VOLTAGE and CURRENT TESTS

SEE PAGE 551

Practical and Amateur Wireless

AND PRACTICAL TELEVISION

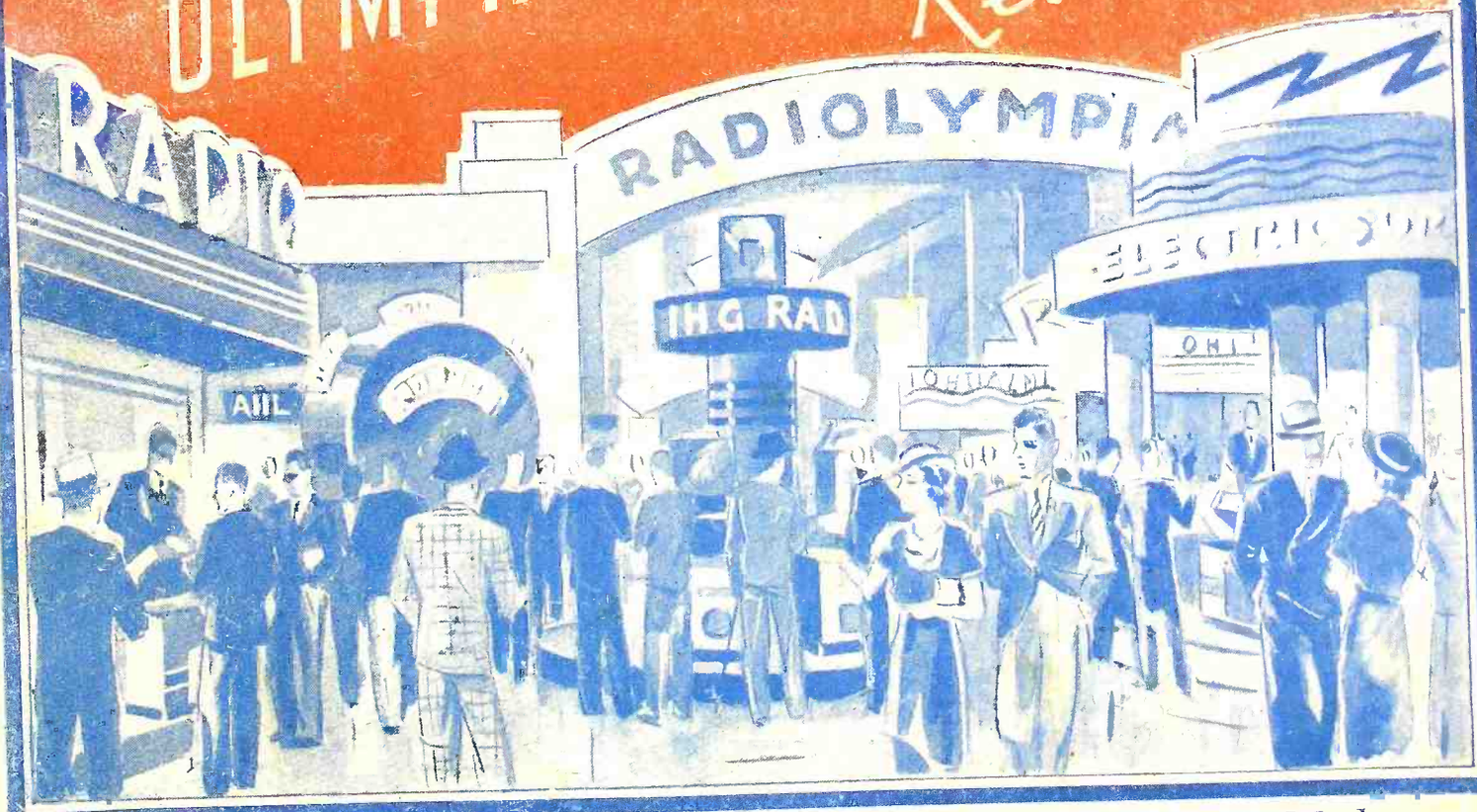
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Edited by F. J. CAMM

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Vol. 8. No. 204. August 15th, 1936.

Some OLYMPIA SECRETS Revealed



The First Novel of the Wireless Industry . . . A Modern Romance on a Blueprint Background—

STRAIGHT BLACK LINES

By FRANK BOYCE

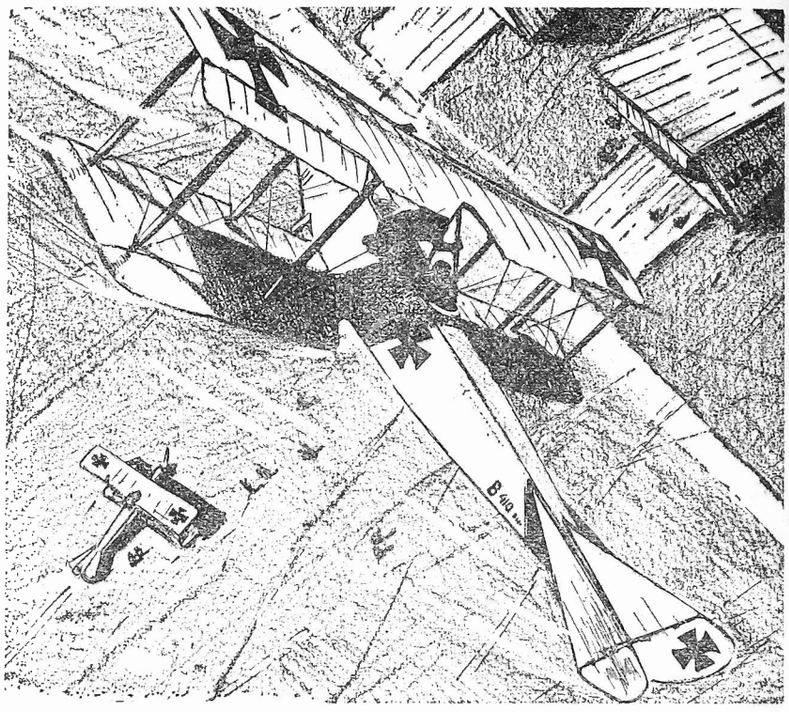
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Practical and Amateur Wireless

Edited by F. J. CAMM

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

VOL. VIII. No. 204. August 15th, 1936.

ROUND *the* WORLD *of* WIRELESS

VK6ME Australia

A FAVOURITE amongst short-wave listeners, this Australian station is being re-designed and rebuilt. A new transmitter is to be installed at Perth, and is now undergoing tests at Sydney. This link with the Dominions forms a very good receiver test for the simple short-wave receiver, and, no doubt, the new station will be even more reliable than the old one.

America Leads

THE latest returns from the International Broadcasting Union show that America still leads the way so far as the number of listeners is concerned. There are, of course, no official records from the U.S.A. owing to the fact that no licences are issued, but the official estimate gives the number as 25,632,000 receiving sets. Next to this total comes Great Britain with a total of 7,695,452 licences, followed closely by Germany with 7,599,252. The figures for France are 2,929,000, after which comes Japan, with 2,474,413.

Irish Broadcast Records

AN announcement has been made that the broadcasting authorities will in future make sound records of important events in Ireland, but that unlike standard types of record, these special recordings will play from the centre outwards. They will be made only of notable happenings in the country and will be stored in a special sound library at Radio Headquarters.

Automatic Tuning

THERE have been one or two suggestions for the automatic selection of a wireless programme, from the separate time-selector to the automatic-tuning indicator, but from California comes a new suggestion. The device is claimed to be capable of selecting as many as fourteen stations at five-minute intervals so that any number of separate items may be picked up automatically during the evening. As so far explained, the device consists of a roll of tape which may be "punched" by the listener, the punch marks coinciding with the times and stations which are required. This roll is then inserted into the receiver and passes through a selector which switches the set on or off and tunes to the pre-selected stations.

Liverpool Police Radio

FURTHER details have now been received concerning the police cycle radio mentioned in our issue dated August 1st. Our informant states that the 1924 Armstrong super-regenerative circuit is employed so that the noisy background which is heard when no signal is received will enable the policeman to know that the set is still working. This device obviates the use of expensive relays and enables the officer to be released from the task of switching on and off and remaining otherwise alert for signals. The carrier from H.Q. biases the first valve sufficiently to cut out the noises, and this gives the officer the necessary warning to enable him to record the message.

NEXT WEEK!

ADVANCE OLYMPIA SHOW REPORT

and

IMPORTANT ANNOUNCEMENT

concerning our

SPECIAL SHOW NUMBERS

Netherlands Indies Broadcasts

THE NIROM started broadcasting officially in the Netherlands Indies on March 31st, 1934, and now have twenty-two stations. Sixteen of them receive their programmes over telephone lines from the Batavian key station, and the remaining six broadcast local native programmes. The wavelengths used are all below 200 metres owing to unfavourable atmospheric conditions, and the power of the main Tandjong station is 10 kW.

Vatican's New QSL Card

THE card sent out by the Vatican to acknowledge reports of reception has been re-designed, and the new card shows two different views of the aerial system and the transmitting gear of the station.

Athlone's Increased Power

IT is hoped that the power of the Athlone transmitter will be increased from 60 to 100 kW by the end of September. This is, of course, the maximum power allowed by international agreement, and will enable the station to cover a much larger area.

A Demonstrometer

A MARCONI recording instrument was recently described in these pages, and a similar device has also been used recently in America. In the case of the American apparatus a thermometer-like chart was suspended in view of everyone, and a microphone in a parabolic collector picked up sounds from every part of the auditorium. The sounds were passed through an amplifier and caused a rise or fall in the "liquid" in the thermometer, and at the same time made a permanent record in the form of the standard graph.

Radiated Power

FROM America again comes news of an epoch-making invention, this time the wireless transmission of power. The invention is attributed to Nikola Tesla, the well-known inventor, but the full details of the invention are as yet unknown. One report of the invention states that the time is now not far distant when cars, trains and similar machinery will be able to operate by means of power picked up on microscopic aerials, micro waves being employed, and the received power being ample for such purposes.

"Wans"

"WANS," for those who are anxious, is almost an Irish equivalent of "ain folk." And when oul' besom man Mat Mulcaghey from County Tyrone comes to the microphone again on August 24th he will tell his crony, Sam Sweedlepipe, all about "Mulcaghey's Wans." However, listeners are not likely to take Mat as seriously as Sam Sweedlepipe does . . . but that is anticipating the programme.

THE PICK of the PROGRAMMES

Baseball in Lancashire

ONE of the most surprising developments in the world of sport this year has been the growth of baseball clubs in this country, and nowhere has this been more marked than in the North. Baseball has already received notice in the Northern programme, but on August 15th listeners will hear the first Northern running commentary on a baseball match. The match will be between Rochdale Greys and Oldham Greyhounds at Willbutts Lane, Rochdale, and the commentator will be E. Landless Turner, Secretary of the Manchester County Baseball Association.

"The Bunch of Roses"

DIANA MORGAN and Michael Sayer, who collaborated in the musical play "Bertie" last year, have written another musical show with a strong note of burlesque entitled "The Bunch of Roses." The play, which will be produced by Cyril Wood in the National and Western programmes on August 12th and repeated in the National programme on August 14th, is set in the West Country, and "The Bunch of Roses" is the name of an inn where a mixed collection of people gather, including commercial travellers, an inn-keeper, highway robbers, Surrealists, a detective and a young waitress. Two of the songs, "Roses" and "Midnight Magic," were recently broadcast in "Music Into Play."

A Welsh Religious Service

ELFED, the only surviving ex-Archdruid, will preach at a religious service in Welsh to be broadcast from Tabernacle Congregational Church, Fishguard, on the Sunday following the National Eisteddfod. The Rev. H. Elvet Lewis, who is the minister of King's Cross Church, is well known as a preacher, a hymn-writer, and a poet of no mean ability.

MAKE THESE DATES WITH YOUR RADIO

Spinnle Climbs His Monkey Puzzle

PEOPLE who are curious about their genealogy and have searched the records do not always return from their study with a glow of pride. That intrepid old gentleman, A. Spinnle Shanks, who broadcasts his experiences for the benefit of Scottish listeners on August 14th, is unlikely to be more fortunate than the rest of us. Indeed, there is a suggestion that his family tree is of the genus Monkey Puzzle. Both ascent and descent of the species are likely to be amusing to the rest of us.

Later in the evening an excerpt from Harry Kemp's Summer Show will be broadcast from the Barrfields Pavilion, Largs. Taking part are Dave Bruce, Elsie Prince, Percy Manchester, Jack E. Raymond, Ann Doel, The Saxon Girls and Harry Carmichael and his Band.

Hare Broth

HOWARD THE HARE, beloved by listeners to the Aberdeen Children's Hour, will offer another plate of Scotch Broth on August 15th. As may be expected when a hare turns cook, the ingredients are bound to be unusual. What Howard apparently does is to bring a collection of gramophone records to the boil and then—all this does not sound very palatable, but those who have already had servings of Scotch Broth will know that they are good.

SANDY POWELL AND PYE



Pye's latest release, battery portable type T.61, is here seen providing Sandy Powell with a little light entertainment in his dressing room. He is dressed for the rôle of coffee shop proprietor.

"Crowded Moments"

THE fourth of the series of impressions, entitled "Crowded Moments," will be broadcast from the Bridgwater Band Festival at Blake Gardens, Bridgwater, on August 15th (West Regional Programme). After hearing the Massed Bands play, listeners will hear Hedley Goodall introduce the Mayor of Bridgwater. This will be followed by a summary of the results by the adjudicator who will present the conductor of the winning band. The conductor will then conduct his band in the test piece.

"Wings Over Westralia"

"WINGS Over Westralia" is the dramatised story of the epic flight of two young German aviators in May, 1932, from Cologne to the North Coast of Australia. They got lost over the Timor Sea and landed some hundreds of miles away from their objective, which was Darwin. They were lost in the bush and very nearly died of starvation, but behaved with considerable fortitude. The action of the play consists largely of the search for them.

The author, Gordon Ireland, is an Australian, and Lance Sieveking has, in order to get the correct accents, cast the play entirely with authentic Australians with the exception of the two Germans themselves, who will be as nearly German as can be managed, the narrator, who will be English, an aboriginal and two Spanish Mission fathers, who will be cast in the usual way. It is hoped that the general dramatic effect of the whole story will be much enhanced by the freshness of the unfamiliar cadences and accents of the cast. It has been a very difficult matter to get hold of the requisite number of Australians, because most of those who have lived here any time have lost their Australian accent and so are rendered ineligible. The programme will be heard from the National on August 12th.

SOLVE THIS!

PROBLEM No. 204.

Cousens bought an eliminator for supplying H.T. to his S.G.3 receiver, but found that it was not provided with an S.G. screen tapping. What method should be adopted for supplying the screen? Three books will be awarded for the first three correct solutions opened. Address your letters to the Editor, PRACTICAL AND AMATEUR WIRELESS, George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes should be marked Problem No. 204 in the left-hand corner, and should be posted to reach this office not later than the first post Monday, August 17th, 1936.

Solution to Problem No. 203.

The grid-bias voltage applied to the power pentode would be approximately 9 volts, and as this would be excessive for the new economy type pentode signals would be weakened and quality of reproduction would deteriorate.

The following three readers successfully solved Problem No. 202, and books are accordingly being forwarded to them: John Surtees, 31, Spencer Street, Heaton, Newcastle-on-Tyne 6: H. Pegg, 146, Lawford Road, Rugby: P. G. Skane, Beverley, Royston Avenue, Prittlewell, Essex.

Concert Party

FROM the Jephson Gardens Pavilion at Leamington Spa a concert party entertainment by the Kit-Kat-Kits, presented by Bert Brownbill, will be relayed from the Midland on August 21st. This Company of seven bright young people was founded in 1931, and in that year began at Newquay, in Cornwall, a series of seaside engagements which has extended to many of the most noted resorts. Mr. Brownbill, who is comedian as well as producer, was for a long time with Julian Wylie productions. The soprano, Agnes Hirst, was at the Gaiety and Adelphi in London; Lena and Follie are dancers and duettists; Olaf Kossen is the light comedian and dancer; Leslie Childs is the entertainer, and Jack Lawton the pianist.

Violin and Pianoforte Recital

PAUL BEARD, who is to be the violinist for this recital on August 22, has recently been appointed to succeed Arthur Catterall as leader of the B.B.C. Orchestra. His grandfather was a Birmingham singer, his father a violinist and viola player. For several years he was leader of the City of Birmingham Orchestra. The pianist will be Margaret Ablethorpe, who is Midland Regional's accompanist.

Voltage and Current Tests

Some Notes on the Use of Meters for Fault-finding and Receiver Testing and Checking. By FRANK PRESTON

ALTHOUGH it is possible to locate the source of many forms of trouble without the use of instruments, the matter is generally simplified when a good multi-range meter is available. And since such an instrument, of quite good quality, can now be bought cheaply enough it is worth while for every constructor and

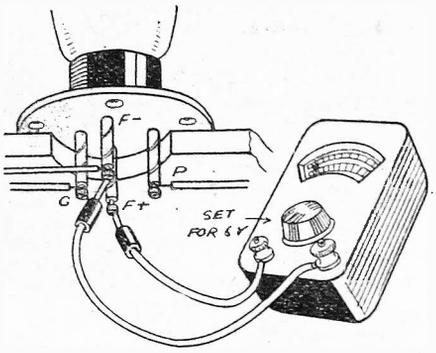


Fig. 1.—The filament voltage of each valve should be checked by connecting the voltmeter as shown here when the set is switched on.

experimenter to invest the few shillings required. Do not buy an unbranded meter—that might be worse than useless—although it is not necessary for normal tests to spend more than about two pounds, for which price a moving-coil unit with up to ten ranges can be obtained. It is, of course, possible to buy a meter for little more than half this price, but it could not be relied upon for any other than very rough checks. On the other hand, you can spend up to ten pounds for a high-grade unit with a guarantee of accuracy of about one per cent.; that price would not be justified, however, in the case of the usual home constructor.

