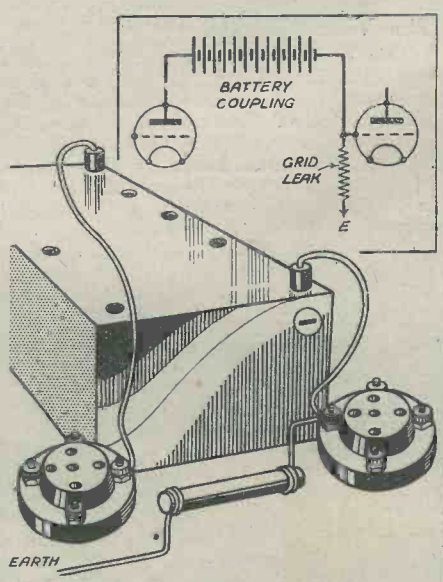


Fig. 3.—Battery coupling, or, as it was often referred to, the "Trigger circuit."

Drawbacks

The drawbacks to this system of amplification are several, but those which principally concern the experimenter are the high voltage loss through the resistance and grid choking. To obtain a satisfactory degree of amplification the resistance must be of high value, preferably four or five times as great as the impedance of the valve with which it is employed. Thus, there may be a drop of 100 or more volts across it, and unless it is possible to obtain a very high source of H.T. supply the valve does not receive sufficient H.T. for efficient working. Grid choking may be caused by the value of the grid leak being too small, or by sudden changes in the character of the received signal, which are so rapid that the leak cannot function sufficiently rapidly, and thus that particular musical effect is lost. Musicians refer to this effect as lack of attack, or rounding off of transients.

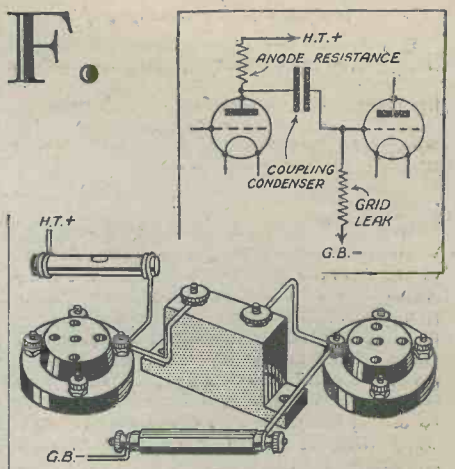


Fig. 1.—Simple resistance-capacity coupling.

Impedance Coupling

One way out of these difficulties, which was popular at one time, was known as impedance coupling. In Fig. 2 will be seen the circuit arrangement where two iron-cored chokes take the place of the resistances previously referred to. Now an inductance provided with an iron core will vary with frequency, and thus a drawback might at first be thought to exist in this method of coupling. Actually, by taking the lowest musical frequency with which we wish to deal, and designing our choke to have a very high impedance at that frequency, this drawback practically disappears. The self-capacity of the choke will, of course, act as in a transformer, and will by-pass high frequencies unless it is of very low value. If large gauge wire is employed, and the above points are attended to, this method of coupling will produce better amplification and handle attack better than ordinary R.C. coupling, and those constructors who would like to try the scheme can employ the primary windings of good high-class transformers for the chokes, ignoring the secondaries. If the impedance is correctly chosen it is possible to obtain 95 per cent. of the

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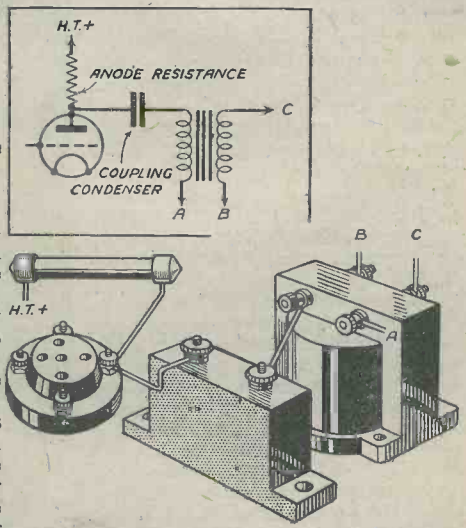


Fig. 4.—A combination of R.C. and transformer coupling. This scheme is familiar to all as the parallel-fed transformer.

(*Continued from previous page*)

amplification factor of the valve, and this is, of course, a very good performance. For general experimental purposes, an inductance between 50 and 80 henrys may be considered satisfactory.

Battery Coupling

In Fig. 3 is shown a form of coupling which was sometimes called a "trigger circuit," and was evolved by Major Prince. The essential feature here is the battery joined between anode and grid, and this, at the time of its development, produced really remarkable results. One of the greatest drawbacks was loss of signal strength due to the capacity of the battery to earth, although this could be overcome by placing the battery on a glass shelf supported on the stand-off insulators used by transmitters. The value of the battery will depend upon the particular valve in use, and the grid leak must also be chosen in conjunction with the remaining circuit characteristics. About 30 or 40 volts will probably be found sufficient for experimental purposes, and it may interest experimenters to try a choke in place of the grid leak.

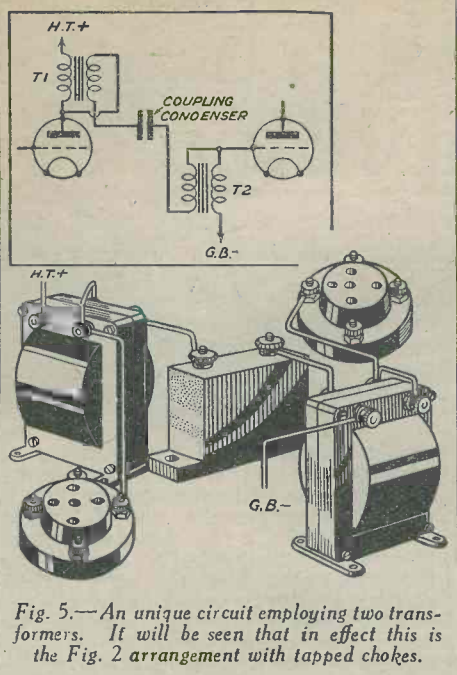


Fig. 5.—An unique circuit employing two transformers. It will be seen that in effect this is the Fig. 2 arrangement with tapped chokes.

Mixing Systems

It is already well known that an L.F. transformer may be resistance fed, placing the transformer in place of the grid leak as shown in Fig. 4. The ends A, B, C may be connected in various ways to provide different degrees of step-up. One terminal is joined to the following grid, and the remaining two may be linked together and then joined to G.B. or earth (according to the type of circuit). An iron-cored choke may be used in place of the anode resistance, thus combining Fig. 2, but it must be borne in mind that the choke and transformer are virtually in parallel, and thus one will affect the other. Similarly, an ordinary L.F. transformer may be used in the anode circuit and another transformer in the grid circuit, thus utilising a system which is shown in Fig. 5. The two transformers must be chosen with care, and the recommendations of the originator are a Ferranti A.F.8 for T1 and an A.F.3 for T2.

A little thought will show that these various systems may be used in combination in a single stage, or in successive stages of an amplifier to level out the characteristic, and those readers who are searching for better quality will no doubt be interested in these details.

THE CLIMAX ALL-WAVE SUPERHETERODYNE

THE Climax receiver under review is an A.C. mains four-valve model, employing a number of novel arrangements. The principal novelty, and one which will no doubt appeal to the majority of listeners, is the fact that the wavebands covered extend down to 10 metres. The second novelty lies in the original visual tuning indicator which is fitted—a Climax invention operating on a rather different principle from that usual in this type of tuning indicator. Dealing with the circuit in detail, we find that the valves employed are of the pentagrid, H.F. pentode, and double-diode triode type, with an ordinary L.F. pentode in the output stage. The double-diode triode is used for detection, A.V.C. (of the delayed type), and first L.F., the triode section being resistance-capacity coupled to the output stage. The aerial input circuit is of the ordinary band-pass type on the broadcast bands, but when the receiver is switched to the short waves an aperiodic arrangement is introduced. In all other respects the circuit is more or less standard.

The Tuning Dial

As may be seen from the illustration, the appearance of the receiver is excellent and out of the ordinary, a plain opening being adopted for the loud-speaker, with the escutcheon arranged almost horizontally on the lower portion of the speaker opening. Such an arrangement greatly simplifies the tuning operations, as the dial may be seen no matter where the receiver is placed. The escutcheon is of rather large dimensions, and the scale, which is very large and is calibrated in wavelengths and marked with station names, is illuminated by two small pilot lamps arranged behind a dark green transparent material. This gives the dial a rather unique appearance, and simplifies the arrangement of the visual tuning indicator which takes the form of a strip of bright light in the centre of the escutcheon.

The Visual Indicator

This indicator consists of a special transformer, the primary of which is connected in the anode circuit of the pentagrid valve. The secondary is arranged with a resistance and lamp in parallel. By arranging the initial brilliancy (with the aid of the resistance) so that a certain value is obtained with no signal, as the anode current of the first valve is lowered by the application of the bias from the A.V.C. circuits, the impedance of the secondary will be increased and thus the lamp will increase in brilliancy. From this it will be seen that the tuning is carried out for maximum brilliancy.

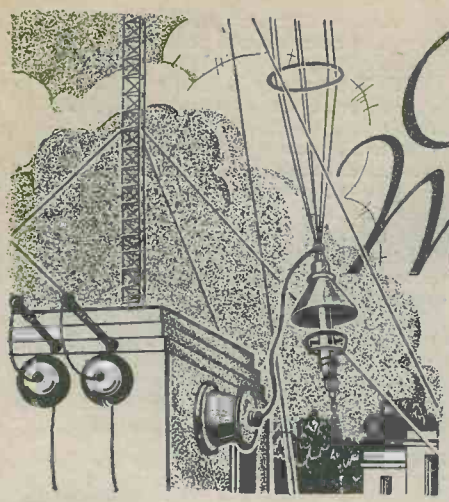
The tuning control is of the two-speed type, a coarse and a fine adjustment being provided. The latter is sufficiently slow to enable very accurate tuning to be carried out on the ultra-short waveband. The remaining controls are for tone, volume (with which is combined the on-off switch), and wave-range. The latter has four ranges, 10 to 30 metres, 28 to 80 metres, 200 to 550 metres, and 900 to 2,000 metres.

Actual Results

On test it was found that the sensitivity was ample for all normal requirements on every waveband, the quality of the reproduction from the normal broadcasting stations being of a high quality on the energised moving-coil speaker which is fitted. Owing to the inclusion of second-channel suppressor circuit arrangements, little difficulty was experienced in obtaining some of the more remote European stations without whistle interference. On the long waves the well-known German stations could be separated (by simple adjustment of the tone and volume controls) from Radio-Paris and Droitwich.

On the short waves many good stations were tuned in in daylight in the centre of London, although the adjustment of the volume control was rather critical on the particular model tested, due to a microphonic valve. As the circuit is of the autodyne type on short waves there are two tuning points for each station, but this did not seem to occasion any difficulty to an inexperienced amateur who was asked to try out the set, and he succeeded in logging many stations at good volume. Unless fading was of the high-speed variety, the A.V.C. functioned admirably and enabled continuity to be obtained on many programmes which would have been lost without the device. The price of the receiver is only sixteen guineas, and provision is made for extension speaker, pick-up, and mains aerial.

The Climax All-wave Superheterodyne. Model 534.



On Your Wavelength

By Thermion

Jazz Music Again

READERS do not like to let sleeping dogs lie. I am not referring to myself, but to that hoary old subject, Jazz Music. I asked readers, you will remember, to settle that much-debated question—which is the best dance band on the air?—by sending me postcards stating their opinions. They are arriving in shoals, some of them couched in vitriolic language about yours truly. Well, it's better to be read and kicked than never to be read at all. One reader, H. M., of Ipswich, who does not wish to be rude, proceeds to be so by sending the following effusion: "Dear Thermion,—With reference to your article in PRACTICAL AND AMATEUR WIRELESS, while not wishing to be rude, you show your utter ignorance of jazz bands when you state that they have to have signature tunes to tell the difference between them. That is a lot of rot because any jazz enthusiast like myself (*note this reader's modesty.*—Thermion) can tell which band it is playing after hearing a few bars. Surely there are few people who take even a very slight interest in jazz who can fail to distinguish such bands as Harry Roy's and Charlie Kunz. Really, Thermion, it's a bit thick to write pages of abuse on something you don't understand as you have been writing lately—you who are usually so impartial. Your articles are very good, but please leave the poor jazz bands alone in future. In my opinion, Jack Payne's is easily the best jazz band."

I like this reference to *poor* jazz bands. Judging from recent accounts, they are anything but that. I will leave my readers to judge as to the relative ignorance of myself and my critic.

Poem!

HEREWITH another effusion recently received:—

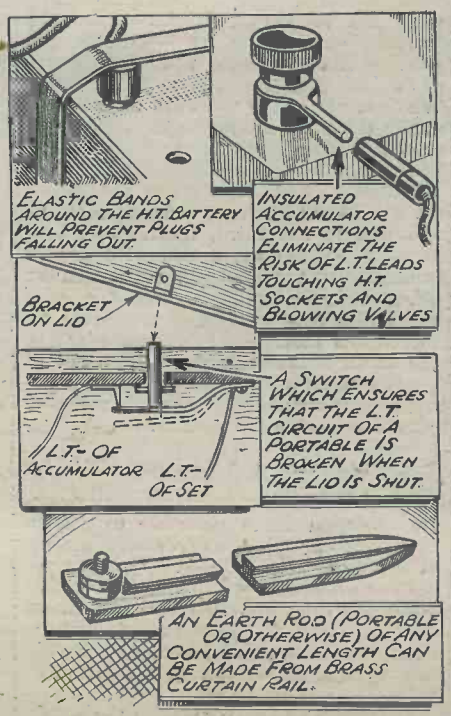
"Dear Mr. Therm,
I am glad to see,
That you will be
At Olympia.
This year.
I long to whisper
Ha-cha-cha-cha
Or boo boo boo
In your ear.
Cheerio,
Croonin' Kid.

"P.S.—Why don't you lay off the crooners?"

Personally, I would rather lay into them. By the way, have readers noticed the very small distance it is from crooner to coroner? Just the transposition of the letter "o" which, in my opinion, expresses the amount of brain which crooners possess, and my ejaculations on their idiotic nigger nonsense. There is another bombshell for the crooning craniacs!

A New Variable Directional Aerial

MR. ALF W. MANN, of 62, Costa Street, Middlesbrough, tells me that he has been granted letters patent for a variable directional aerial system for use in conjunction with all types of radio—short-wave and broadcast receivers and for the reception of all classes of radio signals. With the variable directional adjustment peak signals may be obtained or statics reduced and selectivity improved. Mr.



Mann made tests on many stations, including Java, Manilla, Japanese, American, Australian, and South American short-wave stations. Mr. Mann also tells me that he recently received on an O-V-2 receiver recently described in these pages, operated in conjunction with his new aerial system, understandable signals from the Byrd expedition in daylight. Also American amateurs at 'phone strength at noon and early evening. Mr. Mann is a well-known short-wave experimenter, and I am sure that his claims are well founded.

Loft Aerials

MANY listeners are unable to erect a good outside aerial, and are forced to use an aerial erected somewhere in the house. Now the loft, or space between the roof and the ceiling of the upper rooms, is a very good place in which to place such an aerial, but the actual disposal of the wire is not such an easy matter. A friend asked me to hear his set (built from a design published in these pages) which did not give satisfaction. I heard it and admitted that something was lacking. Firstly, although there seemed dozens of stations all round the dial, they lacked punch. That is to say, they were audible on the speaker but would not give really good volume. I thought at first that the H.F. stage was not functioning correctly, but then I noticed another peculiarity. On tuning through the scale I suddenly noticed a musical item on about 500 metres which I had noticed lower down the scale, and thinking it might be a relay from one of the Continental stations, I turned back to the original position. When the station call was given, however, I was surprised to find that it was the same station and not a relay. This set me thinking, and after two or three adjustments of the controls I found that the apparently large number of stations resolved itself into a dozen or so stations repeating themselves at intervals throughout the scale. I obviously said the ganging was wrong, and endeavoured to right the matter. I took the London National, but could not make any alteration with the trimmers—they were correctly set. Yet the stations were repeating themselves. I must confess I was sadly at sea for some time. Then I thought of the aerial. "Where is the aerial?" I asked. When told it was in the loft, I asked to see it, and there lay the cause of the trouble. The actual space available was rather restricted, and in order to get in a good quantity of wire, it had been taken backwards and forwards across the beams quite a number of times, and then taken down to the receiver. In some manner the adjacent turns were acting upon one another, and completely disorganising the aerial tuning circuit. When a rough wire was slung up to test matters it was found that many more stations were tuned in, and no multiple-tuning points were obtained. As a result, the aerial was taken down, and a single wire taken across the loft and then down to the set. Results were improved tremendously, and the set functioned in a perfectly normal manner.

Short-wave Peculiarities

ON a recent Sunday morning I was tuning round the short waves and was struck with the apparent lack of activity. Only a handful of amateurs

(*Continued overleaf*)

(Continued from previous page)

could be heard, and none of the usual distant stations which are normally tuned in at this time of day could be received. I thought that perhaps the voltage supply was not up to scratch and switched off, deciding to give wireless a rest for a time, and went out into the garden. An hour or so later the weather broke up and I was forced to come indoors, and having very little to do I again turned to the short-wave set. As soon as I switched on I was struck by the great increase in sensitivity, stations rolling in as usual (or perhaps even more so), and the former lack of life having completely disappeared. I naturally thought that my previous assumption that the mains were down was correct, but I suddenly tuned in a Coventry amateur working with a London station and heard him remark on the sudden change in conditions. He told the London man that he was coming through R8, although not many hours previously no signs of London could be obtained. I wonder whether the rain was responsible, or whether some sudden climatic change occurred to render this complete change of conditions possible ?

Radio History

I WONDER how many of my readers can remember their experiences of radio-reception—and perhaps transmission—before broadcasting began. During the time of the Jubilee celebrations I have spent not a little time looking through some of my old log books. One very interesting entry I made was : " Heard faint sounds of telephony—wonder if it is an actual transmission or pick-up from telephone lines." That was before the transmission of telephony was by any means commonplace. Another, and earlier, entry reads : " Cheers—picked up Eiffel Tower time signals after three weeks' experiment with the new crystal set." I think that probably the reception of those few dots and dashes gave me greater pleasure than anything I have since heard " over the wireless."

Another entry in my log book, but this time in 1924 reads : " Marvellous reception conditions to-night ; received KDKA on the loud-speaker at R7 on Det.-2 L.F. set with choke-capacity coupling." Such reception would to-day pass without any note, for it is quite usual for the short-waver.

Hard Work

I WELL remember my first essay into the realms of transmission, and recall the day when I first established two-way communication with a fellow amateur whose station was fifty miles away—my transmitter employed only two B4 power valves in parallel and was fed from a pair of 100-volt H.T. batteries. After that I invested in a small hand generator which had an output of 600 volts at 120 m.a. and increased my range enormously. The difficulty occurred after " keying " with one hand, and turning the handle of the generator with the other ; conditions were not much improved when transmitting telephony, for it is no light task to speak for, say, ten minutes, and at the same time to keep a generator revolving at 3,000 revs.—even though the drive was geared about 50 to 1.

Ministry of Transport and Car Radio

The importance of placing the radio control so as to avoid distraction in driving was strongly emphasised in Philco's original report to the Ministry, and they explain that their sets have been expressly designed so that the control comes effortlessly to the hand of the driver. Any other arrangement has been strongly deprecated by them, and to this factor they attribute the complete immunity of their sets as a cause of accident.

As to the power of the set, Philco state that in discussions with members of the Ministry they have repeatedly expressed their readiness to accept a limit. They are fully aware that power in excess of an undistorted output of 2.5 watts, which they claim is ample for the needs of the private motorist, might tend to become a public nuisance. They have consistently avoided any such possibility.

The Minister's approval of car radio comes at an opportune time for motor manufacturers, who are considering the design of their new season's models.

Notes from the Test Bench

Curing Instability

SOME of the older types of receivers incorporating S.G. H.F. stages utilise unscreened H.F. coils placed quite near each other. Two or three years ago, when the efficiency of H.F. valves was not of a very high order, these coils proved quite satisfactory, and were in many cases more efficient than the modern coil of the screened type. When modern H.F. pentodes are substituted for the original S.G. valves, however, it is generally found that H.F. instability is experienced. Fortunately, there is a fairly simple method of curing this form of instability ; it is only necessary to cover the coils with copper or aluminium screening cans. Care must be taken to keep the screening can at least half an inch from the coil windings, however, and therefore the diameter of the can must be 1in. greater than that of the coil former. It is also necessary to connect the can to a point at earth potential, otherwise the screening will not be effective.

Wave-changing at High Frequency

THE majority of short-wave sets employ low capacity condensers of approximately .00015 mfd. and therefore two coils are necessary to cover the 13 to 50 metre band. Coil changing is not favoured and panel switching also has its disadvantages unless the various components are carefully laid out. A very simple method of wave-changing can be adopted, however, which obviates the necessity for switches and coil bases. Sufficient turns should be wound on the coil former to obtain a maximum wavelength of approximately 50 metres, and very short lengths of 16 or 18 s.w.g. wire should then be soldered to the third, fourth, and fifth turns from the earth end of the grid winding. Wave-changing may then be effected by clipping a crocodile clip, which has been previously connected by means of a short length of flexible lead to the earth terminal of the coil, to one of these tapping points. The reaction winding can be wound on a small former and placed inside the grid former.

S.G. Voltage Adjustment

TO obtain really good quality reproduction it is desirable to use an output valve having an undistorted output of approximately 7 watts. These valves require an anode voltage of 300 to 500 volts, however, and therefore resistances must be connected in the anode circuits of the preceding valves in order to provide the required anode voltage of 200 to 220 volts.

It is very desirable to keep the anode voltage of the S.G. H.F. valve steady, and therefore it is not advisable to control the volume by means of a variable mu bias control, as the total current consumption of the valve drops to a very low level when the control is at minimum setting. The voltage drop across the anode resistance will therefore be very low at this setting.

Short-wave Note

When I mentioned the impossibility of mistaking VQ7LO for an American transmitter, I had in mind W3XAU, of Philadelphia (Pa.), on the same channel, and through which you may receive the WCAU, Columbia programmes in the same city daily from G.M.T. 01.00-04.00. The 49.5-metre wavelength, as you will see, is a very congested one, as it also houses W8XAL, Mason, a 10-kilowatt short-waver, taking the WLW, Cincinnati, radio entertainments, on the air from G.M.T. 10.00-01.00 and again from 04.00-06.00 daily.

Almost immediately above we find GSA, Daventry, on 49.59 metres (6,050 kc/s), and this logging provides us with a good landmark for this particular band of frequencies.

Remember that DIQ, Königs Wusterhausen, Germany, on 29.16 metres (10,290 kc/s), which has been carrying out tests with JVM, Nazaki (Japan), relays from time to time the Zeesen programmes between B.S.T. 22.30–23.30 and from 00.00 to 01.00. On two occasions it has been heard carrying out experimental broadcasts with Pernambuco (Brazil).

Practical Television

I have just been looking through our sister journal, *Practical Television and Short-Wave Review*, and must admit that I was amazed at the diverse subjects which were covered in this interesting monthly. I have not a great deal of interest in television at the moment, and must confess that after looking through this number I shall certainly make up (or borrow) a television receiver. Another feature which greatly interested me was the short-wave superhet. This employs three valves and a pentagrid-frequency-changer, and seems to present many novelties. I shall have to ask the Editor to lend this receiver to me as I have not yet tried out a short-wave superhet employing such a small number of valves. By the way, it might interest readers to know that the usual superhet (if correctly designed) is of little use to those who wish to log amateur transmitters on the short waves, as the majority of these employ continuous-wave transmissions, and this type of receiver will not pick up such transmissions unless the I.F. valve is oscillating. This particular receiver has a manual control and enables this condition to be obtained so that the general use of the equipment is greatly extended, and some really good results should be obtained. There is also an article which will interest those who have ordinary disc apparatus, and are anxious to see the television pictures radiated from France. The article tells you how to get these pictures (60-line) with the ordinary apparatus.

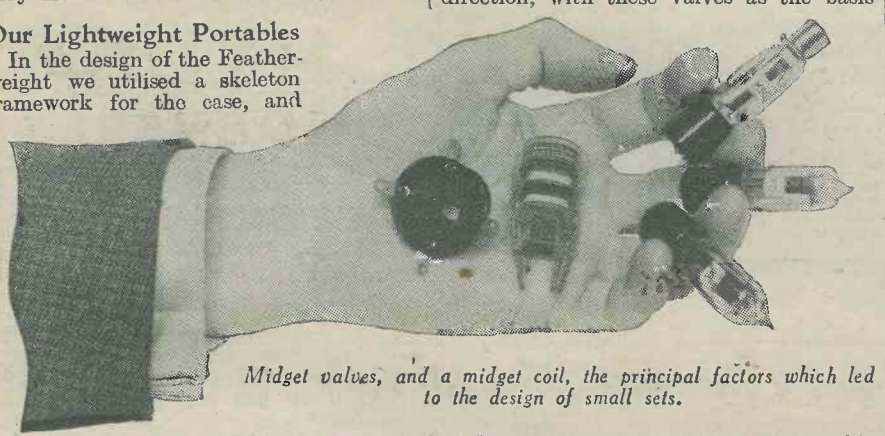
Our Cameo Series of Midget Sets

Preliminary Details of Our New Series of Midget Receivers for Hikers, Cyclists, and Motorists, and Interesting Information Concerning These Tiniest of All Portable and Pocket Receivers. Full Constructional Details Next Week!

FOR some time past we have been giving very intense consideration to the design of small receivers. Readers will remember the original Featherweight receiver which we designed and which was the first real step towards a really portable receiver. In the past the term "portable" has simply meant "capable of being carried," and those who have used some of the older commercial portables will remember that although capable of being carried, their weight prevented them from being taken very far. The term portable when applied to a wireless receiver should mean that it may be conveniently carried, and although the batteries form the greater bulk and weight, there is no need why the total weight should not be very much less than it is to-day.

Our Lightweight Portables

In the design of the Featherweight we utilised a skeleton framework for the case, and this gave a substantial reduction in weight. The remainder of the design also led to a reduction in size and weight, so that together a really neat and convenient receiver was built. In the following year we still further improved upon the design, and introduced the Atom, in which small coils were employed, and other devices were introduced in the interests of lightness and smallness. This receiver represented a real advance in design and received high praise from many quarters. Even so, the hiker or the rambler who wishes to go out into the country during the summer months often feels that the entertainment which is provided by musical items, etc., is well worth while, but a receiver to be taken on such excursions must have many points which cannot to-day be found in a receiver.



Midget valves, and a midget coil, the principal factors which led to the design of small sets.

What Is Needed

Apart from the fact that the total weight must be at an absolute minimum, the overall size must also be such that the receiver may be stowed in the rucksack when not required, or at least carried comfortably in the hand without the necessity of guarding against the corners banging the legs or protruding knobs, etc., which render it necessary to place the body at an angle so as to enable the receiver to hang clear. Travellers in other directions, too, often wish that a receiver was at hand to wile away the time. In the train, in a car, on a cycle, or in many other directions there is a real need for small apparatus, and it may be of the type designed to fit into an overcoat pocket, or built to the dimensions of an ordinary box camera. There were, however, many difficulties in the way of the production of such apparatus. First and foremost is the battery supply. Until recently the standard apparatus was much too large and weighty to enable ordinary supplies to be utilised. The size of components, too, precluded ordinary apparatus from being used in midget. Our experiments have led to the design of a receiver which eclipsed even the Atom and yet we were not satisfied.

Midget Valves

Then came the announcement from the High Vacuum Valve Company that they had succeeded in producing really midget valves, and these have already been mentioned in these pages. Previous ideas were not discarded, and we struck out in a new direction, with these valves as the basis of design. It was obviously impracticable to use ordinary coils and condensers with such small valves, and, therefore, we got into touch with the various manufacturers with a view to the production of suitable components, and we have now succeeded in obtaining some really interesting apparatus as a result of which real midgets are now possible. Obviously, it is not intended that receivers of this nature shall give loud-speaker signals sufficient to fill a small hall. What is intended is that the output shall be sufficient for the needs of the user only. Thus, one model which we have constructed will operate headphones only, and will be admirable for the hiker who desires music whilst he rests for lunch or has a break from his walk. Another model is designed for the cyclist, who cannot wear headphones, but will be content with a moderate loud-speaker output, sufficient to relieve any tedium of the journey but not sufficient to prevent his hearing sounds from overtaking traffic, etc. Another model will suit the car user who wishes to hear the signals on a loud-speaker above the engine and other incidental noises, but does not wish to distract the driver. No doubt there are many other types of receiver which will be required by our readers, and in order that we may cater for all classes we should be glad if readers would write to us and let us know their requirements.

What Circuit?

It must be remembered that there are limitations to the amount of high tension which it is practicable to accommodate. Therefore, it is of no use asking for seven- or eight-valve superhets. Circuits which are economical in low and high tension must be employed, and thus there is a certain restriction upon the type of apparatus which can be built. To many, a one-valve receiver with reaction and an efficient coil will give sufficiently loud signals on a good pair of headphones to offer adequate entertainment under normal conditions, with a throw-out aerial.

Cabinets

One of the most difficult points concerns the type of cabinet in which to house these midget sets, as it is obviously necessary to maintain the smallness of size of the receiver portion without bringing the entire assembly up to the dimensions of the Atom, for instance. In the case of the hiker's receiver a small cabinet would be sufficient, but in the case of a receiver designed for the car it is obviously desirable to arrange the receiver to fit into some convenient part of the car, and the glove-box lends itself admirably for this purpose. A small wooden panel may be shaped to fit the opening of the box, and the receiver itself will go very conveniently into the space behind. Other particular requirements may similarly be fulfilled, and no doubt readers will let us know their ideas and requirements when writing to us concerning the type of circuit which they will find most useful.

Here is an H.T. battery and a small accumulator, the actual sizes of which may be seen from the hand in which they are held.

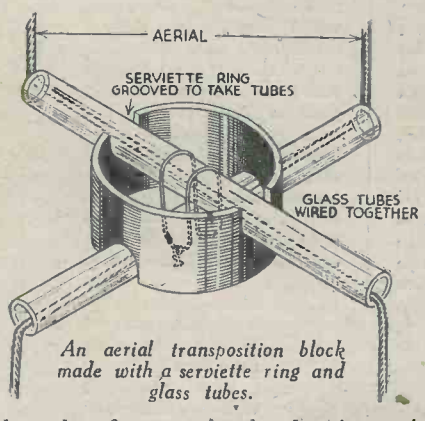
A PAGE OF PRACTICAL HINTS

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

Easily-made Transposition Blocks

IT is well known that a great deal of the local interference caused by car ignition, trams, electric signs, etc., can be cut out by the use of transposition blocks. These are particularly useful when listening to weak signals on the short waves.

The blocks are fixed in the two down leads, one being from the aerial wire and

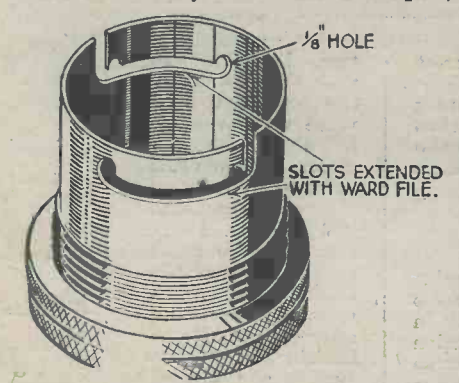


An aerial transposition block made with a serviette ring and glass tubes.

the other from an insulated point. As shown in the accompanying sketch, glass tubes are used which are wired together on to a serviette ring, which has been grooved out to take the tubes to prevent them moving. The rings can be obtained at a local stores and the tubes from a chemist. The sketch shows one the transposition blocks assembled, and they should be arranged at a distance of two feet from each other. —G. LINDSAY (Hitchin).

A Novel Switch Plug

BY the simple modification, shown in the accompanying sketch, a batten holder, when used in conjunction with an adaptor,



Adapting a batten holder to form a switch plug.

forms a handy switch-plug. In the normal closed-circuit position, the contacts of holder and adaptor coincide. The extended slots permit the adaptor to be rotated through an angle of 90 degrees, when the contacts of the holder will rest on the insulation of the adaptor. The device is best suited for use with extension speakers.

THAT DODGE OF YOURS!

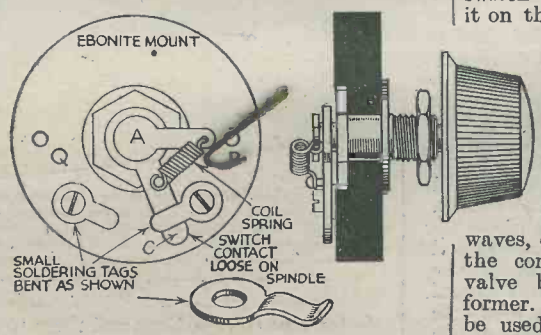
Every Reader of "PRACTICAL AND AMATEUR WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account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

It should be pointed out that the device should not be used with high-voltage mains, as this would be against I.E.E. regulations.—STEENSON RAINEY (Wishaw).

An Easily-made Snap Switch

THE switch shown in the accompanying sketches is of the rotary two-way snap type suitable for radiogram change-over switching. The common contact is taken to the fixing bush and spindle, which are from an old push-pull switch or rheostat. The knife contacts are made from soldering tags fixed by 8 B.A. bolts to which the other contacts are taken.

The large tag "A" is soldered flush with the end of the spindle. Under this tag is placed the snap contact, which pivots



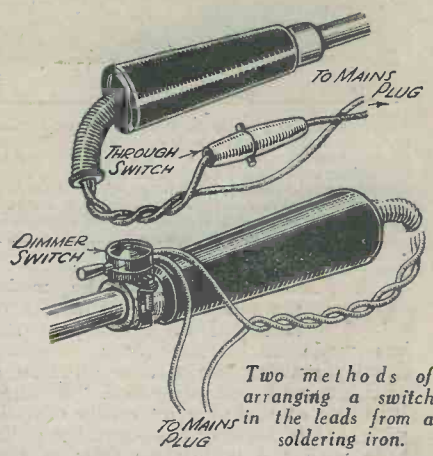
A method of making an efficient snap switch.

easily on the spindle. This contact can easily be made from a brass strip from a flash-lamp battery. To each of these tags is soldered a pin over which the tension spring is fixed.

When the spindle is rotated anti-clockwise, that is over from P to Q, the tag "A" puts a tension on the spring. When the tag "A" is rotated so that the centre line of the spring is to the left of the spindle, the contact "C" will snap over to the left-hand contact. This cycle is repeated when the spindle is rotated in the reverse direction. A compression spring may be placed between the bush and the knob to cause the contact "C" to be pressed against the mount, so making the switch work smoothly.—C. S. HARRISON (Long Eaton).

A Soldering-iron Switch

WHEN using an electric soldering iron, it is very annoying to have frequently to get up to switch it off in order to economise in current consumption. The follow-

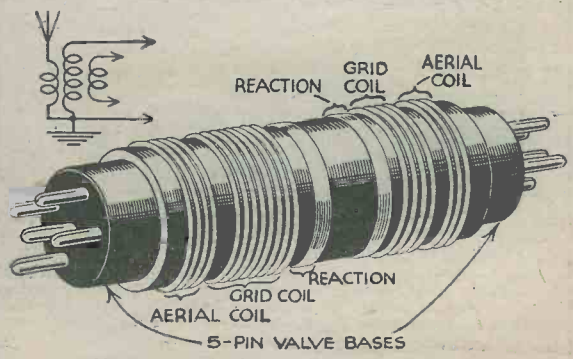


Two methods of arranging a switch in the leads from a soldering iron.

ing dodge eliminates the trouble. Break one side of the flex, near the handle of the iron, and insert a "Bulgin" through switch. Another idea is to obtain a dimmer switch of the pattern illustrated, and fix it on the ferrule of the iron, breaking the lead in the same way as before.—R. LANDELLS (Hendon).

Two Sets of Coils on One Former

BY using the method illustrated in the accompanying sketch, two sets of coils, *viz*, short waves (40–80 m.), long and medium waves, etc., can be wound on one former, the connections being taken to 5-pin valve bases fixed in the ends of the former. This arrangement, which can also be used for Hartley and other circuits, permits of quick wave-change.—S. HAWES (Dunedin, New Zealand).



Using a single former for two sets of coils.

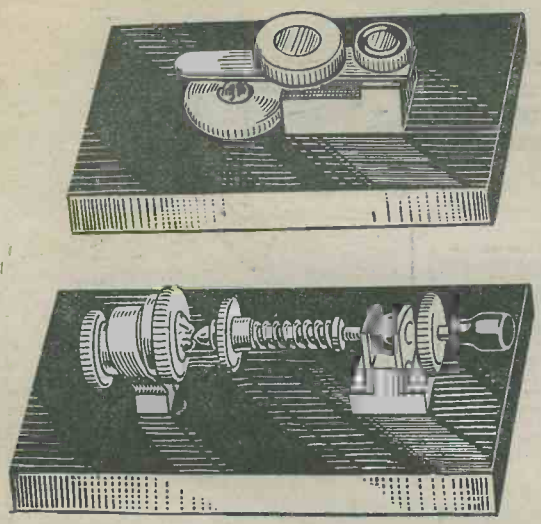


Fig. 1.—Two very early detectors. The upper illustration shows the carborundum detector, in which a flat piece of steel was pressed against a crystal of carborundum. This type of detector was generally employed in conjunction with a small potential, a potentiometer being used in order to vary the applied voltage. The lower picture shows the combination type of detector in which copper pyrites is employed in conjunction with a piece of galena. The pressure applied was a critical factor and thus the small milled adjusting knob was provided on one holder.

TWENTY-FIV RADIO P

At the time of the King's Silver Jubilee it is Int During his Reign. Some Interesting Details are he

WHEN one reviews the modern marvels of the age, surely one is forced to admit that none has made such tremendous strides in development as the science of radio, or, as it is more commonly called, "wireless." When we compare the motor-bus of to-day with that of 1910, or the aeroplane of that time with the luxury air liner of these days we admit that marvellous changes have been brought about in twenty-five years; but if we go back to 1910 and examine the wireless position of that time, what do we find? Broadcasting unheard of and not even envisaged. Marconi, who was in that year on a voyage to Buenos Aires on the S.S. *Princepessa Mafalda*, was able to pick up signals sent from Clifden in Ireland over a distance of 4,000 miles in daylight and 6,735 miles at night. This was, of course, with what might be termed "laboratory apparatus," and the distance created a record and once more revealed the startling effects of the radio signals. By signals is meant the dots and dashes of the morse code, for at this time it had not been found practicable to transmit the human voice, although experiments carried out in secret had shown that it might be possible when more was understood of the nature of the radio-frequency oscillations.

1910

Thus in 1910 we find that wireless telephony (and naturally the transmission of music by wireless) was not an accomplished fact, and that a distance of 4,000 miles for code signals was a record. What was the apparatus like in these days? In general, the crystal detector was in use, although the Fleming valve was being experimented with in complete receivers, and such receivers were being used by the Marconi Company with great success. The magnetic detector was still in existence, and receivers presented a most frightful appearance, with their array of switch studs and arms. Certain ships had been fitted (from an experimental point of view) with wireless apparatus, and it will be remembered that in this year the first real proof of the value of wireless was furnished to the world with the arrest of the notorious murderer Crippen, who was found on a ship going to America, and the captain of the boat sent a wireless message to the authorities which enabled them to take a faster boat to New York and there to arrest Crippen before he landed.

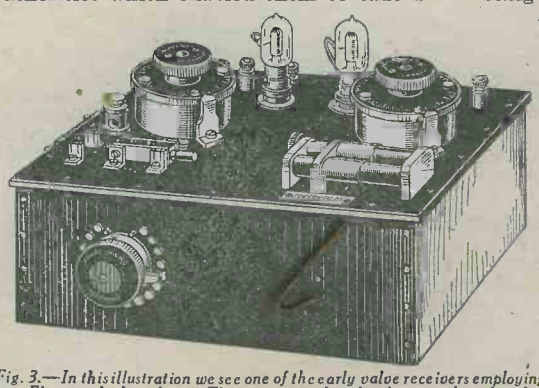


Fig. 3.—In this illustration we see one of the early valve receivers employing two Fleming diode valves. The circuit employed only a single valve, but two were fitted in the interests of reliability, and a switch enabled one or the other to be brought into circuit. Note the massive variable condensers, and compare them with modern components. The dielectric employed in these condensers consisted of plates of thick ebonite, but the components were very efficient.

In this year the first wireless shipping report was published at Lloyds, thus forging another link in the chain which was establishing radio as one of the world's everyday needs.

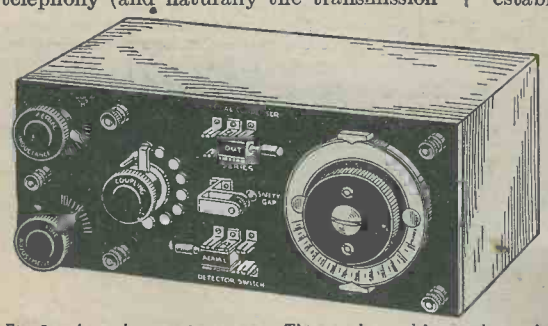


Fig. 2.—An early army-type tuner. This was designed for use during the early days of the Great War, and employed a flat tuning inductance arranged to tune after the manner of a variometer. Switches were provided to enable the detector and phones to be joined across either the "closed" or the "aerial" circuit.

1911

In the following year the Admiralty interest in the possibilities of radio led them to have a station built in Whitehall. The power of this station was 14 k.w., and during the same year an army airship took aloft a transmitter and was able to establish communication up to a distance of thirty miles. In America things were going ahead rather more rapidly, but the world was, in general, taking a much greater interest in the subject, principally owing to the saving of life at sea due to help being received as a result of a wireless call.

1912

This latter use of radio was stressed still more forcibly in 1912, when the *Titanic* struck an iceberg and was able to send for help before finally foundering. In this year a transmitting set designed especially for aircraft was perfected and fitted to military aeroplanes, and in June a seaplane so fitted was able to transmit over a distance of ten miles. Greater distances were being accomplished by land stations, and it was becoming increasingly evident that there was a future for communication between one country and another by means of wireless signals.

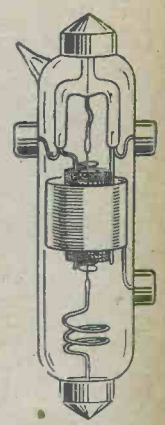


Fig. 7.—Two interesting v the popular V.24, in whic leads are taken to oppos container to reduce capaci clipped into a small hold extremely small, but very e about three inches long by of an inch in diameter. O 4-electrode valve, known were some novel uses sugg 1920, not the least of w struction of a receiver wit supply

1913

In 1913 the Government, seeing the importance of the subject, entered into a contract with the Marconi Company for the erection of a chain of high-powered stations for Imperial communication. Early in the year the first three-electrode gas-filled valve was developed by a Marconi engineer, and from this point receiver design progressed by leaps and bounds. Many amateurs were taking up the study of the hobby, and as a result of the growing interest the Radio Society of Great Britain was formed in this year in the interests of such amateurs.

Fig. 5.—The well-known French "R" valve. This was extremely popular amongst amateurs immediately after the war, but its performance would be extremely poor compared with modern valves. It formed an ideal detector and was used in its thousands.

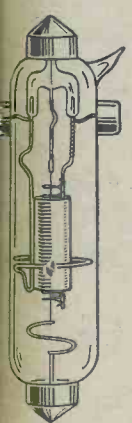
1914

With the arrival of the War, the military development of radio

E YEARS OF ROGRESS

ling to Review the Progress Made by Radio given.

was very marked, and those amateurs who were experimenting at the time will remember that under Government orders the apparatus had to be sealed up and could not be used, in case of communication with the enemy ! Fig. 2 shows the Mark II Long-wave Tuner of these times, and Fig. 3 is the first valve receiver. In the front may be seen a peculiar form of tuning condenser (known as the Bili), whilst the tapping switch for the tuning coil is visible in the front. Direction-finding stations were erected in France, and, although not to be compared with modern D.F. apparatus, it was found possible to trace enemy ships.



...es. On the left is the grid and anode ends of the glass effects. This valve and was not only ficient. It measured about three-quarters the right is the first the F.E.1. There ed for this valve in cu was in the con-ut any high-tension

1915

Owing to the necessity of communication between the various arms of the Service, great strides were now being made in the design and efficiency of apparatus. Communication between aeroplanes and gunners was necessary, and by the end of 1915 600 aeroplanes were fitted for the job, and there was a complete wireless telegraph arm attached to the Royal Engineers. The three-electrode valve was still further improved, and the first "reflex" circuit was evolved during this year, in which the valve was employed. Records also show that night-fading was first discovered in this year. A patent was taken out for the push-pull method of L.F. coupling.

Fig. 9.—One of the earliest, and at the same time one of the most popular, loud-speakers —the Magnavox. This employed an energised magnet (requiring an applied voltage between 6 and 10) and the diaphragm was of the conical type. This was operated by a moving coil and was used on many occasions for public-address demonstrations.

1916-1919

The entire War period may be said to show rapid stages of development. Telephony was adopted in field service sets, the beam method of transmitting was developed from the laboratory to the practical stage, and hard valves were being manufactured. In 1919 the first transmission in this country of speech and music for public reception was carried out from Chelmsford. Unfortunately, this station was closed down by order of the Postmaster-General as it was stated to be interfering with "legitimate services." It was found in 1919 that the self-capacity of a valve was a drawback to good functioning, and as a result the well-known V.24 valve was introduced (Fig. 7). As will be seen from the illustration, the leads were brought out at various points of the glass container.

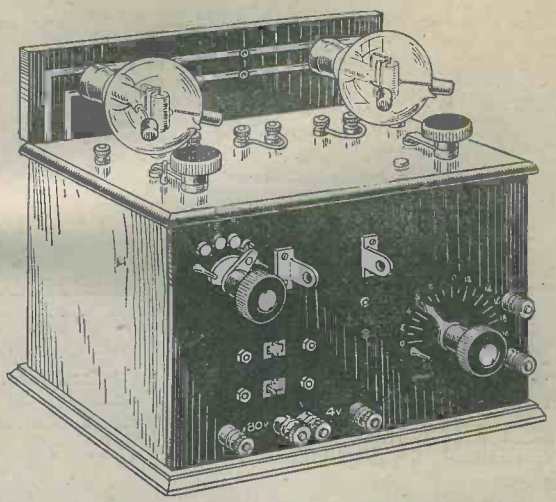


Fig. 6.—Here you see a 1918 short-waver. Again anti-capacity valves are being used, and these are of the French "Horn" type, with the grid and anode leads brought out to separate contact points. The term "Short wave" only applied, of course, to wavelengths down to 200 metres.

1920

This year saw broadcast entertainment introduced as a reliable feature, the Chelmsford station again being the source of the transmission. The wavelength used was 2,800 metres, and in June of this year Dame Nellie Melba gave her famous broadcast, using an ordinary carbon hand-microphone with a small wood and paper trumpet round the mike to improve matters. She had to hold it whilst she sang ! The transmission was picked up by a ship at sea over 1,000 miles away. A well-known London daily newspaper had a receiver installed in order to pick up items of news transmitted from Chelmsford and a number of important transmissions of this nature were made during the year.

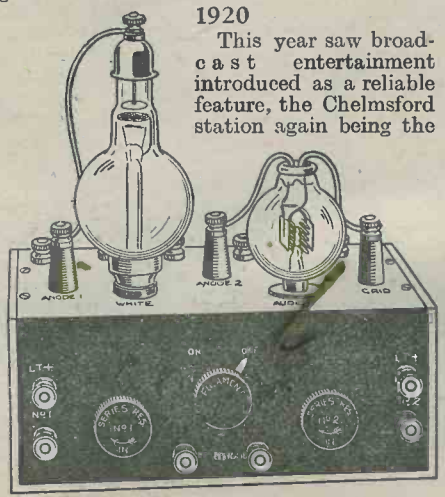


Fig. 4.—An amplifier of 1917. This employed two "soft" valves in an H.F. and detector circuit, but did not incorporate any tuning arrangements. It was intended for use in conjunction with the Mark III Tuner. The leads coming out from the valve should be noticed, together with the large terminal points for them. It was customary even during recent years to de-cap ordinary standard valves and use them in a similar manner for short-wave work in order to reduce inter-valve capacities.

1921

The P.M.G. authorised a limited broadcasting service from Writtle with a power not exceeding 200 watts in 1921, and some interesting receivers began to come into existence to pick up these transmissions.

1922

The now historic 2LO came into existence in 1922, and the British Broadcasting Company was formed. Crystal receivers appeared on the market, and one of these is shown in Fig. 8. This was the Apollo and cost £4 10s. with one pair of 'phones. Notice the two crystal detectors which were fitted in the interests of reliability, and the large tuning coil with the sliding primary winding. Towards the end of the year valve receivers were obtainable, the popular Marconi V2, which employed two valves only, but in a reflex circuit, costing £20.

1923

Now that broadcasting had arrived, the strides were really rapid, and it is only possible to indicate some of the interesting developments of the past decade. Looking through old catalogues I find a 5-valve receiver was on sale in 1923 at a price of £83 7s. 6d. This was fitted with a frame aerial in the interests of selectivity !

(To be continued next week)

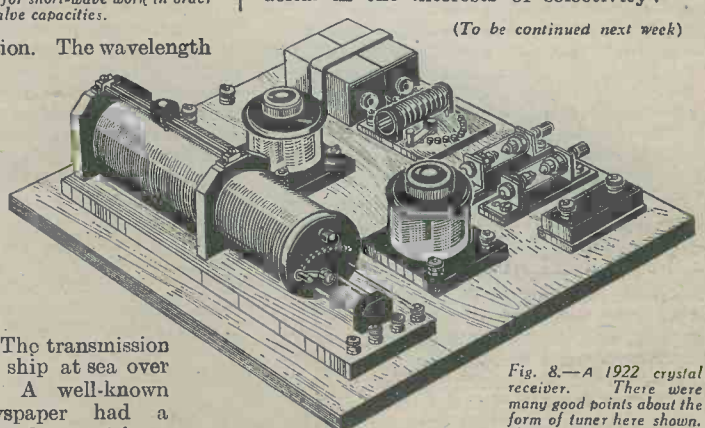


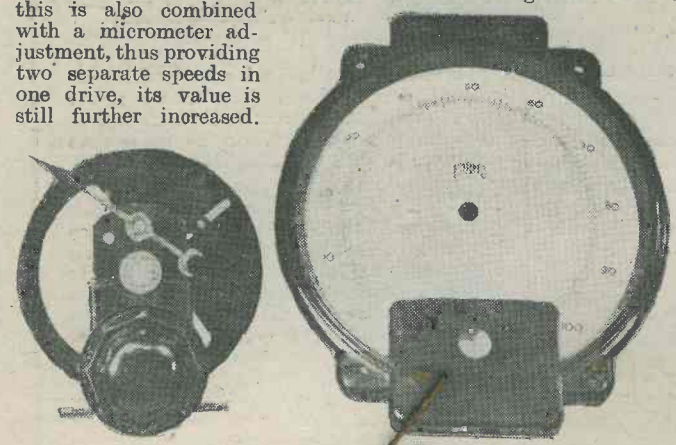
Fig. 8.—A 1922 crystal receiver. There were many good points about the form of tuner here shown. A primary and secondary winding were employed, the primary being tapped at a number of places whilst the secondary was provided with a sliding contact. The adjustment of wavelength could be made by the variable contacts, and the degree of coupling between primary and secondary could be varied by sliding the primary in or out of the secondary.

Facts & Figures

COMPONENTS TESTED IN OUR LABORATORY

A New Formo Drive

THE use of a modern receiver demands also that the actual tuning unit shall be operated through a drive which will enable full advantage to be taken of the modern circuit design. The ordinary old-fashioned direct drive is of little use to-day and a slow-motion drive is essential. When this is also combined with a micrometer adjustment, thus providing two separate speeds in one drive, its value is still further increased.



The Formo snail drive and dial.

The Formo drive shown above is of the latter type, having two separate speeds each controlled by a separate knob, the two being arranged concentrically on a common spindle. The normal speed obtained with the larger knob is approximately 8 to 1, whilst when the smaller front knob is manipulated the gear reduction is brought to 60 to 1. The actual drive is more or less on orthodox lines, except that the pointer which is fitted is of the same pattern as a modern clock hand and is a sliding fit on the spindle—after clock practice. To enable full advantage to be taken of the drive a large diameter (4½in.) matt celluloid dial is provided, and a neat bakelite escutcheon into which it fits. The dial is domed and the pointer is suitably curved to provide a really neat and novel tuning unit. The price is 3s. for the snail drive, and 3s. 6d. for the escutcheon—a total of 6s. 6d. for the complete unit.

A Dual-wave Station Suppressor

LISTENERS who experience difficulty in cutting out local stations should make a point of trying the Whiteley unit which is expressly designed for this purpose. It connects in a simple manner between the aerial of your set and the aerial terminal, and the simple adjustment of a knob on the unit enables any station to be suppressed. A wave-change switch is provided on the unit so that it may be operated on either the medium or long wavebands. The price, complete with easy-to-follow instructions, is 10s. 6d., and further details may be obtained from Messrs. Whiteley Electrical Radio Co., Ltd., of Radio Works, Victoria Street, Mansfield, Notts.

A Useful Bulgin Accessory

USERS of short-wave converters sometimes find that, owing to the particular arrangement of the aerial coil in the standard broadcast receiver with which the converter is employed, some loss in signal strength is noticed. The usual anode wiring scheme of a converter consists of two chokes in series, one a short-wave choke and the other a normal broadcast choke. The little device introduced by Messrs. Bulgin, and illustrated on this page, consists of a specially-wound choke which is intended to replace the ordinary choke in the converter, and owing to the winding which is used on this component it provides a much better transfer of energy and will prove of great value in those cases where the signal transfer from converter to receiver is poor. The price is 2s. 6d.

Mercury Vapour Rectifying Valves

THERE are many advantages to be gained by employing the so-called "gas-filled" rectifiers (*i.e.*, mercury vapour rectifying valves of the hot-cathode type) for high-tension supply to high-power output valves, such as those used for talkie and public-address amplifiers, relay systems, and the like, and for valves of corresponding consumption in transmitting circuits.

Of these advantages, one of the most valuable is that high rectification efficiency is obtained, even at low working voltages, due to the fact that, owing to the low internal resistances of this type of valve the internal voltage drop is very low. For the same reason, the voltage regulation of the supply unit is remarkably good.

The Mullard Wireless Service Co., Ltd., has developed a range of gas-filled rectifiers, and four types are available, having the following outputs:—

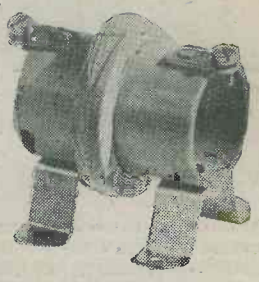
Type.	*Max. Rectified Output.*	
	Volts.	*m/Amps.*
RG1-125	1,200	125
RG2-500	2,000	500
RG5-500	5,000	500
RG5-1,500	5,000	1,500

Of these, Type RG2-500 is an entirely new valve, details of which have only just been released. Its operating data are as hereunder:—

Filament Voltage	5.0 V.
Filament Current	10.0 A.
Max. Anode Voltage	2,000 V. R.M.S.
Max. Peak Inverse Voltage	5,000 V.
Max. Rectified Output Current	500 mA.
Max. Peak Anode Current	2,500 mA.

As in the case of other valves in the range, the internal voltage drop is only some 15 to 20 V.

The RG2-500 is particularly suitable for use in rectifier circuits fed from single-phase or three-phase A.C. supplies where relatively heavy output currents at voltages up to 2,000 V. D.C. are required, and in voltage doubling circuits giving an output voltage of approximately 4,000 V. D.C. at full load.



A useful accessory from the Bulgin range, referred to on this page.

In connection with the smoothing arrangements for a rectifier circuit employing gas-filled tubes, it should be emphasised that the filter circuit should be so arranged that a choke is connected in series with the rectifier *before* the first smoothing condenser.

Two New Marconi Valves, X31 and X41

MARCONIPHONE announce the introduction to their range of two new valves, which will be known as the Marconi X41 and the Marconi X31.

These are triode hexode valves, specially designed to perform as frequency changers in superheterodyne receivers. They offer certain important advantages over previous valves made for the purpose, particularly when used on the ultra-short wavebands, for which they are eminently suitable by reason of the efficient oscillator section and the great reduction of "pulling."

The new Marconi triode hexode valve, type X31 and X41.

The X41 is for A.C. operation and has the following characteristics.

Filament volts	4.0 volts
Filament current	1.2 amps.
Anode voltage	250 volts
Screen voltage	70 volts
Osc. anode voltage	100 volts
Control grid voltage	−1.5 volts
Conversion conductance	550 microamps/V.
Conversion impedance	2 megohms.

The Marconi X31 is an A.C./D.C. valve with a filament voltage of 13, whereas the X41 is an A.C. valve only, with a filament voltage of 4.

The price of either type is 20s.

LEAVES FROM A SHORT-WAVE LOG

By J. G. ABRAHAMS

THE King's Silver Jubilee, and in particular the preparations made by the B.B.C. for the relay of greetings from Colonies and Dominions overseas, afforded many opportunities to short-wave fans of hearing transmissions of commercial stations clearly, on channels which as a rule are confined to scrambled telephony.

World-wide Broadcasts

It was a matter of considerable interest in the course of the celebrations on May 6th, during both day and evening, to pick up echoes of the original broadcasts on various short waves, emanating from not only the Daventry Empire stations, but also from North and South American sources.

In addition to a relay carried out by a number of European countries, and by the Colonies and Dominions, rebroadcasts of portions of the different ceremonies in connection with the Jubilee through the medium of the Daventry Empire transmitters and British Post Office radio telephony systems, were rebroadcast by Alexandria, Cairo, Buenos Aires, and throughout the C.B.S. and N.B.C. North American Networks. Such a world-wide rediffusion must assuredly constitute a record in the annals of radio broadcasting.

Suva (Fiji)

VPD, Suva, of which reception was made recently by a reader, is a station owned by the Amalgamated Wireless of Australia Limited (Sydney), and situated in the Fiji Islands. It works on 22.94 metres (13,075 kc/s) daily except Sundays, between B.S.T. 06.30–07.30, and VLZ2, Sydney, which has been picked up frequently during the past fortnight, is the Pennant Hills short-wave transmitter on 30.74 metres (9,760 kc/s), which is mainly used for communication with New Zealand, but is also devoted to experimental transmissions destined to Europe.

In this waveband also tests have been picked up prior to the opening of the Rome-Tripoli radio telephony service. In addition to traffic with ships, IAC, Coltano, is used as the channel for communication with the Italian North African colony. The wavelength of the Coltano 54 kilowatt transmitter is 35.23 metres (8,515 kc/s), ICK, Tripoli, using mostly 31.71 metres (9,460 kc/s) and occasionally 51.5 metres (5,825 kc/s). The times to search for these stations are between B.S.T. 11.00–13.00 and 18.00–20.00. It is probably through IAC, Coltano, that the Rome programme will be relayed from time to time for rebroadcast in Tripoli.

New South American Transmitters

Two new stations which have been traced and for which it might be worth while to make a search, are HJ2ABD, Bucaramanga (Colombia) on 50.34 metres (5,960 kc/s) and TI6OW, Puerto Limon (Costa Rica) on 42.43 metres (7,070 kc/s). The latter calls itself Ondas del Caribe (the Waves of the Caribbean).

Whilst reference is made to South American transmitters, it is well to note that HCJB, Quito (Ecuador), which was working on 73 metres, now appears to have definitely settled on 36.59 metres (8,200 kc/s). Transmissions take place daily (Tuesdays excepted) from B.S.T. 02.15–04.00.

In addition to the better known Riobamba broadcasting station, Ecuador also possesses two active transmitters in the short-wave band, namely, HC2RL, Guayaquil, on 45.05 metres (6,659 kc/s) and HC2ET, in the same location, on 65,22 metres (4,600 kc/s). Of these the former has been heard more frequently; the call, in Spanish, reads phonetically: Ah-kee es-ta-see-yon atcha say dos air ell, and the schedule at present is: B.S.T. 23.45–02.00 (Sundays) and 03.15–05.45 (Tuesdays). In the course of transmissions you may hear the announcer say: "Hallo America," following which he gives a talk in English and frequently reads out reports of reception which have reached him from oversea listeners.

In recent notes I mentioned a harmonic of P.T.T. Rennes found on 48.1 metres. When searching around 46 metres a few nights ago, I picked up a strong harmonic—apparently the sixth—of Bordeaux P.T.T. on 46.4 metres, namely, immediately below HJ1ABB, Barranquilla, on 46.53 metres. There is no doubt about the harmonic as the call was distinctly heard.

British Commercial Transmitters

No doubt when twirling the dials you must have come across some British commercial transmitters, possibly at the time when operators on this side were talking to their opposite numbers. These, as a rule, will have probably emanated from Rugby, and good landmarks can be registered by noting the following three channels: GBW, 20.78 metres (14,440 kc/s); GBU, 24.41 metres (12,290 kc/s), and GBS, 24.69 metres (12,150 kc/s), all work with New York.

It is not often that transmissions from the West Indies are logged in the British Isles, but I have seen a report from a listener which confirms his reception of ZFD, Bermuda, on 29.03 metres (10,335 kc/s).

SHORT WAVE SECTION

At the Short-waver's Bench—5

Band-spread Tuning, Mains Sets, and Hum-free Reception are Amongst the Subjects Dealt With in this Article

The Ultraudion Circuit

THE present generation of experimenters is probably unaware of the "ultraudion" circuit which used to be very popular in the early days of radio. It was an excellent design for a one-valver, and a somewhat modernised version is given in Fig. 1. Those enthusiasts who are always anxious to be trying out some new form of short-wave circuit may find this old friend of many of us a fruitful source of experiment. Simplicity is the main feature of the circuit; the filament rheostat shown is used to supplement the variable resistance as a reaction control.

You will notice in this circuit that this latter is the main reaction control, and illustrates a method which is very popular in the United States of America. The value of 50,000 ohms is found best for general use, and should always be by-passed, as shown, with a condenser of at least one microfarad. The advantages of this form of control are that it has no effect upon tuning, and that it is a very simple arrangement,

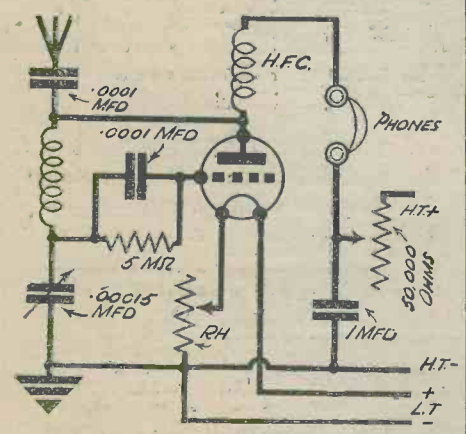


Fig. 1. — A modernised version of the "ultraudion" single-valve circuit.

giving smooth reaction. Care must be taken that a reliable component is used for the variable resistance, as otherwise crackles and noises will arise every time it is touched.

Adding "Band-spread Tuning"

"Band-spread tuning" can easily be added to any short-waver, a fact which few amateurs appear to realise, as otherwise, its advantages being so many, most sets would use it. The additional components required are a .00004 short-wave variable condenser and a good slow-motion dial. These should be mounted on the panel as near as possible to the main tuning condenser; the additional variable condenser being connected in parallel with the main variable condenser—that is to say, the moving plates on each are connected together with a short length of wire, as also are the fixed plates of each. Now the main tuning condenser is the "tank" condenser, and the smaller one is used for most of the tuning. The method of operation is as follows: Tune on the larger condenser until an interesting section of the

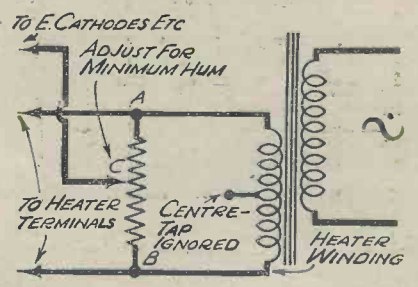


Fig. 2.—Using a potentiometer across the heater windings of the transformer for reducing hum.

band is found. This condenser is then left set and tuning continued on the smaller condenser, which will be found to spread the stations out as simply and easily as though tuning on the broadcast waveband.

Mains Short-wavers: A Source of Hum

My standard receiver for short-wave work is the all-A.C. three-valver which was recently described in the Short-wave Section. This set was originally built using indirectly-heated valves throughout, but just recently I have been trying out a directly-heated power valve. The general hum level has not risen, but a somewhat curious effect has occurred. A loud morse signal, an atmospheric or man-made static "crash," or a sudden spill-over into oscillation causes a loud hum to burst forth and last a few seconds, then gradually dying away. No alterations to the circuit will get rid of this effect, and I can only explain it by assuming that the sudden loud noise causes a slight vibration of the power-valve filament and thus the hum. The filament, or cathode, of an indirectly-heated valve cannot vibrate and so the trouble is not experienced when one is used. The hint is passed on in case other readers come across a similar difficulty. By the way, apart from this, I have found that for hum-free reception the finding of the exact electrical centre of the filament winding is essential. It is preferable, therefore, to use a potentiometer across the winding rather than to take the cathode return leads to the centre-tapping. Fig. 2 shows how this is done, whilst Fig. 3 shows how a filament rheostat may be modified to serve the purpose.

The Care of Headphones

As practically the only place nowadays where we find a pair of 'phones is beside the short-wave set, perhaps a few notes on their care will not be out of place here. The first point to note is that 'phones should not be dropped, as, besides impairing the efficiency of the magnets, this may fracture the very fine wire connections from the bobbins to the leads. If they have been in use for several years they may have lost much of their magnetism, however well you have treated them. Re-magnetising would be carried out very cheaply by many of the firms advertising in PRACTICAL AND AMATEUR WIRELESS and would make a great improvement in the sensitivity of the 'phones. Next, gently unscrew the caps and *slide* off the diaphragms, taking great care not to dent or bend them in any way. Clean them up, removing all traces of rust, and to prevent this in future, a very slight smear of vaseline may be put on each side. When the diaphragms are replaced, not forgetting the large washer under each, make sure they are quite free and not stuck down on the magnets. Finally, new leads may well replace the old ones, which, if worn, are liable to cause a variety of unpleasant noises.

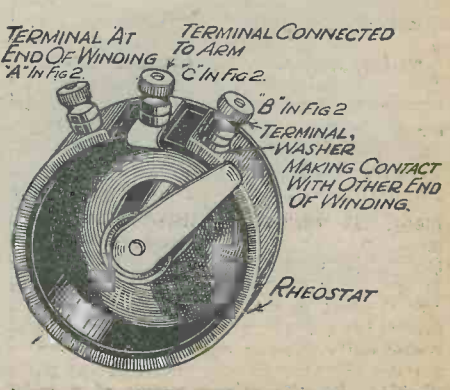


Fig. 3.—A modified form of filament rheostat for use as a potentiometer.

UNUSUAL SHORT-WAVE CIRCUITS

This Article Deals with Three Interesting Circuits of the Cathode-Impedance Type.

THERE has been developed recently a series of short-wave circuits for which are claimed the following advantages: (a) Reduction of background noise; (b) more stable oscillations; (c) smoother regeneration, and (d) tuning largely independent of supply voltages and regeneration control. For reasons which

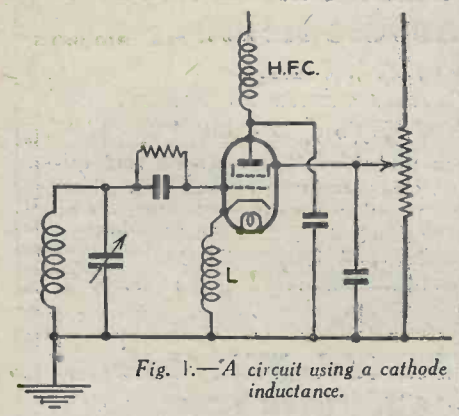


Fig. 1.—A circuit using a cathode inductance.

will be seen later, these circuits are known as the "cathode-impedance" type.

Indirectly-heated Pentode

The first of these circuits is shown in Fig. 1, and makes use of an indirectly-heated screen-grid or pentode valve. In the cathode lead of the valve is connected an inductance, the value of which is chosen so that its impedance to the speech frequency is small, and so does not in any way affect the rectification properties of the valve. As both the grid and anode currents of the valve flow through the cathode circuit, this inductance is common to both circuits. Voltages set up across this inductance by the high-frequency component of the anode current are transferred back to the grid circuit, so producing oscillations.

For the short-wave band this inductance can consist of about 200 to 300 turns of 36 S.W.G. wire, wound in slots on a ½-in. diameter former, or, if desired, a short-wave choke can be used.

Using a Tapped Coil

A modification of this circuit is shown in Fig. 2. Here it has been possible to dispense with the cathode inductance by connecting the cathode of the valve to a tap on the tuning coil.

A portion of this coil is now common to both grid and anode currents, and, as before, oscillations are generated.

This circuit is particularly useful when it is desired to cover a large range of wave-bands, using several coils in the receiver, as the amount of feed-back is not dependent on the characteristics of the inductance, which is more effective at one wavelength than another.

These two circuits can be combined to give that shown in Fig. 3, which has the great advantage that it can be used with directly-heated battery valves.

In this circuit the whole of the filament of the valve is raised above earth potential with respect to the high-frequency currents.

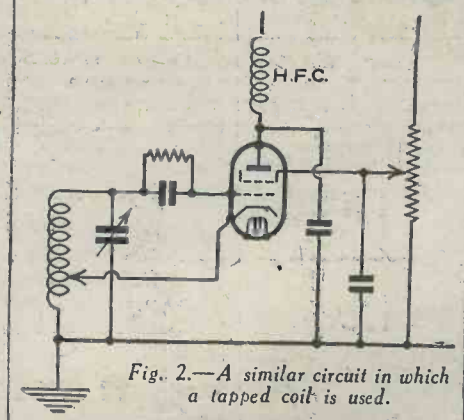


Fig. 2.—A similar circuit in which a tapped coil is used.

This is accomplished by connecting one leg of the filament to a tapping on the tuned circuit, whilst the other leg is connected to low tension through an inductance; a small fixed condenser is connected across the filament terminals of the valve to maintain the whole of the filament at earth potential. It will probably be found that it is necessary to apply rather more than the rated voltage to the valve owing to the voltage drop across the inductance.

A variable resistance is fitted in the filament circuit, and this should be adjusted until the rated voltage is shown on a reliable voltmeter across the filament terminals of the valveholder with the valve in position.

The remarks previously made about the cathode inductance apply also to this circuit, but it is essential that the resistance of this inductance is not excessive, and it should be capable of carrying the rated current of the valve.

Smooth Control of Feed-back

In the three circuits just described it is essential that the anode of the valve shall in each case be short-circuited to earth, with respect to the high-frequency currents, by the high-frequency choke and fixed condenser, as shown.

To vary the amount of feed-back a variable potentiometer is used to vary the voltage applied to the screening-grid of the valve. Alternatively, a variable resistance shunted by a large condenser should be connected in series with the high-tension supply to the anode of the valve.

Either of these methods will give a smooth control of feed-back.

These circuits prove particularly useful for use on the ultra-short waves, where normally it is difficult to obtain a sufficiently tight magnetic coupling between the grid and anode circuits to produce oscillations.

On these waves the value of the cathode inductance to obtain the necessary coupling is small, and can consist of a spiral of wire wound around a pencil and then slipped off.

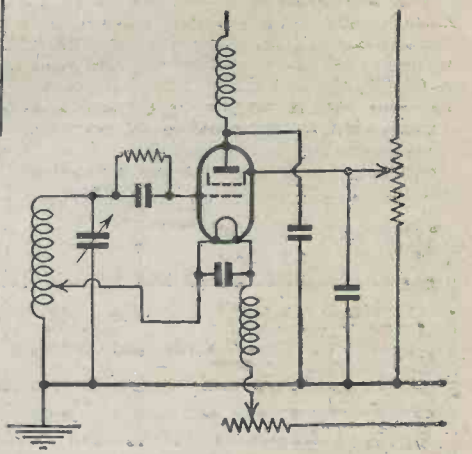
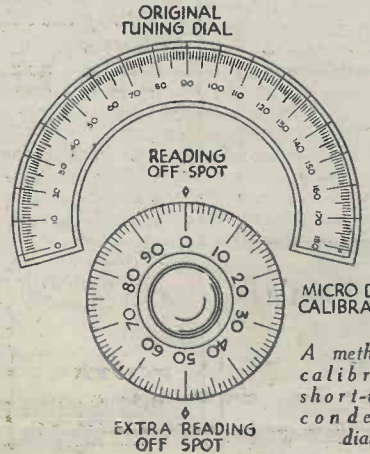


Fig. 3.—A circuit using a combination of tapped coil and cathode inductance with a battery-operated valve.

Micro Degree Calibration for Short-wave Condenser Dials

THE following idea will enable the user of a full-vision condenser scale to calibrate his short-wave receiver much more efficiently than with the usual arrangement. It consists in substituting for the usual control knob a condenser dial, of the panel mounting variety. This should be marked in degrees the whole way round, but if there is any difficulty in obtaining one of these dials, one marked half the way round will suffice, in which case two reading points will have to be marked on the panel in case the dial should arrive at a point where there were no markings. The main



A method of calibrating short-wave condenser dials.

tuning dial is read off in the usual manner, and the additional dial reading is taken and entered into the log, so that when one may wish to return to that particular station at a later time, the receiver will be exactly in tune. The knob should be screwed on to the spindle very tightly, and the slow-motion knob screwed on top of that.

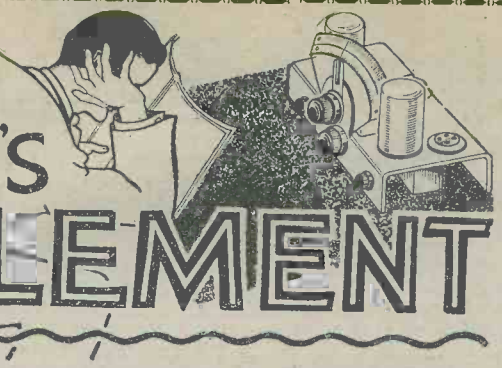
An Important Point

This idea should prove very helpful, since there are so many short-wave stations so near together, but once found they can easily be picked up afterwards with this arrangement. When employing a dial marked only half-way round for the micro-dial, the user will have to enter which of the two spots on the panel is being referred to.

—T. CROOK (Hoghton).

Points About Resistances

BEGINNER'S SUPPLEMENT



In this Article the Author Discusses the Functions of the Various Resistances Used in Receiving Circuits and Gives Helpful Hints as to the Choice of Suitable Types and Sizes.

THE space beneath the chassis of a modern receiver is usually crowded with resistances, and it is sometimes a matter of wonder to the amateur what they are all for, and whether all of them are necessary. It is safe to say that if a designer puts a resistance anywhere in a circuit, that resistance is either essential or at any rate desirable, and to justify this it is wise to discuss the functions of the various resistances used in receiving circuits, and to give some helpful hints as to the choice of suitable types and sizes.

Listeners with even the most elementary knowledge of Ohm's Law know that, with a given voltage, the value of the current in a circuit is governed by the resistance in the circuit. It might, therefore, be imagined that the primary function of resistances in radio sets is to limit the value of the current. This, however, is far from being the case, and in comparatively few instances are resistances employed for this purpose. The chief examples are the filament resistances which were necessary in the old days before the accurate manufacture of valves was fully developed, and the line resistances which are to-day necessary in the heater circuits of D.C. and universal receivers in order to maintain the heater current at its proper rated value.

Voltage Dropping

A simple inversion of Ohm's Law tells us, however, that when a current passes through a piece of apparatus possessing resistance, there is a drop of voltage across the ends of the resistance, equal to the strength of the current in amperes multiplied by the resistance in ohms. It is in order to obtain suitable voltage drops that resistances are principally employed in radio sets.

A typical example of this is in a receiver where only one H.T. positive terminal is fitted. The anodes and screens of the various valves all require different voltages, and these are obtained by passing the anode current or screen current, as the case may be, through a resistance of appropriate value so that the voltage developed across the resistance reduces the applied voltage to the figure required.

In the accompanying illustration, which shows the theoretical diagram of a typical universal receiver, the resistance R_1 is a true current-limiting resistance, while R_2 is employed for reducing the anode voltage to the detector valve to an appropriate value.

The resistance shown at R_3 also produces a voltage drop, but in this instance it is not employed to obtain a correct applied voltage. It forms the "load" in the anode circuit of the detector, and across this load is developed not only a D.C. voltage drop due to the mean value of the anode current, but also an audio-frequency A.C. voltage drop which is applied, viâ the coupling condenser, to the grid of the next valve.

Other Applications

These are typical examples of the three principal ways in which resistances are used in radio circuits, and for the sake of completeness a few other examples may be mentioned. R_4 in the same diagram, is a grid-bias resistance. Its function is to produce a voltage drop due to the passage of the anode current between the high-tension negative terminal and the cathode of the valve. As a result, the cathode is at a higher potential than the H.T. negative lead, and as the grid circuit of the valve is connected to H.T. negative, the cathode is at a higher voltage than the grid or, what amounts to the same thing, the grid is at a negative potential with respect to the cathode—is, in other words, given a negative grid bias.

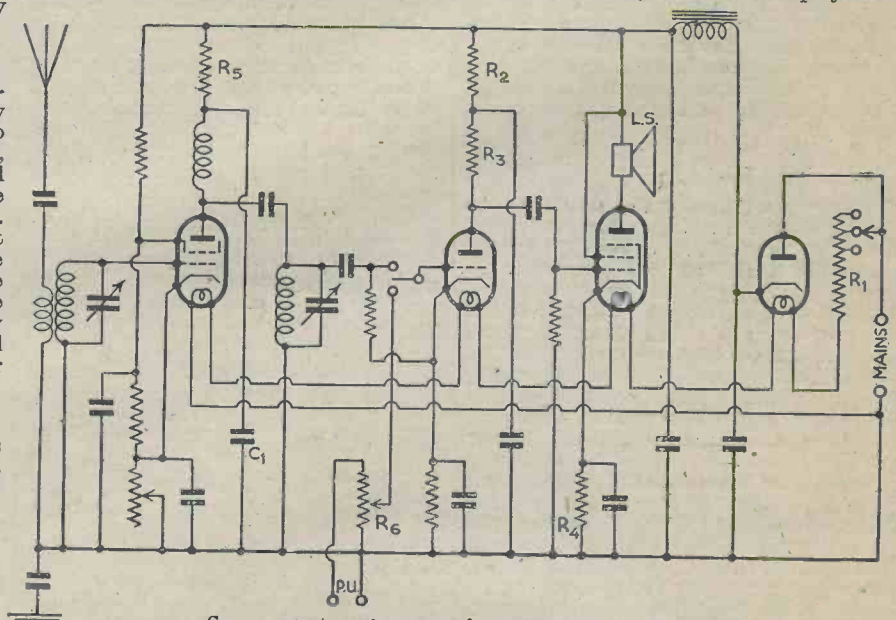
It will be noticed that the resistance R_5, in the anode circuit of the high-frequency valve, is by-passed to earth by a condenser, C_1. This resistance is not primarily intended to produce a drop in the H.T. voltage applied to the anode of the valve, but it *is* intended to produce an A.C. voltage drop. Actually the resistance is called a "decoupling resistance," and its duty is to filter out any alternating voltages due to the fact that the currents to all the valves are derived from one common supply, so that fluctuations due to any one valve, say the output valve, can also find their way through the high-tension wiring to the anode circuits of other valves. If the various anode and grid circuits were not decoupled properly, these back-coupled signals would be re-amplified over and over again, and would then give rise to general instability, of which howling, "motor boating" and distortion are the chief symptoms.

By including a resistance in each of these circuits, and a by-pass condenser to earth, the back-coupled signal produces an A.C. drop across the resistance which is shunted to earth through the condenser. It will be observed that the resistance R_2, which has already been described as the voltage-dropping resistance in the detector anode circuit, is also by-passed to earth so that in this case it also acts as a decoupling resistance.

Types of Resistances

In most cases, resistances employed in receiving circuits can be of fixed value. An experienced designer can work out beforehand the best values for the different resistances, and it will be shown later that the task is not really difficult for the amateur who wishes to design his own set.

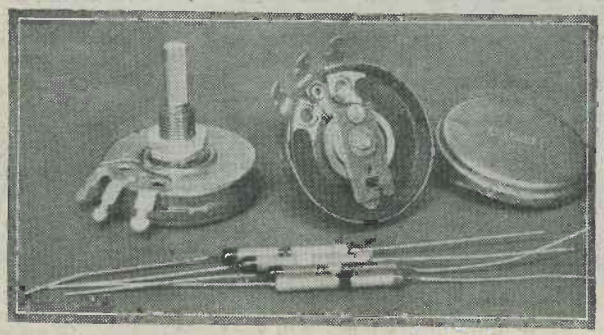
There are, however, some positions in which a resistance of adjustable value should be employed. A line resistance in the heating circuit of universal valves should be adjustable, so that different mains voltages can be catered for. Similarly, the bias resistance, at any rate for the output stage, might well be of adjustable type in order to take care of variations between different valves of the same type, or to permit valves of other types being used if required. In the case of bias resistances, adjustment should be made with a milliammeter



Some typical applications of resistances in a radio circuit.

connected in the anode circuit, and the resistance varied until the anode current is equal to the maker's rated figure. The bias resistance for a mains variable-mu valve must again be adjustable, because it is used to control the volume of sound. But whereas the adjustment of line resistors and the bias resistance of the output valve is made once and for all, that of the variable-mu bias is constantly being altered, so that a type is required which has a sliding contact and knob.

A few positions in a receiver may call for a resistance of fixed value, with a provision for taking a tapping at any desired point, thus making it possible to lead away the whole or any desired part of the voltage drop across the whole resistance. A device of this nature is termed a potentiometer or potential divider. In the theoretical diagram R_6 represents such a potentiometer, which in this case is connected across the gramophone pick-up. The pick-up develops an A.C. voltage due to its needle vibrating in the grooves of the record, and by adjusting the slider of the potentiometer any desired portion of this voltage can be tapped off for application to the low-frequency amplifier of the set, thus acting as a gramophone volume control.



A typical potentiometer and some composition resistances.

Choice of Resistances

There are three main points to be studied when choosing resistances. First the general suitability of the type for the work in hand, secondly the resistance value, and thirdly the current-carrying capacity. All three are intimately bound up with each other, but it will be more convenient to deal with them in the order given.

In the first place, the value of the resistance must be constant under all working conditions. From the nature of their operation, resistances dissipate a certain amount of electrical energy, and this is wasted in the form of heat, so that the temperature of the resistance will rise in service. Most materials sustain an alteration of their resistance when heated, and there are very few whose resistance is absolutely constant under all temperature conditions. The resistance materials employed by reputable makers, however, are so selected that, provided they are not *overheated* by the passage of excessive current, their resistance will not vary seriously under working conditions.

Next, if the resistance is to be used in a radio-frequency circuit, it is advisable that it should be non-inductive, and in this respect the popular composition resistors are entirely suitable, and, moreover, their high-frequency resistance is practically the same as their D.C. resistance.

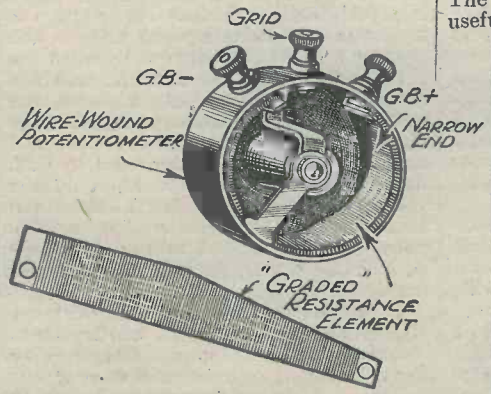
When it comes to variable resistances and potentiometers, the important point is to see that the sliding arm makes good contact with the fixed surface, and that the contact surfaces will not rapidly deteriorate due to wear. Unless the sliding contact is good, and smooth-acting, noise will certainly develop while adjustments are being made, and often will persist. It is sometimes desirable that a variable resistance or potentiometer be so designed that the variation of resistance for a given movement of the arm at one end of the scale is much greater than at the other end, and for this purpose a "graded" resistance should be used. These are often desirable for volume controls, because in most cases all the "control" takes place during a limited portion of the resistance range.

Coming to the discussion of the correct value of each resistance in the case of voltage-dropping resistances, the current to be passed will be known beforehand, as will also the number of volts to be dropped. The correct resistance will therefore be found by dividing the volts to be dropped by the current in amperes or, putting it another way, by multiplying the volts to be dropped by 1,000 and dividing by the current in milliamps. A very simple rule to remember is that a resistance of 1,000 ohms will give a voltage drop of 1 volt for every milliamp passing.

Simpler still is the following table which shows the correct resistance for a drop of 10 volts at various currents between 1 and 10 milliamps. For 20 volts drop multiply the resistance by 2, for 50 volts drop by 5, and so on.

RESISTANCE FOR 10 VOLTS DROP.

Current in mA.	*Resistance in Ohms.*
1	10,000
2	5,000
3	3,333
4	2,500
5	2,000
6	1,666
7	1,430
8	1,250
9	1,111
10	1,000



Showing the construction of a graded potentiometer.

Of course, you will not be able to obtain exact values for such resistances as 1,666 ohms, and must make do with the nearest standard size. They are usually obtainable in steps of 50 ohms between 100 and 500 ohms, in 500-ohm steps between 500 and 5,000 ohms, in 1,000-ohm steps up to 10,000 ohms, then in 2,500-ohm steps to 20,000 and afterwards in steps of 5,000 or 10,000.

In selecting decoupling resistances, make them as large as you can, providing the voltage drop, as calculated above, is not excessive. Load resistances for resistance-capacity coupled L.F. valves should in general be three times the value of the valve impedance, while the grid leak in the same coupling circuit may generally be about twelve times the value of the anode impedance of the previous valve.

Finally, we must consider the current-carrying capacity of the resistance. It has been explained that the power wasted in a resistance takes the form of heat, which causes the temperature of the resistor to rise. For the sake of standardisation, resistances are now rated to dissipate a given number of watts; half-watt, one-watt, two-watt, and three-watt being the usual ratings for composition resistances, with still larger dissipations for wire-wound types.

Now the actual power absorbed by any circuit or portion of a circuit due to resistance can be expressed in watts by multiplying the resistance by the square of the current in amps. Thus, a resistance of 10,000 ohms passing 3 milliamps would dissipate 10,000 x .003 x .003 watts, or .09 watt, or if it passed 10 milliamps it would dissipate 10,000 x .01 x .01 = 1 watt. Knowing the resistance and the current, therefore, it is a simple matter to decide what wattage rating to employ. The above table will, however, be useful.

MAXIMUM PERMISSIBLE CURRENTS FOR ONE-WATT RESISTANCES.

Resistance.	*Milliamps.*
100	100
250	60
500	40
1,000	30
1,500	25
2,500	20
4,000	15
10,000	10
15,000	8
20,000	7
25,000	6
40,000	5
50,000	4
100,000	3
250,000	2

IMPRESSIONS ON THE WAX

By T. Onearm

THIS month there is an impressive "cavalcade" of Jubilee Memories on "His Master's Voice" records. In the "Cavalcade of Famous Artists," *H.M.V. DB*2454-*DB*2455, such famous names as Paderewski, McCormack, Melba, Caruso, Kreisler, Cortot and Elgar make their appearance. This is a record well worth hearing. "Jubilee Music Hall Parade," *H.M.V. C*2739 and *C*2740, and "Jubilee Dance Memories," *H.M.V.* C2738, show how tastes have changed in the music-hall and ballroom. These records contain such favourites as "I do like to be beside the Seaside," "Pack up your troubles," "Ours is a nice 'ouse, ours is," "A wee Deoch and Doris" (sung by Sir Harry Lauder) and "Sally" (sung by Gracie Fields). Dance tunes include "Charmaine," "Broadway Melody," "Stormy Weather," and "Let's have a Jubilee."

The Light Symphony Orchestra play "Homage March," a fine new composition by Haydn Wood, which ends with the National Anthem, on *H.M.V. C*2734 and, finally, there is a most impressive record of Elgar's "Coronation March," composed for the Coronation of His Majesty the King, and German's "Coronation March and Hymn," which was performed in Westminster Abbey during the Coronation Service. These two records are exceedingly well played by the London Philharmonic Orchestra, conducted by Sir Landon Ronald, their numbers being *H.M.V. DB*2437 and *DB*2438 respectively.

Rubinstein's Superb Performance

THIS is perhaps one of the best records issued by H.M.V. in this month's list. It is a revelation of the truly grand style of pianoforte playing. Since Busoni first astonished musicians with his masterly pianoforte arrangements of Bach's Organ Toccatas, Preludes and Fugues, most programmes by the greatest performers contain one of these monumental works. Rubinstein obtains a sonority from his instrument which is almost unbelievable and, in spite of tremendous difficulties which it contains, preserves a complete control which is truly great. Everyone should possess this "Toccata in C Major" (Bach-Busoni) on *H.M.V. DB*2421-2.

Following on the issue of the Mozart and Schumann Sonatas, played by Yehudi and his fourteen-year-old sister, Hephzibah Menuhin, H.M.V. have done well in issuing Beethoven's greatest violin and piano sonata "The Kreutzer," played in a most musicianly manner by this perfect partnership on *H.M.V. DB*2409-12.

