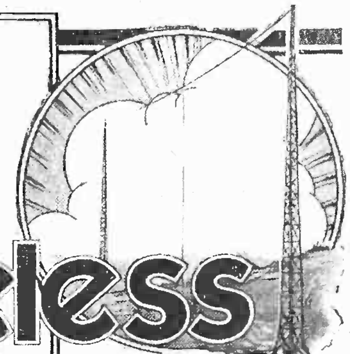
CIRCULATES IN EVERY COUNTRY IN THE WORLD!

Practical and Amateur Wireless



Edited by F. J. CAMM

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

VOL. V. No. 124. FEB. 2nd, 1935.

ROUND *the* WORLD *of* WIRELESS

Our Second Combined Issue

THIS is the second combined issue of those two famous journals, "Practical Wireless" and "Amateur Wireless." Just as we go to press we learn that the first issue is completely out of print, and letters from the readers of both papers are pouring into these offices bearing messages of congratulation on our important amalgamation, which, coming as it does in what promises to be the most important period in the history of wireless—for television is imminent—provides a most powerful force in radio journalism, destined to play a vital part in the perfecting of the new science.

This journal has, during the whole of its career, enjoyed a world-wide reputation. It circulates and is keenly read in every English-speaking country in the world. More, its contents have been translated and published in practically every country in the world!

An Enlarged Short-wave Section

And so "Practical and Amateur Wireless" will lead the way in the short-wave field. In anticipation of the turn which television developments are likely to take, last year we produced a valuable handbook dealing in a popular way with all of the branches of this fascinating new hobby—we refer to our "Television and Short-wave Handbook," many thousands of copies of which have been supplied to our readers. The publication of this book was, indeed, timely, for it is quite obvious that television and short waves will go hand in hand.

It is with especial pleasure, therefore, that we announce as from next week's issue a greatly-increased short-wave section, informative, up to date, and attractively illustrated.

The short-wave section of this journal has always been a popular and keenly-read feature—the best, in fact, in radio journalism; but the needs of this branch of radio telephony have rapidly outgrown the space allocated to it. So we are providing it next week with ampler quarters, enabling our Short-wave experts adequately to deal with all branches of it.

> *Owing to the Growing Importance of Short-wave Radio, we take pleasure in announcing that as from next week's issue, the Short-wave Section of "Practical and Amateur Wireless" will be developed and enlarged.*

A Twenty Hour Day!

THE German high-power long-wave station has extended its transmissions, and is now on the air on most days from G.M.T. 05.00 until 01.00 the following morning. Cologne, Frankfurt, and Stuttgart are now also late birds, and many nights weekly may be heard working long past midnight.

100-Kilowatter for Manchukuo

THE Manchuria Telegraph and Telephone Company has installed a high-power station at Hsinking, the capital city of the new Kingdom of Manchukuo. So far it is the most powerful broadcasting station in the Far East, and is to be used to combat propaganda transmitted to that region by the Soviet transmitters. The broadcasts are regularly picked up in Kharbin, Mukden, and in the later evening hours, in Japan.

New Wireless Electric Clock

IT is reported that at one of the principal New York railway termini, engineers have installed a clock which is entirely controlled by radio transmission. The clock is operated from the Arlington wireless station. All clocks on the railway system are now being set in accordance with this novel timekeeper. If, after several months' testing, the principle gives full satisfaction, similar clocks are to be installed in other public institutions.

Listen to Mexico

NOW that broadcasts from the United States and from the Argentine Republic are regularly heard in the United Kingdom, an effort should be made to tune in some of the Mexican radio entertainments. Stations already logged here are XENT, Nuevo Laredo, 267.7 metres (1,120 kc/s); XEW, Mexico City, 337.1 metres (890 kc/s), and XEPN, Piedras Negras, 508.5 metres (590 kc/s). Broadcasts from XEW are particularly well received on favourable nights between G.M.T. 02.00—04.30. The interval signal is reminiscent of a clock chiming the quarters (four bells). Announcements are made in both Spanish and English.

When You Miss the B.B.C. Weather Forecast

AIR MINISTRY weather forecasts and reports are transmitted daily from Heston Airport (Middlesex) on 1,202 metres (249.5 kc/s) at G.M.T. 08.45, 09.30, then hourly, with the exception of 13.30, until 16.30 during the winter months. Although they are essentially destined to civil aviation, the broadcasts are very useful to the general public.

Holland's Time Problem

THE Dutch Government is considering a proposal to adopt Central European time. The suggestion of making the clocks in that country coincide with G.M.T., as is the case in Belgium, has been turned down. So far, Dutch time is twenty minutes *behind* Central European time, a condition which somewhat complicates railway time tables.

ROUND the WORLD of WIRELESS (Continued)

Belgium's Proposed Third Transmitter

ALTHOUGH the idea of a third station for this little Kingdom had been cast aside in favour of an increased power for the twin transmitters at Velthem, near Louvain, which broadcast the Brussels No. 1 and No. 2 programmes, the suggestion has now been revived by one of the political parties, and is receiving serious consideration. A definite proposal has now been put forward to erect a third station on the Eastern frontier.

INTERESTING and TOPICAL PARAGRAPHS

To Honour the Marchese Marconi

AT the birthplace of this famous radio pioneer, Bologna (Italy), it has been decided to build a 50-kilowatt transmitter entirely of Italian manufacture. It will be run by the E.I.A.R. (the Italian Broadcasting Authorities), and is to be known as the *Stazione Guglielmo Marconi.*

Another Russian Giant

THE Soviet Government, in order to provide adequate service to the Siberian republics, and also for transmissions to listeners dwelling in the Manchuquo and Japanese Empires, have planned a 500-kilowatt transmitter to be installed at Khabarovsk. It is to be built on the same lines as the high-power Moscow station.

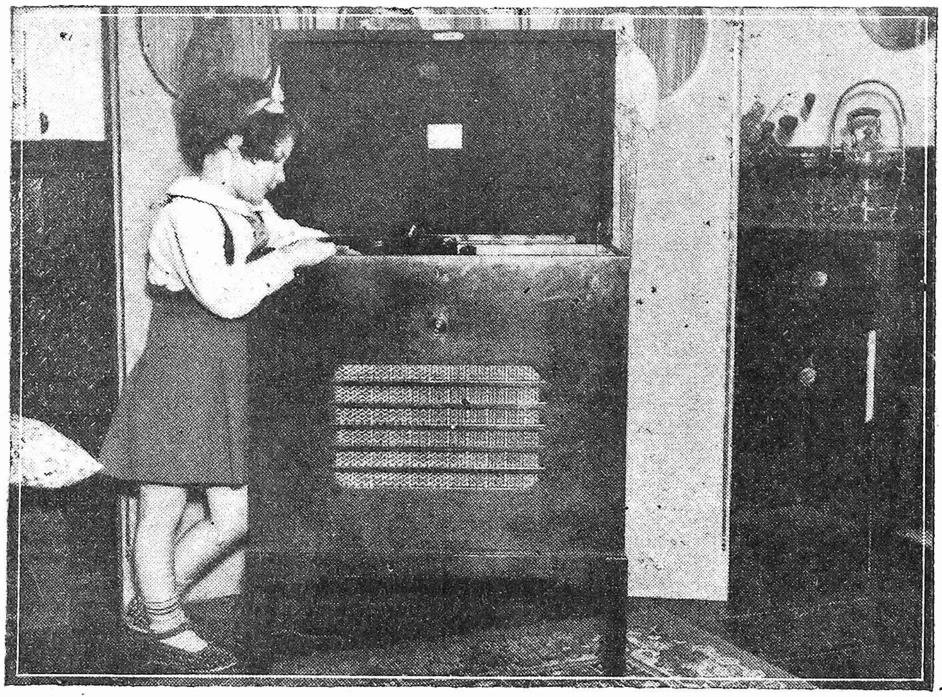
Droitwich's Berlin Rival

THE 150-kilowatt transmitter to be built at Brueck, some thirty miles from Berlin, according to a German report, will prove the most up to date of all European stations. A new aerial system consisting of seven pylons, 825ft. high, set in a circle, will, it is stated, prove an effective cure of "fading."

New Polish Broadcaster

TESTS are now being carried out on 304.3 metres (986 kc/s) by the new 24-kilowatt station erected at Mokre, near Torun (Poland). As the transmissions are purely of an experimental nature, the call heard, in the course of the broadcast, may be that of the Warsaw studio from which the programmes are relayed.

THE YOUNG IDEA



A small enthusiast preparing a programme to be heard on her "His Master's Voice" "Superhet Fluid-light Autoradiogram."

The B.B.C. Symphony Orchestra

THE B.B.C. Symphony Orchestra continues its provincial tour, visiting Bristol on February 13th. Its subsequent visits are Birmingham, February 27th; Dundee, April 2nd; and Brussels, March 12th. So much interest has been occasioned at Bristol by the visit of this enormous orchestra, which is the biggest permanent musical combination in Europe, that the B.B.C. has already received an inquiry for a block of tickets of 400 from one school.

"Mother Goose"

ON February 2nd, Francis Laidler's pantomime, "Mother Goose" (founded on the book by J. Hickory Wood), will be relayed to Northern listeners from the Theatre Royal, Leeds. The cast includes Vera Lennox (Principal Boy), Connie Graham (Mother Goose), Albert Modley (Jack, the Widow's Son), and Olga May (Principal Girl). A Flying Ballet, a Rolls Royce Chorus, and a troupe of Little Sunbeams will also take part.

Wagner's Music from Manchester

THE second half of the William Rees Society's Concert will be relayed to Northern listeners from the Milton Hall, Manchester, on February 2nd. Conducted by William Rees, the William Rees Orchestra will play a programme of Wagner's music, including "Forest Murmurs," from "Siegfried," "Dreams," and the Overture to "Tannhäuser." Supported by the orchestra, Frank Titterton, well-known Northern tenor, will sing "The Prize Song" from "The Mastersingers."

Choral Concert from Ulster

TWELVE Belfast choirs, totalling in all something over four hundred voices, will be seen on the platform of the Ulster Hall on February 1st, when they will appear at a concert given in co-operation with the Belfast Corporation.

"Breakfast in Evening Dress"

CHARLES BREWER, one of the producers of the Light Entertainment Department, has written the book of a musical comedy called "Breakfast in Evening Dress," to be broadcast on February 6th. The music is by Alan Paul. The story revolves round the extraordinary steps needed to comply with a most eccentric will. The cast is a strong one, headed by Wynne Ajello. Opposite her will be Michael Cole, while the humour is in the hands of Dick Francis and Claude Hulbert. Supporting these are Gladys Marlowe, Cyril Nash, and Ernest Sefton. Mark Lubbock will conduct the revue chorus and the B.B.C. Orchestra.

Recital of Russian Songs

MADAME SPIRIDOVITCH is giving a song recital in the National programme on February 10th. She is a well-known Russian singer of Russian gipsy and folk songs and has a large public in Paris. In this recital she will include, in addition to Russian songs, a group of Neapolitan folk songs and also a group of songs by Gretchaninoff.

Rugby Male-voice Choir

THIS well-known choir, which was founded over twenty years ago, will give a programme of part songs in a Midland studio on February 3rd. The conductor, Mr. George Pritchard, was responsible for the reorganisation of this choir in 1930, and since then it has won many awards. In the same programme Winifred Browne, the Birmingham pianist, will play Dr. Byrd's Pavan, "The Earle of Salisbury," and other pieces.

(*Continued on page 733*)

SOLVE THIS!

Problem No. 124.

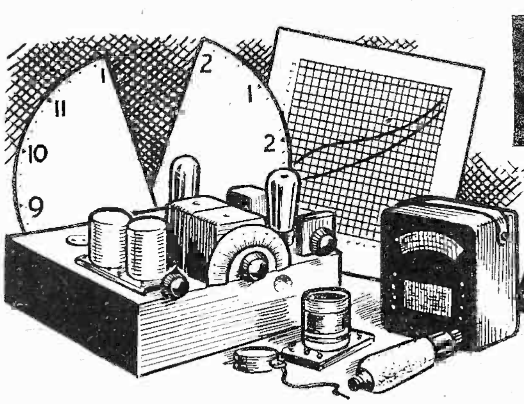
Wilkinson built a three-valve variable-mu battery-operated receiver employing separate dual-range tuners for the aerial and inter-valve circuits. These tuners were not fitted with their own wave-change switches, but a three-point on-off switch was used to short-circuit the long-wave windings of the two coils. On completion of the set it was found that fairly good reception was obtained, but the volume-control potentiometer used in conjunction with the variable-mu valve was inoperative on the medium-wave band. What mistake had Wilkinson made?

Three books will be awarded for the first three correct solutions opened. Mark your envelopes Problem No. 124 and address them to: The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Entries must be received not later than first post on Monday, February 4th.

Solution to Problem No. 123.

The anode resistance in Welbeck's receiver had developed an open circuit, so that there was scarcely any voltage reaching the anode of the detector valve. A very low voltage was passed on to the valve due to leakage, but this was not sufficient to provide reaction.

The following three readers have correctly solved Problem No. 122, and books are being sent to them: J. Orr, 9, West End Place, Edinburgh; W. Shortland, 34, Malvern House, Stamford Hill, N.16; J. Dawney, 39, Courtenay Gardens, Upminster, Essex.



HALF-HOUR EXPERIMENTS

By BERNARD DUNN

> Details are Given for the Construction and Calibration of a Multiple Testing Unit Employing a Moving-coil Milliammeter of Any Type.

SEVERAL readers have expressed interest in the articles in this series that have dealt with the question of taking voltage and current measurements, and have asked for more complete particulars. They have pointed out that although the details given were sufficient to enable them to calculate the values of shunt and series resistances when converting a milliammeter for universal readings, they prefer to eliminate mathematics as far as possible. Even those readers who have no fear of the calculations involved are in many cases "stumped," due to the fact that they are unaware of the resistance of the particular milliammeter that they happen to possess.

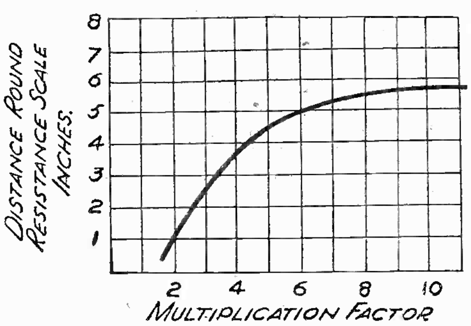


Fig. 1.—A graph can be made to obtain calibration points for currents higher than those for which the battery is suitable by drawing a graph as shown here.

It would therefore seem to be very desirable this week to deal more fully with the matter of making a multi-purpose test instrument, making the information so general that it can be applied in any particular case, and of such a form that mathematics of every description can be ignored. It must be made quite clear that the degree of accuracy to be secured by following the methods to be outlined will not approach the 100 per cent. mark, although it will be adequate for all normal purposes, when a tolerance of, say, 5 per cent. is easily allowable.

A Suitable Meter

The first requirement is a moving-coil milliammeter—this is essential, for a cheap meter of the moving-iron type is entirely unsuitable for our purpose. The meter may be one having a full-scale reading of between 1 and 10 milliamps, and the resistance of this will in all probability lie between 100 ohms (for the lower reading) and 10 ohms (for the higher reading). In the same way it may be considered for the preliminary experiments that meters with other readings will have resistances in the proportions mentioned. That is, a 2-milliamp. meter will have a resistance of about 50 ohms, and a 5-milliamp. meter will have about 20 ohms resistance.

Variable Shunt Resistance

For increasing the current reading of the meter it will first of all be necessary to obtain a variable resistance or potentiometer (*not* of the graded type) having a resistance value of about twice that of the meter, and this should be of the type having a definite "off" position; in other words, the slider should leave the resistance element at one end of its travel. Alternatively, the resistance purchased may be of the type fitted with an on-off switch, since this will produce the same effect. Variable resistances with values between 2 and 50 ohms (type FR), or from 50 ohms upwards (type ST5C) are made by Colvern and cost 3s. 6d. each. As an alternative to buying a new component it will often be found possible to re-wind an existing potentiometer with 36-gauge Eureka resistance wire, which has a resistance of approximately 15 ohms per yard, or with 40-gauge Eureka, which has a value of about 37 ohms per yard.

The method of connecting the variable resistance is shown in Fig. 3, where it will be seen that the centre terminal (slider) is connected to one terminal of the milliammeter, and one of the end terminals is joined to the other terminal of the meter. The next task is to calibrate the resistance for various "multiplication factors." This means that a large circular paper or celluloid scale must be made to fit under the mounting nut, and that a corresponding pointer should be fitted to the knob. Another method is to use an old condenser dial, gluing a ring of white paper round its bevelled edge.

Current Calibration

Now connect the meter in series with a battery and fixed resistance, as shown in Fig. 3, the resistance being of such a value that the meter shows practically a full-scale deflection. This means that, assuming the use of the 6-volt tappings of an H.T. battery, the resistance should be 6,000 ohms for a 1-m.a. meter, 3,000 ohms for a 2-m.a. meter, about 1,200 ohms for a 5-m.a. meter or 600 ohms for a 10-m.a. meter. The full-scale reading should be obtained when the variable resistance is in the "off" position, or is disconnected. Make a very careful and accurate note of the exact reading, and then rotate the knob of the variable resistance until the current passing through the meter is exactly halved; that setting of the resistance will give a "multiplication factor" of 2, or, in other words it will double all the scale readings obtained. Therefore make a mark on the resistance scale and place a figure 2, 4, 10 or 20 beside it, according to whether the meter normally reads up to 1, 2, 5, or 10 milliamps.

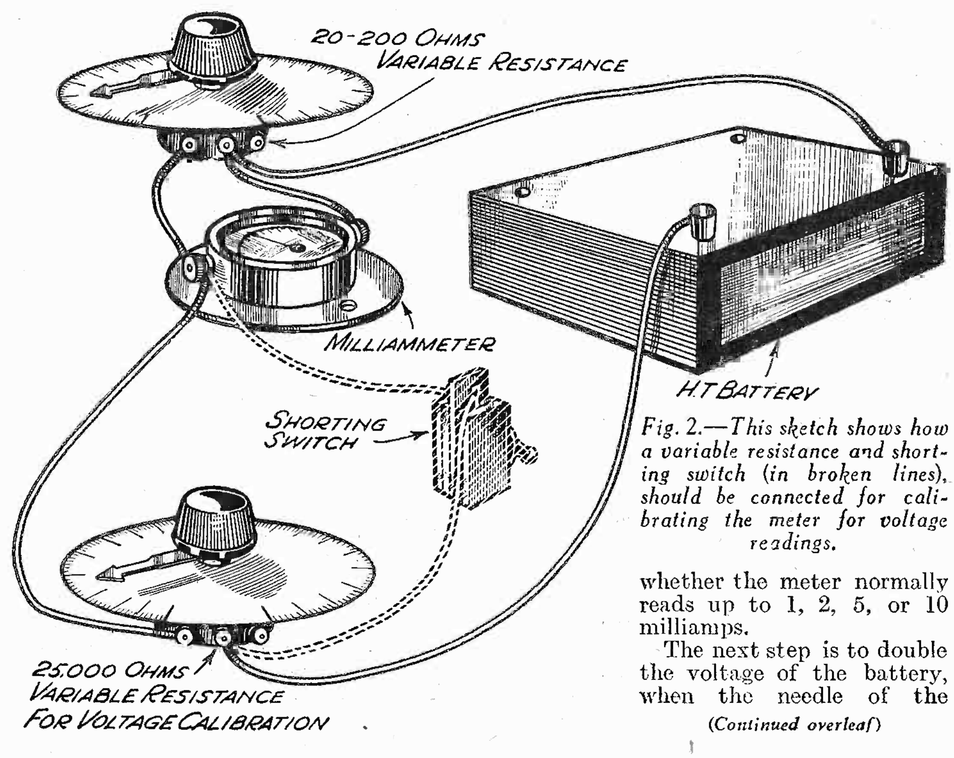


Fig. 2.—This sketch shows how a variable resistance and shorting switch (in broken lines), should be connected for calibrating the meter for voltage readings.

The next step is to double the voltage of the battery, when the needle of the

(Continued overleaf)

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meter should return to its first position. The process previously described should then be repeated to determine the setting of the parallel resistance that gives a "multiplication factor" of 4. This method of calibration may then be repeated until the "multiplication factor" is such that the maximum current that can be read is about 25 milliamps, although if a super-capacity H.T. battery, or a set of H.T. accumulators, is available it may be continued up to 100 milliamps or so, taking care that this heavy current only flows for a second or two.

It might seem that the limit of calibration has been reached at much too low a value, but further calibration points can be obtained by drawing a graph showing the positions of the resistance pointer that have been located. For instance, if the distances of the marks around the circumference of the scale are measured—by means of a tape measure, say—and plotted on a sheet of squared paper against the "multiplication factors," as shown in Fig. 1, a variety of other calibration points can be located with fair accuracy.

Measuring Voltages

Having made the current calibrations, it will next be necessary to provide for voltage measurements, and this can be done by connecting a variable resistance in series with the meter, as shown in Fig. 2. The resistance in this case should be of much higher value than before, the resistance being approximately 25,000 ohms to give a maximum reading of 100 volts with a 5-milliamp. meter, or with the parallel resistance set to ensure a full-scale deflection of this amount. If the meter gives a maximum reading of 10 milliamps., the same value of resistance can still be used, but the adjustments to be described will then be made until the meter shows a reading of only one-half of the maximum.

The idea is to connect the meter and series resistance in series with a 100-volt battery (a new one of reputable make is best), first setting the resistance to its "all-in" position. In these conditions a reading of rather less than 5 milliamps. should be obtained, but a slight variation of the resistance should bring the reading to exactly 5 milliamps. A word of warning is necessary here, because if any mistake were made in connecting the series resistance, or if the component were faulty, there would be a danger of damaging the meter. To avoid anything of this kind it is best to start by inserting the wander plug into the 1½-volt socket, advancing it by short steps until the full voltage is reached, if it is found that the meter reading is always below the maximum.

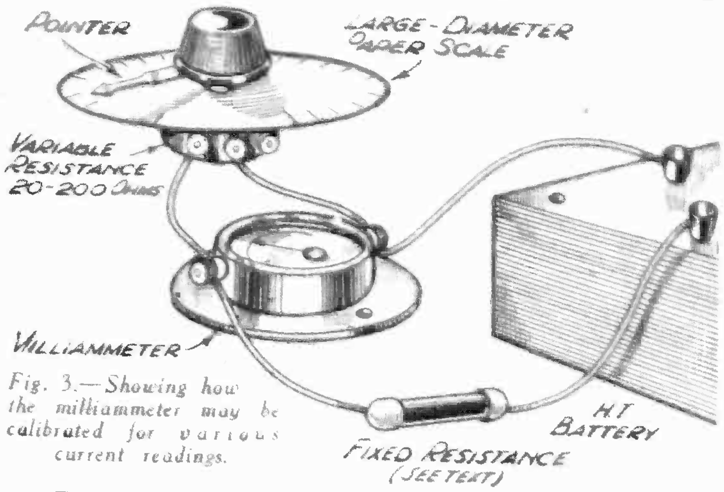


Fig. 3.—Showing how the milliammeter may be calibrated for various current readings.

Up to 400 Volts

Having found that the resistance is of suitable value a scale can be made for it similar to that used for the parallel resistance, and this can be marked with the position of the pointer for the 100-volt reading. Readings up to 200 volts or 400 volts can then be obtained simply by moving the parallel resistance from the 5-milliamp position to those giving 10 and 20 milliamps respectively. On the other hand, the same result could have been achieved by using a 100,000-ohm series resistance and, after finding the setting for 100 volts, rotating the knob until the meter showed a half-scale (200 volts maximum) or a quarter-scale (400 volts maximum) reading. The latter method is better in some respects, because it makes for simplification and avoids the possibility of confusion between the two controls.

It is not satisfactory, however, when voltages lower than 100 are to be measured, and it will generally be desirable to calibrate the meter for reading up to 10 volts or so. When using the 25,000-ohm resistance, this can be done by reducing the voltage of the H.T. battery to 9, and then setting the resistance until a reading equal to nine-tenths of that of the whole scale is obtained. Other scale readings can be obtained by following the same idea.

Mounting the Parts

It is scarcely necessary to give practical details concerning the assembly of the two variable resistances and the meter in a box, since every experimenter will be able to devise a suitable arrangement. A cigar box, however, might be suggested as a container for the components, and a long flexible lead, or plug sockets, can be fitted for connection purposes. A switch will be required for cutting out the series resistance when taking current measurements, and this will be connected as shown in broken lines in Fig. 2.

Short Wave Notes

LONG-DISTANCE DAYLIGHT RECEPTION

Stations to Search For During the Hours of Light

HAVE you tried your receiver out during daylight? If so, you were doubtless surprised at the number of stations which provided loud-speaker reception. If not, you have a pleasant surprise awaiting you. During the mornings, Hilversum, Fécamp, Breslau, Berlin, Langenberg, Athlone, Rome, and a host of other stations provide good loud-speaker reception upon the average receiver. Many distant stations are also audible.

For instance, Budapest provides a good programme during the afternoons, and this station can frequently be heard well as early as 1 p.m. In roughly the same direction, but farther afield, Ljubljana, the well-known Yugo-Slavian station, provides a moderately powerful signal upon many occasions.

Russian Stations

Special attention should be given to Russian stations, for many of them are audible during daylight. Perhaps you have heard RW39, Moscow-Stalino, which operates upon 386.6 metres. If not, I certainly recommend you to tune to that wavelength upon some afternoon—this station provides an astonishingly good signal upon most occasions—when, unless conditions are bad, you will hear Moscow. Because Toulouse PTT and Fredrikstad operate upon its wavelength during the night this station is best heard during daylight. If you are fortunate you may hear Astrakan, RV35, which, although located near the Caspian Sea, provides a good signal upon many occasions.

Some persons—the writer among them—consider that long-distance reception is unobtainable from Europe. In short, we feel that any part of Europe is too near to be labelled "DX."

Asia During Daylight

Therefore DX enthusiasts will be interested to know that what is termed "DX" reception is forthcoming during daylight. Tashkent, on 1,170 metres, provides a good signal upon most afternoons despite the fact that it is just north of India. Even more remarkable is Alma-Alta. This station, which is situated north of Burma, may be heard around 410 metres on most nights after 11 p.m. More remarkable still is the fact that it provides a fair signal during the daylight.

Other Russian stations worth looking for are: RW49, Tomsky, which operates upon 554 metres; Makhatch, 563 metres, and either Nijni-Novgorod or Gorki (RW42) which both operate upon 598 metres. All the above, and many others, are audible during the afternoons unless conditions are particularly bad.

America in the Afternoon

Occasionally one or more American stations can be heard during the afternoon, but this is uncommon. When American stations do come in they are generally situated between 200 and 220 metres. On one or two occasions, however, WBZ, Boston, on 301 metres, has been heard as early as 1 p.m., and it is quite possible to hear this station at fairly good volume around 7 p.m.

On occasions WKBW, Buffalo; WGAR, Cleveland; WLAC, Nashville; and WJSV, Washington, are audible at moderate strength. However, the reception of America during the afternoon is, as remarked above, rather rare. Between the hours of 6 and 9 p.m. many American stations can generally be heard and, because many are low-powered stations broadcasting DX programmes, are generally worth receiving.

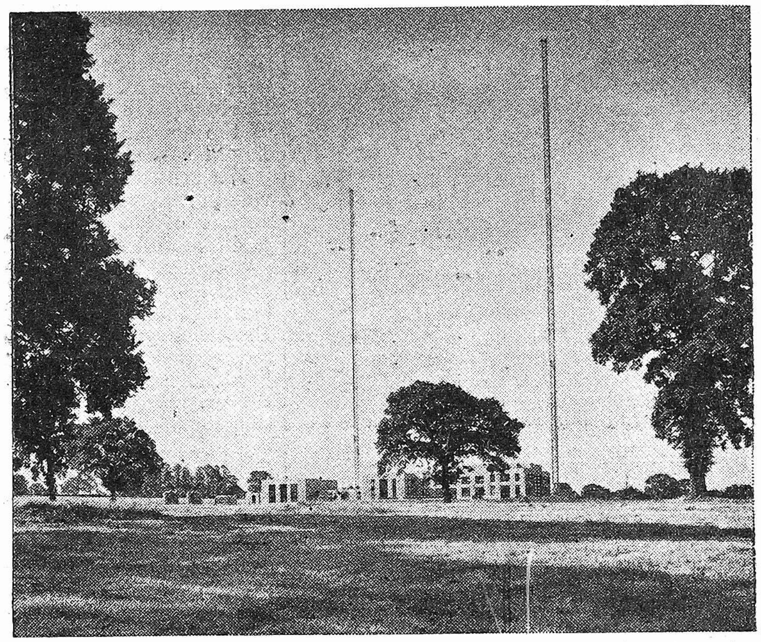
Africa Also

In conclusion, another station may be mentioned which is heard best during daylight. It is Cairo, on 480 metres. During the evening it is interfered with by Brussels, but during daylight it provides a passable signal on most occasions.

MAKING A DROITWICH SUPPRESSOR

Full Constructional Details are Given in this Article of an Easy-to-make Wavetrap for Cutting Out Interference from the Powerful Droitwich Station.

By W. B. RICHARDSON



A general view of the Droitwich transmitting station from the north side.

SINCE the opening of the new high-power transmitter at Droitwich many listeners are experiencing considerable interference on the long-wave bands. In fact, in some cases this station spreads over practically the whole of the dial and renders the reception of other stations almost impossible.

In such instances the usual dodges for increasing selectivity are entirely inadequate. For example, the use of a small condenser connected in series with the aerial, or the employment of a smaller aerial would only sharpen the tuning at the expense of volume. In most cases the degree of selectivity required is such, that the loss in sensitivity attendant upon these methods would be too great. In other words the weaker stations would probably disappear altogether. A better solution is to be found in the use of a wavetrap. This consists of a small unit which is connected between the aerial and the receiver. The unit comprises a tuning coil and a variable condenser and can quite easily be made up from odds and ends obtained from the average constructor's junk box.

