A HIGH-QUALITY AMPLIFIER—

SEE PAGE 472

Practical and Amateur Wireless

AND PRACTICAL TELEVISION

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 9. No. 223. December 26th, 1936.

Building a 2½ watt Transmitter

THE CHOICE OF INTERMEDIATE FREQUENCY—SEE PAGE 470.

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. IX. No. 223. December 26th, 1936.

Round the World of Wireless

Our 2½-watt Transmitter

IN this issue will be found the preliminary constructional details of our simple transmitter. We hope we will be forgiven for again reminding readers that this apparatus must not be built until a Post Office licence is obtained. The unauthorised use of such apparatus is not only a disregard of the terms of the licence, but may easily result in a curtailment of the facilities now granted to genuine experimenters, and we therefore trust that readers will respect the terms of the licence. The present transmitter is simple to build but most efficient in action, and it is our intention subsequently to describe the construction of larger transmitters in this special series.

Pulse by Wireless

FURTHER applications of wireless transmission now include the radiation of a patient's pulse-beats and respiration, for examination by a doctor at a distance. Senator Nicola Pende, a noted physician of Rome, has perfected the apparatus, and the first installation is to be on board the liner *Rex*, in order that passengers who are in need of expert advice may be "radio-ed" to the doctor on shore and a suitable treatment prescribed. It is further stated that the apparatus will be of extreme use in experimental aerial flights and altitude records.

Radio in the R.N.

THE advantages of an installation of sound reproduction equipment on ships of the Royal Navy has been demonstrated so satisfactorily that The General Electric Co., Ltd., has been commissioned to supply a complete amplifying system for H.M.S. *Royal Oak*. The system will comprise a 100-watt output channel adapted to be fed by a special all-wave radio input, by a microphone or by a gramophone pick-up. It will relay to twenty-seven loudspeaker points throughout the ship.

For Horogolists

JOHN HARRISON, the well-known clock maker, was responsible for the discovery of longitude. His No. 1 machine, the first accurate marine timekeeper ever made, was tested at sea in 1736 in H.M. ships *Centurion* and *Orford*, and until that time no practical method of finding longitude at sea had been devised. The maximum error permissible in a marine timekeeper suitable for the purpose had not to exceed one second per day. Lt.-Commander R. T. Gould, R.N., who spent twelve years overhauling four of Mr. Harrison's early watches, will give a talk on the subject from the National transmitter on December 24th. As a point of interest it may be mentioned that Mr. Harrison's No. 3 timekeeper took seventeen years to construct and seven years to overhaul!

An Amateur Trophy

THE President of the Columbia Broadcasting system has been so impressed by the activities and successes of amateurs that he has decided to award a trophy for the amateur adjudged to have performed, by means of radio, the most meritorious service during the year. The trophy will be in the permanent custody of the American Radio Relay League, and the winner will have his name engraved upon it and receive a replica for permanent retention. Seven sculptors have been asked to submit designs, and five famous men are to serve on the Board of Award.

Public Address at the Baths

THE Battersea Borough Council have placed an order with the G.E.C. for the installation of special amplifiers and public address equipment at the Latchmere Road Baths. The equipment, which will be utilised for all public functions, is designed to improve the acoustics of the building.

New Series of Talks

FROM January to March, 1937, a new series of Morning Talks is to be instituted, entitled "Value for Money." This is designed to enlighten women listeners as to the disposal of that portion of their own (or their husbands') incomes which is paid away in the form of "Rates and taxes." Each talk will deal with a particular town or district and will be given by the principal local government authority.

Welsh in the News

FOR the benefit of Welsh listeners a novel programme is to be given from the Welsh transmitter on the last day of the year. In this programme three people who have distinguished themselves during the year will come to the microphone. They are a Golf Champion, a Chief Engineer of one of the world's famous ships, and a Dairy Queen.

Radio Fires a Gun

EXHIBITIONS have been opened by the impulse transmitted from a distance by radio, and similar effects are quite simple to arrange through the medium of relays. It is stated, however, that without the intervention of relays, a high-frequency radiation may be used to detonate a charge at a distance, and the possibility of firing guns without gunners is visualised.

Thirty-five Years Ago

IT is thirty-five years ago this month that the first transatlantic signals were received in Newfoundland from Poldhu in Cornwall. Marconi's belief in the possibility of wireless transmission across the Atlantic had been "pooh-poohed" by everyone, but he persisted in his experiments and laid the foundation of wireless communication as we know it to-day. It was on December 11th that the first experimental transmissions commenced from Poldhu.

ROUND the WORLD of WIRELESS (Continued)

INTERESTING and TOPICAL NEWS and NOTES

Pantomime Tour

PANTOMIME broadcasts are always welcome at this time of the year, and it is interesting to learn that Victor Smythe, Northern Outside Broadcasts chief, is planning another big "Pantomime Tour," to include excerpts from pantomimes at a number of Northern theatres, to be broadcast on December 23rd.

Concert from Torquay

THE popular Torquay Municipal Orchestra, conducted by Ernest W. Goss, will give a concert from the Pavilion, Torquay, on December 29th. Betty Bannerman will be the artist.

B.B.C.'s New Station

IT is reported that the B.B.C. has chosen a site at Start Point, near Plymouth, for a new 100-kilowatt station to serve the West Country. When it is constructed the present West Regional station at Washford Cross, on the Bristol Channel, will be devoted exclusively to the service of Wales.

Scottish Orchestra

PART of a concert by the Scottish Orchestra, conducted by Georg Szell, will be broadcast from St. Andrew's Hall, Glasgow, on December 26th. The broadcast portion will include the Overture "King Stephen," by Beethoven; the Nile Aria ("Aïda"), by Verdi, with May Blyth (soprano) as soloist; and "Serenade No. 9 in D," by Mozart.

Radiograms will provide a good deal of entertainment during the festive season, and the De Luxe Cossor Radiogram shown in the illustration can be obtained for 22 guineas. Quality of reproduction is one of its most outstanding features.

Address on Radio Broadcasting

AN interesting address on the subject of the "Progress of Radio Broadcasting" was given to a large number of the members of the Electrical Association for Women at the Mikado Café, Plymouth, on Thursday, December 3rd, by Captain H. de A. Donisthorpe, of The General Electric Co., Ltd. The chair was taken by Mrs. Councillor Daymond.

Radio for Bungalow Hospital

A NEW radio receiver, the gift of the "News Chronicle" Wireless for Hospitals Fund, was recently handed over to the Witham, Essex, Nursing Association Maternity Bungalow. The three-valve set is to be installed in the rest room, with an extension speaker for the main ward.

Christmas Party

THE Christmas Eve programme in the Children's Hour takes the form of a Christmas party. Two great favourites of the Corner in its early days—Percy Edgar ("The Skipper") and Harold Casey ("Uncle Pat")—will take part. Songs, a Christmas story and Christmas verse will make a well varied programme. Victor Hely-Hutchinson will be at the piano for the songs by Harold Casey and the B.B.C. Midland Singers, conducted by Edgar Morgan.

The New Year at Blackpool

BLACKPOOL is noted for its big musical shows, and on January 1st, Victor Smythe will present another composite O.B. feature from the Northern Regional. The programme will include music by Reginald Dixon, the Savoy Café Orchestra and Larry Brennan and his Band, a variety act from the Palace Theatre, and an excerpt from "Aladdin" at the Opera House. Those taking part in the pantomime include Betty Huntley Wright, Jimmie Britton, Mark Stone, and Leslie Barker.

Orchestral Concert

LISTENERS to the Western Regional programme on December 27th will hear a concert by the Clifton Light Orchestra. This Orchestra, leader Joan Allen, is conducted by Reginald Redman, and the programme will include five dances from "The Duenna," by Reynolds; the Christmas Scene and Finale, Act I, from "The Miracle," by Humperdinck.

Choir Boys of the King's College Hospital Chapel Choir, Denmark Hill, London, rehearsing in their chapel, carols for Christmas under the microphone. These carols are to be broadcast throughout the hospital to the patients at Christmas.

SOLVE THIS!

PROBLEM No. 223.

Davies made a 4-valve superhet. employing a diode detector and a high-efficiency output pentode (A.C.2/Pen.), with simple A.V.C., the cathode of the diode valve being joined to earth. How could delayed A.V.C. be obtained, preferably without adding extra components? Three books will be awarded for the first three correct solutions opened. Address your solutions to the Editor, PRACTICAL AND AMATEUR WIRELESS, George Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2. Envelopes must be marked Problem No. 223 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, December 28th, 1936.

Solution to Problem No. 222.

The probable cause of the trouble was a leaking smoothing condenser. This would cause excessive current to be passed by the rectifier, with consequent reduction of voltage.

The following three readers successfully solved Problem No. 221 and books are accordingly being forwarded to them: E. G. Hunt, The Warrens, College Avenue, Freshfield, Nr. Liverpool; W. Paterson, 61, Blenheim St., Springburn, Glasgow, N.; L. Stinton, 106, Lumley Rd., Walsall.

Cutting the Cost of Construction

Where Economy in the Purchase of Components can Often be Practised Without Sacrificing Efficiency

By FRANK PRESTON

THE question of cost is always an important one with the constructor, and he is always prepared to study means of reducing it. Trouble is the inevitable outcome of thoughtless "economy," but it is frequently possible to prune the component specification without any consequent loss in efficiency of the finished receiver. It should be made perfectly clear that this does not apply to PRACTICAL AND AMATEUR WIRELESS Guaranteed Designs, since these are always prepared with the question of economy well in mind. But when making a receiver to a conventional circuit, it is generally well worth while to study it with care with the idea of eliminating non-essential parts.

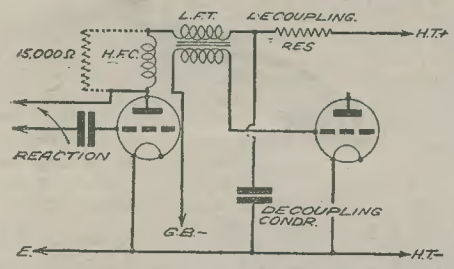


Fig. 1.—The reaction choke in the detector anode circuit can frequently be eliminated or replaced by a fixed resistance, as shown in broken lines.

The Reaction Choke

A good, though very simple and well-known example, is in connection with the H.F. choke used in the anode circuit of the detector valve. This is frequently referred to as a reaction choke, because its main purpose is to prevent high-frequency currents from flowing into the low-frequency circuits, so that they can be usefully employed for feeding-back into the grid circuit. A skeleton circuit diagram to illustrate this point is given in Fig. 1. In this case ordinary L.F.-transformer coupling is used between the detector and L.F. valves, and the primary winding of this frequently has a sufficiently high inductance to provide an effective barrier to H.F. currents. In consequence, it might be found that results are unchanged if the choke is short-circuited or removed from the circuit.

This might not be the case if the transformer is a cheap one having a fairly high self-capacity, or even if it is a good one with a fixed condenser permanently connected in parallel with the primary, and built into the case. In building the set, however, the choke might be omitted unless, and until, it is found that reaction control is very erratic or that oscillation cannot be obtained.

A Resistance "Stopper"

Even then, it is very often sufficient to replace the choke by a non-inductive resistance (which can be a sixpenny ½-watt type). This is shown in broken lines in Fig. 1, where the resistance has a value of 15,000 ohms. The arrangement is nearly always satisfactory because the resistance provides a sufficiently high impedance to H.F. When this idea is employed, it should be remembered that the resistance will reduce the voltage normally applied to the anode of the detector valve; to compensate for this it might be necessary to reduce the value of the decoupling resistance by 15,000 ohms, or to use a higher-voltage tapping for the detector H.T. lead.

When a resistance-fed transformer is used for coupling purposes, as in Fig. 2, the choke is generally unnecessary, and can simply be omitted, because the coupling resistance provides the necessary impedance. In the case of a superhet, where reaction is not employed, it might be found better to connect a .0003 mfd. fixed condenser between the anode and earth, as shown in broken lines. When reaction is employed, a condenser in this position, but with a lower capacity, should be tried.

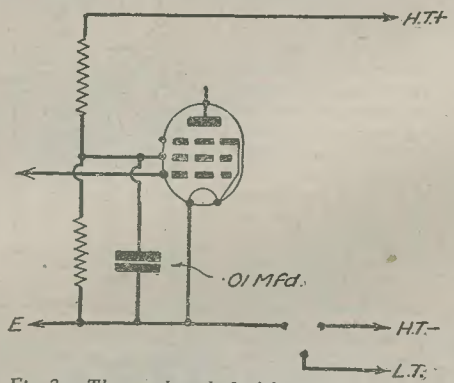


Fig. 3.—The usual method of feeding the screening grid of an H.F. valve, by means of a potentiometer consisting of two fixed resistances.

The S.G. Potentiometer

Another case where a small but not insignificant saving can be effected is in the case of the fixed potentiometer used to feed the screening grid of an S.G. or variable-mu valve. The usual arrangement is as shown in Fig. 3, where two fixed resistances are connected in series between H.T.+ and H.T.—, the feed to the valve being from the junction of the resistances. A fixed condenser is also used between the screening grid and earth, to act as an H.F. by-pass. Yet another practical essential is that a three-point on-off switch is required to cut the potentiometer out of circuit when the set is not in use.

The simplification to which reference is being made is illustrated in Fig. 4. Here it

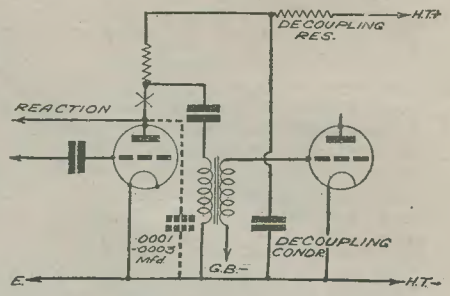


Fig. 2.—When a resistance-fed transformer is used as shown here, an H.F. choke is rarely essential, especially if a small by-pass condenser is connected as shown in broken lines. The H.F. choke, when used, is included at a point marked X.

can be seen that the detector valve and its decoupling resistance are together used as the S.G. potentiometer, whilst the S.G. by-pass condenser also serves to decouple the detector. Furthermore, the three-point switch is replaced by a two-point component, because there can be no passage of current through the "artificial" potentiometer when the L.T. current to the valves is disconnected. In nearly every case this arrangement proves perfectly satisfactory, provided that the detector valve and decoupling resistance can be chosen to provide the correct screening-grid voltage. It is generally satisfactory to apply a voltage of about one-half the anode voltage to the screening grid, which means that if the A.C. resistance of the valve and its decoupling resistance are approximately equal, the correct conditions apply. Actually, the valve should provide rather a greater resistance than the decoupling resistance to allow for the current passed by the screening grid. Consequently, when using a typical detector valve having an A.C. resistance (often referred to as impedance) of 18,000 ohms, it would be correct to use a decoupling resistance of 15,000 ohms, although the difference in performance will rarely be very great if the value is increased up to 20,000 ohms.

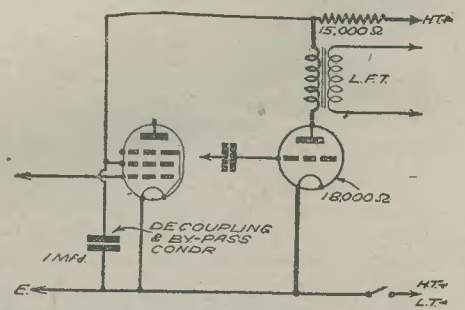


Fig. 4.—How the detector valve and its decoupling resistance can together be used as an S.G. potentiometer. The artificial potentiometer is shown in heavy lines.

(Continued overleaf)

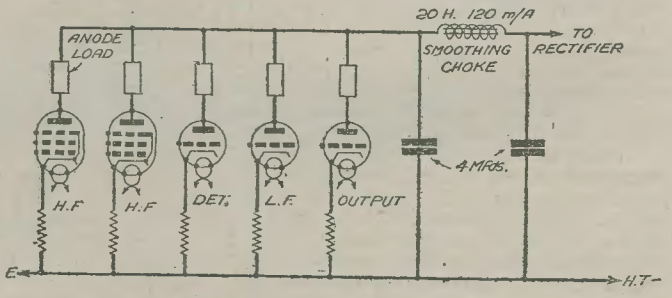


Fig. 5.—A single, expensive smoothing choke used to supply all the valves.

CUTTING THE COST OF CONSTRUCTION

(*Continued from previous page*)

A practical point which should be noted is that the combined decoupling and by-pass condenser should be placed close to the S.G. terminal of the H.F. valve-holder, and should have a value of not less than 1-mfd. The condenser should, of course, be of the non-inductive type.

By-pass Condenser Capacities

Whilst dealing with H.F. by-passing and decoupling it is worthy of note that condensers of unnecessarily high value are often used, with the result that the cost is made higher than it need be. All by-pass condensers in the H.F. circuits (S.G., variable-mu potentiometer, grid bias and anode circuit) can be of .01 mfd. This might come as a surprise to many of those constructors who habitually use components of about 1 mfd. But when it is remembered that a .01 mfd. condenser offers a resistance of only about 25 ohms at 600 kilocycles (equivalent to 500 metres), or of about 11 ohms at 1,500 kilocycles (200 metres) it is evident that such a capacity is adequate. It is important, however, that the condensers be almost completely non-inductive, for otherwise the effective resistance will be considerably greater.

This explanation should not be considered as applying to the detector decoupling condenser, which has to deal with low-frequencies, because the effective resistance of a condenser increases very rapidly as the frequency is reduced. For example, the resistance offered by a .01-mfd. condenser to a current at an audio frequency of 1,000 cycles is something like 16,000 ohms. A 1-mfd. condenser, on the other hand, shows a resistance of only 160 ohms in the same conditions, and this is low by comparison with the resistance of the decoupling resistance—as it should be if the condenser is to act as an easy by-pass.

High-tension Smoothing

The H.T. supply section of a powerful mains receiver or amplifier is, of necessity, expensive, but a saving can often be effected here without any loss of efficiency. One of the most expensive components is the smoothing choke shown in Fig. 5. If this is to provide adequate smoothing for the H.F. and detector circuits it must have an inductance of not less than about 20 henries. But a choke having this inductance and capable of carrying a current of, say, 120 mA is very costly. In many instances the choke can be replaced by the field winding of an energised moving-coil speaker, when the question under consideration scarcely arises. But when for any reason it is proposed to use a permanent-magnet speaker, or when the resistance of the speaker coil is too high, it is cheaper to use two chokes as shown in Fig. 6. One of these is used simply to supply current for the L.F. stages, whilst the other is for the other valves in the set.

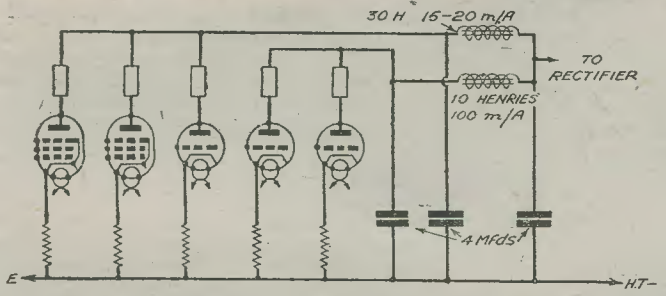


Fig. 6.—It is often cheaper to use two separate smoothing chokes, as shown here, than a larger component as in Fig. 5.

The first-mentioned choke must carry a comparatively heavy current, but need provide only a modest degree of smoothing; thus it can have a low inductance. The second choke, on the other hand, must have a high inductance, but need carry only a light current. Thus it would be possible to employ one choke rated at, say, 10 henries, 100 mA, and another rated at about 30 henries, 15-20 mA. The two components can generally be bought more cheaply than a single one rated at 30 henries, 120 mA.

An alternative system which is often valuable consists of using a single low-inductance, high-current choke for smoothing the whole supply, and using resistances for smoothing the supplies to the individual pre-L.F. valves, as shown in Fig. 7. This arrangement is doubly useful when a considerable voltage drop is required in the supply lines to the earlier valve stages. It will be seen that separate resistances and condensers are used for each of the valves, but these would probably be less expensive than a good choke.

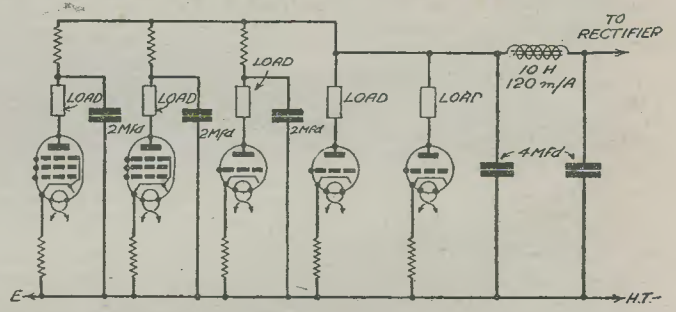


Fig. 7. — Another effective and comparatively inexpensive method of smoothing. The voltage-dropping resistances and smoothing condensers should generally be additional to the normal decoupling condensers, which are included in the rectangles representative of the anode load.