Columbia Records

THOSE inimitable cads, the Western Brothers, have done it again! This time they can be heard in their new "Old School Tie" songs, "We're Frightfully B.B.C." and "Keeping up the old Traditions," on *Columbia DX*685. This record is a clever example of humour and daring allusion to celebrities so prevalent in their other records, and there is no question that it will be very popular.

Hardly a week goes by without some of Percy Fletcher's music being heard in the radio programmes. His tunes, and his reputation as a theatrical conductor, are household words. Of the wealth of music which he wrote before his death in 1933, the "Vanity Fair" is perhaps the most popular. Its light-hearted strains could have had no finer interpreters than the famous B.B.C. Military Band which plays its merry tunes on a Columbia record, just issued.

In playing "For Love Alone" for his new Columbia disc, Albert Sandler pays a handsome tribute to Lance Fairfax, the singer who made it famous, and whose record of it was issued just recently. "Portrait of a Toy Soldier" is the coupling and the number of the record is *Columbia DB*1532.

An Outstanding Record

SUBTERRANEAN sounds of supernatural voices; appearance of the spirits of darkness, followed by that of Satan himself—Glorification of Satan and celebration of the Black Mass—the Sabbath revels—at the height of the orgies the bell of the village church sounding in the distance disperses the spirits of darkness—Daybreak. These words preface Moussorgsky's original composition. With so weird a programme for inspiration a brilliant composition must inevitably result. Rimsky-Korsakov, who completed this work, carried out the composer's intentions. The symphonic character of the work leaves little to the imagination. The isolation of the rugged mountain with the wind beating against the rocks is pictured by the violins, the woodwind adding a gruesome howling. Gruff voices from the interior of caves (performed by the brass) intermingle with the external atmospheric sounds. The chanting of a pagan hymn with responses of raucous character is terrifying in its eeriness. The composition is a sound picture of an engrossing subject which leaves no loopholes for the slightest misunderstanding. This record, the number of which is *Columbia LX*384, is played by the Colonne Symphony Orchestra of Paris, and the exceptional quality of the orchestral recording emphasises the magnificent interpretation. It is one of the finest examples of descriptive music in the recorded repertoire of the concert hall. I can specially recommend this outstanding record.

Decca-Polydor Records

I ANTICIPATE that the most popular Polydor issues in this month's list, from a general standpoint, will be Schlusnus and Sittard records. In the first place, Schlusnus is singing, in outstanding form, two famous Hugo Wolf songs, and, secondly, organ records are becoming increasingly popular—at least, organ records of such quality. Schlusnus, on *Decca-Polydor DE*7032 sings "The Drummer" and "Biterolf," and Alfred Sittard, on the organ, plays Bach's "Dorian Toccata" on *Decca-Polydor PO*5118. Two really great performances.

Another interesting Decca-Polydor publication is by The Lamoureux Orchestra of Paris—three records, *Decca-Polydor CA*8199-8201—"Roussel's Symphony in G Minor." This symphony needs getting used to. It is an example of the new music of our own time.

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.

Quee-Quee (Johannesburg). We cannot give you the information from the details you supply. We would suggest you communicate with the makers of the instrument, giving them some indication as to the particular model as they have made several different types.

R. E. (Harpenden). We would suggest that you build the Progressive Experimenter Series. This commenced in PRACTICAL WIRELESS dated October 21st, 1933, and will fill your requirements exactly.

A. J. D. (Hereford). There is no particular receiver incorporated in the device you mention. Any one-valve set may be built in the form indicated in the article.

D. T. (Milverton). The reference was probably a Readers' Wrinkle, and was published in our issue dated August 19th, 1933.

A. V. R. (Handsworth). So far as we are aware it is not possible to obtain spare parts for metal rectifiers. We would recommend you to communicate with the Westinghouse Company direct.

A. H. (Longside). In view of your remarks we can only assume that one component is defective. The only method of tracing this is to obtain a good meter and take accurate measurements in each stage.

E. H. (Brierley Hill). The address of the firm in question is Bennett Television Co., Redhill.

S. G. B. (Ballintra). We have published no recent portables of the "suit-case" type. Our last portable utilised a very small wooden cabinet and was known as the Atom—Blue print No. PW 36 published in our issue dated June 2nd, 1934.

C. G. L. (East Acton Lane). The S.G. H.F. unit, described in our issue dated February 4th, 1933, will no doubt be found most suitable for your purpose.

J. M. (W.1). Are you using the suppressor with a "mains aerial" device? This would account for the loss of signal strength. Failing this, the resistance of the chokes is higher than you anticipate and is reducing the voltage on the valves.

W. M. (Paisley). We would not recommend the use of the coil you mention in the Lucerne receiver. If you are not getting good results with this receiver we would recommend the addition of an H.F. stage, or the rebuilding of the entire apparatus to include such a stage.

G. F. M. (Sutton Coldfield). We regret that we have no blue prints of receivers which would fit into the box in question.

H. S. (Brighton). We would suggest a resistance in series with the grid lead of the L.F. valve. It would appear from your remarks that the valve has become soft. Alternatively, the grid-bias battery may have developed a very high resistance or even become partially disconnected and thus the grid is becoming isolated from the earth line.

G. E. S. (Hull). The lack of noise when aerial and earth are removed rather points to a faulty H.F. circuit, either the coils being faulty, or one of the associated leads broken.

F. D. (Romford). An eliminator will not deliver the required current. A larger accumulator with a separate full-rate (not trickle) charger would seem to be the best solution.

C. W. (Nelson). It is not practicable to carry out the construction of the device you refer to. The oxidation is not complete on your sample.

P. L. (Willesden Green). The circuit must be wrong in some respect. A faulty component or valve, or wrong wiring may be the cause, but it is impossible to state without further details. Instructions for fitting a pick-up were given in our issue dated Nov. 17th, 1934.

C. S. J. (Soham). The reaction circuit may be ignored and the reaction winding left unconnected. The loss of this feature will be noticed very seriously when trying to receive distant stations, but on locals with an S.G. stage it should not matter at all. For your purpose we would suggest S.G. pentode, diode, and two L.F.s with a push-pull output stage.

R. C. R. (Urmston). We do not advise the modification of commercial receivers. It should not be difficult, however, to fit bandpass tuning or other up-to-date devices, but we cannot give constructional details.

W. W. (N.W.8). We would suggest that you write to Messrs. Heayberd for details of a suitable unit for your purpose.

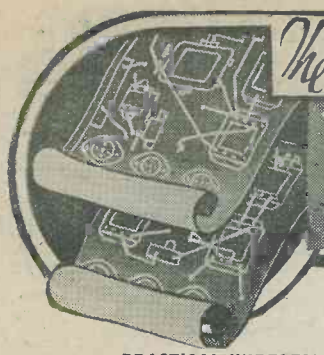
H. R. C. (Middlesbrough). We regret that we cannot trace the firm you mention. Any good repair service should be able to tackle the job.

H. C. (Finchley). If you cannot get a sound of any description it is obvious that there is something seriously wrong. Have you checked each stage with a meter? If you can let us have some further details we might be able to assist you.

L. J. R. (Swansea). We regret we have no blue print for the set in question. Your difficulty may be due to insufficient H.T. on the valve and you would therefore have to test your eliminator in case this is failing to deliver sufficient output.

S. P. (Pontyberem). What type of adaptor do you refer to? A short-wave adaptor could be used and would be joined to the aerial terminal in the usual way. It does not matter which pin is positive or which negative when testing a valve.

A. N. C. (Manchester). The Long-Range Express Three, P.W.2, employed commercial dual-range coils, but a more recent circuit is the Hall-Mark Cadet, P.W. 48. This employed an ordinary unscreened dual-range coil



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A.C. Leader	7.4.34	PW35C
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D.C. £5 Superhet Three	1.12.34	PW42
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Short-Wave Converter-Adapter	23.2.35	PW48A
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F. J. Camm's A.C. All-Wave Silver Souvenir Three	—	PW50
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AMATEUR WIRELESS AND WIRELESS MAGAZINE.

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Cossor Melody Maker with Lucerne Coils	—	AW423
P.W.H. Mascot with Lucerne Coils (D, RC, Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	—	AW424
Pentaquester (HF Pen, D., Pen)	14.4.34	AW431
£5 5s. Three: De-luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All Britain Three (HFPen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.1.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
Multi-Mag Three (D, 2 Trans)	—	WM288
Percy Harris Radiogram (HF, D, Trans)	*Aug.* '32	WM294
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Tyers Iron-core Three (SG, D, Pen)	*July* '33	WM330
C.-B Three (D, LF, Class B)	—	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
All-wave Three (D, 2LF)	*Jan.* '34	WM348
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans.)	*Mar.* '34	WM354
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Four-valvers: Blueprints, 1s. 6d. each.

65/-Four (SG, D, RC, Trans)	—	AW370
"A.W." Ideal Four (2SG, D, Pen)	16.9.33	AW402
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Crusaders' A.V.C. 4 (2 H.F., D, QP21)	18.8.34	AW445
(Pentode and Class-B Outputs for above: blueprints 6d. each)	25.8.34	AW445A
Quadradyne (2SG, D, Pen)	—	WM273
Calibrator (SG, D, RC, Trans)	*Oct.* '32	WM300
Table Quad (SG, D, RC, Traus)	—	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
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Five-valvers: Blueprints, 1s. 6d. each.

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1935 Super Five (Battery Superhet)	*Jan.* '35	WM379

Mains Operated

Two-valvers: Blueprints, 1s. each.

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Economy A.C. Two (D. Trans) A.C.	—	WM286

Three-valvers: Blueprints, 1s. each.

Home-lover's New All-electric Three (SG, D, Trans) A.C.	25.3.33	AW383
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A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
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D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July* '33	WM328
Simplicity A.C. Radiogram (SG, D, Pen) A.C.	*Oct.* '33	WM338
Six-guinea A.C./D.C. Three (HF Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF Pen, D, Pen) A.C.	*Nov.* '34	WM374

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

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

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

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1932 Super 60	—	WM269
Q.P.P. Super 60	*Apr.* '33	WM319
"W.M." Stenode	*Oct.* '34	WM373
Modern Super Senior	*Nov.* '34	WM375

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

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

PORTABLES.

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

General-purpose Portable (SG, D, RC., Trans)	—	AW351
Midget Class-B Portable (SG, D, LF, Class B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	*May* '32	WM282
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM363
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM367

SHORT-WAVERS. Battery Operated.

One-valvers: Blueprints, 1s. each.

S.W. One-valve	—	AW329
S.W. One-valve for America	—	AW429
Roma Short-waver	10.11.34	AW452

Two-valvers: Blueprints, 1s. each.

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

Three-valvers: Blueprints, 1s. each.

World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regea)	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

Mains Operated.

Two-valvers: Blueprints, 1s. each.

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

Three-valvers: Blueprints, 1s. each.

Emigrator (SG, D, Pen), A.C.	—	WM352

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

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

LETTERS FROM READERS

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

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

A "Quality" Two-Valver

SIR,—I notice you are receiving requests for various four or five stage receivers. May I make a request for a humble two-valve set to include certain points. There must be a large number of listeners living within a certain radius of broadcasting stations who receive ample volume on a two-valve set, and being content with programmes broadcast by the B.B.C., do not wish to "tour" the continent. Being one of those listeners, I should like a *quality* set to include,

(1) A form of Plus-1 unit as described in PRACTICAL AND AMATEUR WIRELESS, April 13, page 102.

(2) A wave-trap for cutting out either the Regional or National, the control knob to be on the panel, in place of the wave-change switch, which could be at the back of the set, and

(3) A plug for gramophone pick-up.

The on-off switch could be at side of the cabinet, so that the panel has only three knobs, *viz.*, wave-trap, tuning, and reaction.—C. KEARLEY (London, N.).

The Sixty-Shilling Three

SIR,—Just a note of appreciation of your very practical paper. I have had it for over a year now, and intend to continue taking it. I have a list of over a hundred broadcast stations received on the "Sixty-shilling Three," most of them, including KFI Los Angeles, on a 5-in. cone speaker. Many of the English components can be had out here now, but there is a surprising dearth of English valves, which makes some sets described in your paper hard to build, as the valve circuit of the American equivalent is difficult to find out. Components which I am sure would sell well out here are metal rectifiers, as there appears to be a big demand for these. Wishing your paper the best of success.—S. HAWES (Dunedin, New Zealand).

[*Manufacturers please note.*—ED.]

An Interesting S.W. Log

SIR,—I have been a reader of PRACTICAL AND AMATEUR WIRELESS for about one year and I do not think there is another wireless periodical to compare with it as regards the price, and of course the excellent material it contains. There is one suggestion I would like to make—I think the short-wave section could be extended a little further. For instance, one or two S.W. logs could be included. I would very much like to see a few more logs published to see where I stand in comparison with other S.W. enthusiasts, especially at this time of the year. I enclose a short log of S.W. stations recently received on a three-valve short-wave receiver (H.F.P.3). They came in at audible loud-speaker strength.

SHORT-WAVE LOG

RNE, Moscow. 12.45 p.m. 25 m.
CT1AA, Radio Lisbon (Portugal). 10.50 p.m. 31.25 m.
VK2ME, Sydney (Australia). 4.30 p.m. 31.28 m.
DJN, Zeesen (Germany). 1.10 p.m. 31.38 m.
WBZ, WBZA, Boston and Springfield (Mass.). 2.0 a.m. 31.35 m.
HJ4ABB, Colombia (Manizales), S. America 6.0 a.m. 41.9 m.
W8XK, KDKA, Pittsburgh (U.S.A.). 2.15 a.m. 48.86 m.
W3XAU, Philadelphia (U.S.A.). 2.30 a.m. 49.5 m.
W9XF, Chicago (Ill.). 7.0 a.m. 49.18 m.
DJZ, Zeesen (Germany). 11.15 p.m. 49.83 m.
COC, Cuba, Havana. 5.45 a.m. 49.92 m.

—G. E. ROBINSON (Penge).

A Super A.C. Set Wanted

SIR,—I have read with much interest the letters from Mr. West and other correspondents *re* "baseboard and panel" *versus* "chassis" type of receivers, and gladly give my vote for the former type.

A close study of the various wireless journals reveals the fact that the receivers described are of the chassis type and, with a few exceptions, for not more than three, or at most four, valves. No doubt there are others who, like myself, desire to build more powerful sets, but have not sufficient technical knowledge to design one for themselves, and would welcome the design for a receiver of the baseboard and panel type for five or more valves.

Most of the receivers given in present-day wireless journals are arranged with few valves, and are low-priced; but I am sure there must be many who, like other readers here and myself, would be only too glad to have a design for a super A.C. set that will bring in medium stations about 200-550 metres and the usual long-wave stations satisfactorily; and if easily arranged to receive the short-wave stations, so much the better, though this need not be a *sine qua non*. — HY. FITZGERALD REYNOLDS (Cardiff).

CUT THIS OUT EACH WEEK.

Do you know

—THAT modern short-wave superheterodynes utilise an intermediate-frequency of 465 kc/s (approximately 645 metres).
—THAT the intermediate-frequency generally used in broadcast superheterodynes is 110 kc/s (approximately 2,700 metres).
—THAT the frequency chosen in this stage has a great influence on the production of whistles.
—THAT the inductance, and not the D.C. resistance, of the primary of an L.F. transformer is the most important figure.
—THAT ordinary rocksalt or sal-ammoniac may be used to improve an earth connection in the dry weather.
—THAT loss of volume on long-distance stations at this time of the year may often be traced to dryness of the earth connection.
—THAT twin earth leads should not be employed in view of risk of setting up erratic effects.

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

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

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

MISS CAROL BUSH, organiser of the Ladies' Section of the Anglo-American Radio and Television Society, has appointed Miss Hilda Radish, of 330, Manchester Road, Cubitt Town, Poplar, E.14, as Central and East London Representative of the Ladies' Section.

Persons in that area who desire to join should send their names and addresses to Miss Radish, enclosing a stamp if they desire a reply.

Lady enthusiasts in other parts of Great Britain should send to Miss Eileen G. Harris, of "Frampton," Victoria Avenue, Porthcawl, Glam. (the British Rep. of the Ladies' Section).

The West Middlesex and East Buckinghamshire Branch is holding a picnic on June 2nd, commencing at 3 p.m. There will be no charges, and any reader of this paper who would like to attend may do so. Full particulars may be obtained from Mr. Leslie W. Orton, at "Kingsthorpe," Willowbank, Uxbridge.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

A VERY interesting evening was afforded members of the London Chapter of this organisation when Mr. H. G. Menage described the application of the Rochelle salt crystals to high-fidelity reproduction. Among the various applications were the Piezo-electric microphones, loud-speakers, pick-ups and earphones, all of which were demonstrated, and it was agreed that they were as near perfect as one could wish for. The meeting closed with some recordings of short-wave stations as received at the New York Chapter of the I.S.W.C., which included a very good one of GSA, and a personal message from the President of this chapter.—A. E. BEAR, secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

THE RADIO PHYSICAL AND TELEVISION SOCIETY

ON Friday, May 17th, a lecture was given at the above society's headquarters, on Optical Instruments, by Dr. C. G. Lemon. Dr. Lemon explained the theory of light and the laws of reflection and refraction. Several interesting pieces of apparatus were shown, among then being an instrument for measuring from a distance the amount of space between two points. Two very fine specimens of Iceland Spar were the subject of members' interest. After the lecture Dr. Lemon demonstrated his transmitting station (G2GL), which was operated on 40 m. and with a power of 60 watts. Although several calls were given, members taking it in turn to give calls, it was impossible to make any contacts owing to the very bad interference on the 40 m. band.

On Friday, May 31st, a lecture on 5-metre work will be given, with demonstrations of transmitters and receivers. Readers of PRACTICAL AND AMATEUR WIRELESS are cordially invited to our next meeting which will be held at 72a, North End Road, West Kensington.—M. E. ARNOLD, 12, Nassau Road, Barnes, S.W.13.

CATALOGUES RECEIVED

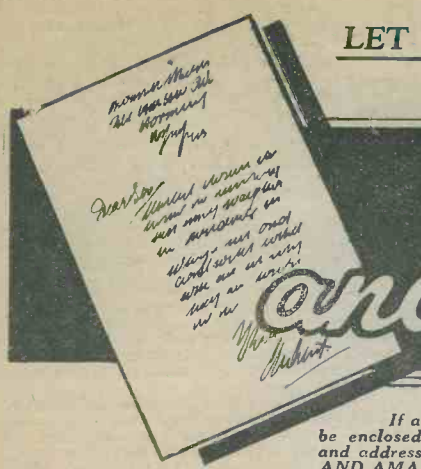
To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL AND AMATEUR WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.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

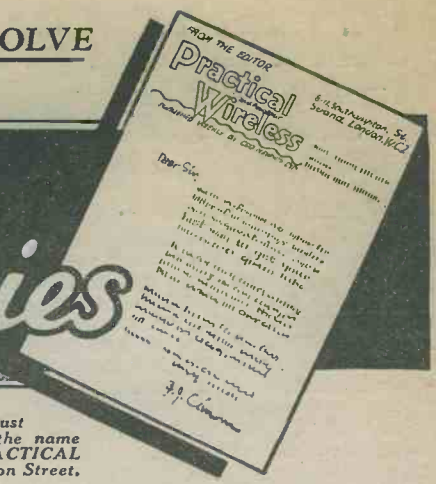
FERRANTI NEWS

WITH the opening of the new Radio Works at Moston, Messrs. Ferranti have issued an interesting brochure entitled "Masters of Power." Unlike many similar publications, this is an enormous affair, consisting of twenty-four pages measuring each 16ins. by 12ins. It is most attractively printed in several colours and gives some interesting details of the new Moston works, together with illustrations and notes of the original Ferranti productions dating back to 1882, when the company was founded by the late S. Z. de Ferranti, D.Sc., F.R.S. Facts concerning the new Moston factory are tabulated, and large photographs of various sections of the works, in black and white and in various self-tones, make up a most interesting souvenir, as well as provide some indication of the work which is involved in the manufacture of modern radio parts. The 1935 receivers are well illustrated, and notes on the various sections of the Ferranti business are given by the heads of those sections.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

Queries and Enquiries





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

SPECIAL NOTE

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

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

Please note also, that queries must be limited to two per reader, and all sketches and drawings which are sent to us should bear the name and address of the sender.

Loud-speaker Problems

"Do all M.C. speakers require D.C. current to excite the field? Approximately what is the consumption of the average speaker?"—W. J. F. W. (Wembley).

The term moving-coil speaker can apply to permanent-magnet models as well as to energised models, and it is only in the magnet system that the differences occur; the actual movement of the cone is carried out by the movement of a small coil—hence the name. A direct current is essential for magnetising those of the energised type, but A.C. speakers are obtainable in which the necessary transformer and rectifier is included in the cabinet or on the actual chassis. The consumption varies according to the type. Between 4 and 10 watts is the usual rating, the sensitivity naturally being the greater with the higher rating. The transformer feeding the speech coil must be chosen to match output valves and speech coil, and the makers' instructions should be followed in this respect.

Amplifier Output

"With regard to the Q.P.P. amplifier described on Blueprint A.W. 376, I should be glad to know the output of which this amplifier is capable."—F. W. (India).

The actual output will, of course, depend upon the valves which are used, and whether or not they are fully loaded. With the majority of the valves specified in the constructional article, the rated output is in the neighbourhood of 1 watt. If larger types of valve are used the output may be increased up to 2 watts.

Amateur Call Signs

"Can you please tell me if such a thing as a complete list of amateur short-wave stations, together with names and addresses, is obtainable? If so, where from and at what price?"—H. E. J. (Birmingham).

The Radio Amateurs' Call Book will no doubt prove of greatest use to you. This is obtainable from F. L. Postlethwaite, 41, Kinfauns Road, Goodmayes, Ilford, Essex, and the price is 6s. post free.

Poor Long-wave Results

"I recently built a 4-valve S.G. receiver which functions perfectly on the medium waveband, bringing in 30-40 stations. But I am unable to get any more than 1 station (Droitwich) on the long waveband and even this is weak. I would be very pleased if you could tell me how to rectify this."—D. W. (York).

As the receiver functions well on medium waves it would appear that the circuit as such is in order. The only change when going over to long waves is in the tuning coils, and we would therefore suspect the wavechange switch or switches, or the loading coil sections on each tuning unit. Examine these points carefully. If you are using ganged tuning circuits there is a possibility that the ganging does not hold over both ranges and thus some external trimmer may be necessary for use on long waves.

Using an Extra Speaker

"I have an all-electric broadcast receiver with a socket for extra speaker. I want to know if I can plug the output of a short-wave receiver into these extra speaker sockets so as to be able to utilise the speaker of my broadcast receiver for stations that are too strong for 'phones on my short waver."—P. F. P. (Paignton).

You cannot adopt the procedure you mention. Firstly, the extra speaker sockets are joined to the output of your broadcast receiver and thus the speaker may be in series with the extra sockets or in parallel—according to the particular circuit which is employed. We would not recommend an alteration of the broadcast circuit so as to enable you to carry out your scheme, but would suggest that you obtain a separate speaker.

Insulator Troubles

"I have a short-wave three on which I get good reception of Daventry, Germany, and Paris up to about 9 p.m. (our time), but then it goes off. A very heavy dew falls here nightly when the air is still and I have formed the theory that the weakening of the signals is caused by the insulators outside getting wet. Can I cure this? I should also like to cure noisy reaction—it starts with a plop and is not smooth."—J. M. G. (S. Rhodesia).

The weakening of signals may be due to natural phenomena and not to the wetting of the insulators. However, you could check this by utilising good quality insulators—preferably of the glass or steatite type with long leakage surface, and in addition smearing them with some grease or other moisture-resisting medium. This would enable you to ascertain whether or not the insulators were responsible. The reaction effects may probably be cured by using a potentiometer across the L.T. supply and returning the grid leak to the arm of the control so that the best working point may be found. Care is also necessary regarding the choice of the detector valve, H.T., choke, etc.

Medium-wave Breakthrough

"I have recently built two straight three receivers employing different coils with different layout, but on testing same I was surprised to hear the Midland Regional in the background on long waves. I checked the coils time after time, also shifting the wiring about to no effect. Would you be so kind as to inform me what is wrong?"—H. T. T. (Wolverhampton).

There is nothing actually wrong with your circuits, but the trouble is due to what is known as breakthrough, and is due to your proximity to the Midland transmitter. You can overcome the trouble quite easily by fitting a special choke in the aerial circuit, or by fitting a commercially-made Droitwich suppressor designed for the purpose. Your aerial and earth leads, with the primary of the coils in circuit, are being influenced by the powerful signal from the local transmitter, and thus the tuning has little effect, even when on long waves, but the fitting of the wave-trap or suppressor, or the alteration of the value of the aerial circuit by the special choke, will prevent the aerial circuit from responding unless the secondary is in tune.

The coupon on page 340 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. Send 1½d. stamp for NEW ILLUSTRATED CATALOGUE.

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 m.a. Full Wave Rectifiers; A.C./D.C. types, 20 volts .18 amp. Filaments; Screen Grid; Variable-mu Screen Grid.; H, HL, Power and Pentodes.

THE following types 5/6 each; 350v., 120 m.a. full-wave Rectifiers; 500v., 120 m.a. 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, 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, 1A6, 1C6, 1V, 12AS, 12Z3, 19, 30, 31, 32, 33, 34, 41, 49, 56, 57, 75, 76, 79, 82, 84, 6Z4, 85, 89.

LISSEN 3-gang Superhet Coils, with switching; listed 30/-, with circuit, 6/-.

12 TO 2,000 metres. Huge Purchase of All-Band 2 gang Coils from prominent British manufacturer. Fully Screened with switching for S.G. Det. type receivers, 4 Separate Bands, 12 to 2,000 metres. 12/6 with circuit.

SPECIAL Offer B.T.H. Moving Coil Speakers, matched pairs, specially manufactured for McMichael Supervox; 8in. diameter, 1,500 ohms-7,500 ohms (1,500 speaker as choke, 7,500 ohms speaker in parallel with H.T. supply); complete with special dual output transformer for pentode, 15/6 per pair; A.C. kit for above pair, 12/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C.154, 2,500 ohms, 12/6; D.C. 152 Magna, 2,500 ohms, 37/6; all complete with humbucking coils; 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.

A LARGE Selection of Pedestal table and radio-gram cabinets by best manufacturers at a fraction of original cost; send for list.

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. 3-5 amps., C.T., L.T., 30/-; 300 v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps., L.T., 27/6.

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

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.C. output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

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

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.

WHITELEY Boneham Energised M/c Speakers, 2,000 or 2,500 ohms, 8 inch diameter, 9/11. Please state which type transformer required.

COSSOR Permanent Magnet M/c speakers, large Darwin Cobalt Steel Magnet, 8 inch diameter, please state transformer required, 13/6.

(Continued at top of column three)

This Triode-Hexode is a new frequency-changer of very considerable possibilities. We have two types available, the X41 for A.C. Mains and the X31 for A.C. or D.C. Both are of real interest to every experimenter, and especially to Short Wave and Television enthusiasts, for reasons which we have described in some useful notes on the subject.

WRITE TO THE VALVE DEPARTMENT, MARCONIPHONE COMPANY LIMITED, 210 TOTTENHAM COURT RD., LONDON, W.1, MENTIONING THIS PAPER.

MARCONI VALVES

THE CHOICE OF THE EXPERTS

(Continued from foot of column one)

LISSEN 2-Gang Condensers, Uniknob Trimmer, Disc Drive, .0005 each section, 5/6.

SPECIAL Offer Western Electric Mains Transformers, input 200-250 volts, output 350-0-350 volts, 120 milliamps, screened primary, 4 volts 1-2 amps., 4 volts 2-3 amps., 4 volts 3-5 amps., 9/6; input 100-250 volts, 300-0-300 volts 60 milliamps, 4 volts 1-2 amps., 4 volts 2-3 amps., 6/6; input 200-250 volts, screened primary, output 500-0-500 volts 150 milliamps, 4 volts 3-5 amps., 4 volts 2-3 amps., 4 volts 2-3 amps, 4 volts 1 amp., 4 volts 1 amp., 19/6.

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., 50 v., 1/9; 8 mf., 500 v., 3/-.

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

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

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

SCREENED H.F. Chokes, by one of the largest manufacturers in the country, 1/6.

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

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

U.S.A. Electrolytic Condensers. 550v. peak working, standard tubular metal condenser, 4 mf., 8 mf., 12 mf., a real bargain, 1/9.

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/-.

RELIABLE Smoothing Condensers, 250v., working, 1mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 350v. working, 1 mf., 1/-; 2 mf., 1/6; 4 mf., 3/-.

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

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

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

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

PREMIER H.T.10 Transformer, rectified output 200 volts 100 milliamps, 4 volts 1 2 amps., 4 volts 3-5 amps., 10/-; or with Westinghouse rectifier, 19/6.

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, 6yds. Systoflex, 1, 1.5, 2 or 2.5 mm., 1yd. 7-way cable, 9ft. resincored solder, 6yds. push-back connecting wire.

PREMIER SUPPLY STORES

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

CLARION VALVES.—All brand new; battery types, 2-volt, HF.2, LF.2, LP.2, 1/9. Super power, PP.2, 2/6; screens and pentodes, 3/9; A.C. Mains, 4-volt, 1 amp., general purpose, 3/3; power, 4/-; screens and pentodes, 4/6; full wave rectifiers, 3/6; postage paid, cash with order, or C.O.D. over 10/-. Clarion Valves, Dept. 2, 885, Tyburn Road, Erdington, Birmingham.

MAINS transformers, 200-250 input, 4v-4amp, 4v-2amp, 350-0-350, 70 milliamps, limited quantity, 5/11, Telsen best quality heavy duty 4v-6amp, 350-0-350, 100 milliamps 7/6. Telsen mansbridge condensers, 250v. working, .01, .02, .05, .1, 3d. each, 2/- dozen; 1mfd., 4½d.; 2 mfd., 6d. Post, C.O.D. extra.—Economic Radio, 321, Argyle Street, Glasgow.

PEARL & PEARL,

190, Bishopsgate, London, E.C.2. All the following Bargains guaranteed new goods. Cash or C.O.D. Carriage Paid in British Isles.

SPECIAL OFFER. Burgoyne Receivers. 3-Valve Class B Models. Complete with Mullard valves; Exide H.T. and L.T. batteries. M/c speaker. Artistic cabinet of highly polished walnut. Chromium fittings. Brand new in original cartons; 1935 Model. List £6/10/0. Cash £3/18/6, or 14/- down and 10 monthly payments of 7/-.

ATLAS ELIMINATORS. Guaranteed 12 months. Model C.A.25 for A.C. mains. 5 tappings. Westinghouse rectifier. List 59/6. Yours for 7/- down; balance in 10 monthly payments of 5/3.

FREE. Our June bargain list "N"

All Mail Orders direct to

PEARL & PEARL,

190, Bishopsgate, London, E.C.2.

Telephone: Bishopsgate 1212.

HULBERT.

HULBERT for Quality Surplus Speakers.

ALL Speakers Listed Below are Brand New and Made by one of the Best Known British Makers of High Grade Moving Coil Speakers. Repeat orders coming in daily.

10/6 Only, original price, 30/-.—Energised, 8in. cone, 6,500 ohms field, for direct use on 200-240 volts D.C. mains; also 1,800, 2,000, 2,200 or 2,500 ohms field; price includes power, pentode, or universal transformer as required.

14/- Only, usual price 45/-.—As above, but with 10in. cone, a very powerful quality speaker capable of handling large outputs.

15/6 Only, usual price 35/-.—Permanent magnet model with cobalt steel magnet of high efficiency, 8in. cone, power, pentode, or universal transformer.

18/6 Only, usual price 39/6.—As above, but with 10in. cone, powerful quality speaker giving large output with given input.

19/6 Only, usual price 41/-.—Permanent magnet model with the new Alni magnet, high flux density and wide frequency response, 8in. cone, power, pentode or universal transformer.

24/- Only, usual price 70/-.—As above but with 10in. cone, ideal for use with quality receivers.

2/9 Only.—Brand new cabinets, suitable for any of above.

SECURE One of These Bargains Now. Repeat orders coming in Daily.

CASH With Order or C.o.d.—Hulbert, 6, Conduit St., W.1.

HULBERT for Surplus Speaker Bargains.

WOBURN Radio offer following Goods:—

ELECTRIC SOLDERING IRONS: 200/250v., copper bit, complete with flex and adaptor, 1/11, post 6d. Immediate delivery.

SHORT-WAVE CONDENSERS: Air-spaced, 0001, 00015, 00016, 0002, 00025, 2/-, with slow-motion dial, 3/-. Popular iron-cored canned coils, dual range, boxed with instructions, 2/6. Dubilier and Erie resistances, all values, 6d. Truwind wire-wound colour coded all values to 50,000 ohms, 3½d. Western Electric Microphones, 2/3. Transformer for same ratio, 100/1, 2/3. Rothermel Speakers, 7" cone, power and pentode transformer, new and boxed, listed 39/6, 17/6.

TRADE LIST NOW READY. Send stamp and trade letter heading.

WOBURN RADIO CO., 9, Sandland Street, W.C.1. Holborn 7289.

RADIO CLEARANCE, 280, High Holborn, W.C.1. Telephone: Holborn 4631.

RADIO CLEARANCE announce the issue of their Grand Jubilee Illustrated Bargain List containing hundreds of special Bargains. Release date, May 30th. Send 3d. to cover cost and postage.

RADIO CLEARANCE announce the purchase of a limited quantity of Dorchester 5 Valve Superhet Sets A.C. 200/250 Volts, Fluid Light Tuning A.V.C., employing Mullard F.C.4, S.P.4, S.P.4, PEN4VA and I.W.4, complete in beautiful Walnut Cabinet.

£7/19/6.

RADIO CLEARANCE announce a further purchase of Plessey 7 Valve A.C. Superhet Chassis, Mullard Valves, delayed A.V.C., suitable for use with Energised Moving Coil Speaker 2,500 ohms. Chassis complete with Valves less Speaker.

£7/10/0.

RADIO CLEARANCE. Palliard A.C. Gramophone Motors 200/250 volts, complete with Unit Plate, 12in. Turntable.

27/6.

RADIO CLEARANCE. Utility 3-Gang Midget Type Superhet Condenser with 110 k/c Section. Also 3-Gang Straight. Brand new, boxed.

Without Dial, 5/11. With Dial, 7/6.

RADIO CLEARANCE. H.T.8 Mains Transformers, fully shrouded, output 250 volts, 60 m.a. 4 volt 4 amp centre tapped.

6/- With Westinghouse Metal Rectifier, 14/6.

RADIO CLEARANCE.—280, High Holborn, W.C.1. Telephone: Holborn 4631.

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

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SILVER SOUVENIR.—Complete Specified Kit. No alternatives. 79/6 cash. Host of other bargains. Kits, Accessories, etc. Lowest prices always.—Write now for free lists, Melfo-Rad, Queen's Place, Hove. (Trade Supplied.)

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SPECIALISTS IN SHORT-WAVE AND QUALITY COMPONENTS AT LOWEST PRICES.

Our stock is much too large to itemise here: From a soldering tag to a superhet we can supply everything, and what is more you won't be "Caught"! Send 1½d. stamp for our latest **CATALOGUE**. No firm has larger stocks or is cheaper than

THE SQUARE DEALERS,

BIRMINGHAM RADIOMART,

19, John Bright Street, Birmingham.

EASY TERMS

Everything Radio supplied on the lowest terms. Send list of requirements for quotation by return of post. Prompt delivery. Car. Paid.

Revitalise your set with the new W.B. P.M. STENTORIAN SPEAKER

Senior P.M. Speaker. Cash Price £2.2.0 or 2/6 with order and 11 monthly payments of 4/-.

Standard P.M. Speaker. Cash Price £1.12.6 or 2/6 with order and 11 monthly payments of 3/-.

5/- Secures delivery. Atlas T 10/30 H.T. Eliminator and Trickle Charger combined. Cash price £3.9.6 or 5/- with order and 12 monthly payments of 5/11.

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STENTORIAN BABY	22/6	5 of 4/1

KIT SETS

We strongly recommend.

LISSEN SKYSCRAPER 3	60/-	5/6	11 of 5/6
LISSEN SKYSCRAPER 4	112/6	10/-	11 of 10/3
COSSOR MELODY MAKER 352 ..	119/-	10/10	11 of 10/10
COSSOR ALL ELECTRIC 357 ..	159/-]	14/7	11 of 14/7

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Unbeatable Value.

COSSOR 3-VALVE 350	112/6	10/- 11 of 10/4
MARCONI 3-VALVE 234	£7.19.6	14/7 11 of 14/7
G.E.C. BATTERY COMPACT 3 ..	117/6	10/9 11 of 10/9
FERRANTI LANCASTRIA.. ..	£12.12	23/- 11 of 23/-

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of merit and fine value.

EXIDE H.T. ACC. 120v.	60/-	5/- 9 of 5/8
ATLAS ELIMINATOR T. 10/30 ..	69/6	6/- 11 of 6/4
AVOMINOR METER	40/-	5/6 7 of 5/6
B.T.H. LATEST PICK-UP.. ..	40/-	4/5 9 of 4/5

Parts for any set. Any make of speaker.

New goods obtained for every order.

Send us a list of parts or valves you require or any speaker or set you may select and we will forward you a definite quotation. Ten years' advertiser in the Wireless Press. Thousands of satisfied customers.

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

SOUTHERN RADIO'S WIRELESS BARGAINS. Every Article Guaranteed New, Perfect and Sent Post Paid.

RECEIVERS. TELSEN RADIOGRAMS. Model 3550/R.G.A. Latest 1935 6 Valves, Superhet, A.C. This receiver embodies the very latest in Radio. Complete with 6 Valves, Mains Energised Speaker, contained in exquisite cabinet with GARRARD ELECTRIC RECORD CHANGER. In Original Sealed Cases, £18/10/0. (List 32 Guineas.)

TELSEN THREE-VALVE BATTERY SETS. Model S93. Complete with 3 Mazda Valves, in attractive bakelite cabinet, 30/-. (List, 75/-.)

TELSEN "AIRMARSHAL 3."—Three-valve Battery Sets. Complete with 3 Mazda Valves, Speaker. In attractive Walnut cabinet, 47/6. (List, 98/6.)

BURGOYNE CLASS "B" THREE-VALVE SETS. —Complete with 3 Mullard Valves, Exide Batteries, and Accumulator. Magnavox Moving Coil Speaker. In magnificent cabinet, finished in chromium, £3/9/6.

SPEAKERS. BLUE SPOT PERMANENT MAGNET SPEAKERS, WITH UNIVERSAL TRANSFORMERS TO SUIT ANY CIRCUIT.—1935 Series, 99 P.M., 24/6. 45 P.M., 20/-. Celestion P.P.M.W., 16/6. Celestion Soundex, 11/-. All in sealed Cartons.

ELIMINATORS. REGENTONE 1935 Series New and Boxed for A.C. Mains 200/250 Volts, TYPE W.5a Complete with Trickle Charger, 39/6. Type WIa (less Trickle Charger), to carry 30 Milliamps, 33/-. WIC (less Trickle Charger), 30/-.

CONDENSERS. PLESSY 4-Gang Superhet Condensers, .0005 Fully Screened, with Trimmers, 7/3. LOTUS 0.0005 Condensers, Fully Screened, with Trimmers. Complete with Escutcheons, Dials, Knobs. 3-Gang, 11/-. 2-Gang, 7/3.

COILS.—Igranic Superhet 4-Coil set (1 osc. 2 I.F. with pig tails and 1 L.F. plain), 9/- per set (List 50/-). Varley Constant Square Peak Coils B.P.5, with all accessories, 2/3. Telsen Twin-matched Coils: Type W.287, screened, with switch, 7/9 (List 17/-). Triple-matched Screened Type W.288, with switch, 10/9. Telsen Twin Coil Unit, Type W.478, 12/6. Type W.476, 17/6. All Brand New and Boxed.

MISCELLANEOUS.—Bifo Static Cut-outs, definitely eliminate all interference, 2/-. Lewcos Spaghetti Resistances, all capacities, new and boxed, 1/6 per dozen assorted. Telsen Binocular H.F. Chokes, 2/-. Telsen ACE L.F. Transformers, 3-1 and 5-1, 2/9.

STOCKTAKING BARGAIN PARCELS.—After our Recent Stocktaking, we gathered at our Head Office a large number of odd lines from our Various Branches. We are offering these in parcel lots as UNDER:—

5/- PARCEL Contains Components to the value of at least 20/-. Including Condensers, Coils, wire, resistances, etc.; 10 different Telsen Radio Circuits included with each Parcel.

10/- PARCEL contains Components to the value of at least 45/-. Includes Transformers, Variable Condensers, etc., etc. Also Circuits as above.

20/- PARCEL. This is the "Small Traders" Parcel and contains a marvellous selection of components valued at 85/-. We have supplied this parcel to hundreds of dealers for re-sale at a profit. Every article contained in these parcels is up to date, new and boxed.

THOUSANDS OF BARGAINS AT OUR VARIOUS BRANCHES.—All Goods guaranteed and sent post paid. Branches at 46, Lisle Street, W.C.2; 271-275, High Road, Willesden Green, N.W.10. All Mail Orders to: 323, Euston Road, London, N.W.1.

SOUTHERN RADIO, 323, EUSTON ROAD, LONDON, N.W.1. Near Warren Street Tube. 'Phone: Museum 6324.

OLYMPIC Combined H.T. (S.G., Det., L. F., Power) and ½a. charger: Special price,

30/- UNIQUE spangled finish, humfree, year's guarantee. Frost Radio, 21, Red Lion Street, E.C.1.

HOMECONSTRUCTOR SERVICE.—Sets modernised, repaired. Diagrams, H.F. units, converters. Radio Service Bureau, 9a, Shepherd's Bush Road, London, W.6.

LISSEN Battery valve bargains. L.2 power detector, 2/10. P.T.225, 5-pin pentode 5/9. Service Radio, 72, Bruce Grove, Tottenham.

BANKRUPT Bargains. List free. 3v kits 15/-. Transformers 1/6, Dual coils 1/6. Telsen 0005 mica 1/3, airspaced 1/9. Screened coils 3/6. Binoc HFC 1/8. Lotus PM. MC speakers 12/6. Celestion Soundex 10/6. Regentone 30 m.a. eliminators A.C. 30/-, with Trickle charger 20ma. 37/6. Telsen 28ma. A.C. 25/-. Lampex A.C. 4v. mains sets £4/10/0. Large stock receivers and components. Quotes. Butlin, 143b, Preston Road, Brighton.

SPEAKER REPAIRS.—New Cones/coils fitted popular makes, 5/-. Mains Transformers, chokes, etc., rewound or made to order.—WEEDON P.L.R. Co., Dept. C., 80, Lonsdale Avenue, London, E.6. Maryland 1782.

FREE ADVICE BUREAU

COUPON

This coupon is available until June 8, 1935, and must be attached to all letters containing queries.

PRACTICAL AND AMATEUR WIRELESS, 1/6/35.

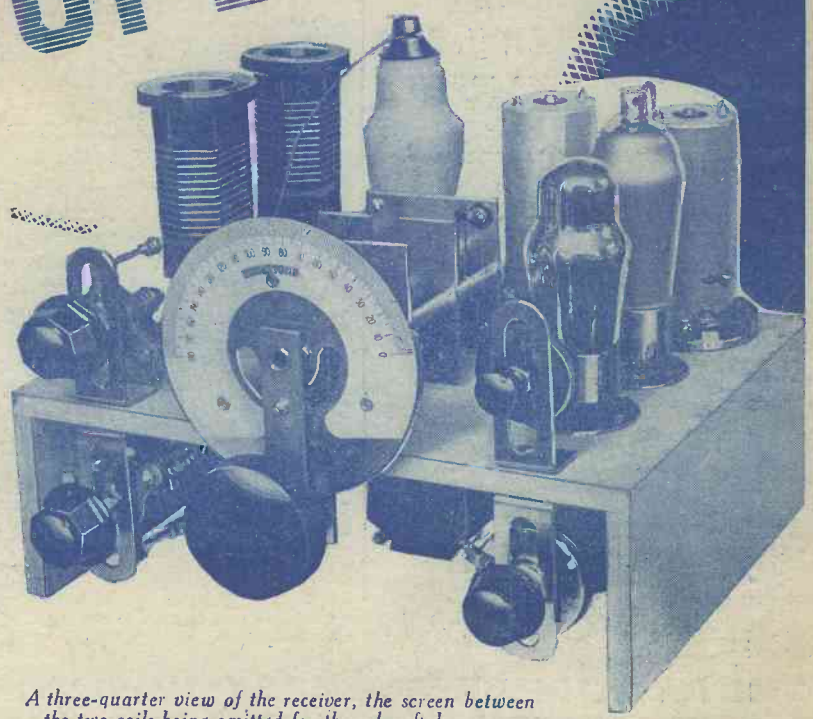
ADVERTISEMENT INDEX

AMERICA
AUSTRALIA
INDIA

F. J. CAMM'S 3 VALVE SHORT-WAVE SUPERHET

THOUSANDS of listeners in this country are obtaining hours of enjoyment from short-wave reception with receivers employing a simple detector stage. Reports received from all parts of the country show that it is possible with a carefully-arranged detector circuit to pick up stations in lands as far away as America, Australia and India, and it is really surprising with what strength these transmissions are heard.

Now comes F. J. CAMM'S latest Short-wave Superhet—the last word in short-wave receivers. Simple to construct, easy to operate, this highly-efficient receiver is fully described for you, with photographs and diagrams, in this month's PRACTICAL TELEVISION and Short-wave Review.



A three-quarter view of the receiver, the screen between the two coils being omitted for the sake of clearness.

Other Splendid Contents in this number include :

- Making a Kerr Cell Amplifier
- Band Spread on the Short Waves
- Receiving the 60-line French Television Broadcasts
- Television Made Easy
- The Beginner on Short Waves
- New Short-wave Components, etc., etc.

THE JUNE

PRACTICAL TELEVISION AND SHORT-WAVE REVIEW

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NEW SERIES OF MIDGET POCKET PORTABLES (SEE INSIDE)

Practical and Amateur Wireless

AND AMATEUR TELEVISION

3d. EVERY WEDNESDAY

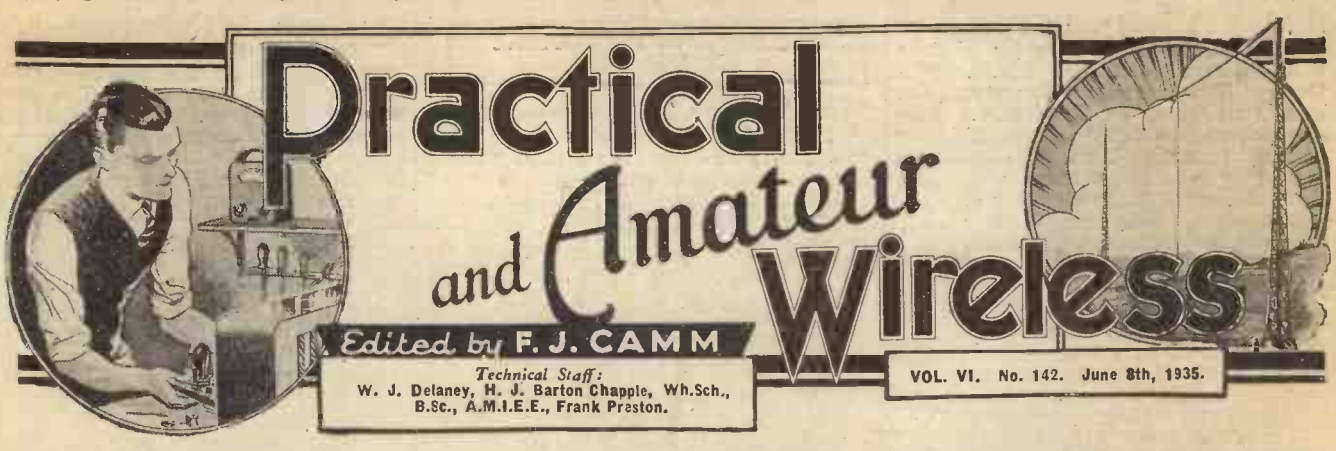
Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 6. No. 149. June 8th, 1935.

Building The CAMEO MIDGET 3-Valve PORTABLE

THERMION'S NOTES ARE ON PAGE 355!



ROUND *the* WORLD *of* WIRELESS

Our Blue-print Service

WILL readers please note, when ordering blue-prints from our Blue-print Department (see page 336 of last week's issue) that the column of figures on the right hand of each column refers to the *Blue-print Number* and NOT to the number of the issue in which the construction of the set was described? For example, AW417 means *Amateur Wireless Blue-print, No.* 417. The *dates of the issues* in which the construction was dealt with are given in the first column of figures; thus, AW417 was described in AMATEUR WIRELESS, dated January 20th, 1934. Will readers also note that a dash (—) in the first column of figures indicates that, *whilst the blue-print may be obtained*, the issue is out of print? All of the blue-prints shown in the second column of figures are hence available.

Index and Binding Case for Vol. 5

INDEXES for Vol. 5 of PRACTICAL AND AMATEUR WIRELESS are now ready, price 7d. each, post free. Complete with Binding Case, the price is 3s. 6d. post free. Whether you have your issues bound or not, an index forms a valuable guide to the contents of our journal and will save a great deal of time in searching for a particular article, or in consulting all of the information we have given on a particular subject. All of the indexes from Vol. 1 to Vol. 5 are available.

How Romania is Hampered

OWING to the lack of suitable landlines for the transmission of speech and music, so far the Bucarest studio has not been able to relay broadcasts from different parts of the country. Work has now been started on the laying of pupinised cables to connect the capital with such important centres as Jassy, Braila, Timisoara, Craiova, Cluj and Constanza. At Cluj a studio is being installed in an available theatre.

Increased Power for Sottens

THE Sottens broadcasting station will close down during September to permit its plant to be overhauled. Reconstruction is also to take place to make it a 100-kilowatter.

Television in Spain

EXPERIMENTS in television transmission are shortly to be carried out through the Madrid EAJ7 station jointly by the Western Electric Company and Telefunken.

North America Hears Vienna

AN interesting broadcast was recently carried out by the Vienna broadcasting station at the request of the Columbia Broadcasting System. During a trip made by one of the Danube pleasure steamers, a running commentary and transmission of orchestral and choral music was relayed en route to Wurrnstein by short waves; from this point the broadcast was conveyed by landline and submarine cable to London, thence to Rugby, from which point it was transmitted to the United States and fed to the stations of the Columbia Network.

ON OTHER PAGES

Salzburg Music Festival

A PROGRAMME of fifteen gala performances, including six operas, five orchestral concerts, and two concerts relayed from the Cathedral, has been arranged for this season. Such works as "Don Juan," "Cosi Fan Tutte," "The Marriage of Figaro," "Falstaff" and "Fidelio" will be conducted respectively by Bruno Walter, Dr. Weingartner, and Toscanini on August 1st, 5th, 13th, 26th and 31st. It is expected that the performances will be relayed throughout Europe.

Radio in British India

THE proposed 20-kilowatt station which is to be erected at Delhi will work on 340.1 metres (882 kc/s); the call letters are VUD. Allahabad (VUA) is also to be given a transmitter for which the wavelength of 280.1 metres (1,071 kc/s) has been reserved.

Not Television!

ALTHOUGH experiments are to be shortly carried out by the Eiffel Tower on 7 metres, the peculiar transmissions now heard on the long-wave channel (1,389 metres) are not, as supposed, a radiovision broadcast, but radio-telephotography in connection with meteorological reports. These are given between midday and 12.30 p.m. daily, and are preceded by ordinary morse transmissions.

France's Army of Crystal Set Fans

NOTWITHSTANDING the number of broadcasting stations already erected in France, the country only possesses 1,882,607 registered licence holders; of these, 58,750 are still equipped with primitive crystal sets! *France* not Scotland!

High-power Station for Reval

FOLLOWING the passing of a Bill by which the Estonian authorities have been empowered to nationalise the broadcasting system, the Government is planning the construction of a 40-kilowatt transmitter to be installed in the neighbourhood of the capital.

More German Relays

MOBILE transmitters in Germany are testing sites for two additional relay stations. It is expected that one will be built at Wurzburg to work on the Munich channel, and another somewhere in Pomerania, to be connected to the Hamburg network. When the constructional programme has been carried out Germany will possess, with the exception of the U.S.S.R., more stations than any other European State.

Calling Firemen by Radio

AT Jutphaas, a little village near Utrecht (Holland), the antique fire bell has been replaced by a more modern radio call. If a street fire alarm is operated, a small transmitter at headquarters automatically sends out a morse signal which is picked up by receivers in the homes of the volunteer fire brigade, and in this manner the members are promptly summoned for duty when an outbreak occurs.

ROUND the WORLD of WIRELESS (Continued)

Band of H.M. Signal Corps

A RELAY will be taken for Western listeners of the Band of H.M. Royal Corps of Signals from the Bandstand, Sea Front, Paignton, on June 15th. This corps is an offshoot of the Royal Engineers and was formed in 1920. The band was formed by the present Director of Music, R. R. Ricketts, who is a brother of Lieutenant F. J. Ricketts, Director of Music, Royal Marines, Plymouth, well known to Western listeners.

Variety from Newcastle

A STUDIO variety show will be broadcast from Newcastle on June 10th—the first that has been presented for several years. All the artists taking part live in the North-east area and a musical background will be provided by Joseph Q. Atkinson's Newcastle Orchestra.

Fun Fair Broadcast

A TOUR of the fun fair at Coney Beach, Porthcawl, will be made on Whit Monday for Western listeners, when Francis Worsley, accompanied by one of the showmen, "Doctor" Ford, will tell listeners about the side-shows. A visit will be paid to the smallest artists in the world (which is the official billing of the flea circus).

"The Other Side of the Medal"

UNDER this title a number of people will come to the microphone to tell of their work in serving the public on the holiday. This programme will be given for Western listeners on Whit Monday.

Looe Fisherman's Choir

THIS well-known choir will broadcast for Western listeners on June 8th, this time not from a concert platform but from the "Shade" at Looe, which is a little shelter on the sea front. This is the unofficial rehearsal room of the choir, for the nature of their calling makes it impossible for the men to meet at regular times for practice. We shall not only hear them sing, we shall also hear them discuss the affairs of men, and particularly the weather.

Morecambe Variety Programme

AN excerpt from the variety bill is to be broadcast from the Winter Gardens, Morecambe, on June 6th, when the artists will include the Two Leslies, V. M. Garston (xylophonist), Captain Ricks (Australian ventriloquist), and Lester and Granston (comedians).

"The Microphone at Play"

ON Whit Monday (June 10th) "The Microphone at Play," which had its first excursion to Oxford for Eights Week, will be at Evesham for the annual regatta on the Avon, an event which attracts crews, pairs, and single scullers from all over the Midlands. Owen Reed will devise and produce the programme. The chief feature will be a radio impression of the Senior Fours final for the Bell Tower Trophy. This trophy is a beautiful silver model of the Evesham Bell Tower. It was given to the Club by the citizens, who raised £400 in 1921 to mark Evesham's unbeaten record at regattas the previous year. Liverpool Victoria are the holders.

INTERESTING and TOPICAL PARAGRAPHS

"Five Winners"

ANONA WINN returns to the microphone on June 7th with her "Five Winners." Anona was heard on two occasions during the Jubilee celebrations, in "Empire Variety" and "From the Royal Box." She was also in the Jubilee programme broadcast from the New Corn Exchange, Brighton. This artist has received so many letters since the previous broadcast of the "Winners," in which she included "One Fine Day," that she has been encouraged to include in future programmes some more "straight" songs.

TAUBER AND HIS RADIOGRAM

Richard Tauber, the famous Parlophone artist, listening to one of his latest records on his radio-gramophone—the "His Master's Voice" Model 580—at his hotel recently.

Memories of Melba

"MELBA: a Musical Biography," devised by Paul Ellingham, will stir many pleasant memories among older listeners on June 7th. This programme, which is composed of old-time gramophone records and connecting narrative, will, as the title suggests, deal with Melba's career. Many of her great successes will live again in sound.

Whitsuntide Cruise Broadcast

A COMPREHENSIVE sound picture of the departure of a liner from Liverpool on a Whitsuntide "cruise" may be heard by Northern listeners on June 8th. Passengers and members of the crew will be interviewed in front of the microphone, and more microphones will be installed on the quayside to pick up the sounds as the vessel moves down the Mersey. These will be connected with the electrical recording apparatus in London, and by the time the electrical recording is broadcast the vessel will be out at sea.

"The Prince of Obolo"

A SPECIAL adaptation of Roger Dataller's play, "The Prince of Obolo," will be broadcast to Northern listeners from Leeds on June 8th. This Yorkshire comedy tells the story of a negro who settles in a mining community and who puzzles the pit folk by assuming the airs and graces of an African prince. The play will be produced by Felix Felton, and is to be followed by a recital by the Welsh Apollo Glee Singers—exiles like the Prince of Obolo—a group of Welsh miners who migrated to Yorkshire after the coal strike of 1921.

B.B.C. Midland Orchestra

JOHAN HOCK, conductor of Birmingham Philharmonic String Orchestra, founder of the Catterall Quartet and 'cellist, is to be the guest-conductor of the B.B.C. Midland Orchestra at its Friday afternoon Symphony Concert on June 14th. Respighi's "Gli Uccelli" is to be played, and the London Symphony of Haydn.

"Wings Over Clyde"

THIS is the title of a programme of impressions of aviation in Scotland, arranged in co-operation with the Scottish Flying Club, to be broadcast on June 8th. The programme aims at presenting a review of flying activities in Scotland with the Scottish Flying Club as a focal point. Listeners will hear the sound of aeroplanes taking off and landing, interviews with pilots (including, if possible, one with the pilot of the Hebrides hospital 'plane), the final words of advice given by the chief instructor to a pilot making his first solo flight, and, what is probably even more interesting, that pilot's remarks after he has brought his 'plane safely to ground.

SOLVE THIS!

PROBLEM No. 142.

Robertson designed a screen-grid three, and decided to build it on a metallised-wooden chassis. To facilitate construction he dismantled the chassis and worked on the flat baseboard, mounting certain components also on the side runners and rear strip. When all parts were mounted, and some of the wiring completed, he reassembled the chassis and completed the wiring, taking practically all the earth return leads to the metallised surfaces of the runners and chassis. When tested out no signals could be obtained. He checked all wiring and this appeared to be correct, and then had valves and components tested. These also proved to be in order. What was wrong? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 142 in the bottom left-hand corner and must be posted to reach here not later than the first post Tuesday, June 11th 1935.

Solution to Problem No. 141.

The mains power section of Harvey's receiver was defective and would not deliver sufficient current to operate the receiver. When tested with a good meter the load on the mains section was so small that the voltage rose and gave a false indication. When connected to the receiver the voltage drop was so large that none of the valves received their correct working voltage and thus the results were very poor.

The following three readers successfully solved Problem No. 140 and books are accordingly being forwarded to them:—T. H. Harrop, 14, Rowsley Street, Beswick, Manchester; H. G. Hodges, 1, Gordon Terrace, Wyche, Malvern, Worcs.; R. F. Mellor, 26, Ramsdale Crescent, Sherwood, Nottingham.

Testing Speaker Magnets

A Simple Method of Comparing the Efficiency of Moving-coil Speaker Magnets of Either the Permanent or Energised Types by Measuring the Flux-density.

IN designing a speaker magnet the object is to provide the most intense magnetic field possible. The stronger the magnetic field in which the coil moves, the more sensitive will be the speaker. Such factors as the nature of the material of which the magnet is composed, the size of the gap, etc., all greatly influence the strength of the field.

This can easily be proved by taking a number of magnets of different design and comparing them by the simple method about to be described.

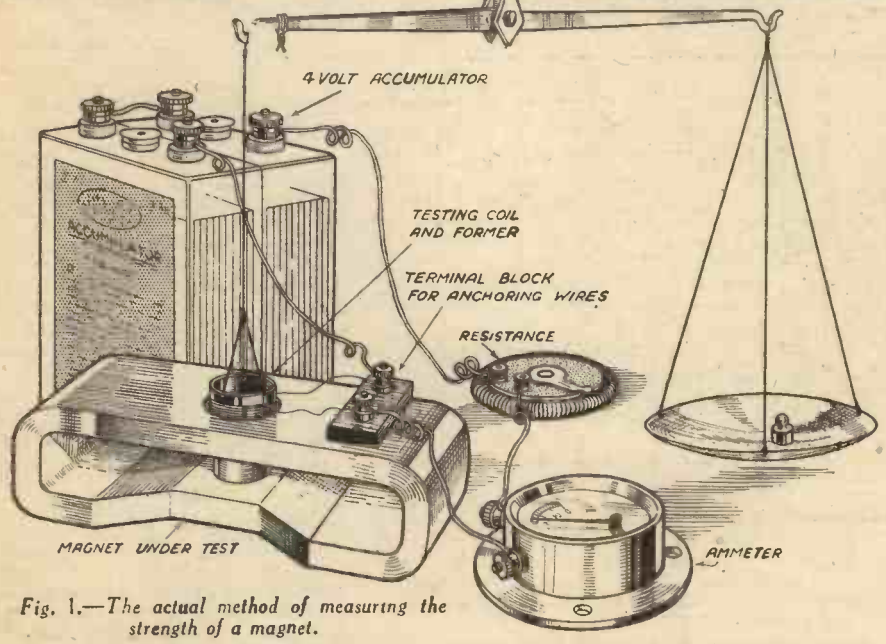


Fig. 1.—The actual method of measuring the strength of a magnet.

The arrangement employed is quite simple as shown by Fig. 1, and the test can be easily carried out by the experimenter.

Measuring the Field Strength

The idea is to measure the strength of the magnetic field at the gap between the poles of the magnet, that is to say, at that part of the field in which the moving coil operates. The part of the field to which we refer is shown in Fig. 2.

Before describing the test it will be well to refresh our memories regarding the nature of the magnetic field itself. This extends in all directions round the magnet, and we could therefore take measurements anywhere in the vicinity.

However, it is only the small area between the pole pieces which is important from the point of view of the efficiency of the speaker. Elsewhere, the field strength should be as low as possible. As we know, the field is generally represented by so-called "lines of force," which radiate in all directions. In a good magnet the greatest number of these lines occurs at the poles with only a few lines elsewhere. In a poorly designed component, on the other hand, there may be considerable concentration of lines of force at other points than the legitimate poles.

The degree of concentration of lines of force is called the *flux density* of the magnet, and it is this which we have to measure. The flux density is the number of lines of force per square centimetre of the sectional area of the magnetic path. Thus, if 5,000 lines of force are crowded into a square centimetre the flux density is said to be 5,000. A very good loud-speaker magnet will have a flux density at the "business" part of the field of something like 8,000 lines.

Apparatus Required

To find the flux density at the gap of a moving-coil speaker the following simple apparatus is required, namely, a pair of small scales, an ammeter, a variable resistance, and an accumulator. A pair of cheap scales of the type sold by photographic dealers is quite suitable. Gramme weights are preferable on the score of simplifying the necessary calculations, but if the apothecary's grain weights only are supplied, these can be used. The necessary conversion can be made by dividing the weight in grains by 15.43. The ammeter should preferably be one reading from 0—.5 amperes, but a milliammeter reading not less than, say, 0—60 milliamperes can be made to serve the purpose. In this case a much smaller weight will be necessary in the scale pan. The variable resistance should have a range from 0—60 ohms or more.

The method of measurement depends on the well-known M/C principle, and instead of detaching the moving coil from the cone of the speaker a similar small coil is made up consisting of five turns of 40 s.w.g. enamelled wire wound round a small former of similar dimensions to those of the speaker coil. The former can be made of paper rolled round a rod, the edges of the paper being stuck down with shellac varnish or liquid glue.

The coil thus constructed is suspended from one arm of the scales as shown in Fig. 1. It should be free to move up and down within the gap of the magnet.

The suspension of the coil necessitates the removal of one of the scale pans, and this will upset the balance since the remaining pan will undoubtedly be heavier than the coil.

Balancing the Magnet Pull

The first thing, therefore, is to restore the balance by tying weights (pieces of wire, paper clips, or anything available) to the arm of the scale. The ends of the thin wires from the coil are anchored to a couple of temporary terminals mounted on the magnet, or in some other suitable position. The connecting wires to the other pieces of apparatus are then taken to these terminals. In this way the weight of the connecting wires will not interfere with the movement of the coil.

Having arrived at a state of equilibrium with the coil suspended exactly in the gap, a weight of about 5 grammes is placed in the scale pan and the current switched on. The variable resistance is now adjusted until the pull of the magnet on the coil is equal to the weight in the pan and the balance thus restored. The current passing through the ammeter is then noted and the flux density calculated from the following formula:—

$$\text{Flux density} = \frac{9810\ F}{IL}$$

where F=force in grammes, I=current in amperes, and L=length of wire in the coil in centimetres.

As an example, suppose the force to be 5 grammes (the weight in the scale pan); the current shown by the ammeter to be .21 amps; and the length of the wire in the coil to be 37.7 cms., the flux density would then be:—

$$\frac{9810 \times 5}{.21 \times 37.7} = 6195 \text{ lines (approx.) per sq. cm.}$$

The length of the wire in the coil is, of course, equal to πdt, where d=diam. of coil, and t=number of turns of wire. In the above example the diameter of the

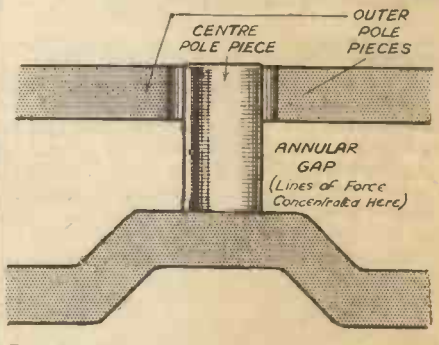


Fig. 2.—This shows the essential part of a speaker magnet.

former was 2.4 cms., and the number of turns 5. Thus the length of wire was $3.1417 \times 2.4 \times 5 = 37.7$ cms.

It should be noted when carrying out the test that the moving coil must be kept exactly in the centre of the gap. If the coil tends to move upwards when the current is switched on, then the connections to the accumulator should be reversed.

TOO MUCH SELECTIVITY!

The Why and Wherefore of this Important Subject is Dealt With in this Article

IN this era of high-powered transmitting stations and equally powerful receivers, and adding to these the congested state of the ether, it is not surprising that selectivity in the high-frequency receiving circuits is of paramount importance. Most constructors realise that the selectivity of a receiver can be progressively increased by the addition of tuned circuits, and indeed, until a year or so ago, this was the order of the day.

What is not always clear in this connection is that the addition of these cascade circuits considerably increases the cost of the receiver, as well as adding to the difficulties of ganging. The main snag is that in multi single-tuned circuits the selectivity is achieved at the expense of frequency response manifesting itself as a falling characteristic at the higher audio-frequencies. If one takes the obvious course of employing band-pass filter couplings this defect is obviated, but objections with regard to difficulties in maintaining the correct band-bass effect at various wavelengths still remain.

A Popular Circuit

It is obvious that these criticisms are based on the ultimate effect which these various couplings have on reproduction. Let us take a typical modern example of a set employing a single H.F. valve, and including three tuned circuits consisting of three iron-cored coils, so arranged as to provide a band-pass aerial scheme and a single inter-valve coupling. This combination is quite a popular one, and as a matter of fact is now used extensively in simple three- and four-valve receivers.

The selectivity which these coils impart in the order stated is surprisingly good, and yet, from the quality point of view, the system is open to serious objection. Unless one deliberately damps the tuning of the inter-valve coupling the ultimate selectivity will be that given by this coil. Theoretically, the band-pass circuits should provide a double-humped response, the inter-valve coupling single peak being adjusted to be midway between these two points, and in actual practice, owing to dissimilarities in the circuit capacities, the ideal response is rarely obtained. Many other technical reasons can be advanced in support of this contention, and one is thus forced to the obvious question, which is the best tuning system ?

The Superhet

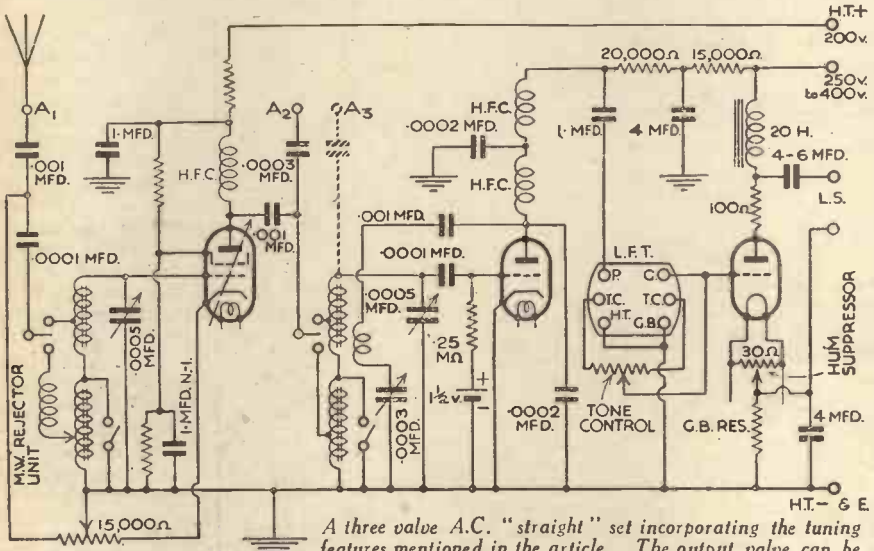
Like many other technical aspects of radio, there is no simple answer to this question, but it is possible to deduce for each receiver a reliable tuning scheme based on the requirements of the operator. For general all-round reception, where quality of reproduction is of equal importance to selectivity, it is difficult to better a simple superhet having a band-pass scheme for the signal circuit and an oscillator circuit, both coupled to a pentagrid valve. In this class of receiver the oscillator tuning can be made to follow the band-pass tuning width, provided the latter is not made to cover too broad a frequency response.

The reader will note that this suggestion vindicates the design of the £5 three-valve superhets described in this journal some weeks ago. There are several other ways of looking at the problem, which are summarised as follows : (1) With the object of deriving the maximum frequency response and selectivity from the receiver one can arrange the complete tuning system to give the required frequency discrimination, and then provide a means whereby the selectivity can be reduced to receive a station just clear of heterodyne whistles. (2) A superhet can be built which will satisfy the utmost requirements of selectivity, and a switch can be incorporated so as to reduce the number of tuned circuits, and perhaps the number of valve stages, or even convert the circuit to a straight one with a minimum of selectivity, but again to provide reception free from interference. (3) A further alternative is to so construct a set of three tuned sections as originally mentioned in this article, and then provide an aerial socket direct to the detector circuit to exclude the H.F. stage so as to employ a single coil and condenser for the reception of the "locals."

Certain radiogram manufacturers have produced a fourth scheme whereby the signal circuits of their superhet receiver units provide a constant maximum band width, but where the intermediate frequency transformers can be adjusted by means of a manual control to regulate the selectivity. In the estimation of the writer, the scheme has a drawback, in that, in decreasing the coupling between the I.F. coils to provide a narrower frequency range for higher selectivity, the amplification of the I.F. valves tends to drop, which would lead these valves to operate at a greater sensitivity level, and thereby increase the background noises.

This argument does not hold where signal tuned circuits are initially adjusted for high selectivity, and then deliberately damped for better quality, because it invariably happens that the latter adjustment is for powerful locals. The damping can, however, be manually adjusted to compensate for any side-band interference not taking into account the demodulating effect of a powerful station on a weaker one adjacent in wavelength to it. Furthermore, the artificial damping is unlikely to have but the most imperceptible effect on the overall amplification of the receiver.

The ultimate aim in each instance is, of course, to provide the flattest possible tuning to meet the prevailing receiving conditions, and this imposes the limitation that the desired transmission must be free from heterodyne and side-band splash. In a few instances one will come across certain Continental transmissions which are so badly heterodyned that unintelligible reception results when provision is made for the suppression of the interference.



A three valve A.C. "straight" set incorporating the tuning features mentioned in the article. The output valve can be arranged to suit individual requirements, such as a PX4 or PP 3/250.

The Stenode Circuit

Some years ago it was argued on behalf of the stenode, an ingenious crystal-controlled circuit arrangement, that even the severely heterodyned stations could be made intelligible. The basis of the circuit was deliberately to provide a frequency response before the first detector (superhet arrangements were advocated) which excluded the high notes, and then suppressed the over-emphasised bass after the detector to level the response, since according to the discoverer the high notes were not lost but merely reduced to a very low value.

The circuit was undoubtedly capable of providing selectivity as low as 1 k/c, and the results were in this respect truly astounding. It was, however, a further claim to high-quality reproduction which the writer is still unable to obtain. This claim was roughly to the effect that the signal could be restored to an even frequency response. In the opinion of many technicians who witnessed the demonstrations, the ultimate effect was not the same, although it was very satisfying. This is no attempt to decry the merits of an invention which provides for reception that is not otherwise free from interference, but rather to show that the scheme is of value, provided automatic circuit adjustments are available which allow for the minimum of selectivity on those stations which are unaffected by interference. (Our contributor must be unaware of the modern Stenode.—Ed.).

Under certain receiving conditions it is not always possible to meet the assumption,

(Continued on page 362.)

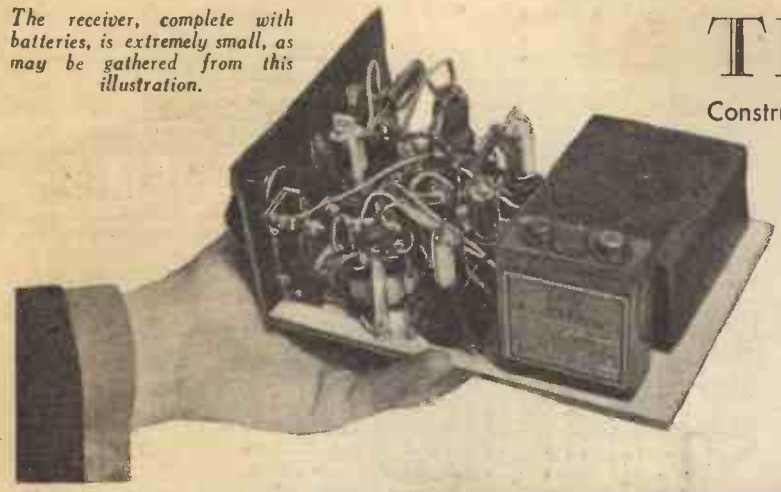
PRESENTING THE FIRST OF OUR "CAMEO" SERIES

POCKET RADIO AT LAST!

On the following pages we have great pleasure in presenting the first of our new series of tiny but amazingly efficient midget pocket portable receivers. These may be adapted for car radio, for motor cyclists, cyclists, hikers, and for all portable radio purposes. Operating from midget batteries and making use of only 45-volts H.T., these midget receivers will even operate a loud-speaker. In following issues other designs for midget receivers will appear; full size blue-prints are available from our Blue Print Department for 1s. each, post free.

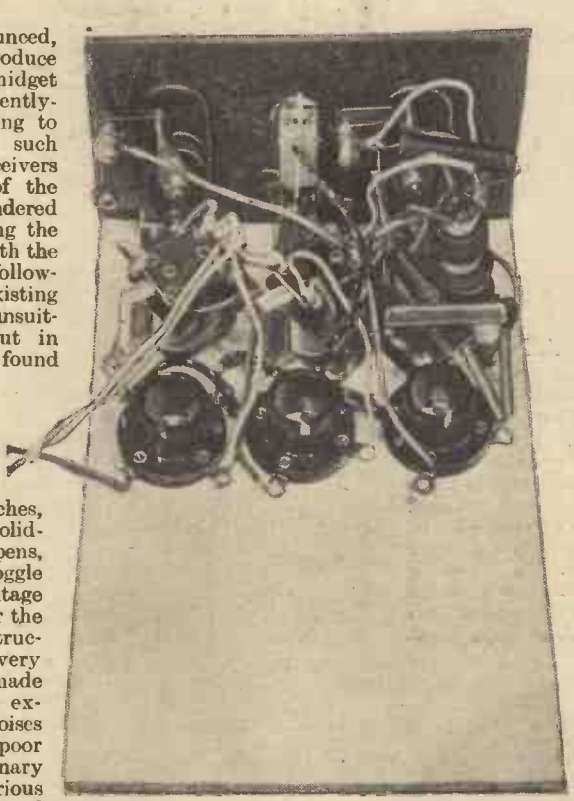
THE CAMEO

Constructional Details of the New Midget Receiver whom portability is one



The receiver, complete with batteries, is extremely small, as may be gathered from this illustration.

AS we have already announced, it is our intention to produce a series of really midget receivers, built around the recently-introduced Hivac valves. Owing to the extreme compactness of such valves, the design of receivers which are in every sense of the word "portable" is now rendered possible, and we are introducing the series of receivers this week with the model shown on this and the following pages. The majority of existing component parts were formerly unsuitable for midget receivers, but in certain cases it has been found possible to utilise parts which are already in existence without detracting in any way from the aim which we had in view. Thus, in this receiver you will find ordinary toggle switches, and variable condensers of the solid-diclectric type. As it so happens, the employment of the toggle type of switch is an advantage rather than a disadvantage, for the following reasons. Every constructor, or for that matter, every user of a receiver, be it home-made or a factory-built article, has experienced the annoyance of noises which arise as a result of poor contact in a switch. The ordinary push-pull type of switch is notorious for the production of noises, and many schemes have been devised for the elimination of these difficulties. One well-known firm of Service engineers has stated that at least 90 per cent. of receivers sent to them for attention are found to be due to faulty switching, and, therefore, we have kept this point in mind when designing these midget receivers as we wished them to be not only miniatures of standard receivers, but highly-efficient pieces of apparatus. The toggle switch is practically faultless, and owing to its snap action it is positive in its contact and at the same time is self-cleaning. This accounts, of course, for its use in mains circuits or other places where large currents are flowing.



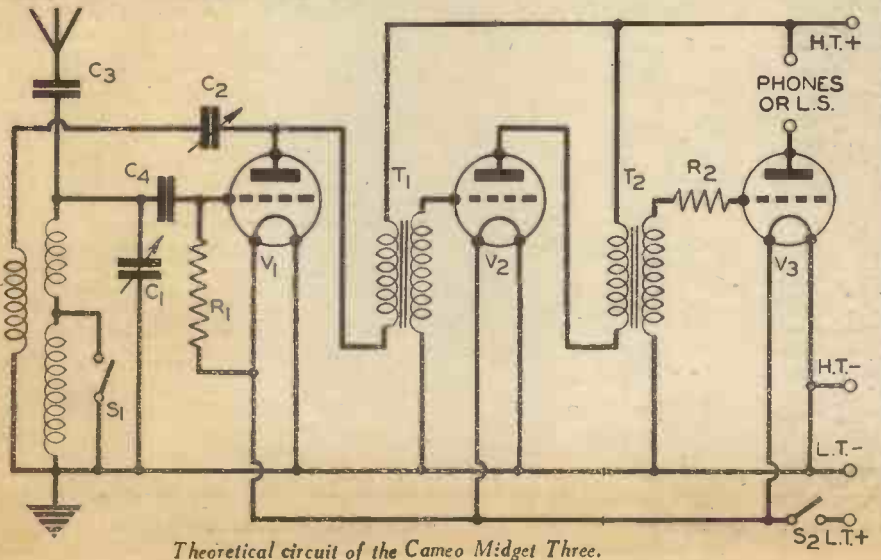
In this illustration the batteries have been removed, to enable the compact layout to be observed.

The Panel Layout

Thus, on the panel of this receiver you will see two toggle switches in the centre, the lower one operating the low-tension supply, and the upper one controlling the wave-change switching. Owing to the necessity for reducing weight, the panel is made from a piece of paxolin board, and this carries, in addition to the two switches, the tuning and the reaction condensers. There are no other controls, and an examination of the theoretical circuit on page 347 will show that the simple detector and two L.F. circuit has been utilised in this receiver, with the coupling between the two L.F. stages in the form of transformers. These have been specially made by B.T.S. and give adequate amplification in spite of their small physical dimensions.

The Circuit

The tuning coil is a straightforward affair, and this has been specially made for us by Messrs. Peto-Scott. No tappings or primary windings have been incorporated, as it is assumed that the receiver will



Theoretical circuit of the Cameo Midget Three.

A small strap will enable the receiver to be carried as easily as a camera.

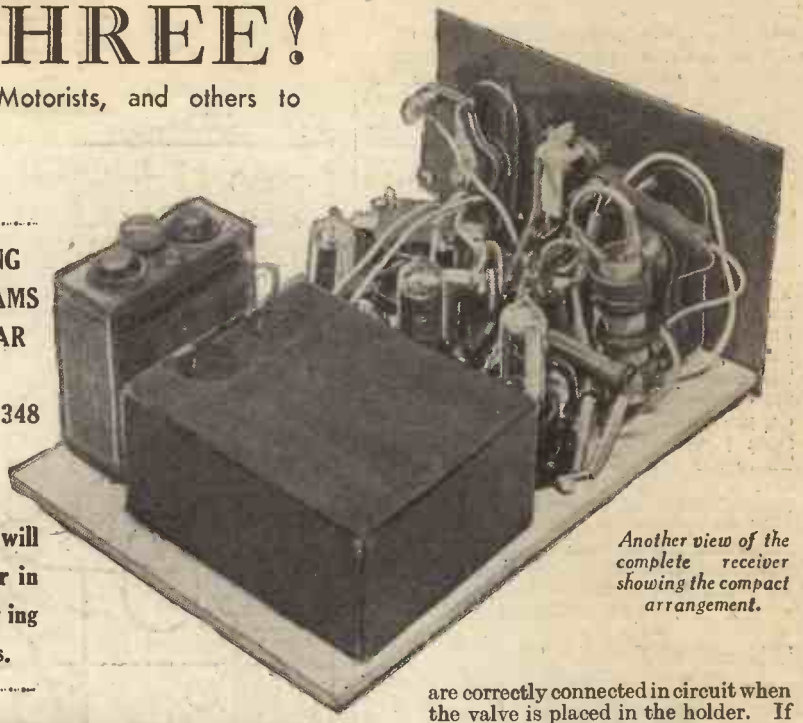
MIDGET THREE!

designed especially for the use of Hikers, Motorists, and others to of the most important considerations

only be used with a makeshift aerial, and thus the maximum signal strength is desired. This factor has, therefore, been given precedence over selectivity, and in most cases the latter quality may be obtained by the adoption of a small aerial, or by modifying the direction in which it is pointed when in use. Normal reaction arrangements are included, but no H.F. choke has been fitted. Obviously, quality cannot be placed in the front rank as a consideration in a receiver of this nature, owing to the limitation in high-tension supplies, and the only H.T. which is used is that derived from a small 45-volt battery. This measures only 3in. by 3½in., but will give long and reliable service under the conditions for which it is designed. Similarly, the low-tension battery is extremely small but will hold sufficient current to enable the receiver to be used for approximately fifteen hours. If, of course, it is only switched on for short periods, then the total length of time between charging will be correspondingly lengthened.

WIRING DIAGRAMS APPEAR ON PAGE 348

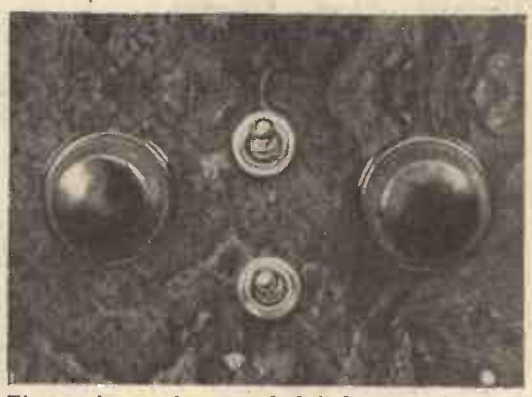
Further Designs will appear in following issues.



Another view of the complete receiver showing the compact arrangement.

Modifying the Panel

The components for the receiver are accommodated on a piece of wood measuring only 5in. by 4in., although the size of the bottom of the box to which the receiver is fitted is 7in. long. This is to enable the H.T. and L.T. batteries to be placed behind the receiver. The panel is rectangular, and measures 5in. by 3in. high. If it is desired to fit this receiver to a car it may be placed in the glove-box on the average dashboard, and the panel may then be cut to the shape of the opening of this box and thus will enclose it totally and present at the same time a neat appearance to the dashboard.



The panel may be cut and drilled to the dimensions given below.

The receiver may be fitted into the glove-box of a car dashboard.

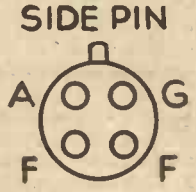
Similarly, for any other specific purpose, the panel may be modified in size, but the actual layout should be adhered to in order to simplify the wiring.

Construction

The mounting of the few parts will occasion no difficulty, and the Wiring Diagramon page 348 will assist in this task. Great care is necessary in mounting the valve-holders, as the contacts are equally spaced and it is necessary to wire these so that the respective electrodes are correctly connected in circuit when the valve is placed in the holder. If the diagram is examined, a black mark will be seen in the ring surrounding the contacts in the centre. This corresponds with the small bayonet slot in the side of the valve base.

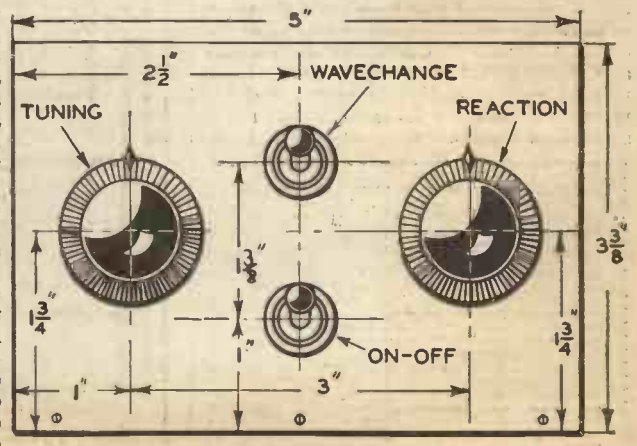
Precautions

In some cases the baseboard used for this receiver may be of the metallised type. In such instances there are one or two precautions to be observed. The first is in regard to the two brackets which are used to mount the variable condensers and at the same time furnish support to the panel. The bracket for the reaction condenser will be in direct contact with the moving spindle of the condenser, and thus the metallised surface of the baseboard should be cleaned away, before this bracket is mounted. Make quite certain that all the metallising is removed, by scraping with a sharp penknife, and then, as an added protection, by mounting a piece of thin card between the bracket and the baseboard. Similarly, as the contact strips on the valveholders are



View of Valve Base, showing connections.

(*Continued overleaf*)



Panel drilling dimensions.

(*Continued from previous page*)

rather near the metallised surface, it would be worth while to scrape away the surface in the vicinity of the holders. Again, the thin card may be interposed as an added precaution. The coil, as well as the two L.F. transformers, are fitted with coloured leads. This obviates the weight and expense of terminals, but necessitates soldering for the connections. This is all to the good, as it will ensure reliability, and all connections should be made in this receiver with the aid of the soldering iron. The low-tension and high-tension batteries are left unprovided with terminals. Spring leads are fitted to the H.T. battery, but the L.T. battery simply has two lead contacts. The constructor may employ crocodile clips for connecting the leads to the batteries, or, preferably, make small contact blocks from pieces of ebonite and spring arms. There are several methods of doing this, and it is left to the constructor to adopt that which most easily comes within his ability or preference. It should be remembered that the contacts for the accumulator should be protected against corrosion, either by using lead coverings, or well smearing with vaseline *after* contact is made.

'Phones or Speaker?

A single ear-piece may be accommodated behind the H.T. battery on the particular cabinet which has been specified for this receiver. Alternatively, a midget loud-speaker may be mounted in a similar cabinet, and the two used together when reception is desired. This method of splitting the complete apparatus will, of course, greatly simplify transport difficulties, and the total load may be distributed between two persons, for instance.