High-resistance Voltmeter

See that the meter to be bought has a reasonably high resistance, because otherwise it cannot be accurate for many of the measurements which it will be required to make; a figure of about 500 ohms per volt for the voltage scales is reasonable. This means that the meter will not pass more than 2 mA when the voltage of, say, a high-tension battery is being taken. A cheap, low-resistance meter might take as much as 20 mA, with the result that the voltage registered might be appreciably less than that of the battery. Additionally, the meter would soon run down the battery if used frequently. The milliampere portion should have a low resistance—and all reputable makes of moving-coil meter can be relied on in this respect.

Under "Load"

But even the best meter obtainable is useless if the owner does not know how to use it. Our correspondence shows that there are many readers who have bought a meter, or even who have made a multi-purpose one from details published in these pages, who have no idea how it should be employed for testing and checking. Let us deal with the principal readings which have to be taken when a set is being tested. First of all we want to know the voltages of the high- and low-tension supplies. It seems quite obvious that all that has to be done is to connect the two prods or leads of the meter to the positive and negative terminals respectively. If this were done without the set being switched on the readings would probably be entirely false: an H.T.

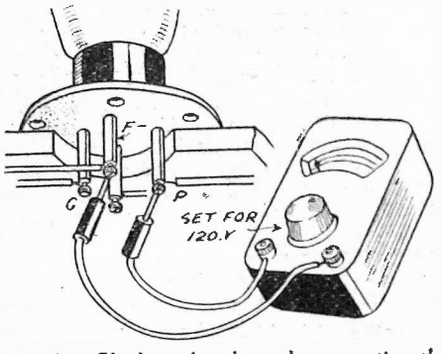


Fig. 2.—Check anode voltages by connecting the meter as shown here.

battery which was badly in need of replacement might show almost full voltage; a run-down accumulator might register 2

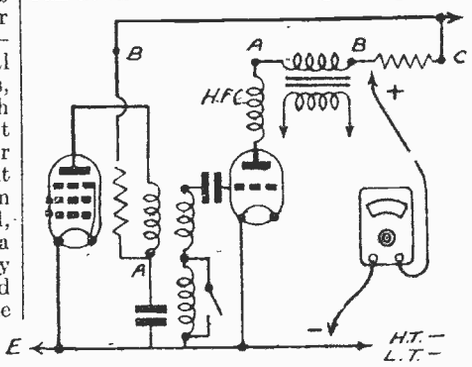


Fig. 3.—Besides testing for anode voltage, as shown in Fig. 2, it is often wise to test between earth and the points marked A, B and C in this skeleton circuit.

volts; and the voltage from a 150-volt eliminator might appear to be 250 or more.

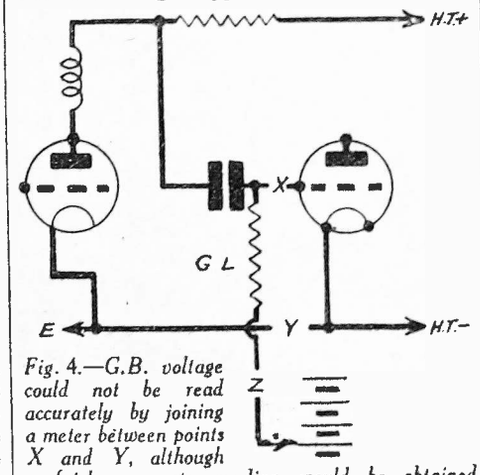


Fig. 4.—G.B. voltage could not be read accurately by joining a meter between points X and Y, although a fairly accurate reading would be obtained by connecting it to the points Y and Z. This assumes G.L. to be in good condition.

The reason is that the voltage varies according to the "load," and it is only under working conditions that a useful reading can be ensured.

L.T. and H.T. Voltages

After measuring the voltage at the input terminals to the set, apply the prods to the filament terminals of each valve holder in turn, as shown in Fig. 1. If the voltage at any pair of terminals is less than that at the input terminals either the switch is faulty or there is a bad connection in one of the leads. Next, after suitably adjusting the meter, measure the voltage between the anode terminal of each valve holder and earth, as in Fig. 2. In any case the reading will be rather less than the actual voltage, due to the increased load provided by the meter—which is in parallel with the valve—but the difference should not be great except in the case of a detector valve passing a very small current and having a high value of resistance in its anode circuit. If any valve does not appear to be receiving its correct voltage, make further tests at the points marked A, B and C in Fig. 3. (Two different circuits are given, one applying to an H.F. valve, and the other to a detector or L.F.) There should be a progressive increase in voltage when the positive prod is moved in turn to these points, although the difference might be negligible as between the two ends of the H.F. choke or primary winding of an H.F. transformer.

Should it be found that there is no indication of voltage between earth and, say, point A, although a reading is obtained by moving to B it will be evident that the component situated between these two points is defective. In the same way, if the voltage difference is very pronounced it might indicate that the component has a higher resistance than it should have.

G.B. Tests

It is not always easy to measure the grid-bias voltage which is being applied to the valve, for the reason shown in Fig. 4. If the meter were connected between the grid and filament of the valve it might be impossible to obtain a reading, whilst if one were obtained it would be considerably lower than it should be. This is due to the resistance of the transformer or grid leak which would be in series with the G.B. supply, and also due to the fact that the meter partly short-circuits the grid-filament

(Continued overleaf)

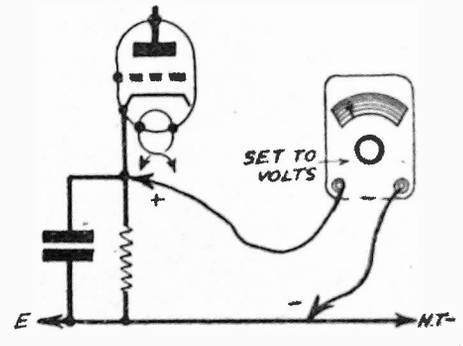


Fig 5.—A fair, though not quite accurate, test of G.B. voltage is possible as shown here.

(Continued from previous page)

circuit of the valve. One method of measurement is as shown in Fig. 4, where the meter is connected between earth and the G.B. negative lead to the transformer, grid leak or coil. The reading obtained even in these conditions might not be perfectly accurate when a variable G.B. voltage is being applied to an H.F. valve through a potentiometer, but if the voltage

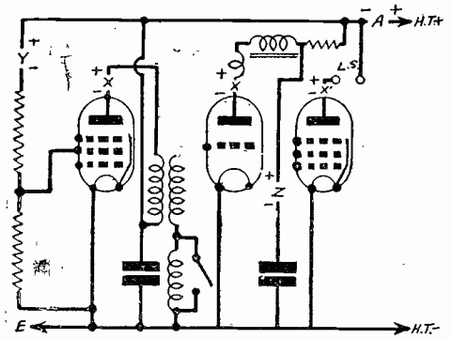


Fig. 6.—Total anode current should be checked by connecting at A and this compared with the sum of the readings at the three points marked. A leaky by-pass condenser can be checked by inserting the meter at Z and the current taken by an S.G. potentiometer by inserting the meter at Y.

varies smoothly as the potentiometer is operated it will be sufficient evidence that the circuit is operating correctly.

In the case of a mains receiver the difficulty is still greater, because the only really simple method of measurement is by connecting the meter between the ends of the bias resistance, as shown in Fig. 5. When this is done the meter is in parallel with the resistance, so that the effective value of the latter is reduced. Nevertheless, provided that the voltage is rather lower than that required, the test will be sufficient for most purposes. The absence of a voltage reading would show that the resistance was either short-circuited by a defective by-pass condenser or open-circuited due to the component being faulty.

Anode Current

The anode current passed by all the valves together, and also by each individually, should be checked and a comparison made. That is, if the meter reads 20 mA when connected as shown at A in Fig. 6, and only 3, 1, and 9 mA when inserted at the points marked X, it will be clear that there is a partial short-circuit somewhere. Before concluding that some component or connection is faulty, however, make quite sure that a screening-grid potentiometer is not used, or if it is that this does not account for the extra 7 mA, by inserting the meter at the point marked Y in Fig. 6. In making this test, see that the variable-mu volume control (where fitted) is set to the same point during the taking of all measurements. Incidentally, the best method of measuring the current to each valve is by using a split-anode adapter, as shown in Fig. 7, and by connecting a .1-mfd. fixed condenser in parallel with the meter, as shown; this is to prevent self-oscillation which might otherwise arise due to the resistance of the meter.

When any component such as a by-pass condenser is suspected of being faulty so that it passes current, an easy check can be made by inserting the milliammeter at the point marked Z in Fig. 6. There should be no reading in this case; if there is the condenser must be at fault, unless there is a partial short-circuit between two leads joined to it.

Caution

A warning should be given that the receiver should be switched off every time the meter is to be changed from one point to another. Additionally, it should be made quite certain that the meter is properly attached, and that there are no bare leads or loose wires which might come adrift. Lack of caution in this respect might result in the battery or the valves being permanently damaged. Still more care should be taken where a mains receiver is concerned, because a short-circuit might "blow" a main fuse, and accidentally touching an H.T. point might result in a

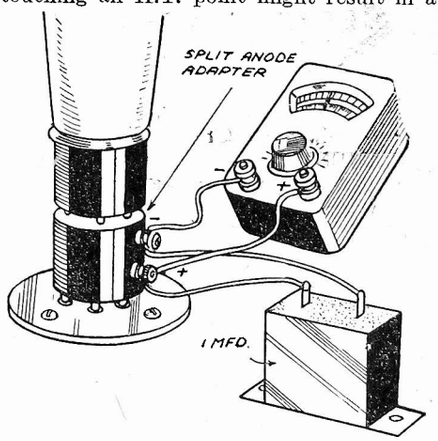


Fig. 7.—This shows how a split-anode adapter can be used to measure the anode current in any valve.

severe shock. Remember that it is not always sufficient to switch off the set, because fixed condensers might store quite enough current to give a nasty "kick" if the terminals are touched. To be on the safe side it is well to short-circuit each large-capacity condenser after switching off and before connecting the meter. This can be done by holding a small screwdriver by the wooden handle and simultaneously touching the two terminals with the bare blade; no need to be alarmed if a fat spark is seen when the terminals are bridged.

AUTUMN PROMENADE CONCERTS

IT is announced by the B.B.C. that new English works will be performed for the first time during the present season of Promenade concerts, which began at Queen's Hall on Saturday, August 8th.

On August 13th, there will be a first concert performance of "Salute to Gustav Holst," by John Greenwood, who is well known as the composer of the music for the films "Man of Aran" and "The Constant Nymph." Then on August 29th comes a first performance in its orchestral dress of John Ireland's "Overture," originally written for Brass Band. The theme is a musical version of the word "Piccadilly," suggested to the composer on hearing a bus conductor calling out the word with varying intensity for the information of his passengers.

"Three Scottish Dances"

Ian Whyte, whose "Three Scottish Dances," conducted by the composer, will receive their first concert performance on August 31st, is the B.B.C. Director of Music in the Scottish Region. Professor Granville Bantock's new Comedy Overture "The Frogs" will be played for the first time on September 9th, the composer conducting. Apart from the fact that this Overture contains a brief allusion to Aristophanes (The Croaking Chorus), it might serve, in the words of the composer, as an introduction to any Greek play. It carries no special programme, and is a complete musical work in itself.

Five foreign composers will be represented by new works to be performed for the first time in a concert hall in England during the "Proms" season. One is a Russian (Vladimir Vogel); one a Hungarian (Ernst von Dohnanyi); one a Finn (Jan Sibelius); one a Frenchman (Jacques Ibert); and one a Belgian (Armand Marsick).

Vogel's "Ritmica Ostinata," to be played on August 18th, was broadcast from a B.B.C. studio under Dr. Boult's direction in June of this year; but the "Proms" will see its first concert performance in England. It is one of three studies for orchestra, the other two "Ritmica Funebre" and "Ritmica Scherzosa" having been performed at the Oxford-London Festival of the International Society for Contemporary Music, in 1931. It is based on a marching song, and was originally composed for a Brass Band.

The "Minutes Symphoniques" by Dohnanyi (September 4), whose music is familiar in this country, were also broadcast last season, but have never previously been given in a concert hall in England. Nor has "The Ferryman's Bride" by Sibelius (September 10), although this is a comparatively early work, being his Opus 33. It is described as a "Ballad" for Mezzo-soprano and Orchestra, and is based on a Finnish legend.

"Concertino"

Jacques Ibert, composer of the "Concertino" for Saxophone and Orchestra (September 12th), is a contemporary of Milhaud and Honegger, and one of the best-known French composers of their generation. Like so many composers he was once a naval officer, but in 1919 he won the Prix de Rome for composition, and since then has written operas, ballets, concertos for 'cello and flute and much orchestral and chamber music. While in Rome at the Villa Medicis he composed music to Oscar Wilde's "Ballad of Reading Gaol." The Saxophone Concertino was first performed at the International Society for Contemporary Music in Barcelona last April.

Armand Marsick whose "Tableaux Grecs" will be performed on September 29th, is one of the leading figures in contemporary Belgian music, conductor of the Liège Symphony Orchestra, and Professor of Harmony at the Liège Conservatoire. Marsick was formerly Director of the Conservatoires of Athens and Bilbao, and is looked upon as the Ambassador of Belgian music abroad. His compositions include "Symphonic Poem, La Source," and three operas—"L'Anneau Nuptial," "Lara," and "La Jane."

A PAGE OF PRACTICAL HINTS

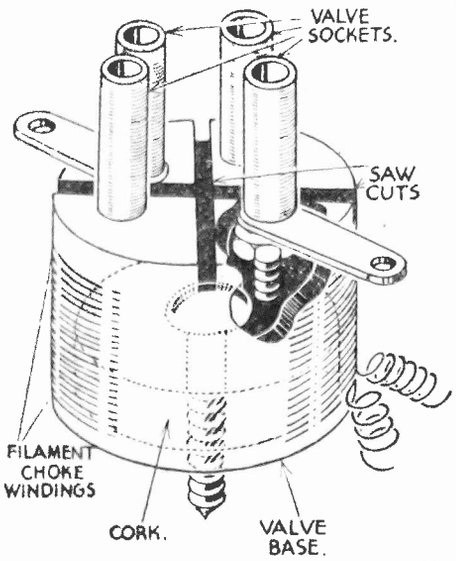
SUBMIT YOUR IDEA — READERS WRINKLES — THE HALF-GUINEA PAGE

Combined U.-S.-W. Valve-holder and Filament Choke

FILAMENT chokes improve the working of many ultra-short-wave circuits and are essential for some of those of the "long line" or lecher wire type. To be effective the chokes must be as close to the valve as possible.

An efficient combination of U.-S.-W. valve-holder and filament chokes can be made from a valve-base—one with parallel sides and of good material is required.

The pins are extracted and four valve sockets fitted in their place. The grid and plate sockets have a small strip of brass clamped or (preferably) soldered under them for the attachment of lecher wires or



An idea for a combined U.-S.-W. valve-holder and filament choke.

coils. Two deep saw-cuts are made at right angles to each other and between the sockets to interrupt the leakage path and reduce dielectric hysteresis.

The chokes themselves are wound in "bi-filar" manner—i.e. the two wires are wound together, side by side—about fifteen double turns are suitable for from 2½ to 10 metres. The top ends of the chokes are taken through a small hole drilled in the side of the valve-base, and of course soldered to the filament sockets. This holder may conveniently be mounted by being pressed on to a suitable cork screwed to the baseboard.

A further advantage of this arrangement is that the valve is kept away from the baseboard, and at a level suitable for the direct attachment of coils, etc.—R. H. McCRE (Balham).

A Valve-tester

I HAVE seen several valve-testers in PRACTICAL AND AMATEUR WIRELESS lately, but none of them will detect high-resistance inter-electrode shorts, which are serious in H.F. valves. I think this tester overcomes that difficulty.

THAT DODGE OF YOURS!

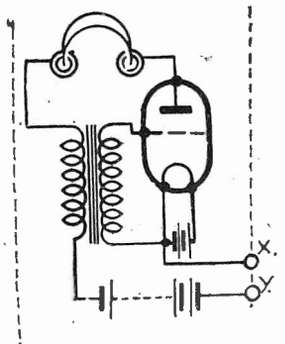
Every Reader of "PRACTICAL AND AMATEUR WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account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

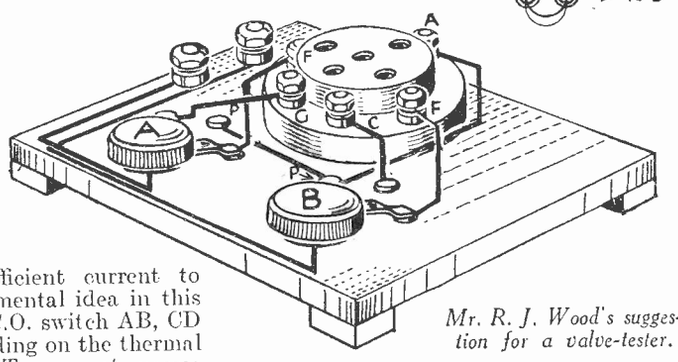
Should the note of the oscillator circuit not be heard when the switches are as shown, the filament is broken. Should it not be heard when the switches are at P, the tester is not functioning.—R. J. WOOD (Leigh-on-Sea).