How It Works

Before engaging on the construction of the actual unit it is just as well to have some idea of the principle on which it works. Reference to Fig. 1 will show that the coil and condenser are connected in parallel in just the same way as an ordinary tuning circuit. Actually there are two condensers shown—one fixed and one variable—but this is done for practical reasons. Theoretically this amounts to the same thing as using one condenser.

The coil and condenser together form what is called a *resonant rejector circuit.* The action of this will no doubt be clearer from a study of Fig. 2 which shows the basic circuit. Such a circuit will *resonate* at a certain frequency dependent on the values of the inductance (coil) and the condenser. This means that if an alternating voltage of this particular frequency be applied to the circuit at the points A, B, it will set up an oscillating current in the circuit as indicated by the arrows. This oscillation gives rise to an alternating voltage at A, B, which absolutely coincides in point of time and magnitude with the applied voltage (this is assuming that the circuit has no resistance). Therefore no current can flow through the circuit from outside. It is this property which is made use of in a wavetrap. If a resonant rejector circuit of this type be connected between the aerial of the receiver, as in Figs. 2 and 3, it will prevent any alternating current flowing through it which has the same frequency as the resonant frequency. Of course, by the choice of suitable values for the inductance and the condenser the circuit can be made to resonate at any desired frequency. In the case of Droitwich, therefore, the wavetrap is designed to resonate at 200 kilocycles. It thus acts as a barrier to signals from this station. Actually is does not offer a *perfect* barrier, although it allows only a very small current to pass. This is because in practice the rejector circuit always contains some resistance.

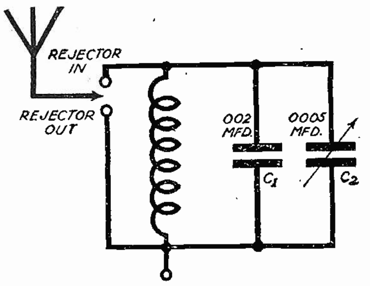


Fig. 1.—Circuit diagram of the eliminator.

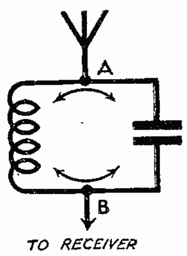


Fig. 2.—A simple rejector circuit.

In the rejector shown here, approximate values are chosen for the inductance and condenser and the final adjustment is made by means of the variable condenser C2. When the eliminator is connected to the receiver its effect is to reduce the sensitivity of the latter to practically nil at 200 kilocycles. However, the sensitivity increases rapidly on either side of this point, and thus other stations can be received on other parts of the scale. Incidentally the selectivity of the unit is an important point, since it is highly desirable to confine the rejector action to just the frequency of Droitwich and for it to pass all frequencies on either side of this point. If the tuning is flat the rejector action will decrease only slowly on either side of the 200 kilocycles point and thus other stations nearby will be also reduced in strength.

The degree of selectivity depends on the ratio of inductance to capacity. Thus with a large inductance and a small capacity the tuning will be comparatively flat while a small inductance and a large capacity will give a more selective circuit. In the unit described here a coil of 100 turns of wire is used in conjunction with a total capacity of about .0025 mfd. On the other hand it would be quite in order to use a coil of 150 turns and a condenser of .0005 mfd. This would have an even more powerful rejector action at the resonant frequency, but there would be some reduction in the strength of nearby stations as well.

Constructing the Unit

The Droitwich eliminator consists essentially of a tuning coil wound on a 2in. cylindrical former, a fixed condenser, and a variable condenser for making the final adjustment. The coil consists of 100 turns of 28 gauge d.c.c. wire wound in a single

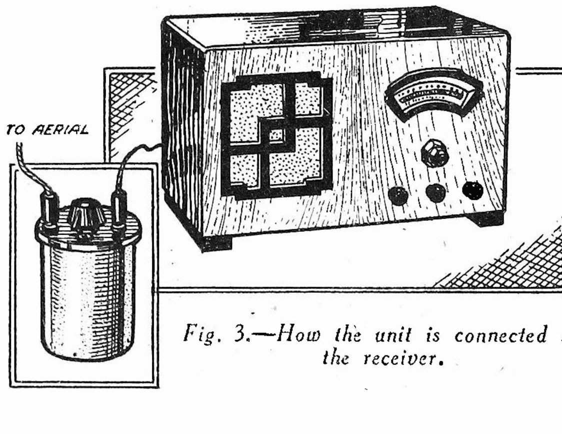


Fig. 3.—How the unit is connected to the receiver.

LIST OF PARTS

- One J.B. "Dilecon" variable condenser, .0005 mfd.
- One .002 mfd. Dubilier fixed condenser, type 670.
- Three Belling-Lee insulated sockets with plugs.
- Paxolin former 2in. diam., by 3in. long.
- Parts for case as detailed in the text.

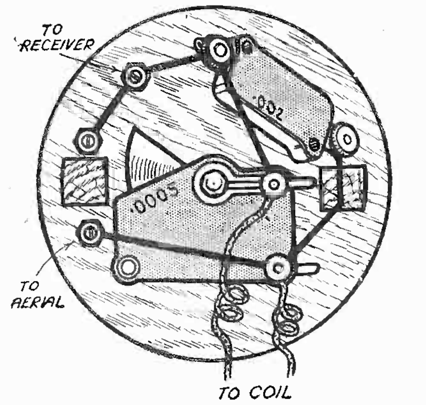


Fig. 4.—Wiring diagram from underside of lid.

layer on a 2in. paxolin former 3in. long. Two small holes are pierced through the former about ¼in. from one end and the wire threaded through in the usual manner, leaving a few inches for connecting purposes. The wire is then wound on tightly and evenly until the 100 turns have been completed, when two more holes are pierced and the wire threaded through as before. The 100 turns should occupy about 2½in.; thus the winding should end within ¼in. of the end of the former.

When the coil is completed it should be put aside while the other parts are being assembled. The top of the unit consists of a round disc of hard wood. Any local handicrafts shop would be able to turn this up for a few pence, but failing that it could be made in a hexagonal form. This can be cut out quite easily with a tenon saw by the average handyman. When the top is finished it is drilled with the necessary holes to take the condenser and the sockets. These parts are then mounted in position together with the fixed condenser and are wired up as shown in Fig. 4.

The next job is to mount the coil on its base. This latter consists of a wooden disc, which is a push-fit in the end of the 3in. cardboard tube which forms the body of the unit. The method of mounting the coil on the base will be quite clear from a glance at Fig. 5. A wooden strip is bradded and glued in position on the base, and the former is then fixed to each end of this with the aid of brads. The card body of the unit is fixed in position next. One or two fine brads are used and driven through the tube into the base. Before placing the top on the unit the two wires from the coil are connected to the terminals of the variable condenser. The unit should then be tested out before the top is finally secured in position.

To test the wavetrap the receiver should be connected to the aerial in the usual way, and then tuned exactly to the Droitwich wavelength. If, owing to the tuning spread, the exact position is not very definite, then the volume control should be turned right down. This will, of course, reduce the spread and enable the exact wavelength to be determined more easily. These remarks apply to the ordinary type of volume control and not to a combined selectivity and volume control in the form of a variable condenser. This latter type usually alters the tuning slightly when it is turned down. Having tuned-in to Droitwich the set should be switched off and the wavetrap connected up. One socket on the unit is connected to the aerial terminal or socket on the receiver and the other to the aerial. The third socket is left unconnected. The receiver is then switched on again and the volume turned up. The tuning control on the unit is slowly rotated until the signals from Droitwich reach a minimum strength. If the instructions have been followed carefully this will occur at a position somewhere near the midway setting of the condenser. Having found this position, a movement of the condenser knob in either direction should cause an increase in volume.

With the control set to give the minimum volume, a mark is made opposite the pointer of the unit in order to mark the position, and the wavetrap should then be left alone. Tuning of the receiver is then carried out in the usual way. It will be found that the reduction in volume from Droitwich will allow other stations to be received free from interference. There is just one warning. With some receivers the tuning positions will be altered very slightly when the eliminator is in use, but the actual amount depends on the nature of the tuning arrangements employed in

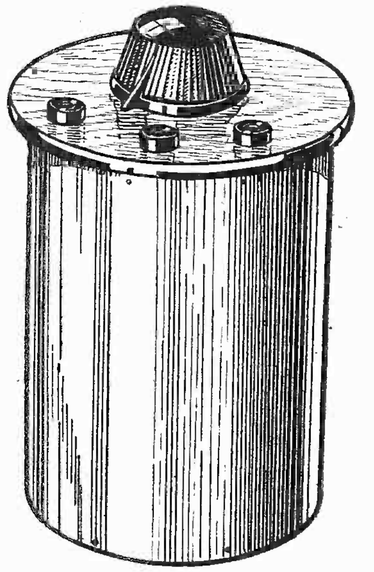


Fig. 6.—The completed wavetrap.

the set. Regarding the setting of the wavetrap, this would normally be left at its original setting, but slight variations can be made to suit particular conditions. For instance, it is sometimes found that a station above the wavelength of Droitwich can best be received with the wavetrap pointer turned a little to one side of the normal position in an anti-clockwise direction. A station below Droitwich, on the

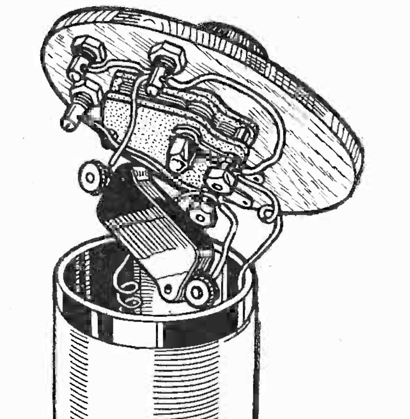


Fig. 7.—How the wavetrap is assembled.

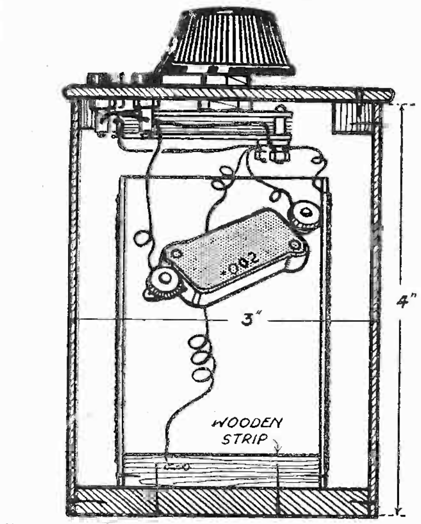


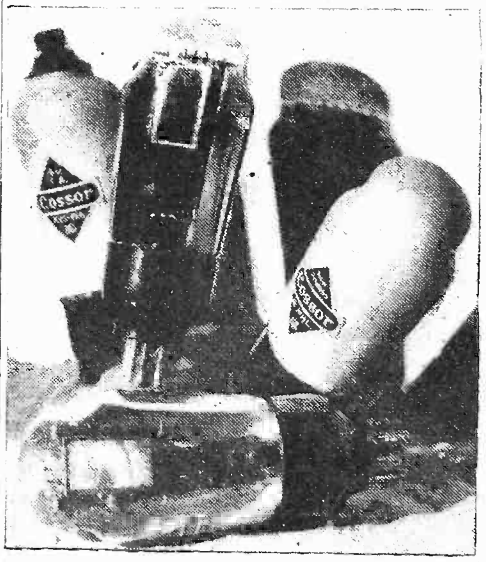
Fig. 5.—Sectional view of the unit showing how the coil is mounted.

other hand, may be found to come through with better strength with the pointer set slightly in the opposite direction. When it is desired to listen to Droitwich there is no need to alter the setting of the eliminator. All that is necessary is to remove the aerial from its socket and to plug it in to the vacant socket. This cuts the wavetrap out of the circuit.

Those who are interested in experimenting may care to try variations in the ratio of inductance to capacity. As an example the fixed condenser might be increased to .004 mfd. when the coil would need to be reduced to about 60 turns. On the other hand, a more powerful rejector action, but less localised, could be obtained by using an ordinary plug-in coil of 150 turns tuned by the .0005 mfd. condenser only.

HIGH-EFFICIENCY VALVES

It is amazing to note the progress that has been made in valve design during the last couple of years or so. We all know of the mains pentode valves that enable a signal output of something like 2½ watts to be

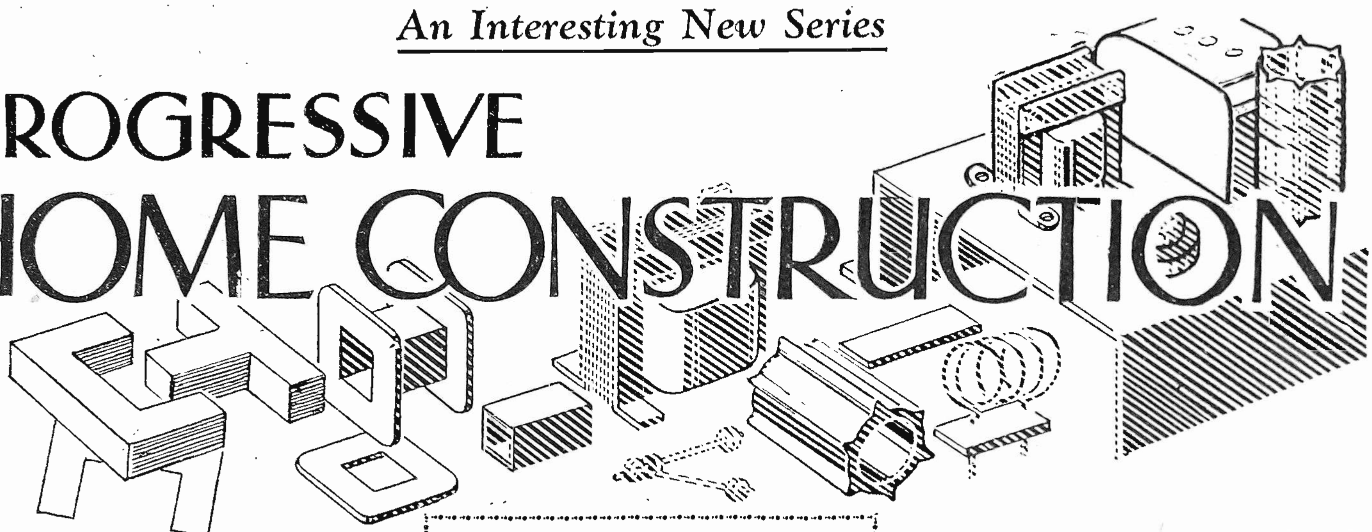


The Valves used in Mr. F. J. Camm's New Receiver—The A.C. Hall-Mark.

obtained with the comparatively small input supplied by the average leaky-grid detector, but I learnt the other day that a directly-heated mains pentode is shortly to be placed on the market that gives an output of 3,800 milliwatts with an input grid voltage of rather less than 6.

An Interesting New Series

PROGRESSIVE HOME CONSTRUCTION



In this Second Article of the New Series the Authors Describe the Construction of the Remaining Parts Required for the Single-valve Home-made Receiver

by The Experimenters

WE hope that you have by now been able to make the coil, reaction condenser, and wave-change switch, for which details were given last week, and trust that no difficulty has been experienced in carrying out the interesting work. Now we must push on and deal with the fixed grid condenser, grid leak, H.F. choke, and on-off switch. Actually, a valve-holder is needed in addition to the components just mentioned, but most readers will prefer to buy that as a ready-made job, since it costs only a matter of pence, and cannot be made very easily if the sockets are to be a perfectly good fit with the valve pins.

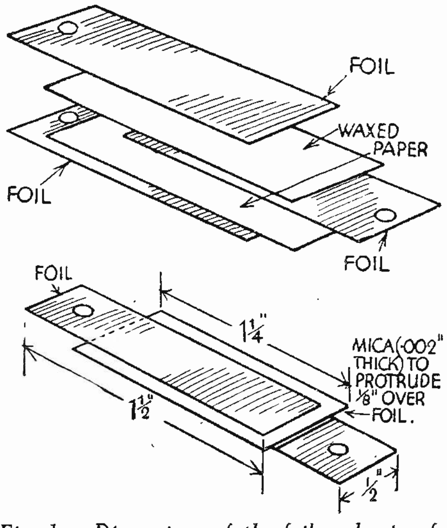


Fig. 1.—Dimensions of the foil and mica for the fixed grid condenser are given in this drawing. Above is shown how the sheets of foil and dielectric are interleaved.

The Grid Condenser

The grid condenser should be considered first, bearing in mind that this component should have a capacity of approximately ·0003 mfd. The exact value is by no means critical, but it is possible to work to fairly close limits if the size of the plates, thickness of the dielectric material, and the dielectric constant are known. You probably think that the last remark means that the accurate capacity could be obtained by a physicist equipped with a variety of measuring instruments and having access to an extensive laboratory; anyhow, you need not be discouraged, for we have cut out all the theoretical work for you and simply say that the correct capacity can be obtained by using two plates of tin or copper foil measuring 1½in. by ½in. with a sheet of mica measuring 1¼in. by ¾in. separating them. As a matter of fact, this assumes the thickness of the mica to be just two-thousandths of an inch, but this is a standard thickness, and so there is no need to take micrometer measurements. If you have any difficulty in getting hold of the mica you can use thin waxed paper instead, the paper being not much more than tissue thickness. When this is used it is necessary to have about six sheets of foil with a sheet of waxed paper between each (because waxed paper has a lower dielectric constant than mica); the foils (condenser plates) and strips of waxed paper (dielectric) are arranged as shown in Fig. 1.

Just a note about the waxed paper; if you cannot find a piece of suitable material ready for use, just take a short end of clean candle, place it in a small jar, and immerse it in a bath of hot water. When the wax is quite molten put a sheet of thin, soft paper into it and allow it to remain for a short time until thoroughly soaked. After that, lift out the paper and let all the superfluous wax drain off. When the wax has become quite cold the separate sheets can be cut out and the condenser assembled. The method of assembly is shown in Fig. 2, where it can be seen that the set of plates and dielectrics are placed together on a small ebonite sheet fitted with terminal holes, after which washers and nuts are securely tightened over the ends of the foil strips.

An Ebonite Baseplate

Before mounting the condenser proper on to the baseplate, however, care must be taken that the plates and dielectrics are all pressed firmly together. To ensure this when using mica dielectrics it is best to brush a little *very thin* shellac varnish over each surface of the micas, place the foils in position, and then place the whole assembly under a heavy book, leaving overnight until the varnish sets perfectly hard. When using waxed paper there is no need to apply shellac, but after the plates have been interleaved the condenser should be tightly pressed with a *warm* (not hot) iron. When the wax has properly cooled the condenser can be mounted on the baseplate.

Making a Grid Leak

So much for the condenser; and now for the grid leak. This requires to have a resistance of about 2 megohms, but again the exact value is not at all critical. The best and simplest arrangement is that shown in Fig. 3, where a strip of ebonite of the dimensions indicated has a wide pencil line drawn on it. Before making the line the surface of the ebonite should be roughened slightly by rubbing it with fairly fine glasspaper, and the two holes shown should be drilled. Then take a "B" pencil and scribble a ring round the terminal holes, afterwards joining the two rings with a line ⅛in. thick. Apply a fair pressure with the pencil, and go over the line a few times until there is a little graphite dust loose on the surface. Then knock off the dust and fit the terminals, placing a large washer between the nut and the pencilled circles. The resistance between the two terminals will now be just about correct, but the graphite might be rubbed off when the leak is in

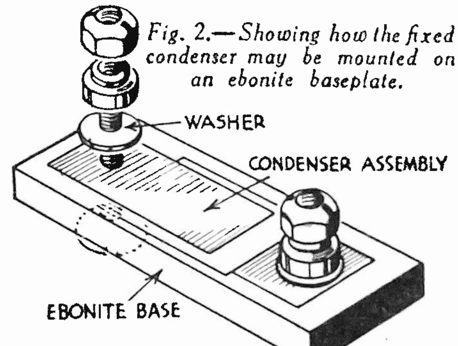


Fig. 2.—Showing how the fixed condenser may be mounted on an ebonite baseplate.

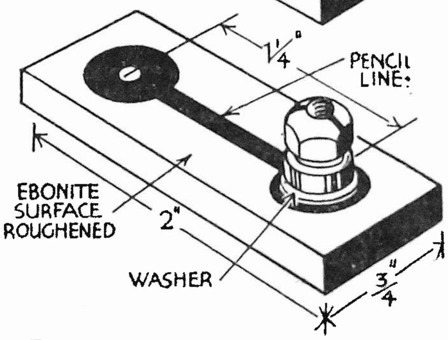


Fig. 3.—The lower sketch shows how the grid leak is easily made.

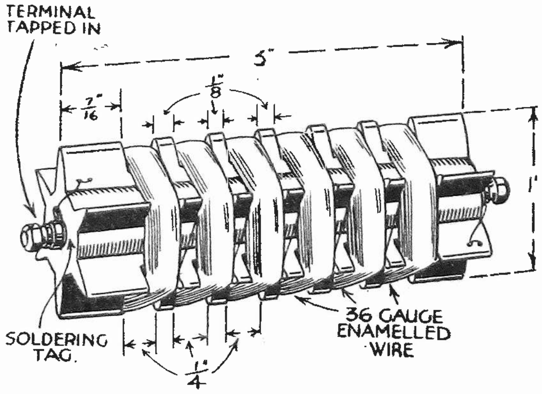


Fig. 4.—Constructional details are given here for the H.F. choke.

use, or alternatively the resistance might vary due to the formation of moisture on the surface of the ebonite. To prevent either of these eventualities the ebonite should be given a couple of light coats of shellac or other varnish.

The H.F. Choke

We have agreed to buy a valve-holder (if there aren't already several spare ones in the junk box), so we can now look to the high-frequency choke. This should have a fairly high inductance if it is going to be of any real value, whilst its self-capacity should be as low as possible. Because of this it is best to divide the winding into a number of separate sections. This can most easily be done by placing the windings on a length of 1in. diameter ribbed coil former, after slots have been made in the ribs in the same way as in the case of the coil described last week. The handiest type of former for the purpose is "Becol" No. 2, which has a ½in. diameter hole running through the centre, and which costs 4d. for a 3in. length, such as is required.

The arrangement of the six slots is shown in Fig. 4, where it will be seen that they are each ¼in. wide and about ⅛in. deep. They can be made, as described in connection with the coil, by means of a file, a few broken hack-saw blades clamped together, or in a lathe. When either of the two former methods is to be used it will be found most convenient first of all to make a cardboard or metal template so that the slots in each of the six ribs will be in line and exactly the same distance apart. After the slots have been made, a terminal should be fitted into each end of the former, a soldering tag being placed under the first nut. The correct method of fitting the terminals, of course, is to tap the hole in the ebonite to the same thread as that on the terminal, but when a suitable tap is not to hand the job can be carried out quite easily by using an old terminal of the same size as those to be fitted. First file the end to a taper of square section, then warm the terminal in a gas flame and screw it into the hole, gripping it with a pair of pliers. After forcing it partly into the hole it might be necessary to give the terminal a second warming, but it should soon be possible to tap the hole in this manner for the required distance.

For the windings a little 36-gauge enamelled wire will be required; a 1oz. reel will be ample, and this can be bought from any good wireless shop, or from an electrician. Start by scraping the enamelled covering from one end of the wire, taking care not to cut it, and then solder this to one of the tags provided. Now commence to wind the wire into the first slot, placing the turns as evenly as possible and continue until the slot is full. Without breaking the wire continue to the next slot, winding in the same direction, and so on until all have been filled. Finally cut off the wire, scrape the end clean and solder to the second tag, so completing the choke. A slight refinement on the method just described, and one that produces a more robust finish, is to solder a short length of thicker wire to the end of the 36-gauge material and use this for making connection with the tags, and winding it round the former for a few turns.

The On-off Switch

It is unnecessary to give full constructional details for the on-off battery switch, since this is almost identical with the wave-change switch described last week. The difference is that only two contacts are required, and therefore connection need only be made to the two soldering tags under the screws tapped into the end of the ebonite base. Alternatively, one of these terminal points could be used, the second connection being made to the single screw which serves to anchor the end of the spring contact plate.

Assembling the Components

Now that all the components have been made they can be assembled on a baseboard or chassis and wired up. Most readers will prefer to use a chassis, and this can be made, as shown in Fig. 5, from a few pieces of 5-ply wood, or a metallised chassis can be bought ready made from Messrs. Peto-Scott. The valve-holder, coil, and a couple of small ebonite terminal strips can be mounted as shown, the two variable condensers, on-off switch, and wave-change switch being attached to the ply-wood (or ebonite) panel. The rest of the parts are placed beneath the chassis, the grid condenser and grid leak being mounted near to the grid terminal of the valve-holder, and the H.F. choke being suspended in the wiring.

The connecting wires, by the way, may consist of any form of insulated wire, although the type known as "push-back"—with which the insulation can simply be pushed away from the ends by means of the finger and thumb—will be found most convenient.

Many readers will wish to have until next week before completing the wiring and testing of the complete set, and so the drawing showing the simple connections required is being held over until the next issue, when notes on using the set, and also on adding a few refinements, will be given.

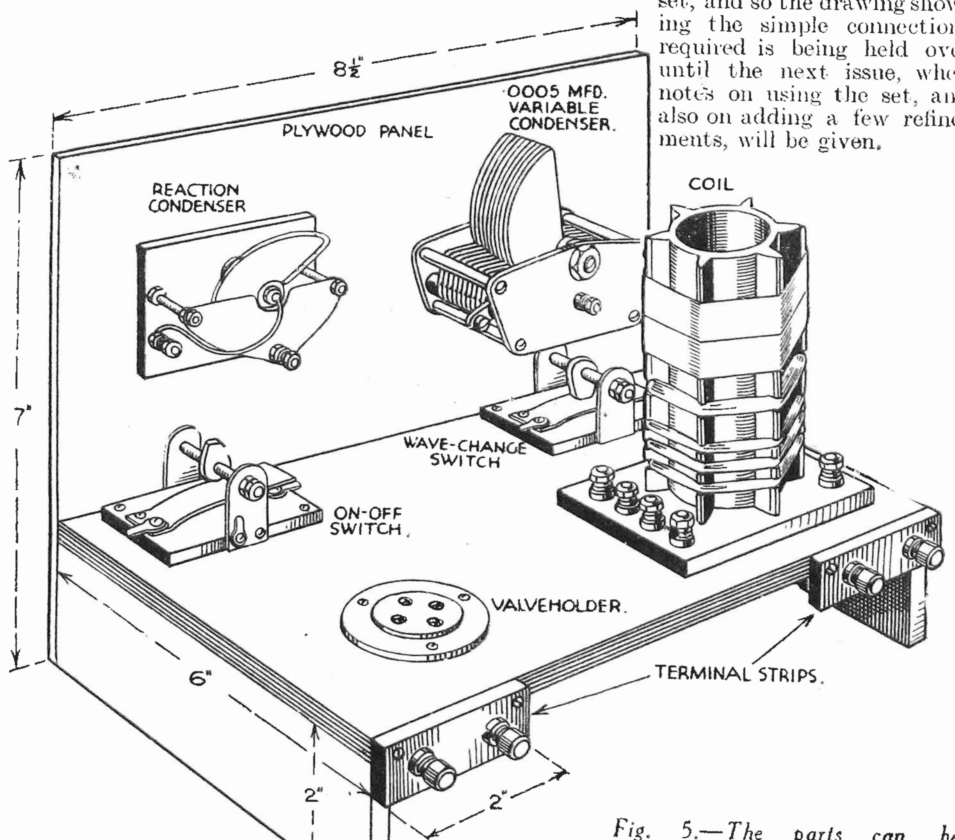


Fig. 5.—The parts can be arranged on a plywood chassis as illustrated here.

New Weather Forecasts

BY order of the Air Ministry, the Marconi Company will erect at the Cranwell (Lincolnshire) Aerodrome a telephony transmitter of which the sole service will be the broadcast of weather bulletins and warnings for aviators. When the station is ready for regular operation the Heston transmitter (1,202 metres) will close down and its duties taken over by Cranwell.

BROADCASTING NOTES

Ultra-short Waves Replace Telephone Cables

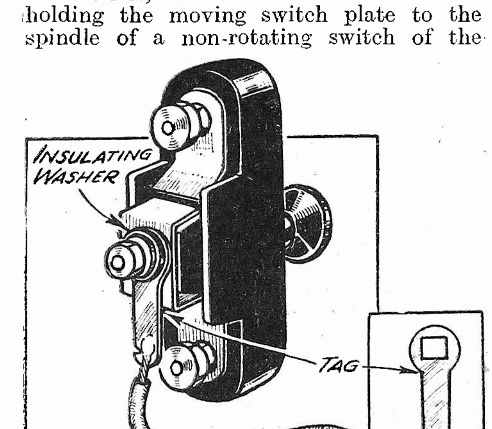
THE new ultra-short-wave service between Portpatrick and Belfast, *viâ* Ballygomartin, has proved an unqualified success inasmuch as it has greatly relieved the pressure on the long-distance telephone traffic between Great Britain and Ireland. The Post Office has already installed five circuits and is using them to their utmost. Across relatively short distances, such as the Bristol Channel, ultra-short waves have proved invaluable. It is expected that a similar service will be shortly tried out with the European Continent, as the system is far less costly than the laying of cables.

READERS' WRINKLES

THE HALF-GUINEA PAGE

A Simple Switch Conversion

HERE is a simple method of converting a two-point switch to a three-point one. First, remove the nut and washers holding the moving switch plate to the spindle of a non-rotating switch of the type shown in the sketch. Place a large-size soldering tag, with hole filed square, over the spindle end, replace the insulating washer, ordinary washer, and nut, and tighten up. To the soldering tag solder a length of flex to suit requirements. The same method applies for converting a three-point switch to a four-point one.—R. M. Ross (Alness).