A VARIABLE SELECTIVITY DEVICE

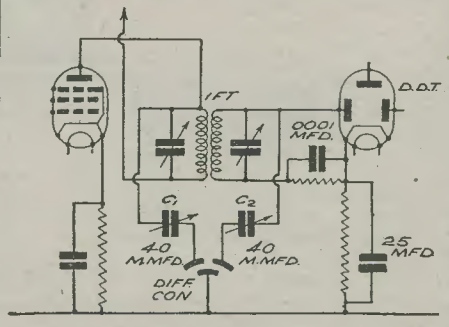
THE reproduction of most sets of the superhet type can be improved by the use of variable selectivity, but if an intermediate-frequency transformer using variable coupling between the primary and secondary circuits is employed, large structural alterations to the set are necessary, and the cost is also fairly high, as a perfectly good I.F.T. has to be scrapped. To overcome the disadvantages of this method, and to render the alteration simple and cheap, the writer evolved the following scheme.

Using a Differential Condenser

Instead of altering the coupling between the primary and secondary windings, the frequency to which they are tuned is altered slightly by the use of a differential condenser in the manner shown in the accompanying diagram, which I think is self explanatory. It will be seen that the frequency to which the primary is tuned is raised, and that of the secondary is lowered on rotating the differential condenser.

There are two methods of using the condenser which are identical as far as the circuit diagram is concerned. The first uses a very small value of differential—of the order of 50 mmfds.—which may be obtained by stripping and suitably modifying a standard condenser which one may have on hand. In this case the method of adjusting the circuit is as follows:

Suppose that when the differential condenser is rotated in an anti-clockwise direction the moving vanes mesh with those fixed vanes which are connected to the primary winding on the transformer. With the vanes in this position, and with the two additional trimmers C1 and C2 both about half in, adjust the trimmers on the I.F.T.'s to get maximum response and selectivity from the set. On rotating the differential in the opposite direction the bandwidth will now increase—too much probably—so that C1 and C2 will have to be reduced until the desired effect is attained.



How a differential condenser can be incorporated in a circuit for variable selectivity purposes.

An Alternative Method

The second method uses an unmodified differential condenser which is set in the mid-way position, with the moving vanes equally meshed with the two sets of fixed vanes while the preliminary adjustments are made. With the condenser in this position, the trimmers C1 and C2 are set at a low value, and the set lined up as before. Rotation of the differential in either direction will result in increased bandwidth, the extent being controlled by C1 and C2 which must be adjusted until the desired results are obtained. For this second method the value of the differential is not critical, although the smallest one available should be used.

If the leads to the condenser are long, it is an advantage to have them screened to avoid interaction with earlier stages of the set, although the leads should, of course, be kept as short as possible to avoid the possibility of the various trimmers being unable to balance out the additional strays introduced.—J. A. B.

NEW SERIES

Amateur Transmitting

Constructional Details of a Single-valve 'Phone Transmitter are Given in This Fifth Article of the Series By L. ORMOND SPARKS

IN this article, the first transmitter of this series is dealt with, so it will be necessary for me to leave the fundamentals. I shall, however, have to return to them later, as there is still a good bit of ground to be covered.

As previously mentioned, there are two types or classes of oscillators, namely, "self-controlled" and "crystal-controlled." The first of these I dealt with last week, but I did not describe the latter, so, as the first transmitter is of the "crystal-controlled" type, it is essential for a few details to be given about such circuits.

Crystal-controlled Oscillators

Most constructors are familiar with "piezo-electric" crystal pick-ups, loud-speakers and microphones, which make use of certain characteristics of crystals in the piezo-electric group. Quartz is the crystal usually employed, and by virtue of its *electro-mechanical* properties it will oscillate at a frequency which is governed by its dimensions.

The crystal must not be confused with the lumps of crystal associated with receivers. Actually, it is cut and ground into little slabs, an operation which is beyond the scope of the average amateur; therefore, it is usual to buy a crystal having the desired frequency, and mounted in a holder which consists of two metal plates.

Fig. 1 shows the method of denoting a crystal circuit, and also represents its electrical equivalent capacity, inductance and resistance in series, and, as the holding plates on each side of the crystal form a certain capacity, it is necessary to consider a parallel capacity, as C.1.

The property of oscillating, at a frequency which can be determined, makes the quartz crystal ideal for governing the frequency of an oscillator circuit in a transmitter, where constancy of oscillation is of *vital importance.*

With the self-controlled oscillators described last week, such things as valve heating, swinging aerials, variations in H.T. feed, grid and output load all tend to affect the frequency of the circuit, thus making it very difficult to hold the output on a definite frequency or wavelength. (I would mention here that a transmitter must not be allowed to wander all over the place, as regards its wavelength. It is definitely not a sign of good operation, while the licensing authorities most certainly do not favour such transmissions.)

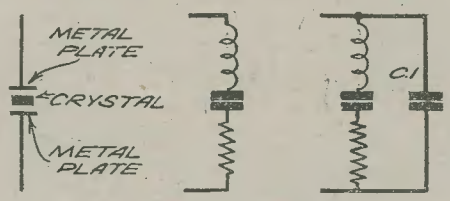


Fig. 1.—Theoretical symbol of the crystal with its electrical circuit equivalents.

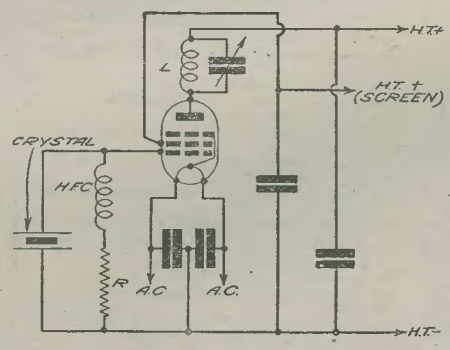


Fig. 5.—Pentode oscillator—crystal controlled.

With a crystal-controlled circuit, these snags are removed, operation simplified, whilst the necessity for accurately calibrated frequency-measuring instruments is removed.

If a crystal circuit is compared to a combination of coil and condenser, i.e., a simple oscillatory circuit, it will be found that the crystal produces a very much sharper resonance. In fact, the state of resonance is so sharply defined that it is impossible to produce similar conditions by the usual coil and condenser arrangements.

Operation

When a crystal is vibrating or oscillating at the very high frequencies usually associated with radio-frequency circuits, a certain amount of heat is generated, due to molecular friction, and the rise in temperature can affect the frequency.

The amount of variation produced depends on the "cut" of the crystal, there being various ways of obtaining or cutting out the little slabs from the natural crystal formation. However, if certain operating points are watched, the temperature/frequency variation can almost be ignored.

The higher the radio-frequency voltages across the crystal, i.e., the greater the amplitude of the vibrations, the greater will be the temperature rise; therefore, certain limiting factors must be introduced if satisfactory operation is to be maintained.

A peculiar part about a quartz crystal is that apart from what may be called the useful vibrations, there are others which tend to produce additional heating and stresses of a mechanical nature in the crystal's structure. If the radio-frequency voltages are great enough, it is possible for the crystal to crack up, due to the excessive stresses thus produced, so it becomes necessary to limit the power to be handled by the circuit. This is one of the points which must be noted about a crystal-controlled oscillator: it will only handle low power, say, 4 to 5 watts. Therefore, it becomes necessary, with the average transmitter, to amplify the output, and the section of a transmitter which attends to that is known as the power amplifier.

It is not always an easy matter to measure the radio-frequency voltages across the crystal, so the more simple procedure of checking the r.-f. current is usually adopted. This can be done with the aid of a suitable meter or lamp in series with the earth potential side of the crystal.

The safe current depends on the type or "cut" of crystal, but for the type concerned with these articles it should not exceed, say, 50 milliamps, the value being also governed by the H.T. applied and the valve in use.

A simple triode crystal-controlled oscillator is shown in Fig. 4, where it will be noted that the usual tuned grid arrange-

(*Continued overleaf*)

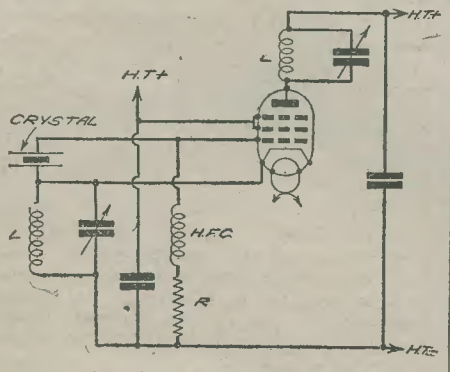


Fig. 6.—The Tritet oscillator.

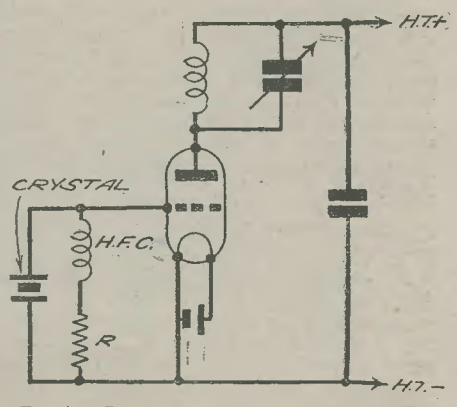


Fig. 4.—Simple triode crystal-controlled circuit.

AMATEUR TRANSMITTING

(Continued from previous page)

ment, i.e., coil and condenser, has been replaced by the quartz crystal. The circuit is really a form of the T.P.T.G. mentioned last week. Other suitable circuits are shown in Figs. 5 and 6, from which it will be seen that pentodes appear to be more favoured that triodes. There is a very

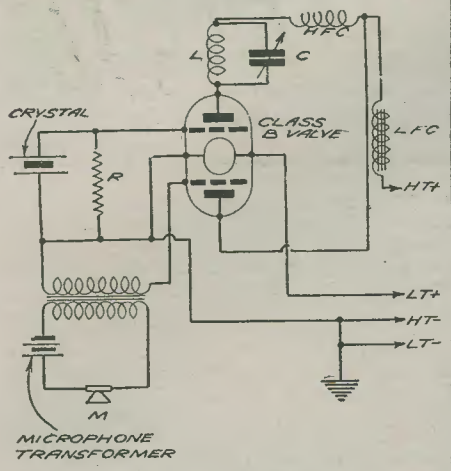


Fig. 7.—Circuit of the 2½-watt transmitter to be fully described next week.

definite reason for this. I have mentioned about the power limitations of a crystal-controlled circuit; well, a pentode helps to overcome that snag, as less heating of the crystal takes place than with a triode for the same power input, and a greater plate voltage can be applied, due to the fact that the feed-back voltage is less owing to the reduction of the plate grid capacity by the presence of the screening grid.

A One-valver 'Phone Transmitter

The first transmitter for home constructors who have not yet explored the more serious and fascinating side of wireless should be as simple as possible, consistent with the purpose it is intended to serve, namely, the progress of the operator's knowledge of wireless.

Bearing this in mind, I do not think that the circuit shown in Fig. 7 can be improved on. It is not a new or original design; in fact, it is one which is already widely used by keen experimenters and experienced transmitters, who require a low-powered "stand by" or "local" outfit.

It also possesses the advantage that if, at a later date, the user wishes to build a more powerful outfit, the components will be usable.

If the circuit is examined, it will be seen that the valve is an ordinary Class B, in this case a Cossor 240B, which consists of two complete triodes, except for the common filament, in the one bulb.

If one triode circuit is traced, it will be seen that it forms a simple crystal-controlled oscillator circuit, which has its plate circuit tuned by the coil L and variable condenser C, its resultant frequency or wavelength being governed by the crystal across the grid circuit.

That section, then, acts as the generator of the oscillations, but that in itself is not sufficient for our purpose. It is necessary to impress on those oscillations speech or music, so some means of "modulating" them has to be employed. Modulation will be described fully in future articles.

If the circuit of the other triode section is followed, it will be seen that it is nothing more than a L.F. amplifier, and it is used to amplify the minute electrical variations from the microphone circuit until they are sufficient to modulate, fully, the oscillator output.

With a circuit of this type, a really efficient microphone having a high output is necessary; therefore, a sensitive transverse-current pattern is advisable.

The coil is perfectly straightforward, the design lending itself to home construction, if so desired, while the construction of the complete transmitter should not present any difficulties to the average enthusiast.

Constructional Details

One is often tempted to sling together test and experimental circuits or "hook-ups" but, with the class of work under consideration, I think every attempt should be made to make the job look neat and compact, so I propose using what is known as "rack" construction, on very similar lines to the large transmitters, as such an arrangement not only looks good, but, what is even more important, it is very reasonable in price, simple to make, and safeguards efficiency.

A general idea of the arrangement can be gathered from Fig. 8. The supports at each corner and the four cross-members are ⅜in. angle aluminium. Their dimensions are given in the diagram, together with those of the two baseboards.

The lower compartment is intended to house the batteries, while the upper one is for the actual transmitter, thus keeping all connecting leads short and constant, and making the whole outfit self-contained.

LIST OF COMPONENTS FOR ONE-VALVE 'PHONE TRANSMITTER

One ebonite panel, 9in. by 7in. by 3/16in.
One valve—Cossor 240B.
One variable condenser—B.T.S..000067 type. Ceramic.
One fixed condenser, .001 mfd.
One H.F.C.—short-wave—Eddystone.
One L.F. choke—Varley.
One microphone transformer—Bulgin, type L.F.35.
One dial—Bulgin, type I.P.8.
One knob, Bulgin, type K. 58.
One terminal block, and two insulated-head terminals.
One Erie resistance, 30,000.
One Quartz Crystal and holder. Frequency 7 M.c. (Quartz Crystal Co.).
Coil to specification (see text).
Two push-pull switches—Bulgin, type S.38 or S.22.
Two panel brackets—Bulgin, type P.B.3.
One valveholder.—B.T.S. U.H.7.
Two brackets.
One strip bakelite.
Four 16in. lengths ⅜in. angle aluminium.
Four 9in. lengths ⅜in. angle aluminium.
Bolts (6B.A.), nuts, 2 spade ends, 2H.T. plugs.

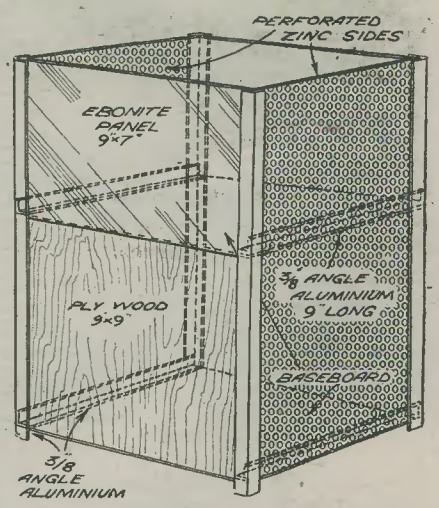


Fig. 8.—Containing case for the transmitter.

The sides of the structure are covered with perforated zinc, which allows ample ventilation for the battery compartment, and forms quite efficient screening for the circuit.

An ebonite panel is used for the transmitter, but the lower part and back can be covered with plywood stained black and left matt or polished, according to taste.

I would suggest that work is commenced on the rack and the fitting of the two baseboards, although the upper one must be removable to allow the assembly of the components, which will be described and illustrated in the next article.

By the way, how are you progressing with the Morse Code? If you haven't settled down to it yet, and made some progress, it's time you did; that is, of course, if you intend becoming an amateur transmitter.

PROGRAMME NOTES

"Aladdin"

A SELECTION from the pantomime produced by Francis Laidler will be broadcast from the stage of the Prince's Theatre, Bristol, on January 2nd, in the Western Regional programme. The cast will include Jean Colin as Aladdin, Leslie Strange, Connie Graham, Monti Ryan, Noyes and Dee, and Norah and Peg St. John.

Christmas Day Music

ON Christmas Day, Midland makes two contributions to the National programme. First, there is an hour's light music by the Coventry Hippodrome Orchestra, conducted by William Pethers, in the early afternoon; and then in the evening there will be something characteristic of the region in the music programme which Felix Felton has been arranging to represent the music of the regions.

Carols from Peterborough

CAROLS by the choristers of Peterborough Cathedral, with Dr. Henry Coleman conducting, have now become a regular Midland broadcast in Christmas week. This year Dr. Coleman, who is in his sixteenth year as Organist and Master of the Music at Peterborough, has chosen a dozen carols, of which one is old Norman, another Breton and the remainder mostly traditional. This broadcast will be given in the Midland Regional programme on December 24th.

City of Bristol Police Band

THIS popular police band, conducted by Captain F. W. Wood, M.V.O., Director of Music, will give a concert from the Western Studio on December 31st. Beryl Chappell (soprano) who first broadcast from the West Regional in "Four Ladies," in April, will sing two groups of songs.

Colliery Band Concert

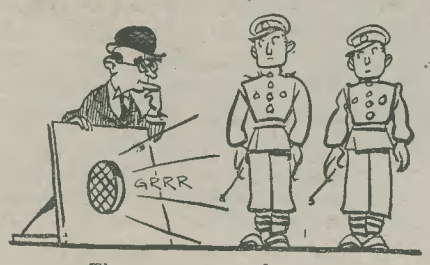
ON December 24th, the Teversall Colliery Band, from Nottinghamshire, are to give a popular programme, T. Parkes conducting. Arthur Cranmer, the well-known Birmingham baritone, will sing two groups of songs.

On Your Wavelength

By THERMION

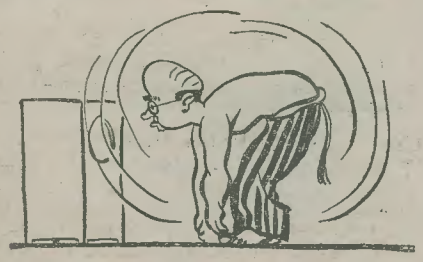
The Short-wave, etc., Society

APROPOS my remarks on this subject last week, a reader points out that, as the critic concerned evidently reads PRACTICAL AND AMATEUR WIRELESS, he therefore must include himself in the castigation he administered to readers of this paper.



The sergeant-major by radio.

As we go to press I have received a large number of letters from readers in the Thornton Heath district expressing indignation and asking me to set the wheels in motion to form a wireless *club* (not a *Society*) in this district. The rule that no member of any other local club will be permitted to join unless he retires from that body, is suggested. I shall be glad to hear



Physical jerks for breakfast?

from other readers in the district, and if necessary will convene a meeting.

The Sergeant-major's Dodge

FIFTY loudspeakers, I learn, are being installed at Llanion Barracks (Pembroke Dock) where the second battalion of the King's Shropshire Light Infantry is quartered. It is quite untrue that the underlying idea is that the sergeant-major can stay in bed and drill his men without getting up. With television in the offing he should be able to do so, however. He will be able to see his men drilling on the square and bawl his expletives through a loudspeaker by means of a P.A. outfit.

Early Morning Exercises

AND speaking of drilling and exercises calls to mind that the B.B.C., anxious to implement the Government's campaign for an A1 nation, proposes to broadcast physical exercises in the early morning. The only obstacle in the way of these slimming exercises at the moment is the fact that the B.B.C. cannot make up its many minds whether to make the broadcast before or after breakfast. So be prepared to bend and touch the toes to the tune of "The Broken Doll."

Fog

DURING the recent thick fog a reader noticed that his short-wave reception vanished. I am not referring to the broadcast fog but to the pea soup variety for which London and Manchester are renowned. We know that the sun and its spots affect radio reception, and so does the moon. This reader says that he has noticed that good reception accompanies a change in the weather. With a little experiment, therefore, it should be possible to forecast the weather from wireless reception. As it is, deep depressions assail me every time I wish to listen to the news.

A Solution

A SENSATION was caused at Broadcasting House the other day when a party of people was discovered sitting round a mike with pegs on their noses. It appears that they were rehearsing a broadcast of Punch and Judy. From my own deductions I should say that this is the solution to the problem of how crooners rattle their larynx, ululate the epiglottis, and make those queer gurgling noises for which they are paid about £1,000 per gurgle. You know the noise—gurgle, gurgle, plonk; plonk, gurgle, gurgle.

A Distressing Scene

I WITNESSED a most distressing scene the other day in a local dealer's shop. A man came in for a set of coils which he had ordered, and as it was being handed to him another man entered the shop and wanted a set of similar coils. His set had not arrived, in spite of the fact

Does the fog affect radio?

that he had had them on order for three weeks. He lost his temper, and tried to collect the other man's coils by force, and a fight resulted in which the coils were damaged. It is really getting very disturbing—the way that manufacturers are getting behindhand with orders. One manufacturer is not giving delivery of one model for at least six weeks, in spite of the fact that his staff is working overtime.

How the crooner gets his 'croon.'

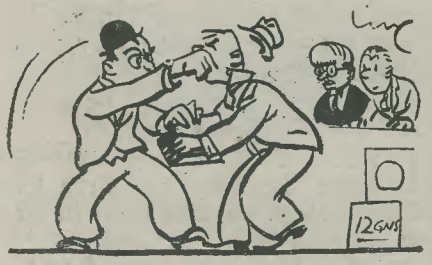
The Overhaul

AS it is getting near the end of the year I must overhaul my set, earth and aerial. I put it off last year until after the Christmas festivities, and having taken the set apart I broke a valve, and thus caused a rift in the lute. Fortunately I have a stock of old sets, so I issue this topical reminder that you should set about the job without delay.

A Curious Phenomenon

I DO so hope that some of my readers will come to the rescue of A. B., of Thornaby-on-Tees, who writes :—

"Dear Thermion,—I wonder if you or other readers have noticed this curious phenomenon. I combed my hair briskly in a dark room whilst holding a mirror opposite my head.