Using the Receiver

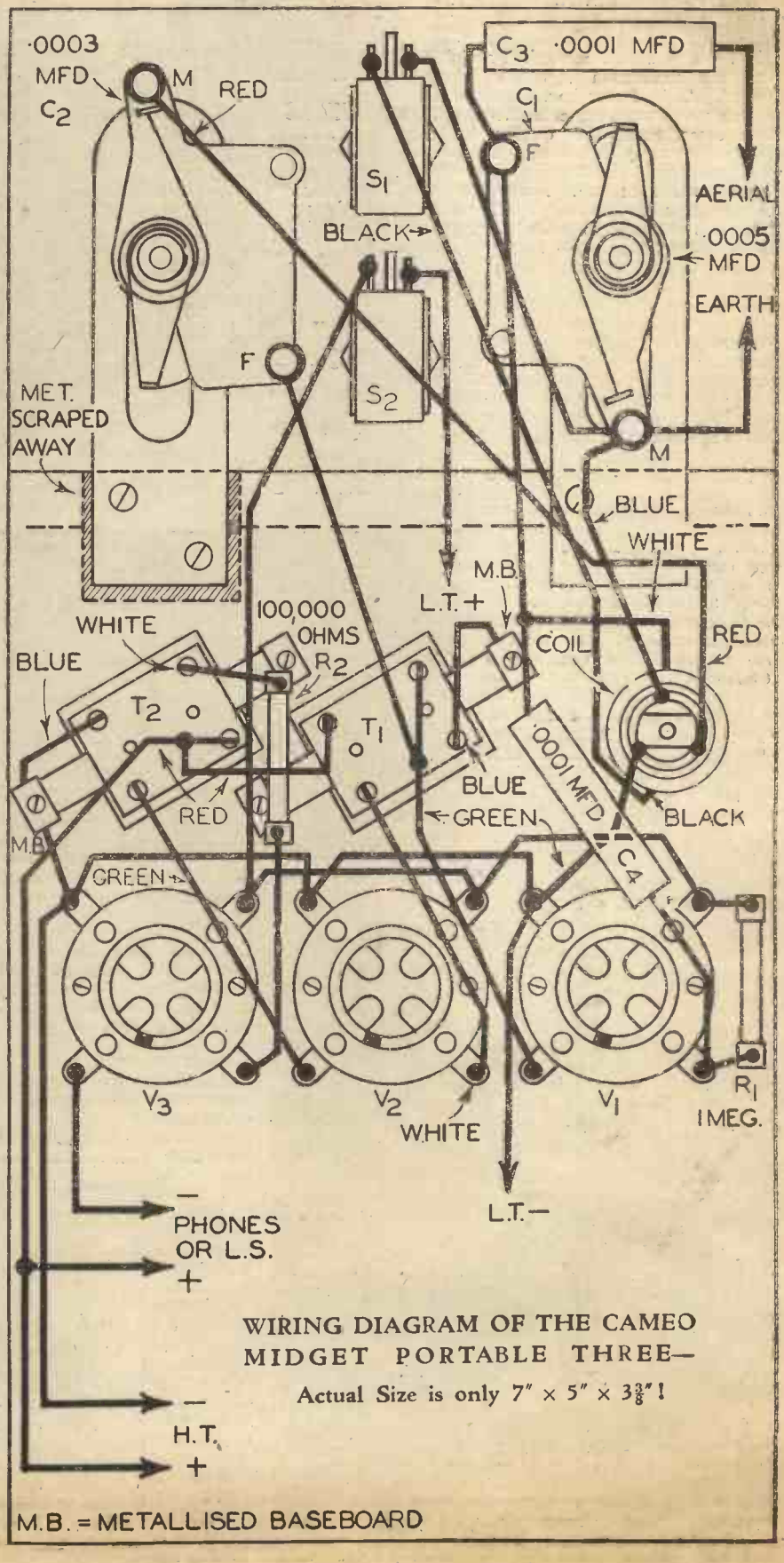
A length of flexible wire should be attached to the small fixed condenser C3. If it is thought desirable a small terminal may be mounted for the purpose on the panel, but this will only add to the weight unnecessarily. The aerial should be about 20 to 30ft. long and may be of the thinnest flex. It should be wound round a small flat strip of cardboard or otherwise wound up out of the way when not required, and a weight should be attached to the free end to assist in throwing it over the branch of a tree when required. An ordinary stone may, of course, be tied on for this purpose. A short wire from the L.T. negative circuit may be attached to a metal rod (a meat skewer is small and very suitable), and this may be pressed into the earth. Remember that a moist connection will often improve results, and, therefore, if a stream or ditch is handy this should be used as an "earth," and it will generally be found that the range of the receiver will be increased by this type of connection. Operation is entirely straightforward, the tuning condenser being rotated until a station is heard, and the reaction control being employed to strengthen signals.

LIST OF COMPONENTS FOR THE CAMEO MIDGET THREE

Two Midget L.F. Transformers (B.T.S.).
Three Midget Valveholders (Wearite).
One Midget Coil (B.T.S.).
One 1 megohm Grid Leak (R1) (B.T.S.).
One 100,000 ohm fixed Resistance (R2) (B.T.S.).
Two .0001 Tubular Condensers (C3, C4) (B.T.S.).
Two Switches Type SSOT (Bulgin).
One .0005 mfd. Compax Variable Condenser (C1) (Polar).
One .0003 mfd. Compax Variable Condenser (C2) (Polar).
Three Crocodile Clips (Bulgin).
One Drydex H.T. Battery Type X325 (Exide).
One L.T. accumulator Type GEL-CEL PRP3 (Exide).
One special Midget Chassis and Panel (Peto-Scott).
One Cameo Cabinet (Peto-Scott).
Two Component Brackets (Peto-Scott).
One Pair Headphones (Ericsson).
Three valves: two type XL, one type XD (Hivac).

THE CAMEO MIDGET THREE!

A REAL TOM-THUMB POCKET PORTABLE

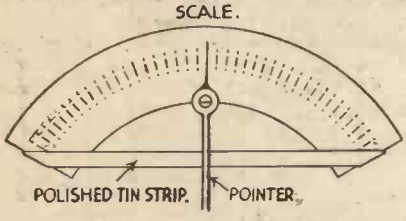


A PAGE OF PRACTICAL HINTS

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

Improving Meter Readings

A NARROW strip of tinned iron is fitted to the scale below the needle, as shown in the accompanying sketch,



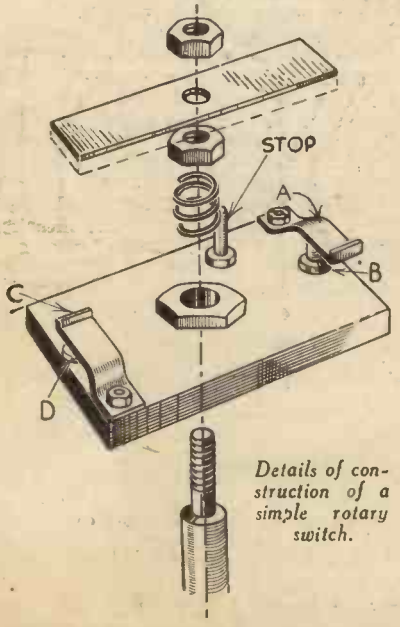
A simple dodge for improving meter readings.

and the pointer end of the needle is twisted 90 degrees to give a narrow edge; the reading is taken when no image is seen in the narrow "mirror." The tin strip must be cut flat on a board, otherwise it will not be perfectly flat when finished. It should be carefully polished prior to fitting. It is then placed on the scale and the ends bent over to clip it to the scale.—W. P. HAMLYN (Charlton).

A Simple Rotary Switch

THE materials required for making this efficient rotary switch are as follow:—

1 piece of ebonite ¼in. thick; 1 old condenser spindle and bush; 2 strips of 16-gauge springy brass; and 5 6B.A. screws.



Details of construction of a simple rotary switch.

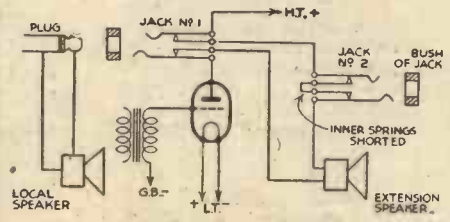
The metal switch-arm is bolted on to the spindle which passes through the bush. When this is rotated it forces down the brass strips A and C against the screws B and D, thus closing the circuit. If it is required to isolate the two circuits a strip of ebonite can be put under the arm as indicated by the dotted line. If desired, a number of these switches can be ganged on one spindle.—D. MCDONALD (Yeovil).

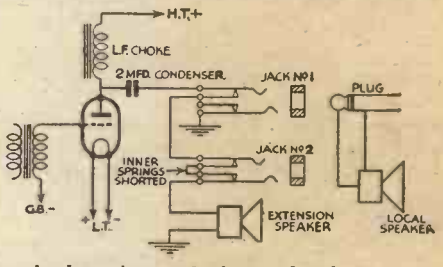
THAT DODGE OF YOURS!

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.

Extension Speaker Switching

THE accompanying diagrams show a method of using 5-point telephone jacks for rapid switching to extension loud-speakers. Fig. 1 shows the circuit for use when the loud-speakers are connected directly in the anode circuit of the output valve, whilst Fig. 2 shows the circuit when the loud-speakers are connected on the choke-filter system. The only apparatus required consists of two 5-point jacks and a plug for same.





Figs. 1 and 2.—Two methods of switching loud-speakers with plugs and jacks.

The diagrams show clearly the connections necessary, and it is advisable to mount both jacks 1 and 2 together on the terminal strip of the set. It should be noted that in Fig. 2 the lower inner spring of jack No. 1 has no connection to it.

The local speaker, i.e., the speaker connected in or near the set, is connected to the plug. The method of operation is extremely simple and is as follows: When the local speaker only is required, its plug is inserted in jack No. 1. The action of inserting the plug causes the outer springs to open and disconnect from the inner contacts. Thus the local speaker is the only one in circuit. When the extension speaker is required the local speaker plug is withdrawn from jack No. 1, and the connections then are as shown in Figs. 1 and 2.

If it is desired to have both local and extension speakers together, the local speaker plug is inserted into jack No. 2. This insertion of the plug causes the "shunt" to be taken off jack No. 2, and puts both local and extension speakers in circuit, in series.

The advantage of this scheme is the rapidity with which any desired speaker can be brought into circuit, which is particularly necessary when testing out a new loud-speaker with an old one.

Another advantage of the scheme is when a pentode output valve is being used. Should the local speaker be removed from the anode circuit when the set is on, there is no fear of a break in the anode circuit, for the extension speaker is immediately brought into circuit.—V. WALKER (Catford).

A Chassis Test Stand

BUILDERS of PRACTICAL AND AMATEUR WIRELESS receivers sometimes find it rather awkward to test out a receiver which is not functioning correctly, owing to the fact that many components are arranged underneath the chassis. The accompanying illustration shows a neat stand which I have built to facilitate this testing, and it may also be used in the assembly process.

As will be seen, the chassis is held on two pivoted strips and is firmly clamped thereto. Thus the chassis may be turned about with ease and there is no need to lift it or otherwise to take any weight. The stand in the illustration is also fitted with valve holders and meter, together with test prods and leads, so that the process of testing a faulty circuit may conveniently be carried out rapidly and with comfort.—Y. C. BURLEY (West Hill, S.W.).

A useful chassis arrangement for set testing.

Twenty-Five Years of Radio Progress

In this Article the Progress from the Year 1923 is Dealt With. Last Week we Covered the Period from 1910 to 1923

1923-1930

A POPULAR receiver, made in 1923 by the well-known firm of Pye, is shown in Fig. 13. This used two valves (H.F. and detector) and cost, with batteries, £18 10s.

During these seven years remarkable changes were witnessed. Grand opera from Covent Garden created tremendous public interest in 1923, and further popularised wireless receivers. Simultaneous broadcasting was inaugurated in 1923 with the broadcast from the British Association Meeting at Liverpool. The B.B.C. made their first attempt to relay for British listeners a programme radiated by KDKA in East Pittsburgh, and the first Wireless Exhibition was opened at the White City. In 1924 His Majesty's voice was heard for the first time in the home through the medium of wireless on the occasion of the opening of the British Empire Exhibition at Wembley. A mains receiver was placed on the market by Messrs.

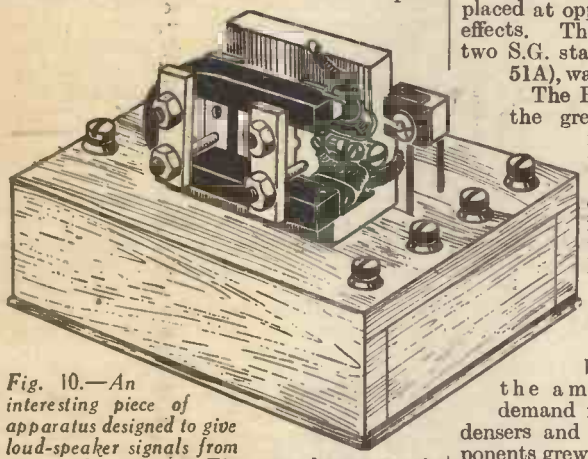


Fig. 10.—An interesting piece of apparatus designed to give loud-speaker signals from a crystal receiver. This was known as the magnetic amplifier.

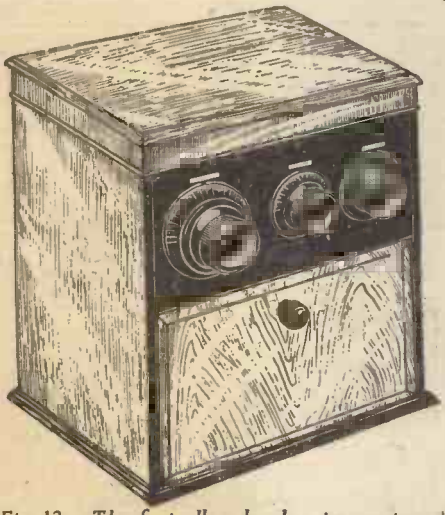


Fig. 12.—The first all-enclosed mains receiver. A 1926 Gambrell set.

Gambrell, and is shown in Fig. 12. Here you see a forerunner of the modern receiver, with valves and other parts totally enclosed. The Great Strike in 1926 went till further to popularise wireless as no newspapers were available, and the wireless receiver was the only link which many people had with the outside world. In 1927 the first screen-grid valve (the Marconi S625) was placed on sale, and this valve, together with a Marconi receiver incorporating it, is shown in Fig. 14. It will be noticed how the grid and anode were placed at opposite ends to reduce capacity effects. The receiver shown, employing two S.G. stages and 2 L.F. stages (Model 51A), was listed at the time at £48 16s.!

The Regional Broadcasting scheme, the greater use by constructors of moving-coil loud-speakers, and various important "feature" broadcasts brought 1930 to an end, and then followed some interesting developments which proved the value of home construction.

1931 to 1933

The superheterodyne was being experimented with by the amateur, and a demand for ganged condensers and screened components grew, with the result that the component industry became stabilised and the components offered to the home constructor took on a more efficient form than ever before. Single-knob control became the order, and some of the components which we know to-day received their birth during this period. To a very large extent the interest in home construction was beginning to wane, but in September, 1932, the arrival of PRACTICAL WIRELESS (as it was then named) re-awakened the amateur to the values of home construction and thus the entire industry received a much-needed fillip. With this revival came such developments as the all-metal valve, Class B amplification, quiescent push-pull, and other similar points of circuit design. Home-constructed receivers took on a new style under the chassis form of construction which we adopted, and the constructor began to take an interest in short-wave work on hearing of the opening of the Empire transmitters at Daventry working on 13 and 50 metres.

1934

The events of last year are, of course, still fresh in our minds. The Lucerne Plan, with its regulation of the broadcasting bands, was adopted to prevent overcrowding in the ether, and in response to the demand we introduced a three-valve superheterodyne—as many constructors believed that such a circuit was the only one to deal with the conditions in the ether. Droitwich took the place of the Daventry transmitter, and a committee was formed to inquire into the position of television. Components in general were decreasing in size, and the day of the midget was obviously drawing nearer.

It was found that generally the public was demanding a higher quality of output from their receivers, and this could be traced, no doubt, to the fact that the recently introduced Class B and Q.P.P. circuits had shown just what could be obtained from battery receivers. The direct result of this quality demand was an improvement in speakers and cabinets, and some important modifications of existing speaker designs were introduced. The question of matching the speaker to the output valve was taken up and the special "matching-transformer" became an important part of the loud-speaker make-up.

1935

In this year we have seen the arrival of really midget valves, and the publication on January 31st) of the Television Committee's Report. This further strengthened interest in short-wave work, and also brought to many an introduction to television. A further note of interest was struck with the opening of the year by the amalgamation of *Amateur Wireless* with this journal, and the consequent change of name to that which it now holds.

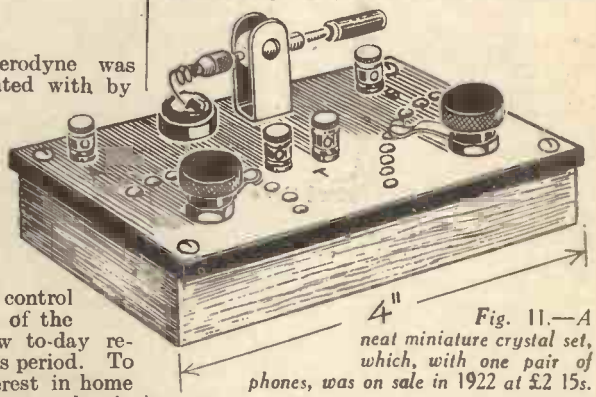


Fig. 11.—A neat miniature crystal set, which, with one pair of phones, was on sale in 1922 at £2 15s.

We have already announced the production of a series of really midget receivers, in which components and circuit schemes hitherto unknown will be employed. This change may result in other modifications as yet unseen. It has been assumed in the past that for real quality a good substantial low-frequency transformer is

(Continued on page 352)

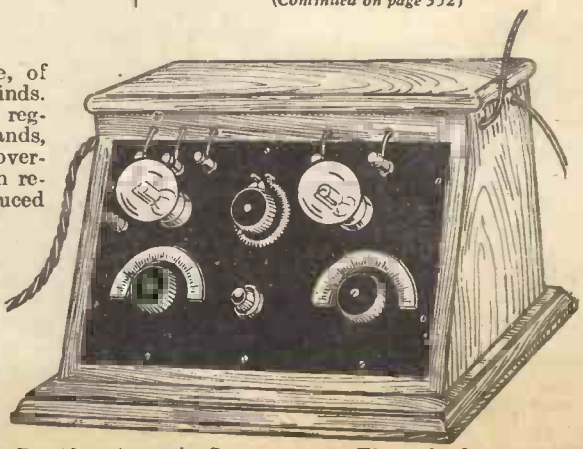


Fig. 13.—An early Pye receiver. This utilised a two-valve circuit without L.F. amplification, and cost £18 10s. in 1923.

TWENTY-FIVE YEARS OF RADIO PROGRESS

(*Continued from page 350*)

essential. We have seen the utilisation of special iron alloys in the cores of transformers and chokes, and these have led to a reduction in overall dimensions, without seriously impairing the quality which is obtainable. As it is evident that the size must be still further reduced, there is the possibility of some new ideas being introduced, such as in the metal from which the wire for the primary and secondary windings is manufactured, and the result may easily be that high-quality components can be made to a size previously thought impossible. Similarly with tuning coils. The iron-cored coil is small, but for really midget receivers we must get the coil still smaller, and yet must maintain efficiency. Can the present system be improved upon? These are only some of the small points which are receiving the attention of the manufacturers to-day, and with the impending arrival of television on transmissions on the ultra-short wavelengths there are still further developments required, not only for short-wave reception as such, but for the handling of the really high quality which is essential when high-definition pictures are being received. Obviously, the transmitter will also come in for attention, and a general improvement all round should be noticed. Can we say that the loud-speaker has now reached perfection? How will it sound when connected to an amplifier designed to handle television pictures transmitted on a 700-line basis? Tremendous surprises are in store for us all during the coming year, as the introduction of high-definition television is bound to affect the design and operation of wireless eqnipment, and it seems impossible to prophecy concerning the trend which events will take. Naturally, in a review of this nature it has only been possible to take a brief survey of the events.

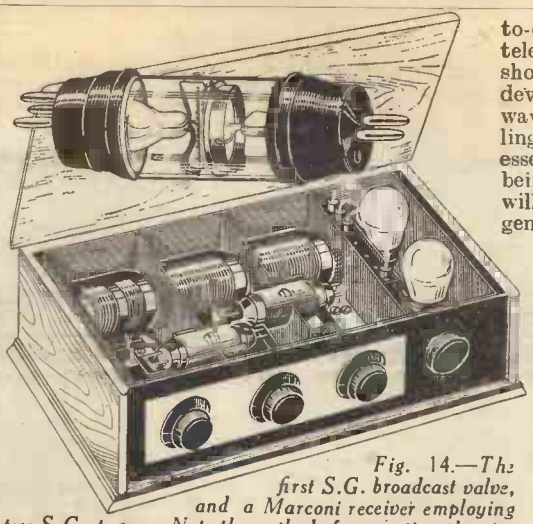


Fig. 14.—The first S.G. broadcast valve, and a Marconi receiver employing two S.G. stages. Note the method of connecting the pins to opposite ends of the valve.

Without Reaction

In this Article the Author Discusses the Need for Reaction, and Clearly Explains the Difficulties of Omission

By PERCY RAY

EVER since the ganged condenser came into more or less general use in 1929 the same old yarn has been heard every year about sets having less knobs; leaving out such things as switches, which are inevitable and anyway are not really controls, and the idea of making one knob do the work of two by turning as well as pushing and pulling which does not simplify control, we are forced to the conclusion that the modern straight set has three knobs, and the modern superhet has two knobs as bare essentials.

The superhet can be dismissed as, obviously, it must have two controls, one to select stations and the other to control volume. In the average three-valve set there is some means of selecting stations and, in addition, volume control and reaction; now, if the volume control were dispensed with the selectivity would necessarily be bad on loud stations, as reaction could not be advanced without shouting the house down, while really loud stations would be unbearable with reaction at zero. Since it is scarcely practicable to put automatic volume control on a three-valve set, or to prescribe a volume level to suit all tastes and all types of programmes, it is quite definite that the volume control is indispensable.

Sufficient reasons have been given why the volume control cannot be dispensed with, and one alternative is left, viz., to abolish reaction. Reaction is far more complicated than is generally supposed, its influence is wide and far reaching, and without it there are many obstacles to be overcome.

Dynamic Resistance

The influence of reaction starts in the screen-grid stage as the actual amplification developed is controlled by the dynamic resistance of the anode coupling. Dynamic resistance is simply the coil resistance offered to the particular frequency to which the coil is tuned. By careful design and the use of suitable iron in the core the dynamic resistance of a coil can be high, say, 500,000 ohms, to choose a round figure. The grid leak of the detector valve is effectively in parallel with the anode coupling, and assuming that the grid leak is 1 megohm, then the figure of 500,000 becomes 333,000 (neglecting odd figures). This is not the end, as the grid damping of a power-grid detector is very considerable, and an average figure would be equal to a parallel resistance across the coil of 50,000 ohms, lowering the effective anode impedance of the S.G. valve to only 45,000 ohms (approx.). Unless the detector is a screen-grid valve there will also be anode damping, but it is scarcely necessary to go into this as it may be avoided by using such a valve.

Next let us see what the fall from 500,000 ohms to 45,000 ohms has done to the amplification of the screen-grid valve having, say, an amplification factor of 1,000 and an impedance of 500,000 ohms under working conditions. The fall in amplification will be from 500 times to 55 times, which is very serious, while in addition the selectivity curve of the coil will have suffered even more. Now reaction when applied will remove all this damping without being pushed, so that the amplification of 500 can be realised quite easily.

Eliminating Damping

By pushing reaction a little beyond that point where the damping above referred to is exactly cancelled out, it is possible to remove nearly all the damping in the coil itself due to various losses, so that an amplification approaching 1,000 times is obtainable.

Even so, when the reaction reaches the point where all damping is cancelled out oscillation begins. It is interesting to note the places where damping exists to a greater or lesser extent. In the coil, insulation of tuning condenser, insulation of anode connector (if screened), grid leak, detector valve damping, detector valve base, and detector valve-holder; quite a formidable list!

We can now profitably reverse the line of inquiry and see what would have to be done to build a successful set without variable reaction. Starting with the coil, great care in design would be the basic essential, using litz wire on glass, or even quartz, formers and a core of iron in dust formation finer than face powder. The screening-can would be a real problem, as if placed close to the coil it would cause too much damping. There would be two possibilities; to use screening boxes about 12in. square (somewhat impracticable?), or to use a toroidal coil (a cylindrical inductance bent back on itself in the shape of a ring). Although the original Voigt iron-cored coil was of this formation, British manufacturers have fought shy of it, possibly due to patent difficulties or the difficulty of manufacture.

The next item would be a nearly perfect tuning condenser with a minimum of very carefully chosen insulating material.

Obstacles to be Overcome

Having paid due attention to details, such as screened leads and chokes, preferably by eliminating them altogether, we come to the grid leak. Obviously this cannot be tolerated, so recourse must be made to anode-bend detection which, in turn, necessitates that the anode "coil" be a transformer so that the grid leak can be left out. H.F. iron-cored transformers are expensive, and the switching is both complicated and likely to give more trouble than the simple type used with anode or tuned-grid coupling.

It has been decided that anode-bend detection is necessary, which in turn brings a train of problems. It is questionable whether it gives good quality on very small or comparatively large inputs, and is likely to cause accentuated fading, a phenomenon first discovered by the writer and published for the first time in PRACTICAL WIRELESS. By the discreet use of an H.F. pentode this trouble will not be serious.

The obstacles presented are considerable, but even if all those outlined above could be dealt with, the net result would be a set as good as one using reaction only to a limited extent. The great selectivity that results from pushing reaction close to oscillation would be lost, in fact the user would be rather helpless. In a nutshell, it can be said that a set without reaction will not equal a set equipped with reaction, and that the difficulties are so heavy that it is unlikely that it will be seriously attempted, particularly as the selectivity problem is getting more and more acute. Finally, it is only those backed by a first-class laboratory who could attempt the problem on any but a local station receiver.

COMPONENTS

Their Action, Principle & Purpose

This Week the Principal Components in a Typical A.C. Mains Receiver are Explained By FRANK PRESTON

IN the previous articles in this series we have confined our attention to a typical battery-operated three-valve circuit, so we should now turn to a mains-operated receiver in order that we may observe the differences and consider the functions of the power-supply-unit components. The circuit in Fig. 1 is an A.C.-mains counterpart of the battery circuit which we have previously taken as our example, and the various components are given letter references which correspond to those previously taken. It is evident that, on the whole, there is very little difference between this and the previous circuit, although the indirectly-heated valves do alter the appearance to a certain extent.

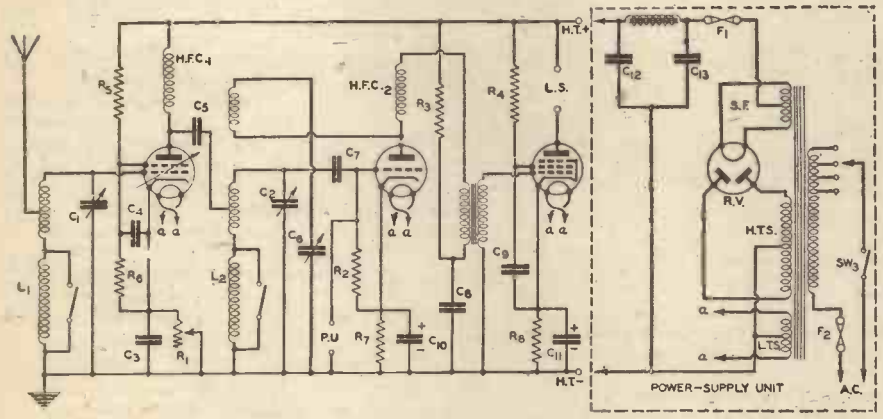


Fig. 1.—This is the three-valve A.C. receiver circuit which is being taken as an example in detailing the principles and function of the various components. The circuit is similar in general principles to the battery-operated one described in previous articles of this series.

Variable-mu Bias

It is not necessary to consider the general receiver components which function exactly as they do in the battery circuit, but there are a few extra parts, whilst the variable resistance marked R.1 and the condenser marked C.3 are connected differently. The main purpose of these two components is exactly the same as in the original circuit, and the value of C.3 may be the same as before, since its function is to by-pass high-frequency currents which appear in the cathode circuit of the first valve. A variable bias-voltage is provided by the variable resistance marked R.1, but this is applied without the need for a G.B. battery such as was required in the battery circuit, the biasing being "automatic" in character. The value of R.1 must also be quite different from that previously assigned to this component, but before considering this point we must briefly consider the difference between battery-operated and indirectly-heated cathode valves.

Actually, both types of valve can be considered as functioning in exactly the same manner, since the cathode and heater together (see Fig. 2) behave in a manner almost identical with the behaviour of the filament in a battery valve. The cathode emits a stream of electrons just as the filament does, but instead of being heated due to the passage of an electric current through it, the heating is provided by the length of resistance wire which is fitted inside the coated porcelain-composition cathode. Because of this arrangement the emitting surface of the cathode is electrically insulated from the heater.

The Variable-bias Resistance

High-tension current passes from the cathode to the anode of the valve, and by including a resistance (R.1 in the present example) between the H.T.— lead and the cathode a voltage-drop is produced, and the cathode is made positive with respect to the H.T.—, or "earth" line. But, as the grid of the valve is connected, through the tuning coil, to high-tension negative, the effect of the resistance is to make the grid negative in respect to the cathode. As to the maximum value of R.1, this can be found by applying Ohm's Law, when the highest G.B. voltage required by the valve, and also the anode current of the valve when passing that current, are known. For example, suppose that the valve required a maximum G.B. voltage of 12, and passed 2 milliamps when so biased; the resistance value required would be 12 (volts) divided by 2 (milliamps) and multiplied by 1,000 (to give the milliamps in terms of amps), or 6,000 ohms. The most suitable value of variable-bias resistance is generally stated by the valve makers, but it is nearly always correct to use a value of 5,000 ohms for a short-base variable-mu valve, and 10,000 ohms for a long-base valve. It will be evident from the simple calculation mentioned above that if two similar valves were controlled by the same variable resistance, the value of this component would be halved, since the current passing through it would be doubled.

As in the case of the potentiometer used in a battery set, it is better to employ a "graded" resistance for R.1, this being connected so that the tapered end of the resistance element is joined to the cathode. By connecting the resistance in this manner the control of volume is more uniform over the full range of the slider, since the increase in bias voltage takes place more slowly near the minimum bias position, when the valve is more susceptible to changes.

Screening-grid Voltage Supply

It will be seen from Fig. 1 that the method of feeding the screening-grid of the variable-mu valve is somewhat different from that employed in the case of a battery receiver, a fixed potentiometer being used. In the case of a battery receiver it is possible to obtain the required voltage from a tapping on the battery, since the two sections ("above" and "below" the tapping) of the battery themselves act as a potentiometer. Resistances R.5 and R.6 in series provide the screening-grid voltage, and the value can be varied by using different resistances in these two positions. In determining the values of R.5 and R.6 it is necessary to know the S.G. voltage required and also the voltage of the H.T. supply, whilst some account also has to be taken of the current consumed in the S.G. circuit. It is generally considered that the voltage obtained can be found from the formula: $\text{voltage} = \frac{\text{R.6} \times \text{total H. T. voltage}}{\text{R.5} + \text{R.6}}$, but this is not quite correct, since it does not take into consideration the voltage drop across R.5. It is, however, generally sufficiently accurate to employ this formula and then slightly to modify the resistance values obtained. For example, suppose that the S.G. voltage required is 75 and that the voltage of the H.T. is 200; the ratio of R.6 to R.5+R.6 should be 75 : 200. The two resistances could thus have values of 75 ohms (R.6) and 125 ohms (R.5). These values would be useless in practice, however,

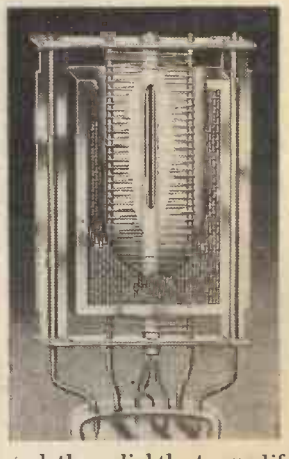


Fig. 2.—The construction and electrode arrangement of an indirectly-heated mains valve are shown here. As explained in the text, the heater and cathode together function in the same manner as does the filament in a battery valve.

(Continued overleaf)

(*Continued from previous page*)

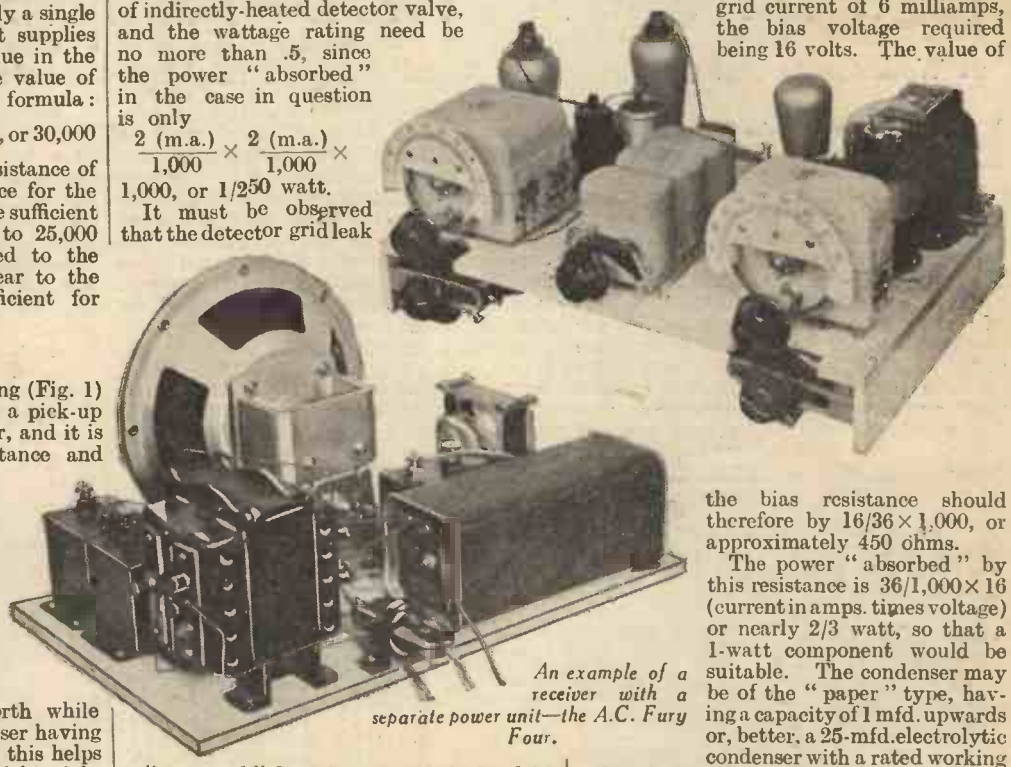
since the resistances would practically short-circuit the high-tension supply. On the other hand, if the values were made 75,000 and 125,000 ohms there would be too great a voltage drop across R.5, and the calculated ratio would not "hold." In practice it is generally found most satisfactory to have the total resistance of R.5 and R.6 equal to about 80,000 ohms when the potentiometer is used to supply a single valve, and 40,000 ohms when it supplies two valves. If we take this value in the present instance we can find the value of the two resistances from the formula: $\frac{R.6}{80,000}=\frac{75}{200}$, or $R.6=\frac{75\times 80,000}{200}$, or 30,000 ohms; thus R.5 should have a resistance of 50,000 ohms. To make allowance for the voltage drop across R.5 it would be sufficient to reduce the calculated value to 25,000 ohms, when the voltage applied to the screening-grid would be very near to the required figure; certainly sufficient for all practical purposes.

Pick-up Connections

In the circuit we are considering (Fig. 1) provision is made for connecting a pick-up in the grid circuit of the detector, and it is for this reason that the resistance and condenser R.7 and C.10 have been included in the cathode lead. The resistance is to provide the necessary bias voltage when working on "gramophone," and the condenser acts as an H.F. by-pass. The capacity of the condenser is not usually critical, but 1 mfd. is suitable, the component being of the non-inductive type. In some cases, however, it is worth while to employ an electrolytic condenser having a capacity of, say, 25 mfd. since this helps to suppress any mains hum which might otherwise be present. The condenser need have a working voltage of no more than 10, since this is well in excess of the G.B. voltage likely to be required by the valve.

The value of R.7 can be found in the same manner as we found the value of R.1 and taking into account the bias voltage required by the valve, and the average anode current which it passes. Generally, it will be found that a bias voltage of about 2 is adequate, and the valve will take about 2 milliamps. In that case, the bias resistance should have a value of 1,000 ohms—2 (volts) divided by 2 (milliamps) and multiplied by 1,000. This value can be used satisfactorily with nearly every type of indirectly-heated detector valve, and the wattage rating need be no more than .5, since the power "absorbed" in the case in question is only $\frac{2\ (m.a.)}{1,000}\times\frac{2\ (m.a.)}{1,000}\times 1,000$, or 1/250 watt.

It must be observed that the detector grid leak is "returned" directly to the cathode of the valve so that the grid is negatively biased only when the pick-up is connected in circuit.



An example of a receiver with a separate power unit—the A.C. Fury Four.

Biasing the Output Pentode

The output pentode is biased in the same manner as the other two valves, with the exception that the bias voltage is fixed and always applied. Bias is obtained across R.8, and C.11 is used as a by-pass. The value of R.8 is found in the same way as that of R.7, but taking into account the combined H.T. current taken by the anode, and also the auxiliary grid of the valve. As an example, the Cossor M.P./Pen. output pentode takes a maximum anode current of 30 milliamps, and an average auxiliary grid current of 6 milliamps, the bias voltage required being 16 volts. The value of the bias resistance should therefore by $16/36\times 1,000$, or approximately 450 ohms.

The power "absorbed" by this resistance is $36/1,000\times 16$ (current in amps. times voltage) or nearly 2/3 watt, so that a 1-watt component would be suitable. The condenser may be of the "paper" type, having a capacity of 1 mfd. upwards or, better, a 25-mfd. electrolytic condenser with a rated working voltage of 25. The electrolytic condenser is somewhat better, due to the fact that it provides a greater degree of smoothing, and so helps to eliminate mains hum; it is important that it should be connected with its positive terminal to the cathode, as shown in Fig. 1.

"Cracked" Top Notes

An Explanation of Some Reasons for a Peculiar Form of Distortion, which is Particularly Objectionable.

WHEN one experiences that peculiar form of distortion which becomes noticeable only when the speaker is reproducing a note of a particular frequency it is usual to suspect the speaker of having a resonance peak, or something of the sort. But this is not always the cause of the trouble, and very often it will be found that the speaker is rather loose on its baffle, that the spider supporting the cone is loose or damaged, or even that the input transformer is not tightly bolted to the chassis of the speaker.

Yet another source of the trouble in question, although by no means a common one, is the output choke or even an L.F. transformer. Should the clamps or core stampings in either of these components be loose it will often be found that they are set into violent vibration at some particular frequency. Whether or not the speaker or some other component is to blame can generally be determined by keeping the ear close to the speaker cone; it might then be found that the vibration is inaudible or, at least, very much reduced in intensity. If that is the case it will be a certainty that it is not the speaker which is at fault, and by listening carefully to various parts of the receiver itself the cause of trouble can generally be located fairly easily.

Should it be found that the vibration is even more pronounced when the head is held near to the speaker this will usually be an indication that the speaker is at fault. But when it has been ascertained that none of the faults mentioned above is present it is well to bear in mind the field winding, when the speaker is of the energised type. Cases have been observed where the winding was loose on its former, or the former on its iron core.

The remedies to apply in any of the instances above referred to are obvious, but it is not always convenient to tighten up the loose parts in the apparently correct manner. For example, it may be found that the offending transformer is held together by means of a pressed clamp or bakelite moulding, or that a wound bobbin is loose simply because it is not a perfect fit on its core (this will not be the case with good components). When these faults do occur it is well to remember shellac varnish, for if a small quantity of this is carefully poured over the loose stampings, or between the stampings and the bobbin, it will set hard and hold everything rigid. The varnish can be obtained ready mixed, or it can be made by dissolving a few flakes of shellac—obtainable from a chemist—in methylated spirit. Remember that the varnish is highly inflammable until it has set hard; after that it is perfectly safe and cannot be set alight even by a spark.—F. P.

On Your Wavelength

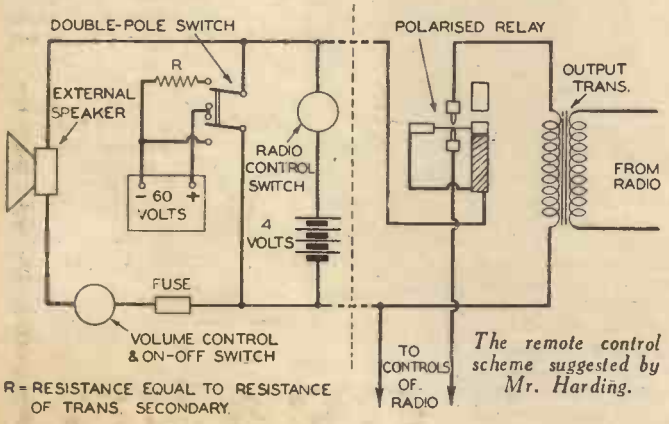
By Thermion

Remote Controls

I RECENTLY asked whether any reader had discovered a method of controlling the set, that is regulating the volume and switching on and off, without using more than the customary two loud-speaker extension leads. I have received many interesting suggestions, and that illustrated below comes from Mr. R. Harding, of Manchester. He writes me an interesting letter, explaining how the scheme works, and I give below an extract from the operating details. The idea may interest others, and I shall certainly try it out during the coming week or two.

Operating Details

"WHEN the polarised relay is operated by the double-pole switch the control circuit is closed, and the L.S. circuit to transformer broken. Control of radio is then achieved by means of the radio control switch in the usual way. Here, however, arises a complication, in that as the control circuit closes an unintended signal is passed on to the radio control. In some systems of control this might upset the radio, but in the case of a sequence control for which this was designed this extra signal is an advantage, for this signal, besides closing the control circuit, can be made to switch the radio on, etc. As the polarised relay is unaffected by current flowing in the same direction as the first signal the rest of the control is easily achieved. Having finished the necessary controlling, the double-pole switch is again operated, but this time the current is sent in the reverse direction to the first signal. This breaks the control circuit and re-opens the L.S. circuit. The L.S. is then switched on by means of the combined volume on-and-off switch. Ah! one fault you say. Surely when the double-pole switch is operated for the second time another unintended signal is sent through to the radio control. No, you are wrong, because this time the current is in the reverse direction, and would not affect a polarised relay in the radio control mechanism. The 60-volt battery is necessary to overcome the resistance of the transformer secondary. Actually, very little current flows and 60-volt batteries can be bought cheaply, and last months. A fuse is inserted in the latter section of the L.S. circuit to avoid accidents to L.S."



R = RESISTANCE EQUAL TO RESISTANCE OF TRANS. SECONDARY.

The remote control scheme suggested by Mr. Harding.

Death Rays

I SAW in a daily newspaper the other day reference to a death ray. This old subject seems to be a favoured one of the dailies, and it is surprising how it catches the public imagination. Personally, I do not think it will ever be possible to invent a wireless ray which will kill human beings. I do not doubt that a form of radiation could be devised which would upset certain types of mechanism. It should not be difficult, for instance, to put a magneto out of action by a suitable type of interference. This might appear that it would thus be possible to wreck aeroplanes, but a moment's thought will show that a protecting cover could be invented for the magneto to keep out the ray. There is no offensive weapon so far invented to which a defensive measure has not been perfected, and thus I am rather afraid that the so-called death ray is a figment of fiction. Doctors and scientists have experimented a lot with ultra-short-wave radiations and they can tell you of the effects of these emanations on the human system, but I do not think they will support the idea of a machine which will send out waves to long distances (that is, out of reach of an enemy) which will carry death to human beings.

Bursting Condensers

I SEEM to be unlucky with condensers. Readers will remember my recent note about a leaking wet electrolytic. Well, I had an ordinary condenser burst over the week-end. This was a high-class component, consisting of two 1-mfd. condensers in one case with a common terminal and designed for use as a "buffer." I had it joined across the anodes of a rectifying valve to prevent modulation hum. Whilst we were listening to the London station there was an audible "phut," not unlike the noise of the discharge of an air-gun. We thought it came from the loud-speaker and emanated from the station, but after a moment or two hum became noticeable in the speaker, and gradually grew in strength. I hurriedly switched off, and realised that something in the set had gone, although at the time I did not guess what it was. Turning the cabinet round, I had no difficulty in locating the trouble, as the condenser in question was oozing black pitch all over the place. The black case in which the condenser was housed had burst at the junction of the bottom and side, and the whole of the contents were spreading over the mains unit. I might mention that the condenser was of the 1,500-volt test type, and was connected across a rectifier of the B class (350-0-350 volts).

Power from the Air

HOW many listeners appreciate that every wireless set is a delicate piece of mechanism which collects power from the ether? It is true that the input signal voltage is of the order of microvolts, but, none the less, it is sufficiently powerful to deflect the needle of a microvoltmeter, indicating that an infinitesimal proportion of the power dissipated by the transmitting aerial can be collected on your aerial and put to useful work. Shall we ever be able to collect power to drive automobiles, aircraft, and trains in this way? The idea is not fantastic, and experiments have been conducted on these lines abroad. How convenient it would be for every form of mechanical travel. A device on the top of the car picking up the power, the circuit being completed by a mechanical shoe in contact with the earth. We all know that steam road tractors need to have a dangling chain in contact with the earth in order to carry away the static electricity generated by the escaping steam. The transference of power *viâ* the ether has been demonstrated as a possibility. If practicable, it would eliminate the need for underground cables, and the wide open spaces created by pneumatic drills.

"Praktisch und Kunstliebhaber Rundfunk"!

EVERY reader will be glad that this journal is not printed and published in Germany. Our title would change from its simple euphonious and all-embracing form to the horrible concatenation of consonants with a minimum number of vowels presented by the following translation of our title, "Praktisch und Kunstliebhaber Rundfunk." The German is not mine but one of a friendly correspondent. If it is wrong, therefore, please don't write and kick me in the pants.

(*Continued overleaf*)

(*Continued from previous page*)

Remote Control

MY S O S for a reliable form of remote control referred to in the first paragraph has produced many suggestions from old experimenters who read my notes. Some of the ideas are indeed remote, but a number of them are quite practicable. H. C. H., of New Malden, suggests a clockwork mechanism connected to the spindle of the condenser in such a way that it is moved very slowly first from left to right and when the end of the dial is reached it reverses and returns again very slowly to the starting-point. On this reader's device a third armature, this time with a spring attached, is fixed on the left-hand side of a coil in such a way that an arm or pointer engages one of the cogs on the clock, thus stopping its action. When the bell push is depressed the set is switched on and at the same time the condenser slowly moves round. When the desired station is heard, then the pressure on the bell push is relaxed, and the armature springs back, and so stops the mechanism. If the desired station is to the left of the one just heard, then it will only be necessary to keep the bell push depressed until it comes into action again on the return journey of the armature. This device, of course, is intended for use only with a battery-operated set; with a mains set a heavier armature should be fixed so as to prevent sparking.

A Valve Danger

A SERVICE Man writes me as follows: "In PRACTICAL AND AMATEUR WIRELESS dated May 25th, you drew attention to the danger of substituting I.H. Triode for D.H. Pen; you, of course, mean danger to the valve. Possibly you have overlooked the fact that most raw recruits never bother to switch off the receiver. I have recently investigated a case of this sort; as the triode had a metal coating the damage was done to the owner of the set. I explained that the metal coating was the cause of the shock. He then informed me that I was a mutt. The metal coating was connected to earth, he said. How, then, could earth kick him? On measuring with an Avo I found that owing to the absence of the pen. the H.T. voltage had risen to 325 volts. Some kick!"

The Midget Portable

I WAS recently privileged to hear the first of the new midget portable receivers which are being developed by the technical staff of this journal, and I must confess that I was amazed by the performance which it gave. The little set which I saw was only an experimental model, but it gave surprisingly good loud-speaker results on the local stations. This was all the more surprising when it was considered that the complete instrument would fit into a good-sized pocket and that the H.T. battery was of only 45 volts. When used in conjunction with a 5in. cone moving-coil speaker the quality was not superb, but it was, nevertheless, far better than I would have believed possible.

I am told that the receiver is being designed (*too late! It has been designed, and is being fully described in this issue.*—ED.) principally for use with 'phones, and this being the case, I am quite sure that there will be a very ample margin of power, and that the reaction condenser will not have to be used too often.

Modern Speaker Design

LISTENING to the reproduction given by the small speaker connected to the midget set, I was set to wonder if the midget speaker may not come into general use. There were available some time ago one or two speakers having moving-coil movements which fed into a logarithmic horn, and these were, in my experience, extremely good. I wonder if these speakers will be revived; since the horn can be "folded" into almost any convenient shape, and so made that it can be housed in a normal type of cabinet, there does not seem to be any objection to its use.

Notes from the Test Bench

Speaker Substitutions

WE had a letter from a reader the other day in which he complained that the valves in his Hall-Mark Four had lost their emission after three months' use. On making inquiries, we discovered that he was using a permanent magnet speaker in place of the specified energised model, with an ordinary L.F. choke substituted for the field winding of the latter. The resistance of the average L.F. choke is approximately 750 ohms, whereas that of the average field winding of energised speakers designed for series connection in the rectifier output circuit is approximately 2,000 ohms. If the low-resistance choke is substituted for the high-resistance field winding, the result will be a rise in valve anode voltage with consequent overheating of the valves.

High-resistance Speakers

IN receivers employing rectifiers having a maximum rated output equivalent to the required valve anode voltage, speakers having a field winding resistance of 2,000 to 2,500 ohms cannot be satisfactorily used. In such cases it is advisable to employ speakers having a much higher field winding resistance—viz., 6,000 to 7,500 ohms. When the rectified voltage is 200 to 250 volts, the field winding of this type of speaker may be connected across the output circuit of the rectifier—*i.e.*, between HT+ and HT— terminals—provided that the maximum rated current output of the rectifier is approximately 50 m.a. higher than the H.T. current consumption of the receiver valves.

Reflexing

REFLEXED circuits seem to be regaining popularity. This type of circuit was widely used when broadcasting was in its infancy, and from the sensitivity point of view the reflexed receiver proved very satisfactory. When quality of reproduction became of paramount importance, however, the reflex circuits were gradually dropped. The advent of multi-electrode pentodes has made it possible to design a reflex receiver that will provide excellent quality together with a high degree of sensitivity, and therefore it is probable that many of the new season's receivers will employ dual amplification valves.

Automatic Bias

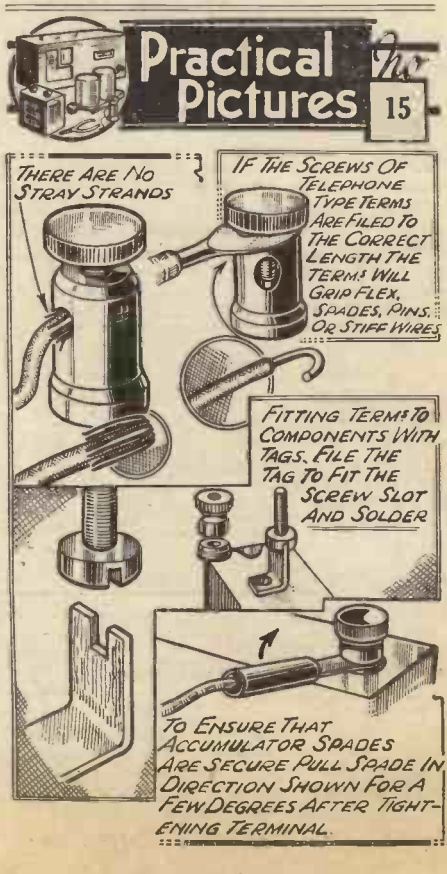
WE have received many inquiries recently concerning the use of "free" grid bias in battery sets, in place of the usual battery bias. This substitution seldom improves quality—a deterioration of quality is experienced in most cases—but free bias has the advantage of being cheaper than battery bias and also provides an automatic reduction of G.B. voltage as the H.T. battery runs down. The bias resistance should be connected between the H.T.– and L.T.– terminals, its value being determined by dividing the required G.B. voltage by the total current consumption of all the valves; for example, if the required G.B. voltage is 10 volts and the total consumption of all valves is 20 m.a., the bias resistance should have a value of 500 ohms.

Television from Gramophone Discs

THE paucity of 30-line Television Transmissions has always been a drawback for experimenters in this field. My readers, therefore, will welcome the fact that the long-promised recorded television records are now available, which will enable them to carry out tests without waiting for the B.B.C. transmissions. The disc is operated from any radiogram or gramophone and pick-up, the leads from the latter being fed to the input circuit of the television receiver or the amplifier in the usual way. You are thus able to transmit your own pictures to a set programme. The records are revolved at the standard speed of 78 revs. per minute, and are suitable for a scanning speed of 750. The records are double-sided and give reasonable pictures. They cost 7s. each, and give 6 minutes' entertainment. I shall be glad to supply the address of the manufacturer to interested readers.

Television at Radio Olympia

AFTER all, it seems that television will not entirely be excluded from this year's Show, although at the moment it is extremely unlikely that any actual apparatus will be permitted to be on view. I learn that a demonstration of high-definition Television may be given so that the public will be able to appreciate that the science has progressed from the Laboratory, to the state where it can be mass-produced and marketed. I read the other day that one firm have a system for 720-line transmissions. Up to the present, I have only witnessed 240-line transmissions and the detail was extremely good.



SHORT WAVE SECTION

At the Short-waver's Bench—6

Connecting 'Phones; H.F. Stoppers; and Overloading in Superhets, are the Subjects Dealt With in this Article

The Hartley Circuit

A DIAGRAM was given in these notes recently of an old favourite circuit known as the "ultraudion," and here is another old circuit which achieved great popularity, but has not been heard of for some time. It is known as the Hartley Circuit, and is given in Fig. 1.

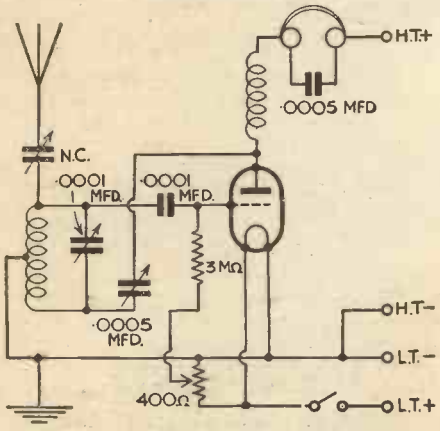


Fig. 1.—The well-known Hartley Circuit which has much to recommend it for short-wave work.

Older readers will remember this excellent circuit well, and it is a particularly good one for short-wave work on account of its simplicity. Its great disadvantage, however, is hand-capacity, as neither tuning nor reaction controls can be earthed. If extension handles are used on these condensers, together with a metal panel connected to earth, any trouble on this account should be minimised. It is as well to include the 400 ohms potentiometer across the filament supply for variation of valve bias, as this greatly assists in obtaining smooth reaction. Indeed, such a scheme is capable of incorporation in any set, and is so highly valued by many amateurs that they have the potentiometer mounted on the panel for easy variation.

Connecting 'Phones in Circuit

Most readers may not know that there is an alternative method of connecting 'phones in a circuit to the stereotyped one of joining them in the H.T.+ lead to the valve. The scheme, as used in the anode circuit of a detector valve, is shown in Fig. 2. Its advantages for short-wave work are that any H.F. current present is quickly and easily by-passed direct to earth, and that the 'phones are "dead" being in the "earthy" side of the circuit. Do not be misled by this latter statement into thinking that no H.T. passes through the 'phones. A little careful examination of the circuit will show that it does.

H.F. Stoppers and By-passes

It has been my experience, as well as that of many others, that the H.F. by-pass condenser usually placed between the anode and filament of the detector valve on broadcast bands is unsatisfactory on the short-wave bands. Its action is to by-pass reaction effects entirely, and no increase in H.T. voltage will assist in putting them back. For a similar reason a differential reaction condenser is of little use on short-waves—speaking generally, of course. As a result of the absence of this condenser H.F. current is very likely to find its way into the L.F. amplifier and output circuits, with undesirable results. Fig. 3 shows how H.F. stoppers may be put into the circuit to eliminate these.

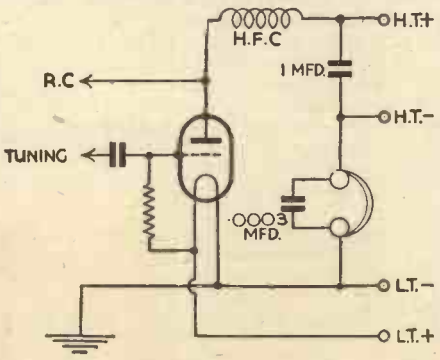


Fig. 2.—An alternative method of connecting 'phones in circuit.

Briefly they are as follows: A is a .25 megohm resistance in the grid circuit of the first L.F. valve, and any H.F. getting past is kept out of the output valve by the choke in the grid circuit (B). Should any H.F. current still have filtered into the output side it is kept out of the 'phones or loud-speaker by two chokes (C) being by-passed to earth by condensers (D) of .0001 mfd. each. If all these devices are fitted to an unstable short-waver you can be fairly sure that any further troubles will not be due to stray H.F.!

Overloading in Super-heterodynes

The following is a hint for those who are designing or building a short-wave superhet. It concerns the second detector, and is this—do not be misled into thinking that, because this is a short-wave set, the second detector must be made as sensitive as possible. This is not so, for a sensitive detector will handle but a small input voltage, and the input from two or three I.F. stages to the second detector is likely to be fairly considerable. Overloading of this valve will result in bad quality, and a loss of efficiency. In fact, although the set is a short-waver the superhet system gives such a tremendous amplification that the second detector may well be a diode, or Westector, without any loss of signal strength.

The Short-wave Earth

Some beginners to short-wave work become rather worried regarding the efficiency of their sets when they discover

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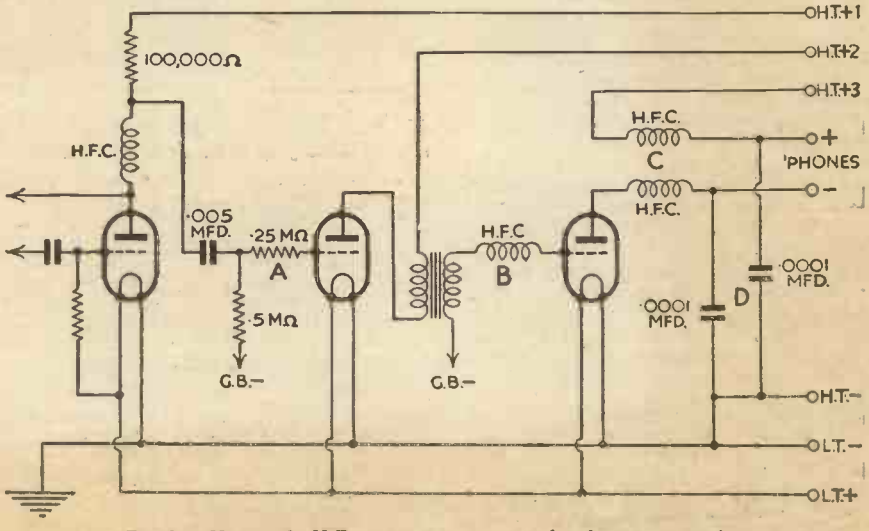


Fig. 3.—How to fit H.F. stoppers to a circuit for short-wave work.

(Continued from previous page)

that no difference in signal strength whatever is made by the addition of an earth. This is frequently the case, however, and is due to a variety of reasons. Where the set is built on a large metal chassis, this is frequently found to act as an efficient counterpoise, as also will the plates of a large accumulator used for the L.T. supply. A long lead to earth is worse on the higher frequencies than no earth at all, and even a highly efficient earth connection is sometimes found to make matters worse, by bringing in static, both "man-made" and otherwise. In such circumstances a proper counterpoise, as distinct from the makeshift kind referred to above, is often extremely good. This must be as well set up and insulated as the aerial, but may be nearer the ground, and should, for optimum results, be placed beneath the aerial.

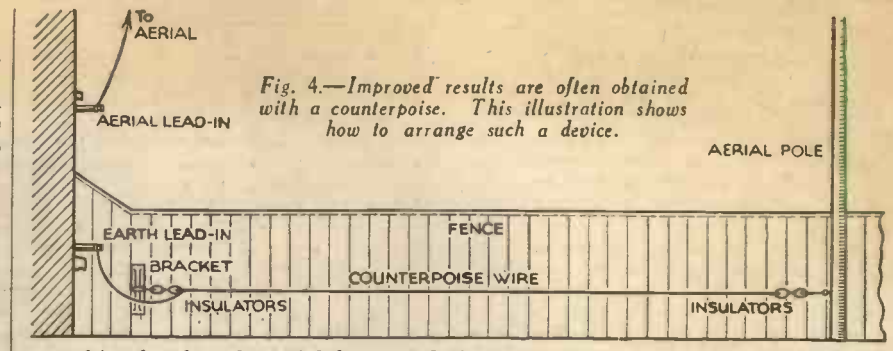


Fig. 4.—Improved results are often obtained with a counterpoise. This illustration shows how to arrange such a device.

Fig. 4 shows a suggested arrangement, the counterpoise being run along the fence below the aerial.

LEAVES FROM A SHORT-WAVE LOG

A RECENT illness, which consigned the writer to his bed for about three weeks, quickly demonstrated the benefits of radio, and in particular, transmissions on short waves. This distinction possibly needs a few words of explanation. Whereas the ordinary broadcasting receiver was undoubtedly a boon during the day, a short-wave battery three with headphones proved more than a godsend throughout the night hours, when pain and discomfort prevented any attempt at sleep. With that simple set the numerous broadcasts picked up during those wearisome hours not only afforded the necessary entertainment, but left one with the feeling that, except for fitful periods of sleep, wakeful nights had not been wasted. With the fact in mind that time is no disturbing factor, greater patience is exercised in the search, with the result that few disappointing periods were encountered and the daily—or rather nightly—log assumed exceptionally healthy proportions.

Congestion on the 31- and 49-metre Bands

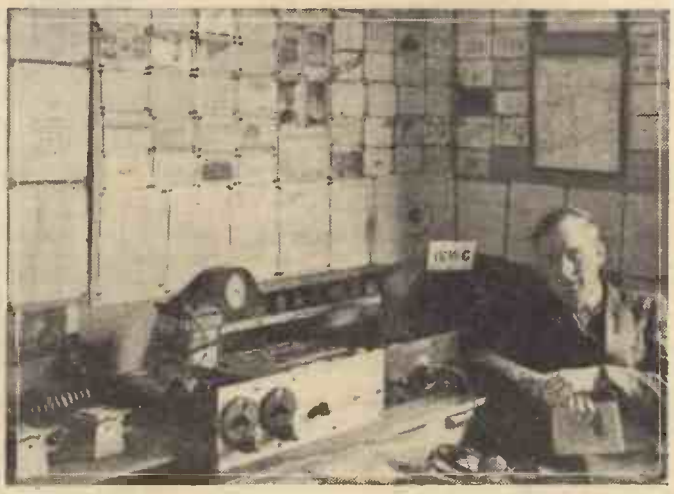
Various portions of the wavebands were systematically scoured and all items of information carefully registered. One of the first conclusions to be arrived at is that the 31- and 49-metre bands in which broadcasters have been crowding recently are getting hopelessly congested; this fact is being realised, and stations are already taking up more favourable positions how and where they can. In this connection we may register the following alterations in wavelengths.

Since I2RO abandoned the 30.67-metre (9,780 kc/s) channel in favour of 31.13 metres (9,637 kc/s), CT1AA, Lisbon, in order to get away from an inconvenient neighbour, has been compelled to move to 31.18 metres (9,590 kc/s) where it is working at present.

Going farther afield, it was also found that HJ1ABD, Cartagena (Col.) which couples to its call its slogan, *Ondas de la Heroica*, has moved from 49.2 metres (6,097 kc/s) to 41.21 metres (7,280 kc/s), namely, in the amateur waveband. Definite information was also obtained of the new call put out by W1XAZ, Millis (Mass.) on 31.35 metres (9,570 kc/s); this station, which is the short wave outlet of WBZ, Boston, would appear to have permanently adopted the call of W1XK. It is an easy transmission to tune in as its reading is just a fraction above the day channel of LKJ1, Jelöy, namely, 31.34 metres (9,572 kc/s).

Valencia

YV6RV, of Valencia (Venezuela), of which reception has been reported so frequently of late, has also slightly changed its position; it is now on 46.01 metres (6,520 kc/s) and consequently is better separated from HJ5ABD, Cali, Colombia (46.22 metres). In the case of the former, identification is simplified by the fact that frequent references are made to the General Electric Company, and all calls are preceded by five notes on gongs. The latter, as mentioned on a previous occasion in these notes, has a three-note signal similar to that used by the N.B.C.



A corner of Mr. Francis A. Beare's wireless den showing two home-constructed battery-operated short-wave receivers.

A transmission which has been heard by two readers a few weeks ago and which was reported to be HJ4GA of Medellin (Col.) is now proved to emanate from HJ4ABA, of that town, on 25.61 metres (11,710 kc/s). It is just clear of the French transmission from Radio Colonial, Pontoise. In the call mention is made of *Ecos de la Montana*.

When an attempt was made to find YV3RC, Caracas, on 48.78 metres (6,150 kc/s), a reading on which the CSL, Lisbon relays of the Portuguese National broadcasts have also been found, although no programme was actually picked up, a Cuban call was registered which, on investigation, might tally with CO9GC, of Santiago, which is said to operate on that channel. Such is the congestion in certain parts of the waveband.

Of the numerous Colombian stations, the one which still seems to be the best heard in Western Europe is HJ4ABL, Manizales, on 49.18 metres (6,100 kc/s) and which frequently comes in at greater strength even than W3XAL, Bound Brook. Announcements are made in Spanish, English, German and Dutch, and it can be distinguished from the U.S.A. transmitter by its signal, recalling a toot on a Klaxon horn.

VE9DR, Drummondville, on 49.96 metres (6,005 kc/s) may be struck out of your lists as I understand that the station has now suspended its broadcasts. Relays of the Canadian programmes, or in particular those of CRCT, Toronto, must now be taken through VE9GW, Bowmanville, on 49.26 metres (6,090 kc/s). Their schedule is B.S.T. 20.00-05.00 (Mondays, Tuesdays and Wednesdays); 12.00-05.00 (Thursdays, Fridays and Saturdays) and on Sundays from 18.00-02.00.

New Station in Mexico City

A new station for which a search might be made after midnight is XECR, Mexico City, on 40.82 metres (7,350 kc/s), as I understand it was formally opened on March 24th last, but so far no further details are available.

Although at various times the German authorities have tried out interval signals from their short-wave transmissions, the one that appears to have been definitely adopted is that regularly used by the Deutschlandsender on long waves, namely, a few bars from the carillon of the Potsdam Garrison Church, reproducing the beginning of an old German song, *Ub Immer Treu Und Redlichkeit*, of which a rough translation might be: Always Faithful and Loyal. I have not heard, in the case of any applications for verification from Europe, that any special answer is given by the German station, but I understand that to listeners abroad who acknowledge reception, the Germans send a small gramophone record of the interval signal, announcer's call and two folk songs sung by a boys' choir. A broadcast which may be of interest to listeners, is given by Eiffel Tower under the call sign FLE, which every Sunday morning transmits messages slowly for the benefit of experimental amateurs on 32.5 metres (9,230 kc/s) and simultaneously on 75 metres (4,000 kc/s).

ARE AERIALS A DRAWBACK TO RADIO?

The Advantages and Disadvantages of Outdoor and Indoor Aerials are Discussed in this Article.

A SHORT while ago there was a strong tendency to dispense with outside aerials, and, bearing in mind some of the hideous contraptions one sees desecrating the skyline, I heartily agreed with the movement, but I do maintain that efficient results, with high quality, demand an efficient aerial and earth system.

Wherever there is a difference of opinion on the subject it is either being viewed from different angles, or there must be sufficient grounds to substantiate the various opinions.

Let us, for clearness sake, look upon our receiving apparatus as a simple machine having work to do. By the most elementary law of mechanics the output of a machine is dependent on the input it receives, while the comparison between the output and input will denote the efficiency.

Efficiency

Supposing the output is greater than that required for our needs, then it is obvious that the input can be decreased, or, better still, a smaller machine used with greater overall efficiency, owing to the possible causes of losses being reduced. This being so, the running costs will likewise be reduced, together with the number of sources of trouble and possible breakdown.

If the comparison holds good, it would seem that the most logical thing to do would be to make our input as great as possible, design efficient receivers employing less valves, and pay particular attention to the efficiency and *appearance* of our aerials.

It is also known that some people, who are not enthusiasts or constructors, only require the local stations, while there are others who have a horror of any outside aerial because of the fear of spoiling the appearance of their garden or residence. These are exceptions, and, if they are content with the results they do obtain, and the apparatus they have to employ, I would not suggest that they make any alterations, providing they are not going to be interested in the short-wave television transmissions, and so forth.

Indoor aerials, of the home-made variety, and many of the commercial types, have their uses, but it can hardly be claimed that their efficiency is comparable to that of a good outside aerial. There are many who will say that an indoor aerial has certain advantages, while others will most emphatically state that an outside aerial is not all that can be desired under the present broadcasting conditions.

To these I would say, make your aerial as efficient as possible, and then pay attention to the design of your receiver. A good commercial indoor aerial is often better than an outdoor aerial, unless the latter is sited high and is of fair length.

Outside Aerials versus Indoor Aerials

An efficient aerial demands low losses, high electrical efficiency, low self capacity, and low high-frequency resistance. A properly designed outside aerial has all these qualifications, while the average indoor arrangement is notable for the exact opposite features.

In the first form it is an easy matter to obtain ample insulation, and to obtain a good electrical circuit needs very little care, while the correct self-capacity and low H.F. resistance can be secured by no further trouble than a little attention to the location of the wire and its size or formation.

Now, with the second form low losses will become high losses, for the various reasons. Greatly reduced pick-up of the signal, losses through heavy damping and high self-capacity, while it is highly probable that the H.F. resistance will be appreciably higher. Here again there are exceptions.

The resultant effects are obvious; the indoor aerial will sometimes call for greater use of reaction or other boosting effects, with consequent losses to the quality of reproduction. Some receivers are likely to become unstable, owing, in certain cases, to the absence of the correct aerial load across the grid circuit, which the design of the coils, or circuit, may require. It will be most unsuited for good short-wave reception, while electrical interferences are likely to be pronounced, and, last, but by no means least, more valves will be used than efficient conditions would require.

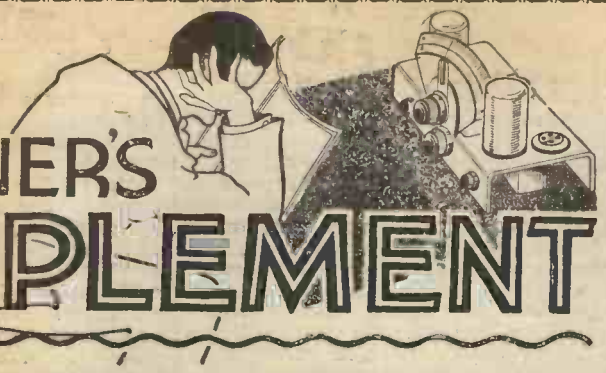
Let us now examine the alleged drawbacks of an outside aerial. With regard to appearance there is a strong argument in this point, but there is *no need* for an aerial to be an eyesore. The whole thing only calls for a little care and consideration in the selection and fitting of the necessary gear. It is necessary to pay attention to details, to have everything taut and neat.

Overloading

The next points are, overloading and selectivity. These can be dealt with in a much more satisfactory manner with an outside aerial than with an inside one, providing the system is properly designed and the receiver is capable of coping with present broadcasting conditions. In these cases, the aerial will help to cover up the inefficiencies in a receiver, but it cannot be expected to give complete compensation.

MODULATION, WAVELENGTH and FREQUENCY

BEGINNER'S SUPPLEMENT



Beginners Should not be Frightened by High-sounding Terms. There is Usually a Very Simple Explanation to These Facts, as Here Explained by W. J. DELANEY

FROM our correspondence it appears that there is still a large number of amateurs who have not grasped—or cannot grasp—the facts associated with the wavelength of a station. They know they have to use a coil and condenser to get a station and also understand that there is some definite relation between the terms wavelength and frequency, but, owing to a lack of knowledge of mathematical calculation, they become confused and finally leave the subject alone. It is, however, very valuable to the experimenter to know just what the tuned circuit does and to appreciate the relation between frequency and wavelength. Analogies often assist in understanding rather involved points, and although it is difficult to make analogies of certain subjects, the following explanation of the tuned circuit will probably clear up the matter once and for all.

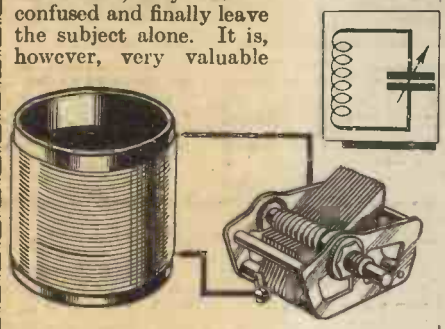


Fig. 1.—An oscillatory or tuned circuit.

The Tuned Circuit

It is hardly necessary to explain that the tuned circuit (as such) consists of a coil and condenser. In the majority of wireless receivers and transmitters these components are in parallel, although it is possible to obtain a similar effect by connecting them in series. However, for the purposes of this explanation, we will take the arrangement which is generally found in the grid circuit of a detector stage, or a crystal receiver, and this is shown in Fig. 1. No tappings or other complications have been introduced as they would only render the explanation more difficult from the point of view of the beginner. At the transmitting end such a circuit is joined to a valve and other apparatus, and to this circuit is applied a voltage. Now, from previous articles the beginner is probably aware that a direct current cannot pass through a condenser. Current can actually pass through such a component; in the case of an alternating current (as will be shown later) the effect is that of a free passage. Consequently there is a stoppage when the current arrives at the condenser, and a building-up process takes place until such time as certain stresses are placed on the condenser, when the current turns round and goes in the opposite direction until it meets the other side of the condenser. Here a similar effect takes place, and it again changes. As an analogy we may imagine the circuit is a field surrounded by a hedge, but with two gates at opposite ends. For our current, imagine a dog who wishes to get out. He rushes to one door, waits for a moment, and when he finds that it will not be opened turns round and runs to the other. After barking and waiting there, he turns back to the former door and so keeps on running from one to the other.

Frequency

It will be obvious that the time which it takes the dog to get from one door to the other will depend upon the size of the field, and if the dog waits at each door for a definite period we should find that he takes a certain time to get from one end of the field to the other. Similarly in our tuned (or oscillatory) circuit, the length of the wire (or as it is more correctly called the "inductance") corresponds with the distance across the field, and the size of the condenser (or in technical language the "capacity") corresponds with the delay which we likened to the barking of the dog whilst he waited to see if the door would be opened. Thus a coil and condenser in parallel will act in a certain manner and will have a current passing first one way and then the other, and it will be seen in a moment that this can be shown in the form of a diagram.

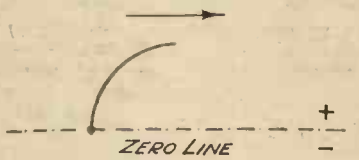


Fig. 2.—Plotting the rise of a current, as described in the text.

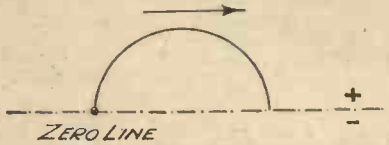


Fig. 3.—A further stage in the plotting of the A.C.

Positive and Negative

In previous articles explaining the nature of electricity, it has been shown that a positive voltage consists of one kind of supply, whilst a negative consists of another, and as our tuned circuit has a voltage applied across it the whole time, then one of the sides of the condenser must be positive and one negative. As, however, we have seen that the current changes its direction periodically, then the relative position of the positive and negative sides of the condenser must change. Now let us draw a horizontal line on a piece of paper, and call this line "zero volts," that is a line representing the state of our circuit when it is isolated, or in the condition shown in Fig. 1. Now make a dot on this line and imagine that this is equivalent to connecting our circuit to some supply source such as the transmitter. We have said that a current will flow and grow to such a point that no further increase is possible, when it will turn round and go back the other way. Well, then, let us draw a line to indicate the growth of the current, and as growth is generally associated with an upward direction we must let our pencil take an upward movement from our zero line, and as there is also a flowing movement we must also allow the pencil to travel along. This will result in the production of the line shown in Fig. 2. At the end of the time which it takes for the current to build up there will be a slight slowing up, and then the current will fall back to nothing before it changes its direction, and therefore we must continue our line back to the zero point. Thus we arrive at Fig. 3. Now the current passes in the opposite direction, and therefore we must allow our pencil to go back, but as the current will now be negative we will go below the line, and by reproducing the first line we shall arrive at the circle shown in Fig. 4. Now, a cycle is also a circle, as every schoolboy knows, and we may therefore say that the circle we have just drawn represents a "cycle of operations."

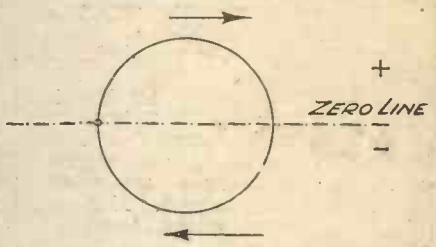


Fig. 4.—A complete cycle, which may be redrawn as shown in Fig. 5.

Deriving the Sine Curve

Now, we can draw this cycle of operations in another way, as shown in Fig. 5

(Continued on page 362)

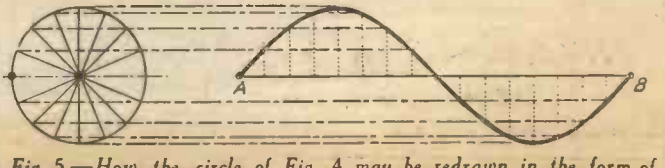


Fig. 5.—How the circle of Fig. 4 may be redrawn in the form of a sine curve.

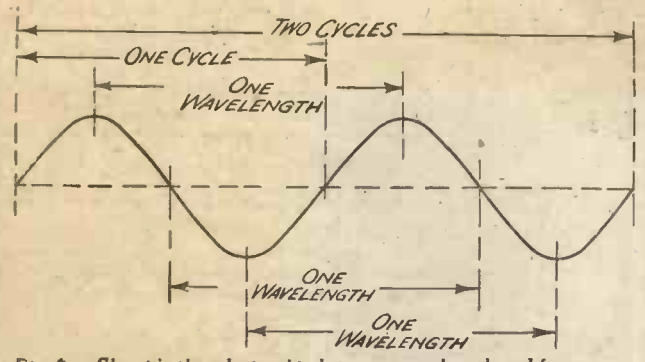


Fig. 6.—Showing the relationship between wavelength and frequency.

to all as the sine curve, or the symbol which is used on A.C. electric light meters, etc., to denote A.C. or alternating current. It is, as we have just seen, one cycle, and thus those who have an electric light meter in the house will see a small panel upon it marked "50" or some similar number, which means 50 cycles and is the "frequency" of the supply mains.

BEGINNER'S SUPPLEMENT

(Continued from page 360)

Here we draw our circuit as in Fig. 4, and we measure the circumference of this circuit and draw a line (A—B) equal in length to it. Now we divide the circle into a number of equal parts, and at the same time measure off the same number of equal parts along the line A—B. Now, if we measure the height from the centre of the circle to the points round the circumference and plot off similar distances from the line A—B we should obtain a number of points which when joined up would give us the peculiar curve shown in Fig. 5, and this will be familiar

Wavelengths

Now, we said that this oscillatory or tuned circuit was used in the transmitter, and if an aerial is joined to it we can imagine the alternations or changes being radiated or sent off from the aerial into space. The resemblance between the curve and the movement of the sea is not difficult to appreciate, and thus we can imagine the oscillations passing out into space as a series of waves. Now look at Fig. 6, where two curves have been joined up. From this it will be seen that the distance from any point on one curve to a similar point on the next curve is one wavelength, but that from the zero line to the point where the curve comes back to the line the second time is one cycle. Now, if you look at Fig. 7 you will see quite clearly how the wavelength *decreases* whilst the frequency *increases*. In this illustration the space between the two vertical lines represents 1 second, and in the upper part of the illustration the frequency is 2 cycles, whilst the wavelength is the distance *x*. In the lower part of the illustration the frequency has increased to 4 cycles, with the result that the wavelength has decreased to the short distance *y*.

(To be continued)

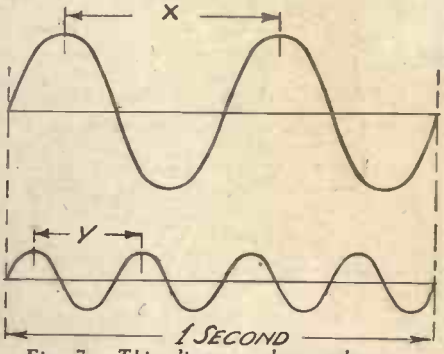


Fig. 7.—This diagram shows why wavelength decreases when frequency increases, and vice versa.

"MIDGET" ACCUMULATORS

A RANGE of accumulators designed for miniature receiving sets, deaf aid sets, and other purposes and used in conjunction with the new type of low capacity midget valves have recently been placed on the market.

These accumulators are supplied with

TYPE	CAPACITY at 20 Hour Rate	Max. Discharge Rate, Amperes	Dimensions Overall in Inches Length	Width	Height	WEIGHT Charged Ozs.
M 1	2	.2	1¾	1	3	8
M 2	2½	.25	1¼	1	3 3/16	9
M 3	2	.2	3¼	¾	2½	6
M 4	3	.3	2¼	1	2¾	10
M 5	4	.4	3¼	1	2¾	12
M 6	4	.4	3¼	1 3/16	2¾	12
M 7	5	.5	2¼	1¾	3¾	15
M 8	7	.7	3¼	2¼	2¾	17
CP 5	10	1	2¾	1¾	5¾	24

jelly electrolyte, fully charged and ready for use.

The method recommended for re-charging is to remove the stopper and add sulphuric acid Sp. G. 1.200, sufficient to moisten the jelly, and charge at the rate specified on the label for approximately twelve to sixteen hours. After charge and before putting accumulators into service, drain off all excess liquid in the cell and replace stopper.

To over-discharge or leave cell in a discharged condition will quickly ruin the plates.

Particulars of the range of 2-volt "MIDGETS" in general use is shown in the table.

Interested readers may have the name of the manufacturer upon application to the Editor.

TOO MUCH SELECTIVITY

(Continued from page 344)

previously mentioned, to the effect that the highest selectivity provided by the receiver assumed a discrimination in band width which excluded all manner of heterodyne interferences. In actual practice this is a very difficult condition to satisfy except by the inclusion in the set of heterodyne filters. These devices, by the way, offer yet a further possibility in receiver design in achieving both selectivity and high-quality reproduction. A set incorporating a filter with a progressively variable response (or suppressor), and with the means for cutting it out of circuit, can be initially adjusted for a full frequency response.

Iron-cored Units

An interesting point arises in this connection, namely, whether the receiver will provide high quality on the "locals." If we confine this question purely to highly sensitive receivers the answer will be no, because it has been proved in practice that better quality results from cutting down the number of amplifying and tuned stages. In comparing the merits of iron-cored coils with air-cored versions the writer recently fitted two 8-valve superhets with four of each of these coils. No difference in sensitivity or volume was noticed, due perhaps to the A.V.C. action, but it was observed that the receiver incorporating the air-cored coils displayed as great a selectivity as its counterpart with iron-cored units, but with better overall reproduction.

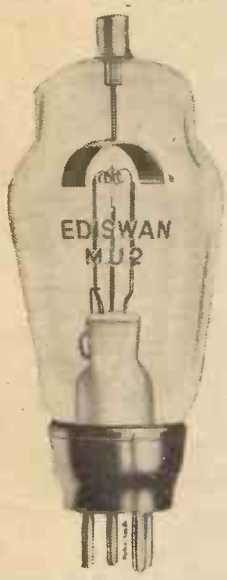
Without entering into the many technical considerations involved, the tests proved that in ambitious receivers of this type the calculated selectivity can be exaggerated, as the iron-cored units used for the tests were some of the most efficient made. It also proves that the design and adjustment of the I.F.T. units are of equal, if not greater, importance. The use of iron-cored coils would seem best confined to more simple tuning schemes and in receivers having a maximum of three tuned circuits.

Facts & Figures

COMPONENTS TESTED IN OUR LABORATORY

Ediswan Mercury-Vapour Rectifier

THE increasing use of high-voltage apparatus for television work, etc., has led the Ediswan Company to re-design the well-known ME.2 mercury vapour rectifier so as to withstand a maximum peak reverse voltage of 10,000. The anode is now brought to a metal cap at the top of the bulb, instead of being connected to the 4-pin base, and the accompanying illustration shows this point very clearly. The price has been raised slightly, and the rectifier now costs 17s. 6d., although a limited number of the older pattern valve (with the standard 4-pin base) will still be available for replacement purposes, etc., at the original price of 15s. The main characteristics of the new model are as follow :—



The Ediswan mercury-vapour rectifier.

Filament voltage ..	2.0 volts.
Filament current ..	1.0 amp. approx.
Maximum anode volts	4,000 (R.M.S.)
Maximum rectified current for simultaneous switching of anode and filament	25 mA.
Peak emission current	150 mA.

The makers are the Edison Swan Electric Company, Ltd., 155 Charing Cross Road, London, W.C.2.

Multi-contact Switch

A FURTHER model of the well-known multi-contact switch has now been produced by Messrs. Burne-Jones & Co., Ltd. We have already reported upon the general design of this type of switch, and have mentioned that it may be obtained in any desired combination, although the makers stock only a limited number of ranges. To the latter has been added the model shown on this page. Three contacts are provided, and the cams upon the operating rod have been so designed that the switch lends itself admirably to wave-change switching or similar purposes, where one contact has to remain closed during two different movements. Thus, in position one all three contacts are open : in position two all three are closed, and in the third position two are open and one is closed. There are, of course, many other applications of this switch, but the battery-user will find it admirably suited to the switching of filament circuits and wave-change operations. It may be obtained with either nickel-silver or gold-silver contacts, and is also obtainable in a special short-wave type. The price of the model illustrated is 2s. 6d.

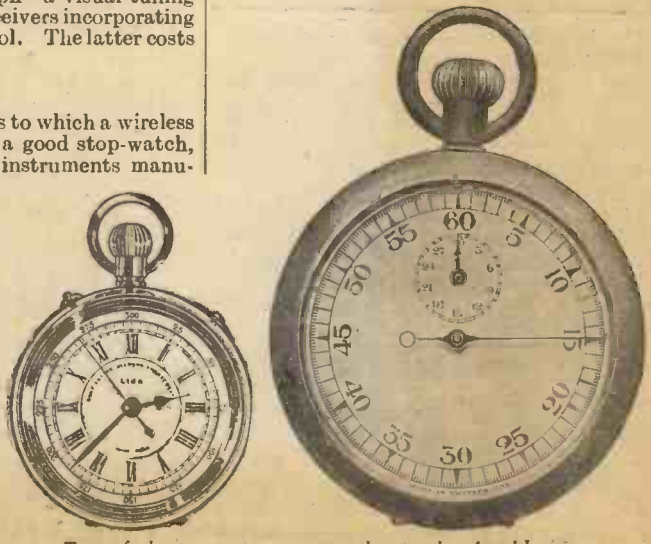
Brimar and Micromesh Valves (Change of Address)

WILL readers please note that the Sales Office originally at St. Chad's Place, 364, Gray's Inn Road, W.C.1, has now been transferred to Standard Telephones & Cables, Ltd., Valve Works, Foots Cray, Sidcup, Kent (telephone, Sidcup 960), to which all future inquiries regarding Brimar and Micromesh valves and Standard radio receivers should be sent ? Readers who are interested in the valves may obtain a copy of the interesting leaflet from the company in which all types are listed. There is a most comprehensive range, including battery and mains types, and also mercury vapour relays and the Tunograph—a visual-tuning indicator suitable for receivers incorporating automatic volume control. The latter costs 17s. 6d.


A new model of the Magnum multi-contact switch.

Stop-watches

THERE are many uses to which a wireless amateur may put a good stop-watch, and the range of such instruments manufactured by Messrs. Arnold & Co., of Clerkenwell, includes the two models shown on this page. The larger illustration shows an independent flyback stop-watch having a large seconds dial and a smaller dial graduated up to 30 minutes. This is guaranteed for three years and costs 25s. The smaller illustration shows a stop-watch and combined time-keeper, the seconds being engraved on the outer portion of the dial. It will be noted that this scale is marked in ⅕-second stages, and in all other respects it is of the same high-class mechanism as other Arnold ranges. This model costs 10s. 6d., and is also available in wrist-watch form complete with strap at 15s. The lever movement which is fitted is of the 30-hour type.



Two of the interesting stop-watches in the Arnold range.

New McMichael Superhet De Luxe

MCMICHAEL Radio, Limited, announce the immediate release of the new Model 135 Superhet de Luxe, the first of a range of instruments to be marketed during the 1935/6 radio season.

From the point of view of the average listener who is concerned chiefly with results and *not* with the methods by which they are obtained, the outstanding feature of Model 135 is undoubtedly the new giant dial, a complete breakaway from accepted methods, and the probable leader of an entirely new fashion in tuning scales.

The giant dial, occupying no less than half the total area of the control deck, incorporates separate and concentric scales for each waveband, the total length of the two being 22ins. ! The markings for station names and wavelengths are thus well spaced and so large—roughly three times bigger than usual—that, in conjunction with the giant dual pointer and overhead flood-lighting, they can be read without any difficulty at a distance of several feet. Skilful co-operation between cabinet designer and technician has enabled the whole assembly to be harmonised perfectly with the attractive modern exterior of the receiver.

In range and selectivity, Model 135 is all that could be desired, both for present and future conditions, its keen station separation, and efficient automatic volume control being shown to full advantage by the new dial. Quality of reproduction is, however, its second most outstanding feature ; the exclusive McMichael stereophonic reproduction principle, using two acoustically-balanced dynamic speakers mounted at the correct angle for uniform, non-focused sound distribution, is employed to decisive effect in this new model, and the resultant realism and balance of tone is definitely well ahead of anything in its class. Among the many technical refinements are such features as a tone control, constant gain couplings, latest multiple valves, extra speaker sockets, and control for inbuilt speaker, etc., etc. Cash price is 15gns. (for A.C. mains.)