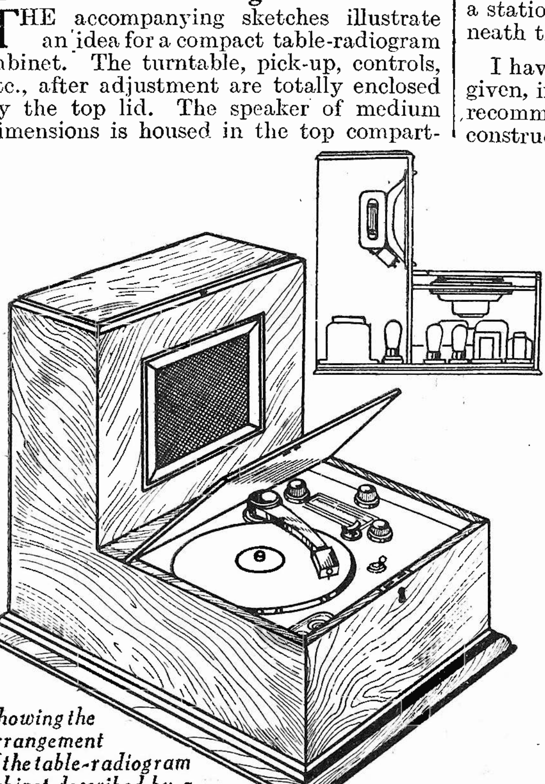
A simple switch conversion.

A Novel Table-radiogram Cabinet

THE accompanying sketches illustrate an idea for a compact table-radiogram cabinet. The turntable, pick-up, controls, etc., after adjustment are totally enclosed by the top lid. The speaker of medium dimensions is housed in the top compartment, as can be seen, the front of which is made of thicker wood so as to act as a good baffle. Underneath, and at the bottom of the speaker is conveniently housed the rectifying unit or accumulator and H.T. battery, if a battery-operated set is used. There is ample room. The set is built directly under the controls, and the majority of the components are mounted on the right-hand side, whilst the gramophone motor is fixed underneath the motor board in the usual way.

A manual volume control is placed outside in the centre front, so that the volume may be adjusted without having to open the cabinet. The principal dimensions of the cabinet are: height 18in., length 22in., width 17½in. The height of the front part is 7in. The plinth may be built according to the maker's own taste, and a station chart, etc., may be placed underneath the lid, for quick reference.

I have made a cabinet to the dimensions given, in figured oak, and can thoroughly recommend it to any reader wishing to construct a very compact, efficient and convenient table-radiogram cabinet.—H. J. Colebrook (Sandwich, Kent).


Showing the arrangement of the table-radiogram cabinet described by a reader in the accompanying paragraph.

THAT DODGE OF YOURS!

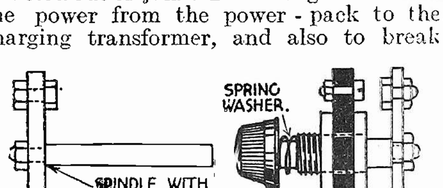
Every Reader of "PRACTICAL AND AMATEUR WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account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

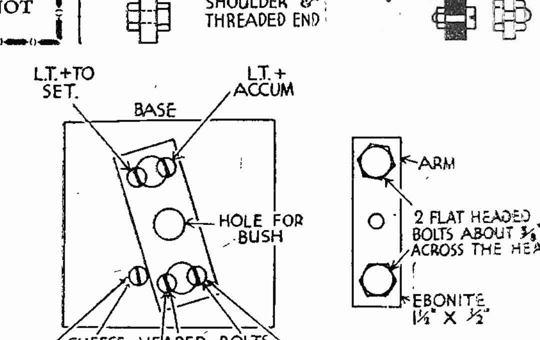
A Condenser Switching Device

IT is sometimes found, when using a dual-range coil, that although reaction on medium waves is quite satisfactory, the set fails to oscillate on long waves. This is probably due to the capacity of the reaction condenser being too small for this waveband, and a method of overcoming the difficulty is illustrated in the accompanying sketch. The wavechange switch, in the long-wave position, presses against a small block of ebonite fixed to a metal strip which, in turn, makes contact with another metal strip, thereby placing the .0002 condenser in parallel with the reaction condenser. For convenience, the theoretical circuit is also shown, as, in the event of a different type of circuit being used, slight modifications may be necessary in the assembly.—F. C. Biddlecombe (St. Margarets).

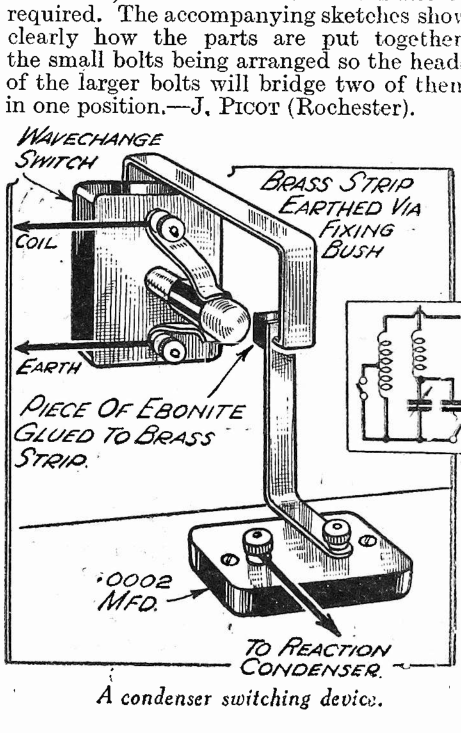
A Five-point Switch from Junk

THE accompanying sketches show a five-point switch I have just constructed out of junk. I am using it to switch the power from the power-pack to the charging transformer, and also to break the connection between the L.T. and the valves in one operation. It is fool proof because the valves cannot be switched on when the accumulator is charging. The parts required are:—1 piece of ebonite 2in. square, 5 cheese-headed bolts about ⅝in. long, 1 piece of ebonite 1½in. long by ½in. wide. The bush and spindle out of an old push-pull switch, or out of an old reaction condenser, and a suitable knob will also be required. The accompanying sketches show clearly how the parts are put together, the small bolts being arranged so the heads of the larger bolts will bridge two of them in one position.—J. Picot (Rochester).





A five-point switch made with odds and ends.



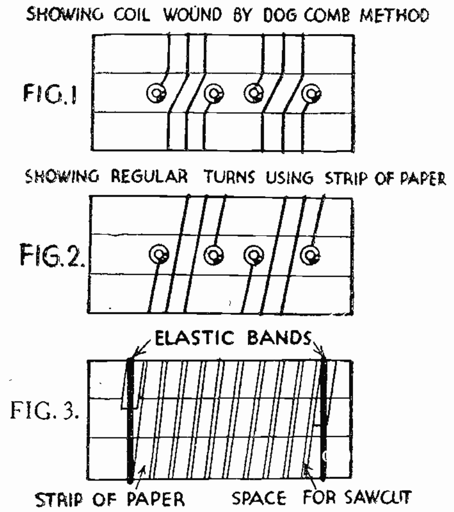
A condenser switching device.

READERS' WRINKLES

(Continued from previous page)

Slotting Ribbed Formers

I NOTICED a rather ingenious method of marking a coil former with a steel dog-comb in the issue of PRACTICAL



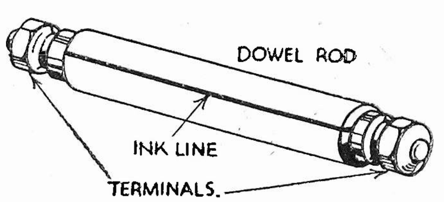
A simple method of slotting ribbed formers.

WIRELESS for January 12th, but the saw-cuts made between the teeth of the comb run parallel to the end of former, and when winding a coil to work on the 15-metre band, on which the windings are approximately ¼in. apart (say, taking two teeth for each saw-cut) the finished coil appears as shown in Fig. 1.

To obviate this, an expedient method of marking a former is to cut a strip of paper with a knife and straight edge, the width of the strip being made according to the distance between the windings desired. Wind the paper strip on the former, leaving sufficient space between each turn to receive a saw blade, and anchor both ends of the strip by fixing an elastic band on each end of the former, as in Fig. 3. The cuts with the saw blade can now be made between each turn. A coil wound by using this method would appear as shown in Fig. 2. Any irregularities in the windings of a short-wave coil are, of course, apt to cause fading.—F. W. RITCHIE (Macduff).

A Simple Grid Leak

THE following method of quickly making a grid leak may interest the wireless constructor who likes to make his own components. It is really practical, is easy to make, and when completed has a real commercial-looking appearance. To make the grid leak, drill a small hole at each end of a piece of ¼in. dowel rod which is about 1½in. long. Having done this, draw a thick line in Indian ink, or with an H.B. pencil, from one hole right along the dowel rod, to the other hole. Now screw two small terminals into the holes drilled in the rod and the grid leak is complete. Its resistance will be about two megohms, but, of course, by drawing two ink or pencil lines on the rod, its resistance may be varied as required.—G. R. WILDING (Liverpool).

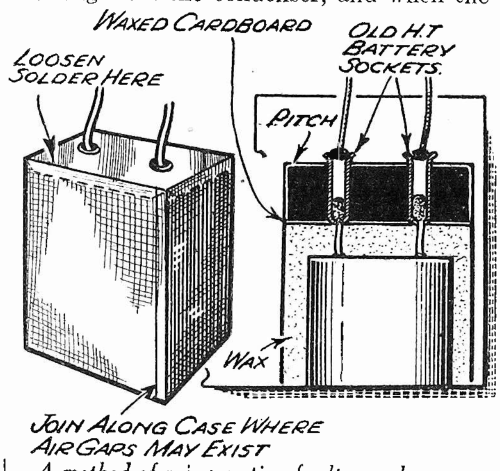


An easily-made grid leak.

Rejuvenating Faulty Condensers

WHEN large condensers of the wax-paper type begin to leak badly they need not be discarded. They can quite easily be rejuvenated by the method described below, after which they will last for a considerable time. A leak is usually caused in a condenser by damp having caused the insulating paper between the plates to become conductive. It is thus necessary to remove this damp, and at the same time to re-insulate.

The top of the condenser may be removed by re-heating the solder, at the same time keeping the whole condenser slightly warm so that the contents slip out easily once the top is removed. When this is done the top is taken off the wires, leaving what looks like a roll of paper with a covering of wax. This is now placed in a tin or can, which must be clean, and gently heated. Bits of clean candle are then added until the condenser is submerged in a bath of molten wax. A piece of thin wood should be placed over the can and the condenser suspended in the wax so that the paper may not be burnt against the hot sides. The heat should then be increased slightly until bubbles are seen coming from the condenser, and when the

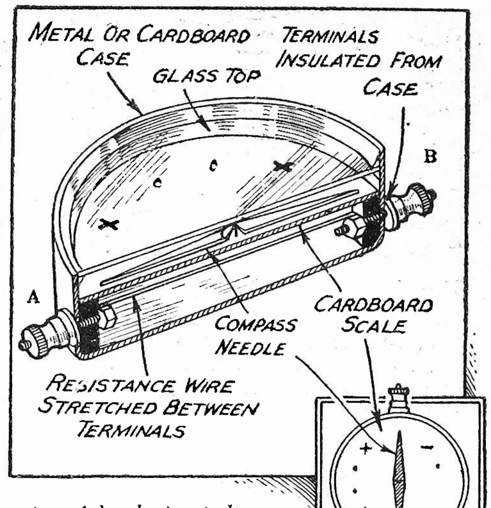


A method of rejuvenating faulty condensers.

bubbles have ceased, the can and contents are removed from the source of heat. The container of the condenser may then be examined for holes, which should then be soldered. The condenser is then lifted out of the wax, placed in its container, and molten wax poured in until the level is as shown in the sketch. A piece of stout cardboard is then waxed and cut into shape, and placed on top of this, two holes being made for the wires to come through. Slightly warmed pitch is then stuffed and packed in tightly after the wax has become cool and firm. This layer should be put on carefully so that no air is admitted to the condenser. The wires are then ready for soldering to the set. If preferred, two sockets from an old H.T. battery can be inserted and soldered to the wires before putting in the pitch. Wander plugs can then be used to connect up.—J. DIAMOND (Greenock).

A Polarity Indicator

A USEFUL polarity indicator, or general-utility current detector, can easily be made from material in the scrap box. The illustration shows the simple construction of the instrument. A wire of moderate resistance is stretched between the terminals A and B beneath a card on which is mounted a compass needle. The card is marked as shown in the sketch. This marking is the most important part of the construction. Four small stops are provided to prevent too violent movement of the needle when the instrument is in

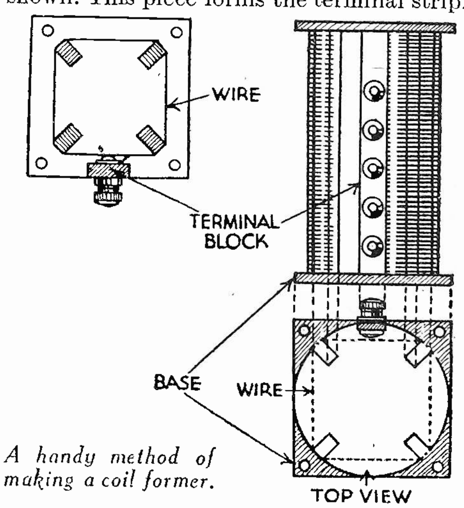


A useful polarity indicator. Due to its low resistance it should be wired in series with one lead.

use. The operation of the instrument is as follows: The case is turned until the needle lies over the one drawn on the card. The wires of unknown polarity are then touched against A and B when the needle at once swings to indicate the polarity of A and B. As previously mentioned, this simple instrument may also be used as a current-detecting device. For small currents the card may be calibrated by means of a standard instrument to read in milliamps. Other possible uses will probably occur to the reader. If any reader does not understand the principle underlying the instrument, it may be noted that it is based on Oersted's Experiment and Ampere's Rule.—H. F. DICKIE (Taunton).

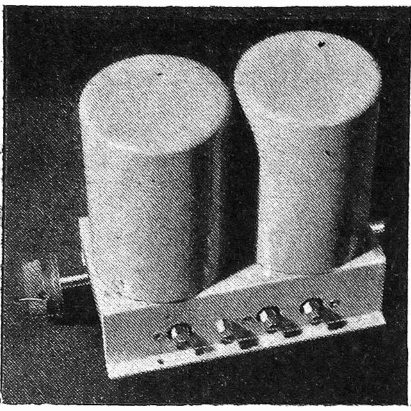
A Handy Coil Former

A HANDY coil former, with connections for tappings, can be made as follows: Cut a square piece of wood or ebonite, about 2in. square, and a circular piece 2in. in diameter. Four pieces ½in. by ¼in. by 4in. will also be required. Fix the parts together, as shown in the sketches, the square piece for the base, the round piece for the top, the four pieces at each corner, and another piece about 4in. by ⅜in. by ¼in. along the middle of one of the sides, as shown. This piece forms the terminal strip.



A handy method of making a coil former.

To save filing grooves to take the wire at each corner, four ¼in.-diameter screwed rods can be used instead of the four pieces of wood. These rods should be covered half way round with insulation tape, where the wire rests, the tape being pressed into the threads of the rod to form the grooves. Finally, bore four holes in the projecting corners of the base, for screwing to the baseboard.—J. S. WATTS (Bristol).



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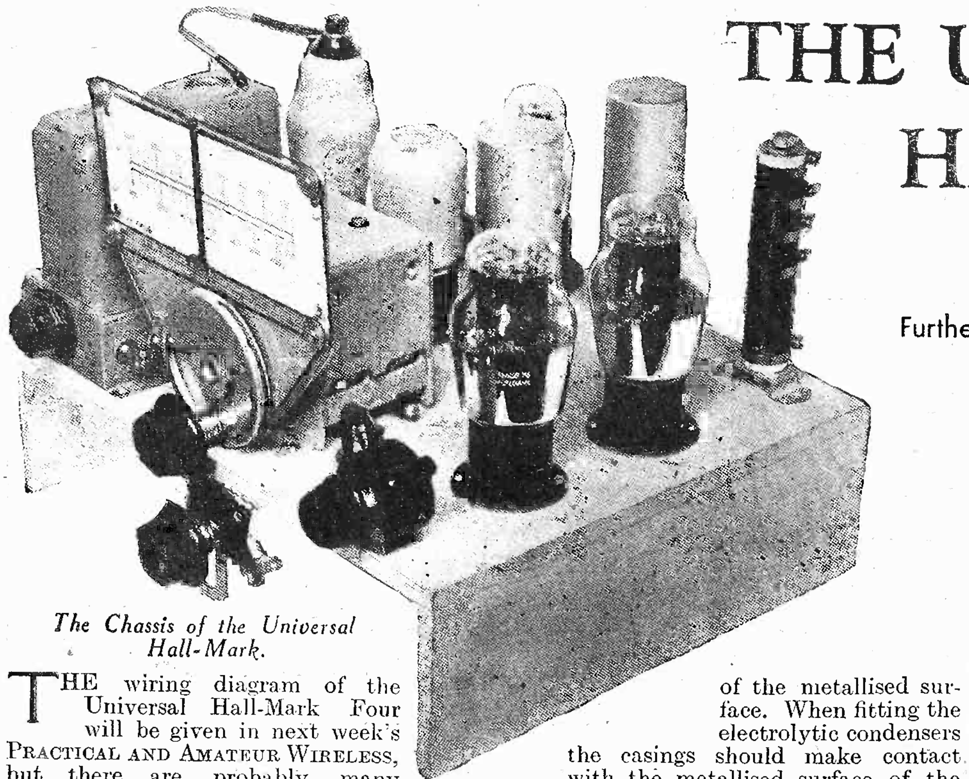
THE UNIVERSAL HALL-MARK FOUR

Further Constructional Details and Wiring Diagrams Next Week!



The Chassis of the Universal Hall-Mark.

THE wiring diagram of the Universal Hall-Mark Four will be given in next week's PRACTICAL AND AMATEUR WIRELESS, but there are probably many readers who prefer to build their receivers from the theoretical diagram, and therefore, this week, we propose to give you a few advance constructional details. Most of the instructions for the A.C. Hall-Mark also apply to the universal model, but there is one point that must be particularly stressed in connection with the latter. The earth lead must not be connected to the metallised surface of the baseboard, as this procedure might possibly cause a mains short-circuit in cases where the supply is D.C. with the positive mains lead earthed. For the same reason a condenser is connected in the aerial lead. This component is the pre-set condenser C3, and in addition to insulating the aerial, it may be used for controlling selectivity, in cases where the receiver is used in close proximity to a transmitting station.

A 1¼in. drill should be used for V1, V3, V4, V5 and rectifier valve-holders, and a 1in. drill for V2 holder. As in all receivers employing a Metaplex chassis, care should be taken to keep the valveholder pins clear of the metallised surface. When fitting the electrolytic condensers the casings should make contact with the metallised surface of the baseboard, as the casing is the negative terminal of this type of condenser.

Mounting the Volume Control

The bracket for the volume-control potentiometer should contact with M.B., but great care should be taken when screwing down the reaction condenser bracket. It is important that the screws do not pierce the metallised surface of the baseboard as this would result in a short-circuit of the reaction winding.

As the smoothing choke partly covers one of the output valve-holders, it will be advisable to fix this component after the valve-holder wiring has been completed.

The Mains Dropping Resistance

This component should be wired to suit the mains supply voltage. The heater pin of V3 should be connected to the lower terminal of the resistance for all supply voltages, but C22 and the fuse terminal should be connected to the second terminal (viewed from the bottom end of the resistance), for a voltage of 200 to 205, to the third terminal for 220 to 230 volts, and to the fourth terminal if the voltage is 240 to 250.

Speaker Leads

The three loud-speaker leads should be soldered to the tags on the Rola speaker transformer, the outer leads (from valve anode) being fixed to the outer tags, and the lead from C18 to the centre tag. A word of warning can be added concerning the speaker. This has a specially selected push-pull transformer attached, and if best results are desired, this must not be substituted. The push-pull valves have an undistorted output of approximately 6 watts, and therefore a small speaker would be hopelessly overloaded.

Further details of this receiver—including trimming and adjusting instructions—and a wiring diagram will be given in next week's issue of PRACTICAL AND AMATEUR WIRELESS.

Using a Pick-up

As this receiver has an undistorted output of approximately 6 watts it is very suitable for gramophone reproduction. Constructors who do not wish to fit a radiogram switch need only fit a pick-up strip at the back of the chassis, and connect the grid of the R2018 (V2) valve *via* a .5 mfd. condenser to one of the sockets, and the other socket *via* a .5 mfd. condenser to the metallised surface of the baseboard. When gramophone reproduction is desired the pick-up leads should be plugged into the sockets, and the volume control on the receiver set at minimum in order to prevent the radio signals from passing to the detector valve.

SPECIAL FEATURES OF THE UNIVERSAL HALL-MARK FOUR

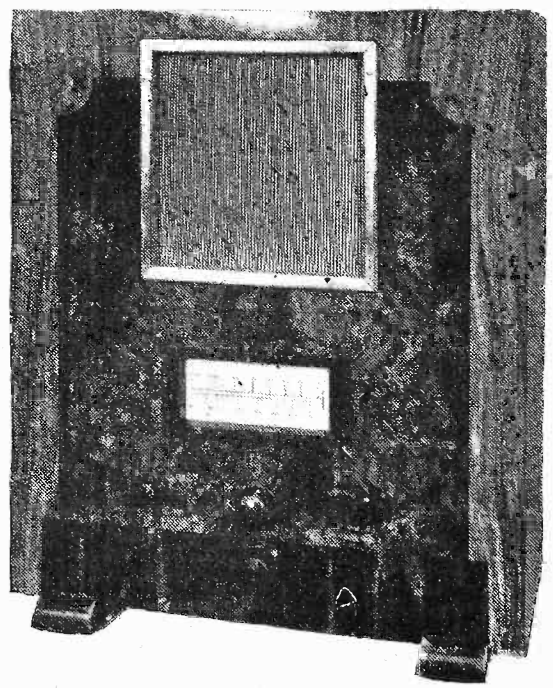
- Suitable for all A.C. or D.C. Mains.
- Large Output—6 watts maximum.
- Wavelength—Calibrated Dial.
- Smooth Control of Volume.
- Absence of Mains Hum.
- Absolute Safety in Use.

Microfuses Ltd.—Change of Address

Readers should note that the address of Microfuses Ltd., makers of the fuse specified for the Hall-Mark receivers, has been changed to 4, Charterhouse Buildings, Goswell Road, London, E.C.1.

LIST OF COMPONENTS.

- One 2-gang set coils, types Q and T.—Wearite.
- One 2-gang .0005 mfd. midget condenser with type V P. drive with wavelength scale (C1, C2)—Polar.
- One .00015 mfd. reaction condenser (C3)—Graham Farish.
- Four .5 mfd. fixed tubular condensers (C6, C11, C14, C15)—T.M.C.
- Two .1 mfd. fixed tubular condensers (C4, C5)—T.M.C.
- Three .05 mfd. fixed tubular condensers (C20, C21, C22)—T.M.C.
- One .0001 mfd. fixed tubular condenser (C7)—T.M.C.
- Three .0002 mfd. fixed tubular condensers (C9, C12, C13)—T.M.C.
- One 2 mfd. fixed condenser (C10)—T.M.C.
- Three 25 mfd. electrolytic condensers (C8, C16, C17)—Dubilier.
- Two 8 mfd. electrolytic condensers (C18, C19)—Dubilier.
- One .0003 mfd. pre-set condenser (C23)—Formo.
- Fourteen fixed resistances, 30,000 (R2), 25,000 (R1), 2,000 (R5), 500,000 (R6), 20,000 (R8), 30,000 (R9), 1,000 (R7), 250 (R12), 250 (R13), 50 (R15), 50 (R.16), 10,000 (R.10), 10,000 (R11), 200 (R3)—Graham Farish.
- Two potentiometers 2,000 ohms, type V.C.26 (R4) and 5,000 ohms, type VC.29 (R14)—Bulgin.
- One Mains dropping resistance (R17)—B.T.S.
- One snap H.F. choke—Graham Farish.
- One L.F. choke H.T.11—Wright and Weaire.
- One Input push-pull transformer type D.P.36—Varley.
- Three potentiometer brackets—Peto Scott.
- One Mains on/off switch, type S.80—Bulgin.
- Five valveholders, 4, 7-pin, 1, 5-pin—Clix.
- Two .5 amp mains fuses—Microfuse.
- One mains lead and plug—Belling and Lee.
- Five valves, types H.P.2118, R.2018, P.P.4118, P.P.4118, PV3018—Tungsram.
- One loudspeaker, type F.R.7. P.M.24—Rola.
- One Metaplex chassis—Peto Scott (12 x 10 x 3¼ins.).
- A.E. strip and plugs—Belling Lee.
- One Hall-Mark Four cabinet.



Here is the Universal Hall-Mark in its attractive cabinet.

On Your Wavelength

by Thermion

The Modern Tower of Babel

MOST of my readers will be acquainted with the verbose and tergiversatory circumambulation (!) of Dr. Johnson, who, in compiling that ridiculous first English Dictionary, really wrote a satire on the human race. His definition of patriotism, for example, was "The last refuge of a scoundrel"! In his lives of the poets, the following phrase occurred :—

"Let observation, with extensive view,
Survey mankind from China to Peru."

I expect you will also be aware of Coleridge's scathing comment on this: that it really meant "Let observation with extensive observation observe mankind." Now lexicography has been, with me, a *bete noire* ever since I learned to read. I have always been irritated by the fanciful imaginations of those who compile our dictionaries and merely hazard guesses at the derivation and pronunciation of some words. Too long has it been anybody's job to produce dictionaries of the English language. I have no doubt that if a Welsh scholar were given the opportunity to compile an English dictionary it would be smothered with Welsh words and Welsh pronunciations, and really be a piece of veiled propaganda for the Welsh race. In other words, a Welshman (where doubt existed regarding the origin or pronunciation), would quite naturally be tempted to give it to the Welsh. The same argument applies (perhaps with greater force) if you placed the job in the hands of a Scot. A language belongs to a nation, and not to particular individuals, and as such the compilation of a dictionary should be a government job. There is no standardisation about language at all. Anyone can publish a dictionary and invent any sort of pronunciation, word, or meaning, at variance with all the other dictionaries. Once it is in print it has the authority of the printed word. You may observe from this the point to which I am leading. The B.B.C. has its own committee on words and their pronunciations, which I think is all to the good. I do not know the members of the committee or their nationality, but it would be comforting to know that it does not intend to make an effort to upset pronunciations of words on which almost all dictionaries agree. As an Englishman, I am always careful in my choice of dictionaries. I prefer them to emanate from an English publisher and to have been compiled and edited by Englishmen. Confusion will be worse confounded if, in addition to our dictionaries, we are to have a radio dictionary as well. Do you agree? My "Shorter Oxford" is a treasured possession.

Where Are the Aerials?

IT does not seem so many years ago since part of the divertisement of my daily journey to town consisted of observing the various types of aerials and counting the weekly increments. Latterly, I have watched their gradual decline as, paradoxically enough, the number of radio sets has increased. On my twenty-five-mile journey I can now count six aerials where formerly they were uncountable. This is silent tribute to the increased efficiency of modern valves and wireless receiving apparatus. It spells the death of the outdoor aerial, with the possible exception of those small and neat commercial aerials which in most cases are more efficient than indoor aerials, and are also of great use in rooms where an indoor aerial is impracticable. Ten years ago there were dozens of different (and indifferent) types of outdoor aerials—unsightly-looking contraptions which did much to retard the progress of radio because people would not spoliate the appearance of their suburban chateaux. A modern receiver does not require a long outdoor aerial.

Fading

NONE of my quondam critics will disagree with me when I state that fading has nothing to do with the receiver. It is purely a transmitting problem, and as such I have always contended that it should be solved at the transmitting end. I do not see why I or any other listener should buy expensive apparatus in the form of A.V.C. units and equipment, merely to get over a problem which comes strictly within the domain of the designers of transmitting apparatus.

Whatever form of A.V.C. is fitted means a loss of efficiency in the receiver. It would be just as sensible for car manufacturers to make all of their cars to suit one-legged drivers because a few people are deprived of one of their limbs. My advice to commercial set designers is this: Supply your receivers without A.V.C. A station which fades is not worth listening to, anyway, and if customers had the point carefully explained to them, they would not require to listen to a station on which fading is consistently bad. There are other reasons I know which cause fading, and which are quite outside the ken even of the transmitting engineer; but even so, I contend that it is not a problem to be tackled at the receiving end. I always believe in tackling the cause rather than the effect!

A Precocious Schoolboy

I AM reminded of the old quotation :—

"And still he spoke, and still the wonder grew,
That one small head could hold one half it knew,"

by the correspondence I sometimes receive from schoolboys. If, in my urge to feed our panting printing presses I fail to cross an i or dot a t, I am certain to be reminded of it in a voluble fashion from a callow youth in his early teens; which is all to the good, keeps me up to the scratch and all that, and reminds me of the fact that a journalist should write for those who don't know rather than for those who do. The former class will learn something whilst the latter will have their knowledge confirmed and regard the contribution purely as an *aide memoire*. I am always pleased to hear from schoolboys and to advise them. We are apt to forget that a new generation of home constructors enters our ranks every year, and we must not hence shirk the irksomeness of going over the same old ground.