Coils—First come, first served!

Imagine my astonishment as I observed flashes of blueish light being emitted. The faster I combed the bigger the flashes.

"After running the comb through my hair a few times I touched my hand with the comb and a blue light appeared on my hand, but no shock. I'm wondering whether I'll be able to run my wireless off this current, as I could devise a machine to automatically comb my hair whilst sitting down and listening in. It would be an easy thing to transfer the apparatus to someone else's head when my head was tired or I was just about bald.

"What do you think about this idea of mine? Will it be worth taking a patent out for? Wishing you a very Happy Christmas and a Prosperous New Year."

I like really serious letters like this; it is such a change from having my leg pulled! Perhaps the learned members of the Short-wave, etc., *Society* would like to debate this point in solemn conclave—sign and countersign, and all that, you know.

Telegraphic Address, "Boot Repairers."

"Practical and Amateur Wireless" Clubs

A READER makes the suggestion that this journal should form clubs in each district in the same manner as has been done with our companion journal *The Cyclist*. He points to the great success of these clubs—*The Cyclist* Road Clubs—and feels that the PRACTICAL AND AMATEUR WIRELESS Clubs would be just as successful. I am willing to help in their formation and endeavour to set some standard of procedure. If you are interested in the formation of a club in the district, drop me a line.

Notes from the Test Bench

L.W. Tracking in 465 kc/s Supers

IN order to obtain best results on the long-wave band of a superhet, very accurate adjustment of the padding condensers is necessary. If a gang condenser with a specially-shaped oscillator section is employed, a padding condenser is not required on the medium waveband, and no great difficulty should be experienced in correctly adjusting the tuning condenser and I.F. transformer trimmers. But even though a shaped oscillator section is used, a padding condenser is necessary for long-wave matching.

When an intermediate frequency of 465 kc/s is used, as in the £4 Superhet, it is customary to employ two padding condensers. One of these is connected in series with the long-wave winding and the other in parallel with it. It often happens, however, that exact tracking cannot be obtained and, consequently, low sensitivity is experienced at one end of the tuning range. A very easy method of overcoming this difficulty, and one that has proved very successful in the above-mentioned receiver is to use a .0001 mfd. variable condenser, of the solid dielectric type as a parallel padder in place of the normal .0001 mfd. preset. Slight adjustment of this enables the listener to obtain maximum volume from every station receivable on the long-wave band.

Improving Superhet Selectivity

WHILST dealing with the subject of 465 kc/s superhets, another hint will probably prove helpful to constructors. It is generally recognised that the selectivity of this type of superhet is not quite equal to that of the 110 kc/s type, but the degree of selectivity can very often be materially improved by providing a feed-back from the anode to the grid of the I.F. valve. This is done by connecting a short length of flex to the cap terminal of the valve and placing the other end of the flex near the grid terminal of the same valve. The valve can then be brought near its oscillation point and sensitivity and selectivity will be improved. In short-wave superhets the amount of feed-back can be increased sufficiently to produce oscillation so that C.W. morse reception can be effected.

The Festivities

BY the time you read these notes the Christmas holiday will be in full swing. Can you imagine what Christmas holidays were like before radio? The newspapers do not publish on Christmas Day, and we were all very much victims to the need for entertaining ourselves. The radio still keeps you in touch with the outer world, and it is the one day in the year when electricity consumption is heavier. How many readers will not listen in on Christmas Day?

Recording History

I AM glad that the B.B.C. has seen fit to record King Edward VIII's broadcast speech made on the eve of his abdication. This record is to be preserved for ever, and future generations will not, therefore, be left in doubt as to what he actually did say. Unfortunately, a good deal of history is pure imagination. There is no tittle of evidence to support the Bruce and the Spider story, nor that concerning King Alfred and the burnt cakes. You must remember that anyone can write a book of history, and there is no one to vouch for the accuracy of the information. Historians merely copy previous histories, and if the original source is wrong,

Getting ready for the annual overhaul.

modern history must be wrong. With radio and modern methods of recording speech, accuracy of history is assured for future generations. It is a remarkable thing to reflect that in a thousand years' time people will still be able to hear the voice of King Edward VIII and others who have played a part in our national history. Past history is very much in doubt. I have always felt that the writing of national history books should be a state-controlled affair.

Practical Television

December 26th, 1936, Vol. 3. No. 30.

Better Synchronising

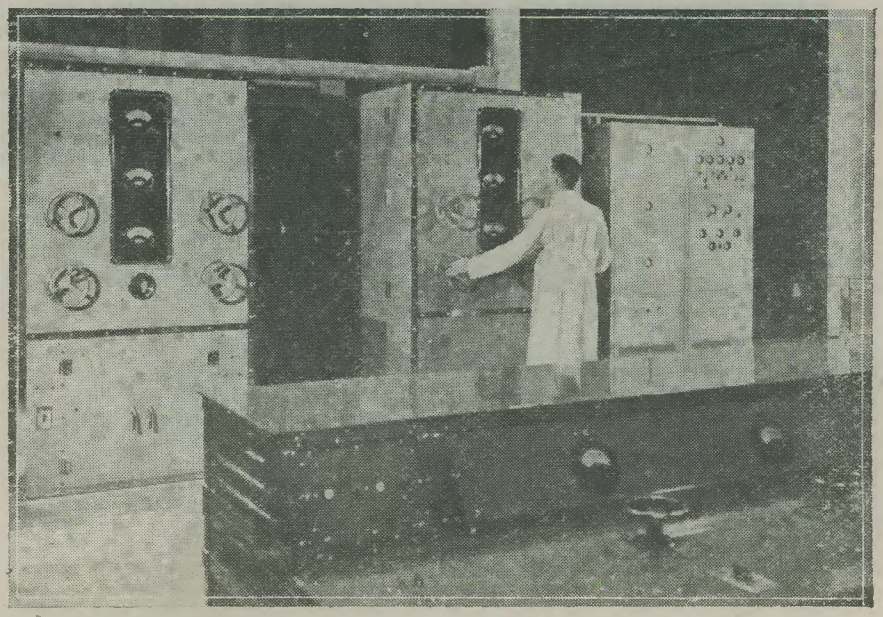
IN watching the results now obtained with high-definition picture reception it is very evident that the question of synchronising does not present a fraction of the difficulty experienced in the days of low-definition transmissions. When using mirror drums and scanning discs for reproducing these thirty-line pictures in conjunction with the source of modulated light, the achievement of good synchronism as represented by a steady, properly phased and framed picture was the prime difficulty of the operator. Ingenious mechanical brakes, electro-magnetic relays, cogged wheels and field coils were incorporated in the equipment and used with varying degrees of success, and many people wondered whether the same difficulty was going to arise with the high-definition television service. In the first place, with low-definition television transmissions only the line repetition synchronising signal was included with the vision signal, this being a pulse having a frequency of 375 per second. The pulse shape was not always definite and no picture repetition pulse was added. The result was that special framing and phasing devices had to be built in the receiver, and even under the best of circumstances hunting effects were present which militated against the measure of success possible with those transmissions.

Two Distinct Signals

WITH the present high-definition television signals, however, quite a different state of affairs exists. At the end of each picture line trace a separately generated and rectangular shaped pulse of known amplitude limits is injected into the modulation, its modulation direction being opposite to that portion of the signal corresponding to picture modulation. Then at the end of each frame a similar type of pulse is injected so that there are two distinct signals of known time duration and shape whose function is to control whatever device is employed at the receiving end for giving the scanning motion. Assuming that a cathode-ray tube picture reproducer is being used, then the time base generators which provide the saw tooth voltage or current variations for imparting movement to the electron beam are so designed that the electrical constants of the dual circuits produce line and picture traces of approximately the correct speed. Filter circuits in the receiving set itself separate these synchronising pulses from the picture modulation signal and apply them to the appropriate control grids of the time base valves. This ensures that the triggering or discharge action of the equipment is timed correctly and the picture takes up its proper position in the available screen area. Picture phasing and framing in the ordinary sense of the terms are functions of the transmitting end, but it is sometimes necessary to "shift" the position of the complete scan on the cathode-ray tube screen so that it is disposed centrally in the cut-out mask representing the picture size. Even in the hands of complete novices, however, the television receivers now in use prove very tractable and after installation by experienced service engineers the user has little cause for complaint on the score of poor synchronising.

Television's Relation to Education

TEACHING in all modern schools has already been supplemented by two mechanical (or more strictly, electrical) aids, namely radio and talking films, and with the establishment of a television service the question is already being raised in certain quarters "Can television help?" The answer is undoubtedly in the affirmative. The young mind needs both sight and sound to impart true knowledge and whereas the radio broadcast to schools has undoubtedly done yeoman work in bringing the specialist's voice to an ever-widening class of scholar, there is a tendency for the mind to become diverted rather easily by anything untoward which may happen in the classroom itself, especially if there are one or two unruly scholars present. The talking film has put a new complexion on this particular angle, but, unfortunately, the expense involved for an installation of this character is very heavy indeed. Again, this last named is localised to the particular school which can afford to pay for the apparatus. With the anticipated rapid development of television, however, especially in the direction of securing larger size pictures which can be seen by a big audience, the whole matter should be reviewed very carefully. Even in the days of low-definition television receiving equipment was built by some schools so that advantage could be taken of certain educational items included in the programmes. It is not suggested, of course, that the personal contact and sympathetic relation between teacher and scholar should be removed.



Part of the Baird transmitter at the Alexandra Palace. In the background (from right to left) are the crystal drive unit, the intermediate radio-frequency amplifier and the power output stage. In the foreground is the control desk.

TELEVISION ON CHRISTMAS DAY

THE chef of a famous Strand restaurant will inaugurate the Christmas afternoon festivities at the London Television Station by carving a prize turkey before the camera. The programme will also present the fourteenth and Christmas edition of "Picture Page," Cecil Madden's topical television magazine, and it is expected that many of those interesting people who come into the limelight only at Christmas time will take part. During the afternoon Edward Shackleton, son of the famous Antarctic explorer, is to give his own account of a lonely Christmas spent on Ellesmere Land. Films actually taken amid the ice and snow will be transmitted during the talk.

A CHRISTMAS party of celebrities enjoying themselves before the television camera will be a high spot in the evening transmission. Cecil Lewis will act as Master of the Ceremonies. The evening programme begins with carols by the Singing Boys from St. Mary-of-the-Angels Song School, the President of which is the Rev. Desmond Morse-Boycott. Then will follow a film programme, "Christmas through the Empire," which is being specially prepared for television. Film sequences have been secured dealing with Christmas in practically all parts of the Empire. There will be glimpses of football in Fiji, a Christmas dance in Basutoland, ski-ing in Canada, the Khyber Pass in winter, and "shots" from Australia, Gibraltar, and the West Indies.

During the evening Commander A. B. Campbell, who is one of television's first "causeurs," or talkers, will describe some unusual Christmases.

The Choice of Intermediate Frequency

An Explanation of the Reasons for Different Intermediate Frequencies and of the Advantages and Disadvantages of Each

THE constructor of a superhet—especially if he is designing his own receiver—is apt to be in doubt as to the type of intermediate-frequency transformers which would prove most suitable. As most readers are aware, these are of three principal types, tuning to 110, 150, and 465 kilocycles respectively. One might ask: Why three entirely different frequencies, and what are the advantages and disadvantages of each? These are fair questions, although it is by no means an easy matter to answer them simply and conclusively. The fact that all three are still in use, and that different designers have their individual preferences, is sufficient proof that it is impossible to be dogmatic in the matter.

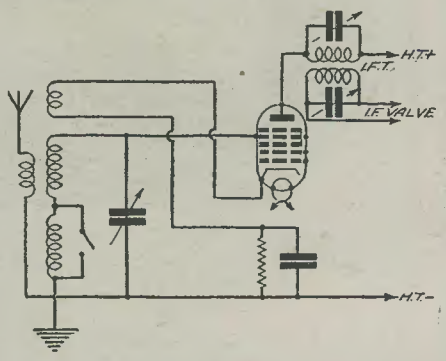
From 110 to 465

Until fairly recent times it was standard practice in this country to use 110 kc/s transformers for broadcast receivers and 110 or 150 kc/s transformers in short-wave sets. To-day, the position is different, partly because all-wave sets are increasing in popularity, and partly because considerable use is being made of the intermediate frequency of 465 kc/s. Why should there be "standard" frequencies, in any case? Why not use any other frequency which seems convenient? In the first place, standardisation is of value because it means that standard superhet gang tuning condensers can be used. But a more important aspect is that the frequency must be chosen so that there is little or no possibility of interference. It is not difficult to imagine that interference would be likely if the I.F. were equivalent to a wavelength which is commonly used for powerful transmissions. If this were the case, such transmissions might be picked up by the oscillator portion of the receiver, even when the first detector were tuned to an entirely different wavelength. The frequencies of 110 and 150 kc/s were originally chosen for this reason more than any other; because these frequencies are equivalent to wavelengths of approximately 2,700 and 2,000 metres, on which there are no regular transmissions.

Second-channel Interference

It was found, however, that interference was still experienced on certain wavelengths, and in certain conditions. The reason is that a beat note occurs which is audible as a whistle at certain settings of the tuning condenser—generally about 450 metres in the region of the London transmitters. This is because the frequency difference between stations operating on about 450 metres (670 kc/s) and the local station on 342.1 metres (887 kc/s) is equal to twice the intermediate frequency, so that a whistle is produced between the 670 kc/s transmission and the oscillator tuned to about 780 kc/s. In other districts, and near to other transmitters, these second-channel whistles are heard, and might be very troublesome. For this reason, some commercial receivers having 110 to 150 kc/s intermediate-frequency transformers are provided with an external adjustment by means of which the exact I.F. can be modified slightly.

Normally, these second-channel whistles are really troublesome only when the receiver is used in fairly close proximity to a powerful transmitter, but the difficulty is always present. On short waves the position might be even worse, and interference might be experienced between two transmissions on wavelengths which are not widely separated. Another reason is that many of the transmissions are picked up at similar strength, and this emphasises the whistles.



One form of image-rejection circuit where the rejector winding (of a few turns) is in series with the cathode of the frequency-change valve.

Non-standard I.F.'s

This was the main reason for the development of an I.F. of 465 kc/s, although it should be mentioned that this and similar intermediate frequencies had been used in America for several years. There was less difficulty in that country, due to the fact that all broadcasting stations operate on medium and short waves. In America, there were, indeed, many alternative intermediate frequencies, according to the whims and fancies of designers. Even in this country there are still many makers of commercial receivers who employ frequencies which do not conform with any of the arbitrary standards mentioned above. In fact, there is still scope for experiment in this direction, although it is difficult for the amateur to take part in it unless he is prepared to employ two separate tuning condensers for the signal and oscillator frequencies, or to go to the immense amount of trouble in making his own gang condensers.

When using the I.F. of 465 kc/s—which is rapidly gaining in popularity—there is little danger of second-channel troubles, since there are no transmissions (on the medium or long-wave bands at any rate) which are on frequencies separated by as much as 465 kc/s. For this reason, there is less need to pay very careful attention to the use of so-called image rejectors (filters for preventing signals at the intermediate frequency from entering the receiver). Several commercial receivers operating on intermediate frequencies of 100 to 200 kc/s are fitted with image-rejection filters of one kind or another. A usual arrangement is to have a special winding on the aerial coil connected in some way to the frequency-changer.

Disadvantages of 465 kc/s

So far, it might appear that the I.F. of 465 kc/s has all the possible advantages with none of the disadvantages. But that is not strictly true. The high I.F. does not normally provide as great a degree of selectivity, whilst rather more care is needed in the tracking and ganging of the tuned stages. Additionally, the amount of amplification per stage is not usually quite as great. It is not possible to deal fully with this point without going into the theory of coil design and allied subjects, but it can be stated that the dynamic resistance (effective resistance in working conditions) of a transformer tuned to, say, 110 kc/s, is greater than that of a similar component tuned to the higher frequency. This means, in effect, that the damping of the tuned circuit is greater when using 465 kc/s.

If it is necessary to sum up the advantages and disadvantages of the various intermediate frequencies, it can be stated that 110 kc/s is to be preferred when *extreme* selectivity and the maximum degree of amplification are required, whilst 465 kc/s is better when a small amount of amplification can be sacrificed, and when the set is connected to a good outside aerial. The I.F. of 150 kc/s is not recommended, since there are very few gang condensers designed for this. Another point is that it is nearly always easier to ensure complete stability with 465 kc/s I.F. transformers; this is due in large measure to the lower amplification and reduced dynamic resistance. Since the sensitivity of modern valves is of a high degree, the very small sacrifice which must be made in the efficiency of the intervalve couplings is not of much importance, and is generally fully offset by the benefits of greater stability.

An All-purpose Meter

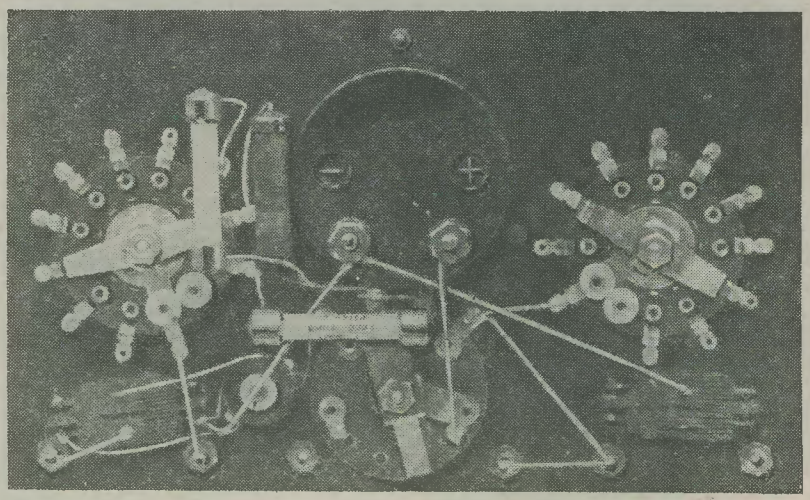
The Main Constructional Features of a Useful Measuring Instrument which has Many Applications. By W. J. DELANEY

TO locate faults in a wireless receiver, or to carry out experimental research, it is absolutely essential to make use of some kind of meter, and practically every keen amateur seems to find the building of a multi-purpose instrument provides a very interesting occupation. We have described various types of instrument of this nature from time to time, and requests are continually being received for meters of various kinds. In this article brief constructional details are given of an all-purpose meter which I recently constructed for a keen amateur, and it will be found that the principles incorporated will be applicable to other instruments of a similar kind. Firstly, it is necessary that such a general-purpose instrument shall be capable of recording voltage, current, and resistance readings, and such a limited range will well fulfil the requirements of the ordinary listener. But the construction will be complicated when it is desired to make the voltage readings cover both A.C. and D.C. ranges, and also when other factors must be measured or calculated.

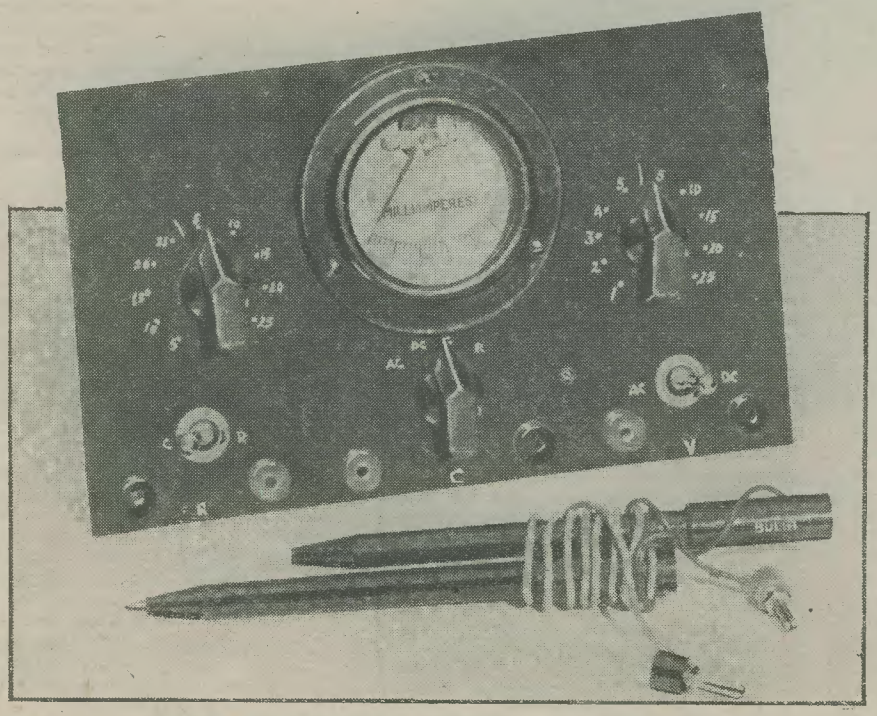
Multi-switching

The general complications of switching need no emphasis, but in the instrument illustrated there are three multi-point selector switches in addition to two double-pole switches of the Q.M.B. type. This particular instrument had to be designed round a milliammeter having a full-scale reading of 5 milliamps, but it should be pointed out that such a high reading is not ideal. However, as the particular amateur had this instrument he wished to avoid further expense, and the limitations were explained and the instrument has to be used with care. The ranges of current are easily arranged for by the use of simple shunts, and the methods have already been explained. The meter is connected to a battery and resistance in series and the current noted, after which a short piece of resistance wire is joined across the meter terminals and adjusted until the reading is half of that previously shown. The multiplication factor with that wire is then 2, and the process is carried out for the various readings which are required.