AUTOMATIC GRID BIAS

In This Conclusion of the Article Published Last Week, the Question of Providing More Than One Bias Voltage is Explained

WHEN two fixed G.B. tappings are required in a set having two L.F. stages the connections are similar to those shown in Fig. 3 last week, with the exception that a pair of fixed resistances are wired in series, as shown for the "Hall-Mark Cadet" in Fig. 5, also in last week's issue.

In this case the G.B. voltage for the output valve is that developed across both R.1 and R.2, whilst that for the first L.F. valve is developed across R.1 only. The values assigned to the resistances and condensers in the circuit are those which are suitable for the receiver mentioned.

pages, but constructors should have little difficulty in applying the methods which have been described, and in modifying the connections shown to apply to other sets of similar types.

When the most suitable value of bias resistance is to be calculated, the experimenter is often in doubt as to what set of figures should be taken. It is generally found most satisfactory, however, to work on those which relate to the anode current and G.B. voltage at maximum anode voltage. Another method is to measure the anode current of the biased value when

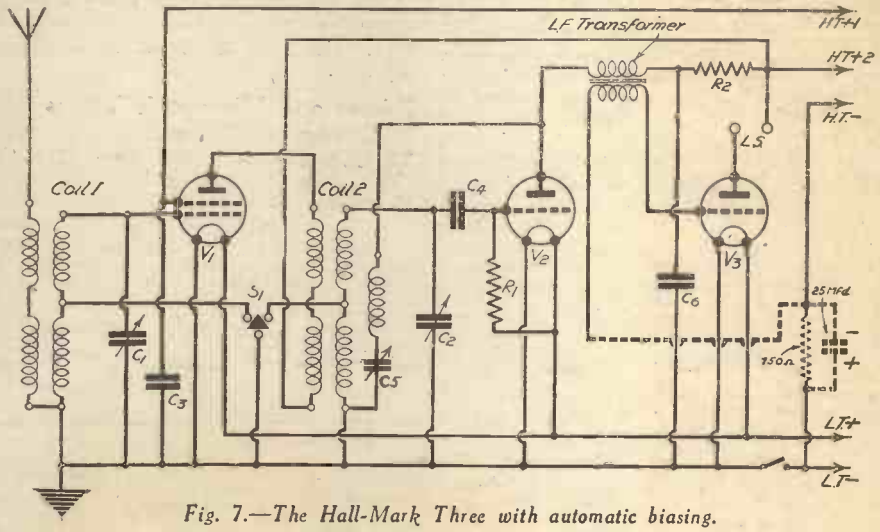


Fig. 7.—The Hall-Mark Three with automatic biasing.

With the idea of saving readers the trouble of calculating the values of components required for automatic bias in a few of the popular PRACTICAL AND AMATEUR WIRELESS receivers these are indicated in Figs. 6, 7, and 8, which are the circuits of the "Battery Hall-Mark Four," "Hall-Mark Three," and the "Atom Lightweight Portable." It would not be possible to deal individually with every battery receiver which has been described in these

using a G.B. battery and then to make the alterations for automatic bias, using a variable resistance adjusted until the anode current reading is the same as before.

The variable resistance may then be replaced by a fixed one equal in value to that of the variable component at the particular setting found by experiment. In any case the resistance is largely self-compensating and regulates the G.B. voltage according to the anode voltage.

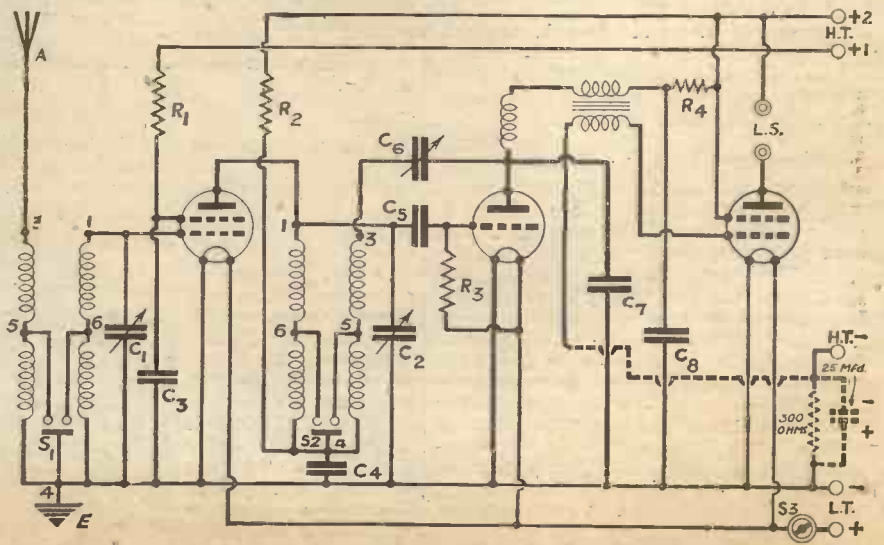


Fig. 8.—The above circuit shows, in broken lines, the modifications which must be made in adding automatic grid bias to the "Atom Lightweight Portable."

REPLIES IN BRIEF

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

R. E. H. B. (Gravesend). The only blue-print we have is for the Luxus Superhet. This is an A.C. mains receiver and employs the tuning pack in question.

W. St. C. J. (Sevenoaks). Any modern dual-range coil may be used. An iron-core coil is not warranted by this circuit. Side terminal referred to is the terminal on the side of the base of the four-pin type pentode. A five-pin valve could be used if desired. A equals IP, H.T. equals OP ; G equals OS, and GB equals IS.

A. W. M. (Copnor). We would recommend the Hall-Mark Four, Blue-print No. P.W.46.

H. G. (Godalming). Probably the coil is causing the trouble. You must expect some little loss in performance when you endeavour to cover so many wave-bands on a single coil. A pig-tail connection for the moving section of the condenser is indicated for short waves and will cure the crackling noises.

R. W. H. (Clitheroe). Aluminium blanks are used for the purpose, with a special cutting needle and microphone. Write to Messrs. Cairns & Morrison, 6, New Compton Street, London, W.C.2, and to Messrs. Muslkon, Lisle Street, London, W.C.2.

J. R. G. P. (Chesham). Your difficulties may be due to the particular detector valve, or to the aerial and earth system. Can you check these points ? Try alternative earths, and modifications in the length and arrangement of the aerial.

H. H. (E.10). Three of your valves—210 H.F., 210 H.F., and 220 P may be used in the Lucerne Straight Three, blue-print A.W. No. 437.

E. L. S. (Athlone). A Wearite Universal coil and any reliable make of 3 or 5-1 L.T. transformer may be used in the receiver in conjunction with a W.B. Bab- or Standard Stentorian speaker.

W. P. (Cape Town). Any further windings may b calculated on the same basis of the number of turns per volt. You would, of course, have to ascertain the voltage output which is required for the trickle charger in question, but the additional winding might be too large to include on the core specified. Thus you would have to completely re-design the unit. The 'phones should be sent to a firm who specialises in remagnetising, etc.

J. A. W. (Heckmondwike). Your diagram is quite correct. We note your remarks concerning theoretical diagrams and will see what we can do to help you.

B. S. (W.9). It is not practicable to run 2-volt filaments from A.C. supplies. You would need a metal rectifier as well as the winding in your transformer, and in addition very elaborate smoothing would be required as the slightest variation in filament supplies would give rise to hum. Why not get 4-volt valves of the indirectly-heated type ?

R. D. (Manchester). It would appear that some component has broken down, but we cannot identify it from your remarks. Stage by stage tests with a meter are necessary.

R. G. B. (Bickley). We regret there is no other circuit than the Lucerne 4 of the type you mention. We have noted your remaining remarks.

A. E. B. (S.W.17). Your scheme should function satisfactorily, but we can give no definite guarantee as we have not tried it.

F. L. (S.W.18). We are sorry that we cannot help you from the meagre information you supply. We should imagine that the reaction circuit is wrongly wired, but a circuit is necessary to enable us to state this with certainty.

B. S. (Bedlington). Any standard pentode will do. The extra pin is joined to the maximum H.T. tapping on your set, that is H.T.+3.

A. O. (N.W.7). The condenser value you give is much too high. Try .0001 or .000025 mfd. Band-pass input tuning should cure the trouble, or the aerial should be modified so as to run in a different direction. It is probably directional on the Brookmans Park transmitters.

H. B. (Nottingham). The only blue-print we have using the coil in question is the Premier Super, P.W. 30.

A. C. (E.11). Your H.T. may be nearly exhausted, and thus no grid-bias is required with the valve in question. Alternatively, the G.B. battery is exhausted and only the connection of the transformer to earth completes the circuit.

S. C. (Cirencester). We regret we cannot publish the transmitting circuit you ask for. You will appreciate that in inexperienced hands a great deal of interference might be caused, and unless you hold the transmitting licence you must not experiment with such apparatus.

T. H. P. (Birmingham). There is no other way out of your wave-trap difficulty. The optimum load is given by the manufacturers, but in the majority of cases may be taken as twice the A.C. resistance of the valve. It may be ascertained accurately by plotting the dynamic curves of the valve.

J. R. H. (Hillingdon). In the particular set referred to there would not be sufficient current to enable an energised speaker to be employed with success. The permanent-magnet type is to be preferred here.

E. T. L. (Welwyn). The nearest set we can suggest is the Car Radio Receiver published in our issue dated February 23rd last.

T. C. P. (W.8). We have no blue-print of a circuit of the type you refer to, and, as stated on our Queries and Enquiries page, we cannot supply complete diagrams to individual requirements.

LETTERS FROM READERS

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

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

A Four-valver Wanted

SIR,—I have been a reader of your wonderful publication since the amalgamation of *Amateur Wireless*, and frankly I think it is the best value on the market.

Several of your readers have lately expressed their desire to build a four-valver designed by you, and may I add my name to them. I would suggest the output valve to give 500 to 800 m.w. undistorted. I would prefer to build it on a flat baseboard.—EMLYN DAVIES (Swansea).

"Whom the Gods Wish to Destroy"

SIR,—With regard to the letter under this heading in the May 11th issue of PRACTICAL AND AMATEUR WIRELESS, I would like to say that H. C. E. (Reading) is still living in the year of 1888 and not with the young people of 1935. I think he would do well to tune in to the Chamber Concert, and smoke his pipe, or lie down and die.—F. V. USHAW (Liverpool).

Morse Code Practice Unit

SIR,—In reference to a wrinkle by J. Vivian, of Southgate, published in the April 6th issue of PRACTICAL AND AMATEUR WIRELESS and entitled a "Silent Morse Code Practice Unit," I have used a similar device for some time, but have found it very unsatisfactory unless a variable resistance is inserted in either the plus or minus L.T. lead, so as to vary the tone of the oscillations.—M. BURGESS, JUN. (Brighton).

Our Midget S.W. Two

SIR,—I have built your Midget S.W. two-valve set, described in the issue of PRACTICAL WIRELESS for September 15th, 1934. I have also constructed several S.W. experimental sets, but the Midget is the best two-valve one I have yet built. It may interest you to know I have logged Buenos Aires, CT1AA (Lisbon confirmed), WOO, U.S.A., W8XK, EHQ Madrid, and numerous amateur transmitters from various countries. The British amateurs come in consistently on the 40-m. band, and the German, French, and other European transmitters are very easily logged with only a short aerial; and with a small set like this one is assured of a good night's enjoyment on the short waves.

I may add that I have been trying an untuned H.F. stage on this set with Class B, and results have been wonderful.

I have just tried a short-wave converter which I built for a friend from a PRACTICAL WIRELESS circuit, and as the set employs three screen-grid valves, A.V.C., and Class B, you may imagine the results. Rome and several German transmitters were as loud and clear as our local broadcasting station.

May I add my vote for a bigger short-wave section in PRACTICAL AND AMATEUR WIRELESS. Wishing the paper every success.—W. W. LOTHIAN (Gordon).

The Beginner's Short-wave Verifications

SIR,—I built the "Beginner's Short-Waver," described in PRACTICAL AND AMATEUR WIRELESS dated March 16th, 1935, and have received several stations, including East Springfield, Mass., on 31.35 metres, and Boston, Mass., on 25.45 metres, besides many European stations.

I want to send away for verification, but do not understand the signal strength and audibility data, R1 to 9 and QSA1 to QSA5 respectively. I have read the article on "DX Reception Reports and Verifications," in a recent issue, and being a beginner at short waves I would be very much obliged if you would enlighten me on the subject.—J. COHEN (Brighton).

[*See article on page 273 of our issue dated May 18th, 1935.*—ED.]

Special H.T. Unit

SIR,—I have been a reader of your excellent journal since No. 1, but so far have not expressed to you my enjoyment of each Wednesday. I would like to endorse the suggestion of your correspondent, A. H. Oliver (Hitchin), who asks for a H.T. unit to be worked from a small accumulator. I have backing me on this suggestion three other readers with the same desire. Further to other correspondence you have received, I support the idea of more diagrams in *theory* and *less* pictorial, and feel that if you included more *theoretical* diagrams, you would urge the newcomer to learn the meaning of symbols.—J. H. CLARK (Lowestoft).

This "Jazz" Business

SIR,—I should like very much to express my disagreement with "H. C. E." of Reading, who "deplores the time given to jazz and its accompanying maddening crooning." First of all, true "jazz" as distinct from the popular "dance music," is very rarely played in this country owing to lack of instrumentalists skilful enough to play it, although there is a tremendous number of "jazz" fans, as proved by the sales of several publications which deal entirely with this subject. Secondly, true "jazz" is never accompanied by crooning or other singing, or at least it should not be, as it is intended solely for instrumentalists. And lastly, as for the friend who calls jazz "idiotic, cacophonous, tuneless tripe," he is typical of the narrow-minded people who cannot appreciate anything more complicated than a simple melody which can merely be heard as a musical background for conversation or something else. He does not really listen to jazz, for if he did, and knew the slightest thing about the instruments used, he would realise the amazing skill of the instrumentalists who play it.—G. BONELL (West Bromwich).

[*Surely listeners are intended to be entertained by the music. The latter is not meant to provide an exhibition of instrumental acrobatics, otherwise it should be included among the flying trapeze and similar silent acts. The instruments are the means to an end, not the end itself. Acrobatics on the violin, saxophone and piano are quite unnecessary to the production of music. Noise is not music—and jazz, according to most of our correspondents, is noise! There can be little doubt, however, that many people like the particular form of noise known as jazz.*—ED.]

A Peculiar Mains Problem

DEAR "THERMION,"—I was very interested in the point you raised recently re a "Peculiar Mains Point," as I have recently had a similar experience, although not with a plug and socket, but with a fixed condenser.

The condenser in question was a 1 mfd. with top terminals, and a moulded bakelite container. This condenser had been working quite satisfactorily for a month or two, when one day a relative switched on the radio and said there was an explosion in the set.

On investigating, I realised at once that something was amiss as the set was as dead as the proverbial dodo. So I pulled out the back of the cabinet and soon realised that an explosion had actually taken place, as the condenser previously mentioned had been blown to bits, and only the foil was left hanging on the connecting wires. The force of the "explosion" must have been pretty severe as fragments of bakelite were scattered over an area of about 2 sq. ft. Incidentally, this condenser was working well within the makers' working voltage.

The conclusion I formed was the same as yours, although I thought the presence of the gas in my case was due to the bitumen which is used to seal the condenser.

I was rather interested to see if the makers could supply a better theory than the one I had formed, so I sent the condenser and its fragments to the makers and asked them if they could account for the explosion, and the only satisfaction I received was a new condenser. I have been a reader of your articles for several years now, and always look forward to your weekly article.—G. W. SYMONDS (West Hamstead).

Flat Baseboard *v.* Chassis

SIR,—I think the letter by Mr. J. B. Raffo in your issue of May 18th has explained the difficulties relating to the above matter in a very able manner, and I thoroughly agree with his remarks.

I hope that you will soon be able to publish a design such as he mentions, as I too am keenly interested.—G. F. GARNER (Norwich).

CUT THIS OUT EACH WEEK.

Do you know

—THAT a Class B driver transformer should not be used to feed a Q.P.P. stage.
—THAT a Class B output choke or transformer may be used in a Q.P.P. stage.
—THAT ordinary push-pull input transformers are not suitable for either of the above-mentioned systems.
—THAT loops of wire for attachment to terminals should always be made in the opposite direction to that of rotation of the nut.
—THAT a very firm connection to a terminal shank may be made by drilling down the end of the shank and soldering the wire inside.
—THAT the above method of connection is to be preferred to a right-angle joint.
—THAT it is possible to receive long distance stations twice—once by the direct ray and once by the reflected ray or the signal which has once traversed the globe.
—THAT proof of the above is obtained in television reception where the second signal is seen as an image superimposed on the original.

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

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

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY.

THE first "shots" of the Anglo-American Radio and Television Society film "Relaxation" were taken at the last meeting of the West Middlesex and East Buckinghamshire Branch. Members present were filmed examining a surveyor's map of Buckinghamshire. Further "shots" will be taken at the Society's picnic on Stoke Common.

Mr. Lawson (of Wembley) displayed his 5-metre receiver to members, whilst numerous stations were tuned in on it.

The Hayes Research Station of the Anglo-American Radio and Television Society will shortly be opened for inspection by members. Cathode-ray apparatus, etc., will be shown. Further particulars may be obtained from Mr. Leslie W. Orton, "Kingsthorpe," Willowbank, Uxbridge.

SOCIETY OF WIRELESS PIONEERS

WILL readers note that Mr. A. Geoffrey Cutts, B.Sc., of 75, Broomhall Street, Sheffield, 3, becomes the publicity manager in succession to the undersigned, and that all correspondence should be sent to him at the address given.

Recent events include the decision to discontinue the bulletin "Random Jottings" in favour of the famous International magazine, *Radio News*, edited by members Taylor and Laurence Cockaday, whose June number carries the first S.W.P. section.

Radio News is obtainable from 461, Eighth Avenue, New York City, N.Y., U.S.A., or from any branch of Messrs. W. H. Smith and Son, Ltd., on approximately the first of each month.

Reports are requested on the code transmissions of the headquarters station W9QJ, 7,100 kc/s, and will be acknowledged by card; address to 2223 East 25th Street, Minneapolis, Minn., U.S.A.; also on W9CRW, W9BHD and W9DXX. In connection with the Silver Jubilee celebrations it is of interest to note that we successfully broadcast respectful greetings to H.M. The King over W9QJ on the morning of May 4th, which were received and relayed to Buckingham Palace by registered mail by member Henry Lassman, G2PX.—Richard L. Rawles, Blackwater Corner, Newport, Isle of Wight.

BOOKS RECEIVED

"B.B.C. ANNUAL, 1935."

IN place of the usual Year Book the B.B.C. have produced "The B.B.C. Annual, 1935." The preface explains that the non-publication of the Year Book last Autumn was due to the fact that it was desired "to present listeners with an integrated picture of the B.B.C.'s activities as a whole instead of, as formerly, a number of vignettes."

The first section of the new "B.B.C. Annual, 1935," contains a "Five-Year Review of Broadcasting," which gives over a substantial period through a classified record an idea of the fields covered and so, by inference, of the Corporation's programme policy. This review is compiled in the usual programme divisions such as music, public speeches, sport, talks, religion, etc. Following this is a brief section, dealing with the Christmas messages, which are reproduced *in extenso*, of His Majesty the King in 1933 and 1934. Then comes an important division called "The Home Service in 1934," which is sub-divided into a variety of headings which should be particularly useful to the student of broadcasting in general. The section opens with programme policy, and ranges through the various programme divisions. It also includes engineering and interesting sections dealt with from an official angle, and these are as follows:—Public Relations, Foreign Relations, Licences and Population, Balance Sheets and Revenue Accounts. The whole division is useful as a comprehensive survey of the activities of the Corporation during 1934. A similar division deals with the Empire Service.

For listeners with a flair for statistics special interest will be attracted by a coloured double sheet giving the percentage allocation of time to the various programme classes in fifteen European countries.

This chart is included in a new feature called "The Forum" which did not appear in the Year Book.

Interspersed through the book, chiefly in the section entitled "Chronicle of Programme Events," are thirty-three illustrations and the Annual runs to 192 pages. It is issued in crown quarto with a blue canvas cover and is priced at 2s. 6d. net, or 3s. 0d. by post.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

Queries and Enquiries

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

SPECIAL NOTE

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

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

Please note also, that queries must be limited to two per reader, and all sketches and drawings which are sent to us should bear the name and address of the sender.

A D.C. Mystery Explained

"While changing the L.T. cell in my set, which is run from an eliminator from D.C. mains, my earth made contact with the H.T.3 terminal, which is the highest voltage terminal on the unit. Instantly the set burst forth into full volume, although it was switched off from the mains (the L.T. was on). As this seems a rather unusual thing I would be very grateful if you could give me some explanation, as the set seems to run normally as regards reception and quality."—W. W. N. (Old Ford).

We think the solution to your mystery is to be found in the fact that your positive mains lead is earthed. The H.T. negative lead would normally be joined to the L.T. negative lead, and as the L.T. switch was in the "on" position the negative H.T. would be in circuit. When the earth lead touched the H.T.3 terminal it was equivalent to connecting the other (positive) side of the mains to the set, and thus you applied the full mains voltage to the set, and consequently it worked. Presumably you did not leave it for long, as it is now working normally; it is probable that had you done so one or more components would have been damaged by the excess H.T. voltage. (We presume it is a battery receiver designed for a maximum of 150 volts.)

Box Baffle

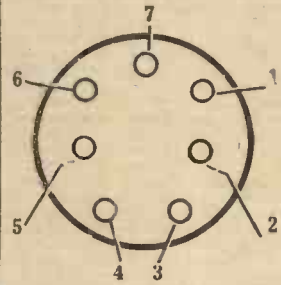
"I am building a box baffle, which I want to do as cheaply as possible. As regard the packing, I have read of various materials but do not know from whence to get them. The cabinet I have constructed would, in all probability, normally have a definite resonance. Will this affect the efficiency of the baffle in any way or will the padding cure the resonance?"—J. B. W. (Littleborough).

The idea of the packing is to prevent the resonance, which only arises when the air inside the cabinet, as well as the entire cabinet material itself, is set into vibration by the sound waves from the loud-speaker. Consequently, if you pack the inside of the cabinet the air will be prevented from vibrating, and thus the cabinet material will also be isolated and no resonance should be obtained. Obviously, the speaker must not be attached direct to the front of the baffle, but should be mounted on some kind of support in a rigid manner. Kapok will prove ideal for stuffing.

Valve Connections

"Would you please advise me as to which pins go to the grids, screens, and anodes of the following valves: Pentode, S.G., H.F. pentode, double-diode-triode, rectifier?"—P. F. T. (West Lavington).

The attached sketch shows a valve-holder of the 7-pin type. In the case of the I.H. Double Diode Triode, terminal No. 1 is the anode; terminal No. 2 is the cathode; terminals Nos. 3 and 4 are the heaters; terminal No. 5 is one diode; terminal No. 6 is connected to the metal coating of the metallised type of valve; and terminal No. 7 is the remaining diode. In a rectifier the filament or heaters are joined to the normal filament terminals, and the anodes to the normal grid and anode pins. The pentode is wired as an ordinary 4-pin L.F. valve, with the extra grid connection taken to a centre pin or a side terminal. The S.G. and H.F. pentode are wired similarly (except in the case of a 7-pin pentode), with the anode taken to the top cap of the valve, and the screening grid taken to the normal anode terminal. Connections for these valves, as well as many others, were shown in our issue dated March 30th, page 36.



A 7-pin valve-holder, numbered to assist in identifying connections.

Tone Control

"I wish to fit to my set some form of control so that I can vary the output from deep to high. I realise that it is quite possible to fit potentiometers and suchlike to the output or L.F. stages, but I am not mathematical and cannot work out the values for various frequencies. Is there no simpler way by which a single control could be fitted to give complete control over the entire range?"—R. T. (Eastnor).

We think the simplest scheme for you is to fit a Multitone special tone control transformer in place of one of your L.F. transformers, with that firm's special potentiometer used in conjunction with it. An alternative is to use a Bulgin Controlatone across the speaker or output circuit.

Varying Meter Readings

"I am making a meter to give voltage, current, and resistance readings, and I understand how to work out the required extra resistances, etc., for varying the reading. There is just one point about which I am not clear, and that concerns the method of connecting the resistances. Do those for reading volts go in series or parallel with the meter?—R. Y. (Bradford).

For voltage readings using the milli-ammeter in question, the extra resistances must be joined in series with the meter, and for current readings the resistances must be in parallel with the meter.

The coupon on page iii of cover must be attached to every query.

Miscellaneous Advertisements

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

PEARL & PEARL,

190, Bishopsgate, London, E.C.2. All the following Bargains guaranteed new goods. Cash or C.O.D. Carriage Paid in British Isles.

SPECIAL OFFER. Burgoyne Receivers. 3-Valve Class B Models. Complete with Mullard valves; Exide H.T. and L.T. batteries. M/c speaker. Artistic cabinet of highly polished walnut. Chromium fittings. Brand new in original cartons; 1935 Model. List £6/10/0. Cash £3/18/6, or 14/- down and 10 monthly payments of 7/-.

ATLAS ELIMINATORS. Guaranteed 12 months. Model C.A.25 for A.C. mains. 5 tappings. Westinghouse rectifier. List 59/6. Yours for 7/- down; balance in 10 monthly payments of 5/3.

FREE. Our June bargain list "N."

All Mail Orders direct to

PEARL & PEARL,

190, Bishopsgate, London, E.C.2.

Telephone: Bishopsgate 1212.

RADIO CLEARANCE, 280, High Holborn, W.C.1. Telephone: Holborn 4631.

RADIO CLEARANCE announce the issue of their Grand Jubilee Illustrated Bargain List containing hundreds of special Bargains. Release date, May 30th. Send 3d. to cover cost and postage.

RADIO CLEARANCE announce the purchase of a limited quantity of Dorchester 5 Valve Superhet Sets A.C. 200/250 Volts, Fluid Light Tuning A.V.C., employing Mullard F.C.4, S.P.4, S.P.4, PEN4VA and I.W.4, complete in beautiful Walnut Cabinet.

£7/19/6.

RADIO CLEARANCE announce a further purchase of Plessey 7 Valve A.C. Superhet Chassis, Mullard Valves, delayed A.V.C., suitable for use with Energised Moving Coil Speaker 2,500 ohms. Chassis complete with Valves less Speaker.

£7/10/0.

RADIO CLEARANCE. Palliard A.C. Gramophone Motors 200/250 volts, complete with Unit Plate, 12in. Turntable.

27/6.

RADIO CLEARANCE. Utility 3-Gang Midget Type Superhet Condenser with 110 k/c Section. Also 3-Gang Straight. Brand new, boxed.

Without Dial, 5/11. With Dial, 7/6.

RADIO CLEARANCE. H.T.8 Mains Transformers, fully shrouded, output 250 volts, 60 m.a. 4 volt 4 amp centre tapped.

6/- With Westinghouse Metal Rectifier, 14/6.

RADIO CLEARANCE.—280, High Holborn, W.C.1. Telephone: Holborn 4631.

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

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

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

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

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

CLARION VALVES.—All brand new; battery types, 2-volt, HF.2, LF.2, LP.2, 1/9. Super power, PP.2, 2/6; screens and pentodes, 3/9; A.C. Mains, 4-volt, 1 amp., general purpose, 3/3; power, 4/-; screens and pentodes, 4/6; full wave rectifiers, 3/6; postage paid, cash with order, or C.O.D. over 10/-. Clarion Valves, Dept. 2, 885, Tyburn Road, Erdington, Birmingham.

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

BANKRUPT BARGAINS. List free. Following all new complete 1935 receivers: Drummer 5v. 14 gn. superhets, £7; Lampex 4v. 8 gn. A.C., 90/-; Lotus 4v. Universal, £5; Burgoyne Class B 3v. batteries, valves, M.C., 65/-; Vidor 8 gn, Universal, £5/17/6; 1934 2v. Lissen D.C. sets, 45/-; 1935 Sunbeam Superhet 8gn. model, £5. M.C. Speakers: Celestion Soundex, 10/6; PPM/W., 16/6; Lotus, 12/6; Rola 6500 field, 15/-. Eliminators: Regentone 30ma. A.C., 30/-, or 20 ma. with charger, 37/6; Telsen 28ma. with I.T. 4v., 27/6. I have all the smaller parts. Write for quotes.—Butlin, 143B, Preston Road, Brighton.

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

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

VAUXHALL. New Lists just issued, 3,000 bargains. New goods. Limited number available free.

VAUXHALL. Immediate delivery of all goods advertised in previous issues.

VAUXHALL-UTILITIES, 163a, Strand, London, W.C.2. Over Dennys the Booksellers, Temple Bar 9338.

WOBURN Radio offer following Goods:—

ELECTRIC SOLDERING IRONS: 200/250v., copper bit, complete with flex and adaptor, 1/11, post 6d. Immediate delivery.

SHORT-WAVE CONDENSERS: Air-spaced, 0001, 00015, 00016, 0002, 00025, 2/-, with slow-motion dial, 3/-. Popular iron-cored canned coils, dual range, boxed with instructions, 2/6. Dubilier and Erie resistances, all values, 6d. Truwind wire-wound colour coded all values to 50,000 ohms, 3½d. Western Electric Microphones, 2/3. Transformer for same ratio, 100/1, 2/3. Rothermel Speakers, 7" cone, power and pentode transformer, new and boxed, listed 30/6, 17/6.

TRADE LIST NOW READY. Send stamp and trade letter heading.

WOBURN RADIO CO., 9, Sandland Street, W.C.1. Holborn 7289.

SILVER SOUVENIR.—Complete Specified Kit. No alternatives. 79/6 cash. Host of other bargains. Kits, Accessories, etc. Lowest prices always.—Write now for free lists, Melfo-Rad, Queen's Place, Hove. (Trade Supplied.)

BIRMINGHAM RADIOMART,

SPECIALISTS IN SHORT-WAVE AND QUALITY COMPONENTS AT LOWEST PRICES.

Our stock is much too large to itemise here: From a soldering tag to a superhet we can supply everything, and what is more you won't be "Caught"! Send 1½d. stamp for our latest **CATALOGUE.** No firm has larger stocks or is cheaper than

THE SQUARE DEALERS,

BIRMINGHAM RADIOMART,

19, John Bright Street, Birmingham.

FREE ADVICE BUREAU

COUPON

This coupon is available until June 15, 1935, and must be attached to all letters containing queries.

PRACTICAL AND AMATEUR WIRELESS, 8/6/35.

ADVERTISEMENT INDEX

SOUTHERN RADIO'S WIRELESS BARGAINS. Every Article Guaranteed New, Perfect and Sent Post Paid.

RECEIVERS, TELSEN RADIOGRAMS. Model 3550/R.G.A. Latest 1935 6 Valves, Superhet, A.C. This receiver embodies the very latest in Radio. Complete with 6 Valves, Mains Energised Speaker, contained in exquisite cabinet with GARRARD ELECTRIC RECORD CHANGER. In Original Sealed Cases, £18/10/0. (List 32 Guineas.)

TELSEN THREE-VALVE BATTERY SETS. Model S93. Complete with 3 Mazda Valves, in attractive bakelite cabinet, 30/-. (List, 75/-.)

BURGOYNE CLASS "B" THREE-VALVE SETS. —Complete with 3 Mullard Valves, Exide Batteries, and Accumulator. Magnavox Moving Coil Speaker. In magnificent cabinet, finished in chromium, £3/9/6.

SPEAKERS, BLUE SPOT PERMANENT MAGNET SPEAKERS, WITH UNIVERSAL TRANSFORMERS TO SUIT ANY CIRCUIT.—1935 Series, 99 P.M., 24/6. 45 P.M., 20/-. Celestion P.P.M.W., 16/6. Celestion Soundex, 11/-. All in sealed Cartons.

ELIMINATORS. REGENTONE 1935 Series New and Boxed for A.C. Mains 200/250 Volts, TYPE W.5a Complete with Trickle Charger, 39/6. Type W1a (less Trickle Charger), to carry 30 Milliamps, 33/-. W1C (less Trickle Charger), 30/-.

LOTUS 0.0005 Condensers, Fully Screened, with Trimmers. Complete with Escutcheons, Dials, Knobs. 3-Gang, 11/-. 2-Gang, 7/3.

COILS.—Igranic Superhet 4-Coil set (1 osc., 2 I.F. with pigtails, and 1 L.F. plain), 9/- per set (List 50/-). Varley Constant Square Peak Coils B.P.5, with all accessories, 2/3. Telsen Twin-matched Coils: Type W.287, screened, with switch, 7/9 (List 17/-). Triple-matched Screened Type W.288, with switch, 10/9. Telsen Twin Coil Unit, Type W.478, 12/6. All Brand New and Boxed.

MISCELLANEOUS. — Lewcos Spaghetti Resistances, all capacities, new and boxed, 1/6 per dozen assorted. Telsen Binocular H.F. Chokes, 2/-. Telsen ACE L.F. Transformers, 3-1 and 5-1, 2/9.

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A GEORGE NEWNES Publication

Vol. 6. No. 143. June 15th, 1935.

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ADDING VISUAL TUNING TO P. & A.W. RECEIVERS

SEE PAGE 373

Practical and Amateur Wireless

Edited by F. J. CAMM

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

VOL. VI. No. 143. June 15th, 1935.

ROUND *the* WORLD *of* WIRELESS

Relay of Java Broadcasts

A.V.R.O., the leading Dutch radio organisation, is planning to broadcast, through the Kootwijk or Huizen transmitters, relays of special programmes from the Dutch East Indies. These entertainments would be re-transmitted through one of the Bandoeng short-wave stations to Holland.

Another Fire Brigade Radio

WHEN an outbreak of fire takes place in Copenhagen, the first motor pump to appear on the scene is accompanied by a special radio car. By this means constant touch is maintained with headquarters, and further assistance can be immediately obtained.

WLW, Cincinnati, Reduces its Power

THE Crosley, Cincinnati, 500-kilowatt radio station has been compelled to cut down its power to 50 kilowatts during the evening hours, in view of its interference with a Toronto transmitter. This has aroused much criticism in the United States, inasmuch as, barring Moscow, Cincinnati possessed the largest transmitter in the world.

Is a Taxi a Radio Station?

TAXI drivers in Paris who have installed radio receivers have been notified that a special licence is required. The tax fixed for receivers used in this manner is double that charged to the householder. It is computed that no less than 5,000 taxicabs in the French capital are equipped with radio sets.

Toulouse-Pyrenees Shortly Testing

THE new 120-kilowatt transmitter which the French P.T.T. has erected at Muret, some sixteen miles south of Toulouse, is now ready to be tried out. It has been equipped, in the last stage, with the first 250-kilowatt water-cooled valves to be used in France. The channel allocated to this station is the one at present in use by the 1.5 kilowatt P.T.T., transmitter, namely, 386.6 metres (776 kilocycles).

Reichssender Heilsberg 100 Kilowatts

THE Heilsberg transmitter which broadcasts the Koenigsberg radio programmes is in course of reconstruction, and will take over its duties as a 100-kilowatt transmitter in July next.

A Mysterious Opening and Interval Signal

A NOISE which has often puzzled listeners on long waves is the peculiar rough and harsh buzz or hoot which precedes the commercial broadcasts of the Dutch Scheveningen-Haven station on 1,205 metres (249 kc/s). It is, as a matter of fact, produced by an oscillating valve. At other times during the day a gong is heard, giving a time signal, namely, Amsterdam Summer Time, which is twenty minutes in advance of British Summer Time.

High-power Station for New Zealand

THE New Zealand Broadcasting Company has intimated its intention to construct a 60-kilowatt transmitter to replace station 2YA, at present in operation at Wellington. So far, the biggest transmitter is rated at 10 kilowatts.

Ultra-short Waves for Post Office Telephones

FOR linking England and Wales to Ireland, Channel Islands, and the Isle of Wight, the Post Office has erected ultra-short-wave transmitters at Ballygo-Martin, Portpatrick, Shaftesbury, and Guernsey. These work on various channels between 4.167 metres (72,000 kc/s) and 8 metres (37,500 kc/s). In addition, for communication with Northern Ireland, a new multiplex telephone link is to be installed near Stranraer, with its opposite number at Belfast. The improved system permits the simultaneous transmission of several messages on one wavelength.

Railway Radio First—Then "Movies"

THE first of its kind in the world is the special cinema van which has now been attached, for the convenience of travellers to Leeds, to the daily 10.10 a.m. express from King's Cross. The L.N.E.R. is certainly making railway travel more attractive and agreeable.

How to Quash Adverse Radio Propaganda

A NEW law has been passed in Austria by which the police are empowered to start criminal proceedings against an owner of a wireless set who allows foreign propaganda adverse to Austria to be heard by a third party. In an endeavour to discourage listeners from tuning in these broadcasts the authorities are imposing fines up to the equivalent of £100—or, alternately, three months in the local gaol!

Italian Radio Forges Ahead

ALTHOUGH Italy already possesses an extensive broadcasting network, considerable extensions are being made with a view to the development of the service. The new 50-kilowatt Radio Marconi transmitter at Bologna, as well as the new 10-kilowatt Bolzano station, are to be formally opened on October 28th next. Work is being hurried forward on the reconstruction of Santa Palomba, or Rome 1 (420.8 metres), which by the end of this year will operate as a 120 kilowatter. It is to be so built, however, that its power may be increased considerably at short notice. Rome (2), at present working on 1 kilowatt, will also be a replica of Rome (1). In addition, Turin (2) is to be raised to 1 kilowatt and will work jointly with Trieste on 245.5 metres (1,222 kc/s).

Columbia's Latest Acquisition

WJR, Detroit (Mich.), hitherto one of the N.B.C. Blue Network transmitters relaying the WJZ programmes on 399.8 metres (750 kc/s), has passed over to the Columbia Broadcasting System, and in future will take the WABC, Wayne (New Jersey) radio entertainments.

ROUND the WORLD of WIRELESS (Continued)

Two Martyn C. Webster Plays

TWO plays—one tense and the other slight but subtle—will be produced by Martyn C. Webster in the Midland programme on June 12th. Both concern young married couples. The first, "Crash," by Frank Cromwell, is concerned with the reactions of a wealthy husband and wife to financial disaster; while Francis Durbridge's "Gay Interlude" hangs on the differences that arise from one wanting to spend the evening at home and the other having accepted a joint invitation to a dance. Stuart Vinden and Elspeth March (of the Birmingham Repertory Theatre Company) play the leading parts in "Crash," Gerald Martin and Vera Ashe in "Gay Interlude."

Slavonic Festival Mass

THE last of the Contemporary Concerts of this season will comprise the Slavonic Festival Mass by the "Grand Old Man" of Czecho-Slovakia, Leós Janacek, conducted by Sir Henry Wood, whose constant and active interest in the best contemporary music of all countries has long been one of the greatest assets to British music. The concert will be given on June 28th. An English translation of the Mass has been made by Mrs. Rosa Newmarch, and the principal singers will be Laelia Finneberg and Walter Widdop, who is about to return from a prolonged Australian opera tour. Boyd Neel has so far appeared before the microphone only with his own String Orchestra, which he has trained to a point of admirable perfection and virtuosity. On June 20th he will appear as conductor of Section E of the B.B.C. Orchestra. It will be interesting to hear what this gifted young conductor can accomplish with another orchestra.

Another Trip to the Stratosphere

AMERICA plans to make a further attempt in early June to secure the blue riband of the stratosphere. The ascent is to be organised by the National Geographic Society in co-operation with the U.S. Army Air Corps and the National Broadcasting Company. The pilots, Captain Albert W. Stevens and Orville A. Anderson, will give a running commentary of their experiences during the flight; this broadcast, transmitted over a short-wave channel, will be relayed to all stations of the N.B.C. Network and may possibly be taken by European stations.

Radio Broadcasting in U.S.S.R.

ACCORDING to official statements made at a recent meeting of the Soviet presidents of the local radio committees, Russia now possesses sixty-six broadcasting stations which transmit programmes in sixty-two different languages or dialects. It is estimated that the number of listeners exceeds twenty million. Moscow alone broadcast in 1934 over 40,000 musical compositions, which included 4,000 folk songs and melodies regularly played by the twenty-nine different nationalities which make up the population.

INTERESTING and TOPICAL PARAGRAPHS

Symphony Concert from Birmingham

ON June 21st Dr. Adrian Boult, Director of Music of the B.B.C., will conduct the B.B.C. Midland Orchestra's Friday afternoon Symphony concert. The programme includes Mozart's Jupiter Symphony and Arnold Foster's Concerto on English Folk Tunes, with Michael Mullinar as the pianist.

A CRITICAL LISTENER

The popular band leader and radio artist, Mantovani, listening in to his new Cossor mains receiver.

R.A.F. Display Broadcast

THE sixteenth annual display of the Royal Air Force at Hendon Aerodrome takes place on June 29th. The running commentary broadcast to listeners on previous occasions by Squadron-Leader W. Helmore aroused great interest, and this officer will again be heard at the microphone this year. The principal points from this year's broadcast will be: Aerial Skittles; Air Drill; and Low-Flying Attack.

"Looking to the Air"

LORD WILLOUGHBY DE BROKE, who is a very keen amateur aviator, and has his own aerodrome at Kineton, gives the next talk in the "Looking to the Air" series for Midland listeners. On June 17th he is to speak on "The Private Owner." Lord Willoughby de Broke is Joint Master of the Warwickshire Foxhounds.

Midland Chamber Concert

THE fifth of the Midland Chamber Concerts to be broadcast on June 20th is given up to a programme by Sir Granville Bantock. Elsa Tookey, 'cello, and Winifred Cockerill, harp, play "Hamabdil" and "Pibroch." Lena Wood, viola, and Margaret Ablethorpe, pianoforte, give the Sonata in F, and Emily Broughton, soprano, sings five songs from the Chinese.

Railway Feature Programme

AN interesting programme will be relayed from a signal cabin near the Central Station of the L.M.S., Glasgow, on June 14th. Listeners will be given some idea of how incoming and outgoing trains are controlled and will hear characteristic engine and train noises.

Midland Orchestral Concert

THE Birmingham Philharmonic String Orchestra have an interesting programme for their concert in the Midland studio on June 18th. Harriet Cohen, their pianist, has arranged the Charterhouse Suite, which Dr. Vaughan Williams wrote as a tribute to his old school, and plays this with the Orchestra. Then there is the first broadcast performance of "Saga Fragment," by Arnold Bax; another unpublished work which will be heard is a Scherzo by J. D. Davies, the Birmingham composer.

"Argyle Follies"

PART of a revue, presented by the "Argyle Follies," will be relayed from the Argyle Theatre, Birkenhead, on June 13th. The cast includes James Hunter, Jack Stanford, Clarice Clair, Daisy Dale, Frank Davison, Norma Meadows, and the Argyle Follies Girls.

Canterbury Music Festival

ON June 18th and 19th listeners will once again hear part of the famous Canterbury Festival of Music and Drama, relayed from the Cathedral. Dr. Boult will conduct the orchestra and choir on June 19th, the former consisting of about eighty members of the B.B.C. Symphony Orchestra.

SOLVE THIS!

PROBLEM No. 143.

After building the battery Hall-Mark Four, Brown was not very satisfied with the volume. He thought the push-pull stage should deliver much greater signal strength than he was obtaining, and wondered whether the valves were faulty. He removed one of the push-pull valves and immediately volume increased slightly, although slight distortion was present. He therefore assumed that the valve he had removed was faulty, and sent it back to the makers. It was returned marked "O.K." Where had Brown gone wrong? Three books will be awarded for the first three correct solutions opened. Envelopes should be addressed to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 143 in the bottom left-hand corner, and should be posted to reach here not later than the first post Monday, June 17th, 1935.

Solution to Problem No. 142.

When Robertson had dismantled his chassis he had broken the metallic connection between the base and the side runners. Consequently, on re-assembling there was no electrical continuity between these parts, and thus the earth return leads on the side runners were not effective.

The following three readers successfully solved Problem No. 141, and books are accordingly being forwarded to them: W. Allwright, 115, Hanley Road, Stroud Green, N.4; D. H. Lawes, 294, Worting Road, Basingstoke, Hants; G. W. Huckstepp, 14, Selwyn Road, Walton-on-Thames, Surrey.

PARAPHASE AMPLIFIERS

High-quality Reproduction may be Obtained by Certain Push-pull Schemes, as Shown in this Article

By G. V. COLLE

THE paraphase system of L.F. amplification is one which provides push-pull effects by resistance coupling instead of the usual transformers. So far as the writer is aware, the system is due to R. E. H. Carpenter (Patent No. 325,833), although F. Aughtie is also believed to have read a paper on the same subject in June, 1929, when the details first appeared. Official technical recognition of paraphase amplification was made public in June, 1930, when a receiver setting a new high-standard of reproduction and incorporating

Fig. 1.—An illustration of the actual receiver built by the author.

A Practical Circuit

This feature allows for good bass or sustained note reproduction, as the voltage supply is not "modulated." In 1932 the writer, wishing to personally judge the merits of paraphase amplification, built a small edition of the Science Museum receiver. (Fig. 1). The set incorporated push-pull power-grid detectors, and six L.F. valves (three in each "arm"), the output valves being LS6a's. A neutralised A.C. pentode (PM26) valve was used for the H.F. stage and a G.U.I. half-wave mercury-vapour rectifier for the H.T. 400-volt 200 m/a supply. This receiver did undoubtedly demonstrate to all who heard it that paraphase amplification was capable of distortionless reproduction with less harmonic distortion than other L.F. systems. The results from this receiver as regards volume intensity (the output was 12 watts) clearly demonstrated that more economical valves having smaller outputs, could usefully be employed for home reception.

Under modern methods of estimating the quantitative outputs of receivers, it is now known that a six-watt output is more than ample for the largest room, and, indeed, sufficient for small halls for dancing, etc. In consequence the L.F. system may be arranged to work into two output valves, such as PX4's, PP3/250's, etc. As a matter of interest, the latter valves, in a four-stage paraphase amplifier, are employed as standard by a leading radiogram manufacturer. Many alternative circuit arrangements are possible for the first two valves in the paraphase chain, and Fig. 2 illustrates the system which offers no difficulties in the way of utilising standard components.

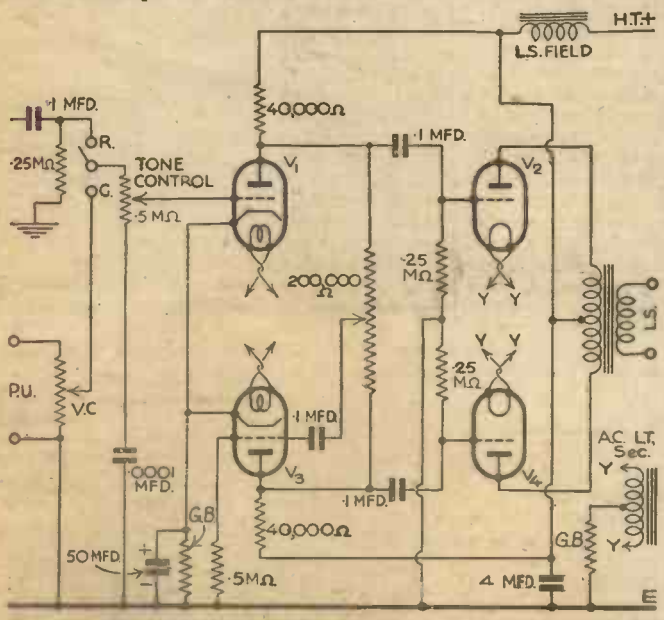

Fig. 2.—A simple circuit employing paraphase amplification.

An Alternative Arrangement

The plate-to-plate connections shown were originally adopted for the Science Museum receiver, but it is possible to use even a more simple arrangement, as in Fig. 3, whereby no current is passed through the potentiometer so as to allow for the use of the carbon type which is cheap and readily available. It will be noticed that the paraphase system does not necessitate a driver valve as in Q.P.P. and Class B circuits although, on the other hand, it is imperative that separate valves be provided for each stage. The minimum number of valves that can be employed is four, but with modern versions the amplification available is considerable. Those who are familiar with normal L.F. amplifiers will find no difficulty in following the operation of the first stage, comprising the two valves which are linked together.

How the Circuit Functions

The signal input, with reference to Fig 2, is passed to the grid of the valve V1 and then amplified in the usual manner to provide the larger grid input for the output valve

(Continued overleaf)

the system was installed in the Science Museum, South Kensington, London.

In less elaborate form the paraphase L.F. amplifier has since been used by many leading set designers, principally for the output L.F. stages of high-class radiograms. Broadly speaking, the outstanding features of this form of circuit can be summed up as follows. (1) By excluding electro-magnetic couplings except for the output transformer, the reproduction of audio-frequencies is not dependent upon the varying magnetic behaviour of the cores of these devices. (2) Despite the use of several L.F. valves the system is commercially cheaper to construct than other types.

The inclusion of comparatively small-power valves allows a generous volume output to be obtained with the minimum of distortion and with an economic H.T. supply. (3) Hum and mains noises are largely cancelled out owing to the balanced-output valves, and this lessens the need for an elaborate smoothing system. (4) The currents in the output anode circuits are in phase opposition, and can, therefore, draw from a source of H.T. a current which is of practically constant magnitude.

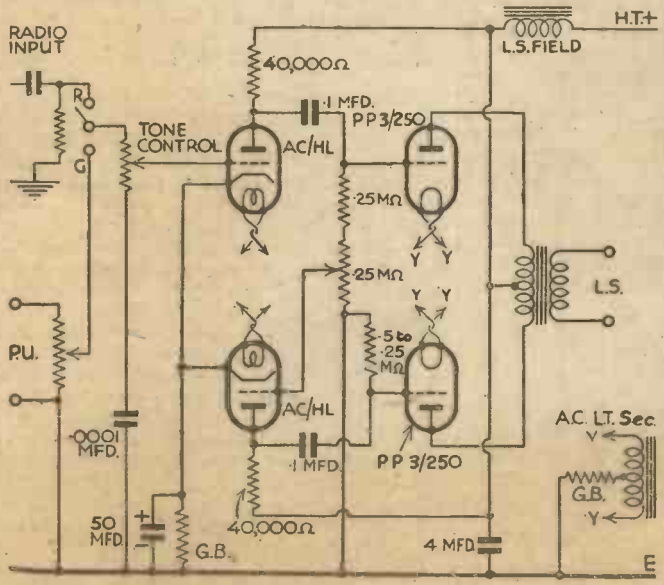

Fig. 3.—A modification which enables a composition type of potentiometer to be employed.

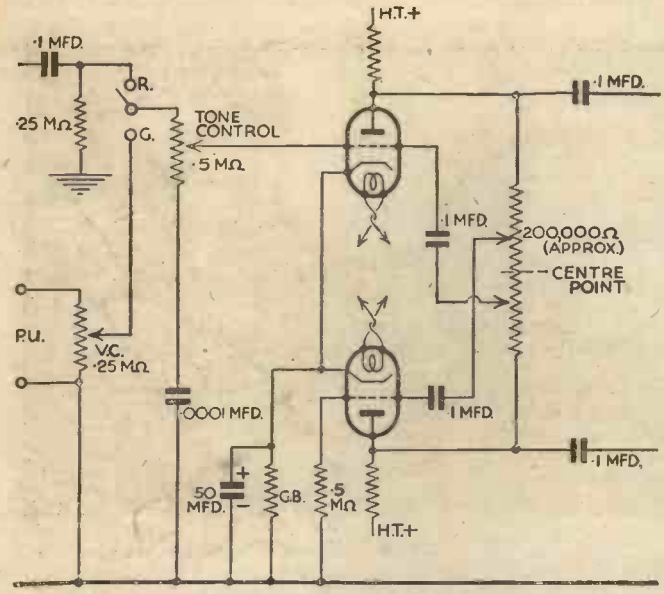

Fig. 4.—Avoiding hum difficulties by adopting cross-connections.

Both the circuits given are capable of excellent results, provided allowance is made for the usual H.T. smoothing equipment, as it is clear that owing to the tapping arrangement and cross connections the low-frequency pulsations due to the mains supply are not balanced. With the object of obviating mains noises with the barest minimum of smoothing equipment it is necessary to provide a symmetrical cross-connection, as shown in Fig. 4. It has been found that the addition of a further condenser and cross connection makes no difference to the amplification of the system. Due to the fact that this second tapping or sliding connection on the potentiometer offers constructional difficulties, and owing to the fact that both home-constructor and set-maker invariably use the field winding of an M.C. speaker for smoothing, it would seem that this latter circuit does not offer the advantages that are at first apparent. On the other hand, for the set maker who wishes to employ a permanent-magnet type of M.C. speaker, it is possible for him to use the scheme shown in Fig. 4, as two small semi-fixed potentiometers can be incorporated in the amplifier and these, once adjusted for the cross-connected valves, can be left untouched until such time as valve renewals may become necessary.

The connections between V3 and V4 are quite straightforward, as is the remainder of the circuit in each case. A standard type of push-pull output transformer can be utilised for the connection to the loud-speaker, or even one of the usual output chokes which have been developed for push-pull purposes. Balancing the phase-opposition valves is very simple, as it is only necessary to connect, say, two 10,000-ohm resistances in series, with the ends joined direct to the anodes of the two output valves. A 1 mfd. condenser is connected to the centre point between the resistances, the other side of the condenser joining to a pair of 'phones, the remaining end of which connects to the common earth lead.

Balancing Out

A signal, consisting either of a radio transmission or, better still, from a gramophone pick-up working with a constant-frequency record, can be fed to the input of V1 and the slider of the phasing potentiometer carefully adjusted about the mid-point of its travel until the signal is rendered practically inaudible in the 'phones. It is rare that the transmission so received will entirely disappear, due to small irregularities in certain of the components. For maximum efficiency in all respects it is desirable that the output valves are a matched pair, especially with regard to their anode currents, but if not, provision should be made for independent grid-bias adjustments so as to achieve the same working conditions.

It is not possible to go into the question of the respective merits of paraphase Q.P.P., Class B and straight amplification at the moment. For the reasons advanced in the early part of this article, the writer can strongly recommend paraphase amplification where mere cost is not the only consideration. From the point of obtaining the fine reproduction possible with resistance coupling, combined with the advantages of push-pull, it has everything to recommend it.

(*Continued from previous page*)

V2. A voltage corresponding to the amplified signal is also developed across the potentiometer which connects the anode of V1 to V3. This potentiometer, or resistance element, is in series with the anode resistance of V3, and the two are virtually in parallel with the anode resistance of V1. The grid of V3, *vid* its grid condenser, connects to the slider of the potentiometer, and consequently a portion of the signal voltage developed across it can be made to feed the input of the valve V3. In practice the slider is adjusted so that the anode circuits of V1 and V3 produce signal outputs which are equal in amplitude and symmetrical with respect to the input of the system, but in phase opposition.

Connecting Small Accumulators

THE small accumulators especially designed for miniature portables have no terminals, and it is therefore necessary to make special provision for connecting to the set.

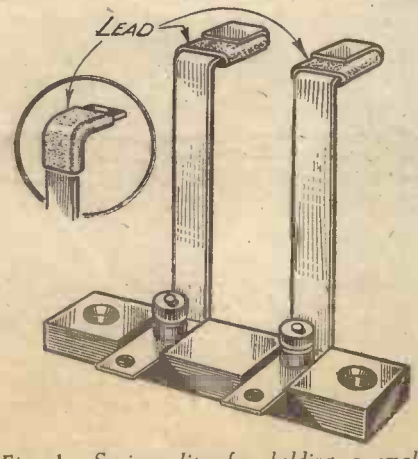

Fig. 1.—Spring clips for holding a small accumulator in place, and at the same time obtaining connections.

One method is to use crocodile clips, and another is to use the clips originally designed to fit the clip-on type of valve top connection.

The accompanying sketch (Fig. 1), shows a method which will be found extremely simple once it is made up and fitted. It has the advantage of lead contacts, thus eliminating any chance of faulty connection through corrosion, and there are no stray flex leads.

The base can be made from wood, bakelite or ebonite, the slots in which the contacts rest preventing the latter from turning and getting out of position. The actual lead contact can be made from foil or sheet lead, but a piece of the outer casing of the lead-covered wire used for house wiring is ideal for the purpose. It is only necessary to slip it on the brass arms, which are then bent as shown in the illustration, the whole being clamped tightly together in a vice or with flat-nosed pliers.

It will be obvious that the brass arms should be fairly springy, and if the metal is too hard for the sharp bend just mentioned, the piece of lead can be slightly longer, being passed over the right-angle

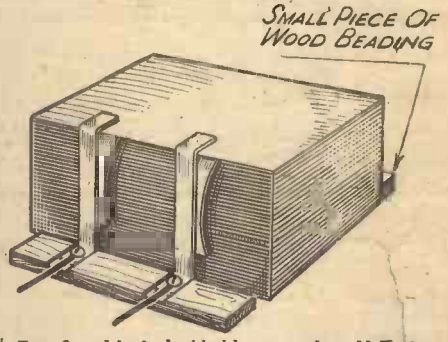

Fig. 2.—Method of holding a midget H.T. battery in place, and making the necessary contacts.

bend, and then clamped in the manner already described.

The extensions at the base are for soldering if this method is preferred; if not, they may be omitted.

It will also be appreciated that a similar type of contact could be used for making connections to the miniature H.T. batteries which are associated with the accumulators mentioned above, but it would be necessary to have a small piece of wood beading to secure the battery against the pressure of the spring contacts, as shown in Fig. 2.

The Experimenters Explain

ADDING VISUAL TUNING TO "PRACTICAL AND AMATEUR WIRELESS" RECEIVERS

by The Experimenters

THE fact that visual-tuning indicators are now fitted to the majority of commercial receivers has led many constructors to suppose that this refinement is almost a practical essential to a modern receiver. That is, however, by no means the case, for visual tuning is of real value only when the receiver is provided with automatic volume control. One might go further by stating that visual tuning is generally applicable only to receivers having A.V.C., since the variation in anode current with tuning is too small to give a good visual indication in the case of the average non-A.V.C. set.

A Current-registering Device

This will be understood more readily when it is explained that all visual-tuning indicators are actually devices for registering current changes. It is by now generally understood—and it was explained in our article three weeks ago when we dealt with A.V.C—that automatic volume control is effected by applying to variable-mu valves a negative bias voltage which is proportional to the intensity of the signal currents applied to the detector, or second detector. The bias increases as the strength of the rectified signal becomes greater and, thus, as the tuning circuits are brought into resonance with a transmission. It is also common knowledge that the anode current of a valve is reduced as the grid-bias voltage to that valve is increased.

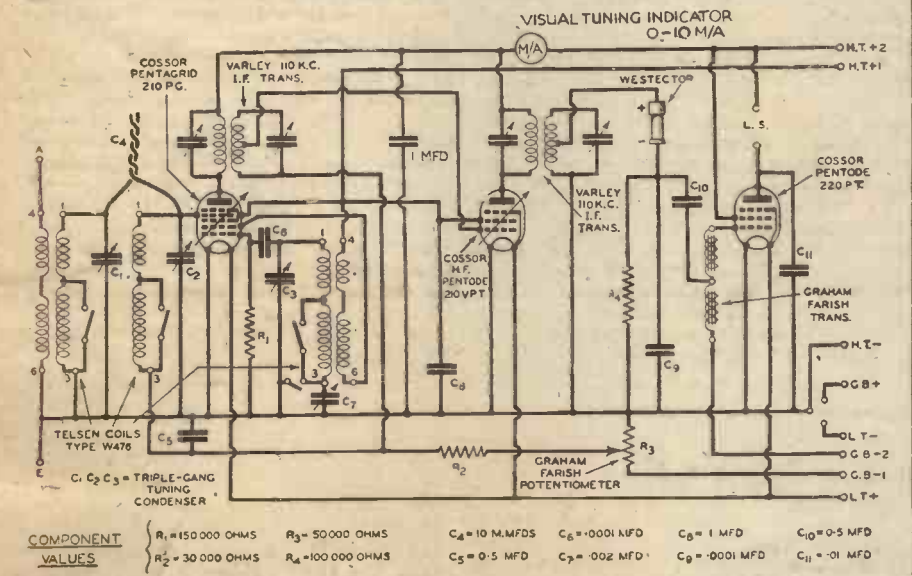

Fig. 1.—This diagram shows the simplest method of fitting a visual-tuning indicator—a milliammeter—in the anode circuits of two variable-mu valves. The circuit is that of the battery model "£5 Superhet" with the addition of simple A.V.C. The method of adding A.V.C. was described in our issue dated November 17th, 1934.

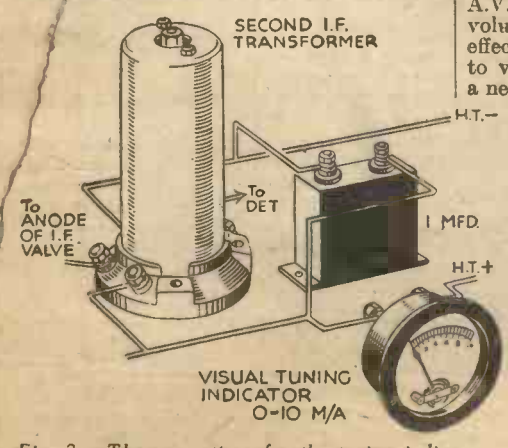

Fig. 2.—The connections for the tuning indicator shown in Fig. 1 are here given in pictorial form.

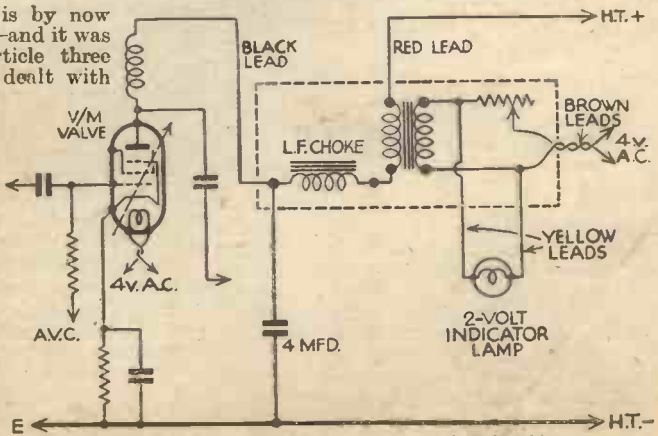

Fig. 3.—This circuit shows the connections for the Climax visual tuning indicator, which is briefly described in the text.

From this simple and brief explanation it will be clearly followed that if a meter such as a milliammeter were included in the anode circuit of the controlled valve or valves it would register the change in current, and would thus act as an indicator of the accuracy of tuning. A meter of this type, although perhaps of rather unusual shape, is frequently employed as a visual-tuning device, but many other types of indicator have been developed, and will be referred to later.

Why Tune by "Sight"?

Before considering the matter, and without experience with a receiver having A.V.C., one might ask why a visual type of indicator should be required, since it surely is a simple matter to tune in by "ear"—operating the tuning condenser until signal strength attains a maximum value. The point is that an A.V.-controlled receiver gives equal response (so far as signal strength is concerned) over a comparatively wide band of the tuning dial. This is because, as the set is slightly de-tuned the degree of high-frequency, or intermediate-frequency amplification, becomes greater, giving the impression of flat tuning. The tuning is not flat really, and when the condensers are de-tuned one of the side-bands of the transmission is attenuated; in other words, only a portion of the signal is actually being fed to the detector. Because of this, the quality of reproduction is impaired and distortion is introduced. But this distortion is not always easy to recognise on certain forms of transmission, and it comes into effect so gradually that

it might not be noticed until a different item is broadcast. Even when it *is* noticed, there is difficulty in re-tuning the receiver so that it may be overcome.

When tuning by means of a visual indicator, however, conditions are quite different, since the slightest movement of the tuning condenser "off tune" is evidenced by a pronounced and immediate increase in anode current to the controlled valve.

The Simplest Arrangement

The method of fitting the simplest possible form of visual-tuning indicator to the "£5 Superhet" (battery model) is illustrated in Fig. 1, where it will be seen that a milliammeter reading 0-10 milliamps is included in the H.T. positive lead which supplies the pentagrid and the H.F. pentode. In giving these connections, it is, of course, assumed that A.V.C. has been added to the receiver in the manner explained in the issue of PRACTICAL WIRELESS dated November 17th, 1934, since the indicator would be valueless otherwise.

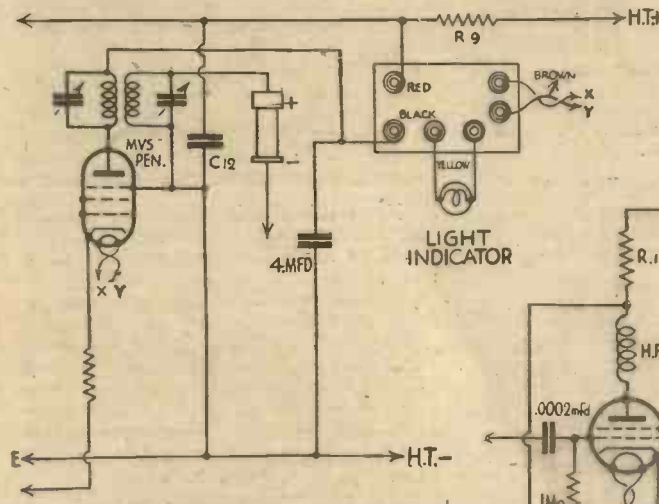

Fig. 4.—Showing how the tuning indicator shown in Fig. 3 can be connected to the I.F. valve of the A.C. "£5 Superhet."

It will be seen that, on the "anode" side of the meter, a 1-mfd. condenser is connected to earth to act as a by-pass and to avoid instability due to the resistance of the meter. When the indicator is in circuit the needle will show the lowest reading when the receiver is exactly tuned to a transmission, but it must be remembered that the actual current reading is also dependent upon the setting of the variable-mu volume control. Thus, if the meter reads, say, 8 milliamps when the set is not tuned to a station, and when the volume control is set to maximum, the reading will probably fall back to about 6 milliamps when the local station is tuned in. On the other hand, a reading of only 5 milliamps may be obtained when the volume control is turned "down" and the set is not tuned in, the needle dropping to, say, 4½ milliamps when a comparatively distant station is being received. From these hypothetical figures, the reader will gather that the actual current reading must not be taken into account; the only important point is that the tuning control must be operated until the meter reading is reduced to the greatest extent on any particular transmission. The correct point will soon be found by watching the needle whilst operating the tuning condenser, for the needle will gradually move down the scale as resonance is reached, and then commence to move up again.

Modified Meters

Many manufacturers fit a tuning meter which reads in the opposite direction to a standard milliammeter, with a result that resonance is indicated when the needle reaches the highest point on the scale, and special meters with reversed scales are available to the home constructor. Additionally, it is possible to buy (notably from Messrs. Bulgin) tuning indicators which, instead of being circular in shape, are fitted with a rectangular or curved face. These are somewhat neater in appearance than the ordinary meter, and are available in types to match the panel layout of any type of set.

The connections shown diagrammatically in Fig. 1, and also in pictorial form in Fig. 2, may be applied to any type of receiver having A.V.C., although the range of the meter should be different in certain cases. For example, if there is only a single controlled valve a meter reading from 0 to 5 milliamps would be more suitable, whilst if the receiver was of the mains-operated type employing indirectly-heated valves of which two were bias-controlled it would be necessary to use a meter reading up to a maximum of 15 or 20 milliamps. In every instance most satisfactory results are to be obtained by employing a meter of which the maximum current rating is slightly less than the maximum current consumed by the valve(s) in whose anode circuit(s) it is included.

Forms of visual tuning used by certain manufacturers operate on the principle of a varying shadow or light band, but such forms of indicators can frequently be devised by modifying the milliammeter used in the arrangement already referred to; methods of doing this were detailed in PRACTICAL WIRELESS dated November 25th, 1933, in a practical article on visual-tuning indicators.

Variable-light Tuning

Of the other types of visual-tuning indicators a very interesting one is that shown in a theoretical circuit in Fig. 3. The indicator shown is made by Climax Radio Electric Ltd., and is sold as a complete unit which comprises the transformer, L.F. choke, variable resistance, lamp-holder, lamp, and coloured connecting leads. This particular unit is very interesting as being entirely different from many of the other devices, but it is designed for use with A.C. receivers only. It will be seen that the primary winding is included in the high-tension supply lead to one of the controlled valves and is in series with the choke. The secondary winding has the 2-volt indicator lamp wired in parallel with it, whilst it is also connected to the 4-volt A.C. winding of the mains transformer (the winding which supplies the valve heaters) in series with the variable resistance.

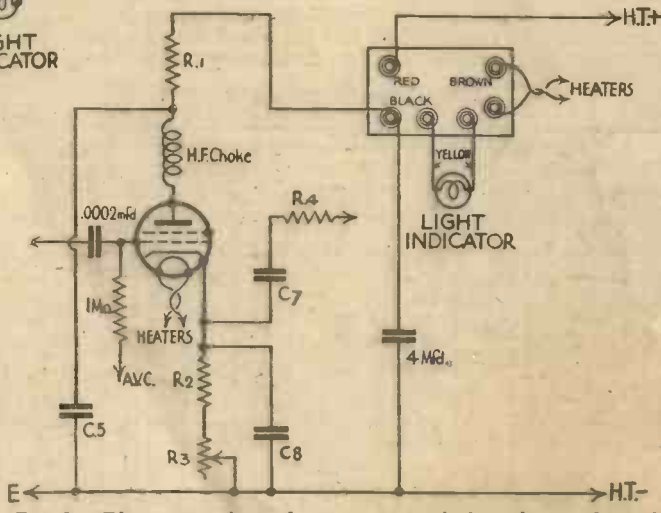

Fig. 5.—This circuit shows the connections of the indicator detailed in Fig. 3 in the A.C. "Fury Four Super."

The principle of operation is that the inductance of the transformer windings becomes greater when the D.C. current passing through the primary is reduced. Thus, when the tuning circuits are brought into resonance with the transmission, and the anode current to the controlled valve is reduced, the inductance rises. And as the inductance of the secondary is increased the voltage developed across it and applied to the lamp is also increased, which results in the brilliancy of the lamp becoming greater. After the indicator unit has been wired in circuit the variable resistance is adjusted so that the light of the lamp is just extinguished when the set is off tune; it should then increase to full brilliancy when the local station is tuned in.

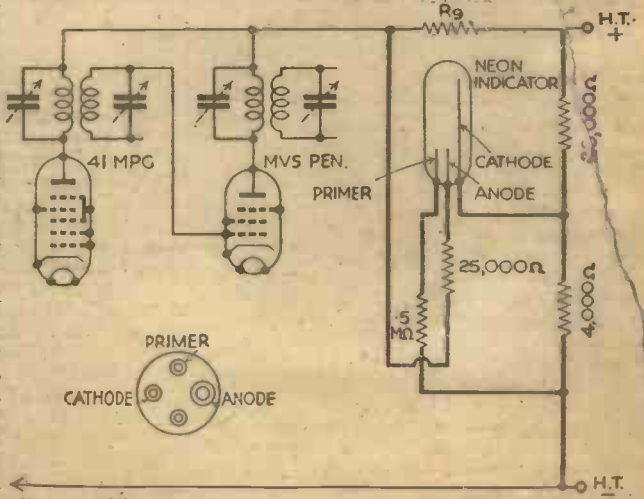

Fig. 6.—This skeleton circuit shows how the Cossor neon tuning indicator is connected in the A.C. "£5 Superhet," the heavy lines showing new connections. Inset is a view of the base showing the connections.

COMPONENTS

Their Action, Principle & Purpose

In this Instalment the Components which Comprise the Power-supply Unit in an A.C. Receiver are Explained

By FRANK PRESTON

AS we have now studied the essential requirements and functions of the various components used in the receiver itself it is time to pass on to the power-supply unit diagrammatically shown on the right in Fig. 1. The object of this is to supply a comparatively high voltage of D.C. for high-tension purposes, and also a low voltage—4 volts—of A.C. for the heaters of the valves. The voltage of the A.C. mains is constant and may lie between, say, 200 and 250; this supply has to be utilised for both H.T. and L.T. purposes. It is, fortunately, a simple matter to change the voltage of alternating current either upward or downward, the component used for this purpose being the so-called mains transformer. In essentials, the transformer is not unlike the low-frequency transformer which we previously considered, for it has a primary and secondary winding; in the example illustrated there are, actually, three secondary windings, but each of these functions separately and can be studied individually.

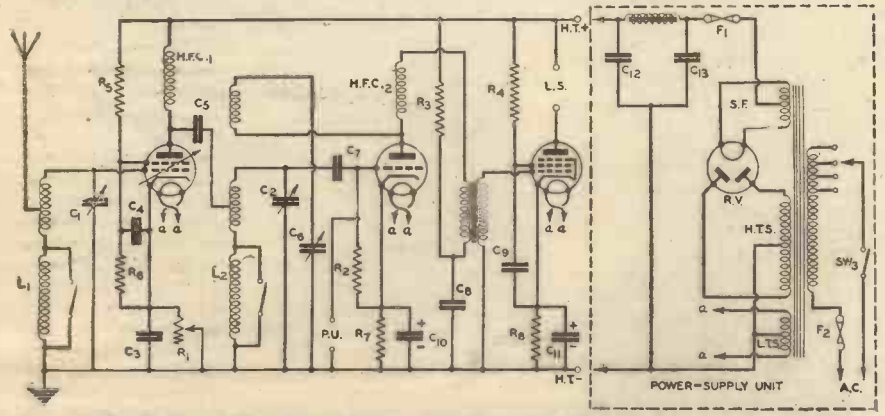

Fig. 1.—The power unit, to which reference is made in this article, is shown on the right in the above circuit, and is enclosed by a dotted line.

The Mains Transformer

The general form of construction taken by a mains transformer is shown in Fig. 2, and if this is borne in mind the method of functioning will more readily be understood. In the first place there is the primary winding across which the A.C. supply is connected. As the alternating current flows backward and forward through this a fluctuating magnetic field is set up round the iron core, so that this becomes magnetised.

Here it is necessary to explain a point which often proves puzzling to the constructor. It would at first appear that the fairly low resistance (it may be only a few hundred ohms) of the primary winding would be equivalent to a short circuit of the mains supply, whereas actually it provides an extremely high impedance. In fact, with a well-designed transformer the current passing through the primary is negligible until current is drawn from the secondary. The reason is that the inductance of the winding is so high that it resonates or tunes to the frequency of the supply; and if it tunes exactly, its impedance is infinitely high. This will be understood more easily if the action of a normal coil-and-condenser tuning circuit is remembered.

The Number of Turns

The formula for determining the number of primary turns and the cross-sectional area of the core to produce the desired effect is complicated, and it might be confusing to quote it here. Instead, however, it will be better to give a simple rule-of-thumb formula which can be applied very easily, and which is sufficiently accurate for most purposes. This is that, when the core has a cross-sectional area of 1 sq. in., the number of turns should be based on a factor of 8 per volt for 50 cycles. Thus, with a core of the size mentioned, 1,600 turns should be allowed for a mains supply of 200 volts, 50 cycles. For other conditions the number of turns should be inversely proportional to the area of core and to the frequency. Thus, if the core area is halved (½ sq. in.) the turns per volt should be doubled (to 16); if the cross-section is doubled (2 sq. in.), the turns per volt should be halved (to 4). If the frequency of the supply were 100 cycles per second the number of turns would be halved, and if it were 25 cycles per second the turns would be doubled.

The magnetisation of the core is "transferred," as it were, to the secondary windings, so that voltages are developed across them, the actual voltage produced being proportional to the number of turns on the particular winding. The voltage which will be produced between the ends of any particular secondary winding can be determined by dividing the total number of turns by the turns-per-volt figure used in connection with the primary. On the other hand, any required secondary voltage can be obtained by applying the reverse calculation.

From A.C. to D.C.

It must be remembered that the secondary voltage, like the primary, is A.C., so that that produced between the ends of the high-tension secondary must be rectified before it can be applied to the receiver. Properly to explain the process of rectification it is necessary to consider the graphical representation of alternating

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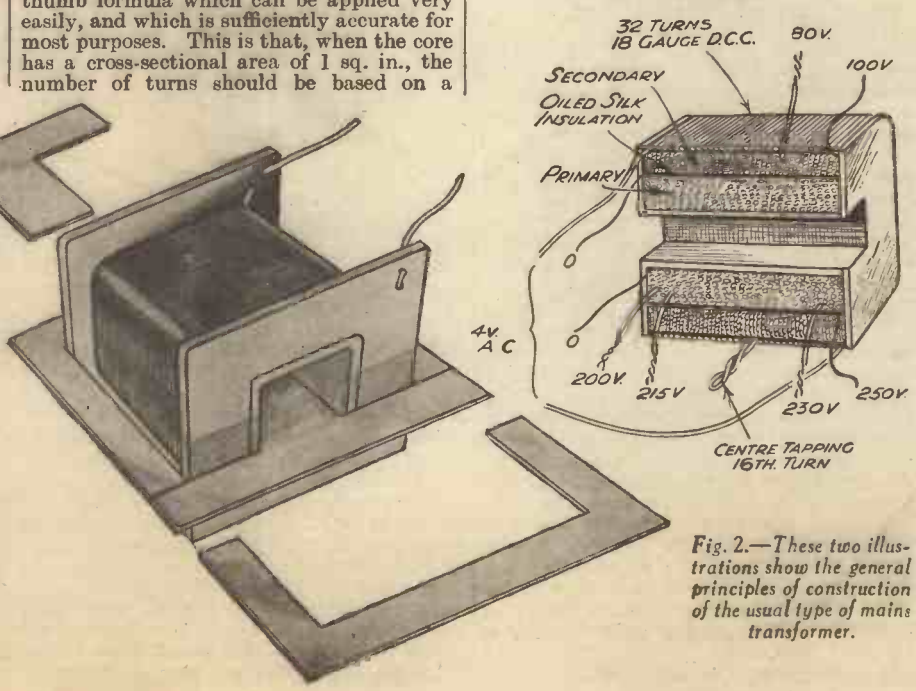


Fig. 2.—These two illustrations show the general principles of construction of the usual type of mains transformer.

(Continued from previous page)

current shown in Fig. 3. It is seen that the voltage varies between maximum positive and maximum negative, and between these two points it falls to zero. But the voltage which we require must be uniform and must have constant polarity. The first requirement cannot be satisfied by the rectifier, but the second can, because it is the property of a rectifier of any type that it passes current in one direction only. Thus, if an A.C. voltage, such as that represented by Fig. 3, were applied to a *half-wave* rectifier (see Fig. 4) one half of the wave would be "discarded" and the output would be as represented by the graph in Fig. 5. On the other hand, if a full-wave rectifier—such as that shown in

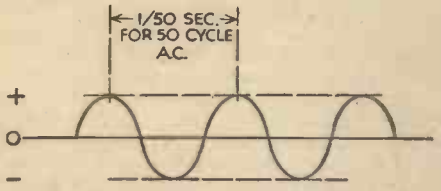


Fig. 3.—The usual diagrammatic method of representing an A.C. voltage. It will be seen that the voltage is constantly changing in value and its polarity varies from positive to negative.

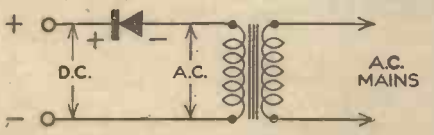


Fig. 4.—Showing the connections for a simple half-wave rectifier of the metal-oxide type.

Fig. 1, for example—were employed, both halves of the wave would be utilised, and the output could be represented as in Fig. 6.

Smoothing the Rectified Output

No matter which form of rectification is employed the resultant voltage, although uni-directional, or of constant polarity, is a fluctuating one which varies between zero and maximum; it is the object of a *smoothing circuit* to make the voltage uniform, as represented by the straight line in Fig. 6. The smoothing circuit shown in Fig. 1 is shown separately in Fig. 7, and can be seen to consist of a low-frequency choke and two fixed condensers. As we have seen in previous articles, a choke possesses *inductance* which tends to impede the passage of an alternating or fluctuating current, and in the present case it may well be considered as an "electrical flywheel," for its "momentum" keeps the output constant.

The choke itself is not able to smooth out the fluctuations completely, but the two condensers connected between the ends of the choke and the negative lead assist by acting as "springs" or "buffers."

Choice of Component Types

Condensers can be charged and discharged, and will hold a certain amount of electricity, so that as the voltage applied to them increases they "absorb" a certain amount of current, discharging or giving it out again as the voltage decreases. Thus is the rectified voltage maintained at a uniform pressure, but if the capacity of the condensers were insufficient or if the inductance of the choke were too low, smoothing would be incomplete and the output would be said to "ripple," due to the fact that the graph representing the output would be wavy instead of straight. Consequently the speaker would emit, in addition to the normal reproduction, a constant hum.

It remains now to consider the choice and suitable types of components for the power-supply unit shown in Fig. 1. In this case, unfortunately, we cannot very well start with one particular part and then deal with the others in sequence throughout the circuit, since there are several which are inter-dependent one upon the other. For example, the type of mains transformer also depend upon the type of rectifier to be employed, whilst the rectifier is governed by the requirements of the receiver. The low-tension windings of the transformer also depend upon the receiver, so we must first of all consider the total amount of power which the set will consume. With the circuit taken as an example we may assess the H.T. requirements at 200 volts (maximum), 50 m.a. for high tension, and 4 volts, 3 amps. for L.T.; in addition to this, the transformer has to supply the filament current for the rectifier valve.

Having settled these values we can proceed to choose the rectifying valve, and if we look up a maker's catalogue we find that there are three main types of valve rectifier, which are rated to give outputs of approximately 250 volts, 60 m.a., 350 volts, 120 m.a., and 500 volts, 120 m.a. It is evident that the first type is suitable in the present instance, and we find that the maximum input to this is listed as 250-0-250 volts R.M.S. We need not consider the exact meaning of the letters R.M.S., but it should be explained that they mean "root mean square" and, applied to alternating current, indicate the corresponding D.C. voltage. The voltage figures indicate that the H.T. secondary winding of the transformer should deliver 250 volts on each side of the centre tapping. The L.T. secondary winding which is used to supply the filament or heater of the rectifier should provide 4 volts at 1 amp. (the current varies slightly according to different makes), whilst the other L.T. secondary winding must supply 4 volts at 3 amps. for the three 1-amp. heaters of the valves in the receiver. In practice, the actual current rating of this winding is

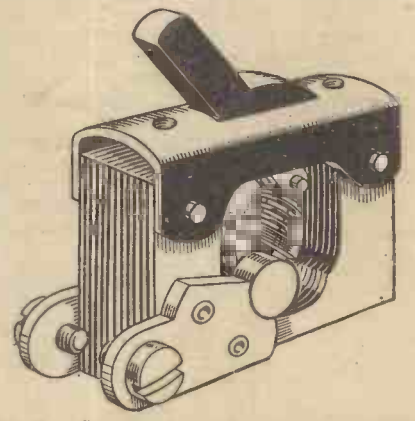


Fig. 8.—Showing the construction of a typical Q.M.B. switch.

not generally important provided that it is not lower than the current required.

Transformer Specification

Assuming that the mains supply is 230 volts, 50 cycles, the complete specification for the transformer required would be: one mains transformer for 200-250 volt mains, with H.T. secondary for 250-0-250 volts, 60 m.a., one 4 volt, 1 amp. secondary, and one 4 volt, 3 amp. (or more) secondary.

The smoothing choke should be rated at about 30 henries, 60 m.a., and may conveniently have a D.C. resistance of 1,000 ohms, since this would reduce the 250-volt output to the 200 volts required

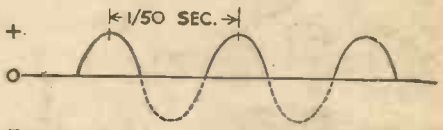


Fig. 5.—This graph illustrates the effect of half-wave rectification; one half of the wave (shown by broken lines) is "discarded."

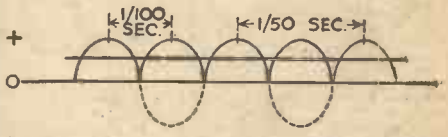


Fig. 6.—A graphical representation of the result of full-wave rectification; both halves of the wave are utilised. The heavy straight line shows the effect of theoretically-perfect smoothing.

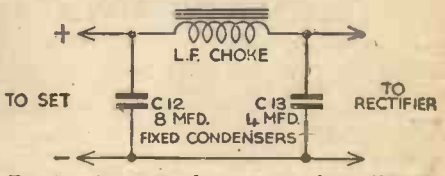
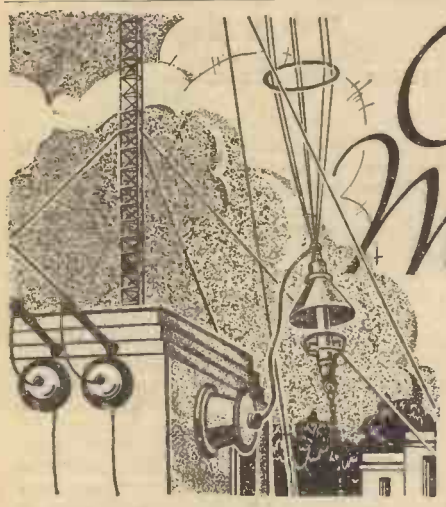


Fig. 7.—The smoothing circuit from Fig. 1, shown separately for clearness.

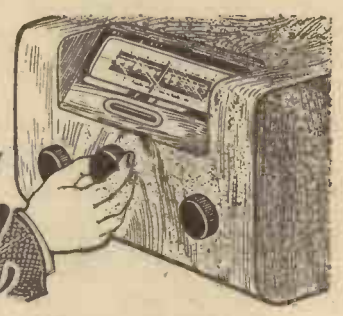
by the valves. With regard to the two smoothing condensers, these should have a capacity of 8 and 4 mfd. respectively for C.12 and C.13, and a rated working voltage of not less than 350, the 100 volts difference between the rating and the actual voltage applied being to allow for the "peak" voltage developed when the set is first switched on and before the valve cathodes become hot. The condensers may either be of the electrolytic or ordinary type, but the former is generally found to be rather more satisfactory for smoothing purposes.

The "Etceteras"

A safety fuse is included in the mains lead to the transformer, and this should be rated at .5 to 1 amp., the actual rating being by no means critical. Lastly, there is the switch, and this should be of the Q.M.B. type. The letters Q.M.B. stand for quick-make-break, and indicate that the contacts are spring loaded (a typical example is shown in Fig. 8) so that an electric arc cannot form between them as contact is made and broken. This would occur with the ordinary type of battery switch due to the high voltage between the contacts.



On Your Wavelength



By Thermion

More Licences

DURING the month of April 702,163 licences were taken out, which represents an increase of 43,378. Of this increase London accounts for 4,597, whilst Scotland, as I suppose one might expect, accounts only for 4,345. Northern Ireland accounts for 788, the English Counties for 32,415, and Wales for 1,233. Do these low figures from Scotland and Wales represent the extent of the migration to England of the inhabitants of those countries? I refuse to believe that piracy is more rampant there than in England.

Remote Control

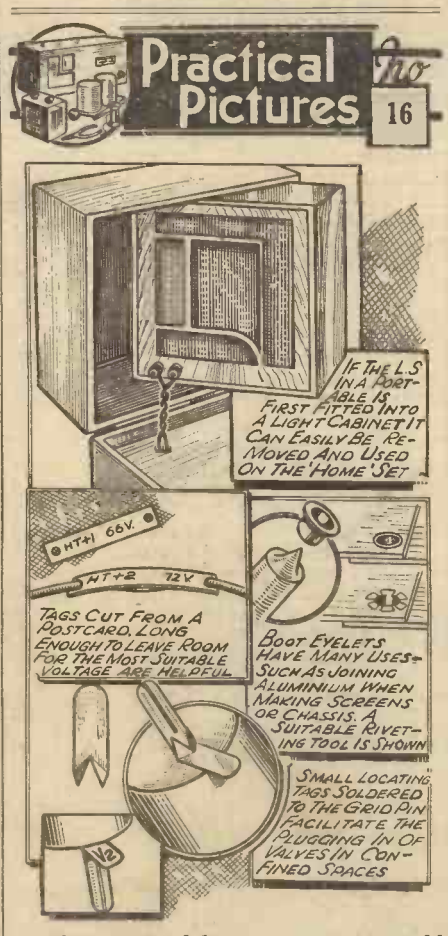
MY dear readers, I thank you. Every one of the many thousands of you who have come to my rescue in response to my request for an efficient remote control. I have enough of them to fill a bulky book, and I am thinking of competing with the facile pen of your Editor by publishing a book on it. The only snag is to find a publisher! And also the time in which to write it. However, I have persuaded the Editor to publish a selection of the ideas submitted for the benefit of readers generally.

Radiolympia

LOTS of readers welcome the fact apparently that I shall be at Olympia, and wish to shake me by the hand, but unfortunately they will not know your Thermion when they greet him. The risk is too great for my identity to be pierced. Even now I am suffering from nightmare as a result of the threats I have received from the Secret Society of Crooning Craniacs. If, you call upon the PRACTICAL AND AMATEUR WIRELESS Stand No. 9, and utter the magic word "Hutcha cha cha" or "Boo boo boo" and you notice a face take on the appearance of a Heath Robinson cartoon of a green crab apple, there unmasked is your Thermion. If some bitter paragraphs of mine have stung you on the raw and you wish to spill my gore, then take your revenge. I shall be wearing my sprints, and have made all arrangements for the exits from our stand to be kept clear. My private bodyguards, too, will be in attendance. Bright thought! Will all those readers who have written in support of my views on jazz music augment my bodyguard? May I enrol them as members? Here's hoping that they are having a right Royful time with our Hall-Mark. As for myself, jazz just gives me a payne!