The £5 Three-valve Superhet

I AM always an unwelcome visitor to the PRACTICAL AND AMATEUR WIRELESS laboratory. On those occasions, however, when I pry into that holy of holies, I make it my business to ask the why and wherefore. The other day, a reader had called to make an inquiry regarding the £5 Superhet., out of which he couldn't get a note. One of the technical assistants had connected an oscillator to his receiver, and was busy trimming the I.F. transformers Within five minutes the receiver burst into life, and it was, indeed, a pleasant thing to watch the barometric change on the reader's face—from extreme gloom to the apogee of pleasure! I imagine from the conversation that he had ignored every instruction regarding matching and trimming, and had turned every knob and screw willy nilly, with the net result that he was entirely lost. He walked away another

(Continued overleaf)

Members of the staff of Whiteley Electrical Radio Co. Ltd., at the annual works dance recently held at Mansfield.

(*Continued from previous page*)

satisfied reader, paying glowing eulogies to the PRACTICAL AND AMATEUR WIRELESS service.

Thanks !

MANY thanks to the many readers who have written to me messages of good will on the transference of my weekly platform. "On your Wavelength" has been a regular feature for many years, and some readers expressed the fear that the amalgamation of the two wireless journals comprised by PRACTICAL AND AMATEUR WIRELESS might see the demise of the feature. Not so! Your unworthy *Thermion* will continue to expatiate on sundry subjects and to hurl his weekly brick bats behind the comfortable anonymity of his pseudonym. Set your fears at rest. All the same, I blush at the soft impeachment!

Anode Connections

I HAVE always loathed the terminal caps fitted to the top of screen-grid and similar valves, and have more than once had the misfortune to find them damaged. But last week I cursed them even more than usual, for they let me down badly just when I wished to demonstrate a new home-made receiver to some friends. The set was a battery-operated one, and I wished to employ the H.F. pentode from a portable that did good service last year. On going to the latter receiver, however, I found that the anode terminal was locked almost solid, presumably due to slight corrosion by fumes from the battery acid. A little hot water was run round the terminal nut, and this appeared to loosen it, but when an attempt was made to remove the terminal the whole cap turned round and parted company with the glass bulb. I blamed myself for my carelessness, and went to the nearest wireless shop to buy another valve. As soon as this was removed from its carton, however, it was discovered that the terminal cap on this valve also was loose—so loose, in fact, that I dare not touch the terminal. The result was that I could not demonstrate the new set after all, and since that time my name has been "mud" with my wireless friends. Some constructors have criticised the new form of metal cap connector, but I am all in favour of it—more so now than ever.

Radio Relays

FROM information that is constantly reaching me, it appears that the wireless relay services that are in operation in various parts of the country are receiving increasing patronage. All those firms who are operating relay stations are reporting increasing business, and appear to be enjoying prosperous times.

I find it difficult to form a reason for this, since relay subscribers are limited to one or two programmes, and must accept whatever the engineer in charge prefers to give them in the way of entertainment. Although I am by no means an "ether-scourer" myself, I do like to be able to turn to the foreign stations once in a while, and, moreover, I frequently enjoy many of the broadcasts from European stations. Admittedly, the bulk of my listening is in connection with the local stations, but even so I often find pleasure in alternative programmes that are sometimes sent out by the Midland and North Regional transmitters. It is therefore hard to understand why other people —and there must be many thousands of them—can be content to have one, or perhaps two, programmes from which to choose.

Notes from the Test Bench

Fitting Variable-mu Valves

A READER who had built the PRACTICAL WIRELESS Leader Three decided to fit a variable-mu S.G. valve and an S.G. bias potentiometer control. He wired the earth end of the grid coil (terminal 3) to the centre terminal of the potentiometer in the usual manner, and connected a .1 mfd. condenser between this terminal and MB. Results were quite satisfactory on the long-wave band but he found that the control did not function on medium waves. This is rather a common fault, and is due to the .1 mfd. condenser being short-circuited by the wave switch when the latter is in the medium-wave position. The remedy is very simple; it is only necessary to connect a .1 mfd. condenser between the switch terminal of the coil (terminal 2) and the switch lead.

Push-pull Output Circuits

WHILE testing an experimental receiver having two pentodes in push-pull, slight distortion was experienced; this was traced to the use of push-pull valves that were not exactly matched. To obtain the full benefit of a push-pull output stage, the same amount of current must pass through each half of the output transformer primary. When this condition exists, the magnetising effect of the direct current on the core is nullified because the direction of current flow in one half of the transformer primary winding is opposite to that in the other half. As it is difficult to obtain two pentodes that pass exactly the same value of anode current, experiments were conducted with various methods of equalising the consumption of the two valves, and it was eventually found that a very good control could be obtained by connecting the priming grids of the pentodes to the end terminals of a 5,000-ohm potentiometer and then joining the centre terminal of the potentiometer to H.T. A rotation of the potentiometer slider increases the voltage on one priming grid and at the same time decreases that on the other priming grid, thus affording the listener a simple means of equalising the anode current consumption of the valves.

Aerial Volume Control

SOME S.G. receivers employing an S.G.-H.F. stage rely on the detector reaction condenser for volume control. This control is not sufficiently effective when the aerial is in close proximity to the transmitter, however. A .0005 variable condenser connected in series with the aerial lead will control the volume, but in most cases this also affects the tuning of the aerial circuit because its operation varies the aerial capacity effect. The following is a simple method of overcoming this effect: connect the terminal of the aerial series condenser to one end of a 50 turn winding of 34 S.W.G. wire wound on a small cardboard former, and connect the other end of the winding to the earth terminal. This former should then be placed inside the existing grid winding former, its best position being found by experiment. The required size of the extra former will be governed by that of the grid winding former—there should be a clearance of at least ¼in. between the two.

Receiver Hire

PERSONALLY, I should have thought that those listeners who are not interested in making a set of their own, or who are not prepared to go to the expense of buying a high-class ready-made receiver, would much prefer to hire a set of reputable make from one of the many firms whose job it is to supply sets on hire terms. I know of several firms who are prepared to loan receivers for quite a few shillings per week, this charge covering all servicing and, in some instances, the replacement of the set by a new model after a certain period.

Interference-proof Receivers

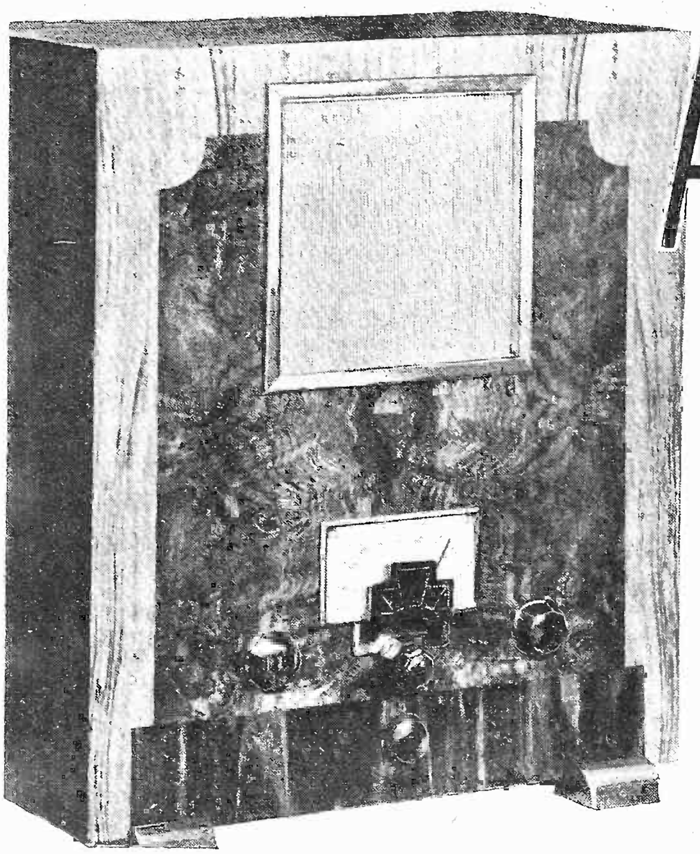
IT was with interest that I read the other day of an appeal made by the section engineer of the Birmingham P.O. Engineering Department to the Midland Radio Luncheon Club. His appeal was to the effect that radio manufacturers should make their receivers static-proof by fitting apparatus that would prevent the set from picking up electrical interference from outside sources. This, to me, seems all wrong, and in my opinion it is the makers of electrical machinery and fittings who should be called upon to fit suppressors to the appliances which they manufacture. It seems rather like "putting the cart before the horse" to allow electrical apparatus to be so designed and made that it constantly radiates interference, and then to attempt to suppress that interference when it is detected by the receiver. The argument in favour of modifying the set will probably be that the set came after the electrical machinery, but surely that is not a good excuse.

If I drive a car the exhaust of which emits an ear-splitting noise when the car is driven down the street, I am liable to be summoned for causing a public nuisance, and yet the maker of, say, an electric hair-dryer, that may be productive of equally ear-splitting noises in the loud-speakers of hundreds of receivers, gets away scot-free.

Wireless Dealers

WHY is it that there is so much incompetence in the wireless trade? At various times I suppose I have been into hundreds of wireless shops, and on only very few occasions have I found that the owner or assistants had any more than a very nodding acquaintance with wireless theory and practice. In one particular instance I found a so-called service engineer carefully "testing" the various components of a simple three-valve battery set which "would not work." At the very first glance it was evident that the constructor of the set had made various "earth" connections to the wooden chassis—which was *not* metallised. And yet this engineer (?) was non-plussed, and could not understand why the set was so absolutely dumb! It is a pity that manufacturers of wireless components and receivers cannot institute some system whereby unqualified people would not be allowed to sell articles of which they have no knowledge. I do not suggest that intending traders and assistants should be compelled to pass a stiff examination, but if they were required to answer a few simple questions put by a competent person a large number of those who are in the wireless business to-day would be compelled to study the fundamentals—or else earn their living in some other manner. A test on these lines would be of considerable assistance to the wireless trade as a whole, and would certainly be to the advantage of the novice and beginner in home construction, as well as to the listening public in general.

TRIMMING, MATCHING AND OPERATING THE A.C. HALL-MARK



Mr. F. J. Camm's Latest Mains Receiver. Battery and Universal Models are Described on Later Pages

EVEN at this early stage it is evident that some thousands of the A.C. Hall-Mark, with its quality and large undistorted output, are in process of construction throughout the British Isles. Aided by the free-gift blueprint which was given last week, the construction presents no difficulty at all and, as a fact, can be accomplished within a couple of evenings. The ample diagrams, instructions, and photographs also included with last week's issue make the position of every component and every wire crystal clear, even to the veriest beginner.

It is not possible to convey by means of diagrams the niceties of adjustments and the fineness of trimming and matching which make all the difference between obtaining perfect results and indifferent results. Even with the most expensive motor-car there are the adjustments to the carburetter, to the driving position, and to the ignition, which differentiate the article as it leaves the workshop from the well-tuned product as it reaches the purchaser.

A home-constructed receiver has that great advantage over the commercial product. It has all the sturdiness and reliability of the hand-made job and the almost inestimable advantage that it does not, like so many commercial receivers, present the appearance of the internals of a telephone switch-box when you remove the back to find out what has gone wrong.

A receiver which you have actually made is known to you in all its constructional elementals, but you must carry out very carefully the matching and trimming operations, and not merely be satisfied that the receiver works directly you attach your aerial and earth to it. For this, of course, it is bound to do if the components and the wiring instructions have accurately been followed.

Final Instructions

Before giving the final instructions, there are a few points regarding the construction to be given. For example, before mounting the ganged condenser and coils, be very careful to ascertain that the underneath surfaces of the components themselves are clean, as it is these surfaces which provide the earth-return path *via* the metallised Metaplex chassis.

Another point: The bracket holding the reaction condenser must not be in contact with the metallised baseboard, and it is particularly necessary, therefore, to ensure that the screws holding this component to the chassis do not make contact with the metallised surface. I stress this point because I have found in the past that many readers who have failed to obtain successful results have used screws which have passed through and made contact with the metallised surface, thus in many cases completely blotting out signals.

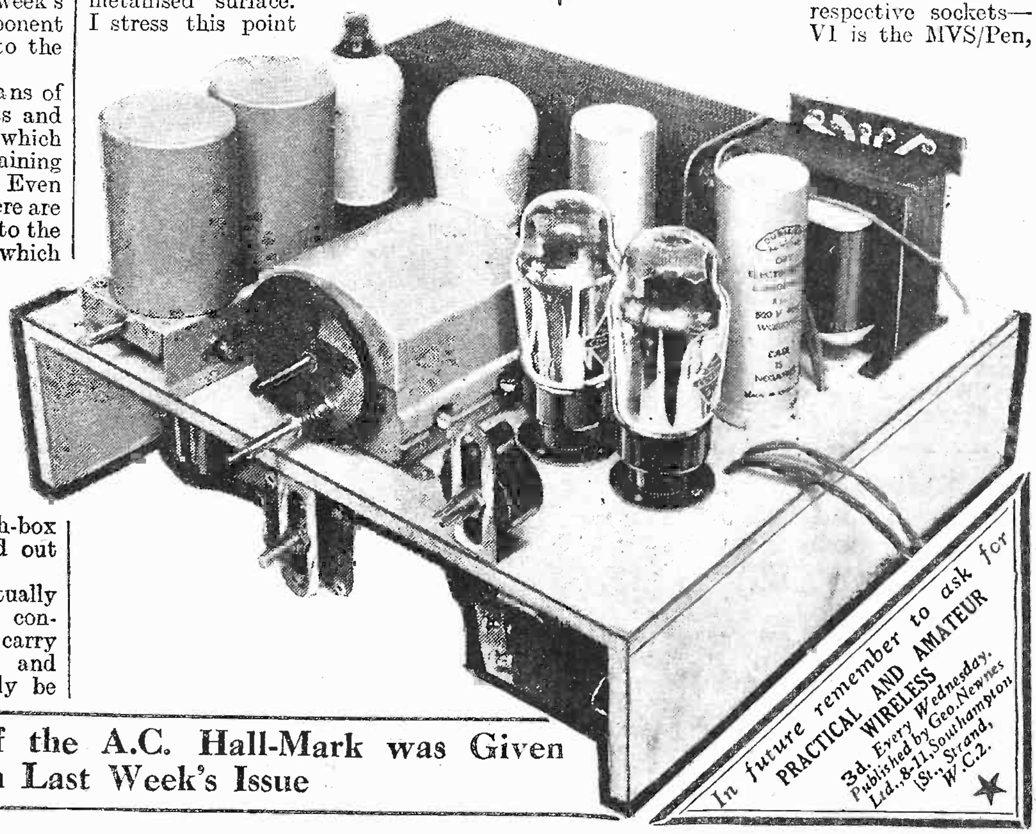
The Electrolytics

The wiring of the electrolytics was mentioned in last week's issue, but as this cannot very clearly be shown on the blueprint, owing to their position, we would particularly emphasise that the casing of C15 (the inner condenser of the two) must not make contact with the metallised baseboard, and the two leads indicated on the sub-baseboard wiring diagram shown connected to the electrolytic condenser fixing nuts must pass through the condenser fixing hole and make good contact with the condenser casing.

The Mains Switch

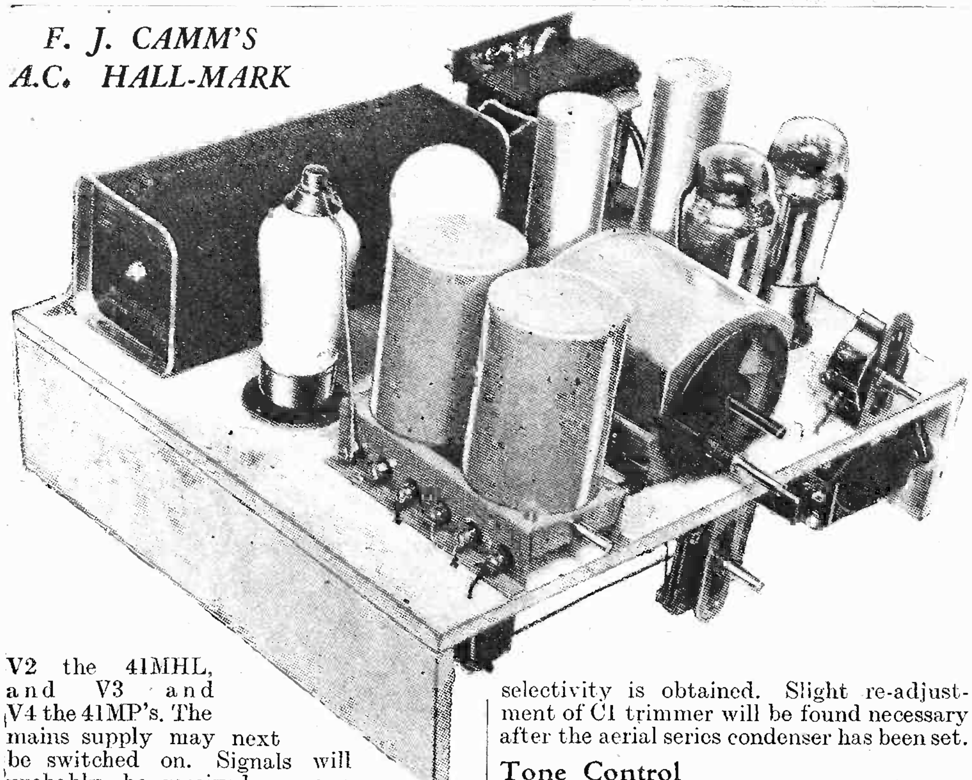
The mains switch has not been attached to the front panel, as this method of connection sometimes tends to produce mains hum owing to the proximity of the main leads and the H.F. wiring.

It is therefore suggested that the switch be connected to the side of the cabinet near the mains transformer. If you have rigidly adhered to the above instructions, the valves may now be inserted in their respective sockets—V1 is the MVS/Pen,



A Full-size Blueprint of the A.C. Hall-Mark was Given Free with Last Week's Issue

F. J. CAMM'S A.C. HALL-MARK



V2 the 41MHL, and V3 and V4 the 41MP's. The mains supply may next be switched on. Signals will probably be received as soon as the aerial and earth leads have been connected and the dial rotated.

Best results, however, cannot be expected unless the gang-condenser trimmers are carefully adjusted. Fortunately, the trimming of a double-tuned-circuit receiver can very easily be effected. First adjust the two trimmers to their mid-way positions. The local station may now be tuned in and the front section (C1) trimmer adjusted for maximum volume. A more distant station should then be tuned in and the two trimmers slightly readjusted for best results. The trimmer position should now hold for stations on all parts of the dial. If this is not the case, it indicates that the coils are not correctly matched.

Selectivity Control

For best quality reproduction from the local station the reaction condenser should be set at its minimum position—this is done by rotating the control knob in an anti-clockwise direction—and volume should be controlled by means of the 2,000-ohm potentiometer. When listening to distant stations, however, sensitivity and selectivity may be improved by rotating the reaction condenser very nearly to its oscillation point. Those who live very near a transmitting station may find that the selectivity does not quite meet with their requirements, and therefore it is suggested that a .0003 pre-set condenser be connected between the aerial terminal and terminal 1 of the coil. The setting of this component may then be adjusted until the required degree of selectivity is obtained. Slight re-adjustment of C1 trimmer will be found necessary after the aerial series condenser has been set.

Tone Control

The condensers shown in dotted lines on the theoretical diagram may be added if more mellow reproduction is desired. These two condensers are connected between G and G.B. terminals of the push-pull transformer.

These tone-compensating condensers simply serve to attenuate the higher frequencies and have no other effect; that is, they do not reduce volume, and their value is sufficiently low to avoid any "boominess" or other unpleasant form of reproduction. As, however, many readers will prefer the rather "crisp" reproduction that the set normally provides, the condensers will not be required in all cases. Much depends upon the position of the loud-speaker and also on the furnishings of the room in which it is situated, for if there is a good deal of upholstered furniture this will itself tend to give a "mellowing" effect.

COMPONENT VALUES

Values of components shown in the circuit given last week are as follows:

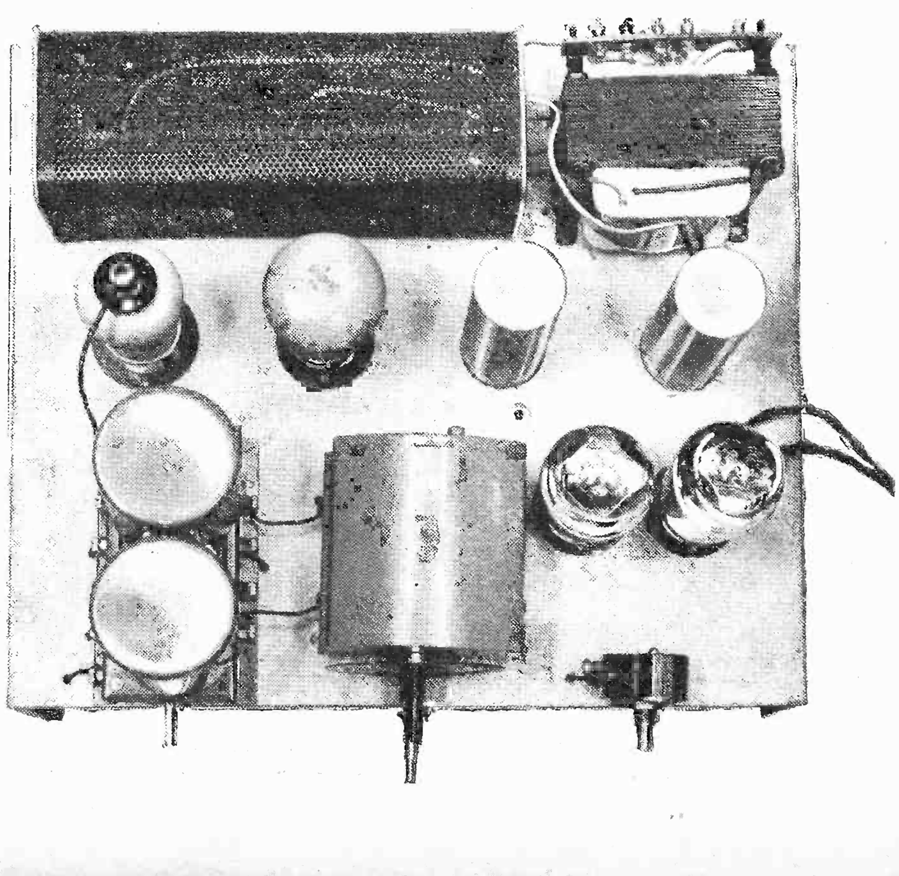
*R*1, 50,000 *ohms*; *R*2, 25,000 *ohms*; *R*3, 250 *ohms*; *R*4, 2,000 *ohms*; *R*5, 2,000 *ohms*; *R*6, .5 *meg.*; *R*7, 750 *ohms*; *R*8, 30,000 *ohms*; *R*9, 20,000 *ohms*; *R*10, 10,000 *ohms*; *R*11, 10,000 *ohms*; *R*12, 350 *ohms*; *R*13, 350 *ohms*; *C*1, .0005 *mfd.*; *C*2, .0005 *mfd.*; *C*3, .00015 *mfd.*; *C*4, .1 *mfd.*; *C*5, .1 *mfd.*; *C*6, 1 *mfd.*; *C*7, .0001 *mfd.*; *C*8, 25 *mfd.*; *C*9, .0002 *mfd.*; *C*10, 2 *mfd.*; *C*11, .5 *mfd.*; *C*12, 25 *mfd.*; *C*13, 25 *mfd.*; *C*14, 4 *mfd.*; *C*15, 8 *mfd.*; *C*16, 8 *mfd.*

LIST OF COMPONENTS

- One A.C. Hall-Mark Four Console Cabinet—Peto-Scott.
- One Metaplex chassis, 12½in.×12in. with 3½in. runners—Peto-Scott.
- One 2-gang variable condenser, complete with drive—Formo.
- One 2-coil assembly, type TDS.—Colvern.
- One reaction condenser, .00015 mfd.—Polar.
- One input push-pull transformer, type DP.36—Varley.
- Twelve 1 watt fixed resistances, 50,000 ohms, 30,000 ohms, 25,000 ohms, 10,000 ohms, 10,000 ohms, 750 ohms, 250 ohms, 350 ohms, 350 ohms, .5 megohms, 20,000 ohms, and 2,000 ohms.—Amplion.
- Three tubular fixed condensers, .1 mfd., .1 mfd. (type 4403), .5 mfd. (type 4406)—Dubilier.
- Two fixed condensers, .0001 mfd., .0002 mfd. (type 65)—Dubilier.
- Three electrolytic condensers, 25 mfd., 25 volt working (type 3046)—Dubilier.
- Two electrolytic condensers, 8 mfd. 500 volt working (type 0218)—Dubilier.
- One fixed condenser, 500 volt working, 4 mfd. (type LEC)—Dubilier.
- One screened H.F. Choke, HFPJ—Wearite.
- One QMB. on/off switch, type S.80—Bulgin.
- One 10-way group board—Bulgin.
- One 2,000 ohm potentiometer, type VC.26—Bulgin.
- One mains transformer—B.T.S.
- One H.T.10 metal rectifier—Westinghouse.
- One .5 amp. fuse and holder—Microfuse.
- One twin socket strip, with plugs marked A. and E.—Belling-Lee.
- Four valves, MVS Pen., 41MHL, 41MP, 41MP—Cossor.
- One mains-energised loudspeaker, type "Practical Wireless"—W.B.
- Two fixed condensers, 1 mfd., 2 mfd., type BB—Dubilier.
- Two component brackets.—Peto-Scott.
- Four valve holders, 1, 7-pin, 3, 5-pin—Clix.

Fitting the Set into the Cabinet

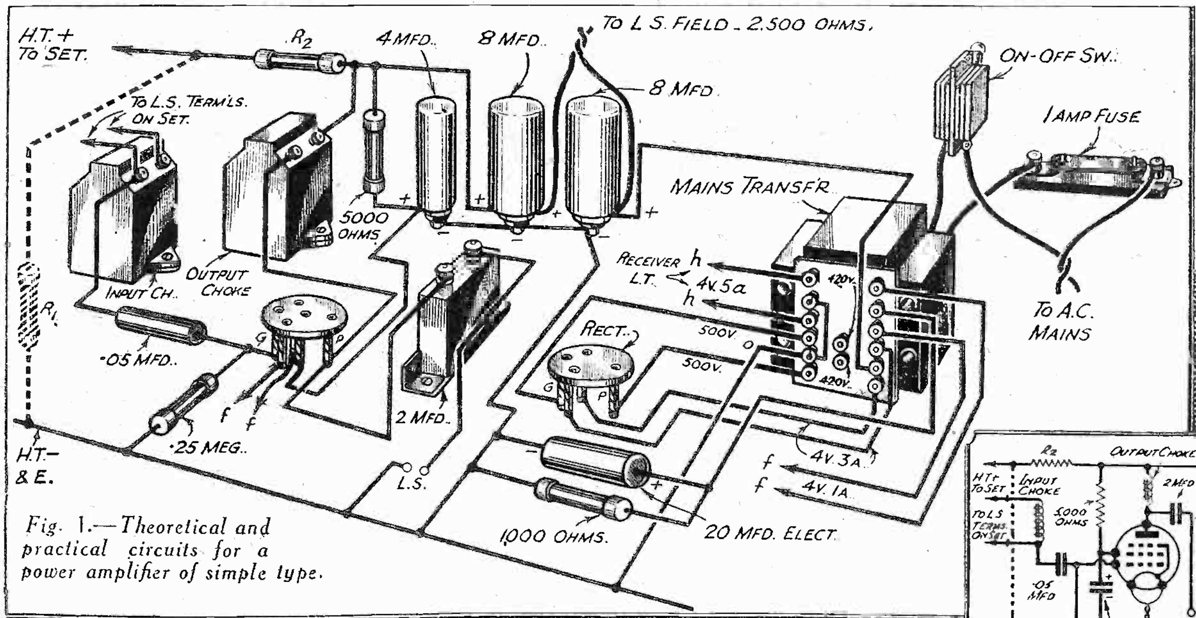
The cabinet is a soundly made job and no difficulty will be experienced in marking out the front for the various spindle holes. An excellent method of doing this is to put a spot of ink on the centre of the projecting ends of the control spindles and then to slide the chassis into the cabinet, so that the longest spindle transfers its ink to the inside of the front of the cabinet. This hole should then be drilled with a woodworker's centre-bit, drilling through from both sides of the cabinet. Next pass the chassis in again and proceed to mark and drill the other holes in a similar manner.



BUILDING POWER AMPLIFIERS

Practical Details of Two Different Types of A.C. Amplifier Suitable for Outputs of Three and Four Watts are Given

By FRANK PRESTON



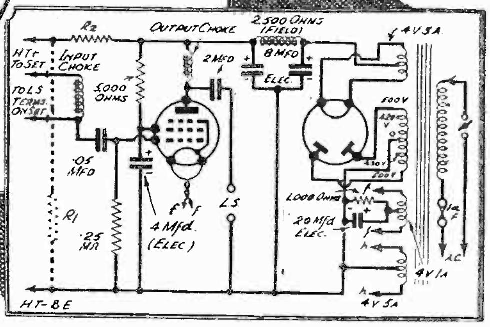


Fig. 1.—Theoretical and practical circuits for a power amplifier of simple type.

THERE are many arguments both for and against the use of high-power amplifiers to feed the loud-speaker, but the fact remains that greater undistorted outputs are coming into wider favour. Whereas an undistorted output of about 1 watt was considered high a few years ago, it is now the rule to find that the average mains receiver has a maximum output well in excess of this; in fact, it is probably true to say that the average output is something like 2 watts. There are many listeners who desire an output higher than this, however, and it is for such people that this article is written. Details will be given of amplifiers suitable for outputs between 2 and 5 watts, so that the units described will be appropriate for use with the average receiver when it is wished to operate a few speakers at full volume or to obtain good reception in a large room. The amplifiers can also be used—in a very limited way—for public-address work indoors, although they are not suitable for use in the open air, when the output should be something like 20 watts.