In the meter illustrated two Bulgin ten-point switches are employed for multiplying the voltage, current, and resistance scales, and a further four-point switch from the Bulgin range is fitted as a safeguarding switch.



This shows the compact arrangement of the switches and other parts. The majority of the resistors have been removed in order to enable the general construction to be seen more clearly.



Panel layout of the All-purpose Meter referred to in this article.

Safety Precautions

It is obvious that when an instrument has to perform several different functions there sometimes arises a risk of damage if it is wrongly connected. For instance, as this particular instrument has to be used for D.C. and A.C. voltage readings care must be taken not to apply A.C. when on the D.C. range, nor connect a voltage source when adjusted for resistance measurements, except within certain limits. Accordingly separate sockets are provided so that the test prods are connected to a different point for voltage, current, and resistance readings. Furthermore, for current and resistance readings a separate change-over switch is inserted, and this is in addition to the four-way switch situated immediately beneath the meter. On the voltage sockets, the change-over switch is arranged to bring into circuit the Westinghouse rectifier for A.C. readings, and thus the user has to exercise a certain amount of thought when using it, which prevents the possibility of damage. It is possible to arrange for all readings with only one input circuit, but this is likely in inexperienced hands to result in the meter being burnt out, as it encourages hasty tests and carelessness.

Output Measurements

In addition to the measurements already given, this instrument was also adapted so that wattage output measurements could be taken, and the usual scheme of connecting it in the output circuit on a high-voltage range is employed, and a complete conversion table was fitted inside the lid of the cabinet. This carried calibration curves and other relative data,

(*Continued on page* 478)

A HIGH-QUALI

Some Interesting Constructional D
Embodying a Novel Circuit. By

FIRST of all let us very briefly outline the main characteristic features of a high-quality receiver from the musician's point of view. They are six in number, as follows:—

1. Softness and purity.
2. Spaciousness.
3. Liveliness.
4. Fidelity.
5. Clarity.
6. Proportionality.

These six characteristics all apply to the performance emanating from the loudspeaker and not, of course, to the electrical constituents of the receiver itself. These are the things that we should expect to *hear*, but most of us go on expecting instead of getting them. The first and third hardly require explaining; the second suggests sound radiation, the fourth means character likeness, the fifth clear definition

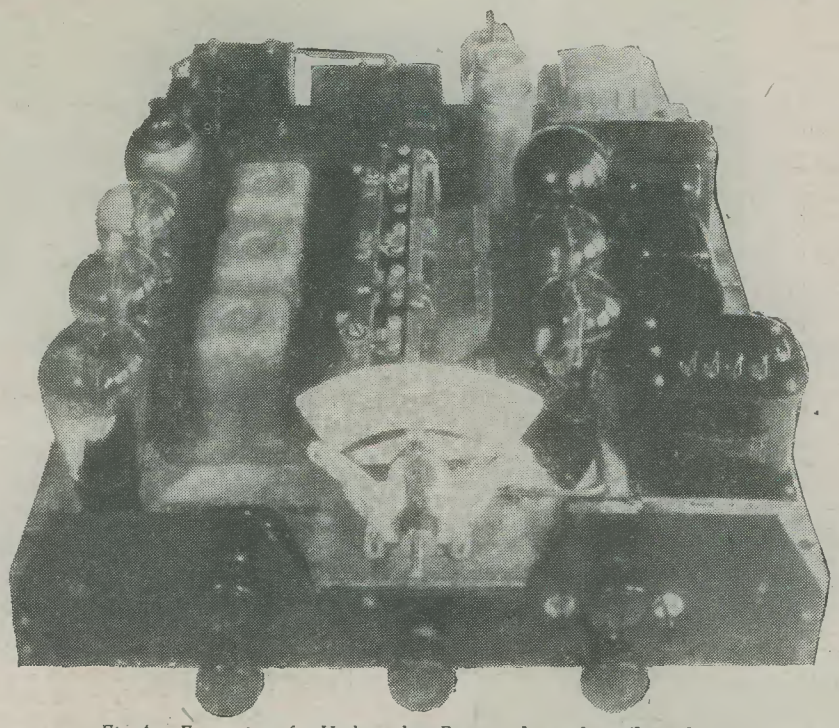


Fig. 4.—Front view of a High-quality Receiver designed on efficient lines.

of all the parts that make up the whole, and the sixth a correct balance between bass, middle and treble registers. It is well known that the third, fourth and fifth characteristics can be obtained reliably from resistance-capacity coupling, while the first and second can, in my opinion, be best secured from the special form of coupling to be described later. The last feature—proportionality or balance—depends on the shape which the frequency response curve is arranged to take. Since the majority of receivers are used in private houses and the volume level is normally below that of the original, it is essential to raise the response curve at the lower end of the spectrum, while the middle and upper portions should be as free from peaks and troughs as possible, in view of the fact that the loudspeaker characteristic is not innocent of these blemishes. Broadcasting conditions being what they are, there may be a distinct advantage in a slightly drooping response above 8,000 cycles provided the droop is gradual, while the reproduction of gramophone records usually demands a gradient in the response curve above 6,000 cycles at least.

A Useful Range

The response curve of the amplifier which I am about to describe is straight between 100 and 8,000 cycles. Below 100 cycles the curve begins to rise till it reaches its maximum point at 50 cycles, where the gain is 8 decibels, and below 50 cycles it starts falling very slightly down to 25 cycles, the drop being of the order of 1 decibel, so that at 25 cycles the actual gain is 7 decibels. Above 8,000 cycles the response gradually drops till at 10,000 cycles there is a loss of 3.5 decibels, which is quite inconsiderable. The frequency characteristic, however, gives only a very imperfect idea of the performance of the amplifier, and it is only mentioned in order to satisfy the curiosity of those who are apt to place undue confidence in response curves.

It has already been pointed out that liveliness, fidelity and clarity of reproduction may be satisfactorily obtained from the employment of resistance-capacity coupling. In accordance with this postulate, the first two stages of the amplifier are so treated, and Fig. 1 gives the fundamental circuit, with (in addition) a special form of high-note control incorporated in the grid circuit of the second valve. This treble control is designed to operate in conjunction with the quarter-megohm potentiometer and will be found extremely serviceable in all circumstances. It is well known that as the volume of the receiver is reduced by means of the usual potentiometer control high-note loss is introduced as the resistance between the coupling condenser and the slider is increased, and in order to compensate for this loss a condenser is shunted across these two points. After careful experiment it has been decided to use a capacity of 0.1 microfarad for this condenser and to graduate the control by means of a half-megohm variable resistor. A switch is also incorporated, since even with half-megohm resistance fully in circuit the

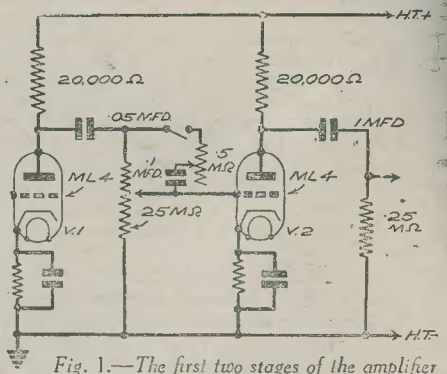


Fig. 1.—The first two stages of the amplifier with the special high-note control.

condenser still affects the quality to a slight degree.

The complete amplifier consists of four stages, and in order to avoid the overloading of the output valve the stage gain of the two resistance capacity coupled stages is kept down to a low value. Hence the anode resistors are in each case only 20,000 ohms, and the valves employed must be of the power class such as the ML4, AC/P, or 104V. If battery valves are used, the P2 type is recommended.

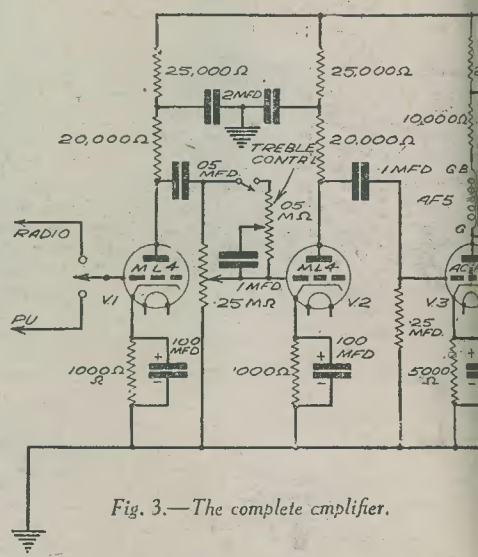


Fig. 3.—The complete amplifier.

HIGH-QUALITY AMPLIFIE

Some Interesting Constructional Details of an L.F. Amplifier Embodying a Novel Circuit. By NOEL BONAVIA-HUNT, M.A.

ometer control high-note loss is introduced as the resistance between the coupling condenser and the slider is increased, and in order to compensate for this loss a condenser is shunted across these two points. After careful experiment it has been decided to use a capacity of 0.1 microfarad for this condenser and to graduate the control by means of a half-megohm variable resistor. A switch is also incorporated, since even with half-megohm resistance fully in circuit the

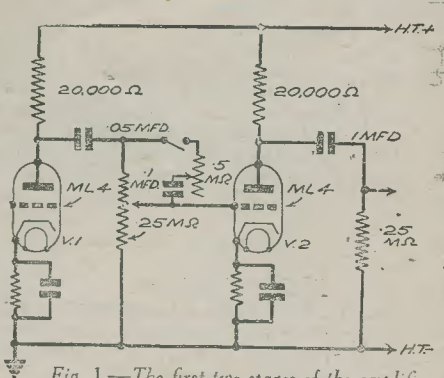


Fig. 1.—The first two stages of the amplifier with the special high-note control.

condenser still affects the quality to a slight degree.

The complete amplifier consists of four stages, and in order to avoid the overloading of the output valve the stage gain of the two resistance capacity coupled stages is kept down to a low value. Hence the anode resistors are in each case only 20,000 ohms, and the valves employed must be of the power class such as the ML4, AC/P, or 104V. If battery valves are used, the P2 type is recommended.

The Special Coupling

The third stage introduces the special coupling which places this amplifier very high in the scale of design. Readers may experience some difficulty in hailing with adequate enthusiasm the appearance in the diagram of Fig. 2 of three transformers. They will doubtless remark that this is an expensive arrangement for a single-stage

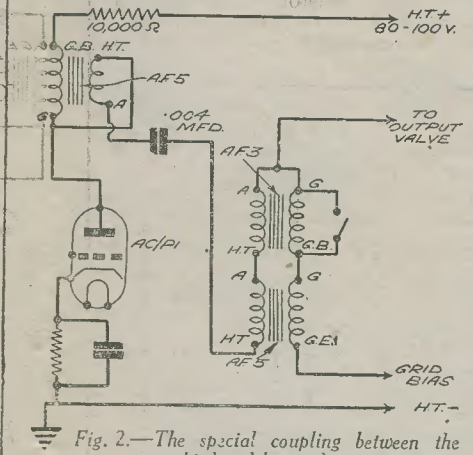


Fig. 2.—The special coupling between the third and last valves.

coupling; but it must be pointed out that the result amply justifies the extra cost. Besides which, it is hoped that most of my readers already possess at least one of these well-known components. The circuit in Fig. 2 is self-explanatory, all the connections being quite clearly marked. The shorting switch across the secondary winding of the AF3 transformer should be noticed, since with this winding short-circuited the response curve of the amplifier undergoes a change which should be easily

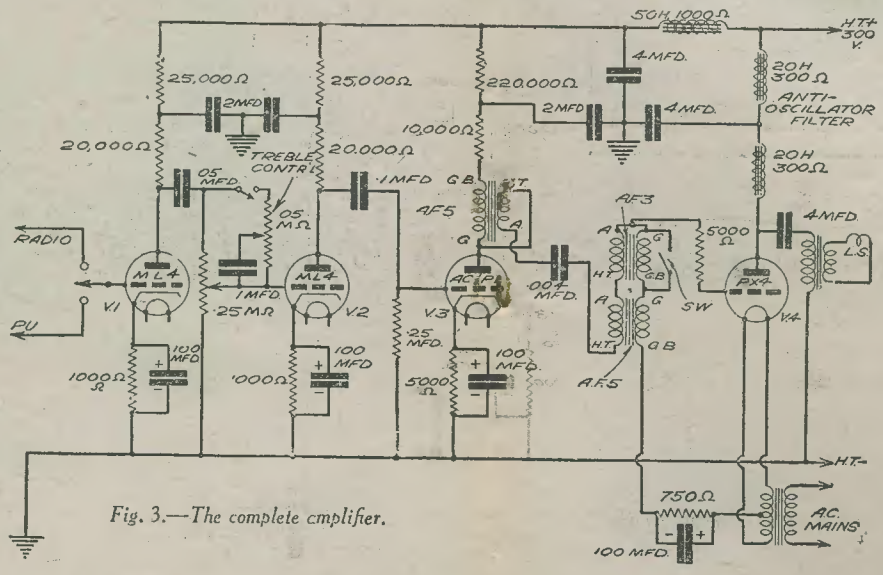


Fig. 3.—The complete amplifier.

perceptible even to the average ear. happens is that the lower frequencies 500 cycles are gradually increase strength till at 50 cycles a gain of t decibels is attained, while in the portion of the curve the response falling above 6,000 cycles till at 10,0 decibel loss reaches the figure of Unless a high-range speaker is emp this attenuation in the upper register be barely noticeable, though if a occurs in the speaker or microp characteristic (or in the pick-up, case may be) the fall in the response may effect a gratifying result. It is h necessary to stress the advantage of a curve in cases where the transmi presents high-note distortion or heterc whistles interfere with the pleasur reception. For gramophone work shorting of the secondary winding o AF3 will in most cases prove the satisfactory course, but much depend the type of loudspeaker in use.

The large winding of the AF5 t former in the anode circuit of the valve (also a power valve of the ML4 c makes it absolutely essential to keep current dissipation down to a low p After the most careful study it has found that the optimum flow of current at 100 volts is 0.75 milliampere, the object being to avoid core magnetisation and consequent amplitude distortion. A series resistance of 10,000 ohms is inserted between the point of high tension and the "G.B." terminal of the transformer, and this resistance forms part of the anode circuit. The valve selected for this stage is the AC/P1 or its equivalent.

Fig. 5.—Under c

The Output Circuit

The output stage follows normal practice, and while it will be observed that only one PX4 valve is employed, there is no reason why two of these should not be used in parallel, or, for that matter, why an output valve of the 400 volt class, such as the DO26 or PX25 should not be substituted, if desired. The voltage-dropping resistances must in this latter case be increased in proportion in accordance with Ohm's law. Attention is drawn to the special arrang ment to obviate instability in the outp valve by means of the extra decoupli choke and condenser (which duplicat the output filter components) and t 50-henry smoothing choke which is insert between the main high-tension volta line and the anode feed supply to t earlier stages including the high- frequen

TY AMPLIFIER

Details of an L.F. Amplifier

NOEL BONAVIA-HUNT, M.A.

The Special Coupling

The third stage introduces the special coupling which places this amplifier very high in the scale of design. Readers may experience some difficulty in hailing with adequate enthusiasm the appearance in the diagram of Fig. 2 of three transformers. They will doubtless remark that this is an expensive arrangement for a single-stage

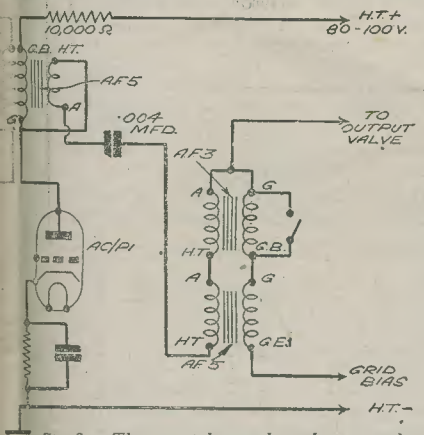
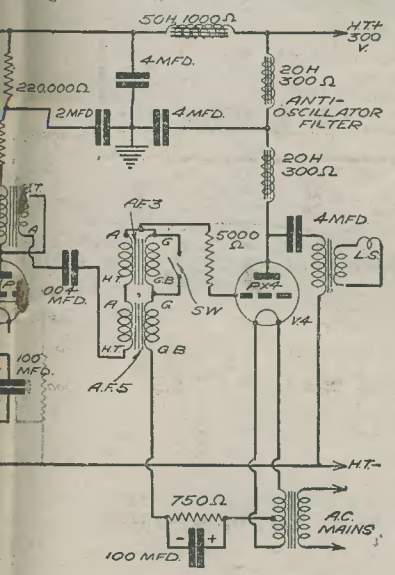


Fig. 2.—The special coupling between the third and last valves.

coupling; but it must be pointed out that the result amply justifies the extra cost. Besides which, it is hoped that most of my readers already possess at least one of these well-known components. The circuit in Fig. 2 is self-explanatory, all the connections being quite clearly marked. The shorting switch across the secondary winding of the AF3 transformer should be noticed, since with this winding short-circuited the response curve of the amplifier undergoes a change which should be easily



perceptible even to the average ear. What happens is that the lower frequencies below 500 cycles are gradually increased in strength till at 50 cycles a gain of twelve decibels is attained, while in the upper portion of the curve the response starts falling above 6,000 cycles till at 10,000 the decibel loss reaches the figure of ten. Unless a high-range speaker is employed this attenuation in the upper register may be barely noticeable, though if a peak occurs in the speaker or microphone characteristic (or in the pick-up, as the case may be) the fall in the response curve may effect a gratifying result. It is hardly necessary to stress the advantage of such a curve in cases where the transmission presents high-note distortion or heterodyne whistles interfere with the pleasure of reception. For gramophone work the shorting of the secondary winding of the AF3 will in most cases prove the more satisfactory course, but much depends on the type of loudspeaker in use.

The large winding of the AF5 transformer in the anode circuit of the third valve (also a power valve of the ML4 class) makes it absolutely essential to keep the current dissipation down to a low point. After the most careful study it has been found that the optimum flow of current at 100 volts is 0.75 milliampere, the object being to avoid core magnetisation and consequent amplitude distortion. A series resistance of 10,000 ohms is inserted between the point of high tension and the "G.B." terminal of the transformer, and this resistance forms part of the anode circuit. The valve selected for this stage is the AC/P1 or its equivalent.

The Output Circuit

The output stage follows normal practice, and while it will be observed that only one PX4 valve is employed, there is no reason why two of these should not be used in parallel, or, for that matter, why an output valve of the 400 volt class, such as the DO26 or PX25 should not be substituted, if desired. The voltage-dropping resistances must in this latter case be increased in proportion in accordance with Ohm's law. Attention is drawn to the special arrangement to obviate instability in the output valve by means of the extra decoupling choke and condenser (which duplicates the output filter components) and the 50-henry smoothing choke which is inserted between the main high-tension voltage line and the anode feed supply to the earlier stages including the high-frequency amplifier. The complete circuit diagram of the amplifier is given in Fig. 3. Readers may be interested to know that several examples of this amplifier have been made and the results are phenomenal. The illustration of the radiogram here shown is one supplied by Mr. R. Foden-Petchler, of Manchester, who has constructed the complete receiver to my design, and it will be seen that it is possible to form a very compact lay-out despite the number of stages in use.

It will be seen that a chassis form of construction is adopted, and the resistors are mounted in "banks" to facilitate wiring. The L.F. couplers will be seen on the right-hand side of the chassis, and, in spite of the number of controls, the receiver is extremely simple to operate and represents a splendid musical instrument. The radio portion of a receiver for use with the amplifier described must, of course, be designed on similar high-fidelity lines, and a "straight" receiver with at least one stable H.F. stage, and a diode-detector may be recommened.

I may conclude by stating that I am at present working the amplifier described in this article in conjunction with a Voigt Domestic Loudspeaker, and there can be no question that the result from the musician's point of view sets a new standard in high-quality reproduction.

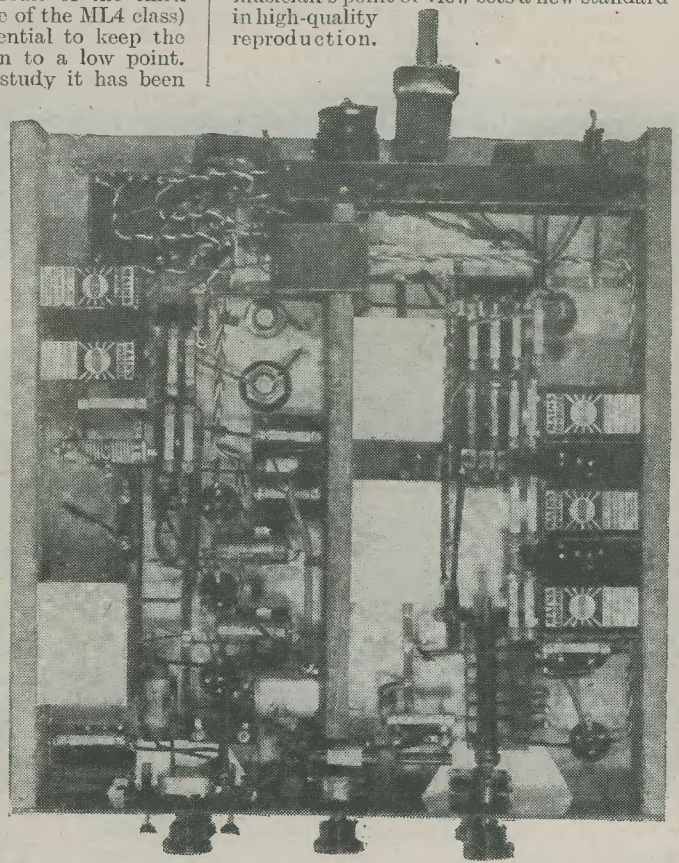


Fig. 5.—Under chassis view of a complete receiver built to Mr. Bonavia-Hunt's design.