Frequency Tests

AS a result of an argument with a friend as to what real quality actually is, we have resolved that the B.B.C. must broadcast some test records. This sounds rather dictatorial, but had you heard the heated argument I am sure you would have agreed that the least the B.B.C. could do would be to radiate test records for two hours every evening! It all arose as a result of a statement that this friend's set gave really good top-note reproduction. When I heard it I was not impressed. He came to hear my set and we went back to his house, but owing to the varying nature of the programmes we could not come to any definite decision. Finally, we borrowed some constant frequency records and these settled the matter beyond all doubt. (Yes, I won!) However, I do feel that some sort of test transmission, when it would not seriously interfere with the ordinary programmes, would be very valuable, and would do much to improve the quality of components as well as receivers. But I believe the B.B.C. have been approached on the subject by Radio Societies and others, but cannot agree to anything in this nature. A great pity.



Battery Fumes

MOST listeners know the dangers of battery fumes, but I should like to repeat a warning, now that portable time is coming near, regarding the fumes from accumulators in these small self-contained sets. In the ordinary way the fumes have a clear passage out into the air, but when shut in some of the small portable cases the fumes cannot get away and they pass into the wiring and other parts of the receiver and set up corrosion. Many a listener with such a receiver incorporating a frame aerial has been forced to have the aerial rewound, owing to the fumes eating through the fine wire and causing a breakdown. Remember that these fumes act on practically all the metals used in a wireless set, and lead and rubber are preventatives. If you see any traces of green upon brass or copper in your set, carefully clean the spot and smear with vaseline, or you may find that at some future date you will be without your set when a particularly interesting programme is being radiated. And, generally, the repair is then a long job.

Tone Controls

IS it good practice to fit a receiver with a tone control? I am of the opinion that it is sometimes bad from one point of view, and that is that the non-musical listener will use it to get a "mellow" tone to the detriment of good quality. It is well known in the radio trade that the majority of listeners like a nice, deep tone, and it does not seem to matter if the top notes are cut off. Consequently, when a tone-controlling device is fitted it is fair to assume that in most cases it will be adjusted to give the deep, mellow tone and thus good-quality reproduction may not be obtained. On the other hand, if the receiver provides a fairly good straight-line amplification but no tone-modifying device were fitted, the listener would, in time, become accustomed to good quality and would not listen to mellow effects obtained by high-note cut off. I know the public does not like to be told what to do, but I am sure that tone-controls are sometimes an evil.

Energised Moving-coil Speakers

A READER writes with regard to my note a few weeks ago in which I recommended the use of an energised moving-coil loud-speaker with mains receivers. He explains that he is using a two-valve receiver which is operated from a mains-supply unit with a rated output of 250 volts at 60 milliamps, and asks if it would be a feasible proposition to connect a speaker having a 7,500-ohm field winding in parallel with the H.T. supply. As the two valves together consume 30 milliamps anode current there should be another 30 milliamps to "spare," assuming that the H.T. unit delivers its rated current. This being the case, it should be quite possible to operate the speaker field from the available supply, since the 7,500-ohm

(Continued overleaf)

(Continued from previous page)

speaker will pass approximately 30 milliamps at 250 volts.

Another reader proposes to employ twin speakers which are provided with two field coils, one of which has a resistance of 1,500 ohms, and the other of 7,500 ohms. This reader intends to use this pair of speakers by connecting one winding (1,500 ohms) in series with the main H.T. lead as smoothing choke, and the other (7,500 ohms) in parallel with the H.T. He asks if this arrangement would prove satisfactory with a four-valve receiver, the H.T.-current consumption of which is about 80 milliamps, and which is fed from a 350-volt, 120-milliamp rectifier. Here again, the arrangement should prove satisfactory, although it will be necessary to include a fixed resistance in series with the 7,500-ohm field, provided that this is intended for operation on 200-250 volts. On the other hand, it is possible that the speaker which this reader has in mind is designed for use in some particular way in a rather special circuit, in which case it may be necessary to take special precautions.

It would rather appear that the reader has in mind a "surplus" speaker of some kind which was probably made for use with a commercial receiver; if that is the case, he should first obtain complete details of the circuit. On the other hand, however, there is little doubt that it would be a far more satisfactory procedure to buy a standard speaker of modern design and of one of the well-known makes, such as those advertised in these pages.

Television Land Lines

IT is interesting to see that the Bell Laboratories have developed a new cable which, it is claimed, can be used for the transmission of a very wide frequency band over land lines. The main feature is that a central wire passes through an outer tube, the two being used as the pair of conductors required. A certain amount of "correction" is, of course, required even with this system, but the originators claim that a "monitor," or correction amplifier, is only required at ten-mile intervals along the transmission line. Here,

Mr. Walford Hyden, famous for his "Café Colette" broadcasts, which have proved extremely popular.

Notes from the Test Bench

Controlling Tone

THE high efficiency of the pentode makes this type of valve very suitable for use in receivers having only one L.F. stage, and, provided that the speaker has a pentode matching transformer attached, the substitution of a pentode for a power valve invariably results in increased volume. It is often found, however, that excessive treble response is obtained after this substitution has been effected. There are several methods of correcting this, the easiest being the connection of a fixed condenser of approximately .0002 mfd. across the secondary winding of the L.F. transformer—*i.e.*, across G. and G.B. terminals. Although this method of tone control proves satisfactory in practice, it is advisable to adopt the more elaborate method of connecting a resistance in series with a condenser across the primary of the speaker transformer. The required values vary slightly with different makes of valves, but a 5,000-ohm resistance in series with a .01 mfd. condenser will prove correct in most cases. If it is desired to make the control variable, the resistance should be of the variable type, a value of 20,000 ohms being suitable.

Using Pentodes

IT is not advisable to use a pentode in the output stage of a receiver having two L.F. stages, however, as this type of valve is easily overloaded. If two L.F. stages are employed, the coupling should be of the resistance-capacity type, otherwise overloading of the pentode will be experienced, or, alternatively, an L.F. volume control must be fitted. This may take the form of a 500,000-ohm potentiometer connected across the secondary terminals of the L.F. transformer, the end terminals of the potentiometer being connected to G. and G.B. terminals of the transformer, and the centre terminal to the grid terminal of the output valve. It is also permissible to use a variable potentiometer in place of the fixed grid-leak in the grid circuit of the first L.F. valve. In this case, the end terminals of the potentiometer should be connected to the coupling condenser and the G.B.—lead respectively, and the centre terminal to the grid.

Superhet Instability

INSTABILITY is often experienced in home-constructed multi-valve superhets, and unless the receiver is very carefully designed results do not compare very favourably with those obtained with commercial receivers. This instability usually takes the form of a roaring noise when the receiver is tuned in to a strong transmission; in some cases where the instability is not so pronounced the actual roar is not heard, but the reproduction on strong signals is very poor. The instability can usually be traced to the pentagrid stage, however, and can be effectively cured in most cases by decoupling the anode of this valve by means of an H.F. choke and a 1-mfd. condenser, and placing an aluminium screening can over the valve.

it would appear, is an excellent medium for the linking up of ultra-short-wave high-definition transmitters.

More from the Jazz Fiends

"FAIR Play Critic," of Luddenden Foot, who, I am flattered to note, "has been reading my articles for years," writes that he has recently been interested in our published opinions concerning crooners and jazz. "Why is it," he asks, "that if someone's opinion of music or singing differs from your own you consider it wrong? One might just as well say, 'I don't like chamber music, therefore those who listen to it must have no sense of music or taste.' There is no doubt about the popularity of dance bands over the air, or they would not have remained so long, nor, as one reader suggests, is it necessary to see them. What about the thousands who listen to football matches and other O.B.'s?" Which only goes to prove that what is one man's meat is another man's poison. I agree that thousands of people like fish and chips; that does not make it an ideal diet. There are some, forsooth, who enjoy eating this delectable food direct from the newspaper in which it is wrapped, after a generous sprinkling of vinegar and a *soupçon* of salt. As this reader says, it all depends upon the taste. Personally, I hate chamber music as wholesomely as I loathe jazz. I prefer light operatic stuff and the music of Lehár and Strauss. Is this a perverted taste, or does it represent the mid point?

Peeved!

"I AM not saying anything about crooners," writes E. A. M. (Haymill), "but am peeved at the way you disparage the remarks of a reader (H. M., Ipswich) on how he can tell which band is playing after a few bars of music. I fully uphold this reader's statement. I cannot tell the name of every band, but such as Charlie Kunz, with the piano, drums, and a string-bass in predominance; Henry Hall, with his straightforward, easily followed style; Lew Stone, with his saxes, etc.; all have different characteristics. It is just the same as being able to tell the make of a car from the sound of its exhaust." I am glad to let this reader have his say.

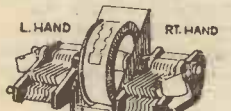
Cléo Nordi, whose association with "Café Colette" has contributed in no small measure to its success.

A PAGE OF PRACTICAL HINTS

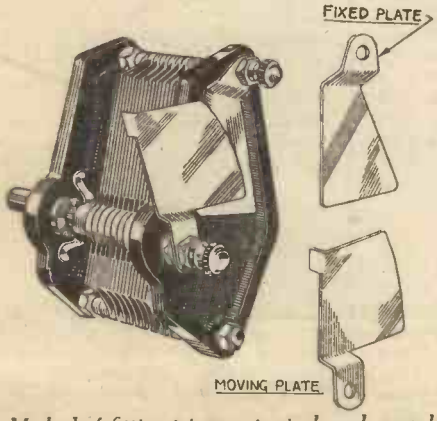
SUBMIT YOUR IDEA — READERS WRINKLES — THE HALF-GUINEA PAGE

Fitting a Condenser Trimmer

THE accompanying sketch shows a neat trimmer condenser which I fitted to two ordinary .0005 condensers, to enable them to be used in a ganged circuit. The condensers were of the type having recessed ebonite end plates. Two aluminium plates or vanes were cut out and bent to the shapes shown, one being arranged to fit into the recess of the condenser moulding, and clamped under the terminal of the fixed vanes, whilst the other was placed under the terminal going to the moving vanes, its adjustment for trimming operations being allowed for by double nuts. As an alternative, a soldering tag could be placed under the bottom nut for connection purposes.



Two condensers coupled for similar movement by reversing end plates.



Method of fitting trimmers to single and ganged condensers.

The trimmer plates should be about 1/16-in. apart. With this type of condenser it is quite a simple matter to reverse the movement to form a left-hand condenser by reversing the end plates, that is, putting them back to front, when a pair can then be fitted to a drum dial, as shown.

Although the type of condenser having a recessed end-plate is referred to, the idea could, of course, be adapted to other types of condenser, provided that the control spindle projects sufficiently far to enable the trimmer plate to be locked into position. The shape of the plate will have to be modified so that the separation above-mentioned is maintained, or alternatively, a piece of mica may be attached to one plate and the two plates then permitted to pass very close together. Capacity may be modified by the space separating the plates.—R. L. G. (St. Albans).

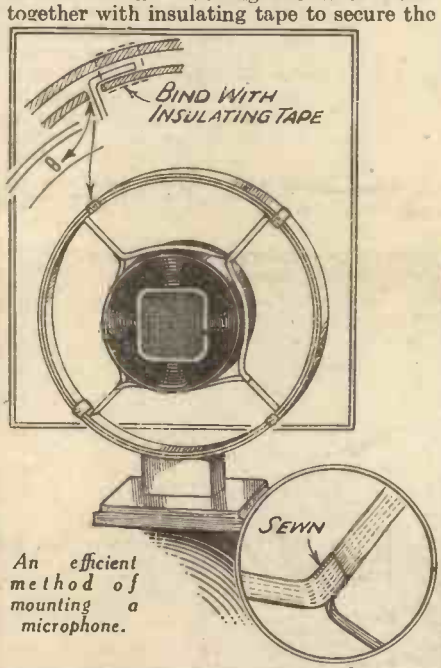
A Microphone Stand

A SIMPLE but efficient method of making a microphone stand is shown in the accompanying illustration. The

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.

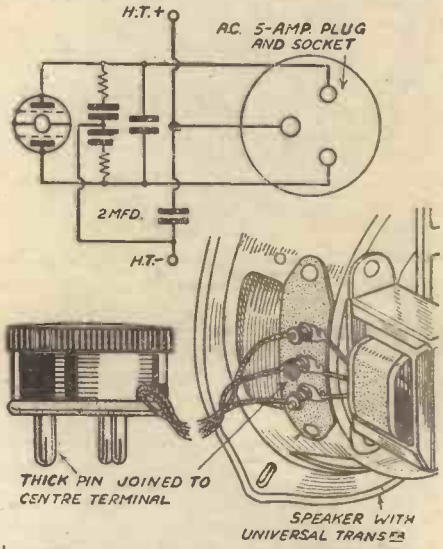
support is formed with two embroidery rings, the inner one having four slots to receive the ends of four lengths of household elastic, the inner ends being sewn in the manner shown. The rings should be bound together with insulating tape to secure the outer ends of the elastic, after which any convenient stand can be fitted. The microphone itself is fitted into the central opening formed by the elastic, no attachments whatever being necessary to the case, so that the removal and replacement of the microphone at any time is a simple operation.—E. L. P. (London, S.E.).



An efficient method of mounting a microphone.

A Loud-speaker Plug

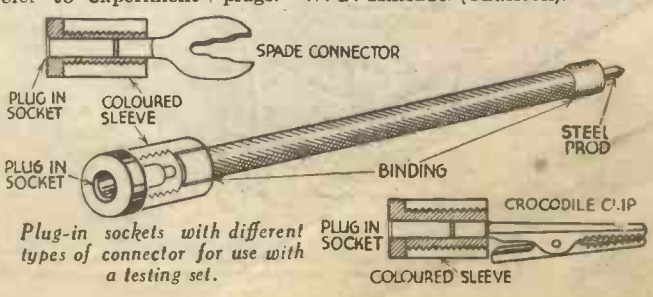
MOST amateurs prefer to experiment with various circuits, and find the plug - and - socket method of connecting has many points in its favour. In the illustration above is shown a method of plugging in the loud-speaker to a push-pull stage. The loud-speaker is fitted with flexible leads to the end of which a standard 5-amp. 3-pin plug is fitted. On the receiver a standard 5-amp. 3-pin socket is mounted, and the connections from anodes and H.T. are taken to the socket, utilising the larger (normal earth) socket as the H.T. connection. By this means it is thus possible to plug in the loud-speaker and there will always be a certainty that the H.T. is applied to the centre of the speaker transformer—a point which would not arise where an ordinary plug and socket arrangement is adopted.—G. A. W. NEILL (Kingswood Frodsham).



A method of connecting a loud-speaker to a push-pull stage.

An Adjunct to the Testing Set

INSTEAD of having to use different leads for various types of connections, I have made up a set of plug-in sockets with different types of connector soldered to them, as shown in the accompanying sketches. The plug-in sockets have coloured sleeves to aid identification and to hide the joint as well as insulate the socket. The test prods consist of steel knitting needles soldered to the socket—sleeving is passed over the needle, the ends being bound to make a neat job. The identification sleeve is then screwed to the socket, covering up the end binding. The leads from the meter consist now merely of two leads with plugs.—W. P. HAMLYN (Charlton).

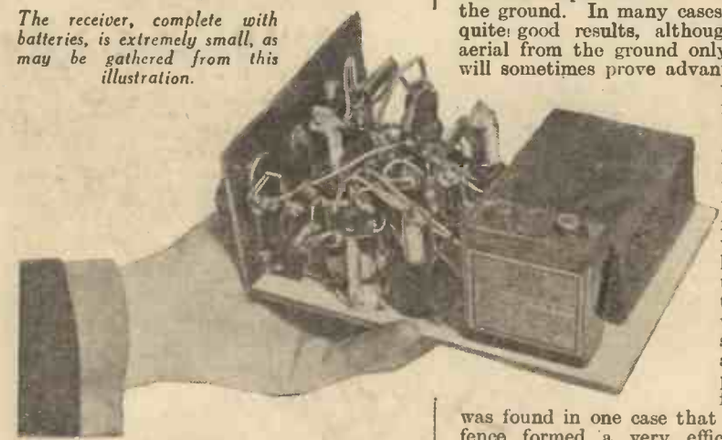


Plug-in sockets with different types of connector for use with a testing set.

MORE ABOUT THE CAMEO MIDG

Instructions for Using this Novel Receiver for Ordinary Home Use are Given this week, in Addition to Hints

READERS who had decided to build this interesting Midget receiver will have experienced no difficulty in the constructional work, and the receiver should have been completed in an hour or so. Unlike the ordinary type of broadcast receiver the use of the special midget components, with the flexible leads instead of terminals, greatly simplifies the connecting of various parts, and with the wiring diagram which was given last week, with the coloured leads clearly identified, the work becomes extremely simple. If the receiver has been tested in the open air it will no doubt have been found how the arrangement of the aerial is a most important matter. Some tests were carried out with a receiver in order to determine just what results could be obtained under varying conditions, and these will now be given in order to assist those who are building the receiver for use in the summer months out in the country.



The receiver, complete with batteries, is extremely small, as may be gathered from this illustration.

Throw-out Aerials

Ordinary thin flex is obtainable from most electricians, and if the right kind is obtained it is extremely flexible and light in weight. Thirty feet of this wire occupies a very small space, and if a small strip of thin wood or paxolin board is obtained and cut in the form of a shuttle, the wire may be wound round it and carried in a convenient manner. The only difficulty which will occur will be in arranging the wire, but if a tree of any kind is situated near to the listening point this may be used as a mast, and a heavy stone or other weight should be attached to the free end of the wire and then cast over a branch. If a suitable point on the branch is selected, it will generally be found that when listening is completed the end of the wire attached to the set may be disconnected and released, when the weight of the stone will bring that end of the wire to the ground and thus enable the wire to be wound up again ready for future use. Where no tree is available other means have to be adopted, and the simplest will be to lay the wire on the ground. In many cases this will give quite good results, although raising the aerial from the ground only a foot or so will sometimes prove advantageous. Two walking-sticks may be stuck in the ground and the aerial twisted round the tops of them. Alternatively the wire may be laid along the top of a fence, twisting the wire round supports here and there to prevent it from falling. It was found in one case that the wire of a fence formed a very efficient arrangement, and the lead from the set was attached to the wire direct, by baring the end and twisting the flex round a point on the fence-wire which was cleaned by scraping with a penknife.

The Earth

Practically anything will serve as an earth connection. A penknife dug into the ground, with the bared end of a wire gripped between the blade of the knife and the earth; even the bared end of wire pushed into the earth with a stick will sometimes prove quite serviceable. A more efficient arrangement will be obtained if a stream or ditch is handy, as the moisture gives a much lower resistance, but with a receiver of the nature of the Cameo the maximum efficiency is not required for general reception purposes.

As a Broadcast Receiver

There is no reason why the Cameo Midget Three should not be constructed for use as an ordinary home receiver, when, of course, a larger cabinet could be employed, and larger types of battery fitted. For such a purpose, it would be more convenient to fit ordinary terminals to a thin strip of ebonite or paxolin at the rear edge of the baseboard, and fit these with ordinary battery flexible leads. The low-tension supply could then be taken from a standard type of accumulator and would give long service. The thick plate type of cell is therefore desirable in order to avoid difficulties from sulphation owing to the long period between charging. For the high tension, an ordinary type of battery may be used, but it should be noted that the valves employed are rated to take a maximum high tension of 100 volts only. A 99-volt battery would therefore be quite satisfactory, and to enable the reproduction to be improved with this higher value grid bias should be applied to the L.F. stages. The blue leads should therefore be disconnected from the fixing screws which at present enable these leads to be "earthed," and flexible leads of suitable length should be soldered to them. Wander plugs on the end of these extra leads should then be inserted into a standard 9-volt grid-bias battery, a voltage of about three being found sufficient. If desired, of course, the H.T. applied to the first L.F. valve may be reduced slightly, with a lower G.B. also applied, but in general such economy is not necessary. When these modifications have been made, the receiver may be attached to a good outdoor aerial and earth system, and will give really good loud-speaker results.

Modifying the Tuning Range

If it is desired to modify the minimum wavelength to which the coil will tune, the size of the aerial condenser (C3) may be modified. If you are not certain just what range you wish to cover, or are anxious to have some variable adjustment at this point so that selectivity may also be modified as occasion demands, you can fit a small pre-set condenser in this position and adjust it as desired.

Readers' Designs

No doubt readers will devise methods of their own of adapting the design, or of accommodating apparatus in a manner more suited to their own particular needs. For instance, it may be thought desirable to employ one of the small fibre attache cases in preference to the special cabinet which we have specified. Some method for earthing the base would, of course, have to be incorporated, and we would not recommend ordinary wood to be used in preference to the special metallised base which we have adopted.

In this illustration the batteries have been removed, to enable the complete layout to be observed.

Similarly, readers may have obtained these Midget valves and have designed their own circuits or receivers. We shall be pleased to hear from such readers, and we shall also be pleased to publish and pay for, at our usual rates, details of receivers which we consider suitable for the purpose.

Midget Components

As we have already pointed out, this is only the first of a series of receivers incorporating these Midget valves, and to assist readers in designing their own receivers, and as a matter of in-

LIST OF COMPONENTS FOR THE CAMEO MIDGET THREE

Two Midget L.F. Transformers (B.T.S.).
Three Midget Valveholders (Wearite).
One Midget Coil (B.T.S.).
One 1 megohm Grid Leak (R1) (B.T.S.).
One 100,000 ohm fixed Resistance (R2) (B.T.S.).
Two .0001 Tubular Condensers (C3, C4) (B.T.S.).
Two Switches Type S80T (Bulgin).
One .0005 mfd. Compax Variable Condenser (C1) (Polar.)
One .0003 mfd. Compax Variable Condenser (C2) (Polar.)
Three Crocodile Clips (Bulgin).
One Drydex H.T. Battery Type X325 (Exide).
One L.T. accumulator Type GEL-CEL PRP3 (Exide).
One special Midget Chassis and Panel (Peto-Scott).
One Cameo Cabinet (Peto-Scott).
Two Component Brackets (Peto-Scott).
One Pair Headphones (Ericsson).
Three valves: two type XL, one type XD (Hivac).

GET THREE

on Using the Receiver in the Open Air

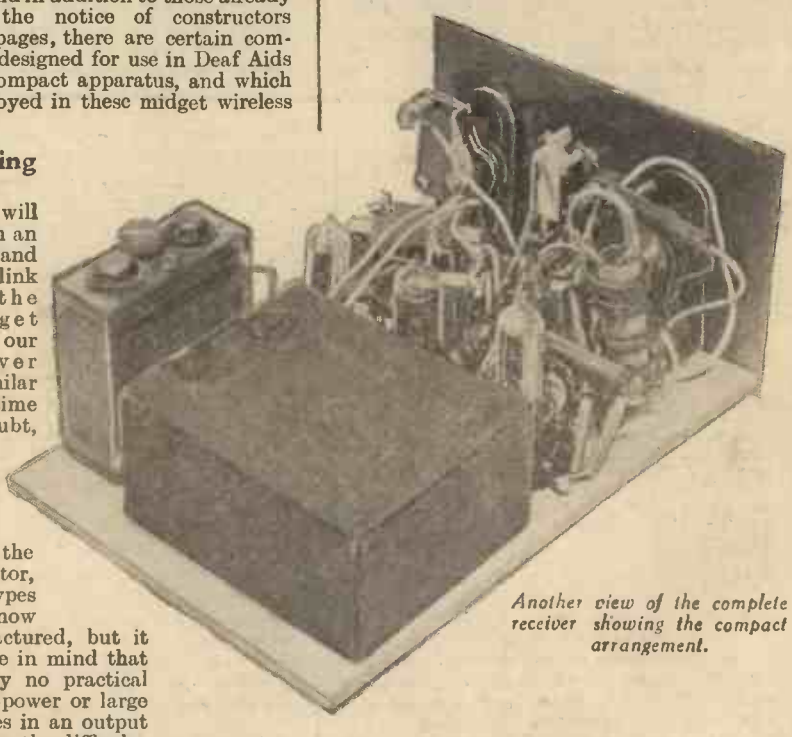
terest to other readers, we propose to publish details of all the Midget components which are at present available for the home-constructor. There are, of course, a large number of component parts which are made extremely small for the use of set manufacturers only, and these are obtainable from certain "surplus" stores. We do not intend to include these in the term Midget components. In most cases they are simply reduced in apparent size owing to the exclusion of containing cases, terminals, etc. We mean, by the term "midget," those components which have been designed especially for their compactness and use in receivers of very small dimensions, and in addition to those already brought to the notice of constructors through our pages, there are certain component parts designed for use in Deaf Aids and similar compact apparatus, and which may be employed in these midget wireless receivers.

An Interesting Review

These parts will be reviewed in an early issue and will form a link between the Cameo Midget Three and our next receiver based on similar lines. As time goes on, no doubt, alternative types of valve will become available, in addition to the S.G., Detector, and L.F. types which are now being manufactured, but it must be borne in mind that there is really no practical use for super-power or large pentode valves in an output stage, owing to the difficulty of providing adequate H.T. supply sources, without increasing the overall size and weight of the receiver due to the large battery which would have to be employed. There are, of course, certain economy schemes which may be applied to output or L.F. circuits to reduce current consumption,

and these are receiving our attention in the course of our experimental work with midget apparatus. Efficiency must not be sacrificed for novelty, and therefore a receiver must offer a creditable performance in addition to offering the novelty of compactness and portability, and we shall be glad to hear from readers concerning the performance which they obtain with the Cameo Midget Three in various parts of the country and under varying conditions.

Reports should be sent to the Editor and envelopes marked "Cameo."



Another view of the complete receiver showing the compact arrangement.

FULL-SIZE BLUEPRINT

is obtainable, for 1/- post paid, from The Publisher, George Newnes Ltd., 8-11, Southampton Street, Strand, W.C.2.

SHORT WAVE SECTION

At the Short-waver's Bench—7

Amongst the Subjects Dealt With in This Article is a Simple Two-valve S.-W. Receiver

Noises in the Short-wave Set

MANY and varied are the puzzling noises which crop up occasionally in a short-wave receiver. They are frequently extremely difficult to trace, and therefore a small amount of space is devoted to them. The noises which will be given but passing mention are the commonplace troubles due to faulty grid leaks, resistances, broken transformer windings, and leaky condensers. These should always be suspected first, and, having been found not to be at fault, attention can be turned to the tuning and reaction condensers. Considerable trouble was recently experienced with a solid-dielectric reaction condenser of which the dielectric had worn through in one place, allowing the moving and fixed plates to scrape at that particular spot. Any scraping of plates in a tuning condenser on short waves will mean very noisy crackles, and so will the rubbing together of the "pigtail" as the vanes are rotated. If a condenser of brass is in use which has steel ball-bearings, it may be found that a noise occurs due to the chemical reaction set up by the rubbing together of two dissimilar metals. This only makes itself heard on short waves, and can be cured by the use of a special S.W. condenser with phosphor-bronze bearings.

In another case, trouble was experienced with an all-mains short-waver which gave out crackles as the tuning condenser was rotated. After a long and arduous search, the trouble was found in the mains-unit in use. This unit was adjustable on the mains side for different voltages by means of sockets, into the correct one of which a plug was placed. Apparently movement of the tuning condenser transmitted *via* the table an infinitesimal movement to this plug. Nothing amiss arose with the unit on broadcast bands, but on short waves noises occurred. Mention of all-mains short-wavers calls to mind the fact that hum can be most unbearable and difficult to trace in such a receiver in which the valves make poor contact with the valve-holder sockets. Many noises, too, can arise from this cause, particularly if a valve is able to make the slightest movement. A valve which is losing its emission will generally increase the over-all noise level, and often give rise to noises similar to atmospherics. These latter, by the way, are now beginning to become troublesome, so that the set must not be accused unjustly of causing them. It is believed that the few hints given will, however, help those who are troubled with a noisy receiver.

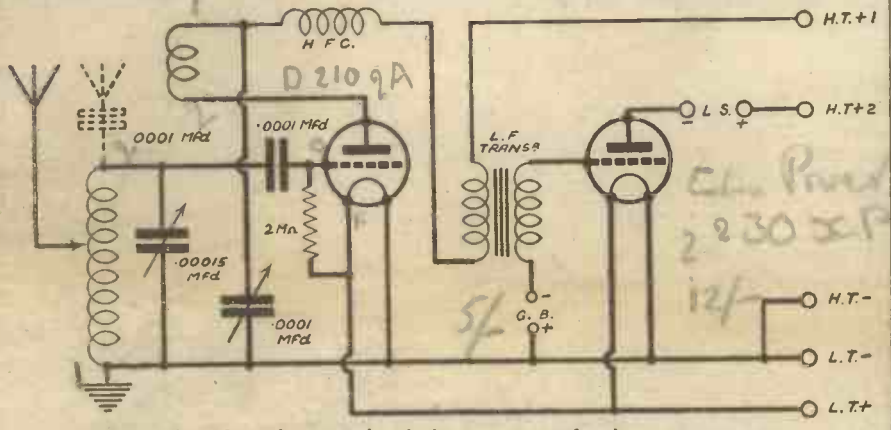


Fig. 1.—A good simple circuit for the beginner to use for short-wave reception.

The Newcomer to Short Waves

Probably there are many who read these notes and the rest of the short-wave section week by week who have never owned a short-wave receiver, but are just "interested" in the subject. They may not realise how much they are missing, and how cheap and easy short-wave work is. I suggest they build a receiver to begin with on the lines of the circuit given in Fig. 1, which shows a cheap and simple two-valver.

Such a set can be built for a few shillings, and if you use the valves and loud-speaker from the "family" broadcast receiver it will be even cheaper. The loud-speaker can be used to begin with, even for America, and, in fact, there will never be any necessity to buy 'phones, unless you become an extraordinarily keen "fan." The aerial is attached to a crocodile clip and is clipped on to any part of the coil that gives best results, or, alternatively, the permanent connection, as shown in dotted lines on the diagram, may be made. The coil used may be of the four-pin variety to plug into a valve-holder, and I recommend that, as a commencement, just one to cover the interesting band from 22 metres to 47 metres be obtained. Suitable coils are made by Colvern, B.T.S., and Eddystone. Reaction is "throttle-controlled," a system which is generally considered the best on short waves. The tuning condenser should be the best it is possible to afford. An air-dielectric reaction variable of the better type may be tried in this position, but a proper short-wave condenser should be fitted for the best results. Little more need be said concerning the circuit, but, with regard to the lay-out, shortness of all wires carrying H.F. is a vital point, and this means that the wiring to the detector valve-holder must be kept from wandering all round the components. Connections from the coil-holder must be made direct. The suggested lay-out for the detector stage is shown in Fig. 2.

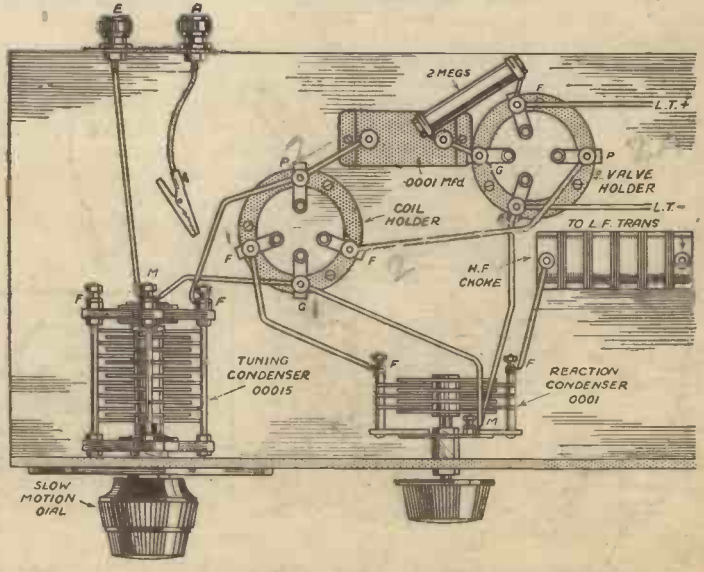
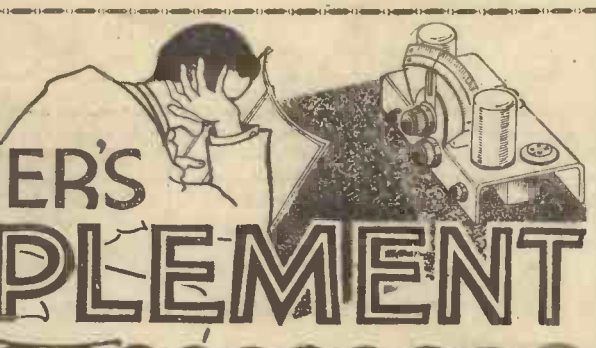


Fig. 2.—A suggested layout for a receiver using the circuit given in Fig. 1.

MODULATION, WAVELENGTH and FREQUENCY—2

BEGINNER'S SUPPLEMENT



Some Further Mysteries Are Cleared up in this Concluding Article of the Explanation of the Principles of Transmission by W. J. DELANEY

AS the wavelength decreases the frequency increases, and this was very clearly explained by the diagram (Fig. 7) which concluded last week's article. When it is desired to find the frequency of a transmission, and only the wavelength is known, we divide 300,000 by the frequency. Similarly, if the frequency only is known and we wish to ascertain the wavelength, we divide 300,000 by the frequency. What has the figure 300,000 to do with this calculation? Why not 100,000 or some other number? This point seems to mystify many amateurs, and even those who have been experimenting for years simply know that you do use this figure, but have never ascertained the reason. However, as with most apparent difficulties, there is a very simple solution. It is common knowledge that wireless waves travel at the same speed as light. The speed of light, as we all remember from our school days, is 186,000 miles per second. If this is converted into metres, we find that it is as near as possible 300,000,000 metres per second. Thus, we may regard this figure as 300,000 kilometres, or use the figure in metres and simplify our alternative method. Let us put this another way.

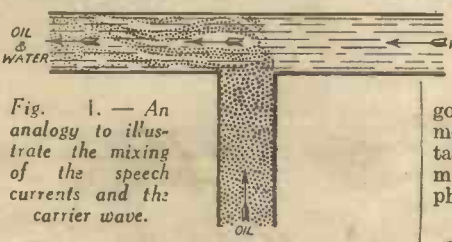


Fig. 1. — An analogy to illustrate the mixing of the speech currents and the carrier wave.

Modulation

If a wireless wave travels at a very slow speed so that one wave measures 300,000,000 metres from crest to crest, when it would have a duration of one second, and in view of the fact that one wavelength may also be regarded as one cycle, the frequency of such a wave would be one cycle. This point will be clearly seen from Figs. 6 and 7, published last week. Now a frequency of one cycle equals a wavelength of 300,000,000 metres, but as we never deal with such low frequencies in wireless transmissions, it is simpler to calculate in thousands of cycles, or kilo-cycles. If we convert cycles to kilocycles, we must also convert metres to a similar standard, and this will consist of dividing the above number of 1,000. Thus a wavelength of 300,000,000 metres equals one thousandth of a kilo-cycle, or 300,000 metres equals 1 kilo-cycle.

So far we have only considered the actual radiation of the tuned circuit, and if the wireless transmitter is set into action with the aerial connected we will have a constant radiation being sent off from the aerial at the frequency governed by the tuned circuits. This is known as the "carrier wave," as it is only a means of carrying or conveying the speech and music of the programmes. If you switch on your wireless set when the B.B.C. stations have just started up (that is, before the tuning note is sent out), you will simply hear a rushing noise as you bring your tuning circuits into resonance. This is the carrier, and the symmetry of the curves shown last week is upset by mixing with the oscillations in the tuned circuit some oscillations produced by speech or music. It is not necessary to go into the method of connecting the modulation circuits, but we must just take it that the variations of speech and music are conveyed through the microphone circuit to the tuned circuits governing the carrier. Now the speech impulses as we will call them are of low frequency, as compared with the carrier of high-frequency, and thus the two may be combined without actually mixing. You may liken the two to oil and water and the combination of the two may be represented by the two pipes in Fig. 1. The water is passing through the upper pipe at a constant speed (representing the carrier wave of constant frequency or amplitude), and the speech and music mixing is represented as oil from a pipe joining the main lead. The two will combine and pass along in the direction of the arrow, but at some further point it is not a difficult matter to separate the two with suitable apparatus.

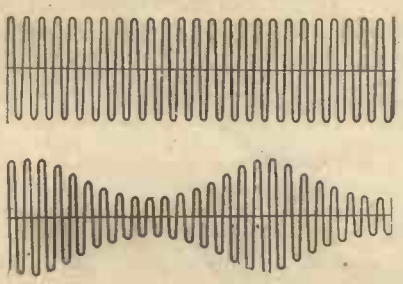


Fig. 2.—A carrier without signal (unmodulated) and the result of modulation.

Degree of Modulation

It is obvious from the above that the curves which were shown last week will be modified and will appear as in Fig. 2. All the little variations may be separated out and turned in our receiver into the original sounds, but these points have already been explained in other articles, and we are concerned now only with the process of modulation. In Fig. 3 is shown a diagram illustrating the carrier wave (which, as you see, is constant), and then the alteration which takes place as the signal is superimposed, and then the return to a normal wave-form as the signal ceases. Now probably when you have been reading some details of the B.B.C. transmitters you have read that their modulation does not exceed 80 per cent. What does this mean? If you look again at Fig. 3 you will see that in the modulated portion of the curve there are two horizontal broken lines, one corresponding with the highest curve and the other coinciding with the top of the unmodulated carrier wave. The maximum rise is indicated as A. and the normal maximum is shown as B. Therefore the modulation is the ratio of increase, or, in other words, A over B $\left(\frac{A}{B}\right)$, and the percentage modulation would be this ratio multiplied by 100. If the variation indicated by A is made too great distortion takes place owing to the fact that sufficient current is not available to enable the highest peak to rise to a correct point and thus the combined carried and speech currents would be of the wrong shape, and when rectified in your receiver you would not obtain a clear signal. Actually, the greater the ratio $\left(\frac{A}{B}\right)$ the louder will be the music for a given strength of carrier and consequently the greater the range of the station, and this accounts for the distortion which often accompanies amateur transmissions and some Continental stations, as they put up the modulation to get range, without paying too much attention to musical quality.

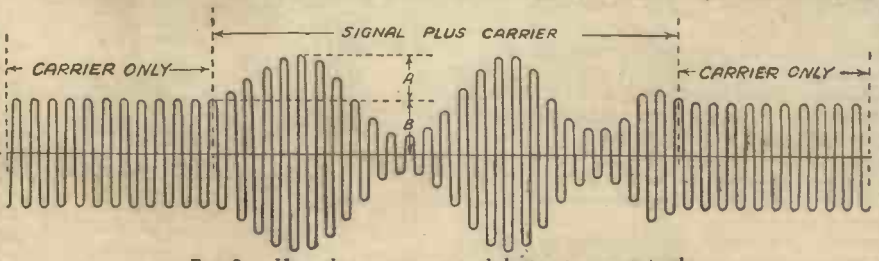


Fig. 3.—How the percentage modulation is ascertained.

FERRANTI'S NEW FACTORY

SOME interesting apparatus is installed in the new factory recently opened at Moston by Messrs. Ferranti. We were privileged to visit this factory, and some of the ingenious methods of testing components and receivers which we saw will no doubt appeal to our readers, as will details of the methods which are adopted in a modern factory for the construction of an up-to-date wireless receiver. The loudspeakers, for instance, which are fitted to the Ferranti receivers are made in the Moston factory, and when assembled undergo two separate tests. In one of these tests the speaker is connected to an oscillator which produces a violent whistle rising through the scale to inaudibility, and known, on account of the noise, as "the whistler." The process is, of course, carried out in a sound-proof cabinet to avoid distracting other workers in the factory. Following this, the speaker is connected to a receiver which is in turn connected to a gramophone apparatus, and actual records are played through it in order to make quite certain that there are no peculiarities which might give rise to "coloration." The whistler should, of course, in itself be adequate proof that the response is level and without peaks, but the makers consider that a musical test should also be employed to make doubly certain.

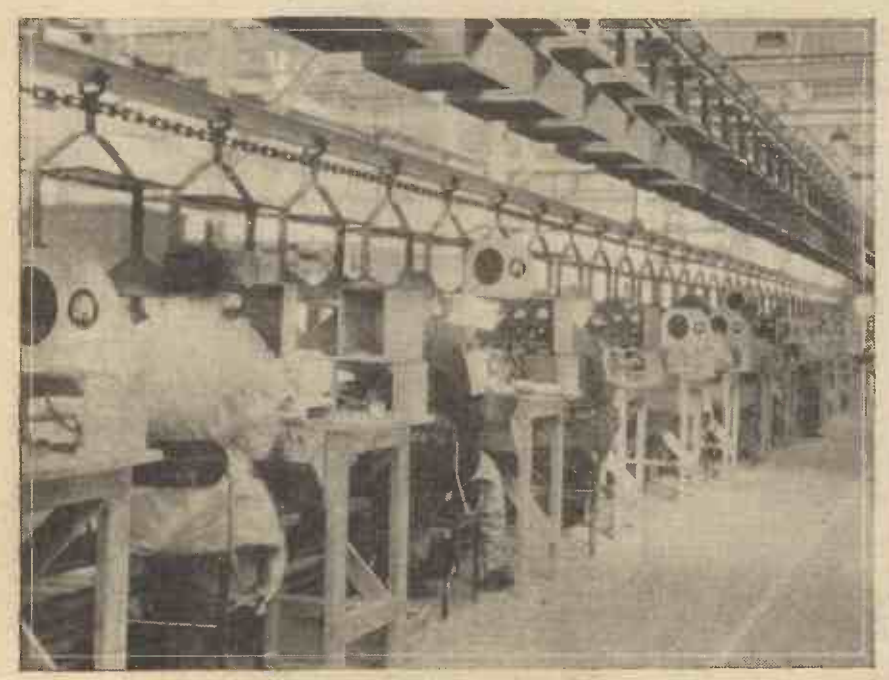


Fig. 1.—The receiver testing section at the new Ferranti factory.

Testing a Receiver

When the receiver has been completely assembled on the conveyer belt it passes through many testing processes. Finally, the most interesting test is applied, and the panel upon which this test is carried out may be seen at the extreme right-hand side of Fig. 1. On this panel there are no less than 23 meters, on the scale of each of which is a coloured mark. A 5-valve superheterodyne receiver, which we had seen assembled, was placed upon the bench in front of this panel, and a peculiarly-shaped piece of apparatus pressed up against the receiver. A switch was pressed and the needles of all the meters moved over to the coloured mark. This process tested every wire in the receiver, every component, and every circuit simultaneously, and when each needle was seen to rest at the prescribed mark, the wave-change switch and volume controls were operated and appropriate meters moved to show that these also were in order. It was really uncanny to think that such a complicated test could be applied to a receiver built in such a compact manner on a metal chassis.

When a receiver is finally passed out it undergoes a "heat test." For this purpose the mains are connected to the receiver exactly as they would be in the listener's home. The set is switched on and left for six hours. At the end of that period there should be no undue rise in temperature anywhere and no part should have broken down. It then undergoes a test on broadcast and gramophone records.

Eliminating Interference

In a factory of this nature there are signal generators and other apparatus for test purposes, and with so many receivers being tested there is obviously great risk of interference. Furthermore, the various pieces of electrical apparatus which are employed in the manufacturing processes would also give rise to troubles on the set-testing side, but throughout the factory special earthing systems have been adopted so that there is no interference between one piece of apparatus and another, nor between mains leads, power apparatus, etc. This in itself is a marvellous feat, when the size of the factory and the multiplicity of apparatus is considered. All the machinery is electrically driven and there is no overhead shafting. At one end of the factory is a timberyard where all the necessary wood is stored, and this passes through the cabinet shops, where the various types of cabinet are constructed, stained, polished, and finished off, and at the other end of the factory are the component shops, where every component part is constructed from raw materials and passes along conveyers until finally assembled in the form of a complete receiver in its cabinet. The makers claim that this is one of the most up-to-date factories in the country, and it is anticipated that no less than 1,000 sets a day will be turned out. Messrs. Ferranti are not leaving anything to chance, and every worker in the factory, before taking his or her place, must pass through the factory training school!

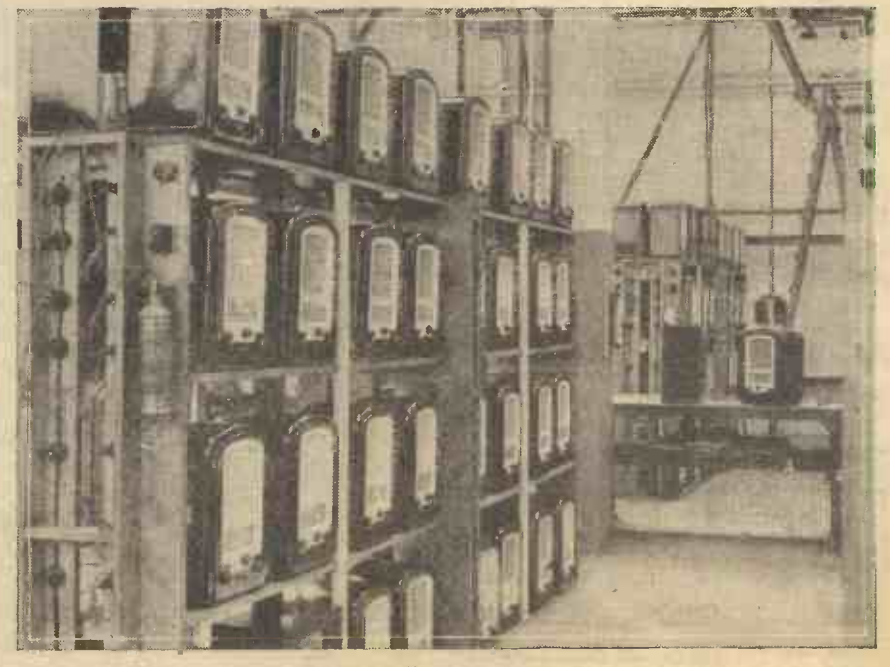


Fig. 2.—Receivers undergoing a "heat test." All voltages are applied to the receiver and it is left switched on for 6 hours.

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 RADIO, PHYSICAL AND TELEVISION SOCIETY.

AT a well attended meeting of this society, held on Friday, May 31st, at 72A, North End Road, West Kensington, a lecture was given on 5- and 10-metre work by Dr. C. G. Lemon. Various circuits for use on the high-frequency bands were described in detail. Demonstrations were also given of 5- and 10-metre apparatus, and it was interesting to note how extremely simple an efficient 5-metre receiver can be. It is proposed to hold a 5-metre field day in the near future, and full details of this and other meetings will be gladly sent to any readers of PRACTICAL AND AMATEUR WIRELESS making application to the assistant hon. secretary, M. E. Arnold, 12, Nassau Road, Barnes, S.W.13.

INTERNATIONAL SHORT WAVE CLUB (LONDON)

AT the meeting of the London Chapter held on Friday, May 31st, Mr. G. S. Holliday described and demonstrated the 1936 "Empire Receiver." This receiver is a 7-valve all-wave superhet for A.C. mains operation. W2XAD 19.56 metres was heard at full loud-speaker strength, so also were many other stations. The aerial in use at the Chapter is an inverted V-type which gives an increase of signal strength of 6 to 1 against any other type of aerial used for short-wave reception.—A. E. Bear, Secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

SLADE RADIO

ON Thursday, May 30th, at the Slade Radio Society, Mr. L. G. Coade gave a lecture and demonstration upon all that is new in electro-medical work. By means of a quartz tube filled with mercury vapour he produced ultra violet light, and he demonstrated how this light could be used for detecting impurities in food, and also how it was used in hospitals for the curing of the sick. He described a good deal of technical matter, showing the range of light at present known, and also traced the history of light as split up by the spectrum since the days of Sir Isaac Newton up to the present time. By means of a graph he showed how the band of radio frequencies only occupied a very small portion of the present known spectrum. The address proved extremely interesting, and there was quite a good attendance. Hon. Secretary, Chas. Game, 40, West Drive, Heathfield Park, Handsworth, Birmingham.

CATALOGUES RECEIVED

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

COMPONENTS AND CABINETS

A COMPREHENSIVE catalogue of radio components, cabinets, and gramophone motors is just to hand from the Premier Supply Stores. In addition to the large range of small components, several moving-coil speakers of well-known make are listed, in chassis form and in cabinets. In the cabinet section there are several bargains in well-finished cabinets in figured walnut and oak in various sizes suitable for receivers and radiograms. Copies of this useful catalogue can be obtained from the Premier Supply Stores, 20 and 22, High Street, Clapham, S.W.4.

Facts & Figures

COMPONENTS TESTED IN OUR LABORATORY

AN interesting range of mains transformers is to be found in the Varley catalogue, and below we illustrate the model EP.36, a model of which has been tested by us. This is one of the new type semi-shrouded transformers supplied without terminals. Long flexible leads are provided on the secondary windings, and these are passed through coloured systoflex sleeving. The paxolin disc through which the leads are brought is clearly engraved (as may be seen in the illustration) so that no difficulty will arise in wiring a receiver, and no mistake should occur in identifying the various leads. On the primary side, plug and socket connections are employed and the primary is tapped so as to enable the transformer to be connected to mains of

The Varley EP-36 mains transformer.

200, 215, 230, or 245 volts (50 cycles) and the H.T. output is 325-0-325 volts 50 mA. This value is rather unusual (the customary output in this type being 350-0-350 60 mA), but has been decided upon by the manufacturers for several reasons. The average output valve is of the 250-volt type and thus this voltage is normally sufficient. When, however, an energised loud-speaker is employed an extra output is necessary in order to enable the field to be used for smoothing without seriously reducing the voltage on the output valve, and with the ordinary three- or four-valve receiver the current is not sufficiently high to warrant the use of 350-volt output. For this type of receiver, therefore, this transformer is eminently suitable, and the heater winding is thus designed to provide 4 volts at 4 amps (with a centre-tap) and the rectifier heater winding is of the 4-volt 2.5 amp. type. On test it was found that the rated outputs were accurately given, and no undue rise took place even when the heater circuit was reduced to 1 amp. The regulation of the H.T. winding is also very good, and although, owing to the method of construction, the temperature rise was rather higher than is usual it is well within the standard safety limits. It is, of course, not nearly so great as the modern output valve, and the windings are designed to withstand this slight rise. An electrostatic screen between primary and secondary removes risk of hum by induction, and the transformer may be recommended for those who are looking for a low-priced transformer suitable for a three- or four-valve set of the type previously mentioned. The price is 22s. 6d.

Reliance Potentiometers

ALTHOUGH it is often stated that volume controls and similar potentiometers should be of the wire-wound type, there is no reason why the composition type of control should not be employed in nine out of ten circuits. In the old days the rule certainly applied to practically every case, but in these days of modern ideas it is found quite practicable to arrange a composition element of such a nature that a fair current may be carried and undue wear from friction will not take place. In the Reliance potentiometers the resistance film is deposited on a bakelite ring (not ordinary paper), and the contacts at the end which are integral with the connecting lug are embedded in the bakelite and thus a definite unbroken contact is obtained. The nature of the resistance element is such that no change takes place with temperature changes and the surface is hard and permanent. The contact arm is fitted with a graphite tip and this passes smoothly across the element without frictional wear. The result of this combination is a delightfully velvety feeling as the control knob is rotated, and the component may be recommended for practically any position. Various stock values are kept, from 50,000 ohms up to 5 megohms, and the price is 4s. 9d. If desired a mains-type switch may be fitted (rated at 3 amps. 250 volts) for an extra 2s. Terminals are not fitted, but the majority of constructors prefer the soldered connection so that this point is not detrimental to the component. For those circuits where high currents have to be carried, a special range of wire-wound controls are available from the same firm at 4s. 6d. The wire is wound on a bakelite former and the terminal ends of this are metallised to ensure reliable contacts. The makers are the Reliance Manufacturing Co. (Southwark), Ltd., Westbury Road, London, E.17.

One of the Reliance composition volume control potentiometers.

IMPRESSIONS ON THE WAX

By T. ONEARM

THE Decca lists for this month show a tendency towards light music. "Glamorous Night" and "Far Away in Shanty Town," by Maurice Winnick and his Orchestra on *Decca F5522*, are two songs from Ivor Novello's present success at Drury Lane—"Glamorous Nights." As you know, this show has a record advance booking, even for Drury Lane. Novello's music, therefore, should be very popular. This is the first record of the show that Decca have issued. "Algernon Whifflesnoop John" and "Sweet Flossie Farmer" on *Decca F5524* are two typical Elsie Carlisle songs, and both have already been strongly featured on the air.

"Ring Dem Bells" and "I Never Knew," by Claude Bampton and his Band on *Decca F5515*, is the first record the Decca Company have ever issued by a semi-professional band. It is well worth hearing.

Old-time Melodies

A RECORD that should appeal to many is "State Ball Memories," played by Marius B. Winter and his Orchestra on *Decca K756*. This orchestra was chosen to play at the State Ball at the Guildhall on May 22nd, when their Majesties were the guests of the Corporation of the City of London. The melodies recorded on this record are the melodies played at the Ball. They are what are now called "Old-time Melodies," which were submitted to their Majesties prior to the Ball.

There are five new records by Ambrose and his Orchestra in this month's Decca list—"B'wanga", and "Fire Dance" on *Decca F5529*, and "Tiger Rag" and "I've Got a Note", on *Decca F5550* being the most popular. The other records are more commercial, but they are all exceptionally well played and recorded.

Following the immense success of "The Three Little Pigs" and "The Grasshopper and the Ants," the Decca Company now present the third of this series, this time on a 12-inch record, *Decca K755*. "The Pied Piper" is featured on this disc and it is a clever piece of recording.

Decca-Polydor Records

CHAMBER music—that is the music for the family circle—is too often adjudged to be dry, stuffy, and formal. Admittedly, some chamber music is involved from the listener's aspect, but a vast amount of it that flowed from the pen of the great masters is of unflagging vitality and interest.

The early Beethoven Sonata, played by Franz von Vecsey and Guido Agosti, is a really jolly work, and records *DE7033-DE7035* are earnestly recommended for you to hear. The records are 10in. in size, and cost only 2s. 6d. each.

Tiana Lemnitz makes her first appearance on *Decca-Polydor—LY6108*—and she is extremely good. I feel sure that this record will secure many enthusiastic devotees.

THE BASIS OF DESIGN

LETTERS FROM READERS

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

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

Transposed Aerial Systems

SIR,—We were interested to read the article on "Transposed Aerial Systems" in your issue of May 22nd, page 298, and agree that aerials using this type of down lead improve reception.

We do not, however, agree that the transposed down lead eliminates interference, although it effects an improvement in the signal to noise ratio by providing the maximum signal transference from the horizontal aerial. The essential, to our mind, of reducing man-made static on short waves is to provide a purely inductive coupling, as then no capacity effects exist between the aerial coupling coil connected to the down lead and the tuned circuit of the receiver.

It is necessary to provide electro-static screening to achieve these objects, and it is significant that the Americans make provision for the coupling mentioned. There is no doubt that the static-eliminating properties depend on this electro-static screening, and this is true of practically all types of special short-wave down leads.—WARD & GOLDSTONE, LTD. (Manchester).

The Know-all

THERMION,—Having read your pages for some years with considerable interest, I would like to draw your attention to a couple of matters that are of importance to both the amateur and service man.

The first is the growing tendency of the "know-all" to attempt to repair sets for their friends when they themselves are entirely ignorant of the simple methods of testing. It has been my lot to be asked recently by a certain acquaintance certain facts about A.C. mains sets, and I have answered his questions and given him information regarding certain faults. Just recently it has come to my knowledge that the person in question has been repairing and overhauling some dozens of his fellow employees' sets, and from the number of questions I have answered I think that my knowledge has contributed to each cure. Now my point is this: that I am unemployed, and am a fully-qualified service man and have always given complete satisfaction with my work. It is the dabbler who is increasing in numbers and who is contributing to our distress.

Mine is not an isolated case, and I am sure that a call for a little fair play is indicated.

The other matter concerns the number of "cheap" components that are making their appearance in various multiple firms' windows. They are obviously "back-room factory" parts and their reliability is nil. The sale of these parts is often pushed for any special set published, with the result that misguided people with little money are very much worse off. I know that you have mentioned it before, but the trouble appears to be growing again. I have seen kits for the "Hall Mark" series of receivers offered at silly prices with a load of junk included.

Wishing PRACTICAL AND AMATEUR WIRELESS every success.—A. T. ENGLAND (Isleworth).

Short-wave Reports Wanted

SIR,—It is with some disappointment that I note in your paper that, in the short-wave section views on amateur transmissions are entirely left out. These are always very interesting, and to give details of broadcast stations is essential to the new-comer, as it gives him some idea on which frequencies, according to whether it is day or night, he should tune his receiver. I feel sure that many other readers would appreciate more news and reports of amateur transmitters.—H. LE TISSIER (Guernsey, Channel Islands).

Suggested Ideal Circuit

SIR,—Having studied and considered various circuits I have come to the conclusion that a circuit around the following lines is probably the best for South African conditions:—

(1) All-wave to tune from 12-550 metres.
(2) To work from A.C. mains 220 volts.
(3) To consist of eight valves including the rectifier valve.
(4) Push-pull output.
(5) Automatic volume control.

As I have taken PRACTICAL WIRELESS for over a year, I have been anxiously awaiting the appearance of this type of receiver in its pages.

I feel confident that almost all South African readers will agree with my suggestion as such a set is the only means by which we might keep in touch with the world.—H. CROUCH (Ladysmith, S. Africa).

[*We shall be glad to hear what other overseas readers think of the circuit suggested by Mr. Crouch.*—ED.]

CUT THIS OUT EACH WEEK.

Do you know

—THAT ebonite should not be used for outdoor insulation unless it is protected from rain and sun.

—THAT the insulation of the aerial system is a vital factor in long-distance reception, and the insulators should be periodically cleaned to remove carbon (soot) deposits.

—THAT enamelled wire is preferable for an aerial system to avoid the risk of corrosion.

—THAT the frequency response of low-frequency transformers may be modified by the method of using them in a circuit.

—THAT the provision of an air-gap in an iron-cored choke prevents serious alterations in inductance with varying currents.

—THAT electrostatic shielding of the primary winding of a mains transformer removes the risk of induced hum.

—THAT the reaction leads may often be screened in an unstable receiver with good effect.

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.

CONSTRUCTOR CRUSADERS' CORNER

Ambition

A CRUSADER wrote last week asking for a circuit and constructional details for a 10- or 12-valve superhet. This is a rather ambitious request, but is, nevertheless, unsound. No one would think of having a car built with an engine of 400 horse-power for ordinary everyday use. There would never be any chance to use it unless it were taken to a special race-course. Similarly with a 10-valve superhet. In these days the power of stations is so great that the set could only be operated very inefficiently to avoid overloading of all the L.F. stages, and the result would then be that background noises, valve hiss, and other sounds emanating from the various circuits would be so bad as to prevent the reception of many stations. Thus, if you were to make up such a set you would find that you could listen to fewer stations than would be possible on a good four-valver. This may sound rather far-fetched, but it is nevertheless true, as you will see if you sit down and work out the combination of valves which could be utilised for a 10-valve super. Five valves should be looked upon, in these days, as the economical limit for a receiver, and a correctly-designed superhet of this type will give as much as anyone could desire.

Loud-speakers

SEVERAL requests have been received recently for opinions regarding the *best* loud-speaker. This is a very difficult request to fulfil, as what is best to one listener may be bad to another. It may be considered that the best speaker is a small moving-coil unit, utilising a flat (or at least very slightly dished) diaphragm, fitted to the end of a logarithmic horn. But to obtain even response down to the lowest broadcast frequency the size of the horn becomes such that it would not go into the average home, unless it is folded back upon itself or otherwise doubled, and this introduces difficulties from echo and resonance effects. Therefore, the listener is forced to use the next best, and from the point of view of even response the ordinary moving-coil speakers as we know them are undoubtedly the best. But they must be correctly fed as they will not produce good music from a bad or indifferent set. They will show up defects in a receiver or amplifier, and, therefore, if you obtain one of these modern speakers and fit it to your set and find that the reproduction is worse than it was with an old ordinary type of moving-iron speaker, you will know that the set wants looking to, or that the speaker is not matched to the output valve. We always specify the speaker best suited to a particular design, and if you are in any doubt, go round to your nearest radio dealer and hear the models he has in stock. When you have made a more or less tentative decision, try to get permission to take them home and hear them in your own surroundings. If a suitable deposit is paid, most dealers will allow you to do this, and you will then know exactly how the speaker will sound and can judge the model which you want or like best.

REPLIES IN BRIEF

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

F. J. H. (Thornton Heath). It would appear that some of your neighbours may be using their sets in an incorrect manner, allowing them to oscillate when receiving the locals. You should have a word with them about it. On the other hand, you may be mistaken, and the fault may be due to your own receiver.

T. R. (Forest Gate). It is not our policy to specify alternatives for our receivers. We advise you to adhere to our specification.

J. C. O. (Addington). We regret we have no blueprint of an amplifier of the type described by you.

J. A. F. (Bangor). The details you require were given, together with a circuit diagram, on page 682 of our issue dated January 26th last.

C. C. (S.E.22). Parallel-feed may improve matters. Use a 30,000-ohm anode resistance with a 1 or 2 mfd. fixed condenser for coupling. This will introduce a bass resonance and will, no doubt, give you what you require.

G. M. (E.2). A converter would be more suitable for the Fury Four. Body capacity could be avoided by screening the panel with a thin sheet of metal on the inside and connecting this to earth. It must not come into contact with any of the panel-mounted parts.

L. P. (Sheerness). When referring to the height of an aerial, the effective distance is that above the nearest earthed object. Thus if an aerial was 5ft. above a roof, but the roof was 30ft. from the ground, the aerial would not be 35ft. high, but only 5ft. high.

J. R. P. (Edinburgh). Yes, an all-wave choke would be most suitable, although you could connect a standard broadcast choke in series with the specified short-wave choke and obtain similar results.

T. P. (Tallesbury). You would need a converter. Write to the Electro Dynamic Construction Co. Ltd., Devonshire Grove, London, S.E.15.

G. H. (Dagenham). We would recommend the Fury Four Super, blue-print No. P.W. 34C.

N. H. (Ashton-u.-Lyne). The particular coils you mention could not be used in the superhet. The entire receiver would require re-designing to use these coils.

R. E. H. (Birmingham). We would suggest blueprint P.W. 43, with the output stage modified to utilise push-pull. We have no complete blue-print of a set exactly of the type you mention.

H. F. R. (Birmingham). You could not use the suggested scheme for broadcast reception without modifying the circuit.

E. E. S. (Athlone). Any standard make of choke and transformer will be found quite satisfactory. The W.B. Baby speaker would be perfectly suitable for this receiver.

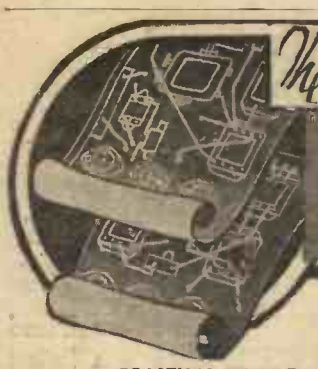
W. G. C. (Pembroke Dock). We have only used the pack in question once. This was in the Luxus Superhet, blue-print P.W. 33. The receiver is for A.C. operation, and we have not used the pack on any battery receiver.

A. P. W. (Southsea). We hope to publish a design for the receiver you require in an early issue. For the particular component get into touch with National Radio Service Co., 15/16, Alfred Place, Tottenham Court Road, W.C.1. We regret that we have no details of the price.

H. W. (Chippenham). We should be glad to demonstrate the receiver here at any time to suit your convenience.

H. A. E. (Antwerp). We regret we cannot understand your letter. The handwriting is very indistinct. Could you please repeat your query in a clearer form?

A Good Power Amplifier. Will readers note that in the circuit of the amplifier as published on page 308 of our issue dated May 25th last, for 1,500 ohms read 15,000 ohms, for 2,500 ohms read 25,000 ohms, and for 2,500 ohms read 25,000. These resistances are in the H.T.+ feed to the first two valves.



The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

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

PRACTICAL WIRELESS.

	Date of Issue.	No. of Blprint.
Blueprints, 1s. each.		
Long-Range Express Three	—	PW2
Mains Express Three	8.10.32	PW3
Sonotone Four	15.10.32	PW4
Bijou Three	29.10.32	PW5
Argus Three	12.11.32	PW6
Empire Short-Wave Three	3.12.32	PW7
Solo Knob Three	10.12.32	PW8
Midget Two	17.12.32	PW9
Selectone Battery Three	14.1.33	PW10
Fury Four	—	PW11
Featherweight Portable Four	6.5.33	PW12
Q.P.P. Three-Four	4.3.33	PW13
Alpha Q.P.P. Three	25.3.33	PW14
Ferrocart Q.P.P. Hi-Mag. Three	25.3.33 and 1.4.33	PW15
Supersonic Six	8.4.33	PW16
Beta Universal Four	15.4.33	PW17
A.C. Twin	22.4.33	PW18
Selectone A.C. Radiogram Two	29.4.33	PW19
A.C. Fury Four	25.2.33	PW20
Radiopax Class B Four	27.5.33	PW21
Three-Valve Push-Pull Detector Set	4.3.33	PW22
Double-Diode Triode Three	10.6.33	PW23
Three-Star Nicore	24.6.33	PW24
D.C. Ace	15.7.33	PW25
Superset	19.8.33	PW26
Auto-B Three	19.8.33	PW27
All-Wave Two	19.8.33	PW28
A.C. Three	16.9.33	PW29
Premier Super	23.9.33	PW30
Experimenter's Short-Wave Three	23.9.33	PW30A
A.C.-D.C. Two	7.10.33	PW31
All-Wave Unipen	14.10.33	PW31A
F.J.C. 3-valve A.V.C. (Transfer Print)	4.11.33	PW32
Luxus A.C. Superhet	14.10.33	PW33
A.C. Quadpak	2.12.33	PW34
Sixty-shilling Three	2.12.33	PW34A
Nucleon Class B. Four	6.1.34	PW34B
Fury Four Super	27.1.34	PW34C
A.C. Fury Four Super	10.2.34	PW34D
Leader Three	10.3.34	PW35
D.C. Premier	31.3.34	PW35B
A.C. Leader	7.4.34	PW35C
Atom Lightweight Portable	2.6.34	PW36
Ubique	28.7.34	PW36A
Four-Range Super-Mag. Two	11.8.34	PW36B
Summit Three	18.8.34	PW37
Armada Maius Three	18.8.34	PW38
Midget Short-Wave Two	15.9.34	PW38A
All-Pentode Three	22.9.34	PW39
£5 Superhet Three	—	PW40
A.C. £5 Superhet Three	24.11.34	PW43
D.C. £5 Superhet Three	1.12.34	PW42
Hall-Mark Three	8.12.34	PW41
F. J. Camm's Universal £5 Superhet	15.12.34	PW44
A.C. Hall-Mark	26.1.35	PW45
Battery Hall-Mark 4	2.2.35	PW46
Universal Hall-Mark	9.2.35	PW47
Hall-Mark Cadet	23.3.35	PW48
Short-Wave Converter-Adapter	23.2.35	PW48A
F. J. Camm's Silver Souvenir (All-Wave Three)	13.4.35	PW49
F. J. Camm's A.C. All-Wave Silver Souvenir Three	—	PW50
Genet Midget Three	—	PM1

AMATEUR WIRELESS AND WIRELESS MAGAZINE.

CRYSTAL SETS.

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

STRAIGHT SETS. Battery Operated.

One-valvers: Blueprints, 1s. each.		
B.B.C. One-valver	—	AW344
B.B.C. Special One-valver	—	AW387
Twenty-station Loud-speaker One-valver (Class B)	—	AW449
Two-valvers: Blueprints, 1s. each.		
Melody Ranger Two (D, Trans.)	—	AW388
Full-volume Two (SG.-Det. Pen.)	17.6.33	AW392
Iron-core Two (D, Trans.)	—	AW395
Iron-core Two (D, QPP)	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D, Trans.)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG., Trans.)	—	AW338A
Lucerne Minor (D, Pen.)	—	AW426
Family Two (D, Trans.)	—	WM278
Three-valvers: Blueprints, 1s. each.		
£8 Radiogram (D, RC, Trans.)	—	AW343
P.T.P. Three (Pentode-Triode-Pentode)	*June* '25	WM389
New Regional Three (D, RC, Trans)	25.6.32	AW349
Class-B Three (D, Trans. Class B)	22.4.33	AW386
New Britain's Favourite Three (D, Trans., Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher, Chassis Model (SG, D, Pen)	3.2.34	AW419
Lucerne Ranger (SG, D, Trans)	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
P.W.H. Mascot with Lucerne Coils (D, RC, Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	—	AW424
Pentaquester (HF Pen, D., Pen)	14.4.34	AW431
£5 5s. Three: De-luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All Britain Three (HFPen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.1.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
Multi-Mag Three (D, 2 Trans)	—	WM288
Percy Harris Radiogram (HF, D, Trans)	*Aug.* '32	WM294
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Tyers Iron-core Three (SG, D, Pen)	*July* '33	WM330
C.-B Three (D, LF, Class B)	—	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
All-wave Three (D, 2LF)	*Jan.* '34	WM348
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans.)	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	*Oct.* '34	WM371
Graduating to a Low-frequency Stage (D, 2LF)	*Jan.* '35	WM378
Four-valvers: Blueprints, 1s. 6d. each.		
65/-Four (SG, D, RC, Trans)	—	AW370
"A.W." Ideal Four (2SG, D, Pen)	10.9.33	AW402
2 H.F. Four (2SG, D, Pen)	—	AW421
Crusaders' A.V.C. 4 (2 H.F., D, QP21)	18.8.34	AW445
(Pentode and Class-B Outputs for above: blueprints 6d. each)	25.8.34	AW445A
Quadradyne (2SG, D, Pen)	—	WM273
Calibrator (SG, D, RC, Trans)	*Oct.* '32	WM300
Table Quad (SG, D, RC, Trans)	—	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
Self-contained Four (SG, D, LF, Class-B)	*Aug.* '33	WM331
Lucerne-Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (H.F., D, 2LF)	*Feb.* '35	WM381
The H.K. Four	*Mar.* '35	WM384
Five-valvers: Blueprints, 1s. 6d. each.		
Super-quality Five (2HF, D, RC, Trans)	*May* '33	WM320
New Class-B Five (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.	—	WM286
Three-valvers: Blueprints, 1s. each.		
Home-lover's New All-electric Three (SG, D, Trans) A.C.	25.3.33	AW383
S.G. Three (SG, D, Pen) A.C.	3.6.33	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen) A.C.	23.6.34	AW439
D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July* '33	WM328
Simplicity A.C. Radiogram (SG, D, Pen) A.C.	*Oct.* '33	WM338
Six-guinea A.C./D.C. Three (HF Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF Pen, D, Pen) A.C.	*Nov.* '34	WM374
Four-valvers: Blueprints, 1s. 6d. each.		
A.C. Melody Ranger (SG, DC, RC Trans) A.C.	—	AW380
A.C./D.C. Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C.	8.9.34	AW446
A.C. Quadradyne (2SG, D, Trans) A.C.	—	WM279
All Metal Four (2SG, D, Pen)	*July* '33	WM329
"W.M." A.C./D.C. Super Four	*Feb.* '35	WM382
Harris Jubilee Radiogram	*May* '35	WM386

SUPERHETS.

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

PORTABLES.

Four-valvers: Blueprints, 1s. 6d. each.		
General-purpose Portable (SG, D, RC., Trans)	—	AW351
Midget Class-B Portable (SG, D, LF, Class B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	—	WM282
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM363
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM367

SHORT-WAVERS. Battery Operated.

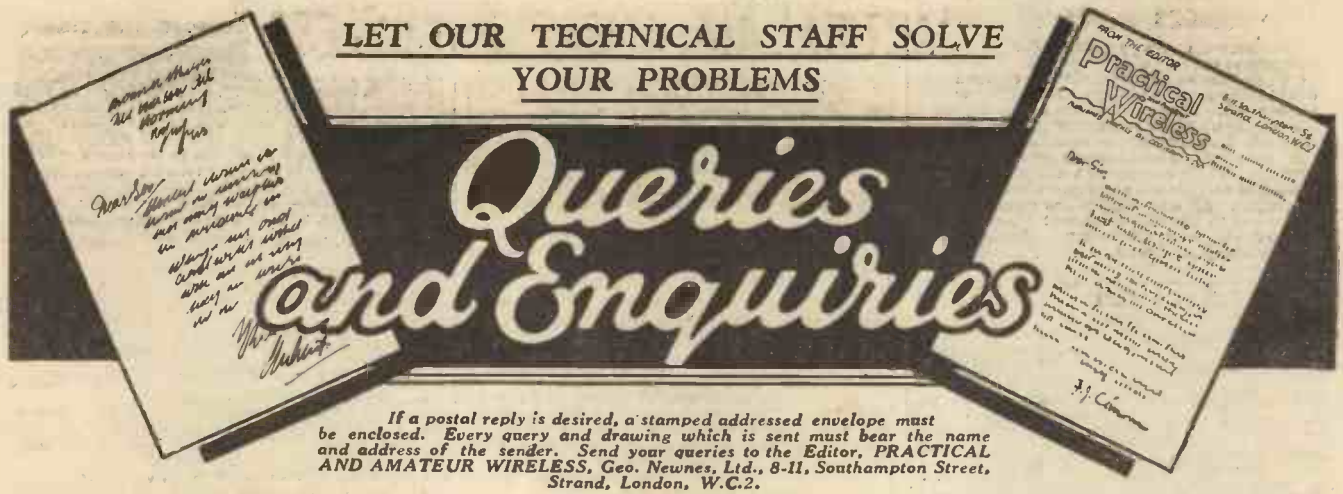
One-valvers: Blueprints, 1s. each.		
S.W. One-valve	—	AW329
S.W. One-valve for America	—	AW429
Roma Short-waver	10.11.34	AW452
Two-valvers: Blueprints, 1s. each.		
Home-made Coil Two (D, Pen)	14.7.34	AW440
Three-valvers: Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver	*Jan.* 19, '35	AW403
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
Standard Four-valve Short-waver	*Mar.* '35	WM383

Mains Operated.

Two-valvers: Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	10.11.34	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	*Aug.* '34	WM368
"W.M." Long-wave Converter	*Jan.* '35	WM380
Three-valvers: Blueprints, 1s. each.		
Emigrator (SG, D, Pen), A.C.	—	WM352
Four-valvers: Blueprints, 1s. 6d. each.		
Gold Coaster (SG, D, RC, Trans) A.C.	*Aug.* '32	WM202
Trickle Charger	*Jan.* 5 '35	AW462

MISCELLANEOUS.

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



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

SPECIAL NOTE

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

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

Please note also, that queries must be limited to two per reader, and all sketches and drawings which are sent to us should bear the name and address of the sender.

Shocks from Controls

"I am rather puzzled about my three-valve mains set, as although I have condensers in the aerial and earth leads I frequently get shocks from the controls. Sometimes it is a week or more before anything happens, and then suddenly, when I go to adjust reaction or volume, I get a tremendous kick from the control. Can you explain this and recommend a cure?"—T. H. (Highgate).

THE trouble is no doubt due to the fact that the grub screws which are fitted to the control knobs are not sufficiently sunk to prevent you from touching them. When you take hold of the knob you do not always grip it in the same position, and thus, on many occasions, you can operate it without touching the screw, but now and again when you grip it your skin comes into contact with the screw, which in turn is in contact with the spindle, and thus you get a shock. Similarly, if the skin is dry less effect would be felt than when the skin is in a moist condition. The remedy is to cover the top of the screw with sealing-wax, Chatterton's Compound, or some similar insulating material.

Dial Lights

"I cannot keep a dial light for more than one week. The set is an A.C. mains 5-valver and is home-made, with the dial-light holder wired to the S.G. heater terminals. It seems to go all right for about a week and then when switching on one day out it goes. I have tried all sorts of bulbs without success and should like to know the reason."—W. K. J. (Bristol).

THERE can be two solutions to your problem. Firstly, you may be using the wrong type of bulb. Although the supply is 4 volts, this is A.C. and therefore you must use a bulb with a filament which will take this supply. An ordinary 4-volt pocket lamp bulb is useless, and you must obtain a 6-volt bulb. Special types are manufactured and are obtainable from any good wireless shop for the purpose. On the other hand, you may be using the correct type of bulb, but the heater winding on your mains transformer may be rated for, say, 8 or 9 valves, and thus there is an undue voltage rise owing to the number of valves which you are using. In this case, of course, you will also be over-running the heaters of the valves, and an artificial load should be placed across the heater winding so as to limit the current to 1 amp.

L.F. Oscillation

"I have just built a set with a push-pull stage, but the reproduction is accompanied by a whistle. This does not alter with tuning, and sometimes can only just be distinguished 'behind' the music. Is this L.F. oscillation? If so, how can it be cured?"—S. E. (Plymouth).

THE noise is undoubtedly due to L.F. oscillation and is probably caused by the push-pull stage owing to differences in the two push-pull valves. If you obtain a milliammeter and connect it in the anode circuits of these two valves you will probably find that the currents differ. You can modify the bias to bring both valves to the same point, or alternatively obtain two matched valves. Much may be done to prevent the instability by fitting high resistances in the grid leads to each valve, and a small resistance (say 100 ohms) in the anode lead of each output valve.

Separate A.V.C.

"I have an old superheterodyne to which I wish to fit automatic volume control. With the valves I have got I have ascertained that the signal H.F. stage will not require the same range of control as the I.F. valve. Is it possible to arrange the A.V.C. circuit so that a variable bias is applied to the two valves so as to accurately control each from the same circuit?"—G. L. P. (Liverpool).

YOUR problem is not quite clear, but we presume you mean that the total voltage required for control of one valve differs from that for the other and you therefore wish to use A.V.C. for the maximum voltage and fit some form of limiting device so that the other valve does not receive the full voltage from the A.V.C. circuits. This could be done by certain circuit arrangements, but it would be preferable to have a wiring diagram of the set in order that we may indicate the best arrangement.

Aerial Interference

"When tuning in I often find that as soon as I have got the station it moves away on the dial, and I have to tune again. This sometimes happens two or three times in an evening, whilst at other times it does not. Is there any explanation of the wave shifting in this manner?"—B. R. (Finchley).

ALTHOUGH your receiver may be faulty, owing to loose windings on the coil, or a condenser spindle which is not securely locked on the tuning dial and drops in certain positions, the most likely cause is to be found in the fact that your aerial runs close to that of your neighbour, and he is also tuning in when you are. Owing to the interaction between aerials the tuning of one set interferes with that of the other and thus you find on some evenings you have to reset your condensers, as does your neighbour. Inquiry will show whether or not this is the case, and if not, then you must look to your coils and condensers.

Over-running or Under-running?

"Will you please clear up a point for me concerning eliminators? Which is the most harmful, to run a set using 23 mA (constant load) from an eliminator delivering 28 mA or from one delivering 20 mA?"—W. N. (Askern).

ASSUMING that both eliminators are constructed from components of good sound make and the regulation is satisfactory, you will have to consider them from the following point of view. If the output is only 20 mA, and your receiver requires 23 mA, the extra current would cause a voltage drop in the rectifier, and thus the output would be slightly lower than that given at 20 mA. At the same time, components in the unit would be required to pass the increased current, but in view of the small value of this no overheating should take place. If the eliminator is rated to deliver 28 mA, the fact that the total load is less than this would result in a voltage rise from the rectifier, and thus the receiver itself might receive damage due to too high a voltage at various points. This could be avoided by fitting a resistance across the H.T. unit to bring the total drain up to 28 mA, but it would probably prove better to use the 20 mA unit, as the slight increase would have practically no effect on a good unit.

The coupon on page iii of cover must be attached to every query.

Miscellaneous Advertisements

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

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. Send 1½d. stamp for NEW ILLUSTRATED CATALOGUE.

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 m.a. Full Wave Rectifiers; A.C./D.C. types, 20 volts .18 amp. Filaments; Screen Grid; Variable-mu Screen Grid.; H, HL, Power and Pentodes.

THE following types 5/6 each; 350v., 120 m.a. full-wave Rectifiers; 500v., 120 m.a. 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, 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, 1A6, 1C6, 1V, 12AS, 12Z3, 19, 30, 31, 32, 33, 34, 41, 49, 56, 57, 75, 76, 79, 82, 84, 6Z4, 85, 89.

LISSEN 3-gang Superhet Coils, with switching; listed 30/-, with circuit, 6/-.

12 TO 2,000 metres. Huge Purchase of All-Band 2 gang Coils from prominent British manufacturer. Fully Screened with switching for S.G. Det. type receivers, 4 Separate Bands, 12 to 2,000 metres. 12/6 with circuit.

SPECIAL Offer B.T.H. Moving Coil Speakers, matched pairs, specially manufactured for McMichael Supervox; 8in. diameter, 1,500 ohms-7,500 ohms (1,500 speaker as choke, 7,500 ohms speaker in parallel with H.T. supply); complete with special dual output transformer for pentode, 15/6 per pair; A.C. kit for above pair, 12/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C.154, 2,500 ohms, 12/6; D.C. 152 Magna, 2,500 ohms, 37/6; all complete with humbucking coils; 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.

A LARGE Selection of Pedestal table and radio-gram cabinets by best manufacturers at a fraction of original cost; send for list.

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. 3-5 amps., C.T., L.T., 30/-; 300 v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps., L.T., 27/6.

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

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.C. output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

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

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.

WHITELEY Boneham Energised M/c Speakers, 2,000 or 2,500 ohms, 8 inch diameter, 9/11. Please state which type transformer required.

COSSOR Permanent Magnet M/c speakers, large Darwin Cobalt Steel Magnet, 8 inch diameter, please state transformer required, 13/6.

(Continued at top of column three)

(Continued from foot of column one)

LISSEN 2-Gang Condensers, Uniknob Trimmer, Disc Drive, .0005 each section, 5/6.

SPECIAL Offer Western Electric Mains Transformers, input 200-250 volts, output 350-0-350 volts, 120 milliamps, screened primary, 4 volts 1-2 amps., 4 volts 2-3 amps., 4 volts 3-5 amps., 9/6; input 100-250 volts, 300-0-300 volts 60 milliamps, 4 volts 1-2 amps., 4 volts 2-3 amps., 6/6; input 200-250 volts, screened primary, output 500-0-500 volts 150 milliamps, 4 volts 3-5 amps., 4 volts 2-3 amps., 4 volts 2-3 amps, 4 volts 1 amp., 4 volts 1 amp., 19/6.

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 micro-farads, 20 volts, 6d.; 8 plus 4 microfarads, 500 volts, 4/-; 50 mf., 50 v., 1/9; 8 mf., 500 v., 3/-.

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

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

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

SCREENED H.F. Chokes, by one of the largest manufacturers in the country, 1/6.

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

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

U.S.A. Electrolytic Condensers. 550v. peak working, standard tubular metal condenser, 4 mf., 8 mf., 12 mf., a real bargain, 1/9.

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/-.

RELIABLE Smoothing Condensers, 250v., working, 1mf., 6d.; 2 mf., 1/-; 4 mf., 2/-; 350v. working, 1 mf., 1/-; 2 mf., 1/6; 4 mf., 3/-.

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

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

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

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

PREMIER H.T.10 Transformer, rectified output 200 volts 100 milliamps, 4 volts 1-2 amps., 4 volts 3-5 amps., 10/-; or with Westinghouse rectifier, 19/6.

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, 6yds. Systoflex, 1, 1.5, 2 or 2.5 mm., 1yd. 7-way cable, 9ft. resincored solder, 6yds. push-back connecting wire.

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190, Bishopsgate, London, E.C.2. All the following Bargains guaranteed new goods. Cash or C.O.D. Carriage Paid in British Isles.

SPECIAL OFFER. Burgoyne Receivers. 3-Valve Class B Models. Complete with Mullard valves; Exide H.T. and L.T. batteries. M/c speaker. Artistic cabinet of highly polished walnut. Chromium fittings. Brand new in original cartons; 1935 Model. List £6/10/0. Cash £3/18/6, or 14/- down and 10 monthly payments of 7/-.

ATLAS ELIMINATORS. Guaranteed 12 months. Model C.A.25 for A.C. mains. 5 tappings. Westinghouse rectifier. List 59/6. Yours for 7/- down; balance in 10 monthly payments of 5/3.

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ELIMINATORS. REGENTONE 1935 Series New and Boxed for A.C. Mains 200/250 Volts, TYPE W.5a Complete with Trickle Charger, 39/6. Type WIa (less Trickle Charger), to carry 30 Milliamps, 33/-. WIC (less Trickle Charger), 30/-.

LOTUS 0.0005 Condensers, Fully Screened, with Trimmers. Complete with Escutcheons, Dials, Knobs. 3-Gang, 11/-. 2-Gang, 7/3.

COILS.—Igranic Superhet 4-Coil set (1 osc., 2 I.F. with pigtails, and 1 L.F. plain), 9/- per set (List 50/-). Varley Constant Square Peak Coils B.P.5, with all accessories, 2/3. Telsen Twin-matched Coils: Type W.287, screened, with switch, 7/9 (List 17/-). Triple-matched Screened Type W.288, with switch, 10/9. Telsen Twin Coil Unit, Type W.478, 12/6. New and Boxed.

MISCELLANEOUS. — Lewcos Spaghetti Resistances, all capacities, new and boxed, 1/6 per dozen assorted. Telsen Binocular H.F. Chokes, 2/-. Telsen ACE L.F. Transformers, 3-1 and 5-1, 2/9.

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SOUTHERN RADIO, 323, EUSTON ROAD, LONDON, N.W.1. Near Warren Street Tube. 'Phone: Museum 6324.

RADIO CLEARANCE, 280, High Holborn, W.C.1. Telephone: Holborn 4631.

RADIO CLEARANCE announce the issue of their Grand Jubilee Illustrated Bargain List containing hundreds of special Bargains. Release date, May 30th. Send 3d. to cover cost and postage.

RADIO CLEARANCE announce the purchase of a limited quantity of Dorchester 5 Valve Superhet Sets A.C. 200/250 Volts, Fluid Light Tuning A.V.C., employing Mullard F.C.4, S.P.4, S.P.4, PEN4VA and I.W.4, complete in beautiful Walnut Cabinet.

£7/19/6.

RADIO CLEARANCE announce a further purchase of Plessey 7 Valve A.C. Superhet Chassis, Mullard Valves, delayed A.V.C., suitable for use with Energised Moving Coil Speaker 2,500 ohms. Chassis complete with Valves less Speaker.

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RADIO CLEARANCE. Pullard A.C. Gramophone Motors 200/250 volts, complete with Unit Plate, 12in. Turntable.

27/6.

RADIO CLEARANCE. Utility 3-Gang Midget Type Superhet Condenser with 110 k/c Section. Also 3-Gang Straight. Brand new, boxed.

Without Dial, 5/11. With Dial, 7/6.

RADIO CLEARANCE. H.T.8 Mains Transformers, fully shrouded, output 250 volts, 60 m.a. 4 volt 4 amp centre tapped.

6/- With Westinghouse Metal Rectifier, 14/6.

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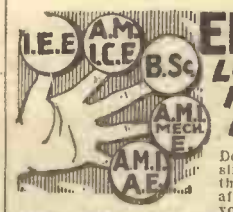
REPAIRS to Moving Coil Speakers, Cones and Coils fitted, or rewound. Fields altered. Prices Quoted Including Eliminators. Loud-Speakers Repaired, 4/-. L.F. and Speech Transformers, 4/- Post Free. Trade Invited. Guaranteed Satisfaction. Prompt Service. Estimates Free. L.S. Repair Service.—5, Balham Grove,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

BAKER'S P.M. M.C. Speakers, list 41/-, our price, 17/6, C.O.D. Roma Radio, 25, Beynon Parade, Carshalton.



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Send NOW together with 3d. in stamps for your copy.

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£4 10s. 0d. 4-valve A.C. All Electric Receivers with Moving Coil Speakers manufactured by R.A.P., Ltd., Surrey. Guaranteed 12 months by makers. Absolutely brand new. Limited number available: cannot be repeated. Cash with order. We pay carriage.—Price and Co. (Manchester), Ltd., 78 and 78a, Tib Street, Manchester.

WANTED, good modern wireless parts, sets, eliminators, meters, valves, speakers, etc. Spot cash waiting. Exchanges. Send or bring. We pay more than any other dealer. Open 9-8.—University Radio, Ltd., 142, Drummond St., Euston, N.W.1. 'Phone: Museum 3810.

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This coupon is available until June 22, 1935, and must be attached to all letters containing queries.

PRACTICAL AND AMATEUR WIRELESS, 15/6/35.

ADVERTISEMENT INDEX

G. W. RADIO offer the following manufacturers' surplus. Cash with order or C.O.D. Over 5/- carriage paid. Under 5/- postage 6d. extra. Orders under 5/- cannot be sent C.O.D.

GENUINE American 5-pin valve-holders 3d. T.C.C. and Dubilier mica condensers, all values 1½d. Carbon resistors, 3d.

1,000 ohm 40 Henri smoothing chokes, 1/-. 1,000 ohm choke coils, 9d. 3-way speaker lead 18ins., 2d.; 4-way, 3d. 2-way motor cord with tags, 24ins., 2d.

CADMIUM plated 5-valve chassis ex-Philco, 12x6x3½, 1/-, or with 3-valve screen, 1/6.

AMERICAN 3-piece valve screen, 8d.; American spring type knobs, 2d.; Igranic Phono jacks, 2d.; 4-way cable, any length, 3d. yard. Pushback connecting wire, 6 yds. 4d. Philco mahogany cabinet, 22x11½x11, horizontal type, 5/6.