The Power Supply

The conditions set out preclude battery amplifiers, since to secure more than 2 watts from a battery set it becomes expensive to obtain the necessary current, and the choice of valves is limited.

When it is proposed to fit a power amplifier to an existing mains receiver it is first necessary to decide whether or not the power-supply unit in the receiver has sufficient "reserve" to enable it to feed the amplifier as well. In the majority of cases it will be found that the mains portion has an output only just sufficient for the receiver itself, and it will therefore be necessary to provide a separate unit for the additional amplifier. It will nearly always be found, however, that the new mains unit can be made to give sufficient output for the receiver and amplifier without going to any additional expense. For that reason it might be found convenient to remove the power-supply components from the set and use some of them in the amplifier. The amplifier circuits to be described will be shown complete with power units, and it will be explained how these can be employed to feed the receiver.

A Single-Valve Pentode Amplifier

The simplest possible type of amplifier is that shown in Fig. 1, and this employs a single directly-heated pentode, fed from a choke-capacity filter circuit. This amplifier is well suited to follow a receiver having a small power valve in the output circuit and having only a single L.F. stage. It is not suitable for use after a powerful set, since the pentode would be overloaded in such circumstances. When the Cossor PT 41 B valve is used the undistorted output is over 3 watts. This valve requires an anode voltage up to 400 and consumes 36 milliamps of anode and screen current, so that it is necessary to employ a rectifier valve of the C class, the maximum output from which is 500 volts at 120 milliamps. A 2,500-ohm loud-speaker field winding is included in the positive lead, and this accounts for a voltage drop of 90 at the H.T. current of 36 milliamps. The bias voltage required for the PT 41 B is 40, so that the voltage actually applied between the anode and cathode is 350, allowing for a drop of some 20 volts across the winding of the output choke.

Component Values

The various resistance and condenser values are indicated in Fig. 1, whilst suitable voltage outputs for the mains transformer are marked. It will be seen that the H.T. secondary winding of the transformer is tapped so that voltages of 500 or 420 can be applied to the anodes of the full-wave valve rectifier. When the amplifier only is being fed from the mains equipment the lower tappings must be used to prevent the voltage from rising to a figure in excess of 500, as it would when the total load on the rectifier is only 36 milliamps. When the mains unit is also being used to feed a receiver, however, the maximum (500-volt) tappings can be used, the total load being made up to 120 milliamps by connecting a fixed resistance in parallel with the output, as shown at R1. The value of this resistance can be found by dividing the difference between the total current consumed and 120 milliamps into 500, and the result will be in thousands of ohms. The resistance must, of course, be of large enough power-handling capacity to deal with the current involved.

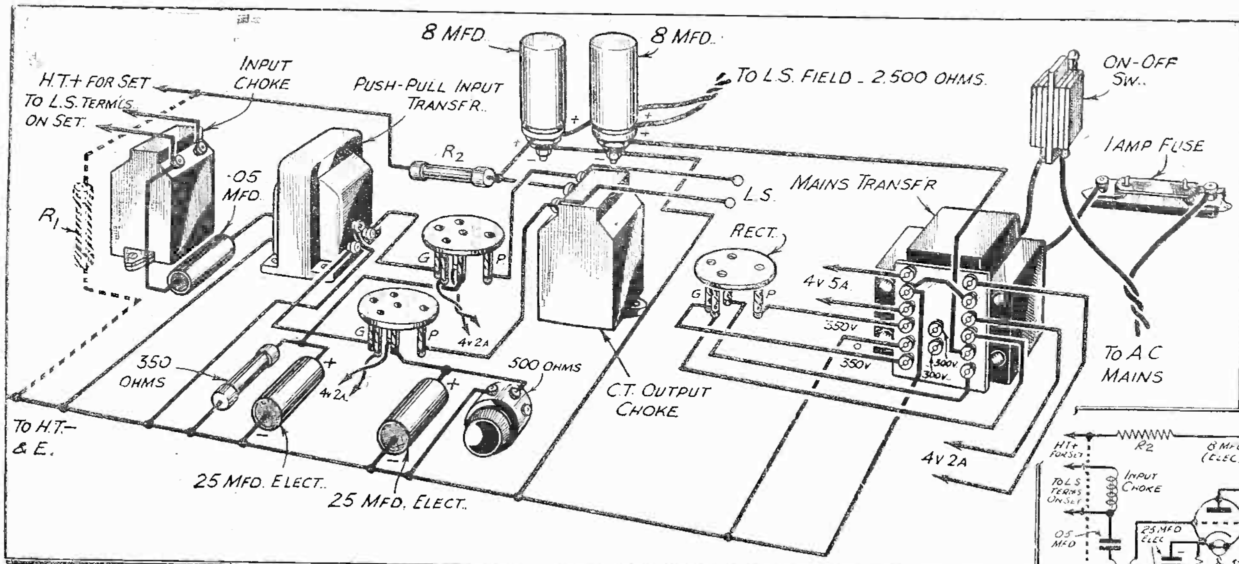
The resistance shown at R2 is for the purpose of limiting the output voltage to that required by the receiver, and its value may be calculated in the usual manner by dividing the current into the voltage to be dropped.

The mains transformer shown has a separate 4-volt, 5-amp. winding for supplying the heaters of the receiver, but the actual current output for this should be chosen according to the set in use.

With regard to the components required for the amplifier mains unit, it should be stated that these should all be of the best quality obtainable. Remember that high voltages are being dealt with, and act accordingly! The electrolytic condensers used for smoothing the H.T. supply should have a rated *working* voltage of not less than 600, whilst that used in the grid-bias circuit need be rated at 50 volts working. The first L.F. choke, used for coupling the amplifier to the receiver, must have a current-carrying capacity of only about 20 milliamps at the marked inductance, but the output choke should be designed to carry up to 50 milliamps, and should have an inductance of 15 to 20 henries when carrying the maximum current. This choke should have a D.C. resistance of about 400-500 ohms. All other details required can be obtained from Fig. 1.

(*Continued overleaf*)

AN A.C.-OPERATED PUSH-PULL CIRCUIT



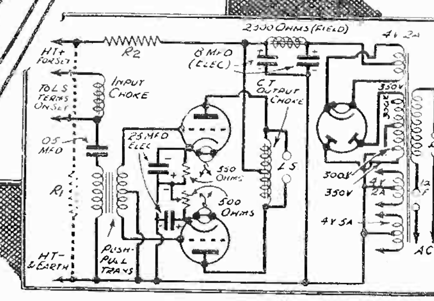


Fig. 2.—The above drawing shows the connections for a 4-watt push-pull amplifier for all A.C. working.

(Continued from previous page)

A Four-watt Push-pull Amplifier

The circuit shown in Fig. 2 is for a push-pull amplifier giving an output of rather more than 4 watts when a pair of Cossor indirectly-heated 41 MXP valves are employed. The component values indicated in the theoretical and practical circuits apply to these valves, but only slight modifications would be necessary if two valves of similar type but of other make were used. This amplifier is suitable for use after a receiver with an appreciable output, since the valves mentioned do not afford such a high degree of amplification as the pentode specified for the first circuit, and are not so easily overloaded. As the valves require an anode voltage of only 200 it is possible to use a rectifier valve of the B type, which gives an output of 350 volts at 120 milliamps, and still to have a sufficiently high voltage to afford the drop occasioned by the use of a 2,500-ohm energised moving-coil speaker.

Directly-heated valves are often specified for push-pull circuits, but by using indirectly-heated ones it is possible to obtain a certain amount of decoupling in the cathode circuits and also to "balance" the two valves, if necessary, by slightly altering the value of one of the biasing resistances; it is for this reason that one bias resistance is shown as being variable. The H.T. secondary of the mains transformer is again shown as being tapped, this time at 300 volts, so that the voltage on the anodes of the valves may be kept down to 200 volts when the receiver with which the amplifier is used has its own mains equipment.

The Push-pull Components

A suitable input push-pull transformer is the Ferranti AF5C, but this should be choke-capacity fed, the choke Ch.1 being chosen to match the output valve in the receiver. Where the receiver is provided with choke-capacity output the choke and condenser may, of course, be omitted. The H.T. smoothing condensers in this case should be rated to work at not less than 400 volts, although the voltage will not rise unduly due to the fact that an indirectly-heated rectifying valve is employed. The bias by-pass condensers should have a working voltage of 25, the bias voltage being 12.5.

If the speaker employed is fitted with its own output transformer this will probably be unsuitable for carrying the full anode current of the two push-pull valves (80 milliamps), and a centre-tapped output choke is therefore shown. Where the speaker is not provided with a transformer, one having a ratio of 40 : 1 can be used in place of the output choke. This ratio is suitable for a speaker having a speech-coil impedance of 5 ohms, but would have to be modified for other speech-coil impedances. For example, if the speech coil were 12.5 ohms the ratio should be 25 : 1, or if it were of 7 ohms, the ratio should be about 30 : 1.

The Choice of a Speaker

It need scarcely be mentioned that the speaker used with an amplifier of either of the types described must be capable of dealing with the fairly large outputs involved. It is useless to obtain a small unit intended for use with an output valve of, say, the 1-watt class. In the case of the first amplifier described the energising wattage available, for a 2,500-ohm field winding, is only about 3½ watts. This is rather low, so that with some speakers it might be desirable to use the 500-volt transformer tappings, and to adjust the parallel resistance to such a value that a sufficiently high current is passed through the field winding. An alternative method, which is often very satisfactory, is to employ a speaker with a field winding designed for use with D.C. mains, and having a resistance of about 6,500 ohms. In this case the winding can be connected in parallel with the smoothed D.C. output, replacing the field winding in the circuit shown by a field-replacement choke. The disadvantage of this method of feeding the speaker is that the energising winding cannot be used as a smoothing choke, and expense is therefore increased to a certain extent. When a permanent-magnet speaker of suitable type is already available this can, of course, be used in either of the circuits shown, simply by replacing the field winding by a field-replacement choke as mentioned in the case of a 6,500-ohm speaker.

HERE AND THERE

Chamber Concert from Midlands

THE second of the Chamber Concerts of music by Midland composers is devoted to Gustav Holst, who was born in Cheltenham and got his early training in choral work in Gloucestershire. The Birmingham Ladies' String Quartet and the Midland Wireless Singers will give a Holst programme on February 4th.

"Ahab and Elijah"

BLACK Country character and humour will be represented in Midland programmes in a short series centring round an imaginary character named Joe Gutteridge. In the first of these series, to be given on February 8th, Joe tells, from inside knowledge, some remarkable stories of experiences during the production of a play called "Ahab and Elijah," which was written as well as acted by Black Country workers.

B.B.C. Midland Orchestra

MARJORIE WESTBURY is the vocalist with the B.B.C. Midland Orchestra in a programme of Italian music to be given on February 9th. Leslie Heward will conduct. The orchestral works include Corelli's Concerto Grosso in G Minor and Respighi's "Trittico Botticelliano" Triptych.

Saturday Concert from Walsall

LATER in the same evening (February 9th) one of the Popular Saturday Concerts at the Central Hall, Walsall, is to be relayed for Midland listeners. The artists are Essie Ackland (contralto), Albert Hodgson (entertainer at the pianoforte), and Miroslav (violin).

Clearing a Channel

ON 514.6 metres, namely, between Vienna and Stuttgart, you will now pick up a French transmission at fairly good volume; it is Grenoble P.T.T., whose channel has now been abandoned by the newly-reconstructed Radio Agen (France). On the other hand, the position taken up by Agen on 309.9 metres is an unfortunate one, inasmuch as owing to its frequent deviations it is causing interference to Poste Parisien (Paris). It is difficult to understand why these small private stations cannot be made to work on a national common wave.

VALVE TYPES AND USES—6

This Week Three Special Hivac Battery-operated Output Valves Are Considered.

THE output circuit of the battery-operated receiver was revolutionised about a couple of years ago by the introduction of quiescent push-pull, for this form of output made it possible to feed a power of between one and two watts to the loud-speaker. When Q.P.-P. was first introduced there were many snags and difficulties, but these have now been overcome, principally due to the improvements in valve design and manufacture that have gradually been introduced. The result is that to-day the quiescent output stage, in one of the two forms in which it can be provided, is thoroughly reliable and not only permits of ample outputs being economically secured from battery-operated sets, but also ensures high-quality reproduction.

The Development of Quiescent Amplification

It is interesting to recall a few of the developments which led up to the introduction of the economy-with-volume output valves now available. In the first place the Q.P.-P. arrangement was rather unpopular, due to the fact that it was expensive, since two high-efficiency pentodes were required, in addition to a special type of push-pull input transformer, and also a special loud-speaker or output transformer. There was also the difficulty of accurately matching the two pentode valves in working conditions, and this often precluded the satisfactory use of Q.P.-P. by the inexperienced constructor.

Shortly after Q.P.-P. had been introduced in this country, and before it had "got into its stride," the Class B valve came along, and rapidly gained in popularity at the expense of the rather similar previous system. As is generally known, the Class B valve consists of two three-electrode valves in a single glass bulb, and the two halves are perfectly matched by the manufacturers, thus entirely removing this difficulty so far as the user is concerned. The chief objection to Class B amplification, however, is that the output (Class B) valve requires to be preceded by a driver valve, so that, although the output valve itself is cheaper than the two pentodes at first used in Q.P.-P., the cost of the output valve and the driver together, with the additional L.F. transformer required to feed the driver, is nearly as great as that of the two pentodes for quiescent push-pull.

A Double Pentode

Because of the facts enumerated above, Class B came into wider use than the previous system, and it is only within fairly recent times that Q.P.-P. has begun to stage a "come-back." The reason is that several makers have produced a double pentode especially designed for Q.P.-P. The two halves of the valve are accurately balanced, and the combination valve can be bought for as little as 19s. 6d. (which is the price of the Hivac QP 240, of which details are given in a panel on this page). As may be seen, the maximum undistorted output to be obtained from this valve is 1,400 milliwatts, which is adequate for most requirements. The quiescent anode current (when no signals are being received) is 8 milliamps, and the average current during reception is 12 milliamps; this assumes that the valve is being employed with the maximum high-tension voltage of 150, and in such conditions that the maximum undistorted output is available on the louder passages. It will be evident that the average anode current is rather higher than that taken by the Hivac B 230 Class B valve, plus that of an L 210 used as driver, but it must also be borne in mind that the maximum output is also greater than that from the Class B. From the point of view of efficiency there is little to choose, therefore, between Class B and Q.P.-P., although the latter has the advantage that it may be used directly after a detector valve, whereas the former must be preceded by an L.F. stage.

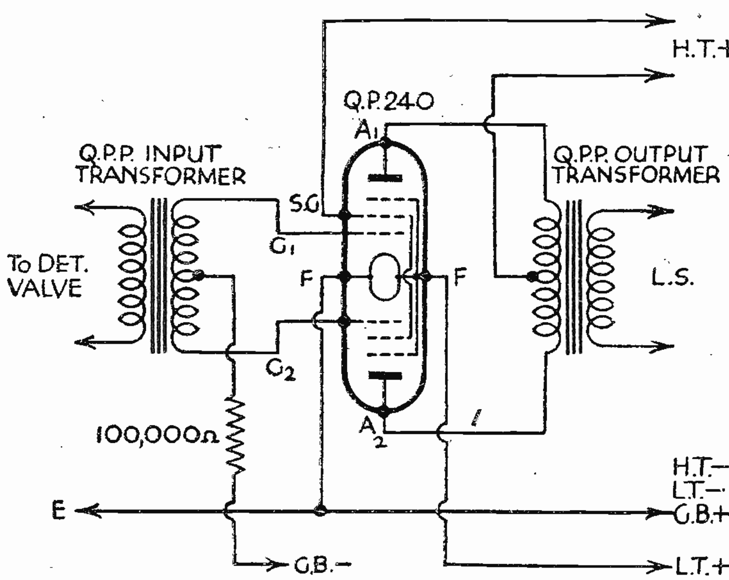
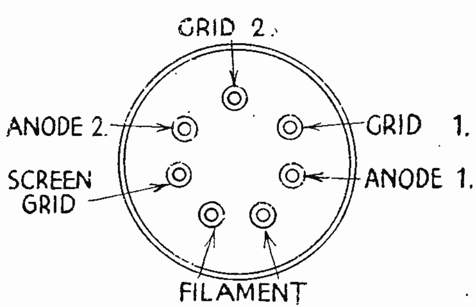


Fig. 1.—This circuit shows how the QP 240 is connected. Valve-base connections are shown below.



Using the QP 240

The connections for the QP 240, which has a 7-pin base, are shown in Fig. 1, where it may be seen that one terminal only is provided for the screening grid of both pentode sections. This is an extremely likable valve, and when used in the correct conditions it is capable of extraordinarily good results. The correct conditions can be enumerated briefly as follows: The input transformer must have a ratio of between 1 : 8 and 1 : 10 (overall); the valve must follow directly after the detector (if an L.F. stage were interposed there would be a risk of overloading); the G.B. battery should have a maximum voltage of not less than 18; the output transformer must be of the special Q.P.-P. type, having a primary resistance of not more than about 300 ohms; the H.T. supply must be well "regulated" and capable of supplying a "peak" current of, say, 40 milliamps.

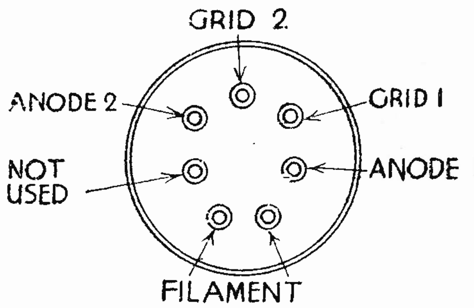


Fig. 2.—Valve-base connections for the B230 Class B valve.

All except the last condition will doubtless be quite easily understood, even by the beginner, but further information may be desirable concerning the matter of H.T. supply. It is not the purpose of this series of articles to deal with the theory of valves, but it can be stated briefly that the whole principle of quiescent working is that the anode current passed by the output valve(s) is proportional to the volume of sound being reproduced at any instant. Thus, although the average anode-current consumption of the QP 240 is only 12 milliamps, it might well rise, for very short periods, to 35 or even 40 milliamps, after which it might fall immediately to 8 milliamps. If the valve is to function correctly the anode voltage must remain constant irrespective of the

(Continued on page 729)

VALVE TYPES AND USES.

HIVAC QP 240 (Double Pentode for Q.P.-P.)

Chief Characteristics :—

Filament Voltage	2
Filament Current	.4 amp.
Maximum Anode Voltage	150
Quiescent Anode Current	8 milliamps
Average Anode Current (for full output)	12 milliamps
Grid Bias (for max. anode voltage)	18 volts
Optimum Load (anode to anode)	14,500 ohms
Maximum Output	1,400 milliwatts

HIVAC B 230 (Class B)

Chief Characteristics :—

Filament Voltage	2
Filament Current	.3 amp.
Maximum Anode Voltage	150
Quiescent Anode Current	2.5 milliamps
Average Anode Current	5.5 milliamps
Optimum Load (anode to anode)	14,500 ohms
Maximum Output	1,250 milliwatts

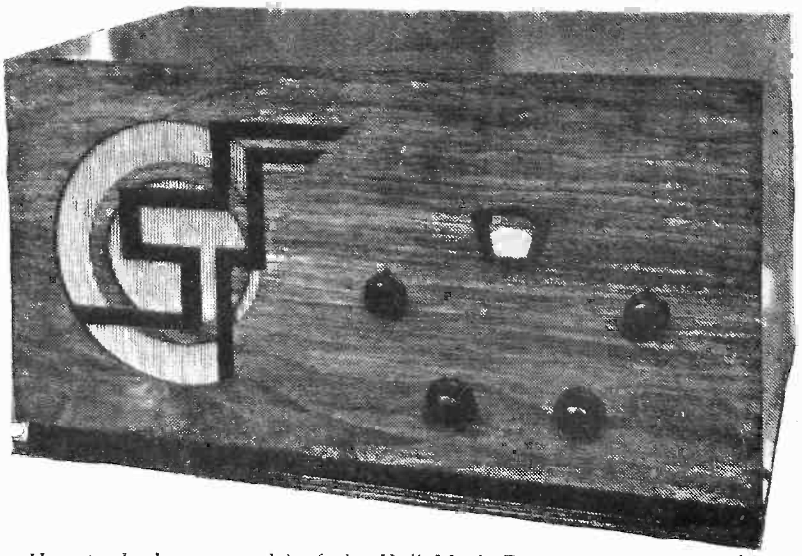
HIVAC DB 240 (combined Driver and Class B)

Chief Characteristics: As B 230, excepting the following :—

Filament Current	.4 amp.
Total Quiescent Anode Current (Driver and Class B)	5.5 milliamps.
Average Anode Current (driver and Class B)	8.5 milliamps.
Driver G.B. Voltage (for max. anode volts)	4.5

THE BAT
HALL-MAR

Constructional Details for This Fa
Given Here. Operating Notes wi



Here is the battery model of the Hall-Mark Four in its attractive cabinet.

LAST week we gave some brief particulars of the circuit and general arrangement of the battery-model Hall-Mark Four, and from the letters we have since received it is evident that there is a large number of readers who contemplate the construction of this set. In the first place we would say that the constructional work involved is of an extremely simple and straightforward nature, as may be gathered by examining the photographs reproduced on this page. The components are few in number and are easily accommodated on the small metallised chassis. Even though the chassis is small there is no crowding and every terminal to which connection has to be made is easily accessible.

Preparing the Chassis

Some readers may prefer to purchase the chassis ready drilled, but those who prefer to drill it themselves should start by marking out and drilling the four holes for the valve-holders. These are all 1in. in diameter, and their positions can readily be determined from the scale wiring plan given. After mounting the valve-holders it will be found most convenient to fix in place all those components that are situated underneath the chassis, starting with the push-pull input transformer. After that, the two component brackets can be fitted and the reaction condenser and volume-control potentiometer attached to them.

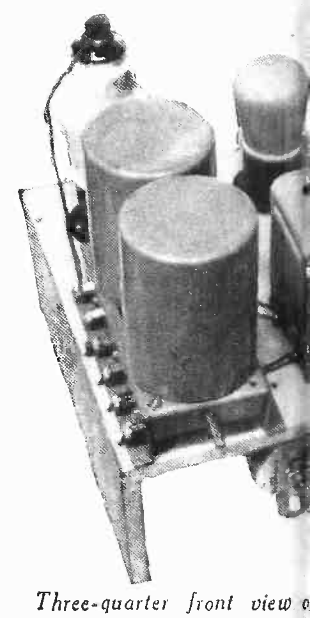
It will be seen that the fixed condensers and fixed resistances are not attached to the chassis, but are supported by their connecting wires. The next step is to mount the third component bracket, variable condenser, and coil assembly on the upper surface of the chassis. Again the correct positions (which are not too critical, by the way) can be found by making reference to the wiring plan. One point that should be watched, however, is that the condenser must be exactly in the centre, so as to make the drive central. It should also be noted that the end of the condenser spindle should be in line with the front edge of the chassis—not overhanging, as might be supposed. This is because the collar on the slow-motion drive has to fit over it, the spindle from this actually passing through the front of the cabinet.

The position is rather different in the case of the wave-change switch rod on the coil assembly, since this must project, and the coil base is so placed that it just lines up with the front of the chassis.

Simple Wiring

Having mounted the various components, wiring may be commenced. The method of making the various connections calls for little explanation, since it is evident from the wiring plan, but it should be explained that several wires pass through the chassis from components mounted on the upper surface to others that are underneath. The holes through which the wires pass are numbered on the two wiring plans, so that the "run" of every wire can easily be traced. It will also be observed that two "earth-return" leads are attached to a wood screw fitted into the chassis just beside the on-off switch; one of the leads is from the on-off switch and the other is from the volume-control potentiometer.

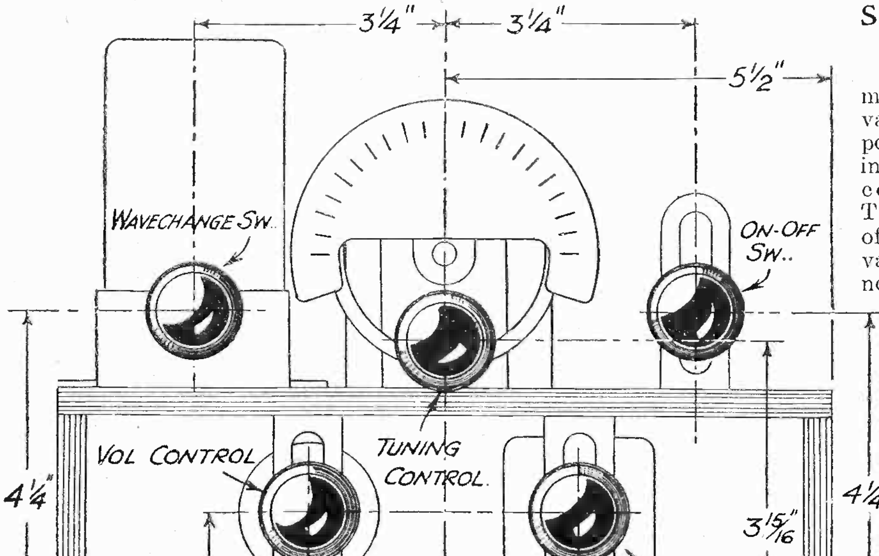
To those who are conversant with theoretical circuits it might appear that there are more terminals on the coil assembly than are actually required, and that some of the connections are duplicated. This is explained by the fact that certain of the coil connections are brought out to two terminals, one situated on each side of the coil base. There is a very good reason for this, which is that it ensures short, direct connections to the fixed vanes of the variable condenser and also to the grid circuits of the first two valves.



Three-quarter front view o

"Earth-Return" Connections

In making the connections to the components on the underside of the chassis it will be seen that several leads are taken to a bolt (marked M.B.). These are "earth-



Front view of chassis, giving dimensions for drilling the cabinet.

LIST OF COMPONENTS FOR THE

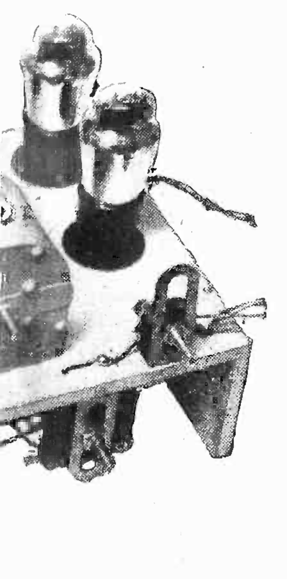
- One Metaplex chassis, 10in. x 8in. with 3in. runners—Peto-Scott.
- One 2-gang condenser, Baby type with dial—J.B.
- One 2-coil assembly, type T.D.S.—Colvern.
- One reaction condenser, .0003 mfd. (C3)—Graham Farish.
- One pre-set condenser, .0003 mfd. (C4)—Formo.
- Four fixed condensers, two .5 tubular (C7 and C10), two .1 tubular type 250 (C5 and C6)—T.C.C.
- Four .0002 fixed condensers, type "M" (C8, C9, C11, C12)—T.C.C.
- One 50,000 ohm potentiometer (R1)—B.T.S.
- Four ohmite resistances, 1 meg. (R2), 30,000 (R3), two 10,000 ohms (R4 and R5)—Graham Farish.
- One input push-pull transformer, type DP36—Varley.
- One H.F. choke, type H.F.8—Bulgin.

TERY
K FOUR

ating Receiver are Given Next Week

eturn " leads, and it is therefore important hat the head of the bolt should make good ontact with the metallised upper surface. 'o ensure this it is well to fit a large washer nder the bolt head, and also to place a imilar washer over the looped ends of the vires before fitting the nut.

It is most unlikely that any reader will xperience difficulty in following the wiring liagrams, but anyone who does should emember that our Advice Bureau is open o them free of charge, and that we shall be glad to assist any constructor who is in difficulty. But do not do as a few have done when building previous sets described by us and employ parts different from those specified. The receiver has been designed to give perfectly satisfactory results when certain components are used—it may, or may not provide good reception if alterations are made.



Battery Hall-Mark Four.