Leaves from a Short-wave Log

Switch Over to 50-metre Band

This is a portion of the waveband which comes into its own at this period of the year. Try for HH2S, Port-au-Prince (Haiti), on 50.85 m. (5,900 kc/s), a 100-watt station which is now well heard. Announcements are made in French, Spanish and English. The studio opens its broadcasts towards midnight with the playing of *The Swan* (St. Saëns), and closes down towards G.M.T. 03.00 with the same melody. The interval signal, consisting of four chimes coupled with the call, is put out every fifteen minutes. Reports may be sent to: Société Haitienne de Radiodiffusion, Immeuble Magebgo, Port-au-Prince (Haiti).

And Talking of Harmonics . . . .

On the upper part of the short-wave band you will discover the fourth harmonic of Radio Toulouse (France) on 82.15 m. (3,652 kc/s), and the fourth and fifth harmonics of Poste Parisien (Paris) on 78.2 m. (3,836 kc/s) and 62.56 m. (4,795 kc/s) respectively. On 44.916 m. (6,678 kc/s) the sixth harmonic of Radio Normandie (Fécamp) is often as powerful as the broadcast on the fundamental wave.

Two Puzzling Harmonics

Identification of short-wave stations is sometimes rendered difficult by the fact that in the higher frequency band there will often be encountered harmonics of medium-wave transmitters. It is wise to note that if a French-German broadcast is found on 31.75 m. (9,449 kc/s), it should be entered in the log as the eleventh harmonic of Radio Strasbourg (349.2 m.—859 kc/s). In the same way the writer was puzzled a few nights ago by the presence of a programme apparently emanating from Yugoslavia on 24.59 m. (12,200 kc/s). It was later revealed as the second harmonic of the Belgrade short-wave broadcast on 49.18 m. (6,100 kc/s). Make a note that this transmitter now relays the medium-wave studio entertainments daily from G.M.T. 08.00 until the latter signs off at the end of the day's work.

New S/W Station in French Indo-China

Paris listeners report the reception of good signals from FZR, Saigon, on 31.49 m. (9,530 kc/s), which I am informed is worked by Mons. Michel Robert, Entreprises Electriques, 98, rue d'Espagne, Saigon, French Indo-China, to whom all reports should be addressed. The times at which the transmissions were logged are G.M.T. 12.00-14.00 (daily) and between G.M.T. 04.00-05.00 (Mondays).

Is This a Harmonic?

On 25.21 m. (11,900 kc/s) a broadcast was recently picked up from Mexico City; the call heard was XEWI, Radio Mex, with the slogan: *Mi Voz al Mundo desde Mexico* (My Voice to the World from Mexico). Interval signal reminded me of the noise made by a turkey gobbler. The puzzle lies in the fact that XEWI has always been advertised on 50.42 m. (5,950 kc/s). Has the station decided to work on the half-wave, or is this the second harmonic of the original transmission? The address is: Estaçion Radiodifusora Cultural XEWI, Apartado Postal, 2874, Mexico City (D.F.), Mexico. You will hear the name phonetically as *Cee-oo-dad May-hee-ko.*

Have You Logged Ecuador?

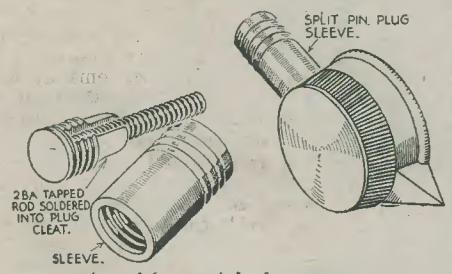
Should you hear the call: *Ondas del Pacifico* in a feminine voice on a channel some few degrees of the dial above GBC, Rugby, jot it down as emanating from HC2CW, Guayaquil, on 35.71 m. (8,410 kc/s). Chimes are used as a signature tune, and the station works daily (Mondays excepted) from G.M.T. 01.30-04.30. The call letters may be rendered phonetically as *Ah-chay say dose dooble-vay.* If you want a "veri" the address is: Sr. Manuel Alvaredo Cobas, Apartado Postal, 1166, Guayaquil, Ecuador, South America.

A PAGE OF PRACTICAL HINTS

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

A Dual-purpose Knob

HERE is a handy dodge for control knobs which have an annoying habit of working loose, with the grub screw



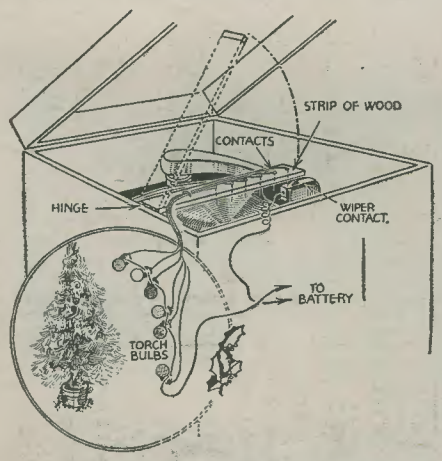
A useful control knob improvement.

awkward to get at, and difficult to tighten.

A piece of 2B.A. tapped brass rod soldered to the cleat of a Clix plug, and then screwed into the sleeve of the plug will serve two purposes, one of tightening the knob at will, and the other of effecting finger control when rapidly scanning the dial.—A. W. WARD (Edgware).

A Novel Automatic Control for Lighting Effects

THE following dodge will probably be found useful at this time of the year in connection with Christmas tree decora-



A novel method of controlling lighting effects for Christmas tree decorations.

tions. With the aid of a few flash-lamp bulbs and a battery, the pick-up arm of the gramophone is used as a circuit breaker, and the lights on the tree changed as the record is played. I use six contacts, each connected to two lamps in series on the tree or used to floodlight the tree in colour.

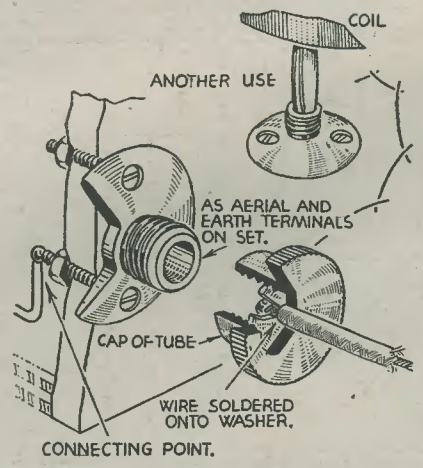
The idea is as follows: The negative contact is a bent piece of tin mounted on the pick-up, whilst the other contacts are mounted on a piece of wood over the top of it, hinged at the end so that it can be lifted out of the way when the record is changed. The wires protrude through the wood just far enough for them to rub the contact on the pick-up and so complete each circuit in turn. As the pick-up only moves slowly to the centre of the record, the slight drag of the connecting wires will not be noticeable.—T. BLAND (Blackpool).

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.

Improvised Terminal Mounts

IN the dodge illustrated in the accompanying sketch the tops of old tooth paste tubes are utilised to make very efficient and cheap terminal mounts. The tops are



Simple but effective improvised terminal mounts.

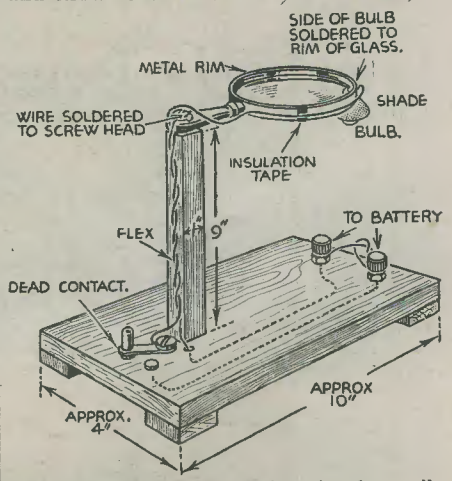
easily drilled to enable them to be bolted to a piece of bakelite or wood. When completed, it will be found that the aerial and earth or speaker leads are provided with a safe anchorage and cannot be pulled off the set accidentally. Intermittent contact is also eliminated.

The tops of the tube can also be provided with banana plugs, and used for extension speaker plug points. In fact, there is no end to their usefulness. If mounted flat on the baseboard they make excellent mountings for short-wave four-, five- or six-pin coils.—H. E. HARRIS (Peckham).

A Handy Device for Small Work

THE accompanying sketch shows a piece of apparatus that will be found very useful for very fine wire work, such as winding chokes, transformers, mending broken wires.

The lens can be obtained with handle at any cheap stores, and the rest from odds and ends. The bulb should be shaded, as



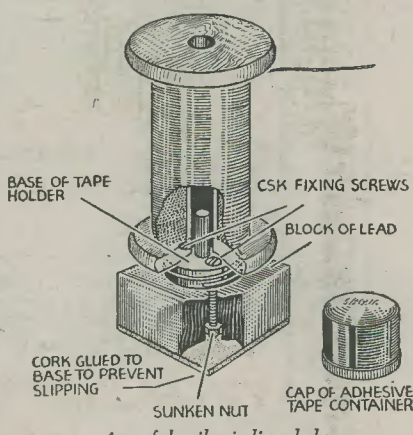
A method of using a magnifying lens for small work.

indicated, to prevent light shining in the eyes.

The work is, of course, held between the baseboard and lens.—E. J. BATES (E. Dulwich).

A Coil-winding Device

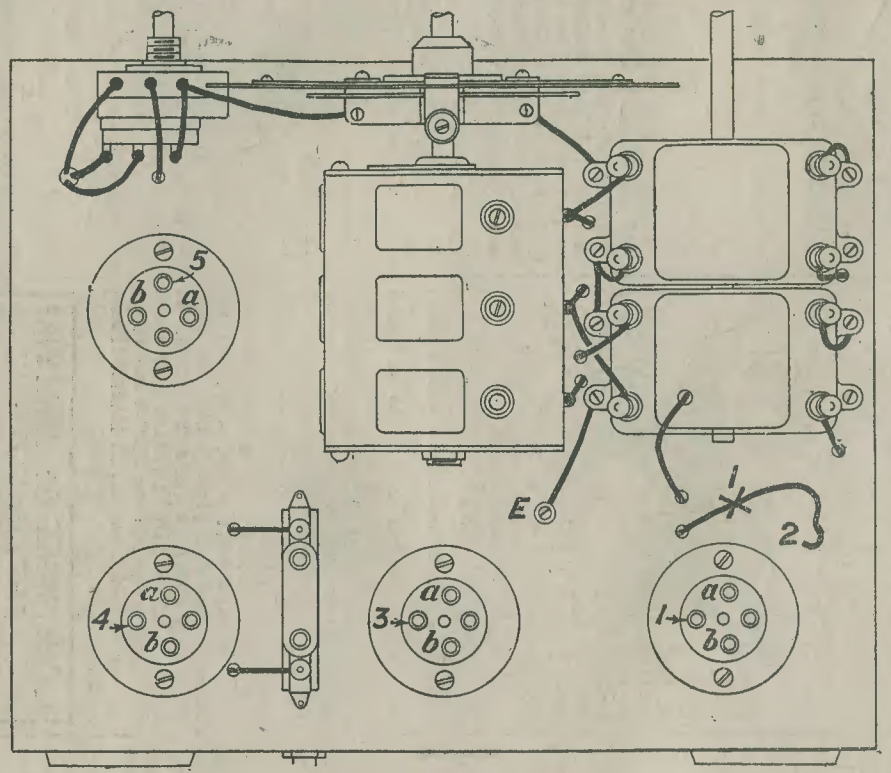
THE illustration shows a simple method which I have adopted when engaged in coil winding. The whole assembly takes a matter of a few minutes only to construct, and the additional refinement of cork constitutes a great improvement.



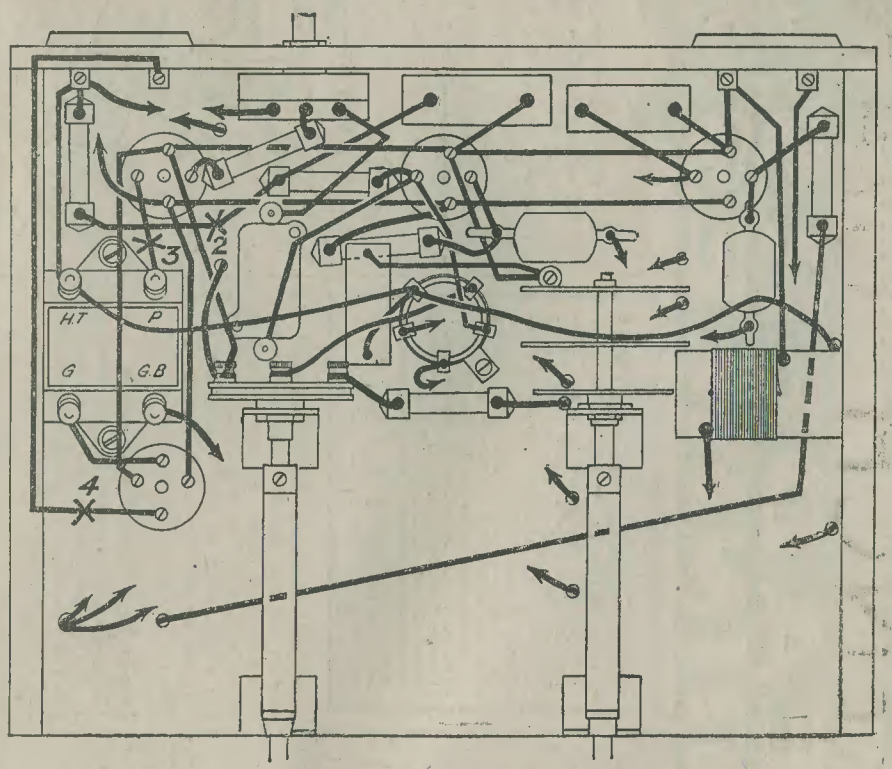
A useful coil-winding dodge.

The adhesive tape holder cost 3d., and its design gives rise to this useful idea.—W. R. HOBBS (Ilford, Essex).

Practical and Amateur Wireless SERVICE DATA SHEET No. 28 FOR THE LIMIT ALL-WAVE FOUR



Top of Chassis View



Underside of Chassis

Approximate Voltage Readings

Voltmeter—to E

„ + to 1=60 volts.
„ + to 2=120 volts.
„ + to 3=40 volts.
„ + to 4=120 volts.
„ + to 5=117 volts.
„ across a and b=2 volts.

Approximate Current Readings

Milliammeter Connected at x1=2½ mA.
„ „ at x2=¾ mA.
„ „ at x3=3 mA.
„ „ at x4=7 mA.

Approximate Resistance Readings

L.F. Transformer
Ohmmeter Connected across P and HT=
750 ohms.
„ „ „ G and GB=
Coil No. 1 4,000 ohms.
A to chassis=1-33 ohms.
D to C=2-13 ohms.
Coil No. 2.
B to top lead=1-5 ohms.
A to 1=2 ohms.
D to chassis=2-13 ohms.

THE FRENCH GIANTS

An Interesting Account of the French Broadcasting Service

By ARTHUR G. ALLAN

EQUIPPED with a potent letter of recommendation I passed the guard and clambered down the steps leading to the subterranean transmitter hall of the Eiffel Tower station some years ago. This transmitter belongs to the French Army, and the sentinel at the door had seemingly passed on the word because a second man received me at the other end of the passage and led me to the Commander of the station. After some preliminary conversation he took me over to the room where the first French wireless station, dating from 1906, stood disused but brightly polished in a corner. We spoke to Général Ferrié, the famous French wireless enthusiast and the Father of French broadcasting, and then an Adjutant was called to accompany me to the top of the Eiffel Tower to inspect the aerials.

The Eiffel Tower station was the first regular broadcasting station in Europe, but the different interests of private and State initiative, and the enrolment of political parties to uphold them one against the other, and a lot of talk regarding the "Freedom of the Ether," caused France to stand back from the general development of broadcasting for many years.

The introduction of a licence fee, which placed State broadcasting on a secure basis, followed by the liberal policy adopted by the Ministry of Posts toward the private stations, has at last put French broadcasting on a level with that in other countries.

The time had now passed when Post-Office Station Directors devised ways and means of equipping studios and transmitters without causing noticeable charges in the budget, and those days are also passed where telephone-lines were refused to private stations and where they were compelled to maintain their apparatus at the "*status quo*" of many years before.

Immediately on the introduction of the licence fee the Post-Office ordered powerful transmitters, and the first batch of these are now "on the air."

They are as follows:—

The 60 kW transmitter Lille-Camphin,
The 120 kW station Paris-Villebon (P.T.T.),
The 60 kW transmitter Nice-La-Brague,
The 100 kW station Marseilles-Réaltor,
The 90 kW transmitter Lyon-Tramoyes,
The 120 kW station Toulouse-Muret,
And the 120 kW transmitter Rennes-Thourie.

Strasbourg and Normandie

Apart from these new transmitters, the power of the Strasbourg station has been increased to 100 kW. A glance at a good map of France will show that a hole has still been left in the centre of France. A new 100 kW transmitter is to be built here close to the geographical centre of the country, and not very far from it the new high-power long-wave transmitter, which is to take the place of the present Radio-Paris station in 1937, will be erected, together with the short-wave stations. Four of these, each with 100 kW in aerial, are to be in operation by 1938. They will provide programmes on a number of beam aerials to all the French possessions overseas.

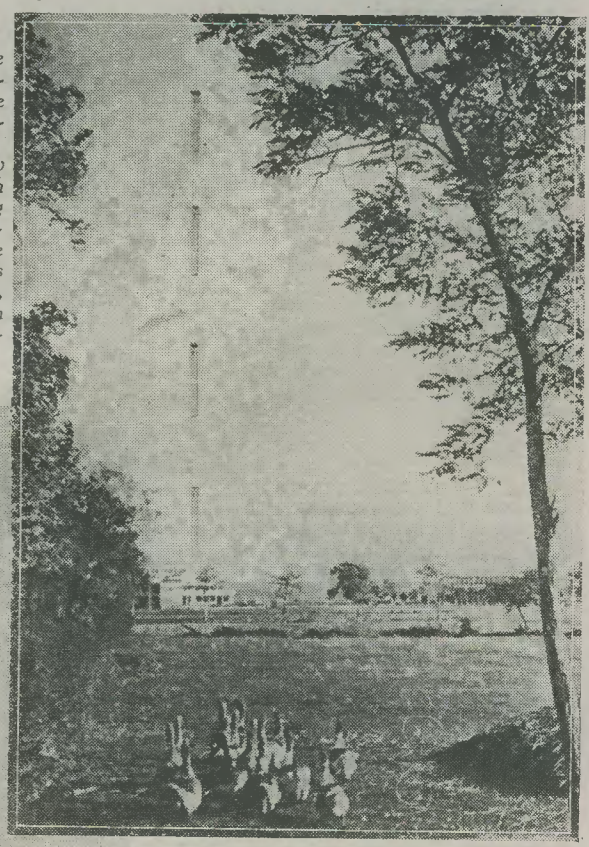
Now that the Post-Office has granted permission for the increase of power for the private stations, Radio Lyon-Emissions and Radio-Normandie have availed themselves of this, and the Lyon private station is already "on the air" with a 25 kW transmitter.

Apart from the Post-Office stations, Paris has three medium-wave private transmitters, so that the fortunate inhabitants of the capital can choose between four local programmes on the medium-waves, and have the long-wave transmitter as stand-by as well.

State Broadcasting and Private Stations

The fact that France operates a system of State broadcasting stations and permits

(Continued on page 478)



(Left) A view of the entrance to the transmitter building of the high-power Lyon-Tramoyes station. (Right) The new 120 kW French State broadcasting station, Toulouse-Muret. The Toulouse district is famous for geese, some of which can be seen in the foreground.

The Eiffel Tower, Paris, from which the first regular European broadcasts were transmitted.

(*Continued from previous page*)

itself the luxury—I think we will have to call it that in view of the shortage of wavelengths—of a number of private stations which provide alternative programmes in most of the important towns, gives cause for the very natural question: "Where do they get the waves from?" The answer is very simple: Under the Lucerne Plan France has been allotted fourteen wavelengths—more than any other European country—and apart from that, private stations make use of a further three with the tacit understanding, or perhaps the permission, of the rightful owner.