An "Economy" Switch

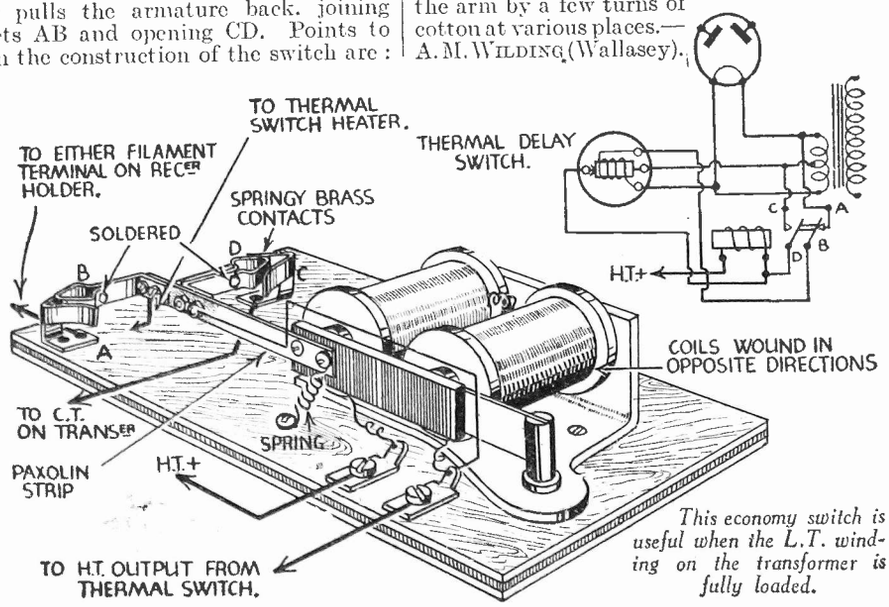
THIS switch will be of interest to many constructors using a high-voltage H.T. supply obtained from a directly-heated rectifier, and who would like to incorporate a thermal delay switch in their set but have not sufficient current to operate it. The fundamental idea in this switch is that the S.P.C.O. switch AB, CD cuts out the heater winding on the thermal switch as soon as H.T. current passes through the operating coil, at the same time shorting out the H.T. contacts of the switch and allowing the H.T. current to flow direct from the C.T. on the rectifier winding, *via* the operating coil, which keeps the contacts CD closed whilst the current is flowing through it.

When the set is switched off a weak spring pulls the armature back, joining contacts AB and opening CD. Points to note in the construction of the switch are: 1, The coils must be wound to include opposite polarity in the pole pieces; 2, The moving contacts B and D must not stick in the fixed contacts A and C; 3, The strength of the electro-magnet must be sufficient to overcome the spring, which must be able to pull back the armature. An old electric bell will do excellently but the coils must be rewound with about 3,000 turns on each; any gauge wire may be used, but the finer the wire is the less current it will carry and the greater its resistance. Also, a new arm must be fixed to the armature to carry the moving contacts, the leads from which should be attached to the arm by a few turns of cotton at various places.—A. M. WILDING (Wallasey).





Mr. R. J. Wood's suggestion for a valve-tester.



This economy switch is useful when the L.T. winding on the transformer is fully loaded.

2 new MAZDA BATTERY PENTODES

V.P. 210

A variable-mu screened H.F. Pentode for use in battery receivers.

The valve is specially constructed for use under conditions where freedom from microphonic noise is required.

The anode-grid capacity is only 0.004 mmfd.

RATING

Filament Volts	2.0	Filament Current	0.1
Max. Anode Volts	150	Max. Screen Volts	150
Mutual Conductance	1.4*		

*at E_a120v. E_s60v. E_g0

The bulb is metallised and fitted with a 7-pin standard base.

PEN. 231

A high slope output pentode for use in battery receivers with a self-biased circuit.

RATING

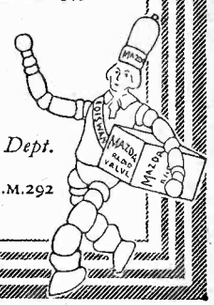
Filament Volts	2.0	Filament Current	0.3
Max. Anode Volts	150	Max. Screen Volts	150
Mutual Conductance	5.3*		

*at E_a100 E_s100 E_g0.

TYPICAL OPERATING CONDITIONS

Anode Volts	120	Screen Volts	120
Grid Bias	2.5	Anode Current	5.0
Optimum Load	19,000		

The valve is fitted with a standard 5-pin base.



EDISWAN

Full details of these valves and others in the MAZDA range can be obtained on application to the Technical Service Dept.
Mazda Radio Valves are manufactured in Great Britain for The British Thomson-Houston Co. Ltd., London and Rugby, and distributed by
THE EDISON SWAN ELECTRIC CO. LTD., 155 CHARING CROSS ROAD, LONDON, W.C.2 R.M.292

This is one of the famous Newnes Home Mechanic Books

HOUSE DECORATION AND PAINTING

There are those who think that to paint the garden gate all one has to do is to buy a pot of paint and a brush. Only when they try do they find out how much more there is to it. Disasters that have befallen the unwary whitewashing ceilings would fill two volumes of *Punch*!

But there is no reason why one should not save time and money and develop a fascinating hobby in home decorating and painting with the help of this modern and practical little volume. Each section has been carefully thought out and arranged by an expert from the initial choice of colours to the mixing of the paints, from the buying of the brushes and other materials to the final application. It is expounded in the simplest and most detailed language, so that the merest novice should produce a workmanlike job.

The illustrations are not mere decorations but an essential amplification of the instructions of the text. The book is the most comprehensive on the subject at the modest price of 1/- and is a triumph of compact compilation. Each paragraph and section is clearly "indexed" for quick and easy reference.

Contents :

Painting Interior Woodwork : The Decoration of Ceilings : Relief Decorations for Walls and Ceilings : Stencilling in Decoration : Decorating a Bathroom : Painting a Kitchen : Painting a Front Door : Painting Ironwork : Painting the Outside of a House : Varnish and Varnishing, Graining : When and How to Use Enamel : Practical Methods of Distempering : Paperhanging on Walls and Ceilings

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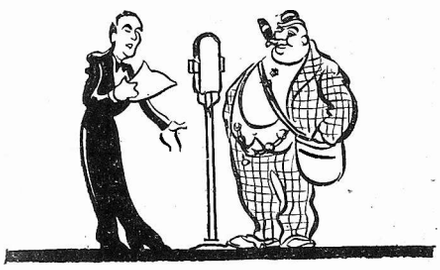
A HOME MECHANIC BOOK

On Your Wavelength

By Thermion

Is Our Radio Feeble?

A CORRESPONDENT who wishes to create a modern Tower of Babel says that the voice of Britain should be heard all over Europe. He thinks that the low power of our stations is ridiculous when compared with that of Russia, Germany, and France. The selectivity problem is sufficiently acute in England, he says, for us to give the foreigners a taste of their own medicine. This individual must live in a detached house surrounded by a moat. Like most other human beings, I have neighbours, some of whom like to operate sets with at least 5 watts output, so that I seldom have to use my own set. Most people with a good set are very proud of it, and like to let the neighbours hear how loud it is. If the B.B.C. increased the power of the stations this correspondent would be the first to complain of swamping,



Radioads.

and he would probably write a "snorter" to the B.B.C. asking them to buy him a new set.

Radioads

I NOTICE that a radio feature in a daily paper is headed "Daily Double." It deals with a couple of selected programmes which it recommends to the attention of its readers. Now I think the racing correspondents should retaliate by heading their dead cert. nap "Short Waves from the Course," or "Variety Programme at Epsom."

The boxing correspondent might head his page "Round the Dial," and the tennis correspondent "All for Love." The Rugger writer would write under a feature heading entitled "I've Got a Hunch."

Ber-lud and the B.B.C.

TOD SLAUGHTER likes a spot of melodrama when he treads the stage. Some few months ago, you will remember, he broadcast the "Crimes of Burke and Hare." At that time many nice people thought it was lacking in good taste to deal with the famous case of body snatching. Now it appears that when Tod Slaughter wished to give "East Lynne" the Empire producer demanded "horror," and suggested the "Crimes of Burke and Hare." Apparently there is still a public for the old style of melodrama in which the red blood flows, like "Maria Marten, or the Murder in the Red Barn."

Speakers and Speakers

PAYING a social call, recently, I was invited into a tastefully furnished lounge containing a large radiogram oozing decibels and phons. There were six or seven other guests present and there were three separate and lively conversations being carried on at the same time. The speakers had to shout in order to make their voices heard. No one paid the slightest attention to the radiogram. This ordeal lasted during the full period of my visit—some thirty minutes. I wanted to ask my host the reason, but I could not summon up the breath necessary for the stentorian bellow required to make myself heard.

Radio in Shanghai

I HAVE received the following most interesting letter from Mr. G. A. Kemp, of Shanghai:—

"I have often wanted to write to you, and now, as I am having my summer holidays, I am getting down to the task of writing you a long screed. Firstly, allow me to praise you for your article which appears each week under the title of 'On Your Wavelength.' I have been a regular subscriber to PRACTICAL AND AMATEUR WIRELESS for the last year or so and am of the opinion that it is one of the best papers on wireless that can be bought here. Contrasting it with other magazines, I find that it is vastly better than, for instance, the majority of the American magazines which nearly everyone here buys who is interested in wireless. Your paper costs me 40 cents a week, and the American papers are 1 dollar per month. And are they worth it?

"Coming to your article again, and not having had the pleasure of writing to you before, I might say that I wholly agree with you and what you say about crooners. In China, where stations broadcast records most of the time, we get crooners of every sort. How do you like Hawaiian music? Awful, isn't it? I'll tell you a whole heap about local broadcasting right now.

In Shanghai, about two years ago, there were ninety-eight broadcasting stations registered. About fifty of them operated every day at the same time. There were no laws about overlapping each other, nor about keeping to any set frequency. You can imagine what it was like. Most of the Chinese stations did not have their signals modulated at all, and their great aim was to get out the rowdiest signal



B.B.C. and Ber-lud.

they possibly could. Now it is better. There are only about thirty-seven stations on daily between 206 and 516 metres; there are seven European stations and the rest are Chinese. The strongest are only 1 kilowatters. You do not have to have such a thing as a licence here, although the Government tried to get people to register their receivers (and this was only partly successful), but stations are run on the American system of having sponsored programmes. As I said before, gramophone records are the mainstay, but there are also relays from the local dance-halls, from churches, and, very occasionally, from abroad. It is supposed to be compulsory for every station to relay the Nanking Government station between 8.30 and 9.35 at night, but there was a row about that. Many station owners said that this was the most important hour of the day for them, and if they complied with this order

no one would sponsor the hour and they would go broke pretty quick. The foreign stations did as they were told, with the exception of one which carried on in the same way as before, and said 'So what!' Nothing was done about it!

"If you are a short-wave enthusiast you may have heard some of the stations at Shanghai which are used for telephone work. There is a short-wave station at Nanking on approximately 31.6 metres. He is usually on about 12-14 hours G.M.T. Hong-Kong (ZCK) is on daily, but the times are somewhat bewildering. In G.M.T. they are as follows. Daily, 4.30-6.00. Mon., Wed., and Friday, 9.00-12.00. Tues., Thur., Sat., Sunday, 11.00-



Speakers and speakers.

3.00. Also on Sundays, 2.30-6.00. Wavelength 34.29 metres. Address: Post Office, Box 200, Hong-Kong.

"As regards sets and parts here, I impart the following. Receivers are about 95 per cent. American. There are many Japanese as well as Chinese sets on the market. A Japanese 5-valve superhet, all-mains, can be bought new for as little as 15 dollars, or at the present rate of exchange about 18 shillings. Hold that one! Then there are parts. English parts are expensive, but they are worth every cent of it. For instance, a Ferranti push-pull transformer costs 41 dollars. I bought an ordinary Japanese L.F. transformer for 45 cents.

"It works O.K., but I should be very interested to see this thing go through a test that our makes have to go through. Resistors can be got for 1d. Variable direct drive condensers for 5d. Soldering irons for 11d., mains transformers for 10s., 30-amp. accumulators for 2s. 6d., and coils can be made for 2½d. Some of the stuff is not to be laughed at, although it would not be of any use in a short-wave set. Recently I went down Peking Road (noted for its rows of second-hand shops) and came across a Polar .00025 mfd. condenser. It was absolutely new, and, knowing that they cost 8 dollars here, I asked the man how much he wanted for it. He said $2.50. I didn't wait long, but snaffled it up, knowing jolly well it would be years before a Polar was sold at that price again. Either the chap stole it from somewhere or else bought it at an auction (even new parts are sold for a mere song)."



S.W. Receivers

THE S.G. valve does not provide a very high degree of amplification below 100 metres, but the inclusion of an S.G. H.F. stage in a short-wave receiver is, nevertheless, an advantage. It smoothes the reaction control considerably and also improves the selectivity. In a set intended for short-wave reception only, it is, therefore, advisable to use a tuned aerial circuit followed by an S.G. H.F. valve coupled by a second tuned circuit to the detector valve. When the set is to be used for all-wave reception, however, the use of two tuned circuits complicates the switching and consequently introduces instability unless very great care is taken with the layout and wiring. The advantages of using a tuned aerial circuit are therefore counterbalanced by disadvantages. This does not mean that it is an impossibility to obtain optimum results from a receiver using two tuned stages for covering the short and broadcast bands, but experiments indicate that this type of receiver is difficult to design. With an aperiodic aerial circuit in use instability is not experienced and a certain amount of H.F. amplification is still obtainable.

Speaker Energising

MAINS-ENERGISED moving-coil speakers generally provide better results than a permanent-magnet type. This is due to the fact that the flux density in the gap is greater with the mains type if the correct value of energising current is used. The expensive permanent-magnet models have a very high density, of course, and compare favourably with the mains-energised type, but their price is rather more than most constructors care to expend. If D.C. mains are available a mains type speaker can be cheaply energised by connecting its field winding leads across the mains leads. Great care must be taken to choose a component having the correct field resistance to suit the mains voltage, however. When this is between 220 and 250 volts a field winding resistance of between 4,500 and 6,500 ohms should be chosen if the speaker is of the medium-priced 5-10 watt type. If a speaker having a resistance of 2,500 ohms is available, the winding may be connected in series with a 2,500 ohm 10 watt resistance.

Teacher Pays

WHERE wireless sets are installed in schools so that the scholars can "listen-in" to school broadcasts it is often the teachers themselves who pay for the set and its upkeep.

An investigation just completed by the Staffordshire County Association of the National Union of Teachers shows that only 81 out of 490 schools possessed wireless sets, and that in only five cases had the local education authority paid for the set.

"Teachers themselves," the investigators report, "have been largely



"Personally, I have neighbours."

responsible for the expense attached to the provision of a set either by using funds accumulated from some school activity, or by providing the money themselves, or by loaning the set to the school. In a few cases some interested person outside the immediate school organisation has provided a set."

No Funds for Repair

WITH regard to expenditure involved in maintenance of the sets, or in the purchase of a licence or of pamphlets, the local authority gave assistance only to half the schools where sets had been bought or lent.

A number of schools where sets had been installed by the teachers or through the efforts of scholars had been forced to discontinue broadcast talks, owing to lack of funds for repair or the provision of pamphlets.

The threat of the broadcast lesson to the teacher is largely discountenanced.

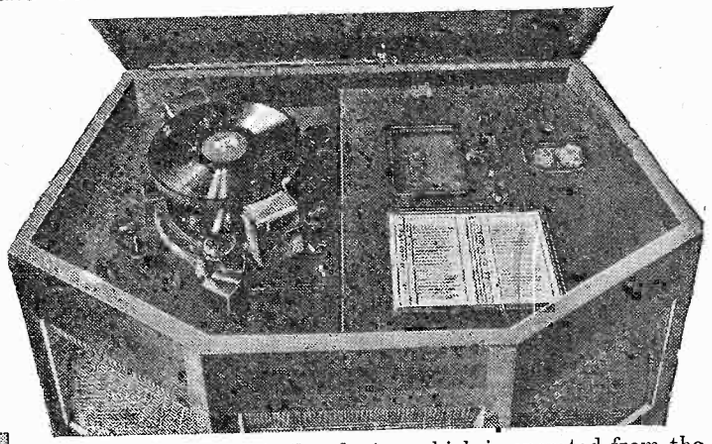
"School broadcasts," the report states, "require the active co-operation of the class teacher and they cannot displace his class-room work."

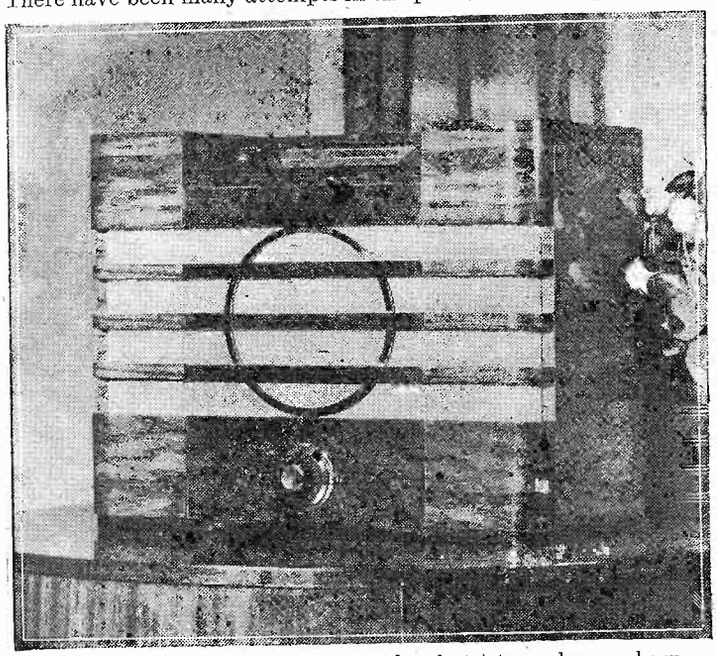
Mr. I. Badger, of Stourbridge, was chairman of the Inquiry Committee, and Mr. H. H. Cartwright, of Dudley, who is on the N.U.T. executive, was one of the members. Mr. Cartwright has taken an important part in the development of school broadcasts and is a member of the B.B.C. Central Council for School Broadcasting.

Some OLYMPIA Secrets Revealed

Although Full Details Have Not Yet Been Released by all the Manufacturers, One or Two Secrets Have Been Revealed by Certain Firms, and Some Details are Given Here

THE amateur and experimenter are already becoming Olympia conscious, and not many weeks now remain before the doors will be opened and the vast range of new season's goods will be on view. What will be the trend of design this year? What new lines shall we see developed for the home-constructor? Will television components be available for the home construction of television receivers? These are only a few of the many questions which constructors are now asking, and it is too early to answer them all. The information which has come to hand so far shows several interesting developments, and no doubt one of the most important is the perfection of the single-knob control. There have been many attempts in the past where a single knob is employed and the rotation of this knob turns the pointer with maximum speed (which is very fast indeed), but as soon as the user arrives at approximately the tuning point required, a slight backward movement is made and the drive is then through a reduction gear, which is again extremely slow. After a few turns the gear again picks up and movement may be carried out rapidly.