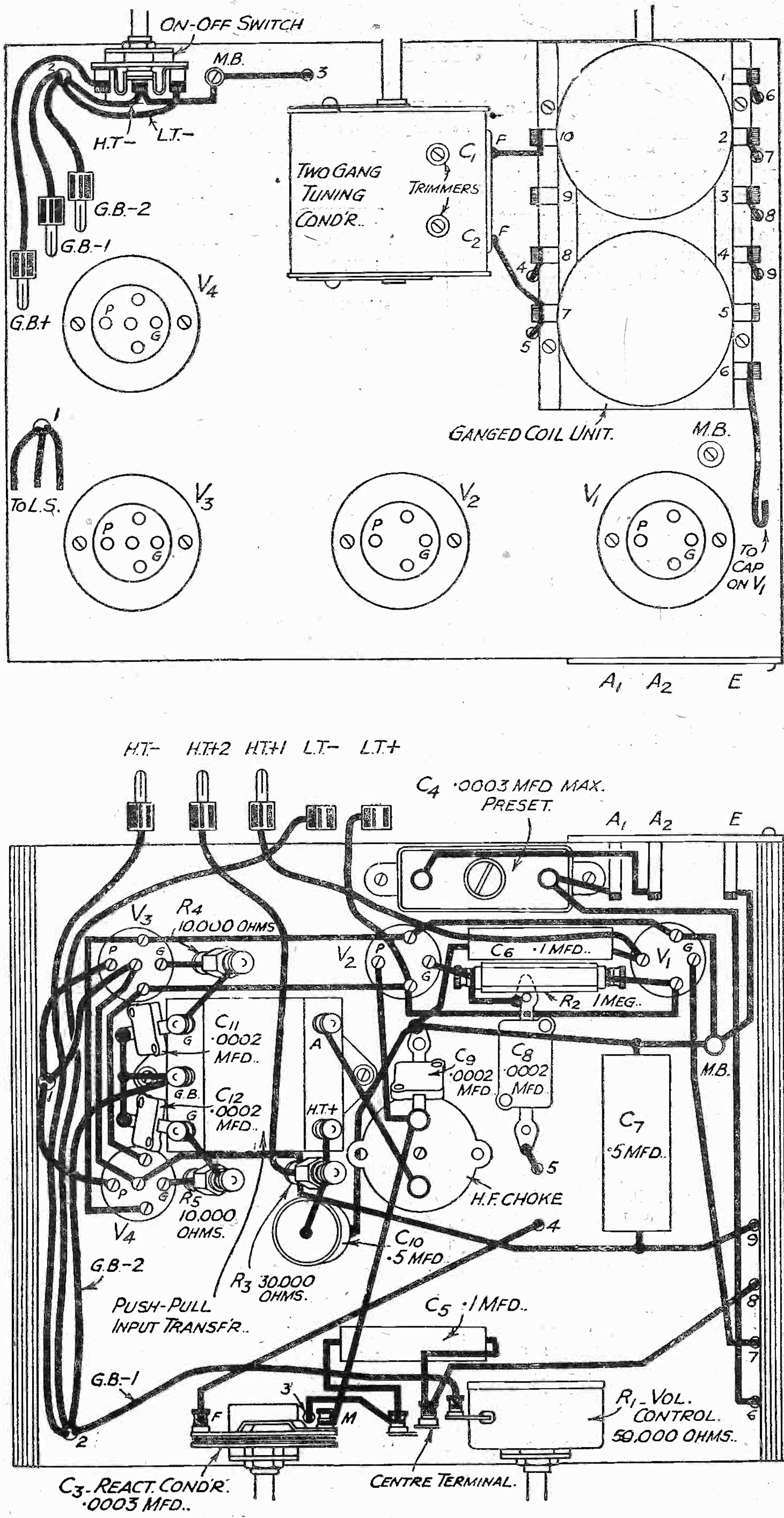
The Output Valves

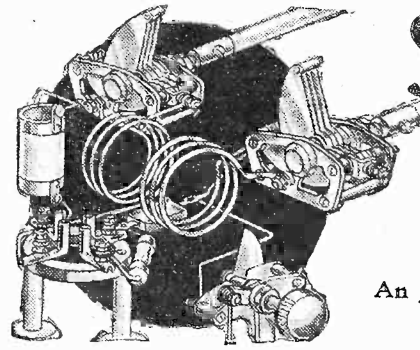
It will have been noticed by readers that n the circuit diagram given last week the output valves in the push-pull stage are represented as power triodes, whilst in the list of components these valves are listed as pentodes. The point is that the extra volume available by employing pentodes fully justifies their slightly greater expense, and for this reason these valves are recommended. Triodes, such as the Cossor 220 PA, can, however, be used if desired.

TERY HALL-MARK FOUR

otentiometer brackets—Peto-Scott.
inal strips, A., E. and L.S./P.U.—Clix.
, G.B.—1, G.B.—2, G.B.+, H.T.—, H.T.+1, H.T.+2
le terminals, L.T.+ and L.T.—.—Clix.
ves, 210 VPT, 210Det., and two 220HPT—Cossor.
ker—W.B.
ff switch (three point)—Graham Farish.
pin valve-holders—Clix.
-pin valve-holders—Clix.
l-Mark cabinet—Peto-Scott.
-volt H.T. battery.
lt G.B. battery.
lt accumulator.

Top and Sub-chassis Wiring Diagram of the Battery Hall-Mark Four



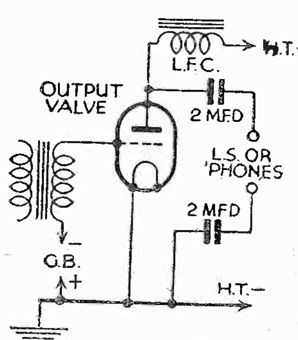


Short Wave Section

USING MAINS UNITS WITH SHORT-WAVERS

An Article Explaining How They Can Successfully be Employed, and How Any Difficulties May be Overcome

WHEN short-wave work first became popular many "fads" and "fetishes" grew up around it owing to the frequent small difficulties which occurred, and which often were cured by some strange and unorthodox arrangement. Because of the immense difficulties which always seem to have been considered to surround their use with short-wavers, mains-units have never, until perhaps very recently, come into favour with the short-wave experimenter. The writer is convinced that, provided a little care is taken in the first setting-up of the combination, a short-waver and a mains-unit can form a very successful arrangement. It is hoped in this article to show how such can be arranged and how likely snags that arise may be overcome.



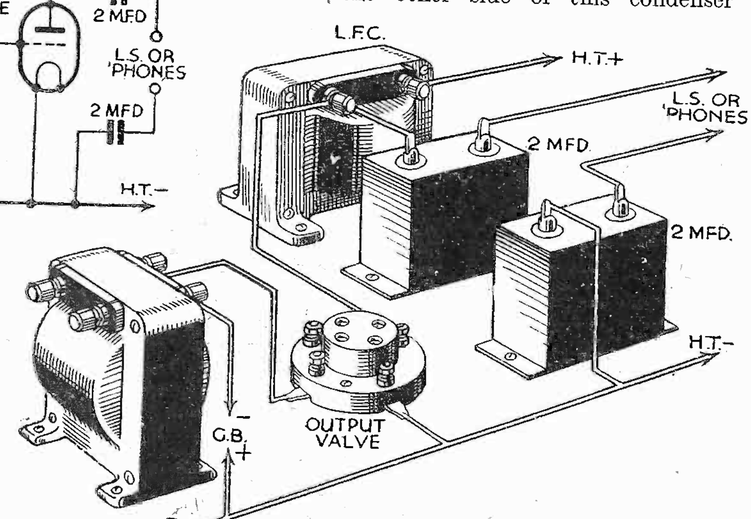


Fig. 1.—Showing how 'phones can safely be used with a mains receiver.

Curing Instability

The first point to consider is that very frequently headphones are used with a short-wave set, and it is definitely not recommended that a mains-unit should be used with 'phones unless with a safe and efficient output filter. A diagram showing the correct circuit to be used is given in Fig. 1. Note that both 2-mfd. fixed condensers should be included in order completely to isolate the headphones. Indeed, this addition is to be advised even though 'phones are never used, as it greatly assists in smoothing out hum, and curing any instability that may arise. The question of instability is the second point which occurs, as, owing to the higher resistance of the mains-unit compared with that of a battery, even a simple two-valver which is not decoupled is liable to become unstable and difficult to handle. If decoupling is to be added, and if it is already included, an alteration is suggested, the circuit shown in Fig. 2 being advised. A 50,000-ohm potentiometer is wired right across the H.T. supply—one terminal to H.T. positive, the other to H.T. minus. The detector H.T. lead is taken to the slider, from which a lead is also taken to one side of a 2-mfd. condenser, the other side of this condenser being connected to earth. Decoupling has now been effected and a variable arrangement for detector H.T. voltage provided at the same time. This has thus overcome what was one of the difficulties of using a mains unit with a short-waver, for critical control of detector H.T. is often necessary in order to obtain smooth reaction. Besides the detector valve an intermediate L.F. valve may also be found to require decoupling, whilst if an output pentode is being used, decoupling of its auxiliary grid may be useful. These suggestions having been carried out it may be found that, although the set works quite successfully, with the mains unit a troublesome percentage of hum and, perhaps, other noises are heard. It is the writer's opinion that some of the mains units on the market are not suitable for immediate use with a short-waver without the addition of smoothing, and Fig. 3 shows a small unit which it is advised should be made up and used between the set and the unit.

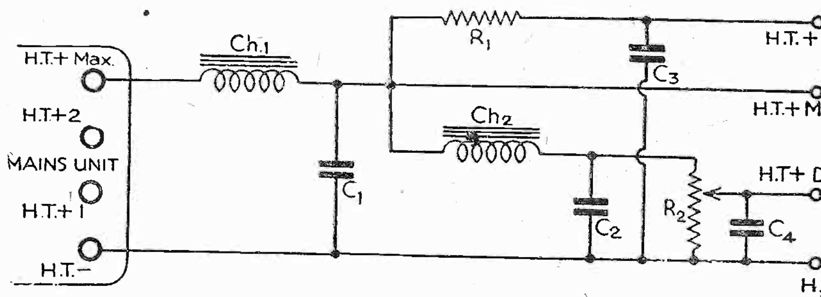


Fig. 3.—Showing the circuit of the simple and useful unit described.

Ch.1 should be a good L.F. choke of about 20 henries inductance at the current required. Ch.2, which feeds the detector only, may be the primary or secondary of an old L.F. transformer, or, better still, a high-inductance L.F. choke (about 100 H.) such as used to be used for L.F. coupling when choke-capacity coupling was popular. There are many such chokes on the market which can be purchased quite cheaply. Condensers C1, C2, C3, C4 should be 2 mfd. each and R1 should have a resistance of 20,000 ohms. R2 is a 50,000 ohms variable potentiometer which, together with C4, makes up the variable detector tapping mentioned earlier in this article. The position shown in Fig. 3 is correct for these components when this smoothing unit is used. This unit is applicable to either D.C. or A.C. mains units and should be connected right across H.T. + maximum and H.T. —, all intermediate tappings on the mains unit being ignored. Residual hum should now be nil, or else

(Continued on page 724)

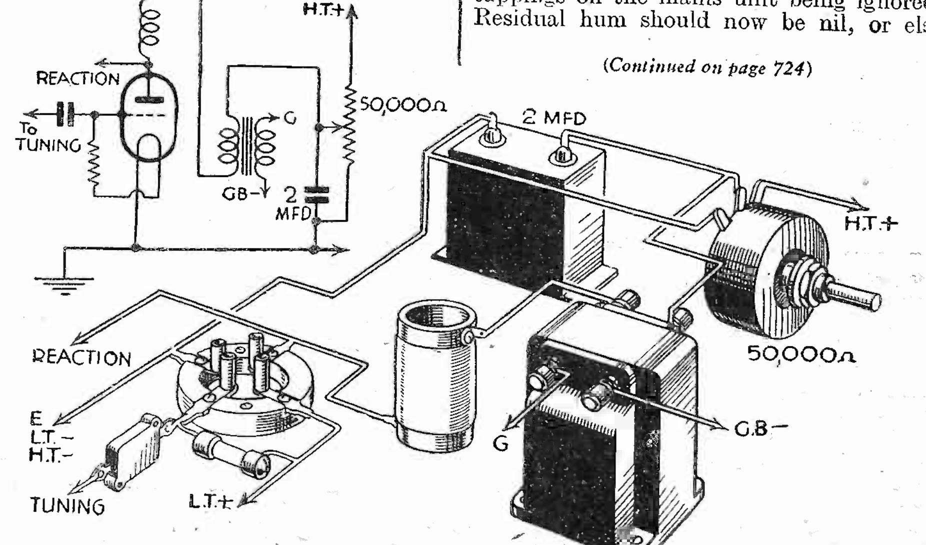


Fig. 2.—This circuit shows how the output circuit can be decoupled, as described in the text.

USING MAINS UNITS WITH SHORT WAVERS.

(*Continued from page 722*)

very small indeed, and may either be due to interaction between the mains unit and the set, or else due to H.F. on the mains. In the former case the remedy is obvious—separate set, mains unit and additional smoothing unit from each other as much as possible and always, in any case, keep aerial and speaker leads well away from mains equipment. If it is found that even with it at the most reasonable distance away from the set hum is still picked up by the latter from the mains-unit, complete screening of the unit should effect a cure. This screening must be carried out with iron or tin, and must be earthed. A large biscuit tin forms a very good screening box, but care must be taken to see that the lid makes efficient contact with the rest of the box.

H.F. Hum

With regard to H.F. creeping through from the mains, a remedy that is fairly simple may first be tried. It is merely to connect a .001 mfd. condenser between one side of the mains and earth, reversing the plug once or twice to see which way round gives the least hum. Failing this, two .01 mfd. condensers in series across the mains with the mid-point earthed should effect a cure. In the event of still troublesome H.F. hum and noises on the mains, two H.F. chokes specially designed for mains working may be added as shown in Fig. 4. Reducing the value of the grid leak frequently assists in eradicating hum, and it is obvious that all grid leaks, condensers and resistances must be in first-class order, for with mains working the slightest variation is liable to cause crackle or hum.

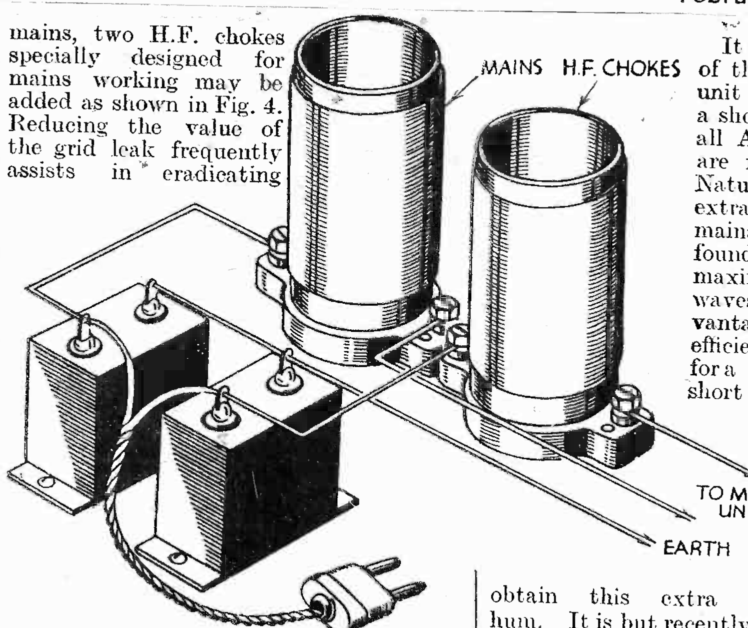


Fig. 4.—Special mains H.F. chokes, connected as shown here, will often prevent mains interference.

It is sufficient proof of the fact that a mains-unit can be used with a short-waver to say that all A.C. short-wave sets are now being designed. Naturally enough, the extra-high efficiency of mains-valves has been found a boon in obtaining maximum results on short waves. Indeed, the advantage of this extra efficiency has been realised for a long time, as many short-wave experimenters have been using indirectly-heated A.C. valves run off batteries in order to obtain this extra efficiency without hum. It is but recently, with the improvement in indirectly-heated valves, as well as in mains components and the provision of high-capacity electrolytic condensers for smoothing, that all A.C. short-wavers have come into their own. The ease and reliability of mains working are great assets well worth the slight effort required to put the few foregoing hints into practice.

METAL SHIELDING AND SHORT-WAVE RECEIVERS

This Article Deals with the Various Points, Advantages and Snags Associated with Screening, and the Design of Screened Short-wave Receivers

THE keen amateur who, as a rule, studies commercial and sponsored designs is quick to realise the advantages to be derived from efficient screening. After carefully studying the fundamental principles followed by a series of practical experiments, the advantages of screening properly and correctly applied are obvious.

Unfortunately many experimenters are less thorough, and regard screening as but a simple undertaking—simply the placing of screens around coils and between stages, and using a metal chassis foundation. Practical experiments on the above lines, as is to be expected, usually end in dismal failure.

Do not imagine, however, that screening is best left alone; this is by no means the case, because screening when correctly applied is a definite advantage. Quite apart from technical considerations, experimental screening will prove of interest to the amateur, who naturally wishes to obtain the maximum efficiency from his receiver.

As previously mentioned, the fundamental principles must be understood in order to reap the benefits of screening, and avoid snags and consequent disappointment.

The purpose of this article is to deal with various points, advantages and snags, all of which are associated with screening and the design of screened short-wave receivers.

Chassis Construction

The foundation of a modern receiver is the chassis. Aluminium is the most common metal used for chassis construction. It is, of course, by no means cheap to buy and must be of a rather heavy gauge in order to avoid whip or fracture. This point is worth remembering. If the chassis is of light-gauge material it is absolutely useless because power transformers, chokes and gang condensers are heavy components which require a solid foundation. To handle a flimsy chassis upon which components of the above nature are mounted is simply asking for trouble, which will undoubtedly be experienced sooner or later.

One of the chief objections to the use of aluminium as a material for chassis construction is that it cannot be soldered. Commercial practice is to solder tags to all leads at earth potential and bolt them to the chassis. This method is quite satisfactory.

The Use of Sheet Steel

The steel chassis is rapidly gaining favour, steel, of course, being cheaper than aluminium. Many experimenters will undoubtedly fancy this steel-chassis idea as sheet steel, in addition to its relative cheapness compared with aluminium, is available in most places. It should be remembered, however, that the shielding efficiency of steel is less than that of aluminium owing to its greater resistance, and much greater losses are to be expected.

It is possible to build a satisfactory receiver into a metal or steel cabinet, but there is no doubt that a cabinet made of sheet aluminium would provide better screening. This, of course, does not mean that to use the former type of cabinet or screening box is definitely bad. As a matter of fact, the best and most sensitive 0—v—2 receiver the writer has ever built is housed in a cabinet of this type. The main point is to know exactly what to avoid and, so far as construction is concerned, act accordingly.

Commercial practice, it will be noticed, is to use steel chassis construction in some instances, but this is not just a case of buying sheet steel in bulk, cutting and pressing to shape and finally arranging various components on both sides. Examination will show that the chassis is either cadmium plated, or copper plated, and later painted. By adopting these methods the skin effect is taken into consideration, for, as is well known, H.F. current travels on the surface. (Incidentally, the same applies to the metallised wooden chassis.) It will be seen, therefore, that cadmium plating is not carried out merely for the sake of appearance, but to increase the shielding efficiency of the steel chassis.

Coil Screening

Next, let us consider coil shielding or screens. Which, quite apart from space, is the most efficient and satisfactory type of coil screen, large or small; that is, of course, relative to the size of the coil to be used in conjunction with it?

For example, our H.F. transformer or coil is 1½in. diameter, and we have choice of two sizes of screening can; one is 2in. diameter and the other 3in. diameter. We may try each in turn, but as the bases must be bolted or riveted to the chassis we cannot entertain the idea of drilling extra holes.

The first point to remember is that if coil shields, or screens, are to be used the coils must be wound suitably in order to cover the desired wave-range. By screening

(*Continued on page 727*)

THE EASY ROAD TO RADIO.

THE BEGINNER'S SUPPLEMENT

ELECTRIC CURRENTS IN WIRELESS

(Part I)

A Clear and Concise Explanation of the Various Currents which Traverse the Circuits of a Modern Radio Receiver, with Particular Reference to the Oscillatory Currents of the Tuning Circuits and the Currents Within the Valves

A WIRELESS set is essentially an electrical machine, and to understand its working it is necessary to understand something about electricity.

Electricity may remain static or it may move in the form of current. In wireless we are chiefly concerned with current electricity. Perhaps one of the simplest illustrations of an electric current is afforded by the working of an electric torch. Current from the battery passes through the fine wire filament of the lamp and causes it to become white hot. The current in this case consists of a steady flow from one pole of the battery, through the lamp, to the other pole.

Electricity a Fluid

From the fact that an electric current is always spoken of as "flowing" from one point to another it would naturally be assumed that electricity is a fluid. This is correct, but it should be explained that it is a fluid in the same sense that the sand in an hour-glass is a fluid, the sand being formed of individual grains. In the case of an electric current the "grains" are electrons or negative particles of electricity, and as a collection these electrons constitute a fluid. It does not mean to say that the electrons themselves are necessarily fluid. Modern theory explains that all matter is composed of electricity. Each little atom of substance is composed of a collection of positive and negative particles of electricity. In the ordinary way these protons and electrons, as they are called, are kept in place within the atom by mutual attraction, and the substance displays no electrical properties. However, some of the electrons are very loosely linked to the rest of the protons and electrons, and under certain conditions can be made to travel about between the atoms. It is the movement of these electrons which constitutes an electric current. If a number of them can be made to leave the atoms to which they are attached and to travel through the substance, say a piece of wire, until they arrive at the other end then that end is said to be *negatively* charged with electricity, while the other end, which is left with a deficiency of electrons, is said to be *positively* charged. It must be emphasised that it is not the atoms themselves which move, but only the electrons. They can move in the spaces between the atoms and can also join up with, or leave, the atoms.

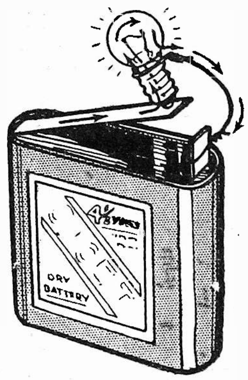


Fig. 1.—A simple example of the flow of a direct current is provided by this torch battery and bulb. The arrows show the path of the current.

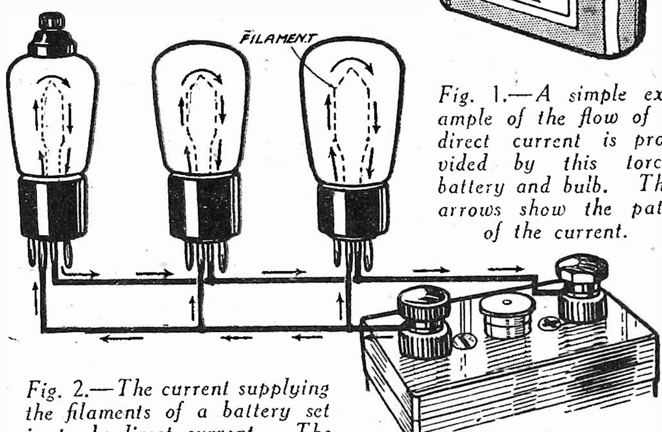


Fig. 2.—The current supplying the filaments of a battery set is steady direct current. The path of the electrons which constitute the current is shown by the arrows.

Different Kinds of Current

We have stated that the current flowing through the filament of an electric torch consists of a steady flow of electrons passing in one direction only. It is, in other words, a steady *direct current*. The currents in a wireless receiver are, however, of a more complex nature than this. Practically the only part of the circuit in which pure direct current is met with is in the filament circuit of a battery set. Here a steady current passes from the accumulator through each of the valve filaments (see Fig. 2) in the same way that the current from the torch battery passes through the bulb. The valve filaments become hot through the passage of the current (although it is not necessary in this case to bring them to white heat), and this causes some of the electrons in their jostling struggle through the restricted path of the filament to be thrust out into space. In other words a shower of these crowded-out electrons flies off in all directions.

The current flowing through the torch bulb or through the filament of a battery-operated valve may be compared with an even flow of water through a pipe. However, the flow need not necessarily be steady. The current from a dynamo, for instance, is never as steady as that from an accumulator. It fluctuates slightly all the time, one moment rising and the next moment falling. This is a fluctuating or impure direct current. The third type of current is one which flows first in one direction and then in the other. This is called an *alternating* current, and according as the alternations are slow or rapid it is known respectively as a *low-frequency* and a *high-frequency* current. A good example of a low-frequency alternating currect is provided by the house lighting supply. If the house is supplied with "A.C.," it means that the current when it passes through a lamp, for example, flows first one way through the filament and then the other way, this change of direction taking place about 50 times per second. This is so rapid that the cooling down of the lamp filament as the current dies down between each change of direction of the current is not perceptible to the eye. The lamp appears to give a steady light as though it were fed with a pure direct current. Of course, 50 cycles is not the only speed at which a low-frequency current can alternate and currents which change their direction of flow as many as 10,000 times or more in a second are still considered to be "low-frequency" currents.

High-frequency Current

The best example of a high-frequency alternating current is provided by the current which traverses the aerial circuit of a wireless set when it is tuned to a broadcasting station. This is produced by the wireless waves which strike the aerial in rapid succession. It is an alternating current because it travels first in one direction and then in the other, but the speed or frequency with which it

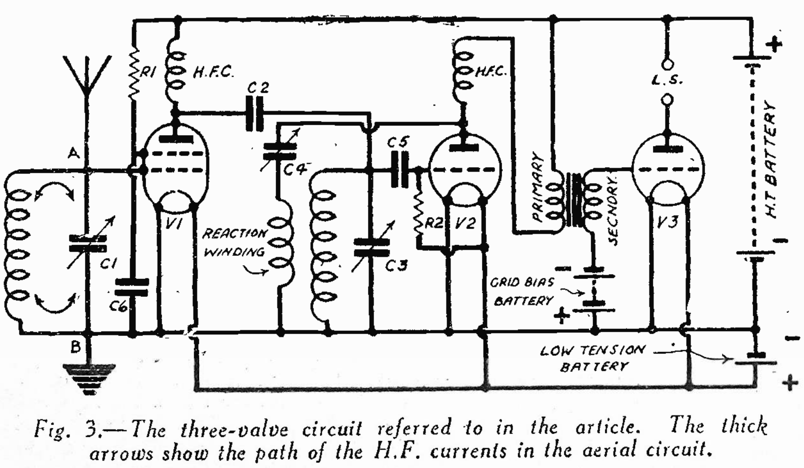


Fig. 3.—The three-valve circuit referred to in the article. The thick arrows show the path of the H.F. currents in the aerial circuit.

changes its direction is colossal—a million or more times per second !

From this very brief description of some of the forms which an electric current may take we can proceed to the study of the wireless receiver itself and analyse the currents in the various parts of the circuit. The circuit illustrated in Fig. 3, which is necessarily made as simple as possible for the sake of clarity, represents a typical three-valve arrangement. Starting from the aerial we come to the aerial tuning circuit. This is also shown separately in Figs. 4-6. The point A is connected to the aerial and the point B to the earth. The incoming waves on striking the aerial set up a high-frequency current which surges up and down it. If the aerial were connected direct to the earth instead of having the coil and condenser interposed these currents would simply flow direct to earth and back again. However, the introduction of the tuned circuit offers an opposition to the passage of the current. The amount of opposition offered depends on the size of the tuning coil and condenser. By using the right number of turns of wire and by adjusting the condenser to just the right size it is possible for the circuit to provide almost a complete barrier to the flow of current through it. When these conditions are arrived at the circuit is said to be "tuned" to the incoming waves.

H.F. Currents and Tuning

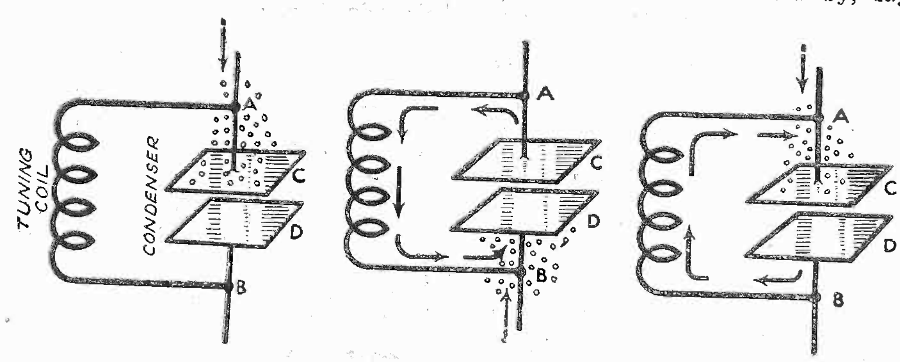
It must be explained why the tuning circuit opposes the passage of the aerial current through it. It is due to the combined action of the condenser and coil, which forms an *oscillatory circuit.* The current induced in the aerial by the incoming waves takes the form of electrons passing up and down it at a very high speed. When they come down the aerial they arrive at the point A (see Fig. 4) and immediately pour into the condenser and fill up the plate C. This action is similar to that of filling a toy balloon with air. However, as soon as the electro-motive force which has sent the electrons into the condenser dies down, as it naturally does before the current changes its direction, the electrons are ejected from the condenser like air from a collapsing balloon. These electrons, or at any rate some of them, instead of going up the aerial again, travel on round the circuit as shown by the arrows in Fig. 5. They pass through the tuning coil and into the other plate of the condenser. In the meantime the current flowing up and down the aerial has reversed its direction and electrons are travelling up the aerial. This means that a collection of electrons attempts to flow into the circuit at B from the earth direction, but they are here met by those which have just travelled round the circuit to D. Incidentally, from an electrical point of view, B can be taken as being contiguous with D and likewise A with C. Since like repels like the newcomers are repelled by the electrons which have collected on D and thus they are unable to pass through to A and up the aerial.

By the time the aerial current reverses again the current in the circuit has also reversed, the electrons having been ejected by D and sent bouncing round to A to meet and oppose the aerial current at this point. This process goes on all the time the circuit is tuned to the incoming waves, the electrons flowing from C, through the coil, to D and back again continuously. This oscillation set up within the circuit is called the *circulating current.*

It must be understood that the arrival of the electrons at each end of the circuit coincides exactly in point of time with the arrival of those forming the aerial current, and thus the latter are met and opposed every time they try to pass through the circuit. However, if the circuit conditions are altered by, say, increasing or decreasing the effective size of the condenser then this balanced state will be disturbed. The circulating current will oscillate slower or faster, as the case may be, than the aerial current, and thus some current will be allowed to pass through the circuit. In this case the circuit is said to be detuned.

This brief explanation of the action of the oscillatory circuit is of necessity not absolutely complete, nor as regards the building up of the circulating current is it strictly accurate since other factors, such as the effect of the inductance of the coil, to avoid confusion, have not been mentioned. However, the ultimate effect is, as we have described, the production of an oscillating current resulting in the piling up of electrons alternately at A and B.

(To be concluded.)



Figs. 4-6.—Diagrams illustrating the movement of the high-frequency currents in the aerial circuit of a wireless set.

METAL SHIELDING AND SHORT-WAVE RECEIVERS

(Continued from page 724)

a coil we automatically reduce its maximum tuning range. If our shielding can is too small in diameter the spread over of the magnetic field produced by the tuning coil is very restricted, and thus the overall efficiency of the tuned circuit or circuits will be considerably reduced. To counteract this defect a large screening can with low resistance is required, therefore it is necessary to use a stout gauge of aluminium, or better still, copper.