During a recent tour of a number of the French provincial stations, I met many interesting personalities who are prominent in the broadcasting world of the country. All these people are radio enthusiasts. They do not administer or direct or announce broadcasting programmes just because they are paid for it.

AN ALL-PURPOSE METER

(*Continued from page 471*)

and a diagram of the panel, with all indications as to the various settings, was given there. For convenience, at each point of the indicator on the two ten-point switches a single number was given, and this indicated the multiplication factor which had to be applied to the scale on the meter at that particular setting. Thus, on the voltage ranges, when the left-hand pointer is at normal, the meter read 5 volts. When the pointer was set to 5, the scale indicated 25 volts, and thus the simple figures on the scale are simply multiplied by the indicating figure. This is found preferable to rewriting the meter scale, although an alternative idea is to redraw the scale very much enlarged and paste it inside the lid, with the various voltages and so on marked against the engravings on the dial. I prefer the former arrangement.

Simplified Design

The resistors which are required for the A.C. and D.C. voltage ranges are different, as on the former the R.M.S. value has to be taken and this means that a lower value of resistor is required. The alternative is to utilise the same resistor, but to re-engrave the scale, marking the exact points for given voltages as indicated by the pointer when an A.C. voltage is applied to the input terminals. The four-point selector switch may also be dispensed with if the additional safeguard is not thought necessary. No fuse is included in the meter shown, but, of course, such an additional safeguard may be included, although care will have to be taken to allow for the variations in reading which are introduced thereby. The most suitable meter to employ for an instrument of this type, if you are starting to make one, is that having a full-scale deflection of only .5 or 1 mA., but it is necessary to order the correct type of rectifier for the A.C. ranges, as this is made in three different types. To measure high A.C. current ranges an additional transformer is essential, but is quite simple to construct. It is also necessary to incorporate a transformer if very low A.C. voltage readings have to be taken, in view of the error of the scale, but it is not proposed to give constructional details for these in this article. It is hoped that the details given, together with the design and circuit arrangements, will be of assistance to those readers who are desirous of making up for themselves a general multi-purpose instrument of this type.

THE BRITISH LONG DISTANCE LISTENERS' CLUB

Mountain Tests

MEMBER J. W. Leech sends the interesting photo seen below, and says: "The photo includes Mr. C. Ford and myself, both members of the 'B.L.D.L.C.', and it may interest members to know that this photo was taken on the 'Great Orme' Llandudno (well known to all holiday makers), which is 679 feet high.

"We used a 10 to 15 ft. aerial, slung-up to a near-by telegraph pole. The result was amazing, considering the time of the year and our conditions.

"I wish the Club every success and I hope in the near future to make further experiments, this time from Mount Snowdon, some 3,000 ft."

We look forward to hearing some more about these tests, and perhaps we may have some detailed notes and illustrations.

A Harmonic Problem

IN our issue dated 5th December we published a letter from Mr. Cottignies concerning the reception of sound and vision signals on wavelengths of 13.2 and 14.4 metres, and we asked whether any readers could offer a suggestion concerning these signals. Several other members have now written to us stating that they also receive these signals, and Mr. D. Jones of East Sheen actually wrote to the B.B.C. concerning them. We think the problem will be of great interest to other short-wave listeners and accordingly we give below the B.B.C.'s reply to Mr. Jones, together with a letter from Mr. D. R. Bowman, B.Sc., on the point. The letter from the B.B.C. says, ". . . . These transmissions are radiated on frequencies of 45 Mc/s (6.67 metres) for vision and 41.5 Mc/s (7.23 metres) for sound. Reception on approximately 14 metres, therefore, cannot be attributed to harmonics of the transmitter, as these would occur on roughly 3.6 metres, 1.8 metres, etc., and it seems likely that your reception is due to harmonics of the oscillator in your short-wave convertor beating with the incoming signals when the convertor is tuned to 14 or 21 metres."

This seems to be quite a feasible explanation, and Mr. Bowman says, "My solution is that his (Mr. Cottignies) tuning coil is resonating to the higher frequency when tuned to the lower. Thus, in exactly the same way, if middle C on the piano be held down, and its octave struck, one hears both the octave and middle C, i.e., 512 c.p.s. and 256 c.p.s. together. With the tuning coil set to double the wavelength (half the frequency) the harmonic is heard. Clearly, if a coil can radiate a *lower* harmonic (in terms of wavelength) it can also pick one up. It will be interesting to perform experiments of this nature."

Finally, Mr. Cottignies himself has been enquiring more into the problem and he has been offered a solution by G6QB. He concludes his letter with some interesting remarks concerning the handling of a receiver, which goes to show that on the short-waves the method of using the various controls will make or mar a set. Those who own simple short-wavers and only get one or two stations should note what Mr. Cottignies says. Here is his letter: "Just to let you know that the solution to the 'harmonic' question has been solved by our friend G6QB. He says the signal heard on twice the wavelength is due to the *receiver*-harmonic on 6.6 and 7.2 beating with the actual television and producing this signal on double wavelengths. Anyone noticing this phenomenon will probably also notice, as G6QB pointed out to me, that signal strength increases as reaction is increased, but as the receiver comes *out* of reaction, the signal weakens and ultimately disappears at the point where reaction begins. Incidentally G6QB is a wizard. At the controls of my receiver, on 40 metres, within 13 (thirteen) minutes, he sorted out of the terrific local QRM, over twelve stations, amongst them the following—calling CQ—FA8BG, W3GHD, U1BX, U1OE, U3CY, W3FLM, U3AG, W1JPJ. *All on C.W.* Then to finish up he said, 'Let's pack in, old man, these locals are getting on my nerves.' Give me some sal volatile quickly, somebody! This worthy wizard is the proud possessor of over 2,500 cards, all genuine QSO's. When I saw this amazing collection I could not find, off-hand, a country not represented. Now, my dear Mr. Everard, try and beat that!!!"

This illustration shows two members of the B.L.D.L.C. experimenting on the Great Orme, Llandudno (679 feet above sea level).

RADIO CLUBS AND SOCIETIES

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

The Cardiff and District Short-wave Club

AT the last meeting of the above club, the secretary, 2BQB, gave an interesting lecture dealing with "Artificial Aerial Transmitters," and the simple circuits, such as the Hartley, and Armstrong, were described. This lecture was eagerly followed by many of the artificial-aerial transmitters in the club.

The meetings are being held weekly at a clubroom belonging to the Society, and in the near future the following lectures will be given.

R. Clapp, G5XN, "Goyder Lock transmitters."
H. H. Phillips, 2BQB, "Crystal-controlled transmitters."
R. T. Mathews, G8AM, "Morse code practices."

The secretary, Mr. H. H. Phillips (2BQB), of 132, Clare Road, Cardiff, will be pleased to give information regarding the activities of the club to anyone desiring same, and readers of PRACTICAL AND AMATEUR WIRELESS are cordially invited to attend any meetings.

Portsmouth and District Wireless and Television Society (Portsmouth Chapter of B.L.D.L.C.)

A VERY instructive lecture on "Receiver Test Sets," by Mr. Batt, was given at a recent meeting of the above society. The speaker explained the various types of milliammeter, voltmeter, etc., used in practice, and went on to describe the evolution of two useful test sets. These were passed round to the members, who appreciated the ingenuity of the apparatus. Many questions were afterwards answered by Mr. Batt.

The society has now got its own room, which eventually will be open to members any time when fitted up with test apparatus, etc. The Portsmouth representative of the B.L.D.L.C., Mr. H. Leigh (2BBG), 20, King Street, Southsea, will be pleased to hear from any readers interested in short-wave work, and who would like to join the society.

Golders Green and Hendon Radio Scientific Society

THE practical design of a 5-10 metre short-wave receiver suitable for the reception of television sound waves was the subject of a recent lecture, given before the Golders Green and Hendon Radio and Scientific Society, by Mr. D. N. Corfield, D.L.C.

The chief points noted were as follow: anode-bend detection was preferable to a diode as there was a better signal/noise ratio and less damping of the I.F. circuit, particularly when the receiver was used for 56 Mc. and 28 Mc. A triode hexode valve was chosen for the frequency changer, no frequency drift with tuning signal frequency circuits, good oscillator, and good conversion gain. A radio-frequency amplifier stage reduced the strain on the I.F. stage, and so reduced hiss.

A 25,000 ω anode resistance is used instead of a H.F. choke which is taken to a tapping on the next tuning coil. This reduces the damping effect, and is also an aid to selectivity.

The radio and oscillator circuits are more conveniently separately tuned. The dial settings can be arranged to be in step at the top and bottom of the frequency band.

Horizontal aerials should not be used, as the television signal is polarised horizontally, also this type is very sensitive to local disturbances, such as car ignition. Directional aerials can be usefully used to reduce such interference.

At the conclusion, an actual demonstration of the receiver was given with excellent results. H. Ashley Scarlett, 60, Pattison Road, Hampstead, N.W.2.

Exeter and District Wireless Society

AT a recent meeting of the Exeter and District Wireless Society a lecture was given by Mr. Marne, A.M.I.E.E., on Electronics and Cathode Ray Tubes. This lecture was illustrated by over 200 excellent lantern slides, and Mr. Marne took his audience right through the construction of the Cathode Ray Tube from its fundamental elements to the finished article.

He also gave an excellent demonstration of the causes of distorted pictures in television, and gave many hints as to the cure of this somewhat prevalent and annoying complaint.

The meetings are held at 3, Dix's Field, Exeter, on Monday evenings at 8 p.m. Secretary, Mr. W. J. Ching, 9, Sivell Place, Exeter.

The Croydon Radio Society

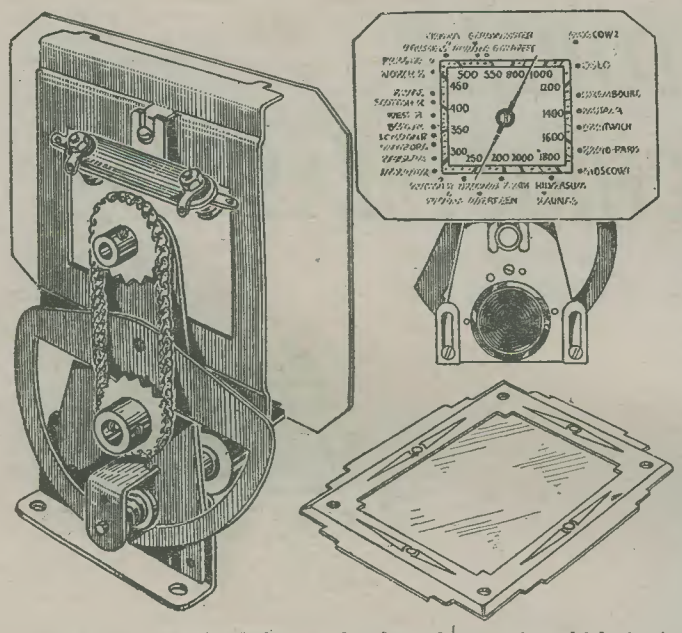
A DEMONSTRATION and account of the application of piezo crystals in sound reproduction was given to the Croydon Radio Society in St. Peter's Hall, Ledbury Road, S. Croydon, on Tuesday, December 8th. Mr. P. Clarke presided, and introduced Mr. H. G. Ménage, the lecturer. The Society wishes all PRACTICAL AND AMATEUR WIRELESS readers a very merry Christmas and all the best of listening for the New Year. Hon. Pub. Sec.: E. L. Cumbers, Maycourt, Campden Rd., S. Croydon.

Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

J. B. Square Plane Drive

IN the Add-on Superhet Unit recently described by us we utilised a square plane dial engraved with station names, and several readers have asked for details of this. The illustration below shows the type of dial, from which it will be seen that the drive from the control knob to the double-ended pointer is carried out by means of a sprocket wheel and chain. The large rectangular dial is engraved in the centre with a square scale carrying the medium-wavelengths on one half and the long-wavelengths on the other half, and, if desired, it may also be obtained with the station names engraved on the outer portion of the dial. A neat metal escutcheon is provided and it is only necessary to cut out a rectangular opening in the panel and attach the escutcheon to the panel front, when the dial may be mounted in the usual manner on the baseboard or chassis. Where a slow-motion drive is required the component may be obtained with a dual-control knob, providing two separate ratios. The price of the single ratio drive is 5s. 9d., and of the dual ratio, 6s. 6d.



A useful J. B. dial which may be obtained with station calibrations.

Calibrated Resistors

IN making experimental apparatus it is often necessary to make use of a resistor which is calibrated so that the final value can be more easily ascertained for subsequent replacement. The old method of doing this was to use a standard rotary element, and draw a circular scale divided into degrees, afterwards working out the approximate value of resistance for each degree and so eventually arriving at the value in circuit. The Radio Resistor Company have now introduced a novel unit known as a Muter Candometer, in which the element is provided with two flexible leads to which crocodile clips of standard pattern are attached. One lead is attached permanently to the end of the resistance wire, whilst the other is attached to a movable contact, and an insulated handle is provided. It is thus very simple to adjust the contact point and ascertain the value of resistance in circuit. Various ranges may be obtained and the degree of accuracy is very high indeed. The price is only 15s.

New Mullard Valve

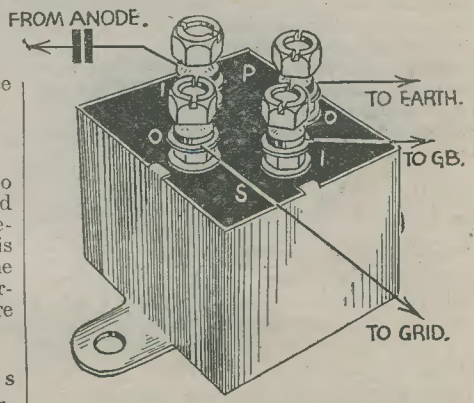
A NEW valve is shortly to be added to the range of Mullard battery valves, and this is to take the form of an octode frequency-changer. The type number is FC2A, and it is an improvement on the present FC2. Further details and characteristics will be given as soon as they are received.

Sound Sales "Filtafeed" Transformer

THE majority of circuits now utilise the parallel-fed L.F. transformer, as this arrangement possesses many advantages. The avoidance of a high direct current through the primary winding enables the component to be made much more compact than the standard instrument, and a typical component of this class is shown on this page. It is of very compact form, measuring only 1¾in. square by 1⅞in. high, and the primary has an inductance of 80 henries. The metal case in which it is mounted enables it to be screened, and so avoid interaction with other inductive components, and terminals are provided for connecting purposes. It may be employed with either resistance or choke coupling and will provide a very efficient L.F. coupling with good frequency characteristics. The price is 4s. 6d., and the makers Sound Sales, Ltd.

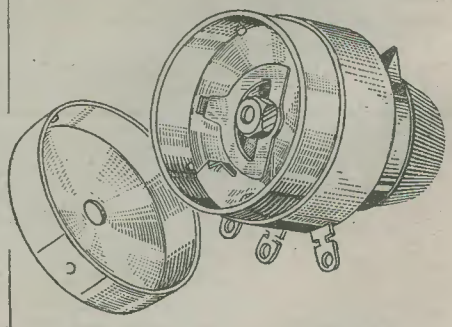
Bulgin Volume Control

THE difficulties underlying the design and construction of a satisfactory volume control have been mentioned before in these pages, and it has been found that a very frequent source of trouble, with well-designed controls, is that they are used in unsuitable positions. A "general purpose" control may well be employed in various parts of a circuit without difficulty, but when various currents are considered it will be found that in some cases the resistance-element will become noisy or break down owing to overloading. In the Bulgin range, however, it will be found that volume controls are classified in various wattage ratings, and thus the difficulty is overcome provided that the constructor first ascertains what current is to be passed through it. Also, to avoid calculation, it will be found in the Bulgin catalogue that each control is given with the maximum current which may be passed. The accompanying illustration shows one of the low-resistance 3-watt controls which are available at 2s. 6d. each in nine different values, from 10 to 50 ohms. The element is wire wound with oxidised nickel-alloy wire, and con-



A neat and efficient filter-fed transformer—the Sound Sales "Filtafeed."

forms to a linear law. Contact with the element is carried out by means of a disc which is "sprung," so that it only comes into contact with the element when the arm attached to the spindle is brought against it. As this rotates, the disc is progressively depressed, and thus there is no rubbing contact on the wire, and all wear and tear is thereby avoided, with the added advantage that there are no noises due to the rubbing contact. The spindle, and, consequently, the mounting bush, are in direct electrical contact with the moving arm, and thus in some cases it will be necessary to mount the component on an insulated panel. The makers supply insulating washers with the component to overcome this difficulty, and an indicating plate and dial are also provided.



This illustration shows the construction of the Bulgin three-watt volume controls.

The component may be thoroughly recommended for all circuits where a low-resistance control is required.

LETTERS FROM READERS

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

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

A Reader's Radio Den

SIR,—The accompanying snap shows a corner of my radio den. I have been a regular reader of your journal since it first started, and have found the articles very instructive. My field of interest has been for some time centred on short-wave work, and of all the reports I have sent to S.W. stations there has not been a single instance in which a verification has not been returned. I take this opportunity of wishing your journal the continued success it deserves.—MAURICE L. HUNT (Knutsford, Cheshire).

Component Shortage

SIR,—I should like to add my complaint about the component shortage. I ordered the coils for the "Record Three" some weeks ago from a well-known firm, and am still waiting. Their acknowledgment is dated November 12th.—S. POYNER (Shirley, Nr. Birmingham).

Back Issues Available

SIR,—I beg to inform you that I have in my possession the whole of the issues of PRACTICAL AND AMATEUR WIRELESS since it started, and would like to dispose of them. If any of your readers would care to have the lot they are welcome to them for the fetching of same, but I would like to get rid of the lot at once, and not in parts.—K. W. BRANCZIK, 10, Spencer Road, Grove Park, Chiswick, W.4.

Back Numbers Wanted

SIR,—May I ask through your columns if someone would be good enough to loan me a copy of PRACTICAL WIRELESS dated July 15th, 1933, or send me a copy and particulars of wiring, etc., for the "Dancing Man" described therein. I will pay all postage, and if the copy is loaned, I will see that same is treated with every care, and returned immediately to its owner.—JOHN F. GILBERT, 165, St. Benedict's Road, Small Heath, Birmingham.

SIR,—I shall be very grateful if any reader possessing a copy of PRACTICAL AND AMATEUR WIRELESS dated January 26th, 1935 would either lend or sell it to me.—G. HENRY, "Solva," Bache Drive, Upton-by-Chester.

SIR,—I shall be greatly obliged if any of your readers could let me have a copy of your journal dated April 18th, as I want to complete my Vol. 8. I will, of course, refund any expense incurred.—F. W. CURREY, Raybridge, Lacock, Wilts.

SIR,—I am a new reader of PRACTICAL AND AMATEUR WIRELESS, and am very anxious to obtain some back numbers. I shall be glad to get in touch with any reader who has no further use fo the following issues: Nos. 124, 127, 132, 135, 136, and 137, of 1935; April 28th, 1934, and December 23rd, 1933.—A. C. WILLSHERR (28, Brigstocke Road, Stokes Croft, Bristol).

Simple Three-valver!

SIR,—With reference to Mr. W. Spence's letter published in the November 28th issue, suggesting a simple straight three-valve battery model, I also would welcome such a set. I quite understand Mr. Stagg, and other readers, wishing for an A.C. S.W. set; they have, of course, more technical knowledge of the matter than we beginners. It must be understood that a new generation is springing up, and they also have got to start at the bottom, just the same as our pro's have had to do. Wishing the finest wireless paper printed every success.—Frank Hallam (Bestwood, Notts.).

Correspondent Wanted

SIR,—I have been reading PRACTICAL AND AMATEUR WIRELESS for over a year, and find the articles on short waves, and Thermion's page, particularly interesting. I shall be very pleased to correspond with any young reader in England with a view to exchanging ideas about short-wave radio.—Albert Ingham, Kirkland, Oneida Co., New York, U.S.A.

A corner of Mr. Maurice L. Hunt's radio den

QSL Cards

SIR,—I have been very interested in the various arguments put forward by readers on this question, and use as my apology for entering the discussion the fact that I claim to have been the first European amateur to issue QSL cards. (See a special article with photograph of the card in the *T. and R. Bulletin* for May, 1931). That card was issued early in 1922, and the step was taken because I thought the idea good, and was receiving, chiefly from the London area, many reports on my signals, the card making it much easier to deal with the numerous reports of that day, and from 1922 to the present day not one single report to this station has passed without acknowledgment. I look upon this acknowledgment not only as a matter of personal honour, but as one of the finest grounds of recruitment the amateur world ever had. Through the medium of QSL card hunting, many of our finest amateurs have been recruited to the movement and a great number of "round the corner" amateurs, to whom the acknowledgment of a QSL card has meant further correspondence, a meeting at the shack, introduction to a club and the final stages to a full-blown transmitter, are too numerous to mention. I have in my file the first QSL card, very often ruled out in ink on a plain postcard, and the present highly coloured work of art of a particular amateur who wrote me many years before and went through the process mentioned. Now, new generations arise very rapidly in the radio world, and if amateurs are going to adopt that obnoxious DX habit and shut their neighbours out of the circle because they are within touching distance, then the time will come when all the amateur spirit will be concentrated into an occasional meeting at a local club, and the local transmitters will be walking about with their noses in the air, and an untouchable swagger in their walk. For heaven's sake let us have a little common sense in the QSL spirit. It does not cost much to buy a packet or two of plain postcards from the local store, and surely even a thank you would be only courteous even to the man next door if he reports your signals. He hasn't reported them for nothing, I am not by any means one of the financially rich members of the community, but I have always managed to keep a supply of cards by me and have a record of every card despatched since 1922. On the question of returns. There are many who do not reply, but I have recently received some due in 1930 and one in 1928 and at least my own conscience is clear. The DX fetish has much to answer for, but I am as much interested in a chat with a local newcomer to radio as with a fellow "Ham" in Australia, and I have had many such conversations. Obviously, the reason so many stations do not receive their reply cards is due to that card being sent to the "Clearing House" of the society of which he is a member.—W. E. F. CORSHAM, G2UV (Wembley).