Above — the control panel of the H.M.V. receiver shown below. On the left, a new Philips receiver showing the new "Mono" knob control.

to reduce the number of controls, but generally the reduction simply consisted in the elimination of one or two controls which, whilst not essential were nevertheless of great value in obtaining maximum performance, or two or more controls were ganged together and operated by concentric knobs.

In the Philips receivers will be seen the latest in single-knob control, where only one knob is employed, but that knob controls tuning, volume, tone, and selectivity. The knob may aptly be referred to as a radio joy-stick, for it consists of a small knurled bakelite knob working in a universal ball-joint movement, and through the medium of bowden leads it actuates the various separate controls. The knob itself may be rotated, whilst the entire assembly is moved in the ball-and-socket joint, the rotation of the knob effecting the tuning, and the direction in which the knob is moved controlling the remaining effects.

Two-speed Tuning

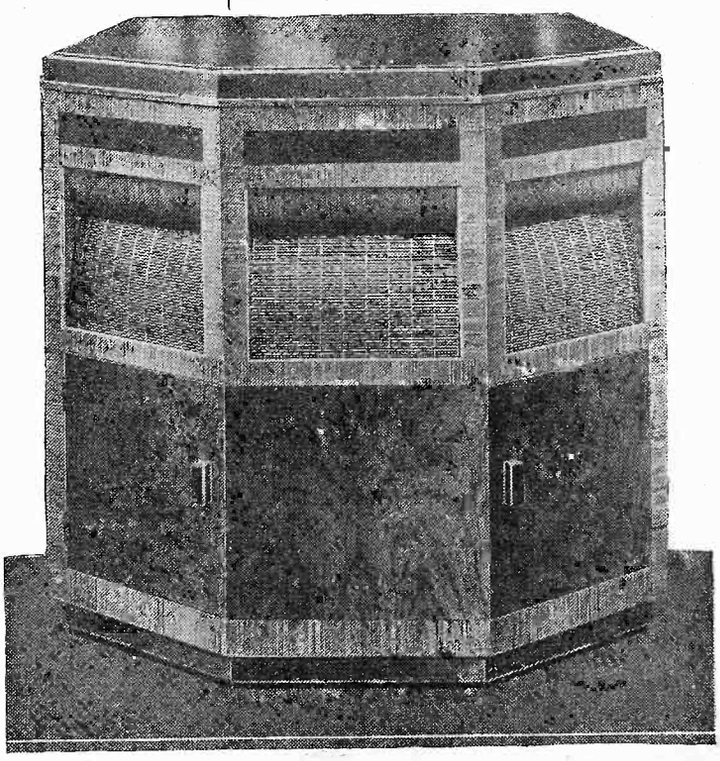
In the Philips receivers, too, will be seen a novel development of the two-speed drive,

Eliminating the Battery

The drawback of the battery user, namely, the continual replacement of the high-tension battery is now claimed to be removed entirely, by the adoption of the vibratory converter or some similar device, which is operated from the L.T. accumulator, and with very little extra drain on the supply will develop the necessary high-tension voltage. Messrs. Ekco have perfected the device, and it will be seen fitted to some of their battery receivers; how successfully we shall see later.

Good News for D.C. Users

The listener who only has D.C. mains facilities has, in the past, been forced to use the D.C. type of valve or use a Universal type receiver, but has had the limitation of the mains-supply voltage. Whilst this is, in the majority of cases, ample to provide good reception under all conditions, the user is debarred from obtaining the same high performance which is characterised by the better type of A.C. mains operated receivers. In these, of course, there is the advantage



On the right is the latest H.M.V. Auto-radiogram, employing three loud-speakers.

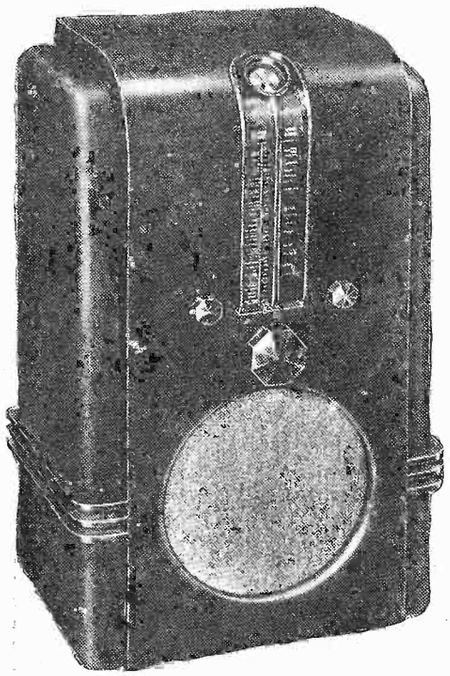
SOME OLYMPIA SECRETS REVEALED

(*Continued from previous page*)

of a very high voltage, obtained from a suitable input step-up transformer, and the valve types available are, in the main, more efficient. Philips have developed a converter which is now fitted as standard to all their D.C. mains receivers, and it converts the D.C. into A.C. and thus the receiver becomes, in effect, an A.C. set. The converter is built in the form of a unit so that it may easily be removed should the mains supply be changed.

New Constructor Components

Messrs. A. F. Bulgin, the well-known suppliers of component parts, announce that over seventy new items will be introduced this season. Full details of all of them are not yet revealed, but they will include clock-face tuning dials with double-ended pointers behind glass fronts, television



The "Electric Eye"—a novel tuning indicator fitted to an Ekco receiver.

apparatus, including a two-part control knob which is designed to prevent the user's fingers from coming into contact with high-voltage points. Other high-voltage protecting devices will take the form of a special top cap for rectifier valves, cathode-ray tube holders, etc.

In the Wearite range, many of the already popular components will be reduced in price, the reduction in some cases being very substantial. This, in conjunction with the recent reduction in the price of valves, will prove of great advantage to the home-constructor and will enable him to enjoy much greater benefits this winter from his hobby. Some new parts are also to be introduced to the Wearite range, and some details of these are given on another page in this issue.

Colvern Components

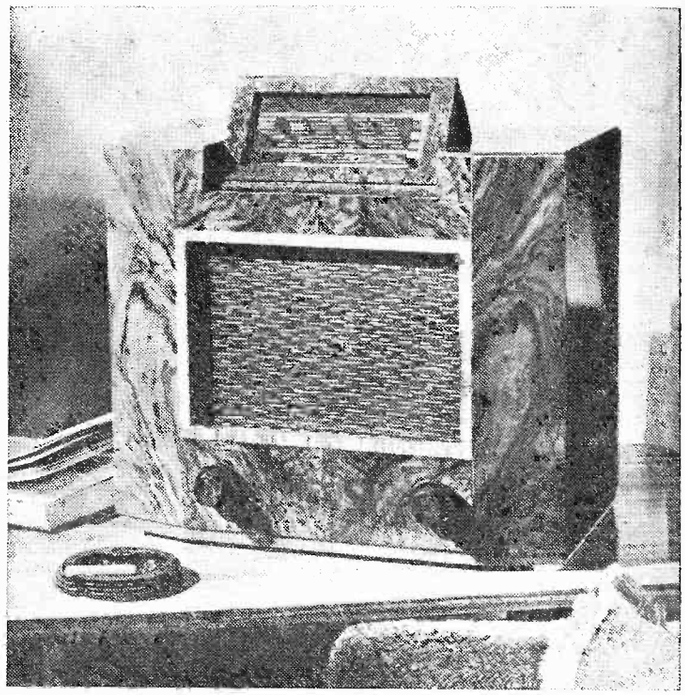
In addition to Colvern coils of the Ferrocart type, made in various combinations and also as complete tuning units (with the necessary variable condenser, etc.), Messrs. Colvern are introducing some potentiometers, strip resistances, short-wave coils and short-wave components. For the construction of multi-valve receivers some special aluminium screens for valves and coils are also to be introduced, and a special aerial, to be known as the "Selectanet Aerial," designed for indoor or outdoor use, will also be a new line.

Television Components

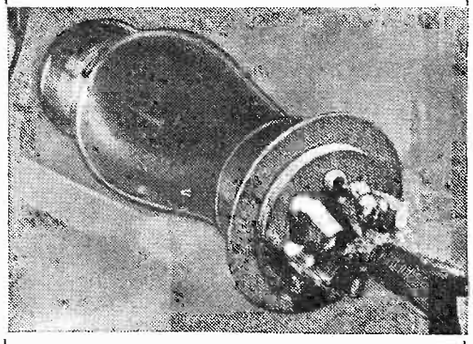
Television should soon be an accomplished fact, although the continued delays have proved very disappointing for the constructor and experimenter, as well as the general public. However, the possibility of building television receivers in the coming season has created a demand for special components, designed either for high-quality reception or for use in high-voltage circuits. The Bulgin components have already been mentioned, and in addition to these the Westinghouse Company are introducing two new rectifiers, types "H" and "J." They are designed for the supply of H.T. and G.B. for cathode-ray tubes and for the bias in a time base unit, and we understand that a typical power pack incorporating these devices will be exhibited at Olympia.

Messrs. Cossor are introducing some cathode-ray tubes for television purposes, and, in addition, some test equipment in which this type of apparatus forms the major part. They will include such items as a ganging oscillator and a portable oscillograph.

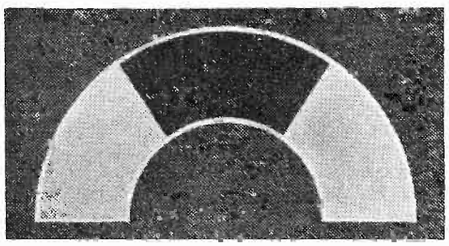
A new twelve-inch cathode-ray tube will also be introduced by Ediswan, in addition to the present 5in., 7in. and 10in. models.

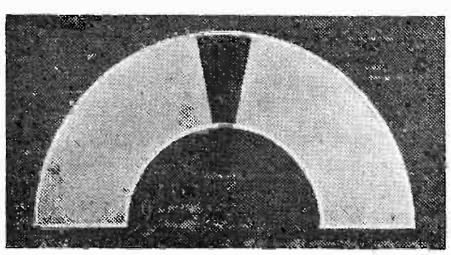


To enable the tuning indicator to be read easily the Philips receivers employ this type of adjustable scale. It may be raised and lowered to the most convenient position.



The tuning indicator fitted to the H.M.V. receivers is operated by the cathode-ray tube device shown above, and below is seen the actual indicator on the panel, showing the "in tune" and "off tune" indications.





A Portable Amplifier

Messrs. Heayberd, makers of the well-known mains apparatus, are this year introducing a portable amplifier, including speaker and microphone. This is a 6-watt unit, designed for connection to A.C. or D.C. mains without alteration. It is extremely compact and light in weight and is entirely self-contained, including a 20-yard length of mains cable. The input arrangements allow for the use either of a pick-up or microphone, and a single fader control is fitted, with a definite centre stop, and the only other controls are for volume and tone. In addition to this unit, Messrs. Heayberd will show some interesting developments of the well-known mains components, including transformers, chokes, condensers, etc.

Noise-free Aerials

Several firms are specialising in the production of aerial systems designed for the elimination of man-made static. These are now designed for use on all-wave receivers and are equally effective whether used on the short waves or on the long waveband. The Belling-Lee Eliminoise aerial system will be sold as a complete kit of parts for one receiver, without cable, for 35s. This particular arrangement is highly suitable for the feeding of a number of receivers, and from eight to ten receivers may be satisfactorily fed from it. Additional "Eliminoise" transformers may be obtained for each receiver for 17s. 6d., and the special cable is sold at 8d. per yard. With this device each receiver fed from the aerial may be tuned to a different wavelength without any inter-action between the separate receivers.

Practical Television

August 15th, 1936. Vol. 3. No. 15.

Not a Flat Face

SOME readers have asked why it is not possible to make the screen end of a cathode-ray tube a perfectly flat face. The prime reason for the slight curvature arises from the bulb shape which has to be adhered to in order to allow the finished tube to withstand the enormous stresses and strains which arise as a result of pumping the tube interior clear of all traces of gas. The whole bulb has to be specially shaped to prevent the glass cracking and so rendering the tube useless. Another point to note in this same connection, however, concerns the change of focus which would occur as the spot of light traced out the complete raster of lines with a flat faced screen. The beam of electrons emitted from the cathode is deflected in the final neck portion of the tube so that it has a combined horizontal and vertical motion. The beam is therefore "tied" to some extent at that portion, and if the screen face was not curved the length of the beam would alter as it moved from side to side. This would alter the focus of the spot and make each line fan out at the ends if the focus adjustment was made to be correct at the centre of the tube. This could be corrected either electrically or magnetically, but only introduces an additional complication in the initial setting up of the tube in the television receiver.

Terms and Definition

It is understood that the British Standards Institute is engaged on the question of finding satisfactory terms and definitions which can be applied to the science of television. This is especially important now that receiving equipment is coming into more common use, and if their recommendations are accepted it will do much to remove the confusion that at present exists among engineers, manufacturers and writers. For example, with cathode-ray tubes the electrode to which a high positive potential is applied for the purpose of accelerating the electrons in a stream towards the screen so that by their impact the screen at that point is rendered luminous, is referred to as the gun, the anode, the accelerator, etc. Again, the electrode to which is transferred the modulating signal whose characteristic is to be converted into terms of light is called Wehnelt cylinder, modulator, grid and so on. If at this early stage in television's development it is possible to secure unanimity in the industry insofar as terms and definitions are concerned it will eradicate much of the difficulty which was experienced under similar conditions with radio.

On the Programme Side

It is known that the programme and production side of the B.B.C.'s television staff have been in residence at the Alexandra Palace as from the early part of August. This may be the signal for the completion of the first section of the programme arrangements which have been in the planning process for some time. One important factor which needs careful study is the question of make-up and clothes. This is due to the colour sensitivity of the different types of scanners which will be employed, with the result that certain colours, particularly red, appear as white on the television screen showing the reproduced pictures. It is conceivable that in time this factor will be remedied, but at present precautions are necessary in order to counter the effect. It is certain that feature or interest items will figure largely in the programmes, especially when related to topical items. Furthermore, talks will take on an added interest, for the lecturer will be able to illustrate his remarks with models or sketches. This is rather reminiscent of several of the low-definition programmes. With the high-definition spot-light scanner which the B.B.C. will use, similar studio scenes will be enacted except that the scanner will be in a separate room with the "flying spot" projected through a suitably positioned window. It is understood that dancing, fashion parades, lessons in various forms of sport such as tennis, golf, cricket, etc., people in the news, physical exercises, and so on, will all be featured, this being quite distinct from the entertainment side in which films, cabaret shows, vaudeville and short playlets will be shown.

A Pioneer's Death

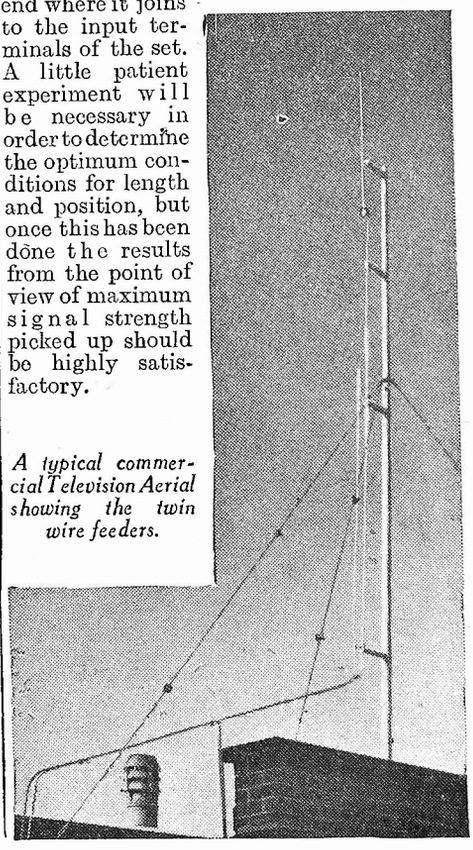
Nearly forty years ago Mr. Will Day gave public shows of the first animated pictures, as they were then called. A pioneer in the film world, he became interested also in the early television experiments and assisted Mr. Baird both financially and technically with his first experiments. Unfortunately, he withdrew his support before developments had materialised to a substantial stage, but lived long enough to see the birth of really high-quality television pictures which contrasted greatly with the postage stamp efforts of ten years ago. His recent death at the age of sixty-three removes yet another pioneer to whose efforts this country owes much for its technical progress in many directions.

Another German Effort

A few days ago the Telefunken Company staged an important demonstration at a Berlin Exhibition. This was a projection television receiver capable of reproducing pictures on a screen four feet wide by three feet high. The German standard of 180-line definition was employed, and the pictures were sufficiently large and bright to enable an audience of three-hundred people to watch in comfort. Good quality pictures were claimed to be obtained, but the distance of the nearest observer was twenty feet from the screen. Not only is this screen to be used for showing the public the television broadcasts from the Witzleben station, but the events televised from the big stadium at the Olympic Games were also shown on this same equipment.

Aerial Importance

Although no data is yet available concerning the field strength of the Alexandra Palace ultra-short-wave radio transmitter for the vision signals, it is known that this will vary very considerably over the area which can be regarded as the extent of the service. Within a few miles, the strength of the received signal is likely to be so high that a relatively inefficient aerial and feeder system will suffice for connecting to the set itself. Anyone situated near the border of the service area, however, is likely to have to pay more careful attention to his installation. Any loss of signal strength in the aerial equipment will be reflected in the quality of the reproduced picture, for instead of the signal to interference ratio being high the reverse will be the case. It is certain that quite efficient aerial systems will be designed and made available to purchasers or constructors of television sets, but if the installation is an amateur one certain precautions must be taken. Height above ground level is one factor coupled with the maximum distance from any source of interference such as the ignition systems of motor-cars on a main road. Whereas an inside aerial of approximately half the wavelength of the vision station connected direct to the aerial terminal of the set, or a simple doublet, may suffice for those close to the Alexandra Palace, an outside aerial would seem to be necessary in other cases. The mast itself, when possible, can be positioned on the house roof clear of obstruction. To the lower end of the aerial a two-wire feeder should be joined, but only one wire is connected electrically to the aerial end. The second one is left quite free and runs parallel to the feeder wire over the whole of its length. The distance between the wires must be kept approximately the same—about two inches is quite satisfactory—and to ensure a parallel run over the whole length it is necessary to insert insulating distance pieces at regular intervals. Keep this double feeder as clear as possible from buildings, and, furthermore, the feeder must be tuned, a process effected very simply by lengthening or shortening the feeder at the set end where it joins to the input terminals of the set. A little patient experiment will be necessary in order to determine the optimum conditions for length and position, but once this has been done the results from the point of view of maximum signal strength picked up should be highly satisfactory.