When purchasing a coil can remember that if it is of stout gauge, and is fitted with a detachable bottom and spigot for chassis use, it is quite suitable. Do not attempt, however, to make a steel chassis and use open-ended cans or nothing but trouble will result. Quite definitely, unless a steel chassis is plated as outlined previously it is better not to use it at all. The writer is strongly in favour of the metallised or copper-foil-lined wooden chassis, for cheapness and efficiency together with ease of construction.

The experimenter with considerable experience may wish to build a receiver which has a professional appearance, and no doubt will make a good job of it. The beginner should not be too hasty and attempt to design before he can construct. Better far to have an amateur-looking receiver which works like a professional job and gives results, than to build a rather professional-looking job which refuses to function. When choice between steel and aluminium chassis is to be made the latter is to be recommended.

Tuning Condensers

Variable condensers especially designed for short-wave work are available. Gang condensers are, however, expensive, and for experimental work readers may wish to use a broadcast type which will allow of the number of plates being reduced to suit requirements.

A condenser of this type, if well made mechanically, will be quite satisfactory, provided that trimmers are fitted on the top, and each unit is shielded from the other, with a separate connection provided for wiring each unit of moving vanes to chassis.

Chassis-type valve-holders should be of reputable make, as flimsy affairs will most likely cause crackling and various other troubles. Make quite sure that the chassis and panel are effectively earthed, and mount the earth terminal directly on the chassis.

All leads which are at earth potential go to the chassis. Do not, however, take three or four of them to the same point, but to the chassis at separate points, which will allow a short and direct lead, remembering that a potential difference exists at different parts of the chassis, panel, and screens.

In modern tuning condensers, metal frames and end plates are used. In these, the moving vanes are earthed (except in trick circuits) by mounting them directly on the metal panel or, in the case of a gang condenser, on the chassis.

Chassis construction reduces the amount of wire required in a receiver and may make a difference of many inches. The writer remembers rebuilding a baseboard short-wave receiver on chassis lines, which reduced one lead previously a foot in length to one inch, and readers who adopt the same methods will be surprised at the amount of connecting wire they have left over.

SUPPLEMENT TO "PRACTICAL AND AMATEUR WIRELESS"

AMATEUR TELEVISION

TRANSMITTING "STILLS"

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

THERE are many amateurs who have carried out a number of experiments in connection with the reception of television, but only a few have turned their attention to the question of providing their own television signals for test purposes. While admitting that the outlay incurred for apparatus would be somewhat high if everything that was required was purchased brand new, it will be found frequently that much of the material is available in experimental apparatus which every wireless enthusiast collects over a period of time.

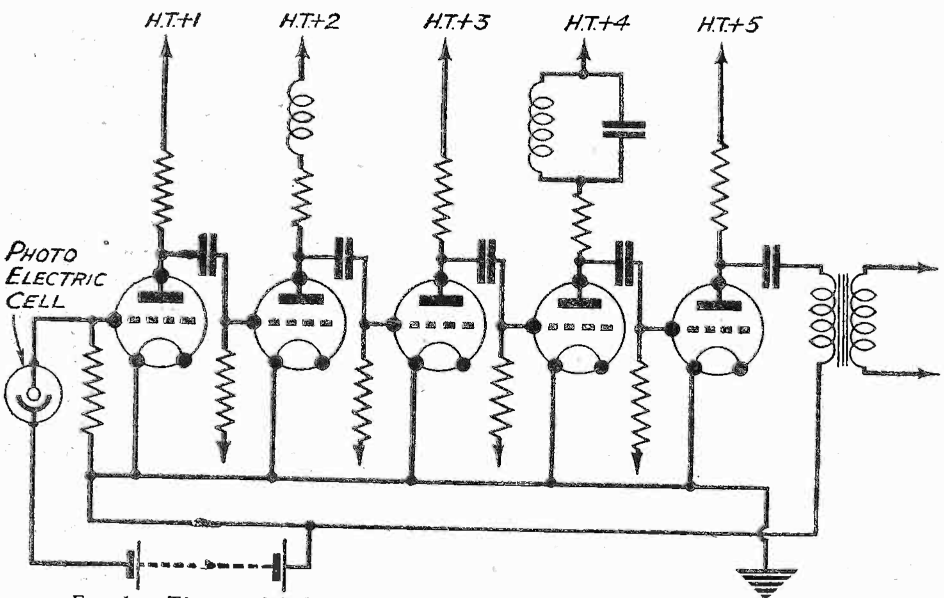


Fig. 1.—The simplified diagram of the photo-electric cell or "A" amplifier.

Apparatus Required

The best way to make a start is in the transmission of "stills"; that is, magic lantern slides or single-frame pictures selected from any standard 16- or 35-millimetre film suitably mounted. The first requirement is some form of projector; that is, a housing for a source of light (arc or metal-filament projection lamp fed from A.C. mains through a step-down transformer), together with a focusing lens. (An old magic lantern outfit will do quite well here.) Next is needed the single spiral apertured scanning disc together with the driving motor. In the case of the disc, a standard twenty- or sixteen-inch receiving disc is quite satisfactory, provided it is free from mechanical errors, primarily in connection with the positioning of the holes. Naturally, the correct type of heavy fly-wheel scanning disc is best for transmitter work, but the substitute suggested is capable of giving results far in excess of what may be anticipated originally.

Assuming that the television signals generated will be observed on the standard type of television receiver built or purchased for looking in at the B.B.C. transmissions, then the square holes need to be of the correct size and appropriately positioned to give the seven-by-three ratio picture having a thirty-line dissection. Designs for discs of this character have been described from time to time in this supplement, or alternatively a ready-made disc can be purchased for a sum as low as 12s. 6d.

Setting Up

The motor should be of good quality and capable of running at a dead steady speed of 750 revolutions per minute. If preferred, a synchronous A.C. motor can be used, but failing that, use a motor with a smooth form of speed control and stroboscopic speed observation to ensure correct running.

Employ a light source as intrinsically brilliant as possible, and position this together with the lantern slide or film still and focusing lens, so that the resultant picture projected on to the disc is properly focused and bright. The exact size of the picture on the disc will depend on the disc diameter, but it should have dimensions which will allow it to be just scanned by the first and last holes of the disc. An arrangement suitable for amateur use is one consisting of the parts previously referred to, the light source and photo-cell being mounted with their axes in line, and one on each side of the disc. Lamp projector and focusing lens are mounted on the left, while the scanning disc is driven by a mains fed motor having a belt drive.

As the disc revolves the individual apertures dissect the projected picture into the thirty strips as they pass across. Since the picture is made up of various light and dark shades this process of scanning will cause varying small quantities of light to pass through the holes to the other side. These light signals must then be made to influence a single photo-electric cell mounted immediately behind the disc and in the correct optical path of the penetrating light. It is often desirable to have a focusing lens between the back of the disc and the photo-electric cell (the cell being enclosed in a light-screening box with a small window aperture of just sufficient size to take the whole of the scan) and placed opposite to the light source.

Cell Amplifier

The rapid light variations activating the electrodes of the single photo-electric cell produce corresponding voltage variations of equivalent amplitude. Quite a wide choice of cells are open to the experimenter, but a very efficient one for the purpose is that designated the C.M.G.8 and made by the G.E.C. Full details for operating the cell are furnished by the makers, so this question need not be gone into here.

The voltage variations produced by the cell are very minute and need amplification in what is commonly termed an "A" amplifier. This is a resistance-capacity-coupled amplifier having, for the best results, a reasonably low gain per individual stage. Furthermore, this amplifier must be quite clear of parasitic noises, otherwise the picture signal will not be considerably above the "mush" level, and imperfect images will result.

One circuit diagram for an amplifier of this type is given in simplified form in Fig. 1, battery fed valves being used for simplicity and stability, each anode being supplied by a separate H.T. feed. The cell is connected direct to the grid of the first valve with the appropriate battery voltage in series. Another point to notice is the inclusion of "boosters" in the second and fourth valve anode circuits. The first is a single inductance, while the second is a similar inductance tuned with a fixed condenser. The values of these components must be chosen to suit individual conditions, but they serve the purpose of maintaining a level frequency response up to well over 10 kilocycles.

The layout of an amplifier of this character is very important, as stray capacities and long leads must be reduced to a minimum. In Fig. 2 is shown one design which proved particularly efficient for some initial thirty-line television experiments of this nature. The valve-holders are partly stripped and mounted on a central platform, while the output transformer is an O.P.2 (step-down).

The resultant vision signals from this amplifier are passed to the normal power amplifier associated with the vision receiver, so that the images can be watched and very many interesting tests made by the experimenter. The effects of using film stills of varying densities can be tried and the limiting factors associated with the detail permitted by thirty-line scanning observed.

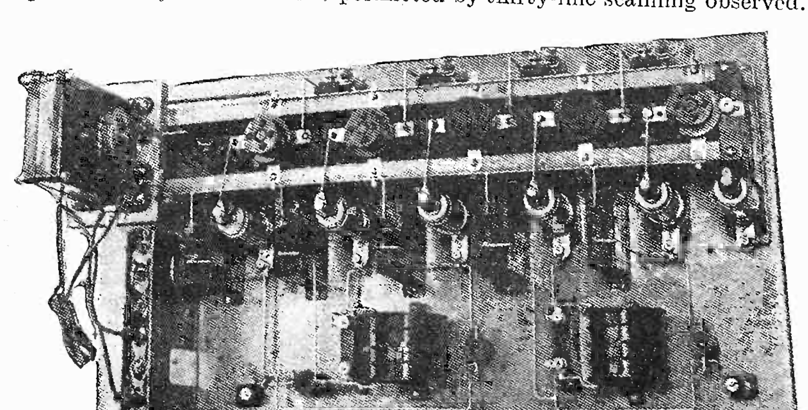


Fig. 2.—A photo-electric cell amplifier layout which avoids unwanted capacity and keeps connecting leads short.

VALVE TYPES AND USES

(Continued from page 719)

current "load," and, therefore, the H.T supply must be capable of providing up to the maximum current taken by the valve without its voltage dropping.

The High-tension Supply

There is no difficulty in securing this result when using a large-capacity H.T. battery or an H.T. accumulator, but conditions are vastly different when a standard-capacity battery or an eliminator is concerned. The small battery will certainly give the maximum current, but in doing so its voltage will drop appreciably, especially when the battery has been in use for a short time. It will be evident, therefore, that the very efficient QP valve is wasted if the H.T. supply is inadequate; in addition to this it must be pointed out that small batteries would prove very expensive, whereas the cost of H.T. current is extremely moderate where a super-capacity battery is employed.

The average eliminator is even worse than a small battery with regard to the voltage output in various conditions of "load," so that if this kind of unit were employed reproduction would be terribly distorted,

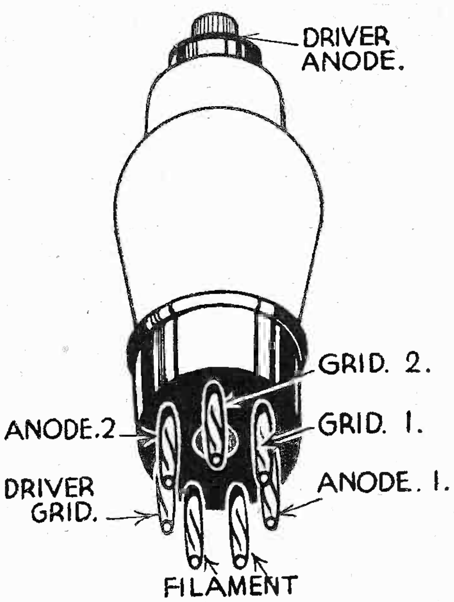


Fig. 3.—This sketch shows the connections for the driver and Class B valve.

and the user might condemn Q.P.-P. as unsatisfactory—which it certainly is not. Eliminators especially suitable for Q.P.-P. working are available and cost little more than those of normal type, whilst an existing unit can be modified by connecting a neon stabiliser across its output terminals. Actually there are a few simple points to be considered in doing this, but these were clearly explained in an article in PRACTICAL WIRELESS dated November 18th, 1933.

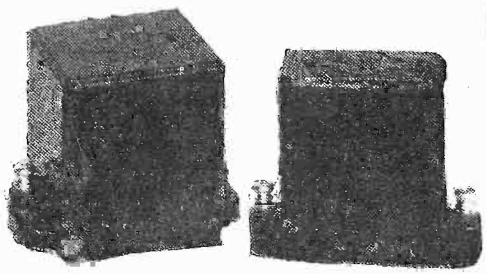
Little has been said in this article concerning Class B amplification, chiefly because class B is so well known and has been adequately described in many previous issues of both of the journals which have now come together under the name of PRACTICAL AND AMATEUR WIRELESS. The connections for a Class B and driver stage are shown on another page in this issue under the heading "Valve Couplings," whilst the connections for the 7-pin base are given in Fig. 2 which accompanies this article.

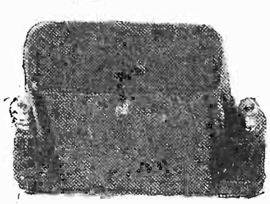
The Hivac B 230 Class B valve, of which characteristics are given in an accompanying panel, is particularly economical in

(Continued on page 733)

Amplion Fixed Condensers

WE have recently had under test a number of fixed condensers made by Amplion (1932) Ltd. Of neat appearance they are certainly a very workmanlike job, which is the keynote of components turned out by this well-known firm. Obtainable in four types, TB, SH, RH and PH, respectively, they range from .1 mfd. to 4 mfd., at varying prices. Type TB (700 volts D.C. test, 350 volts D.C. working) range in price from 1s. 10d. to 5s. 6d.; type SH (1650 volts D.C. test, 600 volts D.C. working) 2s. 6d. to 10s. 6d.; type RH (2,000 volts D.C. test, 800 volts D.C.





A group of Amplion fixed condensers which are of neat appearance and sound design.

working) 2s. 9d. to 15s., and type PH (2,500 volts D.C. test, 1,000 volts D.C. working) 3s. 6d. to 19s. 6d. Under test they were found to give very good results under their stipulated working voltage and their capacity ratings were within a small percentage margin of the measured values.

A General-purpose Triode

THE range of Mullard "Universal" (A.C./D.C.) valves has recently been augmented by the release of a general-purpose triode, known as type H.L.13. The principal application of this valve will be as low-frequency amplifier following a diode detector, in which position it may also be employed as first low-frequency amplifier for gramophone reproduction. It can also be used as speech detector in cases where an amplifying detector is required, and in such instances, also, the valve can be used as the input valve for gramophone reproduction. Like the other valves in the Mullard A.C./D.C. range, the H.L.13 has a heater rated at 0.2 amp., the heater voltage being approximately 13. The characteristics at anode volts, 100, and grid volts, zero, are: anode impedance 10,000 ohms; amplification factor 40; and mutual conductance 4.0 mA./V. The price is 13s. 6d. This valve is available with metallised bulb only, and has the standard Mullard side-contact base, the control grid being connected to a top thimble terminal.

A High-class Radiometer

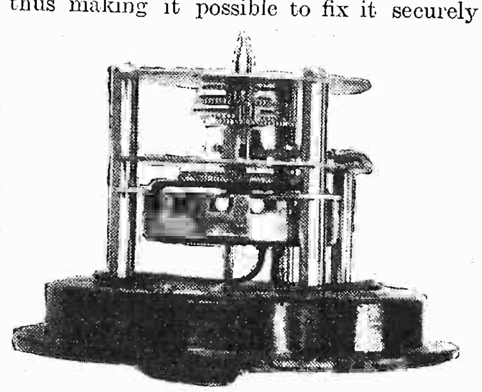
THE "Pifco" de luxe model "All-in-One" radiometer is a moving-coil instrument suitable not only for testing battery receivers, but also for testing all-mains sets. It is suitable for voltages up to 250 and shows 500 ohms resistance per volt. The diameter of the dial is 2½in. The instrument is finished in mottled bakelite, and is sold complete with velvet-lined case at £2 2s. Adaptor sockets for use in testing 7- and 9-pin valves are available at 3s. This is a most useful instrument for the dealer, the experimenter, and the electrician. Particular care has been given to finish, accuracy, and high-class workmanship. In short, this expertly-designed instrument is suitable for the accurate testing of all classes of electrical and radio apparatus.

A New H.T. Battery

THE Fuller Accumulator Co (1926) Ltd., are now manufacturing a new Fuller "Sunbeam" high-tension battery, supplies of which are now on the market. The prices are: 60 volt, 3s. 6d.; 100 volt, 5s. 6d.; 120 volt, 6s. 6d. Samples of these batteries have been subjected to various tests in our laboratories and have proved to have a capacity fully equal to that of the average standard-capacity battery.

A Synchronous Clock Movement

WE show on this page a scientifically designed electric-clock movement recently produced by the Automatic Coil Winding Co., which can easily be fitted into an ordinary clock in place of the clockwork movement. The movement is fitted with a 15 per cent. cobalt-steel magnet, and the epicycloidal cut gears ensure silent running. Of robust design it is mounted on a mottled bakelite back, through which project a knurled knob for starting the motor when connected to the mains, and a second knob for adjusting the hands. Below these knobs are fitted two pins, with the necessary plug for facilitating connection to the mains supply. Three fixing holes are drilled in the back, thus making it possible to fix it securely inside the desired clock case. Selling at the reasonable price of 15s. it will keep very accurate time, and is certainly a useful appliance.



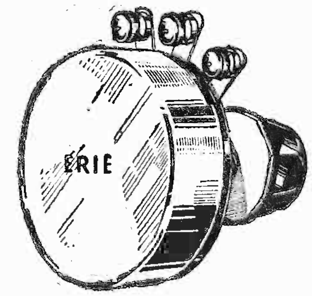
Of efficient workmanship, this synchronised electric-clock movement can be fitted to an ordinary clock in place of the clockwork movement with which it was originally fitted.

The Erie Volume Control

THE Erie volume control, which is fitted with a composition type resistance element, is available in five standard sizes, ranging from 25,000 ohms to 500,000 ohms in value. A thin bakelite disc 1½in. in diameter forms the body of the component, and to this are attached the three soldering tags, a single-hole fixing bush, and the metal protecting cover.

The moving contact is insulated from the spindle and fixing bush, and consists of a light spring terminating in a small graphite

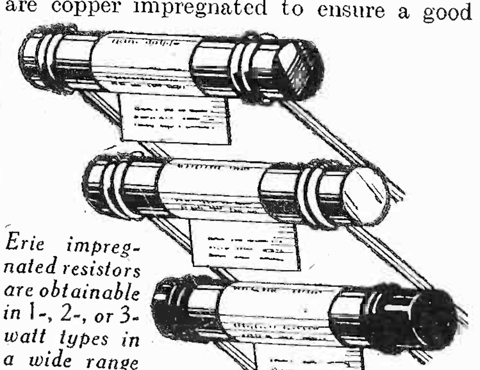
An Erie volume control which is available in five standard sizes ranging in value from 25,000 ohms to 500,000 ohms.



stud. The movement is quite smooth, yet a sure contact is made throughout, the pressure being just sufficient to ensure this, but not so heavy that it imposes undue wear on the element. The resistance is graded to give a smooth and even control, and is quite silent in operation. The price of the Erie volume control is 3s. 6d., or with mains switch, 5s.

Erie Impregnated Resistors

ERIE resistors, which are suitable as grid leaks as well as for voltage-dropping and grid-bias purposes, are made of a composition of carbon and rare earth, the resistance depending upon the quantities of the minerals. Stability of resistance is obtained by a special process by which damp is expelled, after which the resistors are specially impregnated to ensure that variation of humidity in the atmosphere does not affect the resistance value. The tips of each carbon resistor are copper impregnated to ensure a good



Erie impregnated resistors are obtainable in 1-, 2-, or 3-watt types in a wide range of resistance values.

soldered joint for the lead which makes contact with it. They are obtainable in one-, two-, and three-watt types in a wide range of resistance values.

Erie resistors are colour coded, and every genuine Erie carries a label giving the value. Price: 1s. per watt.

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 midnight radio party held by the West Middlesex and East Buckinghamshire branch of the Anglo-American Radio and Television Society was held on January 18th instead of the 19th.

WCAU was the best station tuned in, although WBZ, WJZ, WTIC, and WBT were good seconds. Among the stations heard were WAAB, Boston (500 watt); WHN, New York; WCCO, Minneapolis; WHAS, Louisville; WGY, Schenectady; WLW, Cincinnati; WEAF, New York; WIOD, Miami; WNAC, Boston: WHO, Des Moines: KYW, Chicago; WABC, New York; WHAM, Rochester; and WTAM, Cleveland. The meeting held on the 17th was also a success.

There are no charges in connection with joining the A.-A.R. and T.S., and particulars may be obtained from Leslie W. Orton, "Kingsthorpe," Willowbank, Uxbridge.

At 8 p.m. on February 6th the Huddersfield branch of the Society is giving a public lecture-demonstration. The lecturer will be Mr. J. Louis Orton, who will describe some interesting radio experiments, using G-5XK for transmission. Full particulars from Mr. Leonard Goucher, 10, West Grove Avenue, Dalton, Huddersfield.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

THE London Chapter held a very interesting meeting on Friday, January 18th, at the R.A.C.S. Hall, Wandsworth Road, S.W.8. The first half was given to morse instruction, there being one class for beginners and another for advanced pupils. The second half of the meeting was taken up by a demonstration and description by Mr. W. H. S. Vincent, A.M.I.B., of the "Hyvoltstar" All-wave Superhet 5. The circuit consisted of a heptode frequency changer, var.-mu pentode, I.F., metal oxide second detector, metal oxide A.V.C. rectifier, triode L.F., pentode output, and half-wave valve rectifier. Very good reception was obtained from W8XK, 48.86 metres. The aerial in use at the Chapter is an inverted V.—A. E. Bear, Secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

THE CROYDON RADIO SOCIETY

AT a meeting of this society, held on January 15th, in St. Peter's Hall, South Croydon, Mr. O. Tooth gave a talk on "Modern Gramophone Recording." After showing the meeting a wax disc prior to being recorded upon, he went on to consider apparatus used in recording. First came the microphones which were wired and followed by the amplifier, and ultimately the cutter. He had much to say on microphones, having brought several models with him, and interesting points of such types as the Rein and Condenser microphones were followed with interest.

Cutters came in for much mention, and Mr. Tooth drew sketches of their mechanism, explaining why the cutting edge of sapphire was ground by a specialist.

On Tuesday, February 5th, the vice-chairman, Mr. W. J. Bird, is lecturing on "Electrical Condensers: a brief survey of their theory, manufacture, and application to modern circuits." He is an authority on this topic, and PRACTICAL AND AMATEUR WIRELESS readers are invited to come and hear him.—Hon. Secretary, E. L. Cumbers, Maycourt, Campden Road, South Croydon.

SLADE RADIO

AT a meeting of the Slade Radio Society on Thursday, January 17th, Mr. D. A. Drew, a member of the amateur crew who sailed Mr. Sopwith's *Endeavour* in races against *Rainbow* in America last year, gave an address upon the mechanical and electrical side of yacht racing. Mr. Drew described many of the amusing episodes that happened to him and his colleagues, and gave some very interesting descriptions of the wind-measuring instruments and other mechanical apparatus, such as the capstans, and methods of tensioning the hawsers.

Dr. Ratcliffe loaned and operated his cinema projector, and Mr. Drew had two rolls of films which he obtained from Mr. Sopwith, in London.—Hon. Secretary, Chas. Game, 40, West Drive, Heathfield Park, Handsworth, Birmingham.

SHORT-WAVE RADIO AND TELEVISION SOCIETY (THORNTON HEATH)

A MEETING of this society was held at St. Paul's Hall, Norfolk Road, on Tuesday, January 15th, under the chairmanship of Mr. R. E. Dabbs. Mr. J. L. Hills, of All-wave International Radio and Television Ltd., gave a talk and demonstration on the Allwave international superheterodyne. This receiver tunes from 14–2,000 metres and incorporates high-speed automatic volume control. Two I.F. stages are used, followed by two diode detectors in push-pull, one L.F. stage, and power pentode output. It can be used on either D.C. or A.C. mains, and has provision for an additional speaker. The receiver was then demonstrated and it created a good deal of interest. Particulars of future meetings can be obtained from the Secretary, Mr. Jas. T. Webber, 368, Brigstock Road, Thornton Heath.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Listening Conditions in S. Africa

SIR,—As a regular reader of your paper I have been very interested in your £5 superhet, especially the A.C. model. The only snag so far as South African readers are concerned is that the coils are practically no use to us. Our listening is done on the medium band and the various short-wave bands on 16, 25, 31, and 49 metres. On the medium waves our stations lie between 314 metres and 536.

I am therefore writing to ask whether it would be practicable to substitute other coils in place of the coils specified.

We find that the ordinary straight set (I use a four-valver of my own design) gives excellent results so far as power is concerned, but selectivity, particularly on the 25m. band, leaves much to be desired; for example, it is practically impossible to separate DJD and GSD. When one is tuned in there is a background of the other and, if the aerial is swaying at all, they come in and out alternately. This presumably would be largely rectified by using a superhet circuit.

It is for this reason that American sets hold such a prominent place in the market out here. For some time "all wave sets" have been on the market. The British sets, on the other hand, are for long and medium waves, and it is necessary to obtain a short-wave convertor, which many people will not be bothered with.

The British components and valves are recognised as vastly superior, and many more would build sets if they could find a design suitable for the conditions prevailing in this country. The same would apply to Australia and Canada. One dial tuning would be essential to make it a true family set.—GEO. K. MALLORY (King William's Town, S. Africa).

[*An article in our issue dated January 26th, 1935, gives particulars of suitable alternative coils for use with the £5 A.C. Superhet.*—ED.]

Australia and U.S.A. on a "Practical Wireless" One-valver

SIR,—A few weeks ago I wrote to you mentioning the good short-wave reception I had last summer on the s.-wave set that was described in PRACTICAL WIRELESS of April 14th, 1934.

Having become accustomed to the use of a three-valve S.W. set of late, I thought I would give the above-mentioned one-valve set a trial as a change to the more elaborate three-valver. Appended are a few of the long-distance transmissions heard. On Friday, January 11th, at 11 p.m., PRF5, Rio de Janeiro, Brazil (31.58 m.) was a good signal at R8 on the 'phones, when we had a short talk in English on cocoa production in Brazil.

On Sunday, January 13th, at 2 p.m., VK2ME (31.28 m.), Sydney, Australia, was in fine form, opening with the laughter of the kookaburra (transmission 4), then followed the call signal "VK2ME, Sydney, the Voice of Australia," and "Good afternoon listeners in the United Kingdom." Then followed an interesting programme of gramophone records by such well-known bands as the B.B.C. Wireless Military Band, the Regimental Band of H.M. Grenadier Guards, The Australian Commonwealth Band, Eric Coates and the Symphony Orchestra, and organ recitals by Nicholas Robins at the Arcadia Theatre, Chatwood, Sydney.

This transmission was concluded at 4 p.m. The same evening at 5.20 p.m. I located W2XAF, Schenectady, U.S.A., on 31.48 m., coming over with some punch behind it! A talk was in progress by the Federal Housing Committee, and was followed at 5.30 p.m. by a "Watch Tower Hour" service from Los Angeles, California. In conclusion I would like to thank you for the helpful hints and tips about short-wave reception that have appeared in PRACTICAL AND AMATEUR WIRELESS recently.—STEPHEN J. KEEN (Cirencester)

"Admirable and Entertaining"

SIR,—Good luck to your admirable and entertaining journal, which I think strikes the right note every time. When can we expect an A.C. version of the "Hall-Mark Three" *please*?—CHAS. H. WOODS (London E.).

[*See last week's issue for full particulars of the A.C. Hall-Mark.*—ED.]

A South-African Reader's Thanks

SIR,—I wish to extend to you my sincere thanks for having put me in touch with numerous readers of PRACTICAL WIRELESS, who reside in England. Owing to various reasons, I am unable to communicate with every person who has written to me, but I would nevertheless like to thank everyone who has taken the trouble to write.—H. CROUCH (Ladysmith, S. Africa).

Another Appreciation from S. Africa

SIR,—In connection with your various presentation schemes in *Practical Mechanics* I wish to thank you for the two books and the Wireless Constructor's Tool Kit just received. The books are interesting and entertaining, and the tool kit is very useful, and quite the thing in these out-of-the-way places, where the nearest third-rate shop is over twenty miles away. I see there are two more papers—*Practical Television* and *The Practical Motorist*. Is it possible to get these papers from No. 1, and what is the yearly subscription, please?—[*Yes*—ED.]

As an interested reader of Mr. F. J. Camm's articles in *Work* years ago, and later in the *Motor Cyclists' Review*, I am pleased to see him at the helm of *Practical Mechanics*, and wish it continued success. I have written to Peto-Scott for a 5-valve superhet set, as described in the June issue of *Practical Mechanics*, and will let you have a note regarding its possibilities when I try it out.—GEO. SCHOFIELD (Natal, S. Africa).

Our Short-wave Section

SIR,—As a regular reader since No. 1 I agree with A. Blakeley (Newton-Le-Willows), who asks for one more page on short-wave work. I am writing for myself and four friends. I have all your gift books and they are very helpful. I use an adaptor (2 L.F.) for short waves, and although I have tried many circuits, I do not seem to get satisfactory results. Will you please publish

(*Continued on facing page*)

(Continued from facing page)

a circuit of superhet adaptor using short-wave plug-in coils. I have not built any of your sets yet but hope to when circumstances permit. I live in a swamp area ten miles from Moorside Edge, and get good results using SG., Det. 2 LF. and a wave-trap. I like your superhet 3, and I think that PRACTICAL WIRELESS is the best book of its kind on the market.—H. R. BUTTERWORTH (Oldham).

(See Special Announcement on page 701—Ed.)