SPECIAL offer of following sets: Burgoyne Class B 3-valve sets, complete with 3 Mullard valves, Exide batteries and accumulator, moving-coil speaker. Brand new. List £6/18/0. Our price, 60/-. Burgoyne Olympic 3 De Luxe, M.C. Speaker, Exide batteries, Mullard valves. Listed £5/5/0. In sealed cartons, 57/6.

SPECIAL clearance of following Telsen components, brand new in original boxes.

CLASS B Driver and output transformers (List 10/6), ratios 1-1, 5-1, 3/-. Class B output chokes (List 7/-), 3/-. All-wave H.F. Chokes (List 5/-), 2/3. Intervalve couplers, 10-1, 1-1 (List 10/6), 3/-. Electrolytic condensers, 4, 6 and 8 mfd., 275 and 500 volts (List 5/6), 2/6. Tubular condensers, all values, 4d. Presets, 8d.; Fuses, 2d. Binocular chokes (List 5/6), 1/9. Band pass and oscillator unit (List 30/-), 10/6. Oscillator coils (List 10/6), 4/6, pair 8/-. Triple matched screened coils. Latest type (List 31/6), 10/6. Matched coils, 4/-, pair 7/6.

COLVERN dual range coils, type DMM3 (List 17/6), 7/6. Type T.G.S.C. (List 9/6), 3/-. Watmel binocular chokes, DX2, 1/6. Watmel tuners, R.S.1, 3/6. Colvern Colverstats, all values, 1/-. Lotus disc drives, 2/6.

READY Radio Melody Ranger Kits for 12-2000 metres. Complete with all instructions (List £5/12/6), 50/-.

36 Only Telsen Class B, 4-valve kits complete with cabinet and M.C. speaker, listed £5/17/6. Unopened, our price, 47/6.

BRITISH Radiophone Radiopacks, 27/6.

HAVING purchased £14,000 Philco new parts we offer the following parcels for the experimenter. "A" parcel, price 12/6, contains: 1 mahogany Philco cabinet, 1 5-valve metal chassis, 1 3-valve screen for above, 1 speaker cone chassis, 1 1,000 ohm field coil with core, 1 set of 3 useful coils and a number of Dubilier and T.C.C. fixed condensers and useful parts. "B" parcel, price 4/-, contains: 5-valve metal chassis speaker chassis, coils, condensers, wire, etc. Call and inspect. Thousands of bargains. All goods guaranteed. Money refunded if not satisfied within 7 days.

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HULBERT for Quality Surplus Speakers.

HULBERT. All Speakers previously advertised still available. All are brand new and made by one of the best-known British makers of high-grade moving-coil speakers. Prices from 10/6. All Music lovers interested in realistic reproduction should write for list of amazing bargains. Repeat orders are coming in daily.

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

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

VAUXHALL. New Lists just issued, 3,000 bargains. New goods. Limited number available free.

VAUXHALL. Immediate delivery of all goods advertised in previous issues.

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SHORT-WAVE CONDENSERS. Air-spaced, 0001, 00015, 00016, 0002, 00025, 2/-, with slow-motion dial, 3/-. Popular Iron-cored canned coils, dual range, boxed with instructions, 2/6. Dubilier and Erie resistances, all values, 6d. Truwind wire-wound colour coded all values to 50,000 ohms, 3½d. Western Electric Microphones, 2/3. Transformer for same ratio, 100/1, 2/3. Rothermel Speakers, 7" cone, power and pentode transformer, new and boxed, listed 39/6, 17/6.

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W.C.E. 23

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Practical and Amateur Wireless

3d. EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 6. No. 144. June 22nd, 1935.

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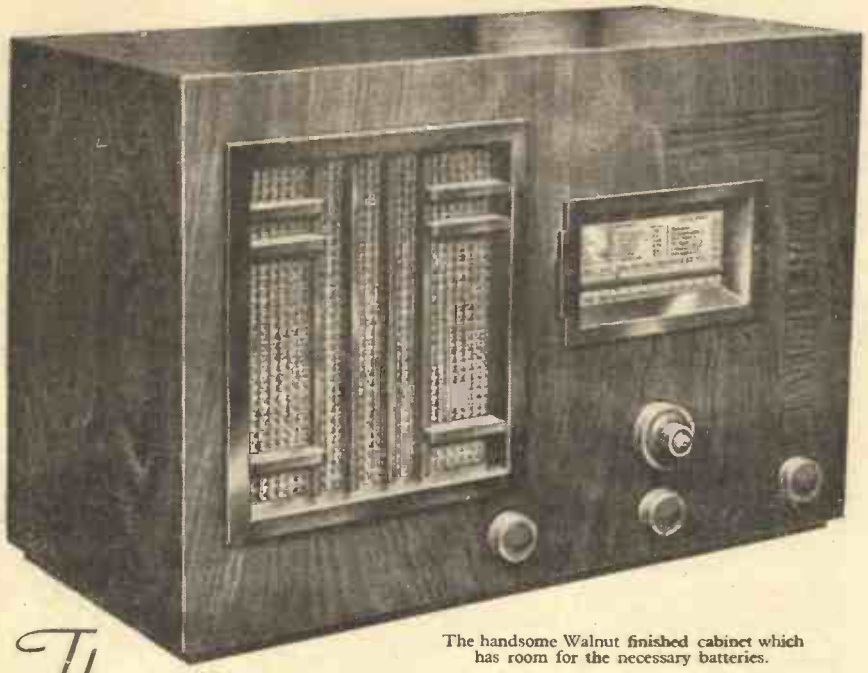

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PRAC. 22/6/35.

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CIRCUITS Readers Ask For!

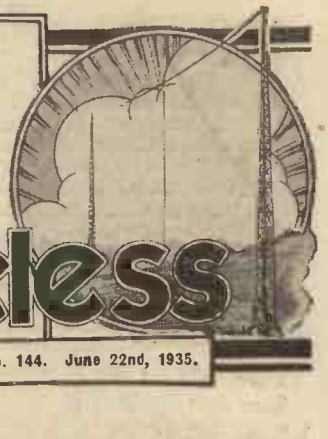
See Page 397

Practical and Amateur Wireless

Edited by F. J. CAMM

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

VOL. VI. No. 144. June 22nd, 1935.



ROUND *the* WORLD *of* WIRELESS

New Television Service Fixed

AT the time of going to press it is learned that details have now been completed regarding the high-definition television transmissions which have been the subject of consideration by the Television Advisory Committee. It has been decided that the London transmitter shall be installed at the Alexandra Palace in North London, and that both the Baird and the E.M.I. systems shall be radiated. The former will adopt the 240-line picture with 25 picture traversals per second with 25 complete frames per second. The E.M.I. system will employ 405 lines, with 25 pictures per second interlaced to give 50 frames per second, each of 202½ lines. With suitable receiving apparatus it will, of course, be a simple matter to receive either of these transmissions, and a manual control will be employed similar to an ordinary tuning system. In spite of the height of the location, it is proposed to employ a 300ft. mast to ensure that as large an area as possible will be covered by the transmission. The wavelength at present proposed is 6.6 metres for vision and 7.2 metres for sound, but definite details will not be settled until the necessary tenders have been made and accepted. Our readers will, of course, be informed of final details in due course.

A New Television Company

WE understand that the well-known firm Ultra Electric Ltd. propose to add to their activities by building complete television receivers. A new company is being formed to carry out this branch of the work and will be known as Ultra (Television) Ltd. No details are available concerning the type of apparatus it is proposed to build.

"Glorious Adventure at Home"

THE above is the title of an interesting book produced by the Philco Company. It will prove invaluable to the short-wave enthusiasts, as it gives an interesting account of short-wave developments, and a world-map of short-wave stations, together with a list of the stations, showing frequencies, wavelengths, times of transmission, and a time-conversion table. In addition there is an alphabetical list of the long- and medium-wave broadcasting stations. There are sixteen pages packed with information, and readers who are interested should write to the company for a copy.

A Wave of Radio Pirates

THE Bucharest daily Press has instituted a campaign for the suppression of radio pirates, which it is stated, owing to their ever-increasing number, is seriously hampering the development of broadcasting in that country. Based on statements made by radio dealers, it is computed that at present there are at least 200,000 possessors of wireless sets who forget to pay their annual licence. As a grand total at the end of 1934, Romania had only 101,000 registered listeners!

Not a Lost Property Office

SINCE May, when the Prague broadcasting station introduced a criminal bulletin somewhat on the lines of our SOS transmissions, it has proved so great a success that recently an official announcement had to be made to the effect that the service could not be devoted to the tracing of straying dogs or stolen bicycles.

ON OTHER PAGES

First Broadcast in Malta

MUCH to the surprise of owners of wireless sets, on May 6 last, many picked up the broadcast of the Maltese Silver Jubilee celebrations. This was not a direct reception, but the result of a relay and rebroadcast made by the Naval Radio Station. Although hope is expressed that Malta may possess, in the near future, its own broadcasting station, in view of the small population it is hardly likely that any such project can be carried out.

Public Television in Berlin

EVERY Monday, Wednesday, and Saturday, from B.S.T. 20.30-22.00, the Berlin public is admitted to four special viewing halls, opened for the free exhibition of televised programmes. They are termed *Fernsehstuben* (distant seeing rooms).

Concerts from Brussels International Exhibition

ALMOST daily, the Brussels studios relay concerts of light music from the halls and grounds of the International Exhibition, and will continue to do so throughout the season. Although the times vary, as a rule, either Brussels No. 1 or No. 2 take some radio entertainment from this source at B.S.T. 12.30, 17.30, and again from about B.S.T. 22.00 onwards. On some nights, the Exhibition also supplies the dance music transmissions.

Radio Romania Testing

ROMANIA'S high-power national station may now be heard carrying out experimental broadcasts in the early morning, on 1,875 metres. This 150 kilowatter is situated at Brasov, which, in pre-war days, was better known as Kronstadt. It lies between Bucharest and the Hungarian capital.

The Way Budapest Closes Down

SHOULD a studio play the National Anthem at the end of the evening radio entertainment, or should this only be done previous to the station closing down? Budapest has decided that its Hungarian news bulletin cannot interest foreign listeners, and therefore, on the stroke of midnight, bids the unseen audience good-night in Magyar, French, and German and plays the National Anthem. Five minutes later the station is again on the air with the final official news broadcast.

Radio Polskie Warszawa

IT is reported from Warsaw that the power of tho long-wave transmitter is to be raised to 200 kilowatts, and that a further 20-kilowatt regional station is to be built. Plans have also been drawn up for the installation of a short-wave transmitter.

ROUND the WORLD of WIRELESS (Continued)

"Humour in Music"

A PROGRAMME entitled "Humour in Music" will be given by the Æolian Quartet with the Western Studio Orchestra, for Western listeners on June 21st. They will give Liza Lehmann's Nonsense Songs from "Alice in Wonderland," the suite "The Carnival of Animals," by Saint-Saëns, when two pianists, Hubert Pengelly and Evelyn Amey, will join with the orchestra, and the programme will conclude with Haydn's Toy Symphony.

"The Tudor Touch"

NEVILLE COGHILL, who is a don at Exeter College, Oxford, is the author of "The Tudor Touch," which is to be relayed from the Oxford Playhouse to Midland listeners on June 24th. This is the first time the Playhouse, where Stanford Holme is in charge, has figured in the Midland programmes. The company includes at present a grandson of Sir Herbert Tree and a granddaughter of Fred Terry.

INTERESTING and TOPICAL PARAGRAPHS

"Strange Nocturne"

THIS is the title of a Midsummer Play for Radio by Froom Tyler, which will be produced by Cyril Wood on June 24th for Western listeners. It is a ghost play with an empty house in a Cotswold valley on a night in midsummer as its setting. Froom Tyler writes of this new play: "It is essentially a piece for the microphone in that it could not be presented through any other dramatic medium."

Leicester Imperial Band

THIS well-known band, which is one of the oldest in the Midlands—its records go back to 1870—give a programme for Midland listeners on June 26th, S. S. Iliffe conducting. The Victoria Singers, from Ilkeston, will be heard in part-songs during the interludes.

"Seeing Life"

THE second in the series of Midland talks called "Seeing Life" is to be given on June 26th by Brendan K. Vallings. The speaker, who is now in charge of the musk rat campaign in Shropshire under the Ministry of Agriculture, had some interesting experiences out West. His stories deal chiefly with life in Alberta. Among the characters he deals with is Dynamite Dan, so called because of the unusual weapon he used against bears.

"North Wales Night"

THIS is the title of a special feature, consisting of relays from various resorts in North Wales, which will be broadcast in the Northern, Western and Midland programmes on June 28th. The programme is being undertaken by the Northern O.B. staff, and indeed the Welsh coast is a favourite haunt of Northerners during the holiday period. Jan Ralfini and his Band will broadcast from the Pavilion Theatre, Rhyl; the Colwyn Bay Follies will be heard performing at the Pier Pavilion, Colwyn Bay; there will be an excerpt from the "Bright Times" concert party, relayed from the Pier Pavilion, Llandudno, and variety from the Winter Gardens, also in Llandudno.

Greta Keller in "Music Hall"

GRETA KELLER, who has been called the Marlene Dietrich of the air, may be remembered by the very earliest listeners when she sang from Savoy Hill. On June 26th she will be heard once more "on the air" in Britain, when she will feature various popular numbers in a show of her own, and on June 27th she will be heard in "Music Hall."

A Radio "V.C."?

THE Prague broadcasting station has instituted a new feature in its Sunday programmes, namely, a special broadcast devoted to the relating of outstanding good or courageous acts performed by its citizens during the previous week. Although no commemorating medal is struck by the authorities, the radio "V.C.'s" consider it a signal honour to hear their names announced.

LISTENING IN COMFORT

This new Pye 1935-36 battery portable, which costs 15 guineas, finds a suitable setting.

"At the Langleys"

THE monthly feature programme, "At the Langleys," including chiefly topical material, will be broadcast on June 26th. There is a seaside entertainment from North Wales resorts the same evening.

Famous Ballads

FRANK TITTERTON, the well-known tenor, who is a native of Birmingham, will give a recital of famous old ballads on Saturday evening, June 29th. "The Three Herons," who contribute to the programme later on Saturday, are a trio of Birmingham sisters who specialise in close harmony.

"Silver Salmon"

A TALK entitled "Silver Salmon," by L. Harrison Matthews, which will be given on June 29th for Western listeners, will deal with the salmon fisheries in the estuary of the Severn. He will tell of the use of wicker basket-work traps and the use of a special landing net in which salmon are caught in the pools left in the bed of the estuary at low tide.

Viennese Light Music

SERGE KRISH with his Septet has on many occasions demonstrated his particular affinity with the Viennese style of light music. He was, in fact, originally a Viennese, though he has lived for some years in this country. On June 20th he will be heard by Regional listeners in another such programme, which promises to be of more than usual interest, as his singer will be Halga Motte, a young Viennese soprano, whose microphone début is eagerly awaited.

SOLVE THIS!

PROBLEM No. 144.

Robinson's accumulator had been in use for some considerable time and appeared to be in need of overhaul as it would not hold its charge for long. When it next required re-charging, therefore, he decided to overhaul it himself and adopted the following procedure. He poured away the acid and washed out the cells under the tap. When all the deposit had been washed away he obtained some acid which was of different S.G. from that recommended on the label and added it to some water until approximately the correct S.G. was attained. He tested it with a hydrometer and found it correct and poured it into his accumulator, which he then took round to the charging station. After a few weeks he found that the accumulator was in a worse condition than before and he had soon to dispose of it entirely. Where had Robinson gone wrong? Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 144 in the lower left-hand corner and must be posted to reach here not later than the first post Monday, June 24th, 1935.

Solution to Problem No. 143.

When Brown removed one valve the reduction in H.T. current resulted in a slight rise of voltage on the remaining valves, giving a slightly greater signal output, but distorted owing to the unbalanced output arrangement. This is a common phenomenon with push-pull stages and does not give any indication that anything is wrong.

The following three readers successfully solved Problem No. 142 and books are accordingly being forwarded to them: N. Moore, 203, Sangley Road, Catford, S.E.6; F. E. Andrews, 36, Denmark Street, Folkestone, Kent; A. Goodall, 3, Holly Bank, High Street, Horsell, Woking, Surrey.

a Wireless Set in Your Hat

Details are Given in This Article for—valve Receiver which Can be Small, Lightweight Batteries Being —the Construction of a Simple Single-Housed in an Ordinary Hat, the Carried in the Pocket

THE idea of having a complete receiver housed in an ordinary hat has intrigued the constructor and experimenter for many years. Moreover, there has been, at various times, a number of different types of set which could be mounted in a hat, but most of these have been of a "freakish" nature, of little practical use, and beyond the scope of the constructor who was limited to the use of standard components.

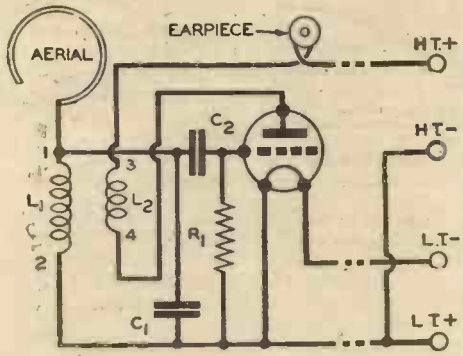


Fig. 1.—The circuit of the single-valve "hat-radio" described. Although the flexible battery leads are shown separate for clarity they are twisted together in practice.

It is only recently, with the introduction of the new Hivac midget valves and the associated components—for the production of many of which PRACTICAL AND AMATEUR WIRELESS has been entirely responsible—that it has become a practicable proposition for the average amateur to build what might be termed a "hat-radio." Even now it is not claimed that a simple receiver of this description will enable the user to receive programmes from all parts of the world, nor even to bring in a large number of British stations. Nevertheless, it is a perfectly simple matter to build a receiver from standard components which can be housed in an average bowler or felt hat, and which will *function* satisfactorily.

Simple Circuit Arrangement

The utter simplicity of a single-valve "hat" receiver can be judged by examining the circuit diagram and other illustrations on this page and on the front cover. Let us first look at the circuit shown in Fig. 1; here a simple tuning coil with reaction is coupled to a leaky-grid detector valve and to an improvised aerial, which may consist of a single insulated wire attached to the brim of the hat, or of a longer wire sewn into the lining of an overcoat. The coil is wound so that it will tune to the wavelength of the local station without the use of a variable condenser, although a fixed condenser, shown at C.1, is used, and may be replaced by a .0005 mfd. pre-set if desired, and if space permits.

Reaction is obtained by a normal reaction winding placed in series with the anode lead from the valve to the single earpiece. This is really equivalent to the once-popular "swinging-coil" system of reaction control, with the exception that the position of the reaction winding is fixed and its size is adjusted so that the valve is fairly near to the oscillation point—when it is most sensitive. A suitable arrangement of the few components is shown in the cover illustration and also in Fig. 4, where it will be seen that the coil is wound on a paxolin or cardboard former which just fits over the valve-holder and round the Hivac type XD valve. The grid condenser is of the tubular type, and is joined between one end of the "tuned" winding and the grid terminal of the valve-holder, whilst the grid-leak, which is of the Ferranti half-watt midget type, is joined between the grid terminal of the valve-holder and the other end of the coil.

One Waveband Only

Incidentally, it should be mentioned that the coil shown in Fig. 4 is intended only to cover a single (medium-wave) band, but it is quite possible to use a dual-range midget tuner such as the Bulgin component

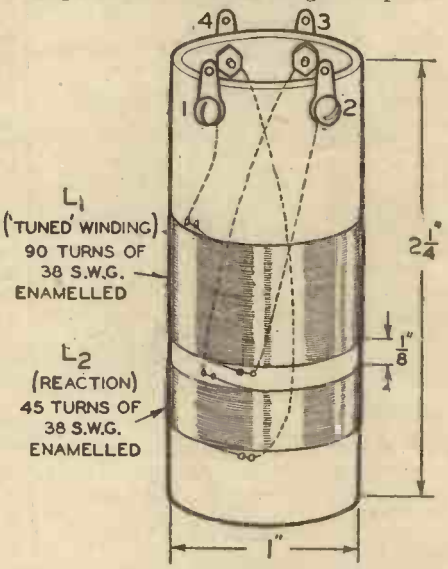


Fig. 2.—This shows constructional details of the tuner for medium waves only.

Fig. 3.—Here is seen the actual receiver being fitted in a hat.

shown in the cover illustration; in the latter case the long-wave winding may be short-circuited for medium-wave reception by bridging two soldering tags which are joined to the ends of the long-wave winding: removal of the bridge enables the long-wave transmissions to be brought in.

Midget coils are now available at such a low price that it scarcely pays to make one.

Those who do propose to make their own coil can easily do so by following the winding details given in Fig. 2. The "tuning" winding L.1 (for medium waves only) consists of approximately 90 turns of 38-gauge enamelled wire, whilst 45 turns are used for reaction, L.2. The ends of the two windings are brought out to small bolts fixed through the upper ends of the tube, and connections are made directly to these. Before fixing the complete receiver into the hat it is necessary to determine the exact number of turns required to tune to the desired station when used in conjunction with the fixed condenser marked C.1; and here a certain amount of trial and error is

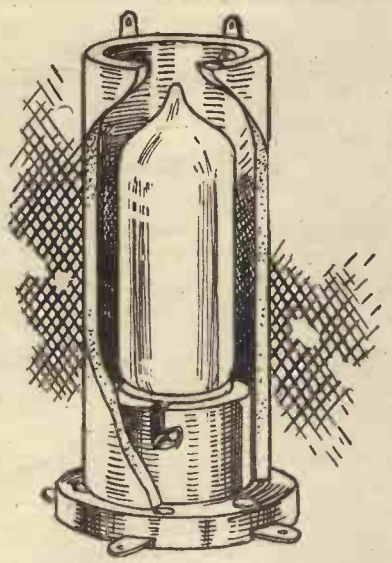


Fig. 6.—Diagram showing how the coil former fits over the valve and valveholder.

necessary. Before determining the number of turns the "aerial" should be fixed in place—preferably on an old and disused hat—and connected to the coil by means of the shortest possible length of wire. After that the battery leads may be connected to standard batteries, using about 60 volts H.T. The next step is to try increasing or decreasing the number of turns on L.1 until the local station is heard.

Adjusting the Reaction Winding

If it is found that the valve oscillates a few turns must be removed from the reaction winding for the time being to allow for the additional H.T. voltage, since only 35 volts will be used when the final receiver is put into action. As an alternative to "juggling" with the number of turns, a .0005-mfd. pre-set condenser can be wired in place of C.1 if it is found that there is sufficient room in the hat to accommodate this. When this condenser is employed it is necessary only to adjust this until the coil is correctly tuned.

After the size of the tuning winding has been determined, the H.T. voltage should be plugged down to 35, when the size of the reaction winding can be settled; as mentioned before, this is adjusted so that the valve is *just off* oscillation. This is done by first of all using sufficient turns to cause oscillation—which may be detected by touching the aerial terminal of the coil with a moistened finger and noting the "plop" which indicates oscillation—and then removing one turn at a time until oscillation ceases.

Preparing the Hat

The receiver is then ready for use and the hat must be prepared to accommodate it. The earpiece can be fitted by one of several methods according to the actual type of 'phone employed. One method is to sew the stirrup of the earpiece to the side of the crown, placing the stitches underneath the band, while another is to use small rivets, again placing these under the band where they will not show.

There are a few methods of fixing the set into the hat, but the simplest is that shown in Fig. 5, where a couple of rubber bands are sewn to the crown of the hat; these hold the coil, and hence the valve-holder and other components. One lead from the earpiece is soldered to the appropriate terminal of the reaction winding, and the other is extended and fitted with a crocodile clip for connecting to the positive metal strip of the Drydex type X81, 35-volt H.T. battery, which measures only 5⅞in. by 1¾in. by 1⅛in., and can, therefore, be accommodated quite easily in any pocket. Two flexible leads are taken from the filament terminals of the valve-holder, and these are also provided with clips which will grip the positive and negative lugs of the accumulator; and also the negative H.T. contact of the Exide, type PRP3, accumulator which measures 2¼in. by 2¾in. by 1in. The leads should, of course, be long enough to reach from the hat to the coat pocket and may be twisted together to make them less conspicuous.

Finally, the end of the "aerial" wire should be passed through a small hole made in the crown of the hat and attached to the appropriate coil terminal.

After this has been done the set is switched on and off by connecting or disconnecting the positive lead to the accumulator. It is evident that the range of reception is very short when using the very small length of wire for an aerial, but appreciably better reception can be obtained by sewing a length of about 12ft. of wire to the inside of the overcoat. This wire should be thin rubber-covered flex, and may be arranged in zig-zag formation running up and down the back of the coat.

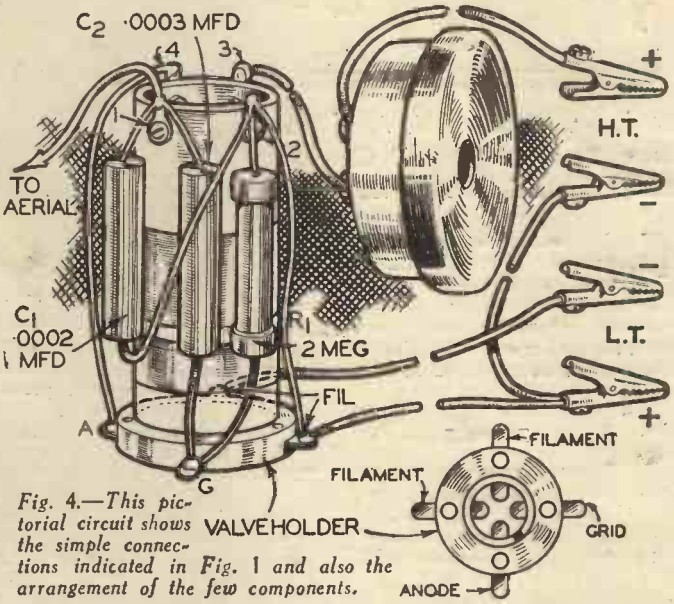


Fig. 4.—This pictorial circuit shows the simple connections indicated in Fig. 1 and also the arrangement of the few components.

When using such an aerial it will be clear that the size of the tuning coil or the capacity of the pre-set condenser (when used) must be varied to suit, since the longer wire will alter the wavelength of the set.

It must be understood that the arrangement suggested will not give long-range reception and can only be used satisfactorily fairly near to a broadcasting station. But, if these provisos are borne in mind, there is no reason why interesting and reasonably satisfactory results should not be obtained, since the valve is highly efficient and the complete instrument very nearly as effective as a simple single-valver of normal design. This type of receiver, moreover, presents ample scope for the experimenter and offers a change from the normal routine and the usual type of set.

Fig. 5.—This shows a simple method of fitting the set into the hat by means of two rubber bands.

PROGRAMME NOTES

Late Transmissions for France

HITHERTO, in France, only private stations have extended their programmes regularly until past midnight; in future, however, a late concert will be broadcast every Friday by all French PTT stations from B.S.T. 23.00—01.00. If the entertainment meets with the approval of the listening public it may be extended to other weekdays.

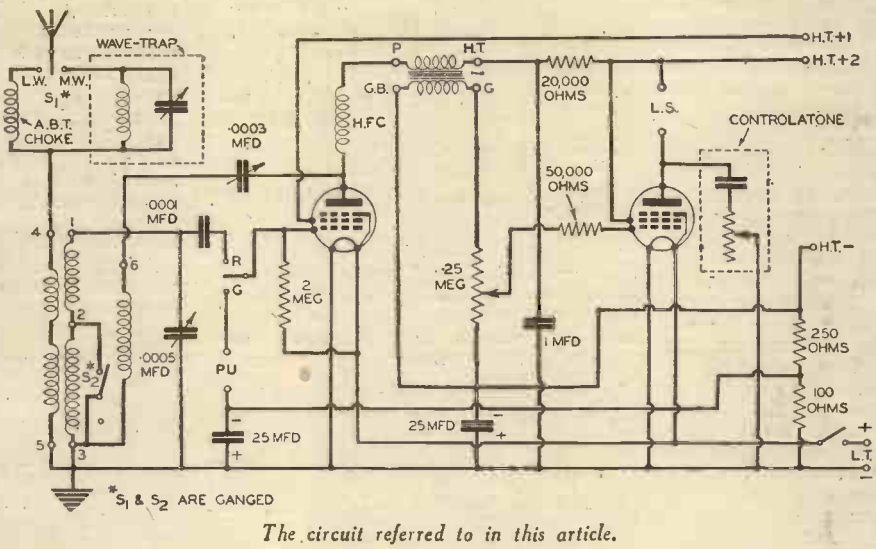
And That's That!

IN Brno (Czecho-Slovakia) recently, a flat dweller was given notice by his landlord, who lived in the same building, for the reason that the former was using his wireless set throughout the day. The local courts declared the notice illegal, stating there was no reason for which a radio set should not be enjoyed continuously during daylight hours.

CIRCUITS READERS ASK FOR

Readers Requiring a Circuit Which Has Not Already Appeared in These Pages are Invited to Write to the Editor Giving Full Particulars

THE circuit diagram reproduced on this page was first drawn up at the request of a reader whose letter was recently published in the "Practical Letters from Readers" section. The reader in question asked for a circuit for a two-valve battery receiver with wave-traps for eliminating either Droitwich or the local medium-wave transmitter, and also with pick-up terminals. It was evident from these requirements that the set must be of the de-luxe variety, and so it was considered advisable to go "the whole hog" by producing a really "super" two-valve design. Let it be made clear in the first place that the object in drawing up the circuit was not to produce a highly sensitive long-range instrument, but rather a receiver which would give good-quality reproduction from the nearer transmitters and give interference-free reception on both long- and medium-wave bands. For those whose main object is to obtain real entertainment value from a comparatively small number of stations, and who are limited to batteries as the source of power, the arrangement shown is very nearly ideal.



The circuit referred to in this article.

Anti-break-through

It will be seen that a normal type of screened dual-range tuner is employed, and that the aerial terminal of this is connected to one end of both an anti-break-through choke for obviating break-through on long waves and of a wave-trap for preventing interference between medium-wave stations. The aerial lead is joined to the centre terminal of a single-pole change-over switch so that either the medium-wave wave-trap or the anti-break-through choke can be brought into circuit as required. In order to make the arrangement foolproof this change-over switch is ganged with the wave-change switch, the result being that the appropriate "stopper" is brought into circuit at the same time as the wave-change switch is moved from one setting to another.

A third change-over switch is used for changing from radio reception to gramophone reproduction, but this is operated separately. This switch is not, of course, essential, but it does prevent radio interference when reproducing gramophone music and also obviates the necessity for disconnecting the pick-up when it is not in use.

Pentode Detector

Another point of interest is that two high-efficiency pentodes are used as detector and L.F. amplifier respectively. The object in using this type of valve in the detector stage is to obtain the greatest possible amount of amplification, and to ensure an ample volume of reproduction. Also included with this object is the 7 : 1-ratio L.F. transformer which makes it an easy matter fully to load the L.F. valve, even when using an acrial of only moderate efficiency. A 50,000-ohm fixed resistance is included in the grid lead from the transformer to prevent the possibility of the L.F. valve being unstable on account of the high degree of amplification which is provided. This resistance feeds into a .25-megohm volume control, which serves for both radio and gramophone reproduction. Most pick-ups are to-day provided with their own volume controls, but when using the present arrangement it is possible to adjust the control on the pick-up to the best position for normal purposes, and then to effect the variation on volume for different types of music by means of the control on the receiver.

Automatic Grid Bias

There is one further point with regard to the circuit which calls for special mention; this is the provision of automatic grid bias. As the "Experimenters" explained in a recent article, automatic bias is a very desirable feature, since, among other things, it ensures that the grid bias voltage is always at the correct value regardless of the condition of the H.T. supply. By so doing it prevents that distortion which frequently occurs in the case of battery sets when the H.T. battery begins to run down. Automatic bias is more than usually valuable in the circuit under discussion because the high-amplification valves employed are rather critical in respect of the bias they require, the consequence being that a variation of so little as 1 volt can have a fairly pronounced effect. The bias for the L.F. valve is developed across two resistances, of 250 ohms and 100 ohms, which are wired in series in the negative H.T. lead, whilst the bias for the detector (when used for gramophone-record reproduction) is obtained across the 100-ohm resistance only. These values have been found to be perfectly satisfactory on H.T. voltages between about 70 and 150, and the H.T. voltage should not in any case be outside these limits.

Yet another small refinement is the tone control connected between the anode of the output valve and earth. This is not an essential, but is nearly always worth while when really good reproduction of all kinds of music and speech is desired. At the same time it should be pointed out that, like all of the other refinements which have been mentioned above, it can be omitted if desired. The fact is that the circuit shown is truly "de-luxe," but it lends itself very readily to considerable modification and simplification.

PRINCIPAL COMPONENTS REQUIRED

One Metallised Chassis or Baseboard.
One Ebonite or Plywood Panel.
Two Five-pin Valve-holders.
One Lissen Anti-Break-through Choke.
One Wave-trap. (See text.)
One Wearite type "Universal" Coil.
Two Bulgin Chassis-mounting change-over Switches (type S81B) with 8-in. spindle.
One Polar .0005-mfd. "Aperture" Tuning Condenser. (This is supplied complete with mounting bracket and slow-motion drive).
One Polar .0003-mfd. No. 4 Reaction Condenser.
One Bulgin Radio-gram Switch, Snap-action type.
One T.M.C. .0001-mfd. Tubular Fixed Condenser.
One Dubilier 2-meg. Grid Leak.
Four Dubilier 1-watt Metallised Resistances: 100 ohms, 250 ohms, 20,000 ohms, and 50,000 ohms.
One Varley "Nicore" H.F. Choke.
One Ferranti 7 : 1 L.F. Transformer, type AF6.
One Erie .25-megohm Volume Control.
One T.M.C. 1-mfd. Fixed Condenser, type 25.
Two T.C.C. 25-mfd. Electrolytic Condensers, type 511.
One Bulgin Q.M.B. On-off Switch, type S80.
One Bulgin "Controlatone," type C.T.2.
Two Cossor 220 H.P.T. Valves.

Component Specification

A list of the principal components required is given elsewhere, but in this particular instance it may be mentioned that the actual parts are not extremely critical, provided that they are of the values indicated and of reliable make. With regard to the wave-trap it should be mentioned that this may consist simply of a coil consisting of eighty turns of 30 S.W.G. enamelled wire on a 1in. diameter paxolin former and tuned by a .001-mfd. pre-set condenser. For the benefit of those who prefer to buy all the parts ready-made, however, it may be added that suitable wave-traps for use in place of this are on the market, being made by such well-known manufacturers as W. B., Ferranti, etc. In use, the wave-trap tuning condenser is adjusted until the local station is eliminated or the signals reduced in intensity to the greatest possible extent. When it is desired to receive the "local," the aerial may be connected direct to terminal 4 on the coil, or the wave-trap may be short-circuited by means of a switch.

Improving the Superhet

Many Older-type Superhets can be Improved Considerably by the Addition of a Few Modern Components, as Described Here. Details are Also Given for the Construction of a Whistle Filter

THE modern superhet is so extremely satisfactory that it is rapidly supplanting the simpler types of "straight" receiver which were so popular a year or two ago. But there are still in use a number of superhets which were built three or four years ago, and which cannot be compared with more recent models. These older receivers are still perfectly efficient so far as range of reception is concerned, but they rarely give the high quality of reproduction which is required of all modern sets. The fact is that the superhet has made considerably more progress during the last three years or so than has any other circuit arrangement, and the faults of earlier superhets—distortion, second-channel interference, and difficulty of operation—have all been eradicated.

Variable Band Width

Poor quality of reproduction with many of the older superhets is due almost entirely to the intermediate-frequency amplifier; the I.F. transformers are designed to give a definite band-width response, so that a certain amount of sideband cutting often takes place. This difficulty can nearly always be overcome by replacing the old-type I.F. transformers with modern components in which the degree of coupling—and hence the band-width response—is variable. In some cases the variable coupling between the primary and secondary windings is obtained by altering the position of a dust-iron core in relation to the windings, and in others by the adjustment of a pre-set condenser which serves the purpose of "top-capacity" coupling the two windings. The position of the pre-set condenser is shown in Fig. 1, from which it will be seen that it joins together the high-potential ends of the windings.

In the case of older types of I.F. transformer in which the two windings are movable in relation to each other it is a simple matter to modify them for variable-capacity coupling by setting them about 1in. apart and then wiring a .0001-mfd. pre-set condenser in the position indicated in Fig. 1. The condenser should be placed as near to the transformer as possible, so that the connecting leads are short. Although this method of modifying an existing I.F. transformer is mentioned, it should be stated that there are on the market transformers which incorporate this principle, and which will effect a considerable improvement on the old receiver.

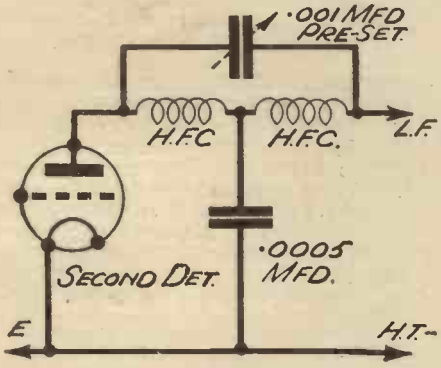


Fig. 3.—Background whistles can often be eliminated by using a filter as shown in this circuit.

Reduced Damping

Another feature of modern I.F. transformers which constructors might wish to adopt in the case of components they have is the centre-tapped primary winding. The transformer is connected as shown in Fig. 2, so that the primary damping (due to the preceding valve) is reduced. This brings about an improvement in efficiency and selectivity, as well as giving the receiver a greater tendency towards stability. There is no need to mention the names of manufacturers who can supply I.F. units provided with a centre-tapped primary, because nearly every maker now includes them in his range.

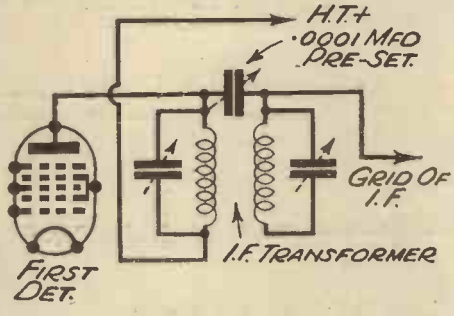


Fig. 1.—Showing how "top-capacity" coupling can often be applied to I.F. transformers in which the inductive coupling between the windings is fairly weak—due to the windings being widely spaced.

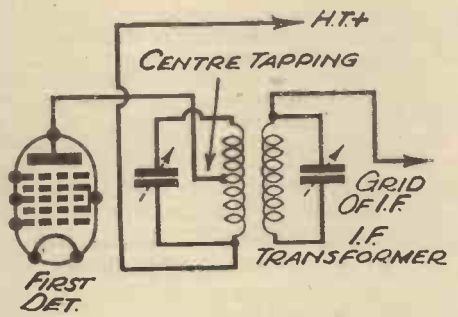


Fig. 2.—Results can often be improved, as explained in the text, by centre tapping the primary windings of the I.F. transformers, and using the circuit shown here.

There may be many constructors who would prefer to modify their existing transformers, and there is certainly no difficulty in this in the majority of instances. Care must be taken in unwinding the primary, however, the wire being wound on to a new bobbin. The wire is fine and generally enamel-covered, in consequence of which it is easily damaged, either by breaking or by the enamel being scratched away.

Centre-tapping the Primary

The turns must be counted carefully as they are removed, and it will probably be found that they number about 500, although the figure will vary widely for different makes and types of component. Having removed the turns, they can be replaced, first winding on one-half of the total number, and then making a centre tapping. This can be done by carefully baring the wire for a distance of about 1in., making a twisted loop and then soldering to it a short length of flex. The insulation can best be removed by rubbing the wire with a rag soaked in methylated spirit; if it is scraped with the blade of a knife the wire might be broken. The centre tapping should then be joined to the terminal which is to be connected to the anode of the preceding valve (first detector or I.F. amplifier). When the transformer is fitted with pre-set trimming condensers connected in parallel with the primary and secondary windings the end of the primary must be joined to one side of the corresponding condenser; this might make it necessary to alter the position or mounting of the condenser.

A Whistle Filter

Another fault in connection with the reproduction afforded by an older type of superhet is the whistle or hiss which is heard as a background to speech and music. This can sometimes be eliminated, or at least reduced, simply by altering the coupling of the I.F. transformers as described above. Very often the provision of a good tone control in the L.F. stage will also cut out the interference, but the most satisfactory method is to include a whistle filter in the anode circuit of the second detector, as shown in Fig. 3. Various forms of excellent filter are available at very modest prices, but the constructor may wish to experiment with the construction of such a unit. Very often it will be found satisfactory to use two high-inductance screened H.F. chokes in conjunction with the fixed and pre-set condensers shown in Fig. 3. Alternatively, a filter for experimental purposes can be made as shown in Fig. 4. In this case two pile-wound inductances are used, the windings being placed on bobbins made by clamping together discs of ebonite or fibre 1½ and 1in. in diameter.

Improving A.V.C.

When A.V.C. is added to an older type of superhet—and methods of doing this have been fully described in previous

(Continued on page 400)

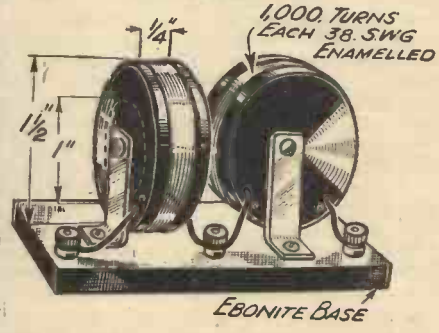


Fig. 4.—Constructional details for a double filter choke suitable for use in the circuit shown in Fig. 3.

(*Continued from page 398*)

issues of this journal—it is often found that the degree of control is insufficient to eliminate fading entirely. This is especially true when an S.G. or H.F. pentode valve is used for first detection, and the variable bias is fed to the I.F. valves only. In such an instance the provision of a signal-frequency H.F. amplifier prior to the first detector is very well worth while.

The method of connecting the amplifier is shown in Fig. 5, where it is assumed that a band-pass filter was previously used in the input circuit. The two band-pass coils are now used separately, one to tune the pre-detector H.F. stage, and the other to tune the first detector. A band-pass circuit is practically essential when a signal-frequency H.F. stage is not employed, but it can well be dispensed with when using the arrangement under discussion, since the two tuned circuits give a similar effect. Additionally, of course, the use of the high-frequency amplifier gives a considerable increase in range and fully compensates for the use of an inefficient aerial system.

It will be seen that tuned-anode coupling is used between the first two valves, and it is for this reason that a 1-mfd. fixed condenser is inserted between the lower end of the second coil and earth; this condenser acts as a by-pass and also as a decoupler for the anode circuit of the first valve. The circuit is practically self-explanatory, and gives all the information required by the average constructor. It should just be mentioned that it is not generally necessary, or desirable, to employ two I.F. stages when using the signal frequency H.F. valve; if all three valves are used there is a probability that valve hiss will be rather too prominent, whilst it may be found more difficult to ensure complete stability.

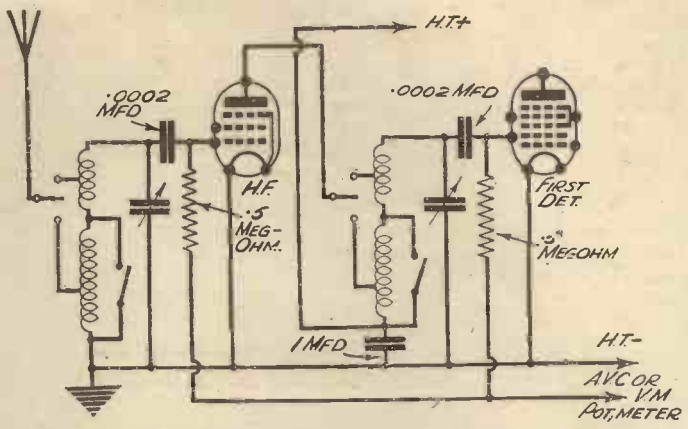


Fig. 5.—This skeleton circuit shows a simple and effective method of adding an H.F. stage (H.F. pen. valve) as a signal-frequency amplifier to a superhet. Two sections of the B.P. filter are used in the aerial and tuned-anode circuits.

Fixed Condensers and Their Uses

This Article Deals with the Construction and Application of These Important Components

OF the various types of fixed condenser, the most familiar is the type composed of sheets of metal foil interleaved with slips of mica. The principal advantages of mica as a dielectric in condensers are first, its high "specific inductive capacity," which means that a condenser of given capacity can be made in mica with a smaller plate area than in most other practicable materials; and, second, its good insulating qualities, which means that it is less liable to breakdown between plates than condensers made with any other dielectric *having the same thickness*.

Mica condensers must be considered as essential wherever small coupling condensers of ".000 something" microfarads capacity are associated with the radio-frequency end of the receiver. As examples may be mentioned series-aerial condensers, grid-coupling condensers, and the like. Mica is also necessary for the detector anode by-pass condenser so frequently employed to improve the efficiency of detection by reducing high-frequency feed back.

Other instances where the use of mica condensers is essential are the small condensers used as couplings between anode and grid circuits where it is required to isolate the grid circuit of one valve from the high-tension current in the anode circuit of the preceding valve; in tone-control devices associated with the low frequency and output stages; for stabilising condensers and all similar applications.

Paper-dielectric Condensers

Another large and important class of fixed condenser is that using paper dielectric. Usually these are made by winding metal ribbon between two paper tapes, or by employing paper which is metal coated. Condensers of this type, and of fairly large capacities—up to several microfarads—are available at reasonable cost and of convenient size, and they can be designed to withstand quite high working voltages. The larger sizes of decoupling condensers and by-pass condensers should be of this type, as may also be the smoothing condensers associated with the high-tension supply. In this connection it is important to remember that manufacturers make several grades suitable for different maximum working voltages. Thus, if a condenser is to be used in a position where a voltage of 250 volts will be applied to it, a type should be chosen which is marked "250v. working" or "500v. test." Remember, too, that in estimating the working voltage, the maximum high-tension feed voltage must be taken. For example, if you are using a power unit giving 350 volts, all the condensers should be for 350 volts working or over, even if some of the valves, such as the detector, operate on a lower voltage *via* a voltage-dropping resistance. The reason is that when the H.T. is on but the cathodes or filaments are not heated, no anode current will flow, there will be no voltage drop in the resistances, and the full pressure will therefore be applied to all the condensers.

In the case of the smoothing condensers of a high-tension unit, the peak voltage of the unsmoothed supply and not the maximum D.C. voltage must be considered as the working voltage, and in all cases due allowance must be made for surges such as those which occur at the moment of switching on when the rectifier is not loaded, and the voltage therefore considerably higher than normal.

Non-inductive Condensers

There are certain positions in a receiver where paper-dielectric condensers are suitable but they must be of special *non-inductive* type. Non-inductive condensers should be used in all circuits associated with radio-frequency signals, such as screen by-pass condensers for screen grid or high-frequency pentode valves, and they are also preferable for the bias by-pass condensers of high-frequency valves.

In the low-frequency side of a receiver it is advisable to employ a non-inductive condenser as coupling condenser if the inter-valve transformer before the output valve is parallel fed.

Electrolytic Condensers

The last class of condenser for consideration is the electrolytic type, in which the dielectric is a very thin film of non-conducting material formed on one plate by the decomposition (electrolysis) of part of the electrolyte in which the plates are immersed. There are two important differences between electrolytic condensers and other types. The first is that they are "formed" for use in such a way that the polarity is fixed once and for all, so that care must be taken that they are connected correctly, with the positive pole connected to the positive terminal of the system.

Second, electrolytic condensers permit a small leakage current—usually something under one milliamp. under normal working conditions. This leakage current tends to hold the voltage steadier, and also tends to prevent surge voltages when the current is switched on and off.

Electrolytic condensers are available for peak working voltages up to about 500 volts. Condensers of this type, of 4 or 8 mfd. capacity, are particularly suitable for H.T. smoothing. They are usually made up in aluminium cases, the case itself being the negative pole, but some makers also supply types in which the case is isolated, two insulated leads being brought out for the connections. Another recent innovation is a combination of two electrolytics in a single case, forming a compact unit of reservoir and smoothing condenser for a high-tension supply system.

"Reversible" Electrolytic Condensers

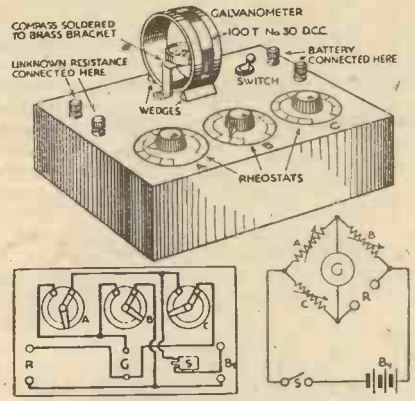
The advent of "universal" receivers which will work equally satisfactorily on A.C. or D.C. mains presents a problem, since if, when working on D.C. mains, the mains plug is reversed, the polarity of the current applied to the electrolytic condensers will also be reversed and, with ordinary electrolytics, damage may result. In a universal set, therefore, it is wise to obtain the so-called "reversible" electrolytic condensers, which do not sustain damage if connected the wrong way round for a few moments. Naturally, a universal set will not function on D.C. unless the plug is connected the right way, but it takes a minute or so to ascertain if the connection is wrong since the valves take that time to warm up.

A PAGE OF PRACTICAL HINTS

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

A Cheaply-made Wheatstone Bridge

THE accompanying description, with sketches, of an accurate but cheaply made Wheatstone Bridge which I have evolved may prove of interest to other readers.



A simple Wheatstone Bridge. The diagram of connections, and the theoretical circuit diagram are shown in the two lower sketches.

The case is a good sized cigar box, drilled to take the spindles of three 10-ohm variable resistances. After fixing the rheostats on the box lid, they were lettered left to right, A, B and C. Under each knob is a paper scale divided into ten 1-ohm divisions, these being divided again into ten points, giving 100 points on each dial for really accurate work. The galvanometer is made with a piece of tube 2ins. diam., and wound with 100 turns of 30 D.C.C. wire. The larger the compass used, the more accurate will be the instrument. Also included on the top of the lid are four terminals (two for battery and two for unknown resistance) and an on-off switch.

The wiring was done with 18 D.C.C. wire to keep down undue resistance. If the unknown resistance varies from the others, adjust A, B and C till no deflection of the needle results. Knowing the values of A, B and C, you then use the simple formula A over B equals X (unknown) over C. This instrument gives results to one-tenth of an ohm—quite accurate enough for amateur experimenters.—J. C. WILLIAMS (Battersea).

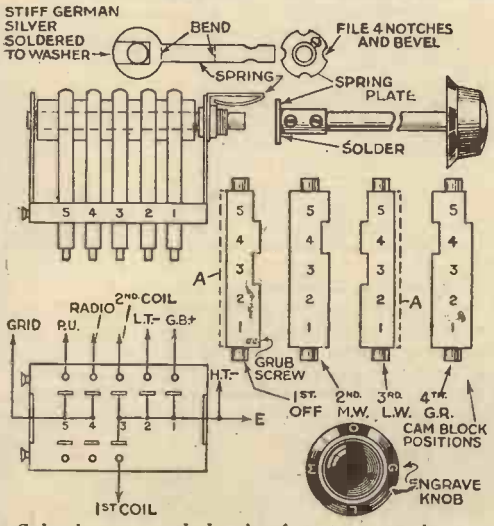
A Combination Switch

THE accompanying sketches show a combination switch made with parts of old components taken from the junk box. No measurements are given as the parts used can be chosen to suit requirements. First, strip an old switch, remove the cam stop, and if of the four-row type, remove the end pair of contacts, and change to the reverse side. Use a block of ebonite, or hardwood, for the cam block, which should be wide enough to close all

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.

contact springs before cutting. The dotted lines A, A, indicate parts to be cut away so that the cam block opens all contacts when in the off position. Bevel all corners after the cams are cut, and also slightly bevel the spring and plate. The coupling sleeve is taken from an old rheostat, with a thick washer soldered on to form the spring plate, which is notched, as shown. Clamp the spring tightly on the bush, put the switch in the "off" position, engage the spring with one of the notches in the plate, and tighten the coupling screw on to the cam spindle. The switch can be

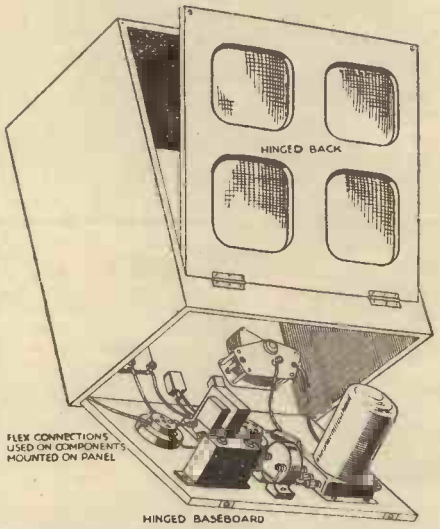


Side elevation and details of a circuit combination switch.

screwed to the chassis under the coil assembly.—T. C. HUMPHRIES (Leytonstone).

Easily Accessible Components

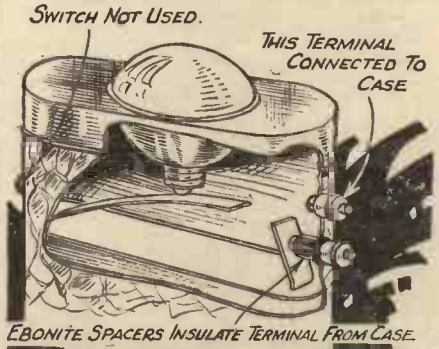
IN order to make the components in my receiver easily accessible, I made the cabinet as shown in the accompanying sketch. The bottom of the cabinet, which is hinged at the front, forms the baseboard of the set on which the components are mounted. The components on the panel are connected to those on the baseboard with flex leads, and the back of the cabinet is hinged, as indicated. By turning a small catch, and laying the cabinet on its face, the components are instantly accessible.—H. WARD (Wealdstone).



Method of arranging a cabinet so that the radio components are easily accessible.

A Pocket Tester

THE simple testing equipment, shown in the accompanying sketches, can be carried in the pocket without inconvenience. Low-resistance components, under test, are connected direct to the terminals fitted on the flash-lamp case. When testing high-



Part-sectional view of a pocket tester and details of earphone connections.

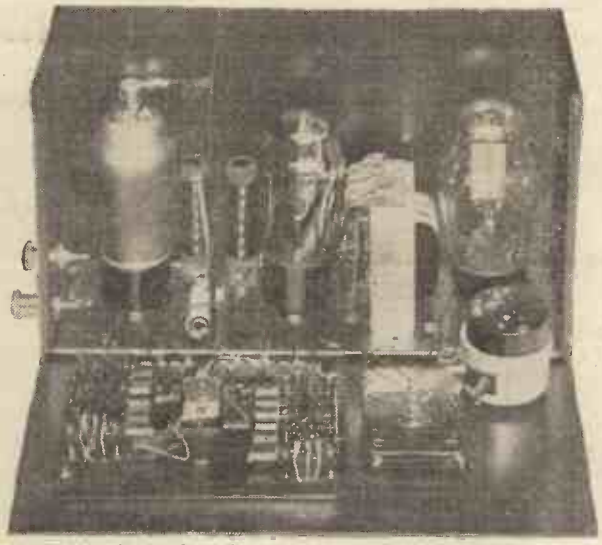
resistance components, such as transformers, the telephone leads, marked A and B, are joined to the terminals, the leads C and D being available for applying to the component under test. — S. RAINEY (Wishaw).

A Circuit for the Brown Tuner

Details of a Suitable Circuit in which to employ the Brown Permeability Tuning Component

SEVERAL readers have written to us for information regarding the type of circuit in which the new Brown tuner may be incorporated. This tuner was described on page 234 of our issue dated May 11th last, and it would appear that there are quite a number of listeners who are anxious to experiment with this new type of component. For the benefit of those who have not already made acquaintance with it, we would mention that it is a new form of permeability tuner covering the normal broadcast bands and is complete with switching. The illustrations reproduced will give an idea of the ingenious arrangement of the coils, which render extremely high selectivity possible.

The circuit to which the coils are wound consists of two H.F. transformers, in association with one of which is a reaction winding. Thus the most suitable circuit is that in which an H.F. stage is employed, and the first set of coils may then be used for the aerial circuit and S.G. grid circuit, with the second set in the form of a tuned grid circuit for the detector stage.



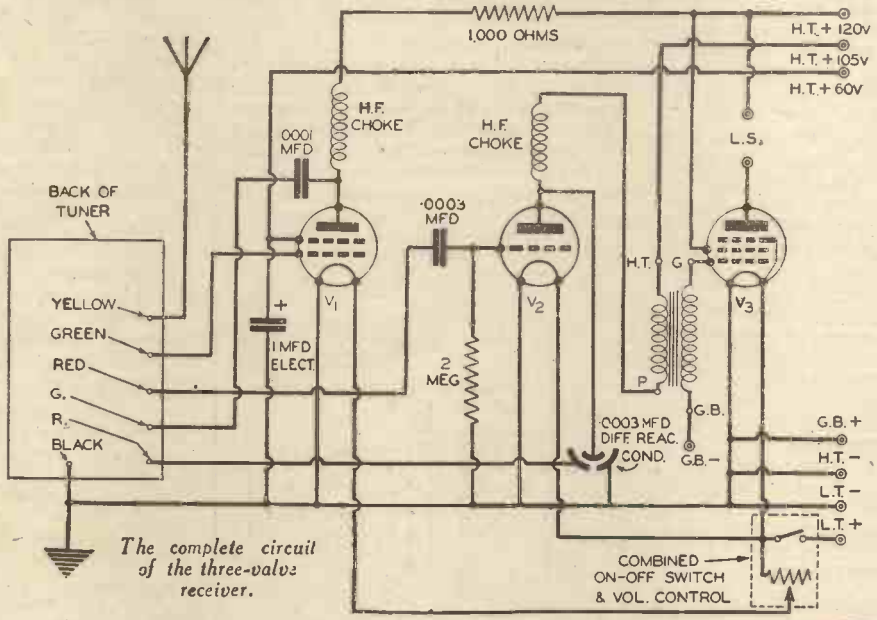
A complete three-valver in metal cabinet.

Components Required

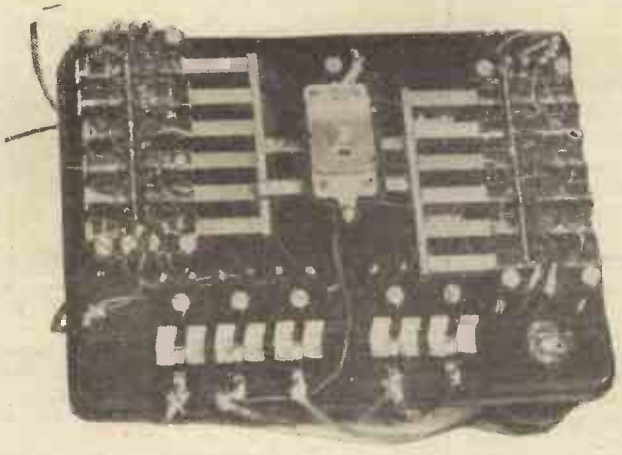
No tuning condensers are, of course, necessary, but for reaction purposes it is essential to use a condenser, and for smooth control the differential type of condenser is recommended in this circuit. The total maximum capacity should be .0003 mfd. The coils are already interwired inside the unit and thus there are only six external connections to be made. The unit is provided with coloured lead to these points, and the accompanying circuit diagram gives full details for a suitable three-valve receiver, with the connections to the unit clearly indicated with the appropriate coloured leads. It will be seen that the circuit is more or less standard, and all values follow normal practice. An electrolytic condenser is specified for the smoothing of the screening grid circuit, although an ordinary non-inductive condenser could be used in this position if desired. In certain cases it may be found desirable to return the grid leak to the L.T. positive leg instead of the negative, but that is a point which will be found best by trial under actual working conditions.

Valve Types

For the H.F. circuit any good standard S.G. valve may be employed, and for the detector one of the general purpose types (that is, with an impedance of about 15,000 or 20,000 ohms, and an amplification factor of 20 or so). The output valve may be of the economy pentode type, or one of the higher efficiency pentodes if the total H.T. drain is not an important factor. The transformer should have a ratio of 3 or 4 to 1. In the illustration it will be seen that a metal cabinet is employed. This facilitates construction and also screens the apparatus, thus giving greater stability and enabling the maximum effects to be obtained with the particular type of coil which is adopted. The latter must be screened, and therefore the unit has to be mounted on a metal panel, and this may conveniently be built as a complete front to the cabinet as shown. As the reaction condenser and volume control are mounted on this metal panel (which should be earthed), these two components must be mounted through insulating bushes to prevent short-circuiting.



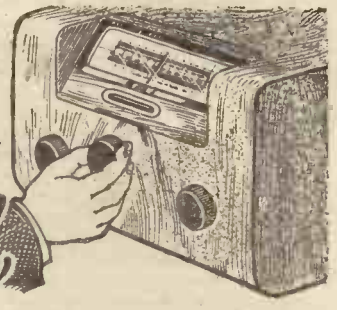
The complete circuit of the three-valve receiver.



Interior of the tuner. The arrangement of the coils and switches may be seen.

How the complete tuner appears in its case. The small spindle inside the tuning control is a trimmer.

On Your Wavelength



By Thermion

More Jazz Critics

WHAT a hornets' nest I seem to have stirred up! All sorts of readers who wallow in jazz have written to me regarding my opinion about it. At the moment the balance for and against jazz is about even. J. F., of Whitefield, for example, writes: "I am bound to admit that two of the criticisms you level against jazz are correct—twenty-five per cent. of the tunes are tripe, and are seldom played in correct tempo. Apart from this, I find it infinitely preferable to, say, the Bach celebrations which have been going on, seemingly, for weeks, or some foreigner with his band. Apart from the B.B.C. programmes we only have a couple of English orchestras. Because of my preference for dance music presumably I am uneducated and low-brow. Before I close down I would just like to say that I wish that a man as widely read as you must be, and therefore with some influence, would not run down other people's pleasure or try to have it abolished simply because you don't like it. After all, dance fans pay their licence fee and are entitled to a certain percentage of what they like. When a programme is what I don't like I turn to another station."

Well, if all of my readers adopted their own formula they would not write to me and tell me what they do not like. I don't like jazz music and some do not like my views thereon. The matter therefore cancels out.

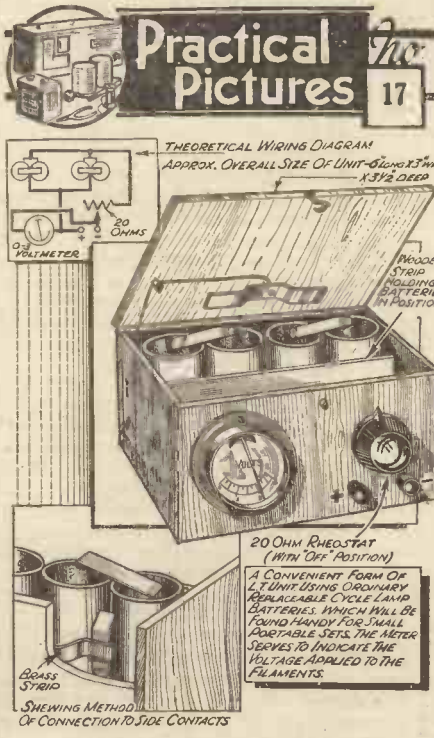
The Television Sites

THE next step forward in the development of television has taken place by the selection of the Alexandra Palace by the Television Advisory Committee as the site for the first British Television station. This presages programmes towards the end of the year and connotes an enormous increase in home construction. As London will be the first to receive the television radiations, it is natural that interest at first will be centred in that locality, but I anticipate an early spread of the new science to the various other localities as promised in the Television Committee's Report.

Local-distance Switching

IT is frequently found with the average type of receiver that the detector or L.F. stages become overloaded when the local station is tuned in, especially when a brass band performance is being broadcast. This difficulty can, of course, be avoided by using a variable-mu valve in the first stage, or by fitting some kind of input volume control. The latter may take the form of a 25,000-ohm variable resistance (non-inductive for preference) connected between the aerial and earth terminals. Another method is to use a differential condenser in the input circuit; the moving vanes of this should be connected to the aerial terminal of the set, one set of fixed vanes to the aerial lead-in, and the other to earth.

Very often, however, a much simpler system than any of these will give the desired effect, since it is not necessary to have full control over the input, but merely to limit this when a very powerful transmission is tuned in. In such a case it is sufficient to arrange for a fixed resistance of about 500 ohms to be switched into



circuit between the aerial and earth terminals. All that is required is a non-inductive fixed resistance and a simple on-off switch. When the switch is in the "off" position distant stations can be received as before, but when it is switched "on" the aerial input is limited and only "local" stations can be received at good strength.

Wireless Clubs and Societies

I OFTEN wonder how many readers of PRACTICAL AND AMATEUR WIRELESS are members of a wireless club, and doubt if many enthusiastic constructors appreciate the full advantages of such membership. Having been a member of several clubs in different parts of the country, I can strongly recommend any reader to join a local branch. Meetings are frequently held and the exchanges of views which take place are always instructive to advanced amateurs and beginners alike. Membership is particularly valuable to those who contemplate the taking out of a transmitting licence at some future date, for there is a good deal of information on this subject which it is much better to acquire at first hand from active transmitters. Those readers who are interested in listening-in, and who are keen on obtaining good quality, have many opportunities for hearing apparatus other than their own, and for judging the relative merits of different types of circuit.

If I have convinced you of the value of club membership you will almost certainly find that there is a branch near to you, and your dealer will perhaps be able to advise you regarding the address, etc. The regular club notices which appear in this paper should be studied, and there might be found the address of the hon. sec. of a branch which is in your district.

Public Taste

IT is a peculiar thing how the tastes of different nationalities vary. I was talking to a manufacturer the other day, and he said that when he offered a customer a receiver capable of receiving short waves as well as the normal broadcast band, it did not seem to offer any increased inducement. In other words, the public did not care whether they had short waves or not, so long as they could receive the B.B.C. programmes with a fair proportion of Continental alternatives. On the other hand, in America, if a set cannot get the short waves it does not seem to sell at all. The public there want everything they can get, and seem to delight in roaming every wave-band and reaching out. Is this because they are not musically inclined, as is the English nation, or because they require value for money, and judge value by the number of stations they can get? It is an interesting problem, and I am glad I am not a manufacturer.

The Side-band Problem

THE question of side-bands cropped up during a discussion with a radio acquaintance the other day. Of course, I suppose most of my readers are aware that there are supposed to be bands on either side of a transmitter which it is essential to receive in order to obtain quality. Many experts hold the theory now that side-bands do not exist—at least in the transmission—and that we have been working on the wrong lines in imagining that such side-bands exist. It has been proved—mathematically and scientifically—that they do not exist, and also that they do exist, each class of supporters proving their assumption up to the hilt. During our discussion on this my acquaintance mentioned

(*Continued overleaf*)

(*Continued from previous page*)

that sometimes whilst he is carrying out a transmission test an amateur with whom he is working will tell him that he is cutting one of his side-bands, and he will adjust his apparatus, without actually knowing how to put back the cut band, and then will be told that the transmission is O.K. On other occasions, however, when he has been told that a side-band is cut, he will switch off but make no alteration to the transmitter. Then when he again switches on he will be told that things are all right, in spite of the fact that nothing has been done. This, of course, tends to prove the theory that the side-bands are formed in the receiver, and not in the transmitter. I think, for the time being at any rate, it is safer to go on thinking that there are side-bands, and wait until some really definite evidence is forthcoming to prove their non-existence.

Standardised Threads

HOW convenient it would be if all threads in wireless component construction could be made of the same size. It is very annoying now, when turning out the "junk" box, to find a valve-holder, for instance, with one terminal missing. You go through the box of sundry terminals and screws and find dozens of terminals, but not one which will fit the particular screw in question. A similar point arises in connection with screw fixing holes for mounting. One component necessitates a No. 4 countersunk screw, whilst another requires a No. 8 round head. You cannot interchange these at present, as the countersunk screw would split the bakelite base of many components owing to the fact that the holes are not countersunk. The aluminium lugs are obviously not countersunk, but many components—in some cases valveholders—are provided with this type of hole. The result is that a large assortment of screws is required for constructional work. No doubt one day all this will be changed, but in the meantime we, as pioneers, must plod along the heavy road and grumble in our beards.

An Obscure Fault

AN A.C. three-valve receiver had been constructed, but when put into commission a peculiar fault was noticed. On local stations results were quite satisfactory, but when used for long-distance reception a peculiar form of fading was obtained. The circuit utilised an H.F. stage with variable-mu valve, and as the control was turned towards the maximum position a point would be reached where the signal would remain constant for about twenty seconds and then would fade. It would gradually die away, and when almost inaudible there would be a slight plop and signals would return at maximum volume, only for the same procedure to be repeated. It was thought, quite naturally, that a grid circuit was defective and the receiver was examined from this point of view. Everything appeared to be in order, however, and components in the various grid circuits were therefore changed.

As the fault persisted it was considered that the valves must be faulty, and, fortunately, alternative types of valve were available and were substituted stage by stage. The fault was present when detector and output valve were changed, but on changing the H.F. valve the fault ceased. The inference was, therefore, that that valve was faulty, and it was accordingly returned to the makers for test. It was returned O.K., but on plugging into the receiver the same fault occurred again. Many tests were carried out before the trouble was eventually traced, and it was then found to be due to the following: The valveholder in use employed a coiled flat strip as a "sprung" socket for each pin, and the intention of the makers was that the pin should be gripped by the inner spiral of each spring, and as such the idea was admirable. What had happened, however, was that the holder had been in use for some time with the older type of valve employing an externally-sprung valve leg. The valve which was apparently at fault was of the modern type with a solid pin, and this was slightly smaller in diameter than the inner spiral of the sockets, but owing to the arrangement of the latter when the valve was plugged in the filament and anode pins were securely gripped, but the grid pin made only a slight contact in one position. At a certain volume, and with an adjustment of the control the arrangement of the circuit apparently caused a partial disconnection at the grid-pin junction with the holder, and the fault arose. The fact was proved by bending the springs slightly so that the pins were all gripped tightly, when the valve functioned quite normally. This is mentioned as an indication of some of the hidden faults which sometimes baffle the novice in tracing trouble.

Notes from the Test Bench

Receiver Tests

ALTHOUGH there is no doubt that it is advisable to entrust receiver repairs to a reliable technician, a few preliminary tests can often be made by the average constructor without fear of damaging the set in any way. If a reliable voltmeter is available, preferably an instrument having a resistance of 1,000 ohms per volt, valve anode voltages can easily be checked, without interfering with the receiver wiring. In the commonly used mains three-valve receiver of the H.F. pen., detector, pentode type the H.F. valve requires an anode voltage of approximately 200 volts and a screen voltage of 80 volts. These voltages can be measured by connecting one terminal of the voltmeter to the metal chassis, and then prodding the other terminal lead to the valve cap and the screening grid pin in turn. In order to make good contact with the screening grid pin the valve may be slightly raised in its socket. The output pentode valve used in the average three-valve table model requires a maximum of 250 volts on the anode and 200 to 250 on the screen; these voltages can be measured in the same manner as those of the H.F. pentode; the valve pin connections will be found in valve manufacturers' guide books. A definite anode voltage value cannot be given for the detector valve, but this usually varies between 60 and 150 volts according to the value of the detector anode resistance. When no voltage is indicated at the valve anode, a break in the wiring or in one of the components between the anode and the H.T.+ line will be indicated. A low voltage is generally due to a high value anode resistance or a low value cathode bias resistance, and a high anode voltage to a low value anode resistance or a high value cathode resistance.

Current Tests

IN order to make accurate anode current tests it is necessary to use an anode adaptor or to actually break the anode circuit for insertion of the milliammeter. As the output valve is the one that takes by far the heaviest current, a measurement of the consumption of this generally enables one to localise a number of common faults, however. If a reliable milliammeter is available it is unnecessary to break the anode circuit; the consumption may be measured by connecting the meter across the output choke or output transformer primary. At first sight this method may appear to be incorrect, but as the resistance of a good meter is very low as compared with that of the output transformer primary, only a very small percentage of the current will flow through the transformer when the meter is in circuit, and therefore, in practice, a sufficiently accurate measurement will be obtained.

The Ultra-short Waves

THIS summer seems to be becoming an ultra-short-wave season in readiness for the anticipated autumn television programmes. Much activity is afoot on the 5-metre band, and, judging from a few tests I have carried out on this band, yet another phase of radio technique seems upon us. An ordinary short-waver is quite unsatisfactory on 5 metres, I find, and a special set I built would on no account oscillate. To those wishing to explore these ultra-high frequencies I recommend a super-regenerative receiver on the lines of that described in PRACTICAL AND AMATEUR WIRELESS for April 13th. I believe the ultimate receiver for these frequencies will be a special form of superhet.

Faulty Valves

I HAVE just come across a case of a valve fault which seems to occur with regular periods of about six months. At least, from my notebook I see that it is just six months ago that a similar effect was reported, and a similar period previous to that before it occurs again. The trouble in each case was due to the user removing a valve by holding the glass bulb and not the ebonite case. Repeated plugging-in and removing of the valve had loosened the cement in the base, and the glass bulb had become loose. In itself, this is not very serious, although it may give rise to microphony. What had happened in the cases under review, however, was that the bulb had been turned round, and a point had arisen where short-circuiting had taken place in the wires to the valve legs. It was found in each case that there was just sufficient slack in the leads to permit of this, although in most modern valves the leading-out wires are brought through holes in the tips of the legs and soldered before cutting off. This pulls them tight, and the risk is non-attendant, as they will break before shorting if the bulb is twisted. Remember, therefore, always to remove a valve by the base, and then you can tug as hard as you like without risk of damaging the valve.

The Experimenters Explain—

CONVERTING A BATTERY RECEIVER FOR A.C. MAINS OPERATION

by The Experimenters

IT is generally known that an A.C. mains receiver is appreciably more efficient than a battery receiver of similar type and having the same number of valves, but there are many constructors who prefer to build the latter type of set because they believe that the construction is easier and that the receiver is "safer." In many respects this is a fallacy, since a mains set is no more difficult to build than a battery one, although there is a little more work involved, principally due to the fact that a power unit has to be made in addition to the receiver proper. But this does not lead to complications of any sort, and the final result, provided that reasonable care is taken, is just as "safe" in every respect. The essential point is that the components which are in connection with the mains supply should be beyond reproach, and should be insulated in the best possible manner.

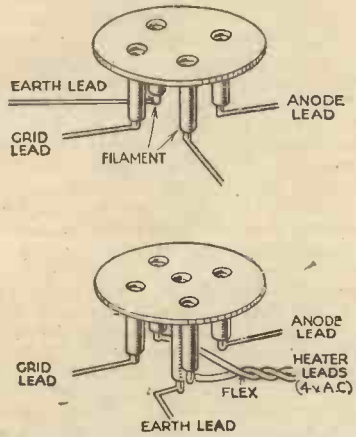


Fig. 1.—The comparative connections to a four-pin valve-holder (for a battery valve) and to a five-pin holder (for an indirectly-heated valve) are shown here.

All-mains or Eliminator?

When the above points are fully realised there may be many constructors who would like to convert their battery sets for mains operation, and the following practical advice will prove useful. It is, of course, a simple matter to construct an eliminator to replace the H.T. battery as well as to provide a source of power for charging the accumulator, but this is only a compromise, and does not give an improvement in reception. We will therefore disregard that aspect of the question and deal, instead, with the alterations required when the set is to be entirely modified for use with the more efficient indirectly-heated mains valves. In the first place the connections to the valve-holders require to be modified, whilst if the holders originally fitted are of the four-pin type they must be replaced by others suitable for five-pin valves.

The grid and anode connections remain as before, but all earth-return leads have to be made to the cathode terminals (see Fig. 1), whilst the original filament terminals become heater terminals, and must be connected to a 4-volt supply of A.C. As it will generally be desirable to build the mains portion as a separate unit, the heater terminals should be re-wired with twisted double flex, as indicated. The object in using twisted flex is to prevent hum, which may be caused due to the magnetic field set up round wires carrying alternating current; the fields are neutralised to a large degree when the wires are twisted together. The flex should be stout material of good quality, so that its resistance, and hence the voltage-drop across it, is reduced to a minimum.

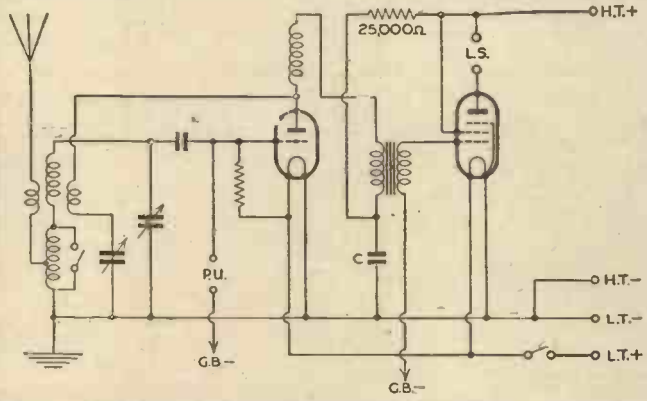


Fig. 2.—The circuit of a typical two-valve Det.-Pen. receiver for battery operation.

Simple Wiring Alterations

We may first of all consider the simple modifications in wiring required in the case of a two-valve (det.-pentode) battery receiver employing a circuit such as that shown in Fig. 2. The few alterations are indicated in the new circuit (Fig. 3), from which it will be seen that in the case of the cathode lead to each valve a bias resistance is included, this being by-passed by a 25-mfd. electrolytic condenser, of which the positive terminal is joined to the cathode of the valve. The value of the resistance is, in each case, governed by the type of valve employed, but the values indicated apply to two well-known types of Cossor valve—the 41 H.L. and the M.P./Pen. When other valves are used the resistance values must be changed accordingly, and the method of determining the correct values was described in the article on "Components" in the issue dated June 1st.

The altered connections for the pick-up should also be noted, whilst it will be seen that additional decoupling has been added in the detector anode circuit in the form of a second 25,000-ohm resistance. Actually this second resistance may not always be required, but it is generally necessary in order to ensure smooth reaction, and to keep down to a reasonably low value the current passing through the primary winding of the L.F. transformer.

Another point which should be borne in mind is that the H.T. voltage employed after altering the set will be a good deal higher than before, so that the decoupling condenser marked C may have to be

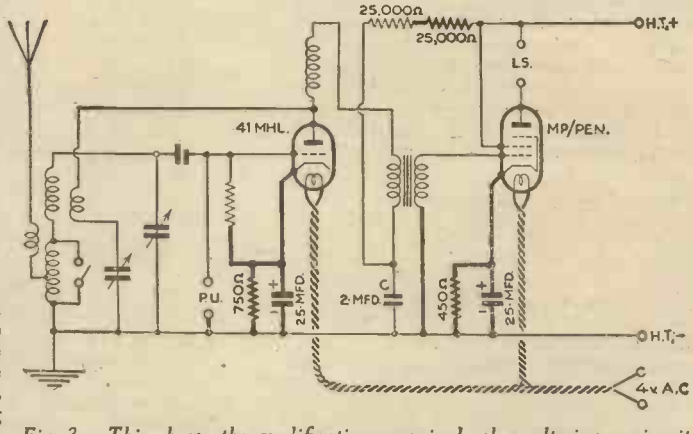


Fig. 3.—This shows the modifications required when altering a circuit like that shown in Fig. 2 for A.C. operation. Altered and new connections are indicated by heavy lines.

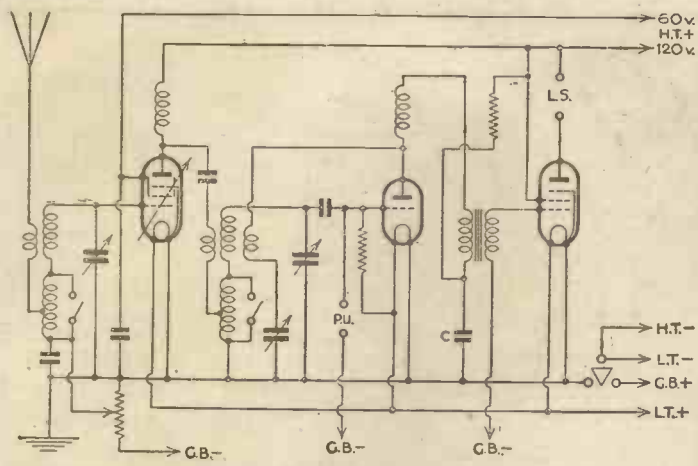


Fig. 4.—The circuit of a simple 3-valve variable-mu battery receiver.

changed. The condenser should have a rated working voltage of not less than 250 when an indirectly-heated valve rectifier is used in the mains unit, or of 350 when a directly-heated valve or a metal rectifier is employed. The rest of the circuit may remain unchanged.

A Three-valver Example

In modifying a receiver having a variable-mu or a screened-grid stage rather greater precautions must be taken if the possibility of instability and self-oscillation is to be avoided. As an example, we may compare the circuits represented by Figs. 4 and 5, of which the first is a standard battery-operated arrangement and Fig. 5 is its A.C. counterpart. In Fig. 5 the variable-bias voltage for the first valve is provided by means of a 2,000-ohm graded potentiometer

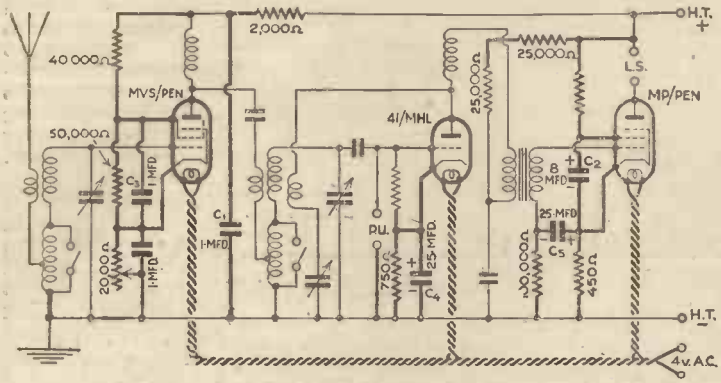


Fig. 5.—This circuit corresponds to that shown in Fig. 4, but is for A.C. operation. Additional and modified connections and components are shown in heavy lines.

included in the cathode lead, whilst the voltage for the screening grid of this valve is obtained by means of a potentiometer comprising two fixed resistances joined in series between H.T.+ and the cathode (equivalent to H.T.—).

Increased Decoupling

Additional decoupling is provided for the detector valve, and the anode of the variable-mu valve is also decoupled by means of a 2,000-ohm resistance and a 1 mfd. fixed condenser. Although not always necessary, the auxiliary grid of the pentode is decoupled instead of being connected directly to the positive high-tension lead. As the modified circuit is likely to prove rather "critical" because of the much higher degree of amplification provided, the grid circuit of the pentode is also decoupled by inserting a 100,000-ohm fixed resistance between the G.B.− terminal on the L.F. transformer and the earth line, the cathode by-pass condenser being connected between one end of the decoupling resistance and the cathode of the valve.

Just as in the case of the two-valve circuit discussed above, the decoupling condensers C, C1 and C2 should have rated working voltages of at least 250 and 350 in the conditions referred to; condenser C3 should be rated at not less than 200 volts working, while the by-pass condensers C4 and C5 may be standard electrolytic condensers, designed for a working voltage of not less than 10 and 20, respectively. In the case of both circuit arrangements considered, the fixed resistances may all be of the 1 watt type, since the current which they have to carry is comparatively low.

Despite the fact that the general modifications required when converting receivers of other types than those mentioned are the same as have been described, readers are recommended not to attempt the modification of receivers having two H.F. stages, or of the super-heterodyne type unless they have a fairly wide experience or are prepared to carry out a certain amount of experimental work. The reason for this is that stable operation is not always easy to obtain with more sensitive receivers, and it is not possible to treat the subject of their alteration in general terms, since each individual circuit must be considered on its merits.

The Power Unit

It remains now to consider the battery eliminator, or power unit, and the connections for two alternative types are given in Figs. 6 and 7; the former employs an indirectly-heated valve rectifier, and the latter a Westinghouse metal rectifier. A satisfactory unit of either type can be assembled on a simple flat baseboard, and may be housed in the same cabinet as the set, or in a separate container. In either case, however, it is desirable that the connecting leads to the set should be kept as short as possible.

For the purpose under consideration it is generally better to use the indirectly-heated valve type of rectifier, since the "peak" voltage when first switching on is not so great, and the condensers in the set do not require to be of so high a working voltage. The circuits are self-explanatory, and the output from both units is approximately 250 volts at 60 m.a. and 4 volts at 3 amps.; provision is, however, made for reducing the H.T. current to about 40 m.a. when only two valves are employed in the receiver. It should also be added that, although the transformers specified under the two circuits will provide up to 5 amps. L.T. they have good "regulation," and will not give too high a voltage when only 2 amps. are required.

There is no necessity for fitting terminals to either of the mains units, and it is generally more convenient to provide suitable flexible connecting leads as shown, these being joined to the appropriate terminals on the receiver. Particular makes of smoothing chokes are not given, since any good instrument rated at 30 henries when carrying 50 m.a. is suitable, provided that the D.C. resistance does not exceed 1,500 ohms. The same remarks apply to the electrolytic smoothing condensers, fuse, and Q.M.B. on-off switch, but all components must be of reputable make and unimpeachable quality.

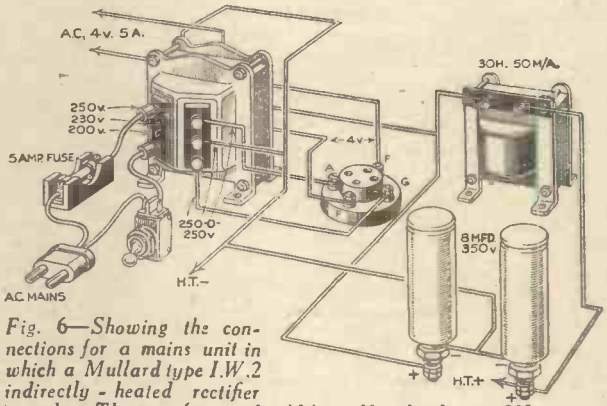


Fig. 6—Showing the connections for a mains unit in which a Mullard type I.W.2 indirectly-heated rectifier is used. The transformer should be a Heayberd, type 803.

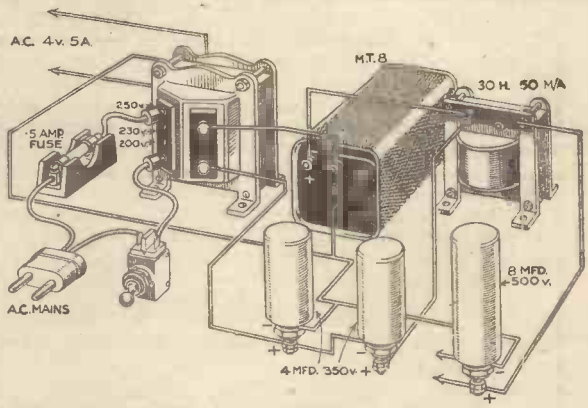
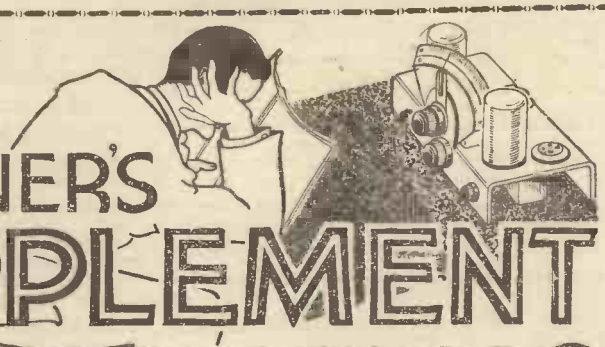


Fig. 7.—This illustration shows the connections for a mains unit in which a Westinghouse, style H.T.8, metal rectifier is employed. The transformer is a Heayberd, type W. 31.

OUTDOOR RADIO

BEGINNER'S SUPPLEMENT



Methods of Connecting Extension Loudspeakers are Among the Subjects Dealt With in this Article.

AT this season of the year, the listener's thoughts naturally turn to outdoor radio, for few people wish to stay in the house during fine evenings, however attractive the radio programmes may be. It is not necessary to say very much about radio in the garden, because this has been dealt with before in PRACTICAL AND AMATEUR WIRELESS. It is seldom necessary to transport the receiver into the open air for this purpose, an extension circuit from the output stage being all that is required. The most satisfactory method of arranging an extension is by means of a choke filter as indicated in Fig. 1, in which case the ordinary moving-coil speaker with its own output transformer may be employed. Many sets, however, are not fitted with extension terminals, and many of those which are use a variety of different arrangements. These are shown in Figs. 2 and 3, and the following notes will assist in making the best possible use of the extension circuit.

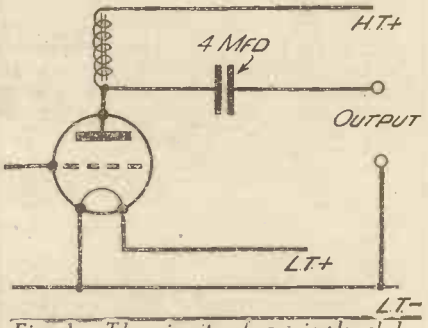


Fig. 1.—The circuit of a simple choke-capacity output filter.