Practical and Amateur Wireless
BLUEPRINT SERVICE

These blueprints are drawn full size.
Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following *prices, which are additional to the cost of the blueprint.* A dash before the Blueprint Number indicates that the issue is out of print.

Issues of Practical Wireless .. .. 4d. Post paid
" " Amateur Wireless .. .. 4d. " "
" " Practical Mechanics .. .. 7½d. " "
" " Wireless Magazine .. .. 1/3 " "

The index letters which precede the Blueprint Number indicate the periodical in which the description appears: thus, PW refers to PRACTICAL WIRELESS, AW to *Amateur Wireless*, PM to *Practical Mechanics*, WM to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the blueprint and the issue (stamps over 6d. unacceptable), to PRACTICAL AND AMATEUR WIRELESS Blueprint Dept., Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS
STRAIGHT SETS. Battery Operated.

	Date of Issue.	No. of Blueprint
One-Valve : Blueprints, 1s.		
All-wave Unipen (Pentode) ..	—	PW31A
Two-valve : Blueprint, 1s.		
Four-range Super Mag Two (D Pen)	11.8.34	PW36B
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow) ..	—	PW35
Summit Three (HF Pen, D, Pen)	8.8.34	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	22.9.34	PW39
Hall-Mark Three (SG, D, Pow) ..	—	PW41
Hall-Mark Cadet (D, LF, Pen. (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Genet Midget (D, 2 LF (Trans))	*June*, '35	PM2
Cameo Midget Three (D, 2 LF (Trans))	8.6.35	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	17.8.35	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen) ..	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P) ..	—	PW64
The Gladiator All-Wave Three ..	29.8.36	PW66
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen) ..	31.10.36	PW69
Four-valve : Blueprints, 1s. each.		
Fury Four (2 SG, D, Pen) ..	—	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	6.1.34	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P) ..	26.9.36	PW67

Mains Operated.

Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen) ..	—	PW18
A.C.-D.C. Two (SG, Pow) ..	7.10.33	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	10.6.33	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen) ..	—	PW29
A.C. Leader (HF Pen, D, Pow) ..	7.4.34	PW35C
D.C. Premier (HF Pen, D, Pen) ..	31.3.34	PW35B
Ubique (HF Pen, D (Pen), Pen)..	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	18.8.34	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF R.C.))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen) ..	—	PW56
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF, Pen, D, Push-Pull)	9.2.35	PW47

SUPERHETS.

Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-valve) ..	—	PW40
F. J. Camm's 2-valve Superhet (Two-valve)	13.7.35	PW52
F. J. Camm's £4 Superhet ..	—	PW58
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve) ..	—	PW43
D.C. £5 Superhet (Three-valve) ..	1.12.34	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. £4 Superhet 4	—	PW59
F. J. Camm's Universal £4 Superhet 4	11.1.36	PW60

SHORT-WAVE SETS.

Two-valve : Blueprint, 1s.		
Midget Short-Wave Two (D, Pen)	15.9.34	PW38A
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-Wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Bandspread S.W. Three (HF Pen, D (Pen), Pen)	29.8.36	PW68

PORTABLES.

Three-valve : Blueprint, 1s.		
F. J. Camm's E.L.F. Three-valve Portable (HF Pen, D, Pen) ..	16.5.36	PW65
Four-valve : Blueprint, 1s.		
Featherweight Portable Four (SG, D, LF, Cl. B)	—	PW12

MISCELLANEOUS.

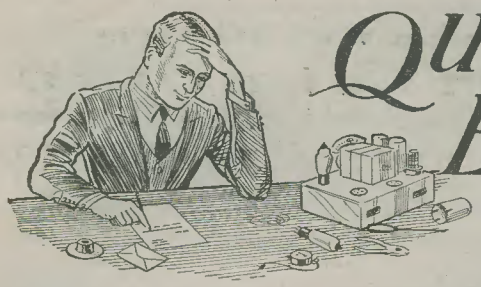
S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE CRYSTAL SETS.

Blueprints, 6d. each.		
Four-station Crystal Set ..	12.12.36	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450

STRAIGHT SETS. Battery Operated.

One-valve : Blueprints, 1s. each.		
B.B.C. Special One-valver ..	—	AW387
Twenty-station Loudspeaker One-valver (Class B)	—	AW449
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans) ..	—	AW388
Full-volume Two (SG det, Pen) ..	—	AW392
B.B.C. National Two with Lucerne Coil (D, Trans)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans) ..	—	AW338A
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	*July* '36	WM409
Three-valve : Blueprints, 1s. each.		
Class-B Three (D, Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	—	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG D, Trans) ..	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher: Chassis Model (SG, D, Pen)	—	AW419
Lucerne Ranger (SG, D, Trans) ..	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
Mullard Master Three with Lucerne Coils	—	AW424
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All-Britain Three (HF Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.11.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
£6 6s. Radiogram (D, RC, Trans)	—	WM318
Simple-tune Three (SG, D, Pen)	*June* '33	WM327
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans) ..	*Mar.* '34	WM354
Iron-Core Band-pass Three (SG, D, QP 21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen) ..	*June* '35	WM389
Certainty Three (SG, D, Pen) ..	*Sept.* '35	WM393
Minitube Three (SG, D, Trans) ..	*Oct.* '35	WM396
All-wave Winning Three (SG, D, Pen)	*Dec.* '35	WM400
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans) ..	—	AW370
"A.W." Ideal Four (2 SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2 SG, D, Pen) ..	—	AW421
Crusaders' A.V.C. 4 (2 HF, D, QP 21)	18.8.34	AW445
(Pentode and Class-B Outputs for above: Blueprints, 6d. each)..	25.8.34	AW445A
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb.* '35	WM381
The H. K. Four (HF Pen, HF Pen, D, Pen)	*Mar.* '35	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	*April* '36	WM404



QUERIES and ENQUIRIES

S.W. Converter

"In your issue dated Nov. 14th last, you gave a simple circuit for a converter. I will be using a metal chassis and should like to know whether a metal panel would be sufficient to screen the I.F. Unit from the rest of the circuit, or would a screening can be necessary. Also, is there a complete I.F. Unit on the market which would be suitable for the above-mentioned converter? If so, could you tell me the maker's name and address and the size and price of the component?"—A. C. (Cowdenbeath).

THE unit indicated in the circuit diagram is made by Messrs. Eddystone and is included in a metal can. It is approximately 5in. high by 2½in. in diameter. You could, of course, employ any tuned circuit at this point, provided that the tuning would be adjustable to the desired intermediate frequency, and if the remaining coils in the receiver are themselves screened there is no necessity to use a screened I.F. unit. A standard screened broadcast coil could be employed, with a pre-set type of condenser across it, and the coil should be set to the long-wave band.

Home Recording

"Could you give me the address of a firm from which the aluminium blank records mentioned in your Christmas number could be obtained?"—A. W. B. (Swindon).

PLAIN aluminium blanks (that is, those which carry no recording grooves and which consequently have to be employed with a tracking device) may be obtained from Electradix Radios, price 5s. per dozen. This firm can also supply some of the chemical blanks, which do not require any after-treatment, and these cost 1s. 6d. each.

Winding a Resistor

"I am building a power amplifier, but find that as at present worked out, I shall need a series resistor in the H.T. lead to prevent over-running of the early valves. So far as my calculations go I shall want about 70 to 100 ohms and to carry 80 mA. What type of resistor do you advise me to make for this particular purpose? Is there any commercial component which will do?"—T. E. (Windsor).

A STANDARD 1-watt resistor is suitable, but as you are uncertain of the exact value it would be preferable to use a variable component. In the Bulgin lists some small-power resistors will be found in which metal clips are attached to the ends, and you could adapt one of these by loosening the clip and slipping it along to the desired position. They cost only 1s., the same as the standard fixed 1-watt resistors, and are wound on asbestos. The rating is 10 watts, so that you have an ample margin of safety.

Soldered Contacts

"I have built your Limit set, but as I cannot solder I made the connections with a patent stuff which I got in a tube, and this is called cold solder. Do you think this is the cause of my failure to get any signals at all? There is a sort of rushing in the speaker, but I cannot get any signals on any waveband. I should like to know how to test this set and find what is wrong. It is my first attempt."—B. W. (E.4).

WE do not know the particular substance you have used for soldering, but there is a possibility that this is the cause of your trouble. Was any heat required to harden the solder, or is it simply spread on the joint direct from the tube? We believe there is a solder which is supposed to melt and make a good joint simply with the aid of a match flame, but there may be some chemical arrangement in the material you used which has resulted in a poor electrical connection. The only satisfactory test is to include a milliammeter in each anode circuit in turn and make certain that all correct voltages are applied. If so, and results are not obtained when tuning is carried out, it would indicate that the coils are not correctly wired, or the switching is faulty. There is no simple method of locating the trouble and systematic stage-by-stage tests must be carried out.

RULES

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

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

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

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

The Coupon must be enclosed with every query.

Quality Amplifiers

"What is the best circuit for a really good amplifier suitable mainly for gramophone reproduction for a music-lover? I have heard numerous claims for push-pull, whilst certain of my friends tell me that harmonic distortion can only be avoided by single output stages. I am anxious to start to build a good amplifier, but am undecided as to the best arrangement for my purpose."—P. R. S. C. (Swindon).

MANY keen listeners claim that the results from a good push-pull stage cannot be beaten, and your references to harmonic distortion apply to both types of output circuit. It is really a matter of personal preference, and we suggest, if you cannot make up your mind otherwise, that you hear good amplifiers of each type and thus judge which suits your ear. We describe in this issue a high-quality amplifier which could no doubt be adapted for your purpose.

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

The Limit All-Wave 4

"I believe the Limit receiver would be ideal for me, but I should like to know what the cost of this set is. I have not seen any advertisements of the complete set, and perhaps you could tell me where I could get all the parts at one time to avoid the delay in awaiting delivery from several firms."—G. R. (Belfast).

THE complete set of parts for this receiver, known as Kit A, costs £4 16s. 6d. To this must be added the cost of the valves, speaker, and batteries. All of the parts may be obtained from Messrs. Peto-Scott or H. W. Holmes.

REPLIES IN BRIEF

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

T. E. B. (Winton). The issue in question is now out of print. You did not enclose a stamp nor a remittance for the issue.

F. R. D. (Bombay). It is unnecessary to know the data referred to. Any standard L.F. transformer will be quite satisfactory in the circuit in question.

F. P. (Gateshead). The article in question appeared in our issue dated May 4th, 1935.

C. B. (Bellshill). We do not think a set of the type mentioned would have a popular appeal. However, we will bear your suggestion in mind.

A. M. D. (Hamilton). The receiver was not designed by us, but by Messrs. Cossor. No details are now available and we cannot supply you with a blueprint.

K. J. H. (Kenton). The change in valves may easily have caused the trouble, as the characteristics are not the same. What load did you apply to the eliminator when you measured it? You should check the current and voltage in order to make a satisfactory test.

G. E. M. (N.19). The only way to use a loudspeaker would be to add an L.F. Amplifier.

A. W. B. (Kettering). P.W.48A should meet your requirements. This can be operated from A.C.

J. A. (Hebden Bridge). It is not practicable to use the half winding as mentioned. You would find it impossible to remove hum troubles, and there would be insufficient voltage to permit of the inclusion of substantial smoothing chokes. You must not exceed the makers' voltage recommendations.

A. N. (Underwood, Notts). The coils required were specified in the list of parts for the receiver. They were two 6-turn and two 4-turn coils, No. 1051 (Eddystone). They are obtainable from Messrs. Stratton & Co., price 1s. 8d. and 1s. 6d. each respectively.

H. E. S. (Ballingarry). As you have used so many mixed parts you have probably had to use alternative wiring, etc., and naturally we cannot advise you concerning the difficulties you have encountered. In a receiver of the superhet type it is especially necessary to adhere to published instructions and components if you have had no previous knowledge.

M. S. (Claverdon). The valves in question would not fit the modern midget valveholders, and special valveholders are required for them. They were used in our Midget Short-Wave Two, blueprint P.W.38A obtainable for 1s. from this office. The issue in which the construction was described was September 15th, 1934.

H. V. (St. Helens). The Cyldon products are manufactured by Messrs. Sydney S. Bird and Sons, Cyldon Works, Cambridge Arterial Road, Enfield.

A. J. L. (Nantwich). The mathematical calculations for working out the desired information are rather difficult, and you will find it much simpler to adopt the rule of thumb method, of bending the paper to achieve the desired size. It is not a critical measurement, and you can easily cut a circle from a piece of newspaper and bend this to form the desired shape, afterwards using this as a template for your thicker paper.

C. E. V. (Birmingham). The consumption is dependent upon the receiver load, and therefore there must be a high leakage in your set or between the primary and earth. There is no way of reducing it if it is the correct load value.

F. N. (E.14). Whilst the various values appear more or less correct, we have not tried the valves and therefore cannot state definitely whether any modification is possible. We do not recommend the omission of the rectifier unless you are certain that no harm can result, and it is particularly important to consider the heater voltages for the other valves.

F. E. G. B. (Womans Wold, Kent). The receiver is not one of our designs, and we believe that the coil was a special type described in another paper. Consequently we cannot recommend any of our blueprints to use with this coil.

W. P. (Liverpool 8). The circuit itself is quite suitable for modern conditions, although better selectivity would be obtained by using a modern band-pass tuning unit. We suggest, if you wish to build a really up-to-date set, that you adopt the circuit in question, but fit a set of three of the new Varley coils, such as were recently described in these pages. Alternatively, Messrs. Varley can supply a blueprint for a three-valver built round the coils.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," 8, Southampton Street, Strand, London.

RECEIVERS, COMPONENTS AND ACCESSORIES

Surplus, Clearance or Secondhand, etc.

RADIOMART

SHORT-WAVE SPECIALISTS

Announce 1937

SHORT-WAVE MANUAL

Packed with short-wave information and circuits of mains and battery receivers, including straight, superhet and 5-metre transmitters, modulators, etc. Information on transmitting licences, aerials, Class B amplification, neutralization, superhet alignment, etc. The most comprehensive manual published, written by practical engineers, price 6d., post free 7½d., including catalogue.

1937 Catalogue only (3 times enlarged) price 1½d. post free.

TELSEN screened dual range coils, 2/6. Pair, 4/6. Milliammeters, 25 ma. upwards, 5/9. Super, 6/9.
AMERICAN mains transformers 230v. fully shrouded, 350/350. 6.3v., 5v., 6/11. Majestic 250/250. 2.5v., 5v., 4/11.
HEAVY DUTY mains transformer worth 35/-, 350/350, 150 ma.; 4v. 2.5ACT., 4v. 6ACT., 12/6.
465 KC/S., IF transformers, 2/11. Telsen Ace, 1/11. RG4, Radio grands, 2/9, 2mf. 300v., 9d.
UTILITY straight line wavelength dials, 3/11. Telsen H.F. chokes, 1/11.
UTILITY 2-gang uniknob and dial, 3/11; 1,500-volt tubular condensers, all sizes, 6d.
ELECTROLYTICS 500-volt 8mf., 1/6; 4 mf., 1/6; 4 × 4, 1/11; 8 × 8, 3/6; 25 mf. 25v., 1/-. etc.
SMOOTHING chokes, 20 hy. 120 ma., 3/11; 100 ma., 2/11; 40 ma., 1/11.
PUSHBACK wire, 6 yds., 6d.; heavy, 9d.; 2 gross solder tags, 6d.; resin-cored solder, 9ft., 6d.
CENTRALAB pots, all sizes, 1/6; switched, 2/-; tubular glass fuses, 2d.
JENSON PM speakers, 12/6. Varley Iron core coils, 2/6; matched pair, 4/6.
SPECIAL OFFER Class B valve, driver transformer and valveholder, new, lot 5/-.
LISSEN 3-gang bandpass, 3-gang superhet, 2-gang all-wave coils, any set, price 7/6.
TRADERS' monster bargain parcels, value £4/10/-, for 10/-; also 5/- parcels.
FAMOUS Continental A.C. valves, 4/6; American Duotron, etc., all types, 3/6; battery from 2/3.
UTILITY 8/6, microdisc dials, 3/11; Radiophone, 0.00016 short-wave condensers, 3/6; series gap, twin, 3/9.
CERAMIC all brass microvariables, 15 mmfd., 1/4; 40 mmfd., 1/7; 100 mmfd., 1/10; short-wave H.F.C., 9d.
CLEARANCE catalogue 1½d. Goods over 5/- post free. All enquirers must send stamp.
Branches: 19, John Bright St., 44, Dale End. Mail Orders, 44, Holloway Head, Birmingham. Telephone, MID 3254.

CONVERSION UNITS for operating D.C. Receivers from A.C. Mains, improved type, 120 watts output, at £2/10/0. Send for our comprehensive list of speakers, Resistances and other components.
WARD, 46, Farringdon Street, London, E.C.4. Telephone: Holborn 9703.

SHORT WAVES

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

MISCELLANEOUS

WESTERN ELECTRIC Microphones, 1/6 each, post free; Transformers to match, 1/3; 500 clearance lines, catalogues 3d. each.—J. Bearfield, 105, Upper Street, London, N.1.

VALVES

NOTHING better available. SIX MONTHS' GUARANTEE, complete range of BATTERY, A.C. MAINS, RECTIFIERS always in stock. 2 volt Det., H.F., L.F., 2/3, POWER 2/9, SCREEN GRID PENTODE, H.F. PENTODE 5/-. American types, fully guaranteed, 5/6 each, Nos. 80, 42, 43, 57, 58, 77, 78, 6C6, 6D6, 25Y5, 25Z5. Write for other prices to Dulci Electrical Co., Ltd., Devonshire Works, Dukes Avenue, Chiswick, W.4.

PREMIER SUPPLY STORES

Get our quotation for your Short-Wave and Television Gear

Offer the following Set Manufacturers' Brand New Surplus Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carr. paid over 5/-; under 5/- postage 6d. extra. Orders under 5/- cannot be sent C.O.D.

ALL POST ORDERS TO **JUBILEE WORKS, 167, LOWER CLAPTON RD., LONDON, E.5**

CALLERS, AS USUAL, TO 20-22, HIGH ST., CLAPHAM, S.W.4 (Macaulay 2381). 'Phone: Amherst 4723
And 165 & 165a, FLEET ST., E.C.4 (Next door to Anderton's Hotel.) **Central 2833.**

MAINS VALVES

MAINS VALVES, famous Europa 4 v. A.C. types, 4/6 each. HL., L., S.G., Var.-Mu-S.G., H.F.-Pens., Var.-Mu-H.F. Pens. 1, 3 and 4-watt A.C. directly-heated output Pentodes. Full-wave rectifiers, 250 v. 60 m.a. **A.C./D.C.** types. 20-volt. .18 amp. S.G., Var.-Mu-S.G., H., HL., Power.
Following Types all 5/6 each. Full-wave rectifiers, 350 v. 120 m.a. and 500 v. 120 m.a. 2½ watt indirectly-heated Pentodes. Frequency Changers, Octodes and Heptodes.
BATTERY VALVES. 2 volts, H.F., L.F., 2/3. Power, Super-Power, 2/9. S.G., Var.-Mu-S.G., 4- or 5-pin Pentodes, H.F. Pens., V.-Mu-H.F. Pens., 5/-. Class B, 3/6.
AMERICAN VALVES. Genuine American **HYTRON** and **TRIAD** first-grade Valves. 3 months' guarantee. All types in stock, 5/6 each. 210 and 250, 8/6 each. New Metal-Glass Valves, all types, 6/6 each. Genuine American **DUOTRON** Valves, all types, 3/6 each. Valve holders for all above types, 6d. each. Metal bases, 9d. each.

SHORT WAVES

SHORT-WAVE COILS, 4- and 6-pin types, 13-26, 22-47, 41-94, 78-170 metres, 1/9 each, with circuit. Special set of 3 S.W. Coils, 14-150 metres, 4/- set, with circuit. Premier 3-band S.W. Coil, 11-25, 19-43, 38-86 metres. Simplifies S.W. receiver construction, suitable any type circuit, 2/6.
COIL FORMERS, in finest plastic material, 1½in. low-loss ribbed, 4- or 6-pin, 1/- each.
SUPER CERAMIC CONDENSERS, S.L.F. .00016, .0001, 2/9 each; double-spaced, .00005, .000025, .000015, 3/- each. All brass with integral slow motion, .00015 tuning, 3/9; .00015 reaction, 2/9. British Radiophone 2-gang .00016, 5/6.
H.F. CHOKES. S.W. 10-200 metres, 9d.; S.W. screened, 1/6; standard screened 180-2,000 metres, 1/6.
CERAMIC S.W. VALVE HOLDERS, 4-, 5- or 7-pin. Chassis types, 6d.; B.B. type, 8d. **GLASS AERIAL INSULATORS**, 4d. each. **BEEHIVE STAND-OFF**, 6d. each. **SCREENED FLEX**, single, 3d. yd.; twin, 4d. yd.