A typical commercial Television Aerial showing the twin wire feeders.

Bridge Measurements

A Bridge-measuring Device Enables Capacities, Resistances and Inductances to be Measured with a High Degree of Accuracy, and the Principle is Explained in this Article - - - By W. J. DELANEY

NO keen experimenter would think of carrying out any detailed experiments or tests without the use of some kind of measuring instrument, and in these days of low-priced test equipment every worth-while amateur has at least one type of meter. We have often described the construction of measuring devices in which the main item is a milliammeter, and this is employed in conjunction with resistors to enable various measurements

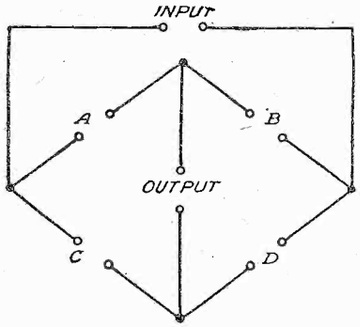


Fig. 1.—The fundamental arrangement of the bridge circuit.

and calculations to be made. But there is another type of measuring device which is very cheap to construct, and which enables some important tests to be carried out, and the results of the tests may be used to operate either a visual or an audible indicator. The basis of this type of device is the Wheatstone Bridge, but there are a number of modern modifications which are actually only elaborations of the device, introduced to simplify certain laboratory calculations, and they will not interest the ordinary amateur. In its simplest form the bridge will be found of the utmost simplicity to operate, and the basis of the arrangement is shown in Fig. 1.

How it Works

It will be seen that there are four arms, as they are called, represented by the points A, B, C and D. Across two of the arms is the input circuit, and across the other two there is the output circuit. The full theory concerning the currents present in these four arms and the method of working out the various values will not be dealt with in this article, but it will be sufficient to state that when the four arms are "balanced," and a voltage is applied to the input circuit, no current will flow in the output circuit. But the moment the arms are "unbalanced," a current will flow in this circuit, and this may be used to operate the indicating device.

Across the points A, B, C and D the known and the unknown components are connected, but if the instrument is to be used for very accurate measurements, reliable and tested comparators must be employed. The component for measurement is connected at point A, and the remaining components adjusted until the device is balanced, when the value of the unknown component is read off from the calibrated scales attached to the comparators, or otherwise calculated from the known values.

Input Devices

The input supply is known as the power source, and the output arrangement is known as the null indicator. From the latter term it will be obvious that when balanced nothing will be present at the output, although this ideal may not be reached by the home-made apparatus. For certain measurements special impedance matching transformers will be required in order that the power source and null indicators may be accurately matched, and these must obviously be well screened and prevented from affecting the balance of the arms.

A standard L.F. oscillator may be used at the input, a buzzer may be employed, or a simple dry battery, the exact source depending upon the component being measured. Such items as a beat-frequency oscillator will only be needed for valve tests and similar high-class arrangements.

Output Devices

For the output (when a D.C. input is employed) the simplest device is a galvanometer, but when an A.C. input is used,

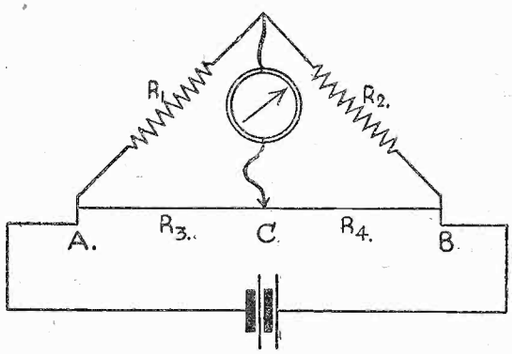


Fig. 2.—A simple bridge for resistance measurements in theoretical form.

a pair of ordinary headphones may be employed, connected through a suitable transformer, or the two output terminals may be joined to a valve amplifier to operate a loudspeaker or other powerful indicator. It will generally be found that headphones form the most reliable form of indicator because the ear is so sensitive to slight changes and to the differentiation between fundamental tones and their harmonics. A valve voltmeter may also be employed, but is not so sensitive.

Standards or Comparators

For standards by which the unknown components are measured, ordinary commercial components may be used, and the normal standard of accuracy of modern components will be found suitable for all ordinary purposes. Where a higher degree of accuracy is required the makers of resistors, condensers, etc., will supply components guaranteed to 1 per cent. plus or minus at a slight extra cost. The keen experimenter will obtain a few resistances of low values and build up a decade or similar box with a ten-point switch such as the Bulgin component reviewed last week, so that the required values may easily be ascertained. A high-class variable condenser with a 0 to 100 scale firmly attached to the spindle will serve for condenser measurements, and a suitable laboratory type instrument may be obtained at a very reasonable figure from Electradix Radios. This firm can also supply ex-Government resistance boxes which will enable various ranges to be obtained very simply.

Standard inductances are not so easy to obtain in the smaller ranges, but a series of small plug-in coils may be built, and the standard formulæ will enable the desired ranges to be obtained, although for this type of measurement it will generally be found that ordinary commercial components may be used, as exact inductances values are not usually required by the ordinary experimenter.

Accuracy

The accuracy of the bridge depends, of course, upon the accuracy of the standards which are used, and if the three arms, and the input and output circuits are so arranged that no interaction takes place a most efficient test instrument will be obtained.

A simple Bridge for resistance measurements is shown in Figs. 2 and 3, and the balance is obtained when R1 over R2 equals R3 over R4. A length of resistance wire is stretched between points A and B with a metre rule alongside. The values of the resistances R3 and R4 will be proportional to the points A C and C B and thus may easily be calculated. By inserting the unknown resistance between points R1 and G and a known resistance between G and R2 the value of the unknown resistance may be calculated from the formula mentioned above.

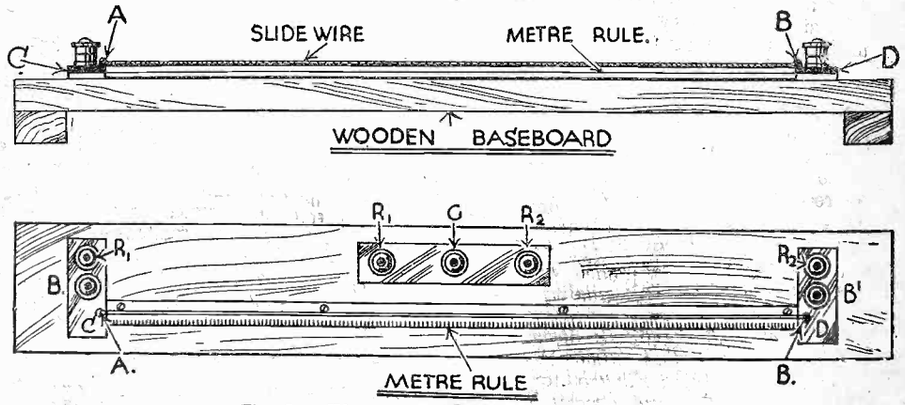
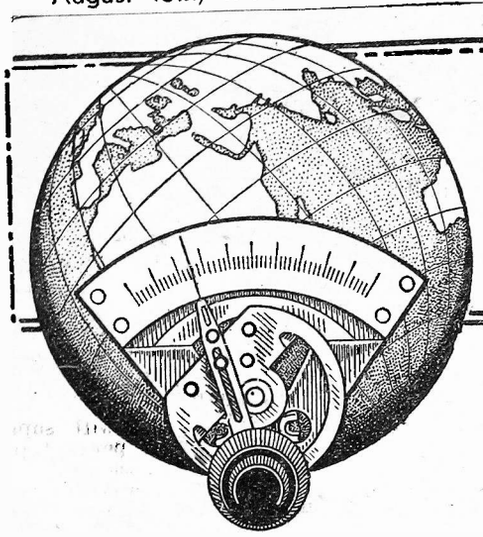


Fig. 3.—The practical arrangement of Fig. 2.



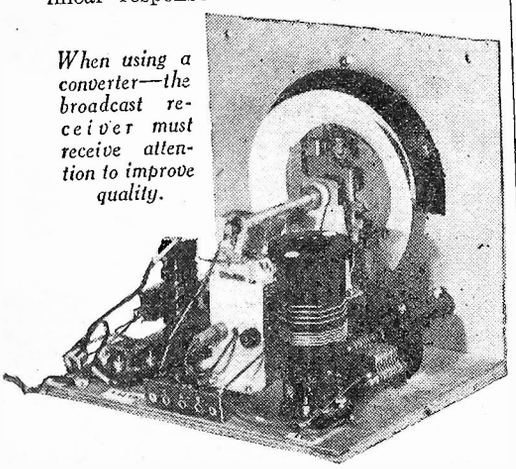
SHORT WAVE SECTION

Artificial Aids to Quality on the U.S. Waves—Part 1

This Article makes Special Reference to Ultra-Short-wave Reception Using a Home Set in Conjunction With an U.S.W. Adapter or Converter

By H. J. BARTON CHAPPLE, B.Sc.

IT is now generally understood by listeners that the average domestic receiver cannot reproduce programmes exactly as transmitted. This is due partly to the fact that in order to achieve the necessary degree of selectivity the sidebands have to be more or less severely cut, thus producing attenuation of the treble response, and partly because certain components, for example, loudspeakers, do not have a truly linear response to all frequencies in the audible range. It is also realised that in many receivers, mainly of the commercial type, these deficiencies are compensated for in a greater or less degree by "tone correctors," whereby the parts of the register which are below par are boosted, or those which are too prominent are toned down.



When using a converter—the broadcast receiver must receive attention to improve quality.

The normal problem, then, for the listener who wishes to doctor his set with the object of obtaining better reproduction, is to devise a form of synthetic quality on these lines, in order to undo some of the harm done by excessive selectivity and the lack of uniformity in audio-response in various parts of the set.

But, as has been explained in previous articles, the ultra-short-wave sound accompaniment to the television programmes will, in due course, provide opportunities for those possessing the necessary equipment to receive sound broadcasts under conditions which do not necessitate undue cutting of the sidebands in the cause of selectivity, and in consequence will offer great possibilities for real quality reproduction.

It is not really difficult to design and build a quality receiver when reception conditions do not impose the need for a high degree of selectivity, and success in this direction depends almost entirely upon correct proportioning of the circuits and the use of a really good speaker. No doubt, large numbers of enthusiasts will produce ultra-short-wave sets of this type during the coming season.

In General Terms

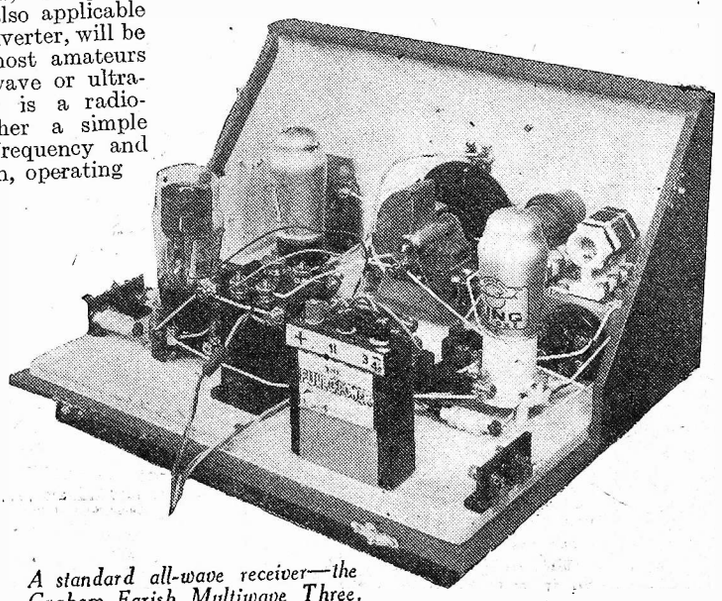
But for every amateur who builds a special ultra-short-wave quality set there will be many who, at first, will content themselves with an ultra-short-wave adaptor or converter connected on to the normal home set. This set may not be a quality receiver in the true sense of the word, but rather one designed to reproduce a reasonably large number of medium-wave and long-wave stations. It would be a great pity if such listeners were debarred from testing the joys of good quality reproduction as made possible by the ultra-short-waves, and it is therefore desirable to examine the question with a view to suggesting means whereby the home set can be adapted for quality reception in connection with an U.S.W. adaptor or converter. The number of different types of set is so great that explicit instructions which are of universal application cannot be given, but by discussing typical examples it will be possible to show the owner of any set of average type how he can approach the problem.

There are really two main types of problem to be discussed, the first being that confronting the listener who intends using an ultra-short-wave adaptor, and the second that which faces the user of a converter. The former, being the simpler, and being also applicable to the owner of a converter, will be tackled first. As most amateurs are aware, a short-wave or ultra-short-wave adaptor is a radio-frequency unit, either a simple detector or a high-frequency and detector combination, operating at short or ultra-short wavelengths, the output of which is intended to be applied to the detector output of a domestic radio set, so that only the low-frequency amplifying section of the domestic set is used for ultra-short-wave reproduction. Since the design of the ultra-short-wave unit is not within the scope of this article, it will be assumed that the adaptor to be used is such that the sidebands are not suppressed to a degree which will mar reproduction so that, other things being equal, the quality obtained will depend entirely upon the design of the L.F. side of the domestic set and upon the characteristics of the speaker.

On the L.F. Side

The problem, therefore, resolves itself into deciding what improvements the listener should make in the L.F. section of his receiver in order to permit it to take advantage of the quality possibilities of ultra-short waves. Generally speaking, the low-frequency stages of domestic receivers have little wrong with them from the point of view of design. The main point to consider is—does the set, as at present constituted, give really good quality on gramophone reproduction? If the answer is in the affirmative then apart from one or two small details the user should be content. In the first place it is necessary to disconnect any device, such as needle scratch filter which may have been embodied in the L.F. side, as the presence of this will deprive reproduction of part of the all-important upper register. Then, if a tone control, consisting of a condenser and variable resistor is connected across the output, this should be turned to full "brilliant," i.e., with the resistance portion all "out." It is not wise to remove this control entirely, as the presence of the condenser is a safeguard against high voltage surges in the pentode circuit in the

(*Continued overleaf*)



A standard all-wave receiver—the Graham Farish Multiwave Three.

SHORT WAVE SECTION

(*Continued from previous page*)

event of the speaker being inadvertently disconnected. Another point which would militate against good quality is small output, and this applies more particularly to battery sets where economy in H.T. supply is important.

In this connection, it would be a good plan to replace an ordinary power triode or pentode with one of the new high-sensitivity pentodes which, while giving a much greater output for a given signal, are particularly economical. In any case, for quality reception it is recommended that the H.T. voltage to the output be raised to the maximum rating of the valve, making sure that the grid-bias is adjusted to suit, and to be fairly liberal in the matter of anode current. Remember that this not only improves the quality of the output, but that most speakers give better reproduction on fairly large outputs than when starved of operating power.

The Speaker

This brings us to the speaker itself, and whatever adjustments are made to the set itself the final result is often limited to the performance characteristics of the speaker. The average small speaker built into the cabinet of a receiver gives very little response above 5,000 cycles, while its cramped position usually means poor bass reproduction and the substitution of true bass by box resonances. If a good quality speaker is available, connect it to the extension terminals of the set and mount it in a good baffle not less than three feet square or a properly-designed cabinet with narrow sides. If no extension circuit is fitted to the set, now is the time to arrange one, and when doing so it is as well to fit a switch to enable the internal speaker to be cut out of circuit.

If, however, in spite of these things, the L.F. side of your set is not really satisfactory, it is advisable to go over the circuit to see where improvements can be made. It may be assumed that a straightforward low-frequency amplifier, using good components of the correct values, introduces very little distortion. Without knowing what the actual circuit happens to be, full instructions cannot be given, but the following few hints may help. A small L.F. transformer, especially if of old type, should be resistance-fed. R.C. coupling should be checked to see that the anode resistance is of the correct value—say, three times the impedance of the previous valve. Try varying the value of the coupling condenser in such stages. In some commercial battery sets the L.F. stages are deliberately somewhat overbiased in order to reduce H.T. consumption, and the adjustments mentioned above will produce considerable improvement. Distortion is sometimes introduced by the presence of high-frequency currents in the L.F. side of the set, and an H.F. filter or a grid-stopper resistance between the detector and the output stage will probably make a lot of difference.

Finally, the best quality input and the best quality output will be spoiled if there are unwanted noises superimposed, and in the interest of quality any measures which you had promised yourself to apply to avoid electrical interference should be applied now, and in addition the receiver should be given an overhaul to discover any bad joints or other small defects liable to introduce noise.

(*To be concluded*)

Leaves from a Short-wave Log

WITH the Civil War raging in Spain, the possession of radio stations is a valuable asset to both parties, and much use is made of them. Tune in to the short waves after B.S.T. 21.00 and you will pick up one or two broadcasts on unfamiliar wavelengths over and above those to which we have been accustomed on the regular channels. On about 31 metres I have heard a news bulletin given out in English, Spanish and Portuguese, and from the announcement I gathered that the Radio Club of Tenerife (Las Palmas), previously working on 41.61 m., has adopted a more favourable wavelength. This station is on the air nightly at G.M.T. 23.00. If you want all the news every night—although, as you will see, you will get different versions of the same incidents—tune in Moscow (25 m.) CT1AA, Lisbon (31.09 m.), and EAQ, Madrid (30.43 m.). Both Moscow and Madrid give you English translations of their news bulletins, as does Tenerife.