Speaker Extensions

The extension circuit may be wired in parallel with the secondary of the main speaker transformer. This, of course, calls for a low-impedance loud-speaker, and in this connection it is useful to know that it is becoming the general practice of speaker manufacturers to fit their instruments with additional terminals, an extra plug, or a switch, to permit them to be used either as low-impedance or high-impedance speakers when employed as extension instruments. What happens when the speaker is arranged for "low impedance" is that the output transformer is cut out of circuit and the input goes straight to the speech coil.

The advantage of a low-impedance output circuit is that no high-tension voltage exists on the extension leads, thus avoiding risk of shock or of earthing the H.T. supply. Another advantage is that losses due to capacity between long leads is negligible. It is important to remember, however, that in a low-impedance output the losses due to the resistance of the extension leads will be serious unless heavy wires are employed.

The second arrangement, shown in Fig. 2, places the extension speaker in parallel with the primary of the output transformer, and suffers from the disadvantage that H.T. voltage is on the extension line, and that the leads must be well spaced to avoid capacity losses. If your set employs this system, it is advisable to convert it to low-impedance output by removing the transformer from your extension speaker and installing it either in or near the set, running the usual low-resistance leads out to the position where it is desired to operate the speaker.

Finally, in Fig. 3 is shown what is probably the most satisfactory arrangement, in which the primary winding of the main output transformer is used as a low-frequency choke, the extension circuit being taken through a condenser. This is really equivalent to the ordinary choke-capacity filter circuit, and any high-impedance speaker, such as a moving-coil instrument with its self-contained transformer, may be used without risk of H.T. shorts or shocks. Remember, however, that low-capacity lines are essential for efficient operation.

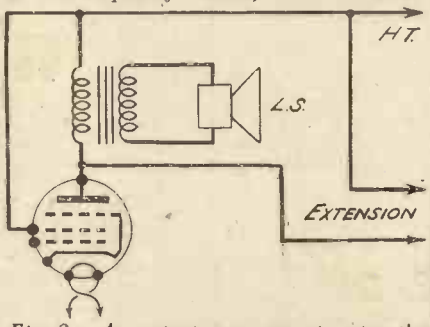


Fig. 2.—An output arrangement, using the extension speaker in parallel with the output transformer primary winding.

Other Suggestions

It is quite hopeless to expect enjoyable results in the garden from a set employing only a small output. The performance obtained from a small pentode or power valve may be adequate indoors, but in the open air will appear very thin, due to the lack of reflection from walls and ceiling. Unless the set is capable of an output of at least two to three watts, radio in the garden may be very disappointing, both in quantity and quality.

Garden radio, however, does not represent the limits of outdoor entertainment during the summer. There is no need to give more than passing mention to ordinary portable sets, which can add so largely to the enjoyment of picnic parties or river excursions, or to car radio, which is becoming increasingly popular. These two making use, as they do, of apparatus specially designed for their respective purposes, call for no special ingenuity on the part of the amateur. But there are other directions in which the handy experimenter can combine his hobby with fresh air.

He may not, for example, be in a position to install a specially-designed car-radio set, but there is nothing to hinder him building a set of more conventional design, to be carried in the family car and used when drawn up by the wayside for a meal. Supplies for such a set will cause no difficulty. For low tension there is the car battery, and the builder has the choice between 2-volt battery valves working from a tapping on the battery, and the new 13-volt indirectly-heated car-radio valves (where a 12-volt battery is available). High-tension supply is best obtained from dry batteries, for although converters operating on the car battery are available, they are somewhat expensive, and are scarcely justified for what is, after all, a temporary job.

Points on the Circuit

As to the circuit the choice is very wide, but in view of the fact that a rather poor aerial will have to be used in any case, it will probably be wiser to rely mainly upon the local stations and perhaps a few of the more powerful foreigners. A single high-frequency stage should suffice for this purpose, and since a very high degree of selectivity is not essential, a band-pass input circuit need not be used. Only two tuned circuits therefore are required—the aerial circuit and the H.F. coupling circuit—and these might well be tuned by separate condensers such as most amateurs have in their box of spares.

The detector should be of the ordinary leaky-grid type, and calls for no particular comment. As for the output stage, in view of the necessity of a fairly large output, either Class "B" or Q.P.-P. is indicated. A set on these lines could be made up very easily from odd spare components and would therefore cost very little, the actual design being modified to suit the parts actually available.

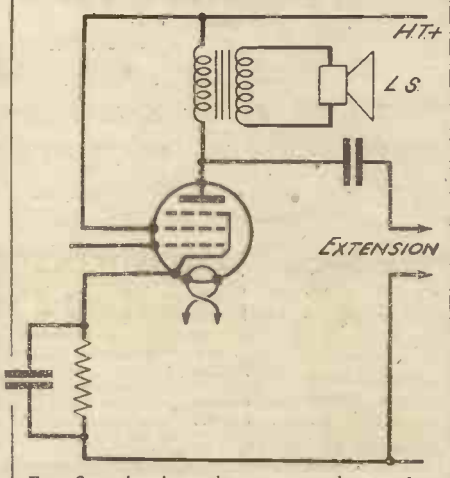


Fig. 3.—Another scheme, using the speaker transformer primary as an output choke.

An A.C. Safeguard

THE dangerous rise in voltage produced when switching on an A.C. receiver incorporating H.T.8, or similar, rectification is a well-known effect, and the following particulars of a simple method which I have adopted to prevent the danger may be of interest to other readers. This consists of a neon lamp of the "indicator type," normally used for electric cookers, etc., connected across the output of the H.T.8, *i.e.*, between H.T.+ and earth as shown. The lamp should be of 250 to 260 volts, rated as taking .5 watts, and may be obtained with small bayonet cap fitting.

This type of lamp is of very small dimensions (2in. by ¾in.), and takes up very little room in the set when plugged into a socket screwed down to the baseboard.

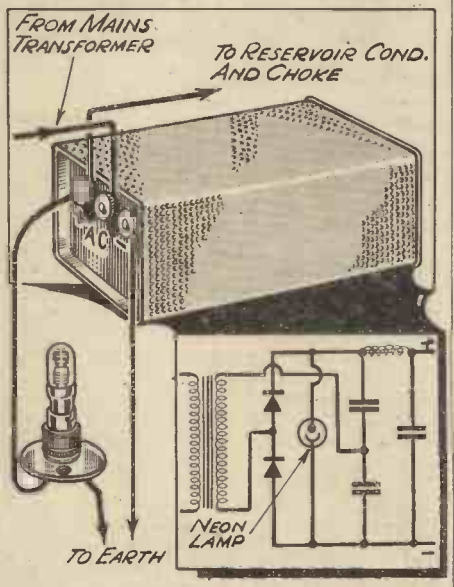
The principle of the idea is simple. When the set is switched on and the voltage rises, the neon lamp glows and takes up the excess voltage. As soon as the valves warm up, the voltage drops to normal, and as the voltage of the neon lamp is rated at 250 to 260, it now takes very little current, although the glow is still appreciable.

The following figures, as measured with an Avometer on my own set, will illustrate the working of the device.

Peak voltages : Without lamp, 500 volts ; with lamp, 400 volts.

Total current passed through rectifier : Without lamp, 44 milliamps. ; with lamp, 49 milliamps.

The neon lamp therefore consumes 5 milliamps., but reduces the peak voltage from the dangerous 500 volts to the more reasonable 400 volts. This means all the difference between using more or less expensive condensers or, on the other hand, risking the breakdown of a condenser and consequent poor functioning of the receiver or even the danger of serious damage to the mains transformer or rectifier.—E. H.



Circuit and pictorial diagram of a Neon safeguard.

AN IMPORTANT TELEVISION DEVELOPMENT ?

AN improved method of and means for transmitting and receiving sound and vision (in natural colours) has recently been provisionally patented.

The invention is not working yet, but owing to its importance the following particulars should prove of interest.

Transmitting will be done with the addition of a modulated light oscillator, which should give a mauve or purple ray, and at the same time register the visual impressions. This will probably be as near to the working of the human eye as we can hope to attain.

The oscillator will cause the carrier wave to oscillate at the same colour frequency in order to carry both light and sound vibrations over the same wavelength. This should also make the background of the receiver silent and free from sound interference. Tuning-in would then more easily be done by seeing the mauve carrier wave or the studio.

The receiver will be quite simple, as the same valves, etc., will be used for both sound and vision with an extra lamp and another arrangement for the vision. Mr. L. V. Charlton, the inventor, is a toolmaker, and has been working on the invention during practically all his spare time for the past 2½ years.

S.W. CONVERTERS AND SUPERHETERODYNES

How to Use the Superhet Type of Receiver for Short-wave Reception.

THE user of a "straight" broadcast receiver is rather fortunate in many respects, and when it comes to a matter of converting the receiver for use as a short-wave set he has two alternatives from which to choose. He can use an adapter or a converter. The former is, in effect, a short-wave detector stage, and thus may be used only in that form or with the addition of L.F. stages, whilst the latter converts an existing receiver into a superhet. It is obvious, therefore, that an adapter may be used with *any* straight receiver, whilst the converter can only be employed when H.F. amplification is present. These latter stages then function as intermediate-frequency stages. The user of a superheterodyne receiver, if he wishes to use an adapter, must sacrifice the frequency-changing stages, as well as the I.F. stages, and couple the adapter to his detector stage. He is thus using a wasteful method. Of course, the user of a broadcast receiver employing H.F. amplification could also use an adapter and ignore his H.F. stages, but this would also be as wasteful as the other method.

Double Frequency Changing

The converter, on the other hand, acts as frequency changer, and functions admirably with an H.F. amplifier, when the broadcast receiver is adjusted to operate on a frequency similar to that to which the original signal is converted by the converter. In general, this is in the neighbourhood of 110 kc/s (2,700 metres), and thus the broadcast receiver is tuned to this point. In a superheterodyne receiver we already have a frequency-changing stage on the input side in which the signal is converted to a predetermined frequency. Consequently, some care is necessary if a converter is used in conjunction with this type of receiver, as a little thought will show that troubles can arise owing to the fact that the frequency of the signal is changed twice. On the short-wave band we may have a frequency band from 30,000 kc/s to 5,000 kc/s or so. Harmonics of these frequencies and of those in between the limits will fall within such a band that they will beat with the oscillator (or frequency changer) in the superhet circuit and thus a whistle will be produced, unless the superhet is adjusted to such a position that the harmonics which come within the tuning range are of such a value that the production of whistles is unlikely, or that only a very weak whistle is produced. In practice, it will be found that if the superhet is adjusted to receive on a frequency of about 200 kc/s (1,500 metres), the minimum of whistles will be produced if the converter is of the more or less orthodox autodyne-frequency-changer type. Users of the £5 Superhet or similar types of receiver may, therefore, use the autodyne-frequency-changing scheme, provided that this point is borne in mind, and quite good results will be obtained.—W.D.

SHORT WAVE SECTION

At the Short-waver's Bench—8

Among the Subjects Dealt With in this Article are a S.W. Amplifier and Increasing Detector Efficiency

The Use of Jacks and Plugs for Short-wave Sets

IT is frequently found when tuning-in with headphones that a station is quite powerful enough to be put on the speaker, but the resultant fumbling with terminals, etc., in order to do this causes no small annoyance. A similar position arises when it is desired to use the 'phones again, and a method of eliminating the trouble is to use jacks and plugs. Both these components can be bought quite cheaply, and they are a great boon for rapidly changing the 'phones or speaker. The working details of these devices are given in Fig. 1, for the benefit of those unfamiliar with them. The jack may, of course, be fitted to the front panel, back terminal strip, or side of the cabinet, and all 'phones and speakers to be used with the set will have to be fitted with plugs.

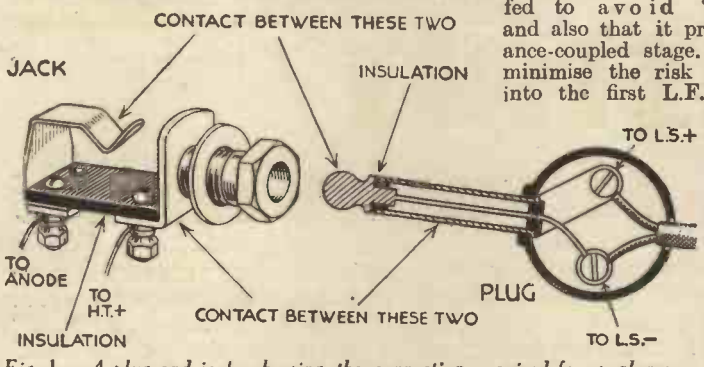


Fig. 1.—A plug and jack, showing the connection required for speaker or headphone switching.

An "Ultra-slow-motion" Device

In these days of slow-motion dials which are mounted behind the panel, as opposed to the old raised dials, it is very simple to arrange two dials together to give an extremely slow motion for short-wave work. Fig. 2 shows how this may be done, the first scale being mounted in the normal way on the panel near the top. Instead of mounting the small control knob at the bottom, another slow-motion dial of the older pattern is fixed there. It may be found that this dial will require a liner or a small amount of packing in order to fit the spindle which is likely to be of rather small diameter.

A Short-wave Amplifier

Another advantage of this idea is that very accurate dial readings may be taken by making use of the readings of both the dials.

It is frequently advocated that, for an experimental layout such as a short-waver often is, it would be preferable to build the L.F. amplifier as a separate unit, to which experimental detector stages could be coupled as desired. This is the system used by the writer, and it seems to be a sound scheme for changes in the L.F. side are rare. Fig. 3 gives the circuit of a suitable amplifier for short-wave work. It is free from refinements such as tone controls, output filters, and output switching arrangements, these being entirely optional according to the experimenter's own requirements.

It will be noticed that the L.F. transformer is parallel-fed to avoid "threshold-howl," and also that it precedes the resistance-coupled stage. This is done to minimise the risk of H.F. getting into the first L.F. valve, for H.F. passes less easily from the primary into the secondary of a transformer than through a fairly large coupling condenser in a resistance stage. Further, arranged in this order the bass response is not quite so good, but this does not matter; in fact, it is a definite asset in a short-wave set where bass is always rather prominent. For a similar reason, it will be noticed that the coupling condensers have been made on the small side. The volume control shown is a real necessity, as even distant stations will have a tremendous punch on this outfit with surprisingly good quality.

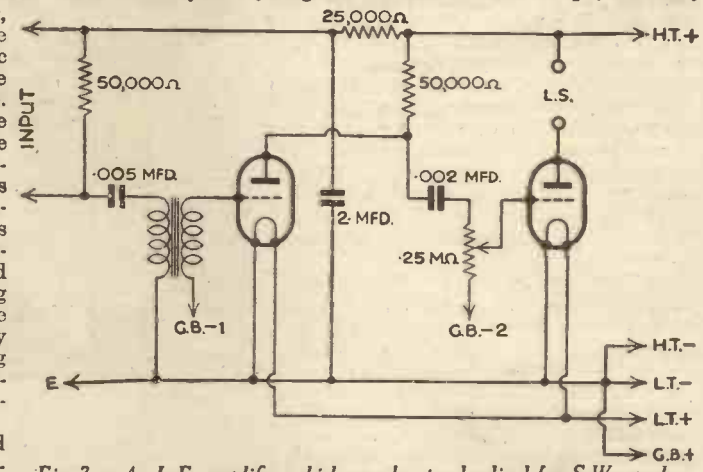


Fig. 3.—An L.F. amplifier which may be standardised for S.W. work.

Increasing Detector Efficiency

As every short-wave enthusiast knows, the detector valve is the absolute heart of the set, and a good station-log depends on its efficiency. The values of .0001 mfd. and 5 mfd. have become somewhat standardised as the best for short-wavers. Actually, the best value for any given valve can only be found by trial and error, and some valves are most sensitive with a grid leak of ten megohms. It is, however, useless to use a leak of such a high value if it has in parallel with it the resistance of its holder, the valveholder, and a tuning condenser amounting, perhaps, to only a megohm or two in all. It pays to buy special short-wave gear having really good insulation. The grid condenser likewise may not be most suitable for the valve when of .0001 mfd. capacity. A very good plan is to use a pre-set variable in this position, locking it at the capacity which is found most suitable for the valve in use. The advantage of this scheme is that the capacity may again be set to the most suitable value, should the valve be changed.

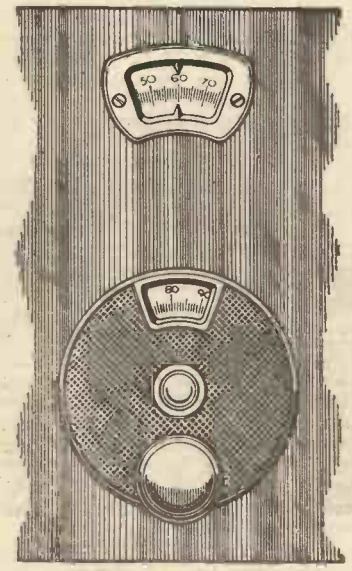


Fig. 2.—Utilising two S.M. dials for reduced gearing.

Facts & Figures

COMPONENTS TESTED IN OUR LABORATORY

Battery Double-diode-triodes

THE original two-volt battery double-diode-triode, produced by the Mullard Company, was type T.D.D.2, and the triode portion is similar in characteristics to the Mullard P.M.2DX, well known as an efficient detector or L.F. amplifier. Later in the year Mullards produced a further type, T.D.D.2A, in which the triode portion gave a much greater degree of amplification, being very similar to the P.M.1HL valve.

The requirements of different types of receiver render it necessary to retain both types, and it is therefore useful to know which valve to choose for any specific purpose.

Because the T.D.D.2A has the more sensitive triode portion, it should be used in sets having only one H.F. or I.F. stage, and when followed by a small triode output valve, a pentode, or a Q.P.-P. output stage.

If, however, two H.F. stages or their equivalent are employed, it may be advisable to use the less sensitive T.D.D.2, the triode portion of which can, in addition, handle a somewhat greater signal input without distortion.

The T.D.D.2 should always be used if a Class "B" output stage follows immediately after the double-diode-triode.

Bulgin Q.P.-P. Output Choke

THE choke illustrated at the foot of this page is designed especially for the output circuit of a quiescent push-pull stage, and has two output tappings. One is rated for a 10,000-ohm impedance, and the other for a 7,500-ohm impedance, so as to enable speakers to be more accurately matched. The remaining three terminals are, of course, for the two anodes and H.T. positive. The winding is accurately centre-tapped for the latter connection and the D.C. resistance of each half is only 150 ohms. The choke has been developed for the recently-produced double Q.P.-P. valves and will simplify connections when using this type of output stage. The terminals are provided with shake-proof washers and the case is of the universal-mounting type finished in frosted aluminium. The price is 15s.

The new Bulgin Q.P.-P. output choke.

Two new adaptors are illustrated on this page, and are intended for use with the modern valves having a metal boss at the top in place of the more usual terminal cap. In the case of the latter type of valve, these new connections may be employed by obtaining a special Bulgin adaptor (List No. P.68, price 2d.), which consists of a metal boss threaded to fit over the existing terminal shank. The valve is thus converted to the newer type. The adaptor on the left of the illustration is an aluminium fitting designed to clamp over the boss, and is fitted with a clamping lug at the side for clamping the screening braid of the lead. In addition, a separate lug is fitted inside for gripping the lead itself. Two models are available, No. P.64 of standard depth, which, with average valves, will completely screen the top cap, and a shallower model, No. P.65, which, when placed in position, will not come into contact with the metallised surface of a valve. This latter model is essential when the type of valve is used in which the metallising is connected to the cathode, as in such cases a short-circuit of the bias resistance might occur. These models are 6d. each. The other component in the illustration is a simple connector which may be obtained in an insulated or an uninsulated form. In the latter pattern the price is three for 2d., and the insulated model costs 1d.

Valve connectors from the Bulgin range.

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.

E. M. A. (Caithness). We can only reply to letters when the name and address of the sender is given. If you let us have this information we shall be glad to reply to you.

B. R. T. (Repton). We cannot give you the information without further details. For what purpose is the unit required? What type of rectifier have you? Our handbook on Accumulators would probably prove of value to you.

V. R. T. (C. C. 2,641), (S.E.23). Full details regarding the Transmitting Licence were given in our issue dated April 27th last.

T. W. (Welwyn). We very much regret that we have no blue-prints of a circuit using the coils in question. These are now obsolete and we, like the manufacturers, have no literature left regarding them. We are sorry we cannot help you.

N. B. W. (S.W.10). A suitable transformer may be obtained from Messrs. Heayberd, whose address you will find in our pages.

J. S., Jnr. (Warley Langley). The Cameo Three will no doubt appeal to you. Future receivers will no doubt also prove adaptable to your especial needs.

J. S. (Oldham). The combination you mention could be used satisfactorily. The maximum tuning range, would, however, not be quite so high as that stated by the makers owing to the smaller maximum capacity of the tuning condensers. The bias arrangement is quite in order.

A. T. C. (Newcastle). When the receiver in question was constructed by us the response was perfectly satisfactory. We would therefore suggest that your speaker is at fault and has an undue bass response. We would advise you to have it tested in case it is faulty.

W. O. (Newcastle West). It would appear that the reaction winding is faulty, and we would suggest that you test the coils from this point of view.

R. W. K. (Norwich). The I.F. Transformers could be employed provided that they were adjusted to the correct frequency.

N. A. (Slough). We would advise you to test the reaction circuit. Check the H.T. applied to the detector valve, the H.F. choke and the reaction winding. Probably some fault exists in the complete circuit, and you must not confuse H.F. instability with reaction effects.

B. I. (S.E.23). Connect the two pick-up leads between the grid of the detector valve and the 1.5 volt tapping on the grid bias battery. We cannot give plug and socket connections without knowing the exact type of component. Preferably one of the two-circuit jacks should be used so as to break the radio connection and prevent signals from being heard as a background on records.

A. H. W. (Bayswater). Your instrument is not suitable for measuring certain parts of the circuit. We would suggest that you include it in the H.T. negative lead (with a 2 mfd. condenser across it) in order to take the total H.T. drain. The resistance of the meter is not too high, but too low and consequently passes a very high current, which is actually greater than your entire receiver, which only consumes probably about 20mA. For the measurements in question with your eliminator you need a meter having a resistance of about 1,000 ohms per volt (i.e., a total resistance of 150,000 ohms for a total voltage reading of 150).

E. A. H. (Tooting). We cannot assist you without further details regarding performance. There may be many causes of the trouble, and as the receiver has been converted you may have overlooked some connections.

E. T. (Acton, W.). Details will be found in our advertisement pages, or may be obtained from Messrs. Peto-Scott.

A. G. (Grangetown). As the receiver was not designed by us, we regret that we are unable to assist you. We would advise you to get into touch with the designer, or communicate with the journal from which you constructed the receiver.

H. J. K. We have no blue-print of a receiver using the coils in question. They were designed by another journal and have not been used by us. We could not send your reply by post, as you omitted to give your address.

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.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

MEMBERS of this society had an enjoyable time at the picnic organised by the West Middlesex and East Bucks Branch, which took place on Stoke Common on June 2nd. Among those present were Mr. Leslie W. Orton (hon. president of the society, and Mr. Ernest Norman, of the London Branch. The Ladies' Section of the society was represented by Miss Hilda Radish. Inter-branch contests were held and several interesting running and cycle races took place. There was also a "find the radio station" contest.

The affair was so attractive that a second picnic will be held later in the year. No charges will be made, and transporting from the headquarters of the society to the picnic ground will be free, as on the first occasion.

TOTTENHAM SHORT-WAVE CLUB

THE above club has just recommenced its activities, after a month's interval, and is prepared to welcome new members of all ages.

Interested readers of PRACTICAL AND AMATEUR WIRELESS, residing in the locality, are invited to write to the Secretary, L. Woodhouse, 57, Pembury Road, Bruce Grove, Tottenham, N.17.

S.-W. RADIO AND TELEVISION SOCIETY (Thornton Heath).

THE weekly meeting of this society was held at St. Paul's Hall, Norfolk Road, on Tuesday, June 4th, under the chairmanship of Mr. R. E. Dabbs. The evening was devoted entirely to direction finding problems on short waves, and Mr. O. L. Crossley described his directional receiver. An ultra-audion circuit was used as it required only one winding on the coil in the detector stage. It was found possible to use this coil as the frame aerial with quite good results. With this receiver it was possible to locate definitely the direction of a transmitter, as was proved to members during the demonstration. Mr. Hoare also described his short-wave two-valve receiver which he had adapted for direction finding.—Hon. secretary, Jas. T. Webber, 368, Brigstock Road, Thornton Heath.

DIRECTION-FINDING COMPETITION

THE 14th Annual Open Direction-finding Competition, organised by the Golders Green and Hendon Radio Scientific Societies, was recently held in the country around Wendover, Hatfield, Hendon and Maidenhead. The scheme was under the direction of Lieut.-Col. H. Ashley Scarlett, D.S.O.; over sixty amateurs attended, and amongst the radio societies sending groups were Southall, Northwood, Pye, Belsize, and Southgate. The objectives were, in the first part of the scheme, to locate the direction of a transmitting station, and in the second part to locate its position. A field mobile transmitter designed and controlled by Mr. Corfield (5CD) operated in an area of 30 square miles, which for the first part was placed out of bounds to the receiving groups. The wavelength used this year was reduced to 84 metres. A fixed transmitting station for reference purposes was operated near Harrow by 2JU.

The returns handed in by the groups were of a very high order of accuracy, and at a distance of fifteen miles an error of only 1° was made. The instruments used, which were all designed and constructed by amateurs, varied in size and type, but obviously produced excellent results and showed great skill in workmanship.

The winning groups were Messrs. Lee, Stephens, Rayner, Rapsey, Dean, Philpots, Child, Griffiths, Bremner sen., Bremner jun. The Southall Radio Society took first and second places, the Golders Green and Hendon Radio Societies taking third place. The judges were Squadron-Leader Struan Marshall, H. B. Dent, and E. J. Hubbard, A.M.I.E.E. A series of 5-metre field meetings have been organised for the purposes of testing receivers, types of transmitting aerials, and their directional properties.

The following are co-operating:

5RD; 2JU; 5BO; 2GG; 6S1. A mobile transmitter will also be available.

Any interested readers of PRACTICAL AND AMATEUR WIRELESS who would care to attend are asked to write, enclosing a stamped and addressed envelope, to the Hon. Secretary, 8, Denehurst Gardens, Hendon, N.W.4.

The first two meetings will be held on June 23rd and July 14th.

CATALOGUES RECEIVED

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

"INTERFERENCE SUPPRESSION"

WHAT causes crackling in wireless receivers? What is the cause of "rain" and other flickers in a television image? These, together with numerous other points, are very clearly dealt with in the 5th Edition of Messrs. Belling & Lee's publication entitled "Interference Suppression; The Causes and Cure of Electrical Interference with Radio Reception." In addition to much interesting matter relating to the generation of various forms of interference, this handy book gives practical methods for eliminating the trouble, and is copiously illustrated. In addition to illustrations of actual apparatus designed for all types of noise suppression, there are diagrams showing various wiring schemes and methods of using the devices which have been produced by Messrs. Belling & Lee for use in such circumstances. The price of this book is 1s., and it may be obtained from Messrs. Belling & Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex.

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).

Wednesday—Red-letter Day

SIR,—Please accept my congratulations on the amalgamation of PRACTICAL AND AMATEUR WIRELESS. Wednesday is now a day to look forward to as a bright spot in an otherwise dreary week.

Having read PRACTICAL WIRELESS for about two years, since I first took an interest in wireless, I think other readers beside myself would like to see published details for the construction of short-wave coils covering from 5-60 metres (a set of about four coils) and afterwards one or two receivers using the coils described.—J. C. JOHNSON (Birmingham).

An Ideal Circuit?

SIR,—Unless I have overlooked it, my ideal straight circuit has not been described yet. Battery—only one H.T.+ (variables not objected to). Sufficient H.F. amplification to produce adequate delayed A.V.C. Output (milliamps) to vary with volume.—J. H. M. SMITH (Westward Ho!).

Midget Sets for Cyclists

SIR,—I am very interested in your new series of Midget Pocket Portables, and would like to make a suggestion with regard to the sets for hikers and cyclists. Whereas the tendency has been for these sets to become smaller, earphones have remained practically unchanged. Would it be possible to design an earpiece in keeping with these midget sets, such as, for instance, the type used in deaf aid apparatus. I do not know how these function, but I make this suggestion for what it is worth.—S. E. RIDGE (Newbury).

[*A suitable midget earpiece can be obtained from Economic Electric Co., 64, London Road, Twickenham.*—ED.]

SIR,—I was very much attracted by your announcement that you are going to publish the circuit of a midget wireless set suitable for use on a bicycle. I intend to build such a set. I have, however, one suggestion to make. Please publish the price of the components so that constructors can tell at a glance how much the set will cost.—EDWARD G. SHAW (Liverpool).

Our Three-valve Superhet

SIR,—Having built your three-valve Superhet, I am more than satisfied with it. I have had it running nearly six months now without giving the slightest trouble. The results are highly satisfactory, and every component used was as specified, with the exception of an all-metal chassis. And now, Mr. Editor, what about a circuit with two H.F. stages, as suggested in April 27th issue by Mr. Bird?—T. TUCKER (Bristol).

S.W. Single-valver

SIR,—May I express my satisfaction with one of your sets for short waves?

The set in question is the one-valver for America, details of which you gave some time ago. I have only got a short aerial from the roof down to my room, and the earth is connected to the water pipe.

Here are a few of the stations I receive almost regularly:—

Rome	12RO on 49.3 metres.
W9XF	Chicago, 49.18 metres.
W1XAL	Boston, Mass., 49 metres.
CT1AA	Radio-Lisbon, Portugal, 31.25 metres.
DJC	Zeesen, Germany, on the 40-metre band.
DJN	Zeesen, Germany, 31.38 metres.
RNE	Moscow, 25 metres.

I should like to know of other readers' experiences with this little set.—D. C. (Balham).

The Screen-grid Stage

SIR,—Having tried many of your past schemes for better radio which have proved beneficial, I have come to the conclusion that one cannot be without a screen-grid stage in their set for selectivity, but I consider that same is a sheer waste of current for the battery user, when listening to the locals. I wonder if you would be kind enough to publish a scheme to switch out the screen-grid stage for this purpose. I suggest that a set such as the "Hall-Mark Three" would be ideal for demonstration purposes. I am sure that such an item would be of great interest to all battery users.—W. A. ALDERSLEY (London, N.).

[*It is not a difficult matter to transfer the aerial lead to the detector grid coil (through a small fixed condenser), and to remove the H.F. valve. We do not consider the complication of switching of an H.F. stage would be justified.*—ED.]

CUT THIS OUT EACH WEEK.

Do you know

—THAT when a metallised chassis is used for a short-wave receiver it is often preferable to keep certain components well away from the metal surface.

—THAT the reason for the above precaution is to be found in the increased capacity to earth which may occur in certain parts of the circuit.

—THAT in a super-heterodyne receiver the I.F. valve may be made to oscillate (for the reception of C.W. signals) by passing the anode lead close to the grid lead.

—THAT the oscillation must be stopped for the reception of speech and music.

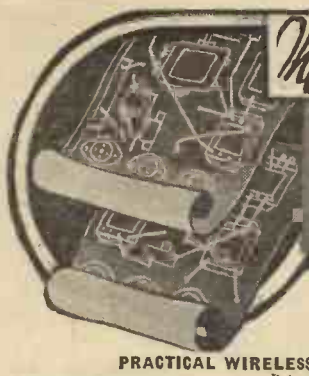
—THAT copper tubing of fairly large diameter is ideal for certain types of short-wave coil, owing to the increased surface which it offers.

—THAT glass may often be employed to increase the capacity of an air-spaced condenser in certain types of circuit.

—THAT anode leads should not be enclosed in metal screening unless all other methods of preventing instability have been tried and have failed.

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

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



The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

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

PRACTICAL WIRELESS.

	Date of Issue.	No. of Blprint.
Blueprints, 1s. each.		
Long-Range Express Three	—	PW2
Mains Express Three	8.10.32	PW3
Sonotone Four	15.10.32	PW4
Bijou Three	29.10.32	PW5
Argus Three	12.11.32	PW6
Empire Short-Wave Three	3.12.32	PW7
Solo Knob Three	10.12.32	PW8
Midget Two	17.12.32	PW9
Selectone Battery Three	14.1.33	PW10
Fury Four	—	PW11
Featherweight Portable Four	6.5.33	PW12
Q.P.P. Three-Four	4.3.33	PW13
Alpha Q.P.P. Three	25.3.33	PW14
Ferrocart Q.P.P. Hi-Mag. Three	25.3.33 and 1.4.33	PW15
Supersonic Six	8.4.33	PW16
Beta Universal Four	15.4.33	PW17
A.C. Twin	22.4.33	PW18
Selectone A.C. Radiogram Two	29.4.33	PW19
A.C. Fury Four	25.2.33	PW20
Radiopax Class B Four	27.5.33	PW21
Three-Valve Push-Pull Detector Set	4.3.33	PW22
Double-Diode Triode Three	10.6.33	PW23
Three-Star Nicore	24.6.33	PW24
D.C. Ace	15.7.33	PW25
Superset	19.8.33	PW26
Auto-B Three	19.8.33	PW27
All-Wave Two	19.8.33	PW28
A.C. Three	16.9.33	PW29
Premier Super	23.9.33	PW30
Experimenter's Short-Wave Three	23.9.33	PW30A
A.C.-D.C. Two	7.10.33	PW31
All-Wave Unipen	14.10.33	PW31A
F.J.C. 3-valve A.V.C. (Transfer Print)	4.11.33	PW32
Luxus A.C. Superhet	14.10.33	PW33
A.C. Quadpak	2.12.33	PW34
Sixty-shilling Three	2.12.33	PW34A
Nucleon Class B. Four	6.1.34	PW34B
Fury Four Super	27.1.34	PW34C
A.C. Fury Four Super	10.2.34	PW34D
Leader Three	10.3.34	PW35
D.C. Premier	31.3.34	PW35B
A.C. Leader	7.4.34	PW35C
Atom Lightweight Portable	2.6.34	PW36
Ubique	28.7.34	PW36A
Four-Range Super-Mag. Two	11.8.34	PW36B
Summit Three	18.8.34	PW37
Armada Mains Three	18.8.34	PW38
Midget Short-Wave Two	15.9.34	PW38A
All-Pentode Three	22.9.34	PW39
£5 Superhet Three	—	PW40
A.C. £5 Superhet Three	24.11.34	PW43
D.C. £5 Superhet Three	1.12.34	PW42
Hall-Mark Three	8.12.34	PW41
F. J. Camm's Universal £5 Superhet	15.12.34	PW44
A.C. Hall-Mark	26.1.35	PW45
Battery Hall-Mark 4	2.2.35	PW46
Universal Hall-Mark	9.2.35	PW47
Hall-Mark Cadet	23.3.35	PW48
Short-Wave Converter-Adapter	23.2.35	PW48A
F. J. Camm's Silver Souvenir (All-Wave Three)	13.4.35	PW49
F. J. Camm's A.C. All-Wave Silver Souvenir Three	—	PW50
Genet Midget Three	—	PM1
Cameo Midget Three	8.6.35	PW51

AMATEUR WIRELESS AND WIRELESS MAGAZINE.

CRYSTAL SETS.

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

STRAIGHT SETS. Battery Operated.

One-valvers : Blueprints, 1s. each.		
B.B.C. One-valver	—	AW344
B.B.C. Special One-valver	—	AW387
Twenty-station Loud-speaker One-valver (Class B)	—	AW449
Two-valvers : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans.)	—	AW388
Full-volume Two (SG.-Det., Pen.)	17.6.33	AW392
Iron-core Two (D, Trans.)	—	AW395
Iron-core Two (D, QPP)	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D, Trans.)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG., Trans.)	—	AW338A
Lucerne Minor (D, Pen.)	—	AW426
Family Two (D, Trans.)	—	WM278
Three-valvers : Blueprints, 1s. each.		
£8 Radiogram (D, RC, Trans.)	—	AW343
S.G. Three (SG, D, Pen) A.C.	3.6.33	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen) A.C.	23.6.34	AW439
D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July* '33	WM328
Simplicity A.C. Radiogram (SG, D, Pen) A.C.	*Oct.* '33	WM338
Six-guinea A.C./D.C. Three (HF Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF Pen, D, Pen) A.C.	*Nov.* '34	WM374
Four-valvers : Blueprints, 1s. 6d. each.		
A.C. Melody Ranger (SG, DC, RC, Trans) A.C.	—	AW380
A.C./D.C. Straight A.V.C. (2 HF, D, Pen) A.C./D.C.	8.9.34	AW446
A.C. Quadradyne (2SG, D, Trans) A.C.	—	WM279
All Metal Four (2SG, D, Pen)	*July* '33	WM329
"W.M." A.C./D.C. Super Four	*Feb.* '35	WM382
Harris Jubilee Radiogram	*May* '35	WM386

SUPERHETS.

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

PORTABLES.

Four-valvers : Blueprints, 1s. 6d. each.		
General-purpose Portable (SG, D, RC., Trans)	—	AW351
Midget Class-B Portable (SG, D, LF, Class B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	—	WM282
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM363
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM367

SHORT-WAVERS. Battery Operated.

One-valvers : Blueprints, 1s. each.		
S.W. One-valve	—	AW329
S.W. One-valve for America	—	AW429
Roma Short-waver	10.11.34	AW452
Two-valvers : Blueprints, 1s. each.		
Home-made Coil Two (D, Pen)	14.7.34	AW440
Three-valvers : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver	*Jan.* 19, '35	AW463
Short-wave Adapter	*Dec.* 1, '34	AW456
Superhet, Converter	*Dec.* 1, '34	AW457
Four-valvers : Blueprints, 1s. 6d. each.		
"A.W." Short-wave World Beater (HF Pen, D, RC, Trans)	2.6.34	AW436
Empire Short-waver (SG, D, RC, Trans)	*Mar.* '33	WM318
Standard Four-valve Short-waver	*Mar.* '35	WM383

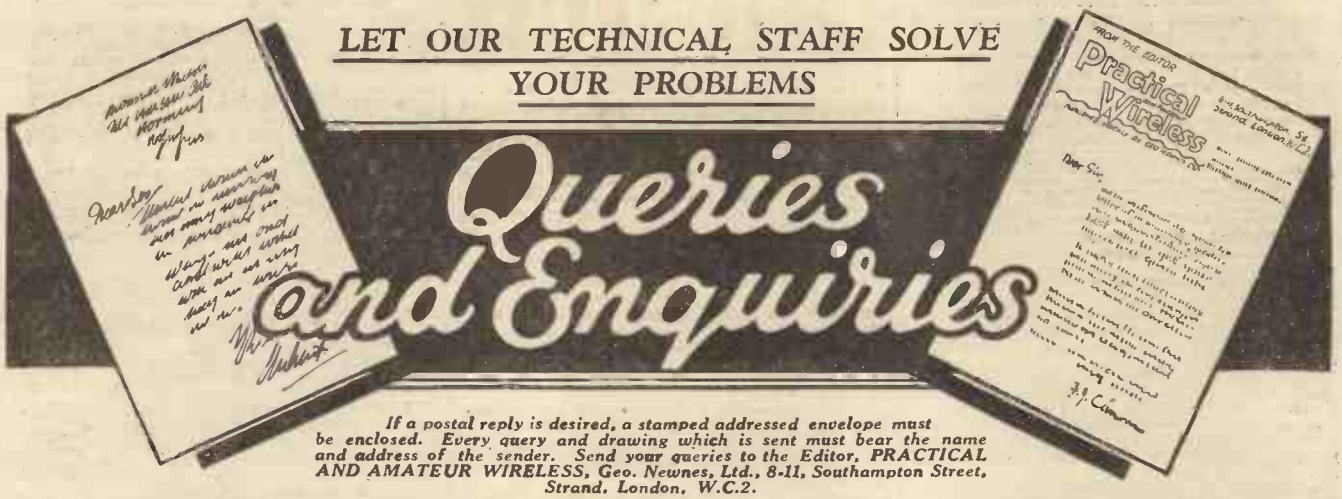
Mains Operated.

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

MISCELLANEOUS.

Enthusiasts Power Amplifier (1/6)	*June* '35	WM387
Newstyle Short-wave Adaptor (1/-)	*June* '35	WM388
P.T.P. Three (Pentode-Triode-Pentode)	*June* '25	WM389
New Regional Three (D, RC, Trans)	25.6.32	AW349
Class-B Three (D, Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D, Trans., Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher, Chassis Model (SG, D, Pen)	3.2.34	AW419
Lucerne Ranger (SG, D, Trans)	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
P.W.H. Mascot with Lucerne Coils (D, RC, Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	—	AW424
Pentaquester (HF Pen, D., Pen)	14.4.34	AW431
£5 5s. Three: De-luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All Britain Three (HF Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.1.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
Multi-Mag Three (D, 2 Trans)	—	WM288
Percy Harris Radiogram (HF, D, Trans)	*Aug.* '32	WM294
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Tyers Iron-core Three (SG, D, Pen)	*July* '33	WM330
C.-B Three (D, LF, Class B)	—	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
All-wave Three (D, 2LF)	*Jan.* '34	WM348
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans.)	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	*Oct.* '34	WM371
Graduating to a Low-frequency Stage (D, 2LF)	*Jan.* '35	WM378
Four-valvers : Blueprints, 1s. 6d. each.		
65/-Four (SG, D, RC, Trans)	—	AW370
"A.W." Ideal Four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D, Pen)	—	AW421
Crusaders' A.V.C. 4 (2 H.F., D, QP21)	18.8.34	AW445
(Pentode and Class-B Outputs for above: blueprints 6d. each)	25.8.34	AW445A
Quadradyne (2SG, D, Pen)	—	WM273
Calibrator (SG, D, RC, Trans)	*Oct.* '32	WM300
Table Quad (SG, D, RC, Trans)	—	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
Self-contained Four (SG, D, LF, Class-B)	*Aug.* '33	WM331
Lucerne-Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (H.F., D, 2LF)	*Feb.* '35	WM381
The H.K. Four	*Mar.* '35	WM384
Five-valvers : Blueprints, 1s. 6d. each.		
Super-quality Five (2HF, D, RC, Trans)	*May* '33	WM320
New Class-B Five (2SG, D, LF, Class-B)	*Nov.* '33	WM340
Class-B Quadradyne (2 SG, D, LF, Class-B)	*Dec.* '33	WM344
1935 Super Five (Battery Superhet)	*Jan.* '35	WM379
Mains Operated		
Two-valvers : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Three-valvers : Blueprints, 1s. each.		
Home-lover's New All-electric Three (SG, D, Trans) A.C.	25.3.33	AW383

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS



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

SPECIAL NOTE

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

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

Please note also, that queries must be limited to two per reader, and all sketches and drawings which are sent to us should bear the name and address of the sender.

Push-pull Circuits

"I have been using an ordinary transformer-coupled push-pull circuit for some years, but would now like to try resistance-capacity coupled push-pull. I am not certain, however, of the method of using the coupling and should be glad of your advice in this connection."—R.Y. (Heston).

THERE are two methods of using resistance-capacity couplings in the push-pull stage, but the form known as paraphase is perhaps the simplest. If you employ ordinary R.C. coupling it will be necessary to obtain phase reversal in the stage feeding the push-pull stage and this is sometimes difficult as it necessitates equal loads in anode and cathode circuits, and is often accompanied by difficulties. On the other hand, the paraphase method can be added after an ordinary L.F. or detector valve, and from the point of view of quality is probably indistinguishable from the other form. An article was published last week on paraphase amplification and will no doubt be of interest to you.

Reaction Windings

"I find that in my set in which I have used well-known standard types of coil the reaction winding is inaccurate. When adjusted to 200 metres reaction is quite smooth. As I proceed up the scale the reaction falls off and on the long waves I cannot get any reaction at all. Would you advise me to return the coils to the makers or to rewind them? In the latter case, what is the rule for finding the correct amount of wire?"—G. J. (Harrow).

THE trouble may not be due to the winding, but to your circuit. It is extremely unlikely that a well-known manufacturer would have wound a coil with an insufficient amount of wire, although it is possible for a coil to become damaged or for the winding to move on the former. We would imagine that you have insufficient H.T. on the detector anode, or a reaction condenser which is too small. We presume there is a suitable anode by-pass condenser in circuit, and therefore the above two points should receive your attention.

Accumulator Charging

"I have just bought a new accumulator but am rather uncertain as to the correct method of charging. The label is destroyed, owing to the top layer of celluloid having been damaged, but I am assured that the cell is quite in order under a money-back guarantee."—W. K. (Merton).

THE accumulator must be filled with diluted sulphuric acid having an S.G. between 1.2 and 1.5. The actual strength varies with different makes and types of cell. The accumulator should be allowed to stand for some hours and should then be topped up as the plates will absorb a certain amount of acid. The cell should then be charged at about .5 amps as you have no details of charging rate, and should be kept on charge for at least twelve hours. If gassing freely at the end of that time take off charge, pour away the acid and fill with fresh acid of the above strength. A further small slow charge should then be given. The test for complete charging is to examine both voltage and specific gravity and they should remain constant for at least 4 hours. If the cell warms up you must reduce the charging rate to a lower value. Our handbook on "Accumulators" would no doubt prove of value to you.

Changing a Circuit

"I have had in use now for some years a well-known circuit employing four valves. I wish to bring this up to date, but as certain parts still seem hard to beat I should like to retain them. I know you do not advise alterations from your specifications, but could I build, say, the Hall-Mark Four, and use my own transformers, condensers, etc.?"—T. R. (Hull).

IT is, of course, quite possible to build a circuit of the Hall-Mark Four type and use any parts which you have on hand. Neither we nor you have any idea, however, what the result will be. It may work just as efficiently as the original receiver, but on the other hand it may fail to function entirely. Therefore, we advise you to adhere to those parts which have been found to work satisfactorily together, and you have a definite idea what to expect. When you use your own parts or build to your own ideas, if the receiver fails to give satisfaction you have no idea where to start looking for the trouble, and the location of faults is thus rendered much more difficult. If you do not mind this, then you can build any circuit you please from your existing parts.

Poor Long-wave Results

"Could you explain the failure of many sets to function properly on long waves? I had a 3-valver which failed, and recently bought a commercial 3—it also failed. Thinking I could remedy it, I made the coil given in the 'Constructor Encyclopædia' on page 119 and although giving grand results on the medium waves, long waves are a complete failure."—S. J. (Eccles).

PROVIDED that the coils are correctly designed there may be several reasons for the poor long-wave results. The H.F. choke in the anode circuit of an S.G. or other H.F. stage may be inefficient. The size of the coupling condenser between H.F. and detector stages may be too small. The aerial and earth system may be poor. The aerial may be too short. The aerial may be directional so far as a local medium-wave station is concerned, and thus give a false impression of medium-wave performance. The coil switching may be faulty. The size of the coupling coil in an H.F. transformer may be incorrect, but, as mentioned above, if the coils are correctly designed this point may be ignored.

Miscellaneous Advertisements

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

THE following unused set manufacturers' Surplus; all goods guaranteed perfect; immediate delivery. MAGNAVOX speakers, complete with hum-bucking coil, output transformers, etc. DC152 (9in. cone), 22/6. DC154 (7in. cone), 16/-. All with 2,500 or 6,500 ohms fields.
WESTINGHOUSE rectifiers, HT8, 9/6. HT9, 10/-, HT10, LT5, LT4, 10/9. Regentone transformers for HT8 or HT9, with 4v. 4 amp. LT winding, 7/-. Eliminators, first-class make. Outputs 150v. 25ma, SG and Detector. AC type with Westinghouse rectifier, 25/-. AC type with .5 amp. trickle-charger, 30/-. DC type, 12/6.
DUBILIER or TCC dry electrolytic condensers 8mfds. or 4mfds., 500v. working, 50mfds., 50v. 200mfds., 10v., 3/3, 50mfds, 15v., and 15mfds.. 100v. 2/3. 50mfds., 12v., 2/-. TCC type "M" condensers, any value up to .001 mfds., 6d. Erie resistances, 1 watt type, 7d., 2 watt, 1/2, 3 watt, 1/9. Send for comprehensive list.
WARD, 46, Farringdon Street, London, E.C.4. Telephone: Holborn 9703.

CLARION VALVES.—All brand new; battery types, 2-volt, HF.2, LF.2, LP.2, 1/9. Super power, PP.2, 2/6; screens and pentodes, 3/9; A.C. Mains, 4-volt, 1 amp., general purpose, 3/3; power, 4/-; screens and pentodes, 4/6; full wave rectifiers, 3/6; postage paid, cash with order, or C.O.D. over 10/-. Clarion Valves, Dept. 2, 885, Tyburn Road, Erdington, Birmingham.

CASH allowances made on your old wireless goods in part-exchange for any new receiver on easy terms. After deducting deposit we pay you balance of allowance in spot cash. Components and Peto-Scott kits supplied for cash, or part exchange. Highest allowances.—R. Wigfield, Furlong Road, Goldthorpe, Yorks.

WOBURN Radio offer following Goods:—
ELECTRIC SOLDERING IRONS: 200/250v., copper bit, complete with flex and adaptor, 1/11. post 6d. Immediate delivery.
SHORT-WAVE CONDENSERS, Air-spaced, 0001, 00015, 00016, 0002, 00025, 2/-, with slow-motion dial, 3/-. Popular iron-cored canned coils, dual range, boxed with instructions, 2/6. Dubiller and Erie resistances, all values, 6d. Truwind wire-wound colour coded all values to 50,000 ohms, 3½d. Microphone Transformer ratio, 100/1, 2/3.
TRADE LIST NOW READY. Send stamp and trade letter heading.
WOBURN RADIO CO., 9, Sandland Street, W.C.1. Holborn 7289.

HULBERT for Quality Surplus Speakers.

HULBERT. All Speakers previously advertised still available. All are brand new and made by one of the best-known British makers of high-grade moving-coil speakers. Prices from 10/6. All Music lovers interested in realistic reproduction should write for list of amazing bargains. Repeat orders are coming in daily.
HULBERT. 6, Conduit Street, W.1.

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

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Or 5/- deposit and 8 monthly payments of 5/3.

KIT "B" Cash or C.O.D. Carriage Paid, £2/19/6 or 12 monthly payments of 5/6.

KIT "C" Cash or C.O.D. Carriage Paid, £3/14/6 or 12 monthly payments of 6/9.

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77 (Pr.W.1), CITY ROAD, LONDON, E.C.1.
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At Wireless — brighter than bright—
He got perfect reception—
His Set WAS perfection—
All connections were SOLDERED — with FLUXITE!

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Ask to see the FLUXITE SMALL-SPACE SOLDERING SET—compact but substantial—complete with full instructions, 7/6.

Write for Free Book on the art of "soft" soldering and ask for Leaflet on CASE-HARDENING STEEL and TEMPERING TOOLS with FLUXITE.

TO CYCLISTS! Your wheels will NOT keep round and true unless the spokes are tied with fine wire at the crossings AND SOLDERED. This makes a much stronger wheel. It's simple—with FLUXITE—but IMPORTANT.

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RECEIVERS, TELSEN RADIOGRAMS. Model 3550/R.G.A. Latest 1935 6 Valves, Superhet, A.C. This receiver embodies the very latest in Radio. Complete with 6 Valves, Mains Energised Speaker, contained in exquisite cabinet with GARRARD ELECTRIC RECORD CHANGER. In Original Sealed Cases, £18/10/0. (List 32 Guineas.)
TELSEN THREE-VALVE BATTERY SETS. Model S93. Complete with 3 Mazda Valves, in attractive bakelite cabinet, 30/-. (List, 75/-.)
SPEAKERS, BLUE SPOT PERMANENT MAGNET SPEAKERS, WITH UNIVERSAL TRANSFORMERS TO SUIT ANY CIRCUIT.—1935 Series, 99 P.M., 24/6. 45 P.M., 20/-. Celestion Soundex, 11/-. All in sealed Cartons.
COILS.—Igranic Superhet 4-Coil set (1 osc., 2 I.F. with pigtails, and 1 L.F. plain), 9/- per set (List 50/-). Varley Constant Square Peak Coils B.P.5, with all accessories, 2/3.
STOCKTAKING BARGAIN PARCELS.—After our Recent Stocktaking, we gathered at our Head Office a large number of odd lines from our Various Branches. We are offering these in parcel lots as UNDER:—
5/- PARCEL Contains Components to the value of at least 20/-. Including Condensers, Coils, wire, resistances, etc.; 10 different Telsen Radio Circuits included with each Parcel.
10/- PARCEL contains Components to the value of at least 45/-. Includes Transformers, Variable Condensers, etc., etc. Also Circuits as above.
20/- PARCEL. This is the "Small Traders" Parcel and contains a marvellous selection of components valued at 85/-. We have supplied this parcel to hundreds of dealers for re-sale at a profit. Every article contained in these parcels is up to date, new and boxed.
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G. W. RADIO offer the following manufacturers' surplus. Cash with order or C.O.D. Over 5/- carriage paid. Under 5/- postage 6d. extra. Orders under 5/- cannot be sent C.O.D.
TELSEN Output chokes 40 henry 4 milliamps (list 5/-), 2/-.
TELSEN Radiogrand Transformers, ratios 5-1, 3-1 (list 7/6), 2/9.
TELSEN Class B driver and output transformers (list 10/6), ratios 1-1, 1.5-1.
TELSEN Class B Output chokes (list 7/-), 3/-.
TELSEN All-wave H.F. chokes (list 5/-), 2/3.
TELSEN Intervalve couplers (list 10/6), ratios, 1-1, 10-13/-.
TELSEN Electrolytic condensers 4, 6 and 8 mfd, 275 and 500 volts (list 5/6), 2/6.
TELSEN Binocular chokes (list 5/6), 1/9.
TELSEN band pass and oscillator units with switching (list 30/-), 10/6.
TELSEN Oscillator coils (list 10/6), 4/6, pair 8/-.
TELSEN Triple matched screened coils, latest type (list 31/6), 10/6.
TELSEN Matched screened coils (list 10/6), 4/-, pair 7/6.
TELSEN Class B 4-valve kits, complete with cabinet and M.C. speaker, listed £5/17/6, Unopened. Our price 47/6.
TELSEN 323 3-valve kits, listed 29/6, Our price 15/-.
TELSEN Super Selective 4 Kits, Complete in every detail, Unopened, listed £4/18/6, Our price 55/-.
BRITISH RADIOPHONE RADIOPACKS, R.F. superhet type 15,000 ohms, 27/6.
SPEAKERS, R. & A. Alpha, P.M. Model B, 10-inch cone (list 52/6), 19/6. R. & A. Challenger, P.M. type B (list 35/-), 12/6. Epoch P.M. type MB. 12/6.
SPECIAL offer of following: READY RADIO Melody Ranger kits for 12-2,000 metres. Complete with all instructions. Listed, £5/12/6, our price 50/-.
FORMO Economy 3 kits Complete and unopened, Listed 39/6, our price 17/6.
BURGOYNE Class B 3-valve receivers, complete with Mullard valves. Exide accumulators and batteries, moving coil speaker, brand new, Unopened. Listed, £6/18/0, Our price 60/-.
BURGOYNE Olympic 3 de-luxe receivers complete with Mullard valves, Exide batteries and accumulators, moving coil speaker, Unopened; Listed £5/5/0, Our price 57/6.
BURGOYNE Horizontal type twin speaker cabinets in ebony finish, brand new 9/6.
ALL goods advertised in last week's issue still available. Call and inspect our stocks. Thousands of bargains. All goods guaranteed. Money refunded if not satisfied within 7 days.
G. W. RADIO (Dept. P.A.), 7, Chapel Street, Lambs Conduit Street, London, W.C.1, 'Phone Holborn 4434.

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COUPON

This coupon is available until June 29, 1935, and must be attached to all letters containing queries.

PRACTICAL AND AMATEUR WIRELESS, 22/6/35.

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A TWO-VALVE SUPERHET NEXT WEEK!

Practical and Amateur Wireless

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

a GEORGE NEWNES Publication

Vol. 6. No. 145. June 29th, 1935.

AND AMATEUR TELEVISION

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Practical and Amateur Wireless

Edited by F. J. CAMM

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

VOL. VI. No. 145. June 29th, 1935.

ROUND *the* WORLD *of* WIRELESS

Canned Church Carillons

MANY churches on the Continent which cannot afford new peals of bells have resorted to the reproduction of carillons by means of gramophone records, amplifiers, and a suitable loud-speaker in the belfry tower. The advantage derived from this method lies in the fact that the poorest community may possess a record of the peals of some famous cathedral.

Continuous Humour on the Air

AT Seattle (U.S.A.) a proposal has been put forward to install a special transmittter for the sole broadcast of humorous programmes. It is felt that this would prove a healthy alternative to the sponsored entertainments given by other stations heard by listeners in that district.

A More Powerful Neighbour for West National

THE Czech station at Kosice, working on 259.1 metres, is closing down this month for its annual overhaul. It is also being rebuilt in order to obtain increased power.

No 1935 Radio Exhibition in U.S.A.

IN view of the present economic situation, it is reported that the annual radio exhibition will not be held this year, but a meeting has already taken place at Chicago to settle the lines on which the 1936 models are to be constructed.

Give Me Paris, London, or Berlin

THE Waldorf Astoria, New York, which claims to be the largest hotel in the world, is completing the installation of a half-million dollar short-wave receiver system which will permit the occupants of its 2,200 rooms to secure, in addition to the ordinary medium-wave radio programmes, transmissions from a number of foreign countries including Great Britain, Italy, France, and Germany. To celebrate the opening of this service the Zeesen short-wave station broadcast on May 18 last a special congratulatory programme.

Broadcasting Equipment of French Crack Liner

THE *Normandie*, for the benefit of passengers, possesses some seventy-five loud-speakers distributed throughout the ship. These are used not only for disseminating news bulletins and communications of importance to the passengers but also for the broadcast of the ship's concerts. The amplifiers have an output totalling 350 watts and over ten thousand metres of cable were required for the installation of the system.

Relays from North-east Africa

A WELL-KNOWN French radio reporter, Jean Antoine, has been commissioned to make a tour of Morocco,

Mauretania, and Senegambia, for the purpose of carrying out broadcast talks from these French possessions. It is proposed to equip the expedition with a short-wave transmitter, to pick up the signals through the Pontoise station and feed them to the State network.

New Czech Time Signals

THE Prague studio now broadcasts official time signals from the State Observatory. These are given in dots and dashes—each quarter hour being indicated by one dot and a dash; half, two dots one dash, and so on, the full hour being shown by four dots and a dash of five seconds' duration.

New Television Development

FROM Charleroi (Belgium) comes the report that a local wireless fan, Léon Damas, with the assistance of Professor Baethelmans, of the Jesuit College of the Sacred Heart, has invented a new television system by which vision and sound can be broadcast on the same channel. In addition, it is claimed that the colours of televised objects can be correctly reproduced and perfectly synchronised with sound on the screen.

Leipzig at Low Power

THE 120-kilowatt Leipzig transmitter, operating on 382 metres, is being closed down for a period of roughly eight weeks to permit the installation of a new anti-fading aerial system as already adopted by other German transmitters. In the meantime the old and weaker station will broadcast the programmes on the same channel.

Radio Through Electric Light Mains

AT Cleveland (Ohio) experiments are being carried out with the installation of two hundred special receiving sets in private houses. They are to be fed with radio programmes transmitted through the network of the local electrical power and lighting generating station.

Further Portuguese Developments

THE Ministry of Communications has ratified a new scheme by which the power of the Lisbon National transmitter is to be increased to 100 kilowatts. In addition, two regional stations are to be installed in North and South Portugal, the former, possibly at Oporto, to be of the 20-kilowatt type to work on 1,261 metres (238 kilocycles), the latter of 5 kilowatts to operate on 291 metres (1,031 kilocycles). It is also planned to install a 5-kilowatt station in the Azores and a 1-kilowatt transmitter at Madeira. The power of the short-wave station taking the Lisbon programmes will shortly be increased to 20 kilowatts.

Back on 500 Kilowatts

WLW, Cincinnati (428.3 metres, 700 kilocycles), which, owing to interference with Canadian stations, had been compelled to reduce its power to the original 50 kilowatts, has now been permitted to go "all out" again. At the cost of some 30,000 dollars the engineers installed a new directional aerial which, whilst serving the desired area, does not mar the broadcasts of other stations.

ROUND the WORLD of WIRELESS (Continued)

Military Band Concert

THE Band of the 2nd Battalion of the King's Royal Rifle Corps (60th Rifles) pays a return visit to the Northern Ireland studio on June 26th. David McBain will conduct, and James Johnston (tenor) will be the soloist.

Variety from Northampton

THE Midland variety bill on July 2nd is from the New Theatre, Northampton, which has been on the air several times, and is an independent theatre run by local people.

"Pagliacci" from Northern Ireland

THE chorus and orchestra of La Scala, Milan, will broadcast from the Northern Ireland studios on June 29th. This is not quite so startling as it might appear at first sight, since they will be heard in a recorded version of Leoncavallo's opera "Pagliacci." The complete opera will be transmitted.

"The Verey Lights"

SEVERAL weeks ago Miss Violet Davidson, for long associated with the Beach Pavilion, Aberdeen, arranged and broadcast a programme of reminiscences of the old days at the Pavilion. This proved so popular that it has been decided to devise another programme for broadcast on July 1st, described as "The Verey Lights." Listeners will hear parts of some programmes which were performed during the war years in the old Beach Pavilion.

"Yankee Doodle"

JULY 4th is Independence Day in America, so Martyn Webster is arranging a programme with the above title, representing American music, including old familiar numbers from the cotton fields, as well as the modernistic type of music from Tin Pan Alley. Reginald Burston will conduct the B.B.C. Midland Orchestra and the Midland Revue Chorus, and the soloists will be Marjorie Westbury, Geoffrey Dams, Jack Wilson, Gerald Martin, and Cuthbert Ford. The title of the programme is "Yankee Doodle."

"Looking to the Air"

IN this series of broadcasts for Midland listeners W. H. Sutcliffe, secretary for the Midland Aero Club, Birmingham, and E. Donald Wynn, of Nottingham Club, will discuss at the microphone on July 1st the service which Midland flying groups are rendering to the development of civil aviation and the encouragement of the keen amateur.

Turner Layton as a Soloist

LISTENERS will be interested to hear that Turner Layton, late of the well-known music-hall act, Layton and Johnstone, will be heard on July 6th in a solo feature in which he will sing many of his popular numbers. Turner Layton is the artist of the act who plays the piano and sings. This is the first occasion that this artist has appeared before the microphone in this country as a solo artist.

INTERESTING and TOPICAL PARAGRAPHS

"Rocks and Climbers"

THE third talk in this series will be given for Western listeners by H. G. Knight on July 4th, when he will give an account of climbing in the gorges of Clifton and Cheddar. These areas have been almost entirely neglected, and there is a great field for further explorations. Both are reputed to be dangerous, which is not entirely deserved, though great care is essential all the time.

KREISLER LISTENS IN

Kreisler, the world-famous violinist, listening to a recording of his own performance on a "His Master's Voice" "Super-het Fluid-light All Electric Autoradiogram."

"Period Pieces"

TAKING the idea that the popular song, particularly the song popular at a party, changes enormously as the years go by, a composite chronological programme, entitled "Period Pieces," will be broadcast for Western listeners on July 3rd. The first song in the programme was popular in the year 1860, and the last will be an original number of 1935 which has not previously been broadcast. Listeners will also hear one of the monologues which were at one time a very popular feature of drawing-room entertainment. The artists will be Walter Glynne, John Rorke, Glyn Eastman, George Holloway, and Mary and Michael.

Radio Revue—"Merry-go-round"

THREE young research chemists employed in Manchester have collaborated in writing a radio revue—"Merry-go-round"—which is to be broadcast to Northern listeners on July 1st. Book and lyrics are by J. H. Stanley and Charles Noel, and the music by Howard Knight. Giles Playfair has been responsible for the general arrangement of the show and will act as compère; the producer will be Felix Felton. The revue is described as "A very grave tour of Northern high-spots," and will include visits to a corporation tram, a civic store, a county cricket ground, a company railway station, the University underworld and the underworld universal. As was the case in the recent "Half a Mo" revue, music will be played by a section of the B.B.C. Northern Orchestra, conducted by Crawford McNair.

SOLVE THIS!

PROBLEM No. 145.

Jackson had a three-valve set employing H.F., detector and power valves. In the aerial circuit and between the H.F. and detector valves he had commercial H.F. transformers, but when tested out the ganging did not appear to hold. After some experiment he removed the aerial lead and connected it to the junction of the second coil and the grid condenser and found that the tuning-point came much lower down the scale. He concluded that the coil did not match his aerial coil and accordingly removed some turns from the winding. When tested again, however, he found that matters were much worse. What had he overlooked? Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL & AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 145 in the lower left-hand corner and must be posted to reach here not later than the first post Monday, July 1st, 1935.

Solution to Problem No. 144.

Robinson washed out the cell with ordinary tap-water, which would be likely to introduce impurities into the cell. Secondly, he refilled the cell with fresh acid when it was in a discharged condition, instead of doing this when it had been charged.

The following three readers successfully solved Problem No. 143 and books are accordingly being forwarded to them: R. F. Radcliff, Berridge, Sunningdale, Berks.; A. G. Haken, Rossendale, Hyde Street, Winchester; K. F. Scotney, 47 Junction Road, Andover, Hants.

"Transatlantic Bulletins"

IN conjunction with the Columbia Broadcasting System, Incorporated, of the United States of America, the B.B.C. have decided to broadcast a further series of "Transatlantic Bulletins" on similar lines to those broadcast in February and March of this year. The speakers from this country will be Sir Frederick Whyte in July; Mr. S. K. Ratcliffe in August, and Commander King-Hall in September. The speaker from America will again be Mr. Raymond Swing, editor and Washington correspondent of the *Nation*. These bulletins will not be broadcast in the country of origin. In his talks Mr. Swing will normally deal generally with the more important events of the week in America, and may in one or two of them speak more particularly of how these events affect the industrial worker. Mr. Swing's first talk will take place at 10.0 p.m. on July 3rd, and thereafter at about the same time on successive Wednesdays, until September 11th inclusive.

WIRELESS ON WHEELS

The Installation and Working of Car Radio Equipment is Discussed in This Article

MUCH has been written of late concerning car radio, but the discussions and articles have dealt mainly with commercial receivers designed expressly for permanent use in the car, and have been of little use to motorists who, through reasons of economy and interest, prefer to build or adopt their own receivers. To such readers the hints and tips given in this article should prove useful.

The design of the actual receivers will not be dealt with here, the problems of installation being the main objective, and first on the list comes the filament supply.

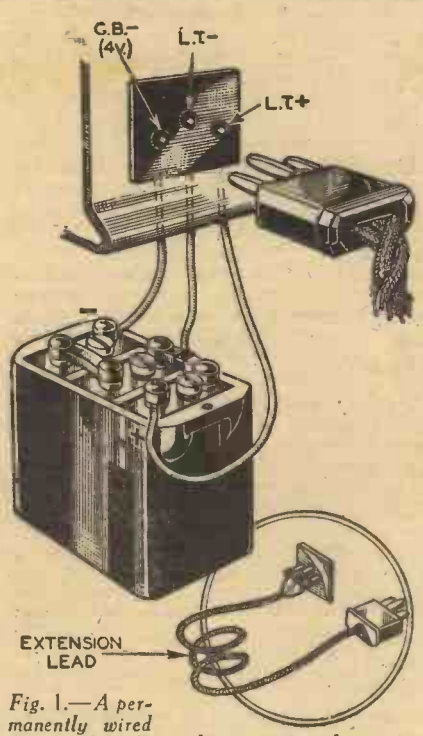

Fig. 1.—A permanently wired point will facilitate the connecting of a receiver.

Filament Supply

It is assumed that 2-volt valves will be used, as ordinary mains valves require too much H.T. current, and short of buying new 13-volt valves, the 2-volt battery valves remain the only alternative. These filaments are normally wired in parallel, and to supply the current for these it is necessary to tap one cell of the car accumulator. Under normal summer conditions the small extra drain on this one cell (approximately half an ampere) will be negligible.

The other four volts can be used for grid bias if desired, this value being eminently suitable for the type of economy pentode which is now so popular, and there is no reason why the car accumulator should not be permanently wired up to a three-pin socket or a valve-holder mounted in some convenient place such as on the dashboard (Fig. 1).

The corresponding plug will be connected to the set *via* a short length of flex. There may be some occasions on which it is desired to use the set at a short distance from the car, and in this case there is no objection to an additional length of flex being fitted with an additional pair of plugs and sockets, the extension lead being plugged into the dashboard, the other end being connected to the receiver.

The length should, however, be kept within reasonable limits owing to the voltage drop experienced in the filament supply, and unless extra thick flex is used it should not exceed eight feet.

It has been assumed that a 6-volt accumulator is available; if it is of the 12-volt variety the remarks still apply, the additional 6 volts being ignored, but in any case the positive and negative connections must be correctly made.

The alternative method of filament connection is to wire them in series, and in this case the procedure is somewhat different. Three 2-volt valves in series obviously require 6 volts, but in this system the amperage of each valve must be the same. The last valve will presumably take .2 of an amp. and this current must pass through the whole circuit to ensure efficient working.

The detector valve usually requires .1 amp., so a resistance capable of passing the remaining .1 amp. must be placed in parallel, and the correct value for this is 20 ohms (Fig. 2). In a similar manner a valve requiring .15 amps. has a 40-ohm resistance in parallel, and a .18 amp. valve a 100-ohm resistance in parallel. If two valves only are used a 10-ohm resistance must be placed in series. It should be apparent that if four or more valves are used they will have to be wired in parallel in the manner first described, unless a 12-volt accumulator is available.

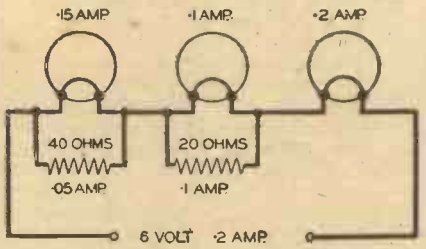

Fig. 2.—Diagram explaining the function of parallel resistances in series-connected filaments.

In this case a total of six valves can be run in series, and for each valve under this number a 10-ohm resistance must be placed in series with the filament winding. For instance, a four-valve receiver will necessitate a 20-ohm resistance.

If it is desired to make these resistances, fibre or hard wood formers should be used (Fig. 3), resistance wire being obtainable in 2-oz. or 4-oz. reels, 28 S.W.G. cotton covered wire costing approximately 1s. 8d. for a 2-oz. reel. The actual resistance can best be gauged by the length of wire, and for the particular gauge given it is 4-ohms per yard.

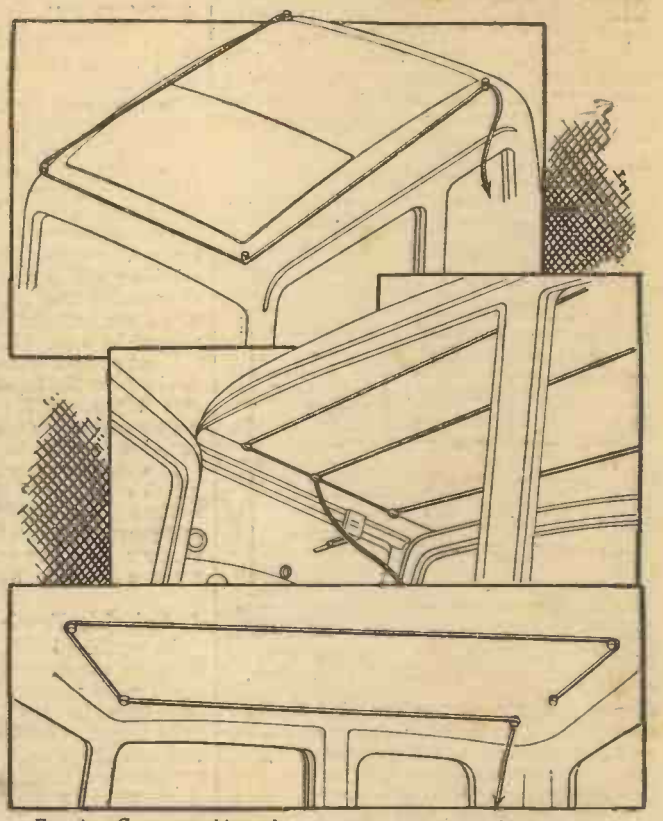

Fig. 4.—Some suitable and inconspicuous positions for the aerial.

Grid Bias Pointers

Before leaving the subject of series connected filaments, the question of grid bias must be dealt with. Indirectly-heated valves have a cathode, the heating element being a separate part used for that purpose only, but the filament of a 2-volt valve serves the double purpose of cathode and heater, and therefore the average voltage between the filament and earth affects the bias on the grid. Fig. 5 explains that the bias on the pentode (incidentally the wiring order shown will be found preferable) automatically becomes 5 volts, but under normal circumstances there is already a bias of 1 volt, so the effect of the series wiring is to apply automatically a negative bias of 4 volts.

Due to the inefficient aerial, the H.F.

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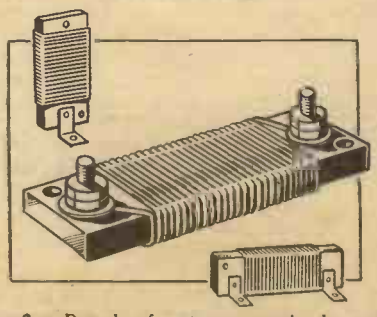


Fig. 3.—Details of resistance with alternative suggestions for mounting.

(Continued from previous page)

valve should normally be used at full sensitivity, *i.e.*, without bias, and a grid bias battery becomes unnecessary. It will be noticed that the grid leak of the detector valve must be connected to the positive terminal of the detector valve-holder, and *not* to L.T.+. If four valves are used in series the automatic bias on the last valve becomes 7V—1V=6V, and if this is excessive it will be necessary to apply a small positive bias to the grid.

H.T. Supply

With regard to H.T. supply, there certainly are methods of obtaining this

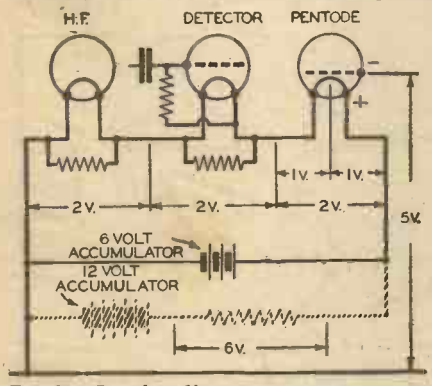


Fig. 5.—Complete filament wiring connections, including automatic bias, with alternative (dotted) connections for 12-volt accumulator.

current from the accumulator, but from an economical standpoint (as far as initial cost and trouble in fitting are concerned), the dry battery is undoubtedly the best, and as weight need not be unduly restricted the triple capacity type (120 V) would seem to fill the need admirably.

If a frame aerial is to be used, it must be remembered that it is highly directional. Consequently, if the set is used whilst in motion, the action of turning a corner will put the frame out of line with the station being received, and volume will decrease. Incidentally, the dash-board switch should not be in the *charge* position when using the set, otherwise the increased voltage from the dynamo may harm the valves.

Aerial Details

The alternatives to a frame aerial are: (1) a wire or wires across or around the roof of the car either inside or outside (in this case the earth terminal of the receiver is connected to the chassis of the car) or (2) a portable aerial (Fig. 4). As a further alternative to (1) one of the several adhesive aerials could be used, the aerial being stuck on the roof or round the sides of the car.

The former type can be used whilst in motion. It will be appreciated that the outside aerial is preferable in the case of an all-metal saloon, the metal tending to shield any interior aerial, thus reducing the volume to a considerable extent.

If any interference is experienced from the ignition the set can be screened, but the agreed panacea for this trouble is to fit suppressors sold expressly for this purpose, but even so screening may still be advisable.

The last-mentioned aerial consists of a length of insulated flex wound on any convenient former for transportation, this being unwound and thrown over the branch of any nearby tree or fixed to a small home-made collapsible mast.

A Suitable Earth

An earth rod will be found more efficient than the car chassis when stationary, as it must be remembered that the car is insulated from the ground by rubber tyres. A short length of brass curtain rod is suitable, and can be pressed into the ground with comparative ease. If possible, choose a ditch, with or without water, or under a hedge, as these places are usually the dampest, and therefore the most efficient.

If you possess a moving-coil speaker having a field winding suitable for 6-12 volts there is no reason why this should not be energised from the car accumulator; providing that there is no connection between the field winding and the moving coil, this should in no way affect the filament supply.

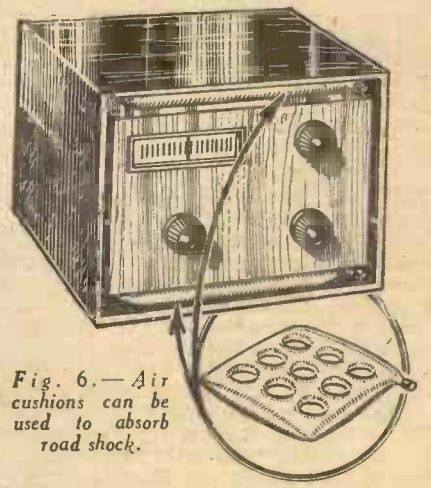


Fig. 6.—Air cushions can be used to absorb road shock.

If it is a question of buying a speaker, it is doubtful if the energised type offers any advantages over the highly efficient permanent-magnet models, at least as far as this purpose is concerned.

Little can be said concerning the actual position and fixing of the receiver, it depends so much on the car and disposition of the available space, but a method of fixing the set into a container which can be secured in any convenient place is illustrated; two of the cheap air cushions now available serving to absorb road shocks, ensuring long life for the valves and reducing microphonic noises to a minimum (Fig. 6).

Finally, use anti-microphonic valve-holders, which are available for chassis mounting as well as for baseboard mounting, and see that all nuts and terminal tops are really tight; small spring washers are advisable for these. There is then no reason why reliable reception from at least two stations should not be experienced even under most adverse conditions.

SELECTIVITY and SENSITIVITY

IT has been pointed out in these pages many times that when the selectivity of a receiver is increased the sensitivity is nearly always reduced. This does not, of course, apply when an extra valve is added along with an additional tuned circuit, but in nearly every other instance it does.

There is an important seasonal conclusion to be drawn from this, for there are probably thousands of readers who, during the winter months, acted upon various hints given in PRACTICAL AND AMATEUR WIRELESS with a view to making their receivers capable of cutting out interfering stations. These readers, as well as all others, will doubtless have noticed during the recent lighter months that the range of reception has fallen off perceptibly and that the need for great selectivity is no longer present. It may therefore prove well worth while to modify the connections to those which were previously employed with the object of improving reception of many of those foreign transmissions which have now almost vanished.

Modifying the Band-pass Filter

Where a band-pass input filter is employed it might be found better to eliminate the first tuned circuit by connecting the aerial, through a small fixed or pre-set condenser, to a tapping on the second coil. This may necessitate a slight adjustment to the trimmers of the gang condenser, but the short time spent in this way should be well repaid by better long-distance reception. There are cases where this alteration should not be made, but they are generally confined to superheterodynes; but even then there is no harm in observing the effect of reducing selectivity.

If selectivity had been increased by using a very small-capacity aerial-series condenser, or if the pre-set had been set to its minimum value, it may be worth while to use a larger capacity now. In the same way, the effect of using a "higher" tapping on the aerial coil should be experimented with, and if a separate loose-coupled aerial winding is used, it might be found advisable to cut this out of circuit.

It is not suggested that any major alterations be made, nor that any great pains should be taken, because it will certainly be found that the original connections will be required when the darker nights return and when selectivity is one of the most important considerations.

Another useful seasonal tip for increasing the range of the set, or at least for keeping it as high as it was during winter, is to add a simple form of H.F.-amplifier unit to the receiver if it is not already provided with more than one H.F. stage. Very few components are required, and details of suitable amplifiers for adding to various kinds of set were given in PRACTICAL WIRELESS dated Feb. 13th, 1934.

RANDOM NOTES

Radio on the High Seas

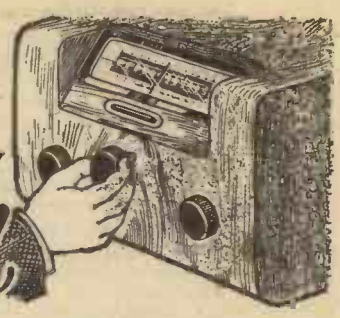
ACCORDING to a recent report published by the Bureau of the International Telecommunications at Berne (Switzerland), there are now in the world over 18,000 ships of every description equipped with radio telegraphy or telephony transmitters or receivers.

Relations with the Netherlands

A "Netherlands and Netherlands Indies Information Bureau" has been established in Shell-Mex House, Strand, W.C.2, under the auspices of the Netherlands Government, and in co-operation with the British Chamber of Commeree, to provide a means of promoting commercial and other relations between the British Empire and the Netherlands.

Included in the executive committee, under the chairmanship of Major the Hon. L. H. Cripps, appears the name of Mr. A. de Jong, Joint Managing Director of Philips Lamps, Limited.

On Your Wavelength



By Thermion

An Improved Method of Television

MR. L. V. CHARLTON, of Edgware, has sent me details of an improved method of transmitting and receiving sound and vision in natural colours. He tells me that the invention which he has provisionally protected is not yet working. Apparently transmitting will be done with the addition of a modulated light oscillator, which has an electro-magnetic eye and is expected to give out a mauve or purple ray in wave form. The colour of the ray (carrier) and the wavelength will be adjustable. The working of the instrument will probably be as near to that of the human eye as we can hope to attain.

The oscillator will cause the carrier wave to oscillate at the same colour frequency in order to carry both light and sound vibrations over the same wavelength. This should also make the background of the receiver silent and free from sound interference. Tuning in would then more easily be done by seeing the mauve carrier wave or the studio.

The receiver will be quite simple as the same valves, etc., will be used for both sound and vision, with an extra lamp and another arrangement for the vision.

Mr. L. V. Charlton is a toolmaker and has been working on the invention in practically all his spare time during the last two and a half years. He is now at a stage when it is absolutely essential to apply full time, as he is confident that the invention will soon be a success.

Frequency Records

APROPOS my recent paragraph under the above heading I have received the following letter from a friendly critic :—

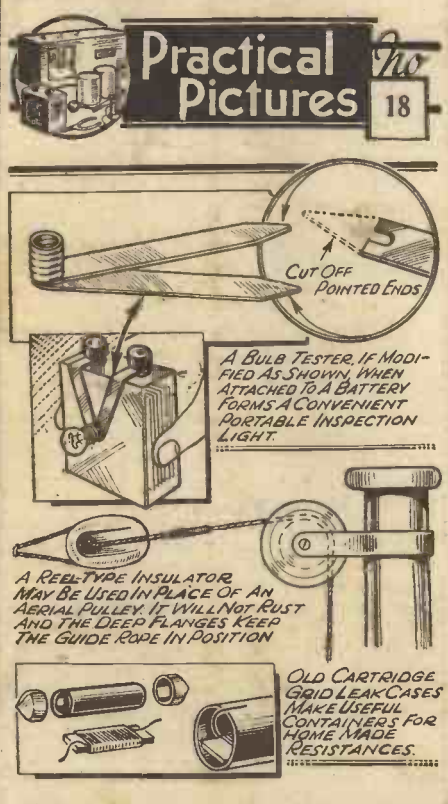
"My dear Thermion,—I have always admired the rather unorthodox but common sense style of your articles, but I did not think you would be such a Simple Simon as to advocate the broadcasting by the B.B.C. of frequency records. Undoubtedly such a broadcast would be a boon to the constructor who is after the genuine article and suffers no sense of disillusionment when the realisation comes that he is far from his journey's end.

"But there is the other side to consider.

"Hardly would the needle be lifted from such a record when Broadcasting House would be raided by a howling mob of infuriated set manufacturers armed with sawed-off shot-guns. After all, you cannot expect these public benefactors to produce sets at fiercely competitive prices which would bear location in the same county as an ordinary bricklayer's straight-edge.

"Again, owners of such receivers, rather bucked really about the quality of their latest acquisitions, would suddenly realise that they had purchased response curves reminiscent of a cross-sectional view of the Himalayas.

"Lastly, a general demand for better high-note response would undoubtedly result in the multiplication of that persistent squeaker, the jazz-band trumpeter, which Heaven forbid!



"By the way, how would a receiver fitted with A.V.C. respond to a frequency record, and why?

Licence Figures

IT is interesting to observe that the figures indicating the number of wireless receiving licences is still increasing with fair rapidity, and I notice that nearly 37,000 new licences were issued during May. This brought the total number of licences in force at the end of May to 7,092,596, which is surely a wonderful indication that the popularity of wireless is still increasing. Over seven million licences! That sounds good when one looks back to the time when we were waiting in expectation of the one-million mark being reached. Even a year ago—at the end of May, 1934—the licence figure was only 6,339,561, so there is certainly no suggestion of a falling off, as so many sceptics have prophesied at regular intervals since about 1923.

Wireless in America

I SEE that a prominent member of the radio industry who has just returned from America draws some interesting comparisons between radio in that country and here. He states that the average quality of reproduction given by American receivers falls far short of that expected by British listeners, and that, despite the fact that many American manufacturers have attempted to popularise sets which give good, natural reproduction their efforts have so far proved in vain. Apparently wireless enthusiasts on the other side of the Atlantic are far more interested in long-distance reception of poor-quality programmes than they are in obtaining the kind of reproduction that the average Britisher demands, even from an inexpensive set.

The P.O. and Static

I AM very pleased indeed to find that the Post Office engineers are still fighting hard with a view to ridding the country of electrical interference with wireless reception. Only a few days ago the Inspector of the Post Office engineering department in Leeds addressed the Leeds Radio Trades Luncheon Club on this subject, and stated that his department was doing everything in its power to trace the sources of interference and to advise on suitable remedies. They did not act as service agents, but after tracing the causes of interference passed the matter over to local dealers and service agents, who were thus helped to effect a satisfactory and speedy cure. In briefly describing the work of his department, the Inspector explained that his area covered approximately 200 square miles and included such important centres as Leeds, Bradford, Halifax, Huddersfield, Dewsbury, and Wakefield, and that four specially-trained and qualified engineers were employed solely in wireless work.

Another piece of good work which has been carried out in Leeds is in connection with the abolition of interference by trams, the motors of which have been modified so that they are interference-free.

Wireless and the Weather

I RECENTLY commented on the peculiarity of signals during a heavy rain storm, and I am interested to receive quite a number of letters from readers explaining the reasons and giving their experiences. During the recent heavy thunderstorms I tried to find a method of cutting out the heavy crashes which coincided with lightning flashes, but I was not successful. At some moments it really seemed that I should have to switch off or chance having

(Continued overleaf)

(Continued from previous page)

the speaker damaged so loud were these crashes. I tried various schemes in the aerial and earth leads to reduce the noises, working on the assumption that the static (for such is the name given to these noises) was untuned and therefore should pass to earth where a tuned disturbance would be accepted by a tuned circuit in parallel. Unfortunately, the only method which I found of reducing them in strength also reduced the ordinary signal so that there was no real gain. Amongst the many schemes I tried were the following, and maybe some keen experimenter would care to carry on where I left off, for I must admit I am leaving it to some of the more ambitious members of the profession. Spark gaps of varying size had little effect, except when the discharge was very close —in fact too close for comfort! Various tuned coils across aerial and earth—coupled to the first coil in the receiver seemed to have varying effects which I traced to the actual type of coil and the manner of coupling. Best results were obtained with a four-turn coil wound over a piece of copper foil wrapped round the "earthed" end of the tuning coil. The latter was wound on a 3 in. paxolin former, and the foil was wrapped round and cut so that only a thin strip (about one-sixteenth of an inch wide) was left, and the four-turn coil was wound direct on this. One end of the coil was joined to aerial and one to earth, and the receiver itself was isolated from both.

Wireless in the Garden

EVERYONE likes to get out into the garden during the fine summer evenings, and it is often desired to hear a programme whilst resting in a deck chair, or otherwise enjoying the benefits of the long evenings. The appeal goes out each year to keep the volume down, as it is very annoying to a neighbour to have a wireless set standing at the french windows blaring forth so that it may be heard at the other end of the garden. It is worth while remembering that it is preferable to take the set or the speaker right down into the garden and place it by your chair. By doing this you can keep the volume down to such a level that it is comfortably heard by you, but will not be sufficiently loud to be heard in the neighbouring gardens. Remember that you only need an output filter circuit and a single lead run down into the garden, with the other speaker lead pressed into the ground or dropped into the garden pool—if you have one.

Talkies and Quality

HAVE you ever wondered how the cinema operator makes certain that his apparatus is adjusted to obtain the best quality from the loud-speakers which are situated near the screen? I often wondered how he judges the volume and other points connected with his apparatus and was thus very interested to receive an invitation to visit an operating box in one of London's most up-to-date trade cinemas. I found that the operator had his own little loud-speaker connected to the apparatus, and fed with the output signals in such a manner that it did not overload, but gave a perfect reproduction of the sounds being radiated to the audience. It was also very interesting to see the amplifiers which were used and the various schemes which had been fitted to avoid overloading, etc. Taken all round the talkie apparatus is a marvellous piece of work, as it has to handle some peculiar effects as you can judge when you carefully follow a modern film. I was surprised at the volume which was given off when the theatre was empty, and I heard some interesting test effects which proved that the amplifier and loud-speaker can certainly deal with transients in no uncertain manner.