PREMIER AMPLIFIER KITS

3-WATT A.C. AMPLIFIER, 2-stage, for mike or pick-up. Complete kit of parts with 3 valves, 40/-.
7-WATT A.C./D.C. AMPLIFIER, 3-stage, high-gain, push-pull output. Complete kit of parts with 5 specially matched valves, £4 4s.
10-WATT 3-stage A.C. Amplifier Kit with 5 valves, £5 5s.
20-WATT 3-stage A.C. Amplifier Kit with 5 valves, £8 8s.
ELECTROLYTICS. U.S.A., 4, 8 or 12 mfd. 530 v. peak, 1/9 each. **Dubilier**, 4 or 8 mfd. 500 v., 3/-; 50 mfd. 50 v., 1/9; 12 mfd. 20 v., 6d.; 25 mfd. 25 v., 1/-. T.C.C. 4 or 8 mfd. 650 v., 4/-; 15 mfd. 50 or 100 v., 1/-; 50 mfd. 12 v., 1/-. **Paper Condensers.** W.E., 250 v. working 4 mf., 2/-; 2 mf. 1/-; 1 mf. 6d.; 350 v. working 4 mf., 2/6; 2 mf., 1/6.
Dubilier 500 v. working 4 mf., 4/-; 800 v. 4 mf., 6/-.
Wego 450 v. working 1 mf., 1/-, 2 mf. 1/9, 4 mf. 3/-; 700 v. working 2 mf. 2/-, 4 mf. 3/6.
COSMOCORD PICK-UPS, with tonearm and volume control, 10/6 each.
PICK-UP HEADS only, 4/6 each.

MAINS TRANSFORMERS

PREMIER wire-end type with screened primaries, tapped 200-250 v. Centre-tapped Filaments. Guaranteed one year. **H.T. 8 & 9** or **H.T. 10** with 4 v. 4 a. C.T. and 4 v. 1 a. **C.T., 8/6. 250-250 v. 60 m.a.**, 4 v. 1 a., 4 v. 2 a. and 4 v. 4 a., all C.T., 8/6. **350-350 v. 120 m.a.**, 4 v. 1 a., 4 v. 2 a. and 4 v. 4 a., all C.T., 10/6. Any of these transformers with engraved panel and N.P. terminals, 1/6 extra.
500-500 v. 150 m.a., 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 3-4 a., all C.T., 17/6. Super Model, 19/6. **AUTO-TRANSFORMERS**, step up or down, 60 watts, 7/6; 100 watts, 10/-.
FILAMENT TRANSFORMERS, Tapped Primaries, 200-250 v. All secondaries C.T. 4 v. 3 a., 7/6; 4 v. 5 a., 8/6; 7.5 v. 3 a., 7/6; 6 v. 3 a., 7/6; 2.5 v. 8 a., 7/6; 6.3 v. 3 a., 7/6; 5 v. 3 a., 7/6.
SMOOTHING CHOKES, 25 m.a., 2/9; 40 m.a., 4/-; 60 m.a., 5/6; 150 m.a., 10/6. 2,500 ohms, 60 m.a. Speaker Replacement Chokes, 5/6.
MILLIAMMETERS, moving-iron, flush 2½in., all ranges from 0-10 m.a., 5/9. Visual tuning, 6 or 12 m.a., 5/9. Moving-coil meters, 2½in. 0-1 m.a., 18/6; 3½in. 0-1 m.a., 22/6. Multipliers, 1/- each.

PREMIER (Reisz Pattern) Transverse-current MIKE, High Output, Straight Line Response, 30/-. Transformer, 5/-. Table Stand, 7/6.

AMPMETERS, all ranges, from 0-1 amp., 5/9.
TRANSFORMERS, latest type Telsen R.G.4 (list 12/6), 2/9. Lissen Hypernik Q.P.P. (list 12/6), 3/6.
OUTPUT TRANSFORMERS for Power, Pentode and Push-Pull, 2/6; Multi-Ratio, 4/6; Push-Pull Input Transformers by prominent manufacturer, 4/6 each.
ELIMINATOR KITS for A.C. mains. 120 v 20 m.a., or 150 v. 25 m.a., 15/-, tapped S.G., det. and output. Complete Kit with long-life valve rectifier (replacement cost only 2/-).
PREMIER L.T. CHARGER KITS for A.C. mains, including Westinghouse Rectifiers and Tapped Mains Transformers. 6 volts at ½ amp., 14/6; 8 volts 1 a., 17/6; 15 volts 1 a., 19/-; 15+15 volts 1 a., 37/6; 15+15+15 volts 1 a., 50/-; 8 volts 2 a., 29/6.
TELSEN iron-cored screened coils, W.349, 4/ each.
Electric **SOLDERING IRONS**, 200-250 v., A.C./D.C., 2/3.
LOTUS JACKS (and Jack-switches), all types, 1/- each. Lotus Plugs, 1/- each.
PREMIER H.T. KITS, all with Westinghouse rectifiers; tapped transformers and adequate smoothing. All Kits absolutely complete. 120 v. 20 m.a., 20/-; with ½ a. L.T. Charger, 28/-. 150 v. 30 m.a., 25/-; with ½ a. L.T. Charger, 31/6. 250 v. 60 m.a., with 4 v. 3 a. C.T., 30/-.

SHORT WAVE KITS

SHORT-WAVE KIT for 1-valve receiver or adaptor, complete with chassis, 4 coils, 14-150 metres, condensers, circuit and all parts, 12/6.
VALVE GIVEN FREE! DE LUXE MODEL, 17/6. SUPERHET CONVERTER KIT, 13/6. **S.W. SUPERHET CONVERTER**, for A.C. Mains Receivers, 20/-. A.C. Valve given **FREE!**
2-VALVE S.W. KIT, 19/6. **VALVES GIVEN FREE! 3-VALVE S.W. KIT**, S.G. Det. and Pen., 42/-. **VALVES GIVEN FREE!**
ALL-WAVE "ALL-WORLD RANGE" 3-valve Kit, 12-2,000 metres in 4 wavebands without coil changing, complete kit of parts with 3 valves, S.G., H.F., S.G., det. and pentode (2 volts); 50/-. Q.P.P. Model, 6/6 extra.
BAND-PASS TUNING PACK, comprising set of Telsen 3-gang iron-cored coils with switching, mounted on steel chassis with 3-gang condenser, illuminated disc-drive and 4 valve holders. 25/- the lot. All Mains or Battery circuit. **FREE!**
LISSEN ALL-WAVE COILS, 12-2,000 metres, complete with switching and wiring diagram, 12/6.
3-VALVE BAND-PASS KIT, 200-2,000 metres. Complete kit of parts, including chassis, all components, valves, M.C. speaker and wiring diagram. Battery Model, 50/-. A.C. Mains Model, 70/-.

MOVING COIL SPEAKERS

MAGNAVOX. Mains energised. 154, 7in. cone, 2,500 ohms 4 watts, 12/6; '152,' 9in. cone, 2,500 ohms, 17/6; 152 'Magna' 9in. cone, 2,500 ohms, 6 watts, 37/6. **Magnavox** P.M.s—'154' 7in. cone, 16/6; '252,' 9in. cone, 22/6. Reliable P.M.s, 10/6.
ROLA latest type P.M.s, 18/6. **KB** 7in. mains energised, 1,500 or 2,500 ohms, 7/9. **GOODMANS'** 8in. mains energised, 1,000 ohms field, 10/6 each.
DIALS.—**Clarion** Illuminated S.W. slow-motion Dial with 2in. knob, 2/-. **Premier** All-Wave 2-speed Dial, full vision straight-line, dual ratios 10-1 and 150-1, 6/6, with escutcheon.
Potentiometers by well-known makers. All values up to 1 meg., 2/-; with switch, 2/6.
GRAMOPHONE MOTORS. Collaro Gramophone Unit consisting of A.C. motor, 100-250 v. high quality pick-up and volume control, 45/-; Collaro motor only, 30/-; Collaro Universal Gramophone Motor, 100-250 v. A.C./D.C., with high quality pick-up and volume control, 67/6; Collaro Universal Motor only, 49/6; Edison Bell double-spring motors, including turntable and all fittings, 15/-; Cosmocord Gramo unit, comprising A.C. motor, pick-up and volume control (list 55/). 35/9.
TUBULAR CONDENSERS, non-inductive, all values up to .5 mfd., 6d. each.
Wire-end **RESISTORS**, any value, 1 watt, 6d.; 4 watts, 1/-; 8 watts, 1/6; 15 watts, 2/-; 25 watts, 2/6 each.
Reliable **MORSE KEYS** with Morse Code engraved on bakelite base, 2/- each.
Bakelite case **BUZZERS**, 1/6; Walnut case "Loud-tone," 2/6 each.
Super Quality lightweight **HEADPHONES**, 3/9 pair.

HAVE YOU HAD OUR LATEST GIANT ILLUSTRATED CATALOGUE AND VALVE LIST? IF NOT, SEND 4d. IN STAMPS FOR THIS AMAZING LIST OF BARGAINS!

RADIO CLEARANCE

63, HIGH HOLBORN, W.C.1.

TEL.: HOLBORN 4631.

8-VALVE A.C. MAINS SUPERHET RECEIVER, by well-known manufacture, incorporating many refinements. Visual Tuning, Illuminated colour coded Volume Control, in Local Distance Switch, etc., fitted in Handsome Bird's Eye Maple Cabinet, size 16" Wide, 12" Deep and 23" High, comprising the following Valves: AC/VP1, FC4, AC/VP1, AC/VP1, AC/HLDD, V914, AC 2 Pen, iW3. Pre H.F. Stage, 2 I.F. Stages, full A.V.C., etc. Limited quantity, **£7 15s.**

EXCLUSIVE BRITISH RIGHTS HELD BY US FOR CONSTRUCTRAD SHORT-WAVE KITS; all Kits supplied, Valves free, 5 Interchangeable coils, covering a range from 15-600 metres; complete set, not a converter.

ONE-VALVE BATTERY KIT, 27/-.

TWO-VALVE BATTERY KIT, 31/-.

ONE-VALVE A.C./D.C. KIT, 35/-.

THREE-VALVE A.C./D.C. KIT, 47/-.

EVER READY 5-VALVE BATTERY SUPERHET; an up-to-the-minute modern Receiver fitted with 5 Ring Valves, etc., A.V.C., Provision for Extension Speaker, and Pick-up, Latest Square Type Dial, calibrated in Metres and Station Names. Listed 12 gns. Last few to clear, **£5 10s.** Carriage Paid.

BRYCE MAINS TRANSFORMERS AND CHOKES, standard for the season, finest made, British and Guaranteed.

250-0-250, 80 m.a., 2-0-2 volts, 2.5 amp, 2-0-2 volts, 4 amp, **8/6.**

350-0-350, 120 m.a., 2-0-2 volts, 2.5 amp, 2-0-2 volts, 4 amp, **10/6.**

350-0-350, 150 m.a., 2-0-2 volts, 2.5 amp, 2-0-2 volts, 4 amp, 2-0-2 volts, 2 amp, **12/6.**

500-0-500, 150 m.a., 2-0-2 volts, 2.5 amp, 2-0-2 volts, 6 amp, 2-0-2 volts, 2 amp, 2-0-2 volts, 2 amp, **17/6.**

H.T.8 TRANSFORMER, 250 volts, 60 m.a. 2-0-2 volts, 4 amp, **8/6.** Ditto with H.T.8 Metal Rectifier, **17/6**

All Transformers are fully shrouded.

BRYCE MAINS CHOKES.

40 m.a. 30 Hys., 500 Ohms, **4/6.**

60 m.a. 40 Hys., 500 Ohms, **6/-.**

150 m.a. 40 Hys., 200 Ohms, **10/6.**

250 m.a. 15 Hys., 200 Ohms, **21/-.**

60 m.a. 80 Hys., 2,500 Ohms for Speaker Replacement, etc., **6/-.**

LISSEN 126 K/C SUPERHET ASSEMBLY, comprising 3-Gang Coil Unit, fully screened (2 Band Pass Coils, 1 Oscillator), 2 I.F. Transformers, fully screened, 1 only 3-Gang semi-screened condenser with drive. **8/11.**

CENTRALAB VOLUME CONTROL, with Switch. 5,000, 10,000, 25,000, 50,000, **2/6** each.

LISSEN ALL-WAVE COILS, complete with Circuit, Switching, etc., sent out in Matched Pairs, covering 2 Short Bands, 1 Medium and 1 Long, **8/-.**

DITTO, Single Coils, **4/6.**

LISSEN 126 K/C IRON CORED OSCILLATOR COILS, screened, **1/-.**

ONE DOZEN PEAK METAL CASED CONDENSERS, Paper Type, all useful sizes. 0.0001 plus 0.0001, 0.1, 0.2, etc., **2/6** dozen.

8 mfd. 500 volt working. 550 volt Surge, heavy duty Electrolytic Condenser, by well-known manufacture, **2/11**

8 mfd. and 4 mfd. Electrolytics, 450 volt working, 500 volt Peak, **2/6.**

8 plus 8 Cardboard, Wire Ends, Electrolytics, 150 volt working, 500 volt Peak, **3/6.**

50 mfd. 12 volt working CONDENSERS. By well-known manufacture, **1/-.**

50 mfd. 50 volt working CONDENSERS. By well-known manufacture, **1/6.**

50 mfd. 25 volt working CONDENSERS. By well-known manufacture, **1/3.**

25 mfd. 50 volt working CONDENSERS. By well-known manufacture, **1/-.**

(Continued at top of column two)

(Continued from foot of column one)

8 plus 8 plus 4 Electrolytic CONDENSERS, Wire Ends, 450 volt working, **3/11.**

LARGE TYPE JENSEN, 2,500 Ohms Moving Coil Speaker, **7/6** each.

MULTI-PURPOSE VALVE, suitable for H.F. Pentode, listed 21/-. **3/6** each.

MIDGET 2-GANG 0.0005 CONDENSERS, fully screened, top trimmers, by well-known manufacture. **5/6.**

LISSEN CLASS B 1—1 HYPERNIK TRANSFORMERS, boxed, brand new, as from the makers, **2/6.**

Enquiries, 1½d. stamp if reply expected.

Hours of business 9 a.m. to 7 p.m.; Saturdays, 9 a.m. to 1 p.m.

All orders value 5/- and over Post Free; orders under 5/- must be accompanied by a reasonable amount for postage.

C.O.D. Orders under 5/- cannot be executed.

RADIO CLEARANCE

63, HIGH HOLBORN, W.C.1.

TEL.: HOLBORN 4631.

RECEIVERS, COMPONENTS AND ACCESSORIES

Surplus, Clearance or Secondhand, etc.

VAUXHALL.—Polar Midget 3-gang condensers, straight or superhet, 8/9; Polar full vision horizontal or Arcuate dial and drive, 5/-.

VAUXHALL.—Flat sheet aluminium, hard rolled 18 gauge, 12in. x 12in., 3/-; 18 x 18, 5/6; other sizes proportionate.

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

VAUXHALL.—Hivac valves, mains or battery, all types. Usual discounts from new prices.

VAUXHALL.—Volume controls, Erie, Colvern, Centralab, 2/-. With Switch, 3/-, 2,000 to 2 meg. Fitted knobs and terminals.

VAUXHALL.—T.C.C. electrolytic condensers, 8 mfd. and 4 mfd., 550 volt, 3/-; 500 volt, 2/6; 200 mfd., 10-volt, 2/6.

VAUXHALL.—T.C.C. condensers, tubular, non-inductive, 0.1 6d.; 50 mfd., 50v. working, 1/6; 50 mfd., 12v., 1/3; 0.05, 6d.; 0.002, 0.0002, 0.001, 0.0001, 4d. each.

VAUXHALL.—T.C.C. mica 0.002, 2,000 volt test, 1/-; 0.0001, 4d.; 0.001, 0.01, 1/-; 1 mfd. Mansbridge, 1/3; 2 mfd., 1/8.

VAUXHALL.—Resistances by well-known manufacturers, 1-watt type, 6d. each; all values.

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

VAUXHALL.—Clix valve holders, terminals, 5-pin, 7d.; 9-pin, 9d.; baseboard mounting, 5-pin, 4½d., 7-pin, 1/-.

VAUXHALL.—Pushback wire, four colours, 6 yds., 6d. 6BA screws or nuts, 4d. doz.

VAUXHALL UTILITIES, 163a, Strand, W.C.2. over Denny's, the Booksellers. Temple Bar 9338. Send postcard for lists free. Post paid 2/6 or over, or c.o.d.

FREE ADVICE BUREAU

COUPON

This coupon is available until January 2nd, 1937, and must be attached to all letters containing queries.

PRACTICAL AND AMATEUR WIRELESS, 26/12/36.

RECEIVERS, COMPONENTS AND ACCESSORIES

Surplus, Clearance or Secondhand, etc.

SOUTHERN RADIO'S Wireless Bargains; all goods guaranteed and sent post paid.

G.E.C. 3-valve Battery Sets, "Battery Compact Three," with 3 Osram valves, moving coil speaker in beautiful bakelite cabinet, brand new, in sealed cartons, fully guaranteed; 50/- each (list £5/10).

SPEAKERS—Celestion Soundex permanent magnet 10/-; Telsen permanent magnet, with 10-ratio transformer to suit any receiver, 12/6; Telsen loud speaker units, 2/6; all brand new and in sealed cartons.

COILS—Telsen, iron core, W349. Midget size, 4/-; Type W478 (twin), 9/- pair; W477 (triple), 16/- set; Type W476 (triple superhet selector and oscillator), 16/- set, all ganged coils complete on base with switch; Telsen I.F. transformer coils, W482, 5/-; Telsen dual range aerial coils, with aerial series condenser incorporated; W76, 4/-; Telsen aerial series condensers with shorting switch, 2/-; Telsen L.F. transformers, Type R.G.4 (4 to 1), 3/-; all brand new, in sealed cartons.

MICROPHONES—Ace (P.O.) microphones, complete with transformer, ready for use with any receiver, 4/6 each.

RESISTANCES.—Tru-ohm 1-watt, colour coded and marked, 36 assorted capacities on card; 6/- per card.

POTENTIAL Dividers.—Lissen wire wound, 3-section, 60-watt, 4,500 ohms, 3,000 ohms, and 2,000 ohms; 3-section, 5 watts, 20,000, 20,000 and 20,000 ohms; 2-section, 5 watt, 50,000 and 30,000 ohms; 1-section, 5 watt, 8,000 ohms, all at 1/3 each; brand new and guaranteed.

AMERICAN Valves.—A full range of valves for all American receivers; 6/- each.

HEADPHONES.—Lightweight headphones, double pole type, 4,000 ohms, each ear piece; 3/- pair.

REPAIRS.—Any type of receivers. American, British, etc., repaired by expert staff.

WE Have Purchased the Complete Component Stock of a Well-known Radio Dealer and Manufacturer, and we are offering the complete stock in parcel lots as under:—

5/- Parcel, containing components to the value of at least 20/-, comprising chokes, resistances, coils, switches, condensers, wire and circuits, 5/- per parcel.

10/- Parcel, containing components to value of at least 45/-, comprising variable condensers, screened chokes, switches, resistances, screened coils, wire, circuits, etc., etc.: 10/- per parcel.

ALL Articles Included in These Parcels are Brand New and Modern.

SOUTHERN RADIO.—Branches at 271-275, High Rd., Willesden Green, N.W.10; 46, Lisle St., London, W.C.2. All mail orders to 323, Euston Rd., London, N.W.1.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren Street Tube). 'Phone: Euston 3775.

HEADPHONES. Brown, G.E.C., B.T.H., Nesper, Sterling, Ericsson, Marconiphone, Telefunken, etc., from 2/6 pair. Postage 6d. List free. CRYSTAL SETS. Complete, Guaranteed, Burne-Jones, 5/6. Ditto, double circuit, 8/-. Large P.O. type, 10/-. Crystal detector. Complete parts, 1/-. Sensitive permanent detector, 1/6.—Post Radio, 183, Caledonian Road, London, N.1.

LOUDSPEAKER REPAIRS

REPAIRS to Moving Coil Speakers, Cones and Coils fitted or rewound. Fields altered. Prices Quoted including Eliminators, Loud-speakers Repaired, 4/-. LF. and Speech Transformers, 4/- post free. Trade invited. Guaranteed. Satisfaction. Prompt Service. Estimates Free. L.S. Repair Service, 5, Balham Grove, London, S.W.12. Battersea 1321.

Published every Wednesday by GEORGE NEWNES, LIMITED, 8-11, Southampton Street, Strand, London, W.C.2, and Printed in England by THE NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH, LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical and Amateur Wireless* can be sent to any part of the World, post free, for 17s. 8d. per annum; six months, 8s. 10d. Registered at the General Post Office as a newspaper and for the Canadian Magazine Post.