Listeners now report the reception of broadcasts from Addis Ababa (Ethiopia). I doubt very much whether they are being picked up direct, although as the station is now in Italian hands and has been entirely reconstructed to give it a power of 10 kilowatts, there is always this possibility. Of the four transmitters, two have been converted for both radio telegraphy and telephony. You may care to note particulars—namely, ETA, 25.09 m. (11,955 kc/s) now IUC and ETA, 39.37 m. (7,620 kc/s), bearing the call-sign IUB. Tests have been recently made in both speech and music with a view to a relay of native entertainments for rebroadcast by Rome and other Italian medium-wave stations. Possibly they have been heard through IBR, San Paolo (Rome) on 20.89 m. (14,360 kc/s), 15 kw., which is the channel used for the wireless link. The call heard was "Addis Ababa per Radio San Paolo," and the tests were preceded by a series of notes on oscillating valves, a signal which is now being adopted by a number of commercial transmitters. One of this kidney which may puzzle you in the vicinity of 12RO Rome (25.4 m.) consists of four notes (G, B, D, G), and which repeated *ad lib.* may last some five or ten minutes before speech is picked up. It emanates from PPQ, Sepetiba (Brazil), on 25.71 m. (11,670 kc/s), working a radio-telephony service with Europe. A simultaneous transmission is made through PPU, on 15.58 m. (19,260 kc/s), where the same interval signal is heard. When calling, the woman operator informs you that it is RIO (de Janeiro).

Radio Podebrady (OLR) is on the air. If the name sounds mysterious, let me tell you that it is the Prague short-wave transmitter to which many references have been made during the past few months. The station is a 34-kilowatter capable of being boosted up to 56 kilowatts, and destined to relay the main Czech programmes for overseas listeners. So far tests of speech and gramophone records only have been carried out on 19.58 m. (15,320 kc/s); 25.54 m. (11,740 kc/s) and 49.06 m. (6,115 kc/s), but the station is also authorised to use 13.99 m. (21,450 kc/s), 19.70 m. (15,230 kc/s); 25.26 m. (11,875 kc/s); 25.51 m. (11,760 kc/s); and 31.57 m. (9,504 kc/s), so you may occasionally pick up trial broadcasts on these channels. The announcements are made in several languages, including English, and the quality of the transmissions is excellent.

Another newcomer recently logged is Batavia (Java), on 19.80 m. (15,150 kc/s); it is a transmitter owned and operated by the N.I.R.O.M., which runs the PMN and other regular Netherlands East Indies short-wave and medium-wave broadcasters.

From Geneva comes good news for both medium- and short-wave listeners, to the effect that the first all-world concert arranged by the U.I.R. will be furnished by the United States of America on September 20th at G.M.T. 21.00. It is to be a star programme to which both the N.B.C. and C.B.S. organisations jointly contribute. On this occasion, as an introductory note, I understand, European listeners will be given an opportunity of hearing the roar of the Niagara Falls. The entertainment which follows is to be relayed to a number of Old World stations.

In this connection, as regards the service for overseas listeners, it is interesting to learn that a new method of recording wireless programmes was recently demonstrated at Washington (U.S.A.). Although the system used is one which employs a species of sound-film, it is claimed by the inventors that an entire day's programme from a broadcasting station can be recorded on a reel the size of an ordinary spool of thread, and that the cost is an exceptionally low one.

BRITISH LONG-DISTANCE LISTENERS' CLUB

ENROLMENT FORM (*See announcement on page 563*).

I wish to enrol my name as member of the British Long-distance Listeners' Club, it being clearly understood that no financial obligation is thus incurred. I am interested in long-distance listening and have*/have not* a short-wave receiver at present in use. I am especially interested in {medium-wave*/short-wave*/ultra-short-wave*} listening.

Full Name (Block letters) .....

Address .....

.....

*Strike out words not needed.

Optional

Please forward me .....pads of 50 log-book sheets price 1s. 6d.

.....badge price 1/- each

.....pads of 50 verification forms price 1s. 6d.

for which I enclose {cheque/postal order} for £.....

The British Long-Distance Listeners' Club



This handsome Badge, in red, blue, and gold, may be obtained by Members for 1s. post free.

AN IMPORTANT ANNOUNCEMENT TO EVERY READER

In the interests of long-distance listening, and especially for the development of short-wave world-wide reception, we are taking over the British Long-distance Listeners' Club which was inaugurated by the Wireless Magazine. The following details concerning this club are given for the benefit of those new readers and others who are not already familiar with this great community of long-distance listeners, and all who find enjoyment and thrills in the searching out and reception of long-distance transmitters should join the club and take advantages of the many benefits which form part of the scheme.

THE purpose of the Club is solely to bring together all those listeners who specialise in the reception of stations situated in distant parts of the world. It is intended to form a community of kindred minds; and its aims are the encouragement of DX reception, mutual help, and comradeship.

The B.L.D.L.C. has no commercial aims. *Membership is free.* Members can, therefore, still belong to all other similar associations with similar aims without incurring any additional financial responsibilities through their membership of the B.L.D.L.C. In order to give members the opportunity of exchanging ideas, the services of the entire technical staff of PRACTICAL AND AMATEUR WIRELESS are placed at the service of every member. PRACTICAL AND AMATEUR WIRELESS, furthermore, will set aside in this periodical a special section in which, besides reports of reception, instructive articles, information, etc., the internal affairs of the Club will be discussed.

To enable listeners to make systematic records of their listening hours, the Club has had special log-book forms printed. These contain spaces for all details necessary for serious reception and will provide the listener in after years with a very valuable record. Furthermore, to aid Club members in the compilation of their verification reports and to enable comprehensive records of such reports to be kept, special forms have been designed for the purpose.

Useful Stationery

In addition to these two forms, the publishers are also issuing stationery which, like the log-book and verification report forms, can be obtained at a very low cost.

If you are keen on short-wave searching, or even if you only listen on the medium-wave band and are interested in the reception of long-distance stations, you should join the Long-distance Listeners' Club and take advantage of all its benefits. By wearing the neat badge you will be able to recognise other members, and this will afford its own introduction and enable you to discuss matters to your mutual advantage.

All readers interested should fill in immediately the application form on page 562 of this issue and post it to us. We would point out once again that membership of this Club is *entirely free.* Address your letters to:—

The Secretary,
British Long-distance
Listeners' Club,
8-11, Southampton
Street, London,
W.C.2.

Advantages of Membership

(1) No enrolment or membership fees.

(2) Organisation centred in **Great Britain.**

(3) Standardised log-books and verification sheets and badges available for members at reasonable prices.

(4) Regular report in "Practical and Amateur Wireless."

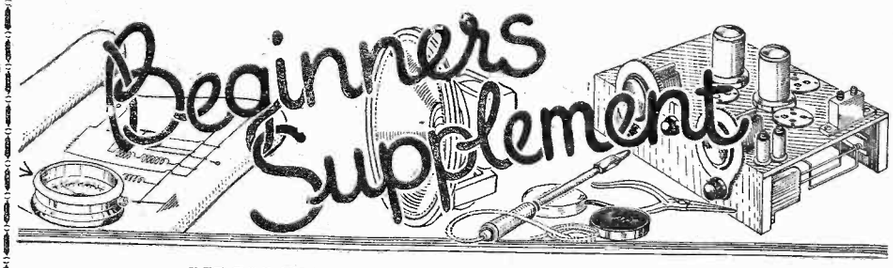
(5) Interchange of ideas with fellow members.

(6) Members in same district placed in touch with one another when desired.

(7) Special meetings and visits to be arranged.

(8) Regular problems for short-wave listeners.

(9) Members' competitions and numerous other advantages to be announced.



HIGH-FREQUENCY AMPLIFICATION

An Explanation of the Purpose of an H.F. Amplifier and of the Systems of Inter-valve Coupling.

IN dealing with low-frequency transformers last week it was explained that wireless valves are voltage-operated devices, their purpose being to increase the voltage of the signals received. In doing this, they amplify the signal. But whereas the low-frequency stages amplify the low-frequency voltage which

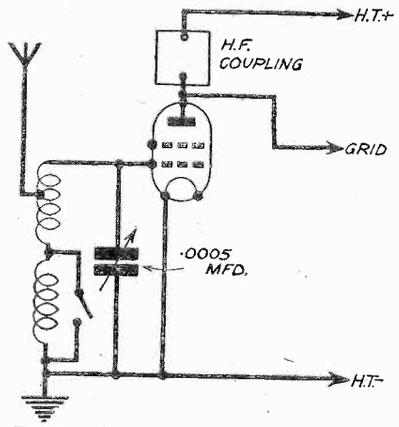


Fig. 1.—Diagrammatic circuit showing the H.F. coupling.

comprises the actual sound impulses, the H.F. stages amplify the combined low and high-frequency voltage in the form in which it strikes the receiving aerial. For present purposes it can be considered that the impulses "handled" by the H.F. valves are of high frequency only, since the low-frequency (or modulation component) is so completely and thoroughly mixed with the so-called carrier wave.

Extending the Range

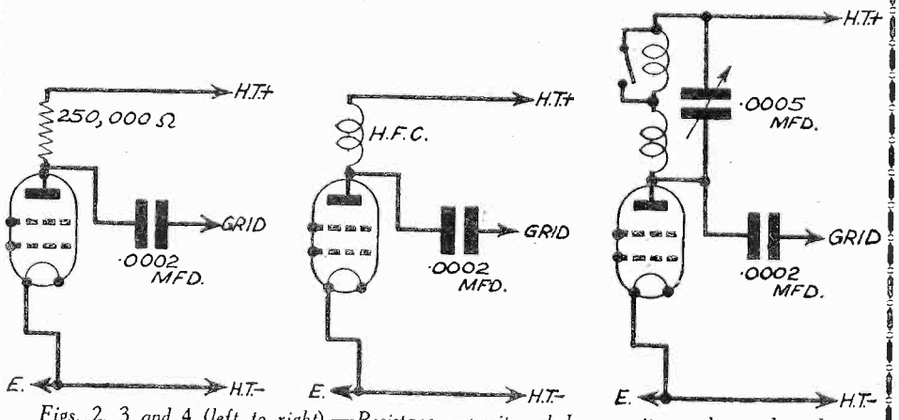
The L.F. section of the receiver serves to increase the volume of reproduction by magnifying the low-frequency voltage, but the H.F. amplifier does not necessarily provide greater volume, but increases the range of the set. The reason for this is that the detector cannot operate at full efficiency unless the signal voltages fed to it exceed a certain minimum figure. Thus, if the input to the detector were below that minimum, satisfactory reproduction could not be obtained however much low-frequency amplification were provided. It is for this reason that the high-frequency amplifier is so useful in extending the range of the receiver; it increases the strength of weak or distant signals to such an extent that they can allow the detector to function. Of course, in the case of signals which are above the minimum required by the detector and below the maximum "handling capacity" of the detector, H.F. amplification does provide a certain increase in signal strength. This is a point which is not always fully appreciated.

The Inter-valve Coupling

Let us consider the circuit arrangement of an H.F. amplifying valve, such as that shown in Fig. 1. It can be seen that a tuning circuit is connected between the aerial and earth, and that a lead from this is taken to the grid of the screen-grid valve shown. In the anode circuit of the valve is shown a simple rectangle, this representing the coupling between the first and second valves. Before dealing with the form which this coupling can take, let us consider its purpose. In the first place it must offer a very high impedance to the signal, because if it did not signal currents would simply pass through it, through the high-tension supply, and back to ear th being received, and is at a maximum only at one particular wavelength or frequency. It is for this reason that so-called aperiodic or untuned coupling is not very efficient, although it can be used with moderate success, especially when it is not required to apply reaction.

A Tuned Circuit

The tuned circuit, shown in Fig. 4, is theoretically ideal, because its impedance is practically constant at all wavelengths to which it is tuned. Moreover, the impedance of a high-frequency circuit is almost infinity to the frequency to which it is tuned. This is the basis of most high-frequency coupling circuits, although the actual connections shown in Fig 4 are modified in the practical arrangement. The most important alteration concerns the connections to the tuning condenser, which is joined between the anode of the valve and earth, instead of to H.T.+. By using these connections it is possible to employ a gang condenser of which all the moving vanes are earth connected. The alteration does not affect the behaviour of the tuned circuit in most cases because there is a complete circuit from the earth line through to the H.T.+ end of the tuned-anode coil by way of the high-tension supply. In many instances this circuit is made to have a still lower resistance due to the connection of a large-



Figs. 2, 3 and 4 (left to right).—Resistance-capacity, choke-capacity, and tuned-anode couplings.

In other words, they would be "lost" and would not be passed on to the second valve. The coupling must also provide another function—that of preventing the high-tension voltage from being applied to the grid of the following valve in the form of a very high bias voltage.

Forms of Coupling

The coupling can comprise a fixed resistance, an H.F. choke or a tuned circuit, as well as a condenser and grid leak as shown in Figs. 2, 3 and 4. It will be seen that all of these are very similar, but they produce different effects. In the first place, the resistance causes a pronounced voltage drop, especially if it has a sufficiently high value to provide a barrier to the H.F. currents, and, therefore, it is impracticable. The choke is much better, because it provides the required impedance to H.F. currents, whilst offering a resistance of only 100 ohms or so to the direct, or high-tension, current. But it is by no means perfect, due to the fact that its impedance varies according to the wavelength of the signal capacity fixed condenser between earth and H.T.+, as shown in Fig. 5.

Tuned Grid

A modification of the Fig. 5 circuit is shown in Fig. 6, where the choke coupling is combined with a tuning circuit joined between the grid of the following valve and earth. This arrangement is known as

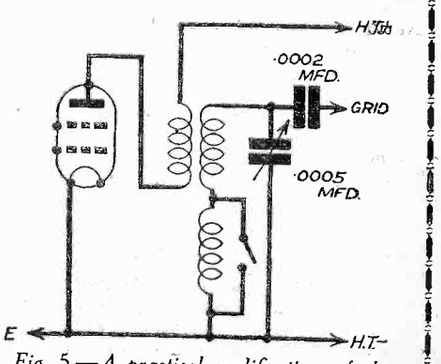


Fig. 5.—A practical modification of the tuned anode circuit shown in Fig. 4.

tuned-grid coupling, due to the fact that the tuning coil and condenser are actually in the grid circuit. The H.F. choke acts as a barrier to high-frequency currents, thus diverting them to the tuning circuit.

Theoretically, this method of coupling is not quite as efficient as the tuned-anode

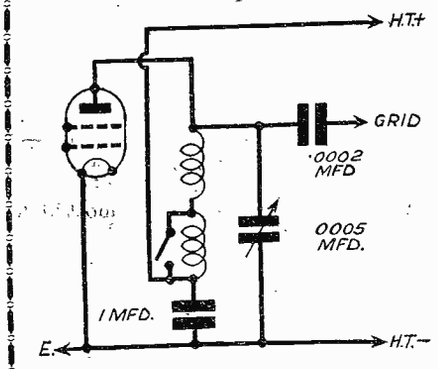


Fig. 6.—The popular tuned-grid circuit, which is a combination of the arrangements shown in Figs. 3 and 5.

system, but it has the practical advantage of being more stable; that is, unwanted oscillation is not as readily provoked. In this case it must be observed that when the following valve is a leaky-grid detector, two fixed condensers are required: one between the anode of the H.F. valve and the end of the tuning coil, and another between the coil and the grid of the detector

The High-Frequency Transformer

Another modification of the basic circuit is shown in Fig. 7. Here the choke and tuning coil are replaced by a double-wound coil, or high-frequency transformer. In many respects this behaves like the low-frequency transformer which was described last week, and the primary winding is included in the anode circuit of the valve. The secondary circuit is tuned by means of one section of the gang condenser and feeds into the grid of the following valve. It will be clear that by having a greater number of turns on the secondary than on the primary winding, a step-up effect would be produced. And since the secondary must be of such a size that it tunes to the wavelength of the signal being received, the number of turns is definitely regulated. Thus, the step-up effect must be secured by reducing the size of the primary. Because of this there is a limit to the degree of step-up which can be obtained, although by careful design a small extra degree of amplification can be obtained by using fewer turns on the primary than on the secondary winding. The difference in results which can be obtained in this manner is small, and there is little practical difference in efficiency between the amplification obtained when using tuned-grid, tuned-anode, or tuned-transformer coupling.

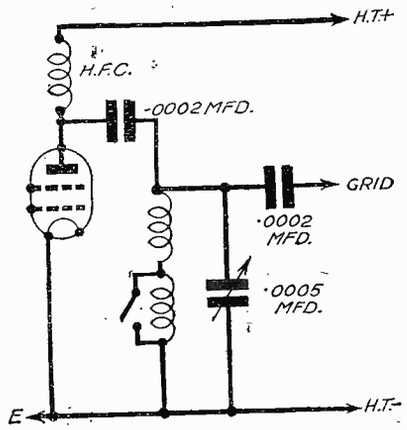


Fig. 7.—Tuned H.F. transformer coupling.

PROGRAMME NOTES

"Filmusic"

THE fifth in the series of six gramophone recitals featuring the best-known tunes from films of the past seven years will be broadcast on August 21st.

"The Tune You Heard"

MARTYN C. WEBSTER will present a programme under this title for the National programme on August 18th. It will consist of a selection of original tunes from recent Midland productions. The vocalists will be Marjery Wyn, Webster Booth and the Southern Sisters, with Reginald Burston conducting the Revue Orchestra. The Southern Sisters had their first broadcast in a Martyn Webster production from London.

Broadcast from the Zoo

IT is Scotland's turn on August 22nd to entertain all listeners to the Children's Hour in Scotland, England and Northern Ireland. A number of microphones will be set up in the Zoological Park, Corstorphine, Edinburgh, to receive the familiar voices and strange language of Sundra, the elephant; Meek and Mild, the hyenas; Susan, the seal; a regiment of penguins; the Ape Family, and a chorus from the lions' den.

Ulster Grand Prix

AS in past years, this thrilling race, which is the grand finale of the British Motor Cycle racing season, and one of the most important events in the calendar of sport, will form the subject of a broadcast commentary on August 22nd. The race is run over the famous Clady Circuit, which is 20½ miles in length, and must be covered twelve times by the 500 c.c. machines, eleven times by the 350 c.c's and ten times by the 250 c.c's.

From the start the course is slightly downhill and practically straight for six miles; then comes a right-angle bend at Thorn Cottage, followed by a left-and-right at Aldergrove. Three miles of fast bends lead to the most difficult corner on the course—at Greenmount, where riders enter an extremely narrow and somewhat rough road.