Notes from the Test Bench

Hum-bucking Coils

WELL-DESIGNED energised speakers invariably have hum-bucking coils attached; as the name implies, these coils are incorporated to eliminate speaker hum. In the cheaper models, however the hum-bucking coil is usually omitted in the interests of economy, and therefore speaker hum is generally obtained. It is a fairly easy matter to incorporate this type of coil, however. It should consist of the same number of turns as the speech winding, and should be connected in series with the latter but wound in the opposite direction. It should, of course, be wound over the field winding in order to provide interaction between the two fields.

Improving Quality

IT is a fairly easy matter to design a three-valve receiver of the H.F., det., pentode type capable of providing an undistorted output of 2 watts, but when outputs of 4 watts or higher are required, two or more L.F. stages are necessary, and much greater care must be taken when designing the receiver and arranging the layout. In the interests of quality it is advisable to use a triode valve, or two triodes in push-pull in the output stage, in preference to a pentode. A well-designed push-pull stage will give better quality than a single-valve stage, but unless accurately matched valves and accurately matched push-pull components are easily available the home constructor is well advised to adhere to a single triode output stage. Valves of the PX25A type are very suitable for this purpose, but in order fully to load these, two L.F. stages are necessary. If a diode detector is used, it should be resistance coupled to a valve having an impedance of approximately 15,000 ohms, and this should be resistance coupled to a small power valve having an impedance of approximately 6,000 ohms. The coupling between the latter and the output valve should preferably be of the low-ratio transformer type, and in order to prevent direct current from passing through the primary winding of this component, it should be parallel fed. In order to prevent low-frequency instability, the anode circuits of both the L.F. valves must be effectively decoupled and grid leads must be kept short. If, for some reason, such as the addition of pick-up connections, the grid leads must be long, they should be carefully screened.

Connection of Field Windings

IN receivers employing output valves requiring an anode voltage of 400 to 500 volts, difficulty is often experienced in choosing the best position for the field winding of the energised speaker. The winding cannot be satisfactorily wired in series with the rectifier-anode circuit in the usual manner, because this will provide an excessive voltage drop. As the H.F. and L.F. valves only require a maximum voltage of approximately 200 volts, however, a speaker-field winding can be connected in series with the common H.T. supply circuit of these valves.

The Fascination of the Short Waves

THE possibilities of short-wave reception out of doors should not be overlooked, and though the entertainment value of such transmissions may not be in high favour with other members of the family, the radio fan who is fond of open country might well consider the building of a simple portable short-waver. A single-valve set, or at most a two-valver, will be all that is necessary for good headphone reception, and quite a small L.T. or H.T. battery will do. Thus the set need not be either bulky or heavy. Short-wave experimenters are already *au fait* with numerous suitable circuits, and will need no suggestions on this point, while beginners will find in recent issues of PRACTICAL AND AMATEUR WIRELESS details of several standard and simple circuits.

The hiking or motoring short-wave enthusiast who thus takes his short-wave receiver out in the country will find much to interest him. He can, for example, compare reception conditions afield with those encountered at home; with his temporary and easily moved aerial he can make experiments on the directional properties of aerials and with aerials of different designs. Moreover, if he is in touch with a transmitting amateur, he may be able to co-operate in interesting and valuable tests of various types.

Adding Visual Tuning

WITH reference to the article on adding visual tuning, which The Experimenters contributed to the June 15th issue, accurate timing is, as they say, indicated when the lamp shows the maximum amount of light. Incidentally, it should be mentioned that the L.F. choke in series with the primary is intended simply to prevent mains hum and, in conjunction with the 4-mfd. condenser shown, it forms a decoupling circuit.

This tuning indicator is specially designed to operate with a primary current up to 10 milliamps or so, and is therefore most suitable for connection in the anode circuit of a single controlled valve only, where it gives excellent results. It can be included in the anode circuit of any controlled valve, but is generally most satisfactory when used with the intermediate-frequency valve of a superhet, or with the first H.F. valve in a "straight" circuit.

Yet another popular and successful type of tuning indicator is the Cossor neon tube, type 3180, the connections of which were illustrated in the article. The values of components shown apply to the A.C. model "£5 Superhet," but they can be slightly modified for other receivers. This device, like that described above, is most suitable for use in mains-operated receivers, due to the fact that a maximum voltage of 180 is required for its successful operation. Those readers who desire a full explanation of the principles of operation are referred to the article in the issue of this journal dated June 16th, 1934.

HARMONICS: THEIR MEANING AND EFFECT

An Interesting Explanation of Harmonics, and Their Importance in Radio Reception.

THE term "harmonics" is so frequently associated (in technical literature) with distortion that listeners may be pardoned if they form the impression that harmonics are noxious things to be avoided at all costs. Yet this is quite an erroneous idea, for harmonics are perfectly normal phenomena and, when naturally produced, are in no way an annoyance—indeed they are essential to good reproduction. Distortion, in one of its most distressing forms, is simply a matter of harmonics in the wrong place.

There are few listeners who do not know that sound is the result of air vibrations, that these vibrations have definite frequencies ranging up to about 20,000 per second, and that the frequency determines the pitch of a note, shrill notes being of higher frequency than deep notes.

Notes and Harmonics

It is, perhaps, not quite so well known that a simple note consisting of a single frequency is of comparatively rare occurrence, in fact, is only experienced in certain scientific instruments specially designed to give a simple frequency. All normal musical notes are more or less complex in nature, consisting of the basic frequeney or "fundamental" which gives them their general pitch, and a varying number of additional frequencies bearing simple numerical relationships to the fundamental, such as twice, three times, four times the fundamental frequency, and so forth. The number and relative strengths of these additional frequencies or "harmonics," as they are termed, give the note its characteristic "tone," and enable a differentiation to be made between the notes of a violin and, say, a piano.

It will, therefore, be obvious that if for any reason the proportion of harmonics is upset either by the suppression or partial suppression of some or by the addition of others, a form of distortion will occur, and the ear will recognise that the sound is not of the tonal quality which one would expect.

Two further things must be explained, the first being in connection with the nature of music and noise. It has been explained that practically all musical notes are of complex harmonic structure; but that structure is still sufficiently simple for the ear to analyse it and recognise its characteristic quality; and a musical note is therefore more or less pleasing to the ear. If, however, a sound is of such a type that the ear cannot analyse and appreciate it, we no longer call it a musical note, but a noise. A sound becomes a noise if either or both of two things occur; first, if the number and strengths of the harmonics are such that the sound is too complicated or unfamiliar for the ear to recognise it as music; second, if the duration of the sound is so short that the ear has not time to analyse it.

The other point is that certain harmonics are more distasteful to the ear than others. It is not difficult to understand why this should be, if the table included here is examined.

In this table there are four columns, the first giving the number of the different harmonics, the second the musical name of the corresponding note taking the C below middle C of the piano as the fundamental, the third giving the mathematical value of the corresponding frequency, and the fourth the actual frequency of the note as tuned on a piano.

The Effects of Odd and Even Harmonics

It will be observed that by successively doubling the frequency the pitch is raised one octave, so that the second, fourth, eighth and sixteenth harmonics of the fundamental correspond to the different "C's" on the piano, each one octave above the other. Clearly these harmonics cannot produce a discord, and an excess of them merely produces the effect of a shriller overall pitch. Moreover, the true pitch and the tuning pitch of all these C's are identical. Now take the third harmonic—it is the G above the first octave, and the sixth and twelfth harmonic and so on are also G's. Sound these notes together on your piano—the fundamental C, the upper C's and the G's, and you will not find them unpleasant. Even the fifth and tenth harmonics representing the E's are not too bad, and in all these notes the true and musical pitches are not very different. But now try playing the seventh, ninth, eleventh, and thirteenth harmonics as shown in the table, together with the fundamental, and you will be rewarded with "a horrid noise." So we see that if harmonic distortion is present, that due to the even harmonics is not so unpleasant as that due to the odd harmonics, and this has an important bearing on the design of "quality" radio equipment.

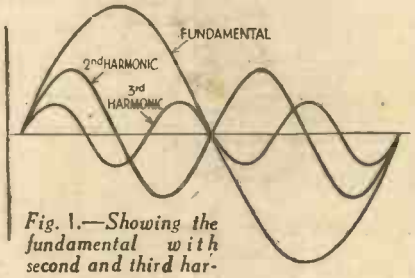


Fig. 1.—Showing the fundamental with second and third harmonics.

Harmonic	*Notation*	*Mathematical Frequency*	*Piano Frequency*
Fundamental	C	129	129
2nd	C	258	258
3rd	G	388	388
4th	C	517	517
5th	E	647	652
6th	G	776	775
7th	B Flat	905	922
8th	C	1035	1035
9th	D	1164	1161
10th	E	1293	1304
11th	G Flat	1423	1463
12th	G	1552	1550
13th	G Sharp	1681	1642
14th	B Flat	1811	1843
15th	B	1940	1953
16th	C	2070	2070

To see how spurious harmonics may be produced in a radio receiver refer to Figs. 1 and 2, which show respectively a fundamental wave with a second and third harmonic, and how these three waves can be combined into a single wave. Now just as fundamentals and harmonics can be combined to produce a more complicated wave form, so can any complicated wave form be analysed into a fundamental and a number of harmonics. So the musical wave form of the signal in a radio set represents the combination of the various harmonics forming the notes broadcast, and can be analysed by suitable apparatus. But if anything should occur in the set to distort the wave form, to change its shape, then the new wave form, if analysed, would show quite a different combination of harmonics—harmonic distortion would have occurred.

Overloading

The usual form which harmonic distortion takes is due to partial rectification of a low-frequency signal, commonly known as overloading, and it can be proved both mathematically and experimentally that the practical result of overloading is to introduce additional harmonics. This gives a spurious shrillness to the reproduction and, if distortion is considerable, a very unpleasant quality results.

Several important and interesting points now arise. In the first place, overloading a triode valve produces in the main a range of even harmonics which, as has been shown, is not quite so unpleasant as odd harmonic contamination. A pentode, on the other hand, produces a greater proportion of odd harmonics than a triode. Thus, when it is stated that a pentode is more easily overloaded than a triode, this is only part of the story. On account of its greater sensitivity a pentode *is* overloaded before a triode, but, in addition, the result of overloading a pentode is far more disastrous from the quality point of view than in the case of a triode, owing to the greater odd harmonic content of the output.

Valve Limits

Valve manufacturers quote optimum loads, maximum signal handling capacities, and similar data based upon reasonably good reproduction. This is usually taken as five per cent. second harmonic distortion in the case of triodes, but a pentode may be operated at five per cent. second harmonic distortion, or even less, and still give very bad reproduction, simply because the more deadly third and other odd harmonic distortion is very much greater. It is as well, therefore, to obtain the fullest possible information concerning the characteristics of any valve used in the output stage. No one wants three watts of output containing, say, ten per cent. total harmonic distortion if, by limiting the input and taking a slightly smaller maximum output, the harmonic content could be reduced to five per cent. or even less.

The next point of interest is that certain valve arrangements automatically produce

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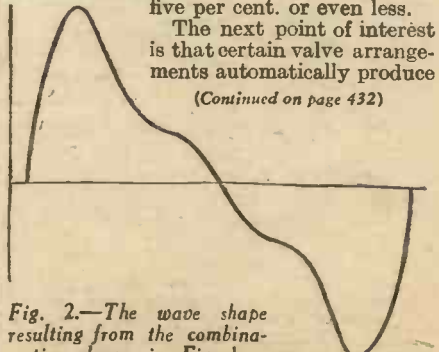

Fig. 2.—The wave shape resulting from the combination shown in Fig. 1.

RECEIVER REFINEMENTS

Constructional Details of Some Simple Devices Which May be Made by the Enthusiast for Incorporation in Practically Any Type of Receiver

By W. J. DELANEY

THERE are many amateurs who are now satisfied with the receiver which they have built, and who are not anxious to build up another receiver. They are still interested in following constructional articles, however, and often build up small receivers simply for the interest of the hobby. There are others who are anxious to understand new ideas as they are brought forward and who use a separate receiver for such experimental work, and keep a good receiver for broadcast reception. To all types of listener, however, there must have come at some time or another a desire to make something to add to a receiver, either for its general improvement, or to gain knowledge of the action of some device. For instance, even the user of a commercial receiver might find at times that the selectivity is not all that could be desired, and would like to add something which would not in any way interfere with the actual wiring of the receiver but which would improve selectivity. Another listener might like to try the effect of modifying the tone of reproduction, again without altering the actual

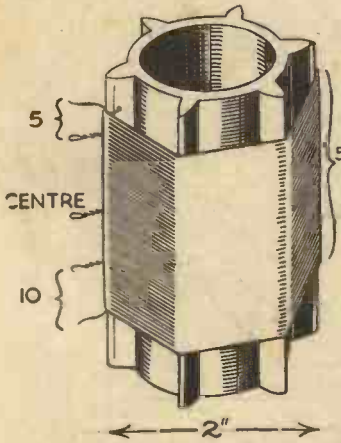

Fig. 1.—Constructional details of the wave-trap coil.

receiver. The following notes will therefore appeal to every listener, no matter whether he has a good receiver or a rough hook-up, and in some cases it may be found interesting to make up all of the devices here described.

Wave-traps

Selectivity is the greatest problem in these days, and the only effective way of modifying selectivity "externally"—that is, without altering the wiring in a receiver—is to fit some form of aerial filter or wave-trap. This consists of a tuned circuit inserted between aerial and receiver, and when it is tuned to the frequency of an unwanted signal it offers a very high impedance to that signal, and consequently prevents it from passing at very great strength through the receiver. Unfortunately, it is not possible to make a wave-trap which will cut out only one particular frequency, and in practice there is a cutting-off effect over a wide band on either side of the unwanted signal. For experimental purposes, a coil may be wound on a good ribbed-ebonite former 2in. in diameter, using 24 D.C.C. wire and winding on 50 turns. Tappings should be made as shown in Fig. 1, and then the coil must be tuned with a good .0005 mfd. condenser. The better the insulation throughout the wave-trap circuit the greater the efficiency. There are many different methods of connecting the wave-trap, and some of these are shown in Fig. 2. Experiment will show which is the most suitable for individual requirements, and the effect will vary

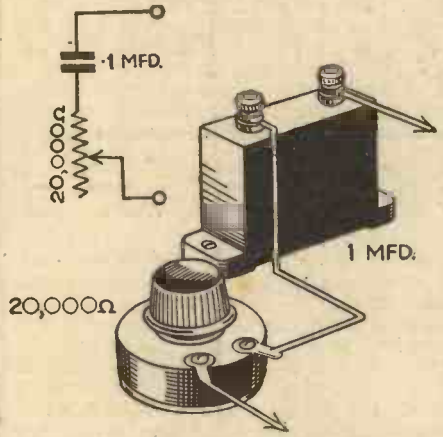

Fig. 3.—The tone-control in theoretical and pictorial forms.

according to the aerial-earth characteristics, the tuning arrangement in the receiver, and the actual wavelength desired as compared with the wavelength not required.

Tone-controls

Another useful adjunct to any receiver is a tone-control, as this enables the actual tonal effects to be modified to suit any particular musical item. When a receiver is being specially built there are many methods of incorporating some form of tone-control, but when a receiver is already constructed, there only remains the inclusion of a control across the output circuit. (I am assuming, of course, that the listener has a commercial receiver, as it is easier to deal with this type than to take the home-constructed receiver with which any circuit modification can be made). This control may be joined direct across the anode load, or between the anode and earth, which actually amounts to the same thing. A fixed condenser in series with a variable resistance is the most effective tone-control, and a small unit may be constructed from a .1 mfd. condenser and a 20,000 ohm variable resistance. The two may be mounted in a small box and two terminals fitted, or two flexible leads. One of these should be joined to the anode of the output valve and the other to H.T. positive or earth. In a commercial receiver, the control may be joined to the "extra loud-speaker" terminals in almost every type of receiver, and this forms a very good method of connection. Variation of the resistance controls the tone, but the experimenter may also care to modify the value of the fixed condenser to suit his particular receiver.

An Output Filter

Practically every well-built receiver incorporates an output filter, as this prevents instability and has other advantages. It

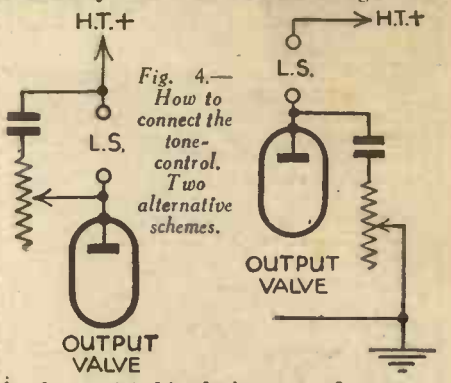

Fig. 4.—How to connect the tone-control. Two alternative schemes.

is often omitted in the interests of economy, but is well worth fitting to a receiver, as it permits of long extension leads, etc. A useful type of filter to build is shown in Fig. 5, and it will be seen to consist of a tapped iron-cored choke and a fixed condenser. The choke is wound to enable it to be used with practically any type of output valve, from the largest super-power valve to the battery pentode. The tappings are placed in such positions that by connecting the flexible lead (which is

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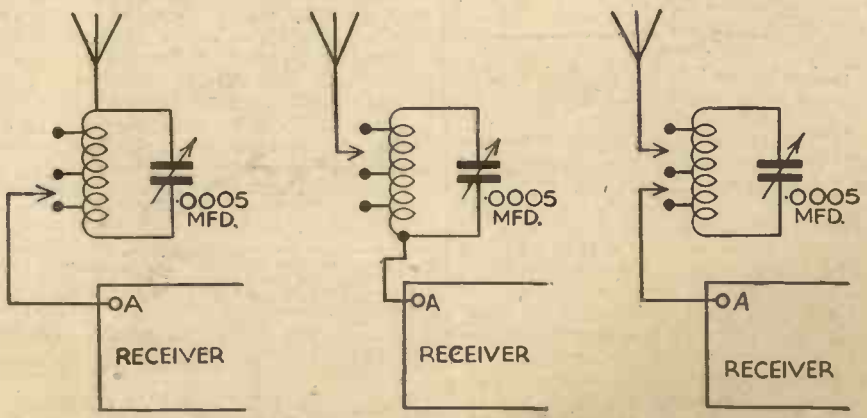

Fig. 2.—Three suggested methods of using the wave-trap. Other combinations will suggest themselves to the experimenter.

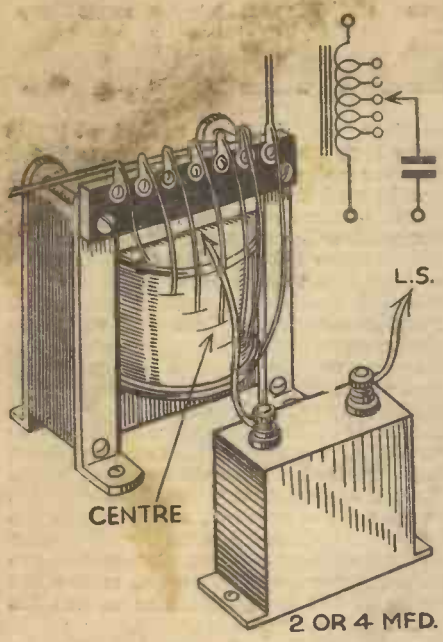

Fig. 5.—The essentials of the output filter.

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joined to one side of the fixed condenser) to one terminal and connecting the anode of the output valve and the H.T. positive lead to two terminals, any desired matching impedance may be obtained. Various connections are shown in Fig. 6, and experiment will enable the optimum position to be found. To wind the choke you will require 100 pairs of No. 30 stalloy stampings, and a paxolin bobbin to fit. These may all be obtained from advertisers in this journal. The bobbin must be wound with ½lb. No. 34 gauge enamel wire, which will give a total resistance of just over 200 ohms. Wind the wire fairly evenly in layers, and between each layer place a thin piece of paper. Make tappings at every 500 turns, which will give 5 tappings, as the wire will wind to a total of approximately 3,000 turns. Place the choke and condenser in a small box or cabinet, with the tapping points brought out to terminals, and the complete unit may then be used as shown in the diagrams given in Fig. 6, or in other ways which will suggest themselves to the user. The choke will have an inductance of approximately 20 henries, and will carry about 55 to 60 m/A comfortably. The fixed condenser may have a capacity of 2 or 4 mfds., the actual value not being a critical factor, but the working voltage should be sufficiently high to avoid breakdown due to surges when switching on.

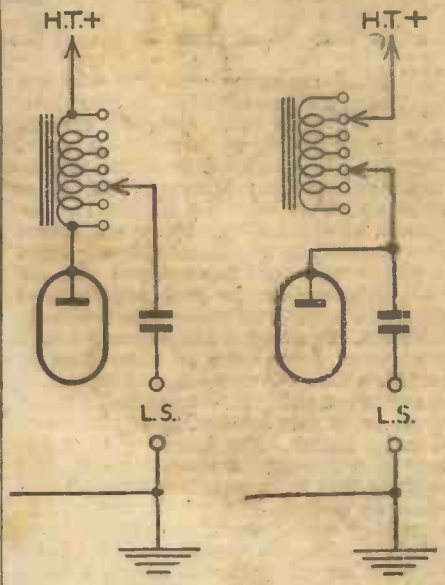


Fig. 6.—Two methods of using the output filter. Many combinations are possible.

Single-knob Control for a Test-meter

NUMEROUS articles have appeared on the subject of utilising a milli-ammeter for measuring different ranges of current, voltage, and resistance, and an idea is here given for an arrangement which can, by means of a "single knob," change over as required to any single range, without the necessity of plugging in to different sockets.

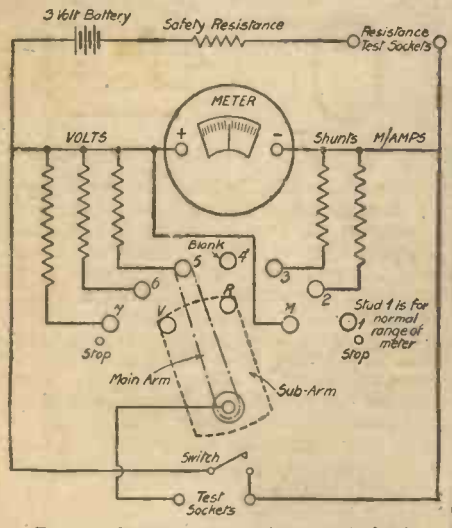


Fig. 1.—Wiring details of the single-knob test meter.

Selector Switch

The circuit diagram (Fig. 1) gives three ranges of milliamps and three of voltage, and the selection is by means of the switch-arm and stud method, seven studs being required—the one in the centre position being a "neutral," for use when resistances are being measured. In the original, an old type of switch-arm was used, and an additional subsidiary arm of springy brass, or copper, mounted below the main arm makes contact as required with each of a further three studs, the latter being mounted on a shorter radius inside the main studs, only one of the three, however, being required to be connected in circuit, the other two being necessary to maintain the level and tension of the sub-switch-arm. On the spindle, and above the two arms, is mounted a card, on which the readings are printed, and this card is so fixed that the lowest reading of milliamps is seen through the shaped "window" when the switch arm is on stud "1." At the same position, the sub-arm must have just made contact with the inner stud "M." The sub-arm must be of such a width that it makes contact with the stud "M" with the main arm in contact with any of the studs 1, 2, or 3; but it must be clear of stud "M" when touching stud "V" on the opposite side, that is, with the main arm on stud 5. Stops are, of course, necessary at each end of main studs.

Panel Layout

The panel on which the studs are mounted is spaced from the upper panel by means of four distance rods of tapped brass or ebonite, of such a length that the card moves smoothly just underneath the upper panel, with the control knob projecting through the top.

The whole can be accommodated in a suitable box containing meter, the necessary shunts, and resistances; and, if required, a tubular 3-volt battery for measuring resistances could also be included. A safety switch is also desirable, and could be made up of odd parts.—F. F.

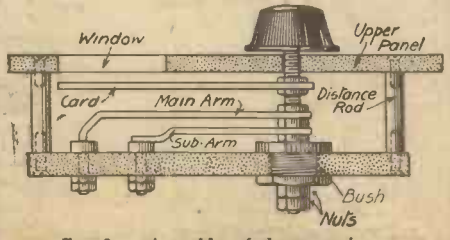


Fig. 2.—Assembly of the control arm.

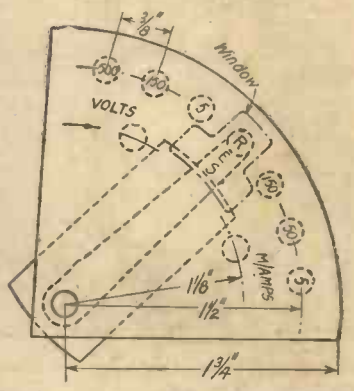


Fig. 3.—How to mark out the indicator.

THE TALKING BEAM

AN interesting transmission was carried out by the American radio network when the liner *Normandie* arrived off New York Harbour on her first trip. A beam of light was transmitted to the ship from the torch of the Statue of Liberty on Bedloes Island. The beam thrown out by a powerful reflector was modulated by speech conveyed to the Statue by submarine cable and there transposed into light pulsations. Special apparatus comprising an outsize concave mirror received the rays which, directed on an electric "eye," changed the light vibrations back into electric pulsations and thus permitted their reproduction through an ordinary wireless receiver. The message was broadcast by loud-speakers throughout the ship and simultaneously over the N.B.C. network.

A PAGE OF PRACTICAL HINTS

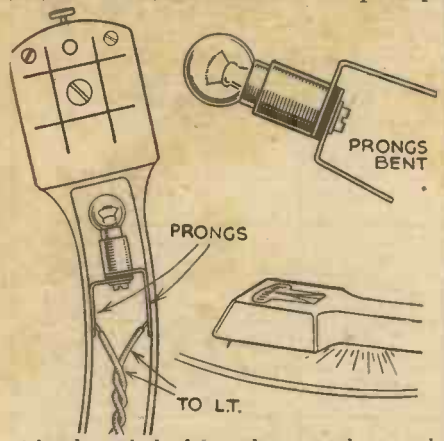
SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

A Pick-up Light

WITH a pick-up of the horizontal type, it is difficult to place the needle in the first groove because the record is covered with the shadow of the pick-up



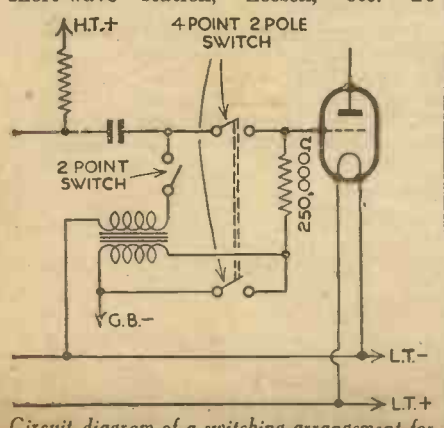
A handy method of providing a pick-up with bulb for illuminating the needle track on a record.

and tone-arm. This can be overcome by the following arrangement, which consists of a bulb tester held in position in the frame of the tone-arm by the pressure of the bent prongs on the inside face of the tone-arm sides, as shown in the sketch.

A bulb is placed in the holder and wires soldered to the prongs are taken to the filament supply of the set. The result of this arrangement is a *direct* beam of light immediately beneath the pick-up, thus eliminating all shadows.—T. CUNNINGHAM-BURLEY (West Hill).

Switching Arrangement for Changing L.F. Coupling

I HAVE a three-valve, all-wave set, det., L.F., and power, using an all-wave coil, with both L.F. stages R.C. coupled, which gives me ample volume with good quality from the local station, but not enough volume for distant stations, and the empire short-wave station, Zeesen, etc. To



Circuit diagram of a switching arrangement for changing L.F. coupling.

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.

remedy this I tried the following scheme, which works splendidly:—

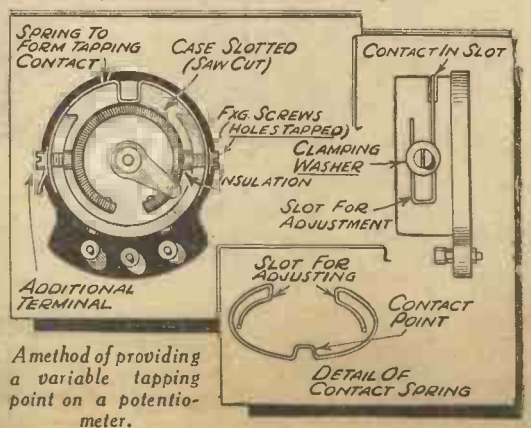
I obtained a 3½-1 L.F. transformer for the second stage and resistance fed it. A 250,000-ohm resistance connects the grid of the power valve to the grid terminal of the transformer. Between the coupling condenser and the plate terminal of the transformer I fitted a two-point switch, and between the coupling condenser and the grid of the power valve, and across the secondary of the transformer a four-point, two-pole switch. When the two-point switch is pulled out the transformer is in circuit. Pushing in the two-point switch and pulling out the four-point switch brings the R.C.C. into circuit. The two switches may be mounted on the panel or on a strip of ebonite at the back of the set.—H. E. DOBLE (Retreat, C.P., S. Africa).

Variable Tapping for a Potentiometer

CONFRONTED by the problem of inserting a variable tapping point approximately half-way down a potentiometer, and yet not to interfere with the normal operation, I decided to make the following modification. Removing the potentiometer winding, the case was slotted with a hack-saw blade sufficiently wide to receive a contact spring bent as shown in the accompanying detail drawing. The two ends of this spring are made so as to form an elongated slot to allow for the necessary adjustment.

The spring contact is held in the desired position by means of two fixing screws, under one of which an additional terminal is clamped.

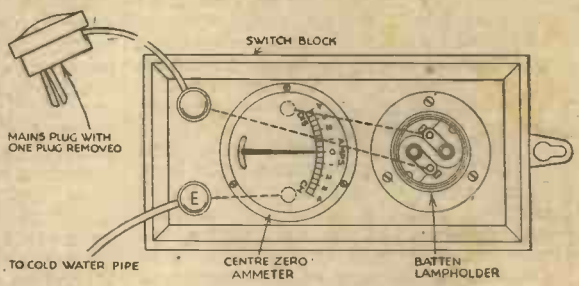
Upon replacing the resistance winding, it is advisable to place a piece of thin insulating material between the winding and case immediately below the tapped hole (for the fixing screws) to prevent a possible short circuit owing to the screw projections. It will be seen that normal operation of the potentiometer is unaffected and, if wound with very fine wire, the difficult problem of soldering is quite unnecessary, and, moreover, re-adjustment of the tapping point is possible. W. A. HARRISON (Aintree).



A method of providing a variable tapping point on a potentiometer.

A Polarity and Earthed-main Indicator

THIS useful instrument can easily be constructed as shown in the accompanying sketch. The ammeter has a terminal located immediately behind each indication, and the pointer always moves towards the terminal carrying the positive wave. Connections are shown by dotted lines. To use the device, put a lamp of suitable voltage in the batten holder, and, employing an insulated lead, join the "E" terminal to the nearest water pipe. Insert the wander-plug in one socket of the point under test. Failure of the lamp to light, when the switch controlling the point is



Plan view of a polarity indicator, showing wiring connections

closed, indicates that the socket is at earth potential. Transfer the plug to other socket and the lamp will light, since the plug will be in contact with the outer main. With the lamp glowing, the position of the ammeter pointer should be noted: A deflection to "charge" indicates that the earthed man is positive. Before removing the plug from the outer socket, open the switch. It may be found that the lamp remains lighted, with the switch in the open-circuit position, indicating that the switch has been installed in the earthed main. This is against I.E.E. rules, and should be remedied. Copies of these rules may be purchased through any bookseller. —S. RAINEY (Wishaw).

DETECTION, OR RECTIFICATION

BEGINNER'S SUPPLEMENT

Continuing our Explanation of the Principles of Modulation, etc., the Function of Rectification by Various Systems is now Explained.

IT has been shown how the carrier wave is modulated by the signal and arrives at our aerial in the form of an alternating or varying current. In the diagram on page 383 (Fig. 3), we can see that there are rises and falls above a mean value in the A.C. which is received by our aerial, and before we can operate any form of reproducing device it is necessary to convert these changes into a different form. We have referred to the variations caused by the signal as "modulations," and, therefore, as we wish to return to these original variations at the receiver end, we must "demodulate" the signal, and the process of demodulation is generally referred to as detection or rectification. There are various methods of carrying out this demodulation, and the essential for the purpose is some object which will more readily pass current in one direction than in another. This point has already been fully covered when dealing with mains rectifiers, and the principle is more or less the same. In the simplest form we may use a crystal or combination of crystals, but in view of the very small use of this arrangement to-day we will not devote space to it, but pass on to the valve.

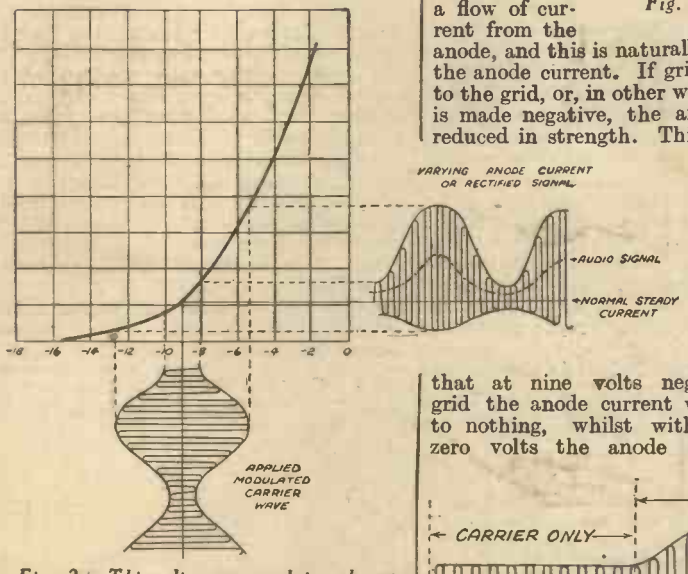


Fig. 2.—This diagram explains how the incoming signal is rectified, and shows the signal which operates the speaker or next L.F. stage.

Two Forms of Rectification

The ordinary three-electrode valve may be employed in two separate ways to provide rectification. One is to use the anode-current method and the other is to employ the grid circuit. In principle both schemes are alike, but the latter method has the advantage that as the grid circuit only is employed for rectification, the anode circuit may be employed for amplification, and thus we can perform two functions in the single valve. There are drawbacks to this method, but they are principally concerned with distortion of a form which does not interest the beginner. When the L.T. and H.T. are applied to a valve there is a flow of current from the anode, and this is naturally referred to as the anode current. If grid bias is applied to the grid, or, in other words, if the grid is made negative, the anode current is reduced in strength. This fact is shown by the ordinary anode-volts anode-current curve supplied with the majority of valves, and one of which is reproduced in Fig. 1. This clearly shows that at nine volts negative on the grid the anode current will be reduced to nothing, whilst with the grid at zero volts the anode current is as high as 7.5 mA. Now for anode-bend rectification a negative bias is applied to the valve in exactly the same manner as in ordinary L.F. amplification, with this exception: For L.F. operation the amount of bias applied is only about one half of that which is applied for anode bend rectification. Now look again at Fig. 1. If six volts are applied to the grid the anode current will be approximately .75 mA. Now let us take the curve shown on page 383, and see what happens when a current of the type illustrated is applied to the biased valve. In Fig. 2 the anode current curve has been shown again, and part of the incoming signal has been shown below the curve, with the zero line corresponding to the working point on the curve, and this latter point is decided by the amount of grid bias which is applied. On the right of the valve curve is the current variation, which will be found in the anode circuit. It is obvious that as the valve is made less negative the anode current will increase, and vice versa, and as the value of grid bias applied is chosen to bring the working point so low on the curve, it is seen that only positive half-cycles of the signal will cause an increase (or change) in anode current, whilst the negative half-cycles will simply be shown by the slight fall below the new zero line, and thus to all intents and purposes these half-cycles are cancelled out and the signal becomes rectified or demodulated.

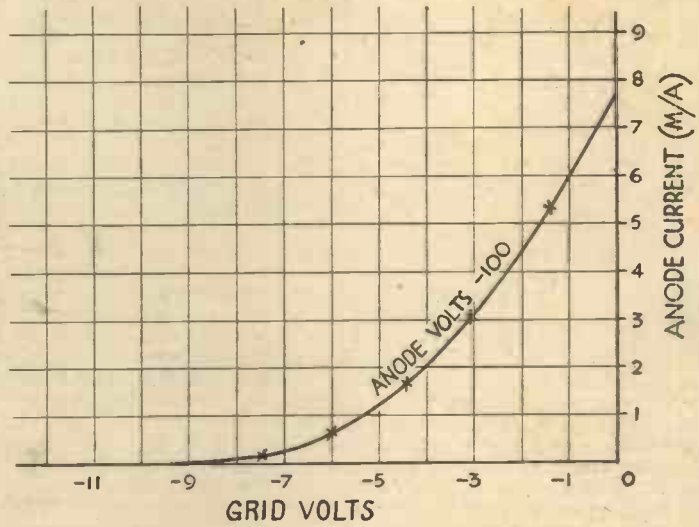


Fig. 1.—The grid-volts anode-current curve of a standard valve.

Distortion

If we examine the shape of the curves produced by a modulated signal we shall see that there is a definite "outline" corresponding to the signal impulse, and this outline—or envelope has been marked in and is reproduced in Fig. 3.

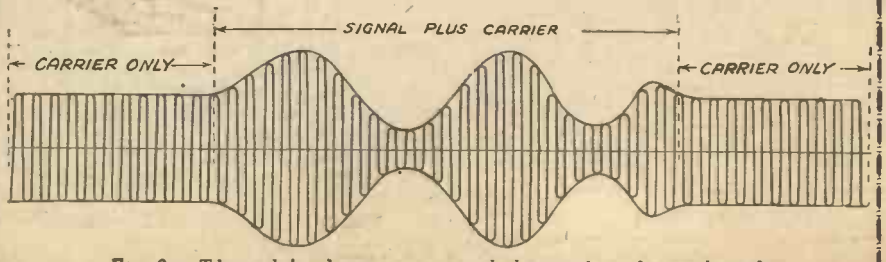


Fig. 3.—The modulated carrier-wave with the signal envelope indicated.

REPLIES IN BRIEF

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

G. H. D. (Plumstead). We regret that we have no details of the French transformer and do not know the name of the manufacturers.

N. N. (Northumberland). The voltage drop through the 7,500-ohms speaker connected across a 250-volt supply would be 250 volts. You have probably misunderstood the point, as the speaker would not be joined in the manner you outline.

A. R. (Hednesford). The coil is connected with the tuning condenser across it, between aerial and receiver. See the article in this issue entitled "Receiver Refinements." The coil switch may be used to change from medium to long waves.

H. W. F. (Battle). It would probably prove most effective to rebuild your receiver as a good broadcast set, and then use a short-wave adaptor. We would not advise the switching arrangement you outline. We do not know of any tubular lamps of the type you mention. The blueprint of the Melody Ranger Two is AW388.

T. W. (St. Albans). We would suggest the B.B.C. One-Valver, blueprint AW344. The cost will vary according to the particular components you obtain, and the headphones will be the most expensive part.

C. A. (East Sheen). By using short-wave coils the set could certainly be used on short waves, but it would be preferable to adopt capacity-controlled reaction, with an H.F. choke in the detector anode lead.

J. B. S. (Enfield Chase). We regret that we cannot answer your query. Prices of parts for all types of receivers may be obtained from Messrs. Peto Scott, and a list of blueprints appears each week in these pages.

Q. K. (Ruthergien). You could probably use your present components by removing half of the wire from each winding (that is, primary and secondary). This would give you an approximate value, which, if each coil is roughly the same, will enable you to use them by adjusting the small condensers in the base. As each bobbin is in two sections we would suggest that you remove the wire on the lower section of the bottom bobbin and the wire from the upper section of the top bobbin. This will permit of tight coupling with the remaining sections.

W. W. (Slough). The energised speaker may be used as a choke, and to prevent signals the transformer primary or secondary may be disconnected. If you do not intend to use it at all the primary may be disconnected, but if you wish to use it or an external speaker, fit a switch in the secondary winding so that the primary may be left in circuit as a choke to feed the permanent magnet speaker.

E. R. P. (Romford). We are sorry that we cannot understand your query. Can you repeat it in a clearer form? The gauge of wire is 24, not 18.

E. McC. (Derby). The aerial is simply wound round the cardboard to facilitate carriage. It is not a frame aerial, but a length of wire which is thrown out when desired. An earth is advisable but not essential.

E. P. (Walton). So far as we can gather from the details which you give, the coils will be quite suitable for the circuit in question.

A. W. (Argyll). The Silver Souvenir would definitely be the best circuit for your particular requirements. The surplus goods are not always suitable for home use, not only because they are unscreened and not provided with terminals, etc., but because they may have been designed for a special purpose and will only function satisfactorily in the original circuit. Furthermore, if anything goes wrong you can obtain no satisfaction from the makers.

T. R. S. (Hyderabad). The intervalve transformers are wired as follows: Anode of H.F. valve to terminal P; H.T. lead to terminal marked "—"; grid of next valve to terminal G and the F terminal must be joined to earth. The Universal output transformer must be connected between anode of output valve and H.T. positive, using the P terminals to suit the particular impedance. The speaker is then joined to a pair of the S terminals to obtain correct matching.

C. R. M. (Darlington). We would not advise rewinding the transformer. It will probably be quite satisfactory to use the transformer in a direct anode connection, ignoring the H.T. tapping point and connecting one terminal to the anode and the other to H.T. positive.

D. H. (Bristol). We regret that we have no blueprints of receivers employing the coil in question.

G. R. J. (Wonford, Exeter). We are sorry we cannot help you. The set is probably a very early B.B.C. model bearing the Marconi licence plate, but is not of Marconi manufacture. We cannot assist you to use up those old parts and cannot help you regarding the wiring. Why not build the Hall-Mark Three, which is a modern set? If you referred to 12.30 a.m., then "Good morning" is correct. At 12.30 p.m. (that is, lunch time) "Good afternoon" is correct.

2 B.F.A. (West Kirby). The records are manufactured by Major Radiovision Co., 10, St. Christophers Place, London, W.1.

W. C1 (Glasgow). We regret that we have no blueprints of receivers employing the coils in question. We have not employed these coils in any receiver and have not issued an A.C. superhet of the type you refer to.

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).

VUB (Bombay) Wants Reports

SIR,—The following extract from a current American radio magazine devoted to short waves may be of interest:—

"Unless listeners come to the aid of VUB or VUC, Bombay, India, these stations will close down, as they claim that no reports are being received on their station. Will you help?"—K. DOWKER (Carnforth).

A Good S.W. Log

SIR,—May I congratulate you on the excellence of your paper? I have been a reader of PRACTICAL AND AMATEUR WIRELESS since the first issue, and have always found it the most interesting radio paper. Your short-wave section is very good, and should help to convert thousands of readers to the fascinating art of short-wave reception.

Perhaps some of your readers may be interested in the results obtained in the Wiltshire district? A selection from my log is as follows: VE9GW Bowmanville, W1XAL Boston, VUB Bombay, YV2RC and YV3RC Caracas, W9XF Chicago, COH Havana, LKJ1 Jeloy, CT1AA Lisbon, EAQ Madrid, HJ4ABB Manizales, RW59 Moscow, CT1GO Parede, W3XAU Philadelphia, W8XK Pittsburgh, PRF5 Rio de Janeiro, 2RO Rome, W2XAD and W2XAF Schenectady, W1XAZ Springfield, VK2ME Sydney, HVJ Vatican City, YV6RV Valencia, OER2 Vienna, W2XE Wayne, and lastly HP5B Panama City.

My only difficulty in getting the DX stations is selectivity, or rather lack of it. The set is a four-valve battery-operated, home-constructed receiver, using a variable-mu H.F. pentode untuned, triode detector R.C. coupled to L.F. valve, transformer, and pentode output.

I am now looking forward to see details of a good battery short-wave superhet in your excellent paper.—C. A. HARLEY (Salisbury).

Paris Television Transmissions

SIR,—As a regular subscriber to your excellent paper, I have read with interest your report on the experimental transmissions of vision from Paris.

For some time past I have been receiving the London Television transmissions, and wishing to avail myself of the experimental vision transmissions from Paris I wrote to the Paris authorities. I received the following information, which may be of interest to other lookers-in:—

(1) Times of Transmission: *Monday*, 15.15 to 15.45; *Friday*, 16.00 to 16.30. Also special transmission on *Friday* evening at 20.30, Central European Time.

(2) *Wavelength*, 175 m.; *no. of lines*, 60; *no. of pictures per sec.*, 25.

Synchronisation: Similar system to that of London. There is a possibility of synchronising current supply systems being interconnected with that of Paris.

Scanning: horizontal. Picture ratio: 21 x 18.—C. N. RAFAREL (Acton).

Our Midget Receivers

SIR,—I am extremely interested in your series of midget sets. I am a chauffeur having a lot of waiting time, and a small set with L.S. is just what I require. I can tap the car battery for L.T. supply and the set can be fixed under the dash and an aerial fitted under the roof.—WM. ATHA (Ilkley).

SIR,—You ask readers to write to you about the type of midget receiver most suited to their requirements. I am an enthusiast for car radio, and as my car is an Austin Seven and the only available space very small, I have been unable to install a set in the car, but I hope that one of your midget sets will meet my requirements. I shall be pleased, therefore, if you could give me some information regarding these sets, where the parts, prints, and accessories are available, and their prices.—R. C. HATTON (Nuneaton).

[*Blueprints are obtainable from this office and parts from advertisers in this journal.*—ED.].

SIR,—What I would like to build is a battery-operated portable—small and light—preferably of the attaché-case type, that will get Droitwich and the nearest Regional or Midland at Land's End on a loud-speaker, but only sufficiently loud to be heard in a small room without annoying people in adjacent rooms.

The batteries need only be large enough to last a few weeks with about two hours' use daily.—G. THOMPSON (Birmingham).

SIR,—I read with interest your article on midget radio receivers. With Hivac valves, a 3-valve portable (S.G., det., output) should be practicable. I have worked out sets on these lines but was baffled over the sizes of batteries and loud-speaker, and also how to get the length of frame aerial required into a small space and still keep it inductive. It would be extremely gratifying to know that all these problems had been solved, and I look forward to future articles on the subject with great interest.—KEITH N. KEVENEN (Cheltenham)

A D.C. Mystery; An Alternative Explanation

SIR,—In reference to your explanation to W. W. N. (Old Ford) on page 368 of your June 8th issue, the point is that, even if the positive lead is earthed and the main switch in the off position, the set should not operate. The earthed wire of any electric supply company is termed the neutral wire, and no current can be drawn from this wire alone. The solution to the peculiarity is this, that the point from which current is derived is wrongly connected to the supply mains. Normally the neutral wire is taken direct to the point, and the live wire, or outer in the case of D.C. mains, *via* the switch, so that if the switch is off there remains a dead wire, and the neutral from which nothing can be taken. If the live wire went to the point and the neutral to the switch, there is always a potential between point and earth, irrespective of whether the switch is on or off, and that is how the set operated. This is a fault in wiring that supply companies should be more particular about.—H. J. PATTEN (Lr. Edmonton).

ZFD, Bermuda

SIR,—Since my last letter to you concerning my short-wave log, I would like to report that I have received a verification of reception of the short-wave station ZFD at Bermuda and, incidentally, a new Jubilee stamp of Bermuda. The following information has been sent concerning ZFD—"Transmitter ZFD is located at St. George, Bermuda, and operates on 10,335 kc/s (29.03 m.). No regular schedule is in effect. ZFD uses an aerial input power of 2 kw., and employs non-directional transmission. The transmitter is of British Marconi manufacture and is owned and operated by Cable and Wireless Ltd., London. ZFD is controlled from the Receiving and Control Station at Devonshire, eight miles distant from St. George."

I hope the information given may be of some use use to other readers.—C. A. HARLEY (Salisbury).

Transposed Aerial Systems

SIR,—In the issue of PRACTICAL AND AMATEUR WIRELESS for June 15th I note a letter from Messrs. Ward and Goldstone *re* my article Transposed Aerial Systems. Your correspondents do not agree that a transposed down lead eliminates static interference. With whom they disagree on this point is not stated. If they will re-read the article in question it will be found that whilst reference to the fact that a transposed aerial system will reduce static interference effects I make no statement that a system of this type eliminates such interference. Paragraph six under the heading Doublet Aerials will make this clear if other references do not. Whilst I appreciate Messrs. Ward and Goldstone's interest, I fail to see any justification for their misleading letter, and assume that my article has been misread, as grounds for misunderstanding would appear to be non-existent.—A. W. MANN (Middlesbrough).

CUT THIS OUT EACH WEEK.

Do you know

—THAT loss of high notes in the reproduction may often be traced to stray capacities in the H.F. portion of a receiver.

—THAT the window glass may be used as the dielectric of a home-made series-aerial condenser.

—THAT variable condensers should not be oiled to make them turn easily unless you are certain that friction is not relied upon for the electrical contact.

—THAT tuning coils, especially of the ganged type, should not be handled unnecessarily in view of the danger of the turns moving and the matching being upset.

—THAT in an A.C. receiver the leads carrying raw A.C. should be kept away from the H.F. part of the receiver, except so far as the heater supply is concerned.

—THAT this point is of particular importance in the case of a radio-gram. employing an A.C. motor.

—THAT a small spark gap in the aerial lead (with a connection to earth) forms a valuable safeguard in times of thunderstorms.

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

SIMPLE TRANSMITTING CIRCUITS

An Explanation of the Requirements of a Transmitting Circuit, with Some Practical Notes Regarding the Use of Such a Circuit Arrangement.

By FRANK PRESTON

DESPITE the fact that one or two elementary articles dealing with amateur transmission (particularly the article entitled "Amateur Transmission," in the issue dated May 12th, 1934), have previously been given in PRACTICAL WIRELESS, regular inquiries are being received for further particulars. It is principally for this reason that the present article is being written, and details will be given concerning the simpler types of transmitting circuits. It must not be overlooked by readers that it is a serious and punishable offence to set up and operate any form of transmitting apparatus without first obtaining the sanction of the Postmaster-General,

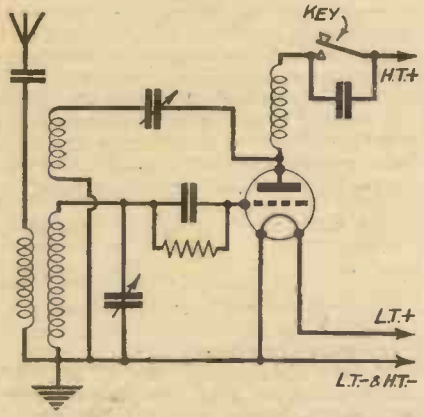


Fig. 1.—The simplest form of transmitting circuit; it is for morse only, the key being in the H.T.+ circuit.

since more than one "pirate" has been prosecuted even during recent times. For this reason readers who are interested in the transmitting side of wireless are asked to consider the present article as a sequel to the previous one referred to above, and to study the latter carefully before attempting to build any form of transmitter.

A Simple Oscillator

It should first be pointed out that a simple transmitter does not differ very much in principle from a single-valve regenerative receiver. The transmitting valve has to be set into oscillation, and the oscillations so produced are "modulated," either by speech frequencies or by a series of dots and dashes. The simplest form of transmitting circuit, therefore, is that shown in Fig. 1, which is obviously the same as that of a Reinartz receiver, with the exception that a morse key is used in the anode circuit instead of a pair of 'phones. The valve is made to oscillate by using a larger reaction winding or a reaction condenser of larger capacity than in the case of the average receiver. Once the valve has been made to oscillate—with the contacts of the morse key closed—morse can be transmitted simply by operation of the key.

To obtain good results, however, the valve should be of the large power type, and should be supplied with an H.T. voltage of at least 150. It will be clear, of course, that the key must be well insulated to prevent the operator receiving a shock, and that the particular circuit shown would be impracticable for a "full-blown" transmitter, due to the safe limitations of H.T. voltage naturally imposed. Keying may be obtained in many other ways, since the object is merely to prevent the valve from radiating oscillations except when the key contacts are closed. Thus, it would be possible to transmit by inserting the key in the H.T. negative lead, in the grid circuit, between the "earth" end of the tuning circuit and the valve filament, or in many other positions.

When telephony is to be transmitted a microphone (complete with the appropriate microphone transformer and battery) may be used in place of the key in any of the circuit positions mentioned; these connections will more fully be dealt with at a later stage.

The Beginner's Favourite Circuit

A very good and popular circuit for the beginner in transmission is that known as the "Hartley," and shown in Fig. 2. In this case also the key or microphone can be inserted in one of the positions described. First of all; however, it will be desirable to consider the requirements of a circuit of this nature, omitting the question of modulation. That portion of the coil L1 which is between aerial and earth serves as the aerial-coupling winding, and must be of the approximately correct inductance for the wavelength to be employed. The portion of L1 between the aerial and the anode circuit serves for reaction, and should normally consist of about twice as many turns as the aerial portion. The grid winding L2 is tuned, and must, in consequence, be designed to cover the particular wavelength range to be employed. The proportions of this coil are the same as those for the grid coil of a receiver, and are arrived at in precisely the same manner. For example, if the transmitter were to operate on the highest amateur wavelength range (151.1 to 173.4 metres), a winding, consisting of 15 turns on a 3in. diameter former, would be about correct. For a similar range the coil L1 would require to consist of about 40 turns of 4in. diameter.

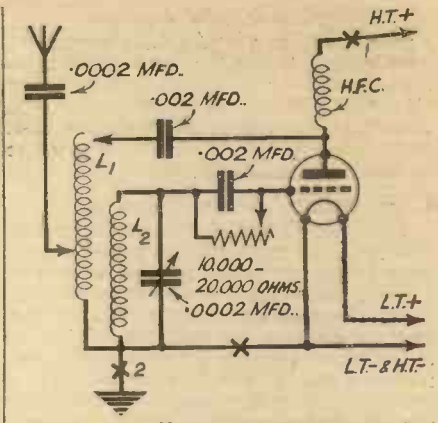


Fig. 2.—The Hartley transmitting circuit; a popular favourite. A microphone circuit may be connected at one of the points marked X.

The Tuning Coils

In a low-power transmitter it is essential to ensure the highest possible degree of efficiency, and for this reason it is usual to make the coils from ¼in. diameter copper tubing, the turns being spaced by about ¼in. As is well known, ready-made coils of correct type are available from such firms as Stratton and Co ("Eddystone"), Ward and Goldstone, and others. The coils are usually mounted on porcelain stand-off insulators, and can be bought for any wavelength range desired. In the case of the circuit illustrated, it is best to have the coupling between L1 and L2 variable, for which reason L2 is often so mounted that it can be rotated within one end of the larger-diameter winding. On the other hand, however, the coils can be made of similar diameter and provision made for moving L2 in relation to L1.

The optimum tapping points for the aerial and anode leads have to be found experimentally, but the tappings are readily transferable when using the bare copper tube if the leads are fitted with crocodile clips.

The tuning condenser must be of the low-loss, short-wave type, and may have a maximum capacity of about .0002 mfd. The fixed reaction condenser in the anode

(Continued overleaf)

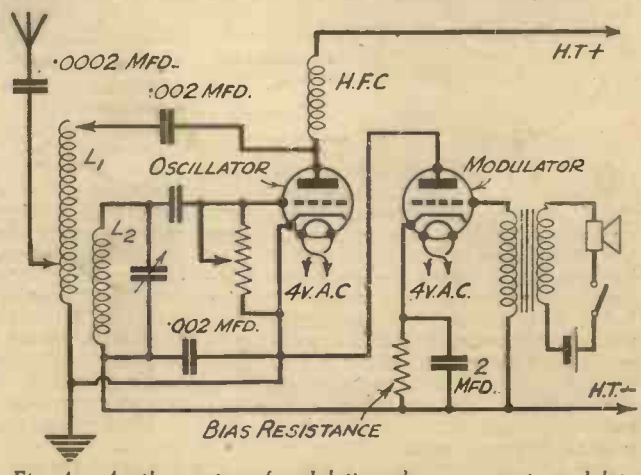


Fig. 4.—Another system of modulation where a separate modulator valve is employed, this being in series with the H.T.— lead. Separate L.T. windings should be used for supplying the heaters of the two valves.

(Continued from previous page)

circuit should be a good-quality component with mica dielectric, because it has to withstand not only the full H.T. voltage, but also the signal, or oscillating, voltage. Assuming the use of 200 volts for H.T. supply, the condenser should be rated to work at not less than 750 volts.

Component Values

With regard to the grid condenser and grid leak, the most suitable values depend very largely upon the type of valve employed, but in the case of one such as the PX4, the grid condenser should have a capacity of about .002 mfd., the leak having a resistance variable between 10,000 and 20,000 ohms. The H.F. choke should be a well-made component capable of carrying the full anode current of the valve employed and should have an inductance of something like 2,500 microhenries. It can be made by winding 250 turns of 30-gauge enamelled wire on a 2in. diameter former.

The H.T. and L.T. supplies can be obtained in the same manner as with a receiver, from batteries (u neconomical) or from a mains unit. In the latter case the valve filament can be fed from A.C., the H.T. being rectified and smoothed in the normal way. Practically anyt ype of power valve (either directly- or indirectly-heated) can be used, but the output from the transmitter will naturally vary with the rating of the valve and the H.T. voltage applied to it.

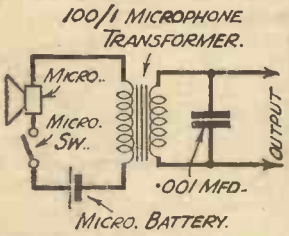


Fig. 3.—Showing the simple microphone circuit for modulation. It should be connected at one of the points mentioned in the text.

Systems of Modulation

Further particulars can now be given regarding the method of injecting the speech modulations. One of the best, although perhaps the simplest, method, is to connect the microphone circuit shown in Fig. 3 in the earth-return circuit at the point marked X in Fig. 2; this method is known as grid modulation, due to the fact that the microphone is actually in the grid-cathode circuit. Another method (anode-circuit modulation) is to connect the microphone circuit at the point marked X1. A slight variant of this is to connect the microphone transformer in series with the H.T. negative lead, and this is better from the point of view of safety. Yet another arrangement is shown in Fig. 4, where two indirectly-heated valves are employed. This method gives better control and deeper modulation, since the output from the microphone transformer is amplified by a second valve before being applied to the oscillator, but as the modulator valve is in series with the H.T. negative lead this entails a voltage drop, so that a higher initial H.T. voltage is required. Both valves may conveniently be of the same type, since the same amount of H.T. current passes through both.

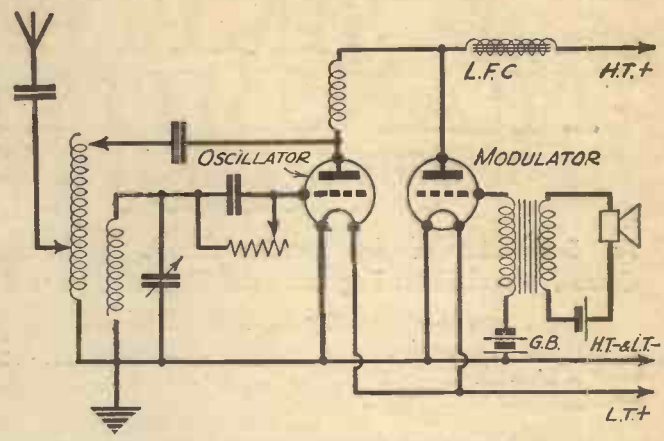


Fig. 5.—Showing a system of choke, or constant-current, modulation.

Another popular method of modulation—choke control, or constant-current modulation—is shown in Fig. 5, where the modulation is developed across the low-frequency choke in series with the H.T. positive lead. There are, of course, very many variants of the systems and circuits described, but all are similar in principle to one or other of the standard arrangements. It would be impossible in the course of a short article such as this to deal with one-tenth of the available transmitting circuits, but the object was only to give an insight into the principals concerned.

By T. Onearm

ANNOUNCED in the latest Columbia list is a great Italian tenor discovery. His name is Carlo Buti, and not only does he sing beautifully in the mellifluous Italian style, but sings as he feels, straight from the heart. Whether in the gay passionate strains of "On a balcony in Naples," or the dreamy "Sorrento," one cannot fail to notice the enchanting way in which Carlo Buti expresses himself. It is not surprising that the Columbia Company intend to star him as their leading tenor. Both airs are sung in Italian on *Columbia DB*1542.

For his latest Columbia record, Albert Sandler has turned to Jacob Gade, a celebrated Continental composer, for his subject. The titles are "Give me your Heart" (from "Hvorfor") and "Illusions," the fourth of a set of gipsy romances. Sandler has given tunes a lustre that will set them on their feet. The number of this record is *Columbia DB*1545.

A Musical Box of Miniatures

THE element of novelty in all the Orchestra Raymonde records is demonstrated at its best in a "Musical Box of Miniatures" just issued by Columbia. This double-sided record offers an abundance of pleasing airs and effects; there are pizzicato strings, tinkling bells, quaint staccato phrases, and a particularly lovely pianoforte solo of Rachmaninoff's famous "Prelude." This record, which is a *Columbia DB*1544, is a fine piece of recording.

"Softly Awakes my Heart," the most popular vocal piece composed by Saint-Saëns, has been recorded by more singers than any single operatic item, but it has not previously been issued in its original form—a duet between Delilah and Samson—as it appears on the Columbia list this month. This record brings a new artist to the Columbia list, Mlle. Germaine Cernay, of the Opera-Comique, Paris. Her associate is the famous Georges Thill of the Grand Opera, Paris—perhaps the greatest tenor living. This record, *Columbia LX*385, is an exceptionally fine one and you should make a point of hearing it.

Organ Train Effects.

A DARING and wonderfully life-like imitation of a train in action is furnished by Sidney Torch on the Edmonton Regal Organ, in "Orient Express," on *Columbia DB*1549. We first hear the express moving out of the station, the hiss of steam, grinding of wheels; thundering roar of the great locomotive as it gathers momentum and tears along the rails at terrific speed—all providing a background to the racy tune itself. It is an outstanding record.

The world's greatest duettists, Layton and Johnstone, are to end their partnership after an association lasting fourteen years. This is sad news for their many thousands of admirers, and each month's issues of their records will now be anticipated with greater keenness as being among the fine examples of the art of two truly great artists. We have them in the June Columbia supplement in "March Winds and April Showers" and "When the Robin Sings his Song Again" on *Columbia DB*1551, and "I Believe in Miracles," backed with Turner Layton singing "A Little White Gardenia" in his own inimitable style on *Columbia DB*1550.

A Humorous Record

NORMAN LONG makes a welcome appearance in the latest Columbia supplement with a couple of new songs. The first is "Anything Can Happen Nowadays," and such is progress these days it seems nothing is impossible—and the other is a cockney song, "Wot For." This latter song is about 'Arry and his incurable craving after importance. Even when told that a Beefeater's costume is hardly the thing for eating a cut off the joint, he still hankers after being Lord Mayor. This is the song, by the way, which Norman Long broadcast in the all-star variety programme on Jubilee Day. The number of this record is *Columbia DB*1547.

Whilst talking of humorous records, you should certainly hear Flanagan and Allen on their latest Columbia record, singing their two big song hits from the "Life Begins at Oxford Circus" production. The titles of the two songs are "Life Begins Again" which contains some of their famous "gags" and "Where the Arches used to be," written by Bud Flanagan. *Columbia DB*1548 is the number of this record.

Facts & Figures

COMPONENTS TESTED IN OUR LABORATORY

P. A. Amplifiers

DANCE bands, and various other social bodies, often find the need for a good public address equipment in order to entertain a large gathering of people. A radio-gramophone can often be supplied by a local dealer, but when the apparatus is required on more than one occasion it becomes more economical to have your own equipment. Electradix Radios, of Upper Thames Street, London, E.C.4, have a very extensive range of equipment ranging from the 2½-watt type up to 10-watt amplifiers, suitable for Universal or A.C. mains operation. One model, the Pentavox, will give an indication of the type of equipment. This gives an undistorted output of 6 watts from A.C. or D.C. mains for gramophone reproduction or with a microphone. The containing case measures 21in. by 15in. by 12in. and is of polished oak. A 30-ft. coil of extension cable and a transverse current microphone are provided, and the total weight is 40lbs. Independent mike and record fader control and tone controls are mounted on the panel, together with a main volume control. The microphone is fitted to a telescopic stand, and the complete equipment costs £12 10s. In most cases Messrs. Leslie Dixon are supplying the piezo-crystal type of microphone to their amplifiers as this is capable of such superior results. Leaflets describing this apparatus may be obtained from the above address.

"Megacite"

A NEW low-loss high-power-factor dielectric material has been specially produced by British Television Supplies, Ltd., for use as an insulator in high-frequency circuits. This will be very suitable for the ultra-short-wave instruments which are now being developed in connection with television and similar apparatus. B.T.S. are already employing Megacite in their popular short-wave coils, holders, chokes, etc., and it will be exclusively used in their wide range of new season's ultra-short-wave components. Full details of these will be forthcoming in a week or so.

Cavac Batteries

MOST suppliers of dry batteries have completely altered their types and prices in the last few months, and now Joseph Lucas, Ltd., makers of the well-known CAV products, have introduced a standard range of cells and an alternative cheap range under the name "Cavac." There are now super batteries of 60, 100, 108, and 120 volts ranging in price from 5s. 6d. to 10s. 6d., and standard batteries in 60, 99, 108, 120 volts priced from 3s. 9d. to 8s., the latter being a 120-volt battery with a 9-volt G.B. battery included. The new Cavac batteries are obtainable in 60, 100, and 120-volt types priced at 3s., 5s., and 6s. Grid-bias batteries of 9 and 16 volts are obtainable at 1s. 3d. and 2s. respectively.

Bulgin Low-loss Valve-holder

THE illustration below shows a new valve-holder having a Frequentite base produced by Messrs. Bulgin. This is fitted with silver-plated contacts and has integral soldering tags. For those who wish to adopt terminal connections there are terminals fitted to these tags so that both methods of connection are possible. Shake-proof washers are fitted to the terminals to prevent accidental or unwanted loosening. The contact sockets are split so that excellent contact is made with all types of valve leg. The holders may also be used for coils, and they will prove very efficient on the short waves owing to the special low-loss material used in their manufacture. Even so, the amount of this material which has been employed in this holder has been kept down to a minimum, and it is also kept clear of important points of high self-capacity. The price is 2s. 3d.

The new Bulgin "Frequentite" valve-holder.

Another new line from the Bulgin factory is a valve-holder for the new Midget Hivac valves. These holders are moulded in black bakelite, and are provided with nickel-silver leaf springs with integral soldering tags. The springs are slightly recessed so that the holder may be mounted on a wooden or metal chassis, and the strength of the springs is sufficient to ensure that the contacts on the base of the valve will be firm enough to prevent noises due to movement. As readers are by now aware, the valves are not fitted with pins at the base, but simply a round contact surface something after the manner of ordinary electric-light bulbs. The spring contacts on the holder are eyeletted into position, but no identifying letters are engraved on the base. This is not really essential, as the position of the bayonet slot provides a very clear identification point. The price of the holders is 1s. each.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

SLADE RADIO

MEMBERS of this society were recently invited to the Midland Telephone Exchange. They were shown lantern slides and films of how the apparatus works. After this, parties were taken by guides over the entire exchange, and were shown the old manual operated and the new automatic exchange apparatus. The guides gave a very thorough and interesting technical description of the circuits, and the most intricate electrical apparatus was demonstrated. This showed to what a high degree of proficiency the modern telephone has been brought. The evening was a great success.—Hon. Secretary, Chas. Game, 40, West Drive, Heathfield Park, Handsworth, Birmingham.

INTERNATIONAL SHORT-WAVE CLUB (MANCHESTER CHAPTER)

A GATHERING of short-wave "fans" has been arranged by the above Chapter to be held on June 30th, from 3 to 10 p.m., at the Assheton Arms Hotel, Long Street, Middleton, Manchester. Radio enthusiasts from various parts of England are attending this gathering. In the afternoon there will be a mass meeting, at which various speeches will be made, and at which a sixteen-valve all-wave receiver will be described and demonstrated. It is expected that representatives of the B.B.C. will also be present. This important gathering is open to all interested, and further particulars can be obtained by writing to the Secretary, Mr. R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, near Manchester.

THE RADIO, PHYSICAL AND TELEVISION SOCIETY

ON Friday, June 14th, members of the above Society spent an interesting evening, when member's 10 m. sets were tested, and various circuits for receivers and transceivers were dealt with on the blackboard. The most popular circuit used by members for high-frequency work seems to be an adaptation of the old Flewelling circuit, which utilises a very low value grid leak in order to obtain the quenching effect, and thus the extra expense of the quenching coils is done away with.

Later in the evening, Dr. C. G. Lemon demonstrated his improved 20-watt Class B amplifier, which has recently been improved.

New members are still wanted; no technical qualifications are needed, and a warm welcome will be given to any readers of PRACTICAL AND AMATEUR WIRELESS attending our meetings. Headquarters are at 72a, North End Road, West Kensington. For further details, apply to the Assistant Hon. Sec., M. E. Arnold, 12, Nassau Road, Barnes, S.W.13.

CATALOGUES RECEIVED

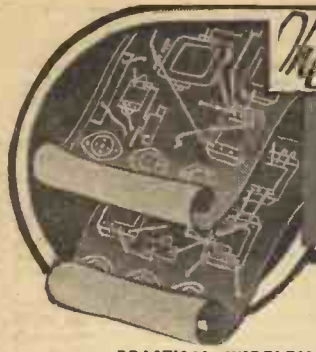
To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL AND AMATEUR WIRELESS, c/o. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.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

STATOFORMER LEAFLET

THERE are many listeners who experience interference from various sources on their wireless receivers, but who do not understand the causes or cures and are unable to understand technical explanations of them. A leaflet has now been prepared by Messrs. Ward & Goldstone setting out the various causes in simple language and describing their noise-free aerial system employing the Statoformer, together with prices. This leaflet may be obtained free on request from Messrs. Ward & Goldstone, Pendleton, Manchester.

B.T.S. RADIO PRODUCTS

THE latest list from Messrs. British Television Supplies contains interesting details and illustrations of apparatus designed for the home constructor. Amongst some of the items in this list may be mentioned L.F. transformers ranging from the simple model at 4s. 6d. to the tone-correcting model at 8s. 6d. The latter has a rising characteristic to correct high-note loss due to highly selective circuits, etc., but may be used in a straight circuit arrangement by connecting a .01 mfd. fixed condenser across the primary winding. Mains transformers, H.F. chokes, L.F. chokes, fixed condensers, volume controls, tuning coils, terminal mounts, and sundry other items will be found in this list which may be obtained upon application to the above company. A special short-wave and television list will be issued shortly.



The PRACTICAL AND AMATEUR WIRELESS Blueprint Service

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

PRACTICAL WIRELESS

	Date of Issue.	No. of Blprint.
Blueprints, 1s. each.		
Long-Range Express Three	—	PW2
Mains Express Three	8.10.32	PW3
Sonotone Four	15.10.32	PW4
Bijou Three	29.10.32	PW5
Argus Three	12.11.32	PW6
Empire Short-Wave Three	3.12.32	PW7
Solo Knob Three	10.12.32	PW8
Midget Two	17.12.32	PW9
Selectone Battery Three	14.1.33	PW10
Fury Four	—	PW11
Featherweight Portable Four	6.5.33	PW12
Q.P.P. Three-Four	4.3.33	PW13
Alpha Q.P.P. Three	25.3.33	PW14
Ferrocart Q.P.P. Hi-Mag. Three	25.3.33 and 1.4.33	PW15
Supersonic Six	8.4.33	PW16
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Selectone A.C. Radiogram Two	29.4.33	PW19
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Three-Star Nicore	24.6.33	PW24
D.C. Ace	15.7.33	PW25
Superset	19.8.33	PW26
Auto-B Three	19.8.33	PW27
All-Wave Two	19.8.33	PW28
A.C. Three	16.9.33	PW29
Premier Super	23.9.33	PW30
Experimenter's Short-Wave Three	23.9.33	PW30A
A.C.-D.C. Two	7.10.33	PW31
All-Wave Unipen	14.10.33	PW31A
F.J.C. 3-valve A.V.C. (Transfer Print)	4.11.33	PW32
Luxus A.C. Superhet	14.10.33	PW33
A.C. Quadpak	2.12.33	PW34
Sixty-shilling Three	2.12.33	PW34A
Nucleon Class B. Four	6.1.34	PW34B
Fury Four Super	27.1.34	PW34C
A.C. Fury Four Super	10.2.34	PW34D
Leader Three	10.3.34	PW35
D.C. Premier	31.3.34	PW35B
A.C. Leader	7.4.34	PW35C
Atom Lightweight Portable	2.6.34	PW36
Ubique	28.7.34	PW36A
Four-Range Super-Mag. Two	11.8.34	PW36B
Summit Three	18.8.34	PW37
Armada Mains Three	18.8.34	PW38
Midget Short-Wave Two	15.9.34	PW38A
All-Pentode Three	22.9.34	PW39
£5 Superhet Three	—	PW40
A.C. £5 Superhet Three	24.11.34	PW43
D.C. £5 Superhet Three	1.12.34	PW42
Hall-Mark Three	8.12.34	PW41
F. J. Camm's Universal £5 Superhet	15.12.34	PW44
A.C. Hall-Mark	26.1.35	PW45
Battery Hall-Mark 4	2.2.35	PW46
Universal Hall-Mark	9.2.35	PW47
Hall-Mark Cadet	23.3.35	PW48
Short-Wave Converter-Adapter	23.2.35	PW48A
F. J. Camm's Silver Souvenir (All-Wave Three)	13.4.35	PW49
F. J. Camm's A.C. All-Wave Silver Souvenir Three	—	PW50
Genet Midget Three	—	PM1
Cameo Midget Three	8.6.35	PW51

AMATEUR WIRELESS AND WIRELESS MAGAZINE.

CRYSTAL SETS.

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

STRAIGHT SETS. Battery Operated.

One-valvers : Blueprints, 1s. each.		
B.B.C. One-valver	—	AW344
B.B.C. Special One-valver	—	AW387
Twenty-station Loud-speaker One-valver (Class B)	—	AW449
Two-valvers : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans.)	—	AW388
Full-volume Two (SG.-Det., Pen.)	17.6.33	AW392
Iron-core Two (D, Trans.)	—	AW395
Iron-core Two (D, QPP)	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D, Trans.)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG., Trans.)	—	AW338A
Lucerne Minor (D, Pen.)	—	AW426
Family Two (D, Trans.)	—	WM278
Three-valvers : Blueprints, 1s. each.		
£8 Radiogram (D, RC, Trans.)	—	AW343
P.T.P. Three (Pentode-Triode-Pentode)	*June* '35	WM389
New Regional Three (D, RC, Trans)	25.6.32	AW349
Class-B Three (D, Trans, Class B)	22.4.33	AW386
New Britain's Favourite, Three (D, Trans., Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher, Chassis Model (SG, D, Pen)	3.2.34	AW419
Lucerne Ranger (SG, D, Trans)	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
P.W.H. Mascot with Lucerne Coils (D, RC, Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	—	AW424
Pentaquester (HF Pen, D., Pen)	14.4.34	AW431
£5 5s. Three: De-luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All Britain Three (HFPen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D. Pen)	3.1.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
Multi-Mag Three (D, 2 Trans)	—	WM288
Percy Harris Radiogram (HF, D, Trans)	*Aug.* '32	WM294
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Tyers Iron-core Three (SG, D, Pen)	*July* '33	WM330
C.-B Three (D, LF, Class B)	—	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
All-wave Three (D, 2LF)	*Jan.* '34	WM348
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans.)	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	*Oct.* '34	WM371
Graduating to a Low-frequency Stage (D, 2LF)	*Jan.* '35	WM378
Four-valvers : Blueprints, 1s. 6d. each.		
65/- Four (SG, D, RC, Trans)	—	AW370
"A.W." Ideal Four (2SG, D, Pen)	16.9.33	AW402
2 H.F.Four (2SG, D, Pen)	—	AW421
Crusaders' A.V.C. 4 (2 H.F., D, QP21)	18.8.34	AW445
(Pentode and Class-B Outputs for above: blueprints 6d. each)	25.8.34	AW445A
Quadradyne (2SG, D, Pen)	—	WM273
Calibrator (SG, D, RC, Trans)	*Oct,* '32	WM300
Table Quad (SG, D, RC, Trans)	—	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
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Lucerne-Straight Four(SG, D, LF, Trans)	—	WM350
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The H.K. Four	*Mar.* '35	WM384
Five-valvers : Blueprints, 1s. 6d. each.		
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New Class-B Five (2SG, D, LF, Class-B)	*Nov.* '33	WM340
Class-B Quadradyne (2 SG, D, LF, Class-B)	*Dec.* '33	WM344
1935 Super Five (Battery Superhet)	*Jan.* '35	WM379

Mains Operated

Two-valvers : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Three-valvers : Blueprints, 1s. each.		
Home-lover's New All-electric Three (SG, D, Trans) A.C.	25.3.33	AW383
S.G. Three (SG, D, Pen) A.C.	3.6.33	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF, Pen, D, Pen) A.C.	23.6.34	AW439
D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July* '33	WM328
Simplicity A.C. Radiogram (SG, D, Pen) A.C.	*Oct.* '33	WM338
Six-guinea A.C./D.C. Three (HF Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF Pen, D, Pen) A.C.	*Nov.* '34	WM374
Four-valvers : Blueprints, 1s. 6d. each.		
A.C. Melody Ranger (SG, DC, RC, Trans) A.C.	—	AW380
A.C./D.C. Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C.	8.9.34	AW446
A.C. Quadradyne (2SG, D, Trans) A.C.	—	WM279
All Metal Four (2SG, D, Pen)	*July* '33	WM329
"W.M." A.C./D.C. Super Four	*Feb.* '35	WM382
Harris Jubilee Radiogram	*May* '35	WM386

SUPERHETS.

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

PORTABLES.

Four-valvers : Blueprints, 1s. 6d. each.		
General-purpose Portable (SG, D, RC, Trans)	—	AW351
Midget Class-B Portable (SG, D, LF, Class B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	—	WM282
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM363
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM367

SHORT-WAVERS. Battery Operated.

One-valvers : Blueprints, 1s. each.		
S.W. One-valve	—	AW329
S.W. One-valve for America	—	AW429
Roma Short-waver	10.11.34	AW452
Two-valvers : Blueprints, 1s. each.		
Home-made Coil Two (D, Pen)	14.7.34	AW440
Three-valvers : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	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
Standard Four-valve Short-waver	*Mar.* '35	WM383

Mains Operated.

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

MISCELLANEOUS.

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

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

SPECIAL NOTE

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

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

Please note also, that queries must be limited to two per reader, and all sketches and drawings which are sent to us should bear the name and address of the sender.

Synchronous Motor

"I have a synchronous gramophone motor and this is mounted in the ordinary way, but as it may be started only by turning by hand I have not fitted a switch. I start it by turning it when desired, but have now noticed that it becomes very hot. Does this indicate that something is wrong, or is it necessary to cut off the electric supply when not being used?"—R. Y. (Yarmouth.)

THE current should not be left on when the turntable is motionless. Fit an ordinary mains on/off switch in one of the motor leads and switch off when not required.

Output Transformer

"I have an old moving-coil loud-speaker which has a tapped input transformer fitted to it. I have built a push-pull stage and should like to use this speaker to save the expense of a new one. Could I adjust the leads to the tappings on the primary so as to select one near the centre? If the exact centre is not obtainable would it affect results?"—N. R. T. (Blackpool).

ALTHOUGH the arrangement would function, even if you tapped the primary at a point one-third of the way along, the results would not be good. The push-pull stage must be accurately balanced for best results, and therefore it would be worth while to obtain a correct tapped transformer, or alternatively a tapped choke with which to feed your present speaker. To avoid the troubles of the extra iron, you could obtain a step-down tapped choke and connect it direct to the speech coil on the speaker and thus cut out the input transformer.

Midget Batteries

"Please could you tell me how much the Drydex H.T. midget batteries cost?"—M. W. (Liphook).

THE Drydex battery type X81 which was specified for the Cameo Midget receiver costs 3s. 6d. The accumulator which was specified for this receiver costs 7s.

Choosing a Speaker

"Will you please tell me what type of M.C. loud-speaker would be suitable for my Hall-Mark Three? Up to the present I have used an ordinary loud-speaker, but desire to get better quality from such a good little set."—L. G. M. (Slough).

YOU should, to obtain the best results, obtain the speaker which was specified. In general, however, it is not possible for us to state which is the best speaker for your own requirements, as we have no knowledge of your musical tastes, etc. It is always preferable when choosing a speaker to obtain one or two on appro. from your local dealer so that you may hear them under your own conditions. The preliminary selection may, of course, be made in the shop.

A Switching Peculiarity

"I am writing again *re* my Wireless League Three. When I switch off, just the instant before the switch snaps over, the set comes on at full volume. I cannot understand, from studying the circuit, how switching off the L.T. gives the increased volume."—J. H. B. (Nr. Chorley).

THIS is a peculiarity which is often experienced in a battery receiver, and unfortunately, there seems to be no really definite solution to the problem. In some cases the trouble is experienced in a battery receiver fitted with a three-point on/off switch. One point of the switch is joined to G.B. positive, and when switched off the G.B. contact breaks first, thus removing the bias and causing an increase in anode current and consequently a jump in signal strength. In other cases a fixed condenser is joined across the H.T. supply, and this discharges when the circuit is broken, and as the filaments do not extinguish immediately, there is a surge again producing the increase in signal strength. In other cases the filaments, as they extinguish, may arrive at some value which is capable of better results than when they are operated at 2 volts, and this gives the increase. Users of old-time receivers will remember how the filament rheostat was used to obtain this optimum filament brilliancy. Probably the above facts will enable you to find your particular cause and to effect a cure.

Mains Transformer

"I wish to wind a mains transformer, but am uncertain concerning the L.T. winding. I am using a cross-sectional area of the core of 1 sq. in. and propose to adopt a winding of 4 turns per volt. Is this correct? Secondly, what must I do about the L.T. winding if I decide to use more valves at a later date. Does the number of turns have any relation to the current which is to be carried?"—T. H. (Bath).

THE number of turns per volt is quite correct for that size of core assuming the use of standard stalloy stampings of the No. 4 type. With regard to the L.T. winding, you must calculate the number of turns according to the voltage required, and the current will then decide the gauge of the wire. In view of the fact that at some future date you may use more valves it would be preferable to wind the L.T. winding with a gauge of wire sufficient to carry the maximum current you will at any time require and use the four-turns-per-volt winding. Then when the transformer is constructed, measure the output with a good meter and if it is found that, owing to the thickness of the wire and the low current which is taken, there is a voltage rise, an artificial load may be placed across the winding to bring up the total current drain to that which you have computed in your working.

Coil Details

"I am building a small home receiver in which I do not want any switching or tuning, as the receiver is to be used by elderly people who know nothing of wireless. What would you advise me to do with regard to the tuning circuits?"—G. R. W. (Hackney).

IN view of your proximity to the London stations we presume you wish to have the choice of the two stations. We think the most suitable idea would be to obtain modern dual-range coils and to remove the connections to the switches used in the bases for wave-changing. Across the medium-wave sections connect a pre-set condenser, and short-circuit or remove the long-wave windings. Adjust the pre-set condensers for one station, and connect a second condenser across the windings, but joined to the switches, and adjust this for the second station. By this means the normal wave-change switch will change from one station to the other, and once adjusted there should be no necessity for re-tuning. It may be possible to gang an on/off switch with a volume control, but we cannot give you information regarding this point without knowing your desires concerning the actual circuit.

Miscellaneous Advertisements

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

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. Send 1½d. stamp for NEW ILLUSTRATED CATALOGUE.

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 m.a. Full Wave Rectifiers; A.C./D.C. types, 20 volts .18 amp. Filaments; Screen Grid; Variable-mu Screen Grid; H, HL, Power and Pentodes.

THE following types 5/6 each; 350v., 120 m.a. full-wave Rectifiers; 500v., 120 m.a. 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, 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, 1A6, 1C6, 1V, 12AS, 12Z3, 19, 30, 31, 32, 33, 34, 41, 49, 56, 57, 75, 76, 79, 82, 84, 6Z4, 85, 89.

LISSEN 3-gang Superhet Coils, with switching; listed 30/-, with circuit, 6/-. Straight ditto, 10/6.

12 TO 2,000 metres. Huge Purchase of All-Band 2-gang Coils from prominent British manufacturer. Fully screened with switching for S.G. Det. type receivers, 4 Separate Bands, 12 to 2,000 metres. 12/6 with circuit.

SPECIAL Offer B.T.H. Moving Coil Speakers, matched pairs, specially manufactured for McMichael Supervox; 8in. diameter, 1,500 ohms-7,500 ohms (1,500 speaker as choke, 7,500 ohms speaker in parallel with H.T. supply); complete with special dual output transformer for pentode; 15/6 per pair; A.C. kit for above pair, 12/6.

SONOCHORDE P.M. Moving-Coil Multi-Ratio Transformer. Ideal for battery sets, 10/6.

BLUE SPOT 29PM P.M. Moving Coil, Multi-Ratio Transformer. Handles 4 watts, 15/-.

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.

A LARGE Selection of Pedestal table and radio-gram cabinets by best manufacturers at a fraction of original cost; send for list.

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. 3-5 amps., C.T., L.T., 30/-; 300 v. 60 m.a., with 4 volts 3-5 amps., 37/6; 200v. 50 m.a., with 4v. 3-5 amps., L.T., 27/6.

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

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.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 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/-.

LISSEN 2-Gang Condensers, Uniknob Trimmer, Disc Drive, .0005 each section, 5/6.

DUBILIER Electrolytic Condensers, 12 micro-farads 20 volts, 6d.; 8 plus 4 microfarads, 500 volts, 4/-; 50 mf., 50 v., 1/9; 8 mf., 500 v., 3/-.

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

(Continued at top of column three)

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PILOT AUTHOR KITS

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COMPLETE KIT £3:17:6

Cash or C.O.D. Carriage Paid

Comprising Author's Kit of First specified parts to build the Cameo Midget 3 including special cabinet with panel and chassis, batteries and valves, less headphones.

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TEN TESTING INSTRUMENTS IN ONE!

Measures 0-6, 0-30, 0-120 m.a., 0-6, 0-120, 0-300 volts, 0-10,000, 0-60,000, 0-1,200,000 ohms, and 0-3 megohms. Complete with leads. Send only 2/6; balance in 10 monthly payments of 4/3. Cash or C.O.D. Carr. Paid. £2/0/0.

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(Continued from foot of column one)

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U.S.A. Electrolytic Condensers. 550v. peak working, standard tubular metal condenser, 4 mf., 8 mf., 12 mf., a real bargain, 1/9.

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/-.

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

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

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

PREMIER H.T. 10 Transformer, rectified output 200 volts 100 milliamps, 4 volts 1-2 amps., 4 volts 3-5 amps., 10/-; or with Westinghouse rectifier, 19/6.

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, 6yds. Systoflex, 1, 1.5, 2 or 2.5 mm., 1 yd. 7-way cable, 9ft. resincored solder, 6yds. push-back connecting wire.

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

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TELSEN Radiogrand Transformers, ratios 5-1, 3-1 (list 7/6), 2/9.

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TELSEN Intervalve couplers (list 10/6), ratios, 1-1, 10-1, 3/-.

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for any mains complete 6 watt Amplifier in cabinet with carbon Mike and stand, speaker and cables. **£12-10.**

6-watt ditto with Electric Gramo, tone control, &c. - - - - - - - - - - **£17.**

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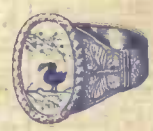
"I was startled to find myself enveloped by a horrid blackness"

MY husband held a decent position in London. Our home was well furnished; we kept a maid, and we owned a car.

Every now and again I went to Town on little shopping expeditions, never failing to scan a certain small jeweller's establishment in Oxford Street.

One day I beheld an inexpensive silver ring that took my fancy. I thought then—and still think—that it was of ancient Chinese workmanship.



I bought it and, leaving the shop with my purchase on my finger, boarded a bus. There was only one vacant seat, near the door, and I sank into it.

I was about to settle back comfortably when I was startled to find myself enveloped by a horrid blackness—that is the only word I can think of to describe the sensation. I couldn't have fainted, for I could still hear the conversation of the people around; I also felt the conductor brushing past me.

I seemed to be submerged in an inky flood, occasionally rising to the surface and gazing around helplessly, and then sinking back into unfathomable darkness.

My brain, however, worked normally enough for me to feel puzzled and alarmed. The ring on my finger seemed to add to my discomfort, and I mentally decided, when next I "came to the top," to exert all my will-power to remove it. It was a tremendous effort, but somehow I managed to draw the thing off and slip it into my bag. Strange to relate, I began to feel better almost directly . . . .

Scanning the faces of the other passengers, I beheld nothing but disgust and suspicion, and it slowly dawned upon me that they imagined I was intoxicated!

That night I told my husband about the peculiar "turn" I had had, and then put on the Chinese ring to show him how it looked. I got into bed still wearing it, and speedily fell asleep—to dream a most peculiar dream. . . .

This curious true experience and its amazing sequel are recounted in "THE CHINESE RING," published in the July WIDE WORLD MAGAZINE—the only monthly of its kind; the magazine which searches the four corners of the earth for true narratives stranger than the writings of the novelist. Other contributions in this issue include striking true stories from South America, Java, Australia, Persia, Canada, Arizona, Poland, etc. You'll enjoy the Wide World—it will enlarge your horizons!

W.C.E. 25

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