A Super Set

SIR,—With reference to several of your readers' pleas for a super set, may I offer my suggestions? I am of the opinion that a set as outlined below would find plenty of support from your readers, and if the L.F. unit was published first, the total cost would be divided over a period, and so by adding a simple bandpass aerial filter it could easily be made into a high quality local station receiver, besides reproducing records for use with a "mike."

I am personally anxious to see a circuit published, which with an automatic record changer would make an outstanding set. The features embodied should include a paraphase amplifier of above 5 valves, giving approx. an output of 4/5 watts. Response curve nearly flat from 50 cycles to 6,000 or more. Reproduction as distortionless as possible. Sufficient amplification for use with an average pick-up. Effective volume control, and facilities for high-tension connection to H.F. stage. The circuit for the paraphase amplifier could be similar to the one published on page 101 of the issue for October 6th, 1934.—W. J. ABBOTT (Clapham Common).

A Quality Short-waver

SIR,—With reference to a letter, "A Short-waver Wanted," in your issue of November 17th last, I consider that a short-wave design, with the medium band as a secondary consideration, is what is wanted in Kenya, and suggest a really powerful battery-driven superhet which will enable the most distant stations to be picked up at programme value. Personally, I should like a design that does not try to cut down the initial cost too closely.—D. B. CRAMPTON (Cherangani, Kenya Colony).

CUT THIS OUT EACH WEEK.

Do you know

—THAT electrolytic condensers can be used in a voltage-doubler rectifier circuit?
—THAT the polarity of the voltage applied to certain electrolytic condensers may be reversed without causing damage?
—THAT an earth lead can be used for an aerial by connecting it to the aerial terminal?
—THAT a long earth lead should be insulated?
—THAT the peak-voltage rating of a fixed condenser should be at least twice the voltage normally applied to the condenser?
—THAT the use of a choke-capacity output filter often prevents L.F. instability?

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.

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.*

MAGNUM COMPONENTS

WE have received a folder from Burne-Jones and Co., Ltd., giving particulars and prices of this firm's chassis assemblies, coils, switches, etc. Also included in the list are metal screening boxes, solid dielectric variable condensers suitable for tuning, reaction, or series aerial use; a dissolver for controlling the volume of radio-gramophones, or two pick-ups; and a neat and efficient multi-contact switch. Copies of this folder are now available, on request.

BOOKS RECEIVED

BROADCAST TALKS

A BOOKLET containing the B.B.C. programme of talks to be given from Droitwich National and London Regional transmitters during the present session is now available to the public.

The series on India provides the most imposing list of speakers. The talks will be in the National programme at 10 p.m. on consecutive Tuesdays and Fridays until February 5th. The remaining speakers in this series are: Mr. George Lansbury and Mr. Stanley Baldwin.

Details of a further series of talks to be given on alternate Sundays at 9 p.m. are also given. These talks will include news from the Law Courts, headlines from foreign newspapers, extracts from Blue Book publications, important new scientific discoveries, etc. Particulars of other talks to be given for listeners in unemployed clubs and centres are also included. The booklet can be obtained free from the Publications Dept., B.B.C., or any local B.B.C. office.

NEW FEATURES IN THE PRACTICAL ELECTRICIAN'S POCKET BOOK

SOME of the most important of the new sections in the "Practical Electrician's Pocket Book, 1935" are evidence of the rapid changes in the electrical industry. Noise measurement appears for the first time. A complete new chapter on traffic signalling is introduced. The wiring notes are based on the 10th Edition of the I.E.E. Regulations. Trolley buses are discussed in the chapter on tramways.

Complete revision has been made of the sections on the control of lighting circuits, joints, and connectors, measuring instruments, armature construction, and railway signalling.

In addition, Mr. A. P. M. Fleming, C.B.E., M.Sc., M.I.E.E., F.Inst.P., has contributed a valuable twenty-page summary of the high spots of electrical progress in 1934.

The system, introduced last year, of sectionalising the sixty chapters is retained, and rearrangements have been made to give more logical, order and to assist general study of any one department of electrical activity.

By means of the 1,000-subject index any obscure electrical fact can be found in a moment. There is also an extensive guide to mains-voltages in the United Kingdom covering sixty-two pages and indexing 5,000 places. This guide has been fully revised and brought right up to date.

The book is a little giant of information on a wide variety of subjects and well maintains its position as one of the leading reference books of the industry. It is published at the very reasonable price of 2s. 10d. post free by Odhams Press Technical Book Department, 85, Long Acre, London, W.C.2.

THE 1935 BROADCASTER ANNUAL

AN encyclopædic survey of the Radio Industry and its technicalities is given in the 1935 edition of the "Broadcaster Radio and Gramophone Trade Annual," just published by the Broadcaster and Wireless Retailer, of 29, Bedford Street, Strand, London, W.C.2. Much of this work has gone into the technical sections. Radio Servicing, to which thirty pages are devoted, is divided into four "chapters."

Radio design is looked after by two abacs, a section on simplified circuit design, three pages of essential electrical formulæ and data, and a valve chart giving detailed characteristics of every valve on the market.

There are six parts of the Annual which contain directory information. The Directory Section proper has nearly eighty pages. It gives manufacturers' and wholesalers' names, addresses, telephone numbers and telegraphic addresses; an index of trade names in radio, and a section giving the names of all firms making standard types of apparatus.

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(See page 736)

VALVE TYPES AND USES

(Continued from page 729)

respect of both high-and low-tension requirements, but the same remarks apply as in the case of the QP valve with regard to the source of H.T. supply, because the anode current is constantly varying with the volume of reproduction.

A Combined Driver-Class B Valve

Another Class B valve that is made only by Hivac is the DB 240, and this is of particular interest in that it actually consists of three valves in one—a triode L.F. driver and two Class B triodes. The valve can thus be used directly after a detector valve, the usual input L.F. and driver transformers being connected as in the case of a normal Class B amplifier. The driver-class B valve has a 7-pin base, the connections being as shown in Fig. 3, whilst an eighth connection is made to a terminal mounted on top of the bulb; this is in contact with the anode of the driver section. It will be seen from the tabulated details that the total quiescent current passed by the complete valve is 5.5 milliamps, whilst the average working current is 8.5 milliamps. The Class B section is exactly the same as the B 230 and, apart from its external appearance, the valve may be considered as identical in every respect with two separate normal valves of the L.F. and Class B type. It is extremely convenient, especially in portable receivers or others in which space is limited.

ROUND THE WORLD OF WIRELESS

(Continued from page 702)

Proposed S.B. Programmes for Morocco and Algeria

WITH the completion of an underground pupinised cable some 2,500 kilometres in length, between Tunis and Morocco, it is hoped in the near future to effect exchanges of broadcast programmes between Radio Maroc and Algiers, and later with the new transmitter to be erected in Tunisia by the French Colonial Authorities. As the power of the Rabat and Algiers transmitters is to be increased, the programmes would be available to listeners in the greater part of Southern and Western Europe.

Broadcast Station for Singapore?

UP to the present, British residents in the Straits Settlements have relied for their radio entertainments solely on a local amateur broadcaster; but it is now reported that an official transmitter is to be owned and operated by the municipal authorities. The station will be built and erected by two British concerns, namely, General Electric Company, Limited, and Standard Telephones and Cables, Limited. When completed this year, it will offer a regular service of radio programmes on a wavelength between 300 and 600 metres.

Solving the Wavelength Problem

THE Soviet Government, in addition to installing high-power stations, has decided to cover the country with a network of small, low-power transmitters, working on channels between 120 and 150 metres. As a start, over two thousand are to be erected in State farms and other agricultural colonies. As their power is low and the effective area covered not greater than about 100 square miles, little interference between stations working on common wavelengths is anticipated. The transmitters will take their main programme from Moscow.

By T. Onearm

Decca Records

THE new titles for January are not, perhaps, quite so interesting, as they have not become widely popular yet. For that reason I will not attempt to suggest a choice, but leave it to you to select your own. You will not be disappointed in any of them.

Roy Fox, who will in future be heard more regularly on the air, has also given us two new records. He has been touring the country for the best part of the past year, and in the majority of towns his band has played to capacity, beating box office records on all sides. There is no question of Roy Fox's popularity, and the sales of his records alone place him as one of England's greatest attractions.

It is my personal opinion that the singing of Denny Dennis has brought Fox still further friends. Dance vocalists are so few and far between that one only has to listen in to the majority of dance band broadcasts to wish sincerely that Parliament would immediately place a ban on crooners.

An Amusing Record

It is interesting to pause a moment to consider this point. Have you ever heard a really good tenor, or baritone, singing a vocal dance refrain? If not, hear the record *Decca* made two years ago. For a joke, Al Bowlly sang the song selected by Owen Bryngwyn "Glorious Devon" and Bryngwyn sang Al Bowlly's song "Let's put out the Lights and go to Sleep" (*Decca F*.3369). The interesting point was that Bowlly's technique resulted in a really pleasant rendering of "Glorious Devon," whilst Bryngwyn's "crooning" appeared so amateur as to be somewhat amusing (I hope Mr. Bryngwyn will not take offence at my remarks).

This example alone proves my point. Crooners, as such, are born and not made. The chief difficulty a band has to-day is to find a good vocalist, and you may have heard of certain vocalists being shared amongst several broadcasting bands to-day. Musicians can be found with comparative ease, but vocalists have grown to become one of the most important selling factors in a band's success. For instance, when Al Bowlly left Roy Fox to join Lew Stone, Fox searched the country unceasingly, knowing that it would be impossible to get hold of one of the few accepted vocalists, as they were too strongly tied to their respective outfits. It was over a year before he chanced upon Denny Dennis, and he quickly snapped him up and has worked really hard on the boy's development. The result to-day is that Roy Fox has one of the few really pleasing dance band vocalists broadcasting.

It is interesting to look back on this somewhat new development in dance band business. Little did any of us realize the importance that the singing of the chorus would have on the sale of a dance record. Broadcasting has, of course, enhanced this importance.

So Roy Fox, apart from his older stalwarts, such as Peggy Dell, is now a complete and best selling unit, and he is, in addition, one of the most efficient leaders in this country.

"June in January"—*F*.5351—is a title of which great things are expected, and I would like you to hear Fox's record of this, and "Give me a Heart to Sing to"—*F*.5352.

"Be Still My Heart" and "If I Had a Million Dollars," sung by Al Bowlly on *Decca F*.5326, is the first record of Bowlly recorded in America, and very good it is, both sides of it.

Another good record is Tessie O'Shea singing "No One Loves a Fairy When She's Forty" and "Live and Let Live" on *Decca F*.5336.

The Sixteen Singing Scholars

I think that their record, *Decca F*.5359, will become a big novelty seller. Sixteen Welsh scholars have been selected to make this record, one of them, Master Cyril Lewis, having already made solo Welsh records for *Decca*. Two well-known ballads have been chosen, and these boys have performed them both as part songs, and very interesting they are. Whilst they were in London, the B.B.C. put them on the air in "In Town To-night," and I understand that they were very popular.

Brunswick Records

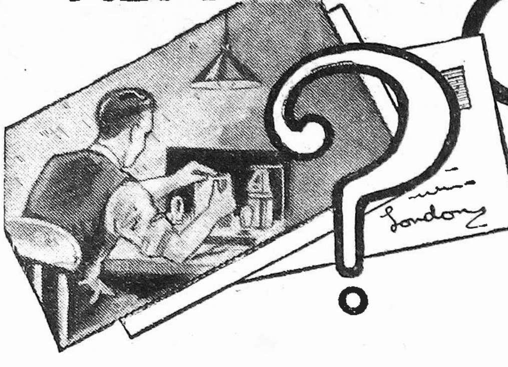
A new star appears in the *Brunswick* list for this month. Lanny Ross jumped into prominence in the film "Melody in Spring," and there were numerous inquiries for his records. He had not, however, made any records until *Brunswick* gave him a contract following his success in "College Rhythm," which is shortly to be generally released in this country. "Stay as Sweet as You Are" and "Let's Give Three Cheers for Love," *Brunswick O*1936, is his first record, and I think you will enjoy it. The numbers are from his new film "College Rhythm."

A splendid record by the Boswell Sisters appears this month; "If I Had a Million Dollars" and "Rock and Roll," on *Brunswick O*1957. The titles should be good sellers, as they are from the film "Transatlantic Merry-go-round," in which the Boswell Sisters make a personal appearance. Incidentally it is the longest part they have ever played in a film, as usually they are only used to sing one or two numbers, which are usually interpolated and have little bearing on the story. The girls are, as I think I have told you, still in Hollywood, where they are broadcasting regularly with Bing Crosby on a "Commercial Hour." This is a typical Boswell Sisters' record.

Connie Boswell gives us another record, too (*Brunswick O*1895), "Lost in a Fog" and "Isn't it a Shame."

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff



The coupon on Page 740 must be attached to every query.

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

SPECIAL NOTE

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

(1) Supply circuit diagrams of complete multi-valve receivers.

(2) Suggest alterations or modifications of receivers described in our contemporaries.

(3) Suggest alterations or modifications to commercial receivers.

(4) Answer queries over the telephone.

Please note also that all sketches and drawings which are sent to us should bear the name and address of the sender.

Short-wave Coil Construction

"I should be obliged if you could give me some information with regard to the construction of a coil to cover the wavelength range from 140 to 200 metres. I have made several short-wave coils, employing valve bases for mounting purposes, and these have proved very satisfactory on every short-wave range except that mentioned. When I do wind a coil for the higher range (I never use the receiver for wavelengths higher than 200 metres) trouble is experienced due to poor reaction control or lack of selectivity."—K. A. C. (Westcliff-on-Sea).

From the particulars you give it seems that the set you are using is designed essentially for short-wave reception, and it is probable, therefore, that the detector H.F. choke is of the short-wave pattern, and is unsuitable for use on wavelengths above, say, 100 metres. If this is the case, good reception on the waveband you mention could probably be obtained by employing a new choke, of a type suitable for all-wave working, or by connecting a normal reaction choke in series with that already fitted, the new choke being placed between the previous one and the L.F. transformer.

Assuming that your coil is to be wound on a ribbed ebonite former 2in. in diameter approximately 18 turns of 22-gauge d.c.c. wire would be required for the tuned winding, and 30 turns for reaction. Both windings should consist of side-by-side turns, and there should be a space of about ¼in. between the ends of the two.

Use For a 20-volt Rectifier

"I have just dismantled a mains receiver, and have taken from it a 20-volt. 1-amp. rectifier which was apparently used to supply the field winding of the moving-coil speaker. Could you please tell me of any use to which the rectifier could be put, and advise me if it will be suitable for charging 10-volt, 5,000 m.a.-hour H.T. accumulator units?"—J. A. P. (Liversedge, Yorks).

The rectifier unit (complete with the appropriate transformer) could certainly be used for charging purposes, and you could charge approximately eight 2-volt accumulators at 1 amp. It might also be employed for charging the H.T. units you mention by connecting four or five of these in parallel, and regulating the charging current by means of a 10-ohm variable resistance connected in series with one lead from the rectifier.

Leader Three Coils

"Could you please tell me if the twin-coil assembly recently introduced by Wearite could, with advantage, be used in place of the Wearite "Universal" coils specified in your issue?"—N. C. (Arbroath).

The coil assembly to which you refer is not suitable for the Leader Three, and we strongly advise you to employ the exact parts specified, to ensure the excellent results of which this receiver is capable.

Building A Trickle Charger

"I have recently made a mains transformer giving an output of 12 volts, and as I have a silver-oxide rectifier marked S.C.A.2 I should like to know if I can use these two parts together in order to charge a 2-volt accumulator."—B. M. J. (Swansea).

We regret to advise you that we do not know the type of rectifier you mention, and as you do not state the current and voltage rating it is not possible to say whether or not the component is suitable for use with the mains transformer that you have made. If you can give more complete details of the rectifier, at the same time stating the current output from the transformer secondary, we shall be pleased to give you further assistance.

Preventing Voltage Surge

"As I am using an indirectly-heated rectifier I have been warned that the voltage surge on first switching on is likely to damage the transformer windings. Instead of using a thermal-delay switch I have been considering the possibility of connecting a fixed resistance across each half of the secondary winding of the mains transformer. Will this be satisfactory, or will the resistances interfere with rectification?"—H. G. (Leigh-on-Sea).

It appears that you have been misinformed; the object of an indirectly-heated rectifier is to avoid a voltage surge on the D.C. side, and this it does satisfactorily. There will no doubt be a certain voltage surge across the secondary terminals of the transformer, but this will not cause any trouble provided that the transformer is of sound construction. We do not consider it necessary to fit the resistances you mention, for there will be no harm done by the rising voltage so long as the insulation used in the transformer is adequate.

Coils For The 60/- Three

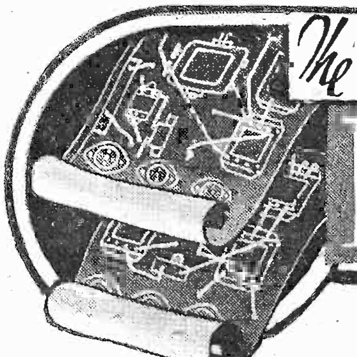
"As I am constructing the 60/- Three described in "Practical Wireless," dated December 2nd, 1933, I would like to wind my own coils and H.F. choke. Could you please supply the necessary constructional data?"—L. R. (Brentford).

We cannot, in the course of a reply through this Free Advice Bureau, give constructional details for components, and in any case would strongly recommend you to obtain the coils specified in making the 60/- Three. We might add, however, that details for making various coils were given in the series of articles published in the issues of PRACTICAL WIRELESS, dated December 9th, 1933, to January 6th, 1934, under the title, "Making Your Own Screened Coils."

A One-Valve Loud-speaker Receiver

"In the issue of your paper, dated October 20th, 1934, there appeared a very interesting article describing the construction of a one-valve receiver for universal operation. It was stated that a 16-volt D.C. valve should be used, and the circuit showed a metal rectifier. Could you please tell me the correct type of rectifier to use in this circuit as I propose to build a receiver round the design given?"—W. L. (Parkstone, Dorset).

The type of rectifier was not stated because it is not very important and there are several Westinghouse units suitable for this circuit. Actually, however, the type H.T.12 is as suitable as any, although the H.T.7 or H.T.8 could be employed.



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

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Midget Two	17.12.32	PW9
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All-Wave Two	19.8.33	PW28
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Ubique	28.7.34	PW36A
Four-Range Super-Mag. Two	11.8.34	PW36B
Summit Three	18.8.34	PW37
Armada Mains Three	18.8.34	PW38
Midget Short-Wave Two	15.9.34	PW38A
All-Pentode Three	22.9.34	PW39
£5 Superhet Three	27.10.34	PW40
A.C. £5 Superhet Three	24.11.34	PW41
D.C. £5 Superhet Three	1.12.34	PW42
Hall-Mark Three	8.12.34	PW43
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AMATEUR WIRELESS AND WIRELESS MAGAZINE.

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Twenty-station Loud-speaker One-valver (Class B)	27.9.33	AW449

Two-valvers: Blueprints, 1s. each.

Melody Ranger Two (D, Trans)	13.5.33	AW388
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B.B.C. National Two with Lucerne Coil (D. Trans)	17.2.34	AW377A
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Lucerne Minor (D, Pen)	24.3.34	AW426
Family Two (D, Trans)	*Apr.* '32	WM278

Three-valvers: Blueprints, 1s. each.

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New Regional Three (D, RC, Trans)	25.6.32	AW349
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£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)	3.3.34	AW422
Cossor Melody Maker with Lucerne Coils	17.3.34	AW423
P.W.H. Mascot with Lucerne Coils (Det, R.C., Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	24.3.34	AW424
Pentaquester (HF, Pen, D, Pen)	14.4.34	AW431
£5 5s. Three: De-luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	9.6.34	AW437
All-Britain Three (HF Pen, D, Pen)	6.9.34	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.10.34	AW451
Transportable Three (SG, D, Pen)	*Feb.* '32	WM271
Multi-Mag Three (D, 2 Trans)	*June* '32	WM288
Percy Harris Radiogram (HF, D, Trans)	*Aug.* '32	WM294
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Tyers Iron-core Three (SG, D, Pen)	*July* '33	WM330
C.-B. Three (D, LF, Class B)	*Sep.* '33	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
All-wave Three (D, 2LF)	*Jan.* '34	WM348
"W.M." 1934 Standard Three (SG, D, Pen)	*Feb.* '34	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	*Oct.* '34	WM371

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

65/- Four (SG, D, RC, Trans)	17.12.32	AW370
"A.W." Ideal Four (2SG, D, Pen)	16.9.33	AW402
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(Pentode and Class-B outputs for above; blueprints 6d. each)	25.8.34	AW445A
Quadradyne (2SG, D, Pen)	*Feb.* '32	WM273
Calibrator (SG, D, RC, Trans)	*Oct.* '32	WM300
Table Quad (SG, D, RC, Trans)	*Nov.* '32	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
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Five-valvers: Blueprints, 1s. 6d. each.

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

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Consolectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C. Two (D, Trans) A.C.	*June* '32	WM286

Three-valvers: Blueprints, 1s. each.

Home-lover's New All-electric Three (SG, D, Trans) A.C.	25.3.33	AW383
S.G. Three (SG, D, Pen) A.C.	3.6.33	AW390
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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	WM333
Six-guinea AC/DC Three (HF, Pen, D, Trans) A.C./D.C.	*July* '34	WM364
Mantovani A.C. Three (HF, Pen, D, Pen) A.C.	*Nov.* '34	WM374

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

A.C. Melody Ranger (SG, DC, RC, Trans) A.C.	4.3.33	AW380
AC/DC Straight A.V.C.4 (2 HF, D, Pen) A.C./D.C.	8.9.34	AW446
A.C. Quadradyne (2SG, D, Trans) A.C.	*Apr.* '32	WM279
All Metal Four (2SG, D, Pen) A.C.	*July* '33	WM329

SUPER-HETS.

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

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

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

1934 A.C. Century Super, A.C.	10.3.34	AW425
1932 A.C. Super 60, A.C.	*Feb.* '32	WM272
Seventy-seven Super, A.C.	*Dec.* '32	WM305
"W.M." D.C. Super, D.C.	*May* '33	WM321
Merrymaker Super, A.C.	*Dec.* '33	WM345
Heptode Super Three, A.C.	*May* '34	WM359
"W.M." Radiogram Super, A.C.	*July* '34	WM366
"W.M." Stenode, A.C.	*Sep.* '34	WM370

PORTABLES.

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

General-purpose Portable (SG, D, RC, Trans)	9.7.32	AW351
Midget Class-B Portable (SG, D, LF, Class B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	*May* '32	WM287
Two H.F. Portable, (2 SG, D, QP21)	*June* '34	WM362
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM363

SHORT-WAVERS. Battery Operated.

One-valvers: Blueprints, 1s. each.

S.W. One-valve	23.1.32	AW329
S.W. One-valver for America	31.3.34	AW427
Roma Short-waver	10.10.34	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)	20.8.32	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438

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	WM313

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

Quartz-crystal Super	*Oct.* '34	WM372

Mains Operated.

Two-valvers: Blueprints, 1s. each.

Two-valve Mains Short-waver (D, Pen) A.C.	10.10.34	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	*Aug.* '34	WM368

Three-valvers: Blueprints, 1s. each.

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

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

Gold Coaster (SG, D, RC, Trans) A.C.	*Aug.* '32	WM292

Practical and Amateur Wireless Blueprint Service Geo. Newnes, Ltd., 8-11 Southampton Street, Strand, W.C.2

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(Continued at top of column three)

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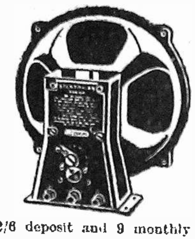

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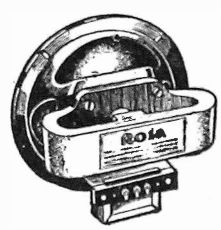

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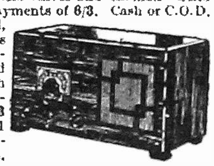

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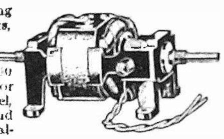

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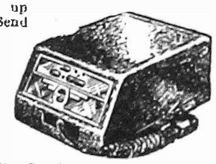

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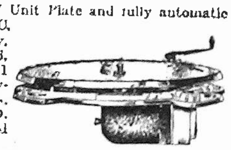

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(Continued from foot of column one)

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THE Following Types, 5/6 each: 350v. 120 ma., full wave rectifier, 500v. 120 m.a., full wave rectifier, 2½ watt indirectly heated pentode.

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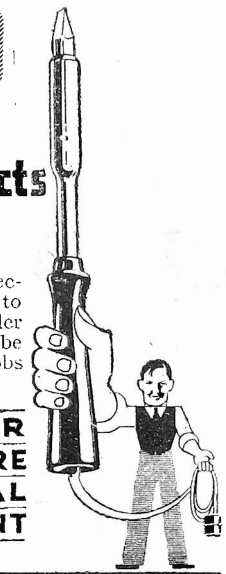

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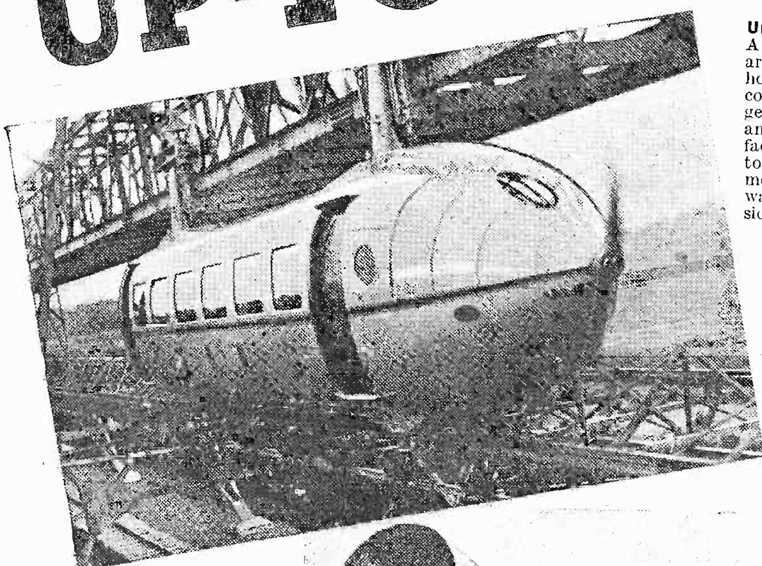

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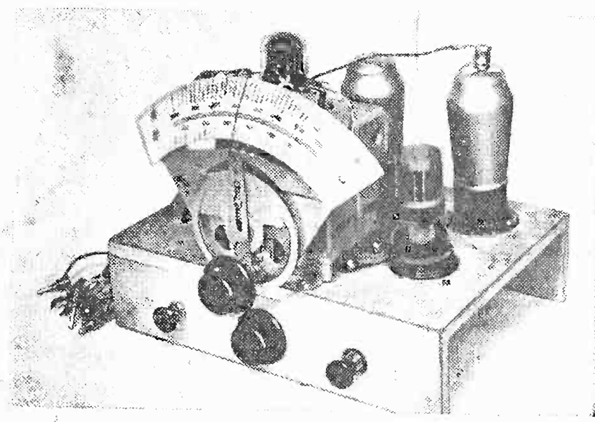

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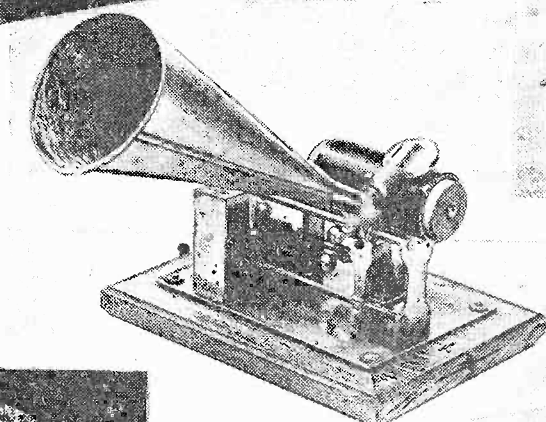

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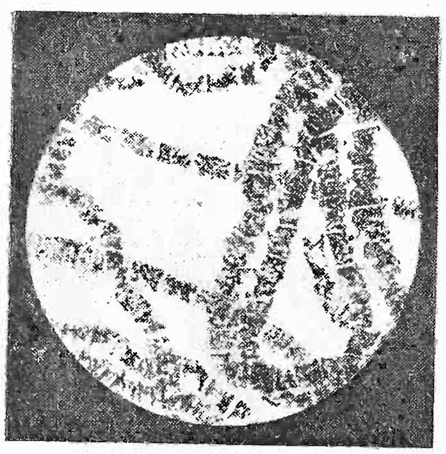

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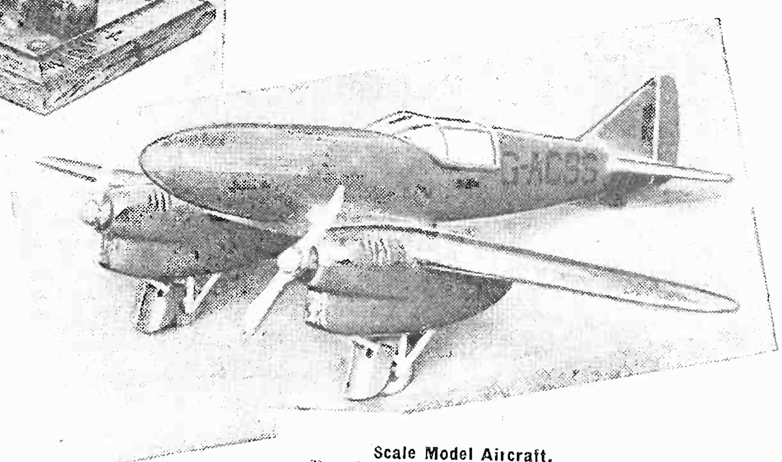

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