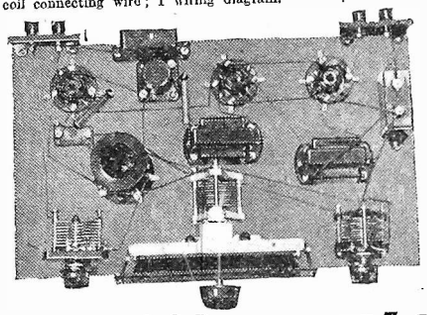
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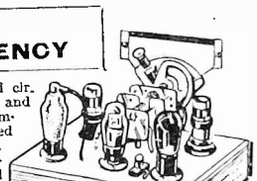
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Address .....

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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.

D. B. (Mill Hill). The receiver is of American origin and we do not know of any firm who can supply a blue print in this country.

J. H. (Marsh). Your earth connection is probably inefficient. Experiment with different earths in an endeavour to improve conditions.

A. W. (Slaithwaite). We cannot understand why you experienced the difficulty mentioned, unless you selected the wrong type of valve. You must make certain that the different makes of valve have exactly the same characteristics, and your guide in the particular case mentioned is the Mutual Conductance.

A. T. A. D. (Walmer). The valve is an obsolete type. At 150 volts on anode and screen and with 15 volts grid bias, the anode current is 14 mA and the screen current 2.7 mA. The A.C. power output is only 400 milliwatts, and the optimum load is 10,000 ohms. Is your 22D valve overloaded? This would account for the other trouble mentioned.

D. E. (No address). No, you should certainly include the Driver valve for best results. The circuit is otherwise quite in order.

G. H. (Norwich). We regret that we cannot follow your remarks, and should be glad to receive a wiring diagram or theoretical circuit, together with your complaints.

J. A. (Dublin). Any flex may be used, but the material usually fitted by the makers is made up of a metal foil interwoven with cotton threads. You should at least hear two stations on the set referred to, Dublin and Cork. Belfast and other stations may be heard under favourable conditions.

G. H. (Dorking). If the eliminator will deliver 30 mA it is suitable. A similar output would be required for the push-pull circuit mentioned.

D. G. B. (Berkhamsted). Generally speaking the device is not very efficient. If a good coil is obtained quite good results may be obtained provided that the required current is of a low order. Otherwise, a special induction coil must be used, and these are not obtainable. In the case referred to a special unit has been made for the purpose.

P. T. B. (Catford). We do not recommend the procedure outlined by you. The difficulties of running from one cell on the accumulator may be overcome by using a series resistance from the entire battery, or by using each cell in turn to level up the discharge rate.

J. McC. (Lurgan). The valve may be used and follows normal practice. The additional pins are for connection to the suppressor grid and the metallised surface, and these should be joined direct to earth.

R. C. (Belfast). The volume control may have a value of .25 or .5 megohms.

J. G. R. (Ipswich). We have no blueprints of such a receiver in a modern form. The four-valve midget published last week may prove suitable, or the Midget Class B Portable, Blueprint A.W. 389, which employs a class B stage, may prove suitable. The latter is not so compact as the latest receiver, but there is no blueprint for this particular set.

J. F. (Cardiff). We cannot suggest improvements for a commercial receiver, and if it proves unsuitable and is not up to specification, you should communicate with the makers.

F. G. S. (Rubery). We have several circuits of the type mentioned, but none with the particular condenser and coil named. You may be able to select a suitable circuit from our blueprint list and incorporate your own coils, but we cannot give you instructions for carrying out such modification.

D. O'C. (Twickenham). The coils used in the Leader Three were two Universal (Wearite) components, and the condenser was a double Nugang, Type A, made by Jackson Bros.

G. R. (King's Lynn). It is possible to use certain rectifiers in the manner outlined, but this is not in accordance with the recommendations of the I.E.E. The output from the set in question (when the output valve is fully loaded) is 3 watts.

E. G. C. (N.W.2). In view of your proximity to the London transmitters we suggest a superhet. As your present components would not then be suitable we advise you to dispose of the present receiver and obtain the new parts for a modern superhet such as the £4 Superhet, for either battery or mains operation.

J. A. (Gwernymynydd). The trouble is fairly common and is known as L.F. instability. A reversal of the connections to either the primary or secondary generally cures the trouble by making the two signals out of phase. It is, of course, better to prevent the trouble by correct design and operation than to cure it by this device.

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 West London Radio Society

AT the committee meeting held on July 24th it was decided that no further meetings should be held by the Society until a later date in August, as the attendance at such meetings would probably not be as good as it has been up till the end of July.

It was also agreed that in future more field days should be held on land than on the river, as they have been during June and July.

Any communication should be addressed to the hon. sec., H. A. Williamson, 22, Cambourne Avenue, West Ealing, W.13.

CATALOGUES RECEIVED

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

FERRANTI RADIO VALVES

THE latest copy of the Ferranti valve list, No. R.115, is just to hand. Twenty-seven pages (9in. by 6in.) are devoted to the various types issued by Ferranti, and in addition to the essential characteristics of the various types, typical circuits are given for every individual valve. Characteristic curves are included, and in the case of the output valves the dynamic characteristics are shown. The catalogue includes a diagram of base connections, table of pin connections, complete list of the valves and prices, and a table of valve equivalents. The catalogue may be obtained free on application either direct to Messrs. Ferranti or to us.

COSSOR RECEIVERS

BOOKLET B.30 has just been issued by Messrs. A. C. Cossor, and gives all details of the new range of receivers. These range from the popular Melody Maker, a battery three-valver at £5 19s. 6d., to Model 537, a console radiogram at 16 gns. There are table radiograms, superhets and straight sets in various cabinet types to suit all requirements, and sepia-toned illustrations of each model are given in the catalogue.

I.S.W. CLUB NEWS LETTER

THE International Short Wave Club, London Chapter, have sent us a copy of their monthly publication the News Letter. This gives various details of the forthcoming club features, late station news, and a short-wave review. The July issue contains an article on the Frequency Monitor, in the series "How to become an Amateur Transmitter." A copy of the News Letter will be sent to readers on application to the secretary, A. E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16, if they will enclose 1d. stamp.

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LETTERS FROM READERS



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

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

"Sound Recording for the Amateur"

SIR,—The article by L. Ormond Sparks on "Sound Recording for the Amateur" in the August 1st, 1936, issue must have been welcomed by many experimenters in this work, which in recent months has experienced a great revival of interest.

As one who is devoting much of his time to the subject, may I offer a few miscellaneous hints, and a correction of a slight error?

It is usual to make first test recordings on aluminium, or aluminium-alloy blanks, as they are cheap and easy to obtain, but it is advisable to cover the blanks with a lubricant. This can be, say, paraffin oil, shoe cream or a good wax polish, and a thin layer should be smeared over the blank before cutting. The object is to fill in the "pores" of the blank, thus making the surface more homogeneous and also reducing the frictional resistance to the recording stylus. In the article referred to one particular blank is recommended but, in addition, I would like to draw readers' attention to the "Simplat" blanks of the V.G. Manufacturing Co., Ltd., and a flexible type invented by Dr. C. G. Lemon. The former consist of a glass base, with a black surface coating of a gelatinous composition which, after cutting, is hardened and polished by fluids. The latter are made of a cellulose material, which is thin and transparent, and are softened, hardened and polished with fluids. These blanks are not yet marketed, but will shortly be available at an inexpensive price.

Another serious difficulty that will be met with is fluctuation in recording turntable speed; this trouble must be avoided as it will introduce objectionable "wows" into the reproduction. An electric motor with a high torque is necessary, and a suitable model just released is the Simpson Heavy Duty Electric Turntable, which is a synchronous type, priced at five guineas. Remember that a stroboscope, or stroboscopically marked turntable rim, when illuminated by a neon lamp working off A.C., will enable the speed constancy, or otherwise, to be checked.

Finally, regarding the error. On page 513, column 3, paragraph 3, line 6, the term "positive counterpart" should read "negative counterpart." This will be realised, as when the copper "master" is stripped off the recorded wax blank, which is positive, the grooves appear as ridges, or, one might say, in relief. The correct order in processing is as follows: recorded wax blank, or "filled blank" (+), copper "master" (—), series of copper "mothers" (+), and required number of stampers, working matrices or dies (—), and the pressed disc (+).—DONALD W. ALDOUS, M.Inst.E. (Ilford, Essex).

SIR,—I was very interested to read the article by L. Ormond Sparks on "Sound Recording for the Amateur," having studied the subject for some years, but I feel I must question the statement concerning the distance between groove walls being governed by frequency.

Surely the amount of side swing of the stylus is dependent upon *amplitude* and *not* frequency, which only governs the shape and number of fluctuations per given distance.

Admittedly, with most amateur recording systems, if there is any tendency to "over modulate," and consequently cut through the walls of the groove, it is at the lower frequencies that this occurs.

There is a reason for this inasmuch as the popular cutting head or, in many cases, a converted pick-up has a marked rising bass characteristic.

Wishing continued success to your splendid paper.—CECIL L. APPLEBY (Shortlands, Kent).

Modifying Coil Connections

SIR,—Wanting to try the 2-valve circuit on page 445 of PRACTICAL AND AMATEUR WIRELESS dated July 11th, and having no six-pin coils, I hit on the following dodge. The low potential ends of all three coils are connected to one pin, on a 4-pin former, and the other three pins take the high potential ends, thereby doing away with both 6-pin former, and the base. The use of such a coil has one snag, viz., the reaction condenser has to be placed at the live end of the coil; it also necessitates bushing the panel if it is a metal one.

There is no disadvantage in having one end of the aerial in common with one end of the grid coil, as both would normally go to earth, and leave the reaction winding to connect in the normal manner. In that case the aerial would go to the loose end of the aerial coil.—H. FIELDING (Oldham).

CUT THIS OUT EACH WEEK

Do you know

—THAT in a modern testing laboratory the individual circuits of a receiver are ganged by means of cathode-ray tube indicators.

—THAT an ordinary A.C. voltmeter may be used to measure the audible output of a receiver and may be calibrated to show the gain or loss in decibels.

—THAT the maximum theoretical amplification of an H.F. stage cannot be obtained as instability occurs before the maximum gain is reached.

—THAT special valveholder spacing is adopted for high-voltage power-output valves, and a special base is employed.

—THAT although the core of the modern transformer is extremely small compared with older models, the inductance is just as high owing to the use of special metals for the core.

—THAT high-efficiency coils in some modern receivers are wound on glass formers, and litz wire is employed for the winding.

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

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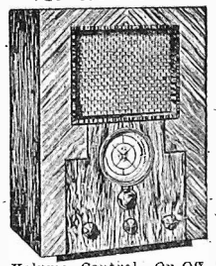
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Variable-Mu H.F. Pentode, High Efficiency Detector, Harries High Efficiency Distortionless output Pentode Valves, **Double Ratio slow-motion self-indicating colour coded Airplane Dial**, 8in. Tone Corrected M.C. Speaker. Latest type low-capacity switch with silver-plated self-cleaning contacts. Ganged Ball-Bearing Shielded Condensers. Combined Volume Control, On-Off Switch. H.T. Consumption 10 m/a, **H.T.** and **L.T.** and **G.B. Batteries.** Walnut veneered cabinet (illustrated). Aerial equipment. **READY TO PLAY.** *Post Coupon for Free Illustrated Folder.*

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Model 36S. P.M. Speaker. Cash or C.O.D. Carr. Paid **£2/2/0**, or 2/6 down and 11 monthly payments of 4/-.

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A Modern Note!

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Telephone: Hop 1837



Random Jottings

By JACE

Radio in Italy

DURING the next "Fiera del Levante," the great Radio Exhibition will be inaugurated, in a special stand of enormous proportions. The most important Italian firms will be represented and will exhibit their latest models.

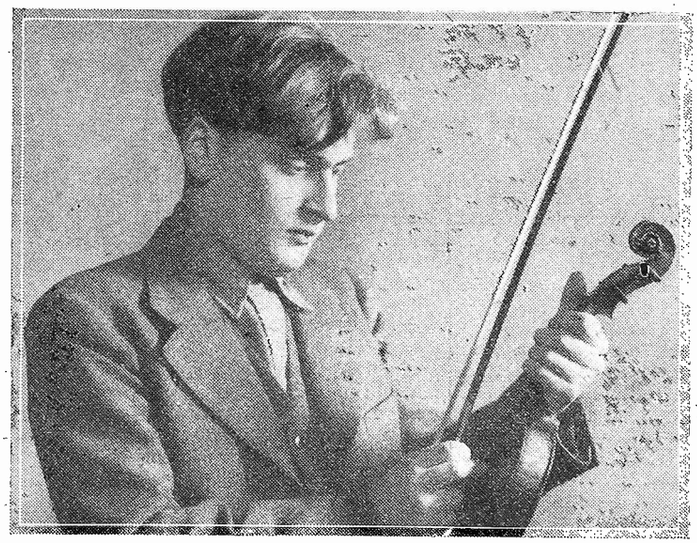
The firm Allocchio and Bacchini has constructed a portable carbon microphone (model 1864), fitted with a holding device or handle, cord and plug connection, destined to all uses which call for a high output whilst avoiding great amplification, and for which a very critical response curve is not absolutely indispensable.

The "Soc. Scientifica Radio Brevetti Ducati" has presented a complete series of applicances for the elimination of radio noises, both at the receiver and in the appliances. This is claimed to be the first series of such silencing devices which has been produced in Europe.

The latest novelties in sound-film technique will be demonstrated in the Open Air Cinema installed in the "Giardino delle Fontane Luminose," at the fourth Cinema Exhibition at Venice, which is being held from August 10th to August 31st. The most interesting exhibit will be cinematographic stereophony, i.e., the perspective reproduction of sounds, which gives the impression of listening to music performed by a large orchestra. This differs, in its Italian realisation, from what has been done until now abroad. In the Open Air Cinema some ten loud-speakers will be employed, four large-cone giant dynamics, for the reproduction of low notes, two snail-shaped giant exponential horns for the reproduction of the central scale, and, lastly, four direct special type exponential horns for the reproduction of high notes (up to 12,000 cycles). This tri-phonic ensemble, based on the three wave scales (low, medium, high), includes three amplifiers (one for each scale), which allows of the complete selecting and amplifying independence of each scale. In the three amplifiers, a special tone control allows of controlling the breadth of the three acoustic bands transmitted to the three groups of loud-speakers, and this follows exactly the phonic characteristics of the film in connection with the ambient sterophonic effects.

Shrewsbury Floral Fête

THE Shropshire Horticultural Society is in its sixty-second year and the Show it will hold in the beautiful Severnside park known as "The Quarry" will be its fifty-sixth (there was a gap during the War years and 1919). In that period the total takings have been £353,851, and donations totalling £25,639 have been made to various societies, chiefly concerned with the beautification of the town of Shrewsbury, and for the purchase of the old Castle. There are one hundred and seventy-five classes and a number of valuable cups, including the £100 Perpetual Challenge Trophy, presented by Alderman Charles Aveling, of Southport, in recognition of help received by Southport Show from the Shropshire Society. C. H. Harvey, a former Mayor of Leominster, and Honorary Secretary of the Horticultural Section of the old Leominster Show, will give an eye-witness account of the Shrewsbury Fête on its first day, relayed from the Midland transmitter, August 19th. On the second day (August 20th) the concert by the Massed Bands of the Irish Guards, the Welsh Guards, and the Royal Air Force will be broadcast in the National programme. the conducting being shared by Flight-Lieut. R. P. O'Donnell, M.V.O.; Lieut. J. L. T. Hurd; and Major Andrew Harris, M.V.O. (Senior Director of Music of the Brigade of Guards). For nearly forty years Massed Bands have been the distinctive feature of the musical entertainment at Shrewsbury Fête.



Yehudi Menuhin, the brilliant young violinist, is now away in California and will not be heard again for two years. The only music which you can hear, therefore, is from gramophone records, the latest of which is "Schön Rosmarin" and "Tambourin Chinois."

Ulster Grand Prix

ONCE more the time of the Ulster Grand Prix is coming round; the time when Northern Ireland is for a few days the motor cyclists' Mecca. It was in 1928 that the Ulster Grand Prix was won at an average speed of more than eighty miles an hour, and it then sprang into fame as the world's fastest motor-cycle race. It began in 1922 as a small amateur affair and it has had a romantic rise to fame during the last fourteen years, until to-day it is an exciting and thrilling event in which the whole of Ulster seems to take a keen, almost personal interest. From Belfast, as from other centres in Northern Ireland, there will again be a great exodus of people in almost every kind of conveyance, all bound for the course on August 22nd.

The B.B.C. arrangements for broadcasting of running commentaries on the race are now almost complete. This year there will again be two commentators, but the second commentary point is to be moved from Muckamore to Aldergrove corner, a sharp bend just before the course passes the Royal Air Force station. Here Graham Walker, himself a former well-known Grand Prix rider, and winner of many motor-cycle events, will be stationed in a raised box on the inside of the bend. He will be able to see the machines approaching the corner down a gentle incline at very high speeds, rounding the corner, and roaring away past the aerodromes. Aldergrove Corner is one of the particularly exciting points of the course, and Graham Walker will have plenty of material on which to exercise his powers of graphic description. Raymond Glendenning will give the commentary from the Grand Stand near the famous hairpin bend at Clady Corner. From this point he will describe the general scene, the start, and the finish, as well as the passage of machines during the race.

The commentary is to be broadcast on the National as well as the Northern Ireland wavelength, from 1.45 to 2.30 and again from 4.15 to 5.15. Listeners will also be interested to know that on the Friday evening before the race—that is August 21st—D. A. Boyd is to give a short talk, "Ulster Grand Prix Prospects."

Promenade Concerts, 1936

REFERENCES have been made in the Daily Press to the collective subscription system, or season-ticket pool, which enables a group of people to club together to buy a season-ticket for the Promenade Concerts. This system has met with universal approval, which is not surprising when one reflects that a season-ticket for forty-nine concerts costs only £1 17s.6d. (i.e. 9d. per concert, instead of 2s.) so that six people sharing, and dividing the ticket among themselves, can each go to one concert a week throughout the season at a total individual cost of 6s. 3d.

It is incorrect to say that the B.B.C. looks upon the scheme with disfavour; on the contrary, on the principle of "the more the merrier," it welcomes it as being calculated to increase considerably the sale of season-tickets.

THE NORTHERN POLYTECHNIC

THE next session at this institute opens on September 7th, and in the latest prospectus received from the institute we note that the Radio Technology section may be attended both by day students and evening students. This section works in conjunction with the Music Industries Council, the Wireless Retailers' Association, and other influential musical and associated bodies, and provides a very complete series of lectures covering all branches of radio and television. Students are prepared for the diplomas of the Music Industries Council and the Institute of Wireless Technology.

Full particulars of the course, fees, etc., may be obtained on application to the Polytechnic, Holloway, London, N.7.

Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

New Goltone Lines

MESSRS. WARD & GOLDSTONE announce some interesting new lines for the coming season, several of which will appeal particularly to the home constructor. We have already reviewed the Bulldog connectors (see our issue dated November 16th last), and although these have universal application for the experimenter, when being used in high-voltage circuits such as may become quite common when television apparatus is being dealt with, there will be a risk of severe shocks being felt unless the clip is protected. Small rubber cowls are therefore being produced, designed especially to fit over the three sizes of clip. They slide over the body of the connector, are flexible, and respond to the movement of the springs and thus act as a protection not only against shock but also against corrosion. A hole is provided for the entry of the cable or connecting lead. Prices range from 2d. to 4½d.

Another interesting item is the double-pole 2-pin fused plug designed for any small electrical appliance such as a wireless receiver, electric clock, etc. These plugs are interchangeable with B.E.S.A. standard 5-amp. 2-pin plug bases, and incorporate a cartridge fuse in each pole. These blow at approximately 2 amps., thus saving the house fuse and avoiding a sudden plunge into darkness in the event of a breakdown during the evening. The plugs are available in round or oblong patterns, the price of each type being respectively 1s. 4d. and 1s. Spare fuses cost 3d. only.

Electro-dynamic Converters

THE Electro Dynamic Construction Co. announce that they have carried out much research with a view to finding suitable anti-interference filters for use with converters and the new ultra-sensitive short-wave sets. As a result they have produced a filter which is satisfactory for all wavebands from 10 to 2,000 metres. In future this filter will be fitted as standard to all their converters without extra charge, and the machines will be designed so that they will be suitable for tropical use.

Magnum Multi-contact Switches

THE range of Magnum silver-contact multi-point switches has now been extended and includes eleven standard types, having from 2 to 12 pairs of contacts. These are available with two, three, four, five or six positions and the prices range from 2s. 6d. to 6s. Special short-wave models are available at slightly increased prices, varying from 3d. in the case of the small model to 1s. for the large model. In addition to these standard lines, the switches may be obtained in any desired combination to order, and double-sided switches are available at an extra cost of 10 per cent. on the above prices. For special combinations a chart is available on request and the user may indicate the details required in an unmistakable manner. The makers are Messrs. Burne-Jones & Co., Ltd., Magnum House, 309-317, Borough High Street, S.E.1.

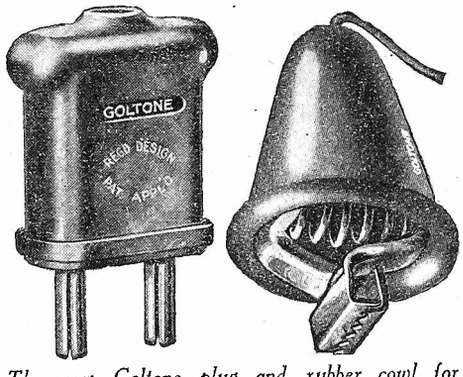
Marconiphone 3-Valve Battery Set

A NEW 3-valve battery receiver was released on the 4th of this month by Marconiphone, and the model will be known as Model "294." This is of the T.R.F. type, similar in many ways to Model "282," but has a much greater measure of efficiency and incorporates a very greatly improved cabinet. The appearance of this receiver leaves nothing to be desired and reveals a further development of the metal frame wooden cabinet which has proved so popular of late. The list price of the receiver is 7½ guineas and it may be obtained on convenient hire purchase terms.

The main circuit details are as follows: S.G. H.F. valve transformer-coupled to a triode detector, auto-transformer coupled to a high-efficiency pentode valve, with a special tone-correcting circuit. Three controls—tuning, volume and master switch, with a supplementary sensitivity control. Tuning scale marked in wavelengths in metres, provision for extra speaker and pick-up. Maximum undistorted output 400 mW., with a H.T. and L.T. consumption of 8 mA and .4 amps. respectively.

New Mazda Pentode

MESSRS. EDISON SWAN announce a new battery valve to be included in the Mazda range. This is a battery pentode of the high-slope type, with a 2 volt .3 amp. filament. The maximum anode and screen voltage is 150, and the normal working values are 120 volts for anode and screen, 2.5 volts grid bias, anode current 5 mA. The optimum load is 19,000 ohms, and the price is 11s. The base is of the standard 5-pin type.



The new Goltone plug and rubber cowl for the Bulldog connectors.

New Polar Components

SOME new lines are to be included in the Polar range of components, and a new type of ganged condenser has been tested by us. This is known as the "Bar" type, and is much smaller than the usual ganged unit. It is not entirely enclosed, but is fitted with end plates and a solid bar running through the unit at top and bottom. The entire framework is of steel, but the vanes are of aluminium. The minimum capacity is very low, and it was found that when the unit was screwed down, even when the screw holes were deliberately made out of line, the structure did not pull out of truth and thus cause fouling of the vanes. The sections were found to be very accurately matched, and the trimmers are conveniently placed on top. In the standard models bakelite insulation is provided, but when desired special models may be supplied with ceramic insulation. The prices for a two-gang straight or superhet standard model is 12s., and for a three-gang straight or superhet 17s. 6d. The prices for the special ceramic model are 14s. and 20s. respectively.

The remaining new lines include a single-type ball-bearing condenser, a mica-dielectric trimmer and midget condensers in the ordinary and compax types.

New Ferranti Valves

TO the Ferranti range two new mains valves are now to be added. One is a double-diode triode of the universal (A.C.-D.C.) type, with a 5 volt .3 amp. heater, type SD, and the other an A.C. variable-mu pentode, type VPT4B. The double-diode is intended, of course, for use as a combined detector and automatic volume control valve, the separate type of valve providing an undistorted signal free from interaction with the L.F. section, and permits the use of a high delay voltage without a reduction of the available anode voltage at the output valve which occurs when the diodes are operated from the output valve cathode.

The VPT4B has a 4 volt 1 amp. heater, and is rated for 250 volts on the anode and screen voltage up to 100 volts. It has a higher slope than the VPT4 valve and a shorter grid base. The price is 12s. 6d.

The Fuller Accumulator

FULLER Accumulators announce a new high-capacity accumulator of the 2 volt type, rated at 24 A.H. at the 20-hour rate. This is of the standard Fuller type, having dimensions of 3⅜ins. by 3⅜ins. and is 7½ins. high. The type reference is FMG, and the price is 10s. The range of H.T. dry batteries made by this firm is to be greatly extended for the coming season, and a number of special models intended as replacements in standard receivers will be included.

Wearite Components

A NEW volume control potentiometer is announced by Messrs. Wright and Weaire, and some of the older components have now been improved and modified. The new volume control is of the carbon element type, and is available in various values from 5,000 ohms to 2 megohms. It may be obtained with or without a switch, and the price is 4s. or 5s. The coils types P, Q, R, S and T, are also improved and reduced in price, costing only 7s. now. Short-wave coils, types A, B and C, are reduced to 2s. 6d., and a new model, type D, covering from 97 to 200 metres, is now introduced. The H.F. choke, type HFJ, is now available with a pig-tail connection and costs 2s. 6d., whilst type HFO is reduced from 4s. 6d. to 3s. 6d. Short-wave choke, type H.F.3, is also reduced in price, and now costs only 2s. 6d. The remainder of the popular coils, transformer switches, etc., are still continued, and in the range of test instruments a new signal generator is to be introduced, but at the moment of going to press no details are available. No doubt this unit will be produced in time for the Radio Exhibition.

THE BEST WEEKLY FOR CYCLISTS
THE CYCLIST
2d. WEEKLY

Practical and Amateur Wireless
BLUEPRINT SERVICE

These blueprints are full size. Copies of appropriate issues containing descriptions of these sets can in most cases be obtained as follows:—"Practical Wireless" at 4d., "Amateur Wireless" at 4d., "Practical Mechanics" at 7½d., and "Wireless Magazine" at 1/3d., post paid. Index letters "P.W." refer to "Practical Wireless" sets, "P.M." to "Practical Mechanics" sets, "A.W." refer to "Amateur Wireless" sets, and "W.M." to "Wireless Magazine" sets. Send (preferably) a postal order (stamps over sixpence unacceptable) to "Practical and Amateur Wireless" Blueprint Dept., Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS

STRAIGHT SETS. Battery Operated.

	Date of Issue.	No. of Blueprint
One-valve: Blueprints, 1s. each.		
All-Wave Unipen (pentode)	—	PW31A
Two-valve: Blueprints, 1s. each.		
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 (R.C. & trans.))	2.12.33	PW34A
Leader Three (SG, D, Pow.)	—	PW35
Summit Three (HF Pen, D, Pen)	18.8.34	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 (R.C.))	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 (R.C.))	31.8.35	PW55
The Monitor (HF Pen, D, Pen)	8.2.36	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	—	PW64
Four-valve: Blueprints, 1s. each.		
Fury Four (2 SG, D, Pen)	—	PW11
Beta Universal Four (SG, D, LF, Cl. B)	15.4.33	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

Mains Operated.

Two-valve: Blueprints, 1s. each.		
A.C. Twin (D (pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Power)	7.10.33	PW31
Selectone A.C. Radiogram Two (D, Pow.)	—	PW19
Three-valve: Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, D.D.T., Pen)	10.6.33	PW23
D.C. Ace (SG, D, Pen)	15.7.33	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Power)	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, 2LF (R.C.))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	31.8.35	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: Blueprints, 1s. each.		
Midget Short-Wave Two (D, Pen)	15.9.34	PW38A
Three-valve: Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Power)	—	PW30A
The Prefect 3 (D, 2 LF, RC and Trans.)	8.2.36	PW63

PORTABLES.

Three-valve: Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	16.5.36	PW65
Four-valve: Blueprints, 1s. each.		
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	—	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 Loud-speaker 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
P.W.H. Mascot with Lucerne Coils (D, RC, Trans)	—	AW337A
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, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
P.T.P. 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-value: Blueprints, 1s. 6d. each.		
65/- Four (SG, D, RC, Trans)	—	AW370
"A.W." Ideal four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D, Pen)	—	AW421
Crusaders' A.V.C. 4 (2HF, D, QP21)	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, 2LF)	*Feb.* '35	WM381
The H.K. Four	*Mar.* '35	WM384
The Auto-Straight Four	*April* '36	WM404
The Request All-Waver	*June* '36	WM407
Five-valve: Blueprints, 1s. 6d. each.		
Super-quality Five (2HF, D, RC, Trans)	*May* '33	WM320
New Class-B Five (2SG, D, LF, Class B)	*Nov.* '33	WM340
Class-B Quadradyne (2SG, D, LF, Class B)	Dec. '33	WM344
1935 Super Five (Battery Superhet)	—	WM379

Mains Operated.

Two-valve: Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	23.9.33	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C./D.C. Two (D, Pen)	*Sept.* '35	WM394
Three-valve: Blueprints, 1s. each.		
Home-lover's New All-electric Three (SG, D, Trans) A.C.	—	AW383
S.G. Three (SG, D, Pen) A.C.	—	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen) A.C.	23.6.34	AW430
Mantovani A.C. Three (HF Pen, D, Pen) A.C.	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan.* '36	WM401
Four-valve: Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen)	*July* '33	WM329
Harris Jubilee Radiogram	*May* '35	WM386

SUPERHETS.

Battery Sets: Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
Varsity Four	*Oct.* '35	WM395
Mains Sets: Blueprints, 1s. 6d. each.		
1934 A.C. Century Super A.C.	10.3.34	AW425
Heptode Super Three A.C.	*May* '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
1935 A.C. Stenode	*Apl.* '35	WM385

PORTABLES.

Four-valve: Blueprints, 1s. 6d. each.		
Midget Class B Portable (SG, D, LF Class B)	20.5.33	AW339
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM363
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM367

SHORT-WAVERS—Battery Operated.

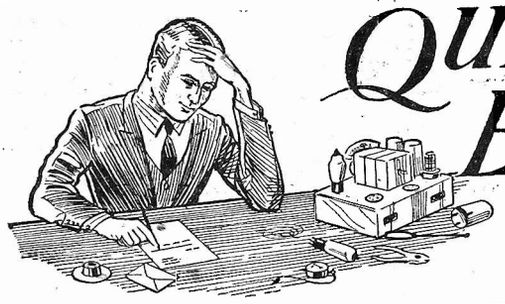
One-valve: Blueprints, 1s. each.		
S.W. One-valve converter (price 6d.)	—	AW329
S.W. One-valve for America	—	AW420
Roma Short-waver	—	AW452
Two-valve: Blueprints, 1s. each.		
Ultra-short Battery Two (SG det, Pen)	*Feb.* '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve: Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver	*Jan.* 19, '35	AW463
The Carrier Short-waver	*July* '35	WM390
Four-valve: Blueprints, 1s. 6d. each.		
A.W. Short-wave World Beater (HF, Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valve Short-waver	*Mar.* '35	WM383
Superhet: Blueprint, 1s. 6d.		
Simplified Short-wave Super	*Nov.* '35	WM397

Mains Operated.

Two-valve: Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	—	AW453
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	*Aug.* '34	WM368
"W.M." Long-wave Converter	—	WM380
Three-valve: Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve: Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	*Aug.* '35	WM391

MISCELLANEOUS.

Enthusiast's Power Amplifier (1/6)	*June* '35	WM387
Listener's 5-watt A.C. Amplifier (1/6)	*Sept.* '35	WM392
Radio Unit (2v.) for WM392 (1s.)	*Nov.* '35	WM398
Harris Electrogram (battery amplifier)	*Dec.* '35	WM399
De-Luxe Concert A.C. Electrogram	*Mar.* '36	WM403
New style Short-wave Adapter (1s.)	*June* '35	WM388
Trickle Charger (6d.)	*Jan.* 5, '35	AW462
Short-wave Adapter	*Dec.* 1, '34	AW456
Superhet Converter	*Dec.* 1, '34	AW457
B.L.D. L.C. Short-Wave Converter (1s.)	*May* '36	WM405
Wilson Tone Master (1s.)	*June* '36	WM406
The W.M. A.C. Short-Wave Converter (1s.)	*July* '36	WM408



QUERIES and ENQUIRIES

All-wave Set

"I have a commercial all-wave set (6-valve superhet) which works perfectly on M.W. and L.W. On the short waves, however, it will work perfectly up to about 35 metres, and then the remainder of this band is absolutely silent. The 48 to 150 metre band works perfectly up to about 110 metres. The silence does not always occur from 35 metres upwards. Sometimes it starts at 45 metres and at the opposite point on the 135 metre band. If the needle is rotated into the silent area, the set turned off for a while and then turned on again, sound is heard for a moment and almost immediately dies away. I wonder if you can suggest the cause of the trouble."—S. B. (Stamford Hill).

WE do not as a rule like to suggest the causes of faults in commercial receivers, as this generally leads the user to attempt to cure the trouble and, if unsuccessful, the set is then returned to the makers and the result is that they do not care to undertake the work after the set has been tampered with. Furthermore, the cost of repairs will be increased as damage may be done through ignorance of the exact circuit details. It is always desirable in the case of a commercial receiver to return it to the makers or take it to their nearest service agent so that it may be attended to. In this particular case, however, the fault is an interesting one and it is interesting to note that the trouble can be removed by switching off. As signals are heard for only a very short time the inference is that either a resistance is faulty and varies in value when a certain current is passed, and this results in a voltage drop preventing oscillation at a certain point; that a leaky condenser forms a similar loss, or, what is more probable, that the oscillator fails to function at a certain temperature due to faulty windings on the coils. However, it would be preferable to have the set tested by a good service agent if you cannot approach the makers direct.

Mains Breakdown

"My three-valve A.C. set has broken down and I am at a loss as to the cause. When I switch on there is a hum from the speaker, not so loud as it used to be. All the valves get hot, the rectifier unusually so. I only have a small two-range voltmeter, but when I put this to the terminals of the heaters on any valve in the set the needle vibrates. Is this A.C.? When I put it from earth to any of the H.T. positive points it jumps a very little bit but comes back to 0. Is it possible to make any suggestion to locate the trouble?"—S. W. (Hampstead).

AS hum is heard from the speaker and the needle of your meter vibrates or quivers on all heater terminals, the indication may be regarded as acquitting the heater winding on the transformer. The slight flick when the H.T. circuit is measured may be due to condenser discharges, but some indication should be given of the approximate voltage even with your cheap meter, and the failure to obtain this, together with the failure of signals would indicate an interrupted H.T. circuit. This may be due to the transformer winding, the choke, the rectifying valve, or a by-pass condenser which has broken down and is short-circuiting the H.T. supply. If the transformer winding failed the rectifier would only receive the normal heater voltage supply and would not, therefore, get very hot. If the H.T. was applied to the valve and it was in order, but the choke had broken down, the valve would still only rise to a temperature slightly above normal. Similarly, if the H.T. negative return was interrupted no undue rise should be observed. Therefore, the fact that the rectifier gets unusually hot would indicate that it is being seriously overrun, and as no H.T. can be detected in the receiver the H.T. must be short-circuited in the mains unit. The smoothing condensers should therefore be removed one at a time, when signals will be restored as soon as the defective condenser is removed, although hum will, of course, be experienced. Alternatively, you can remove the condensers and test them in the usual way, although in the case of electrolytics it is rather difficult to locate an excessive leakage of current which may cause a breakdown of the type mentioned in your case.

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.

Making a Superhet

"I am rather keen to build a superhet, but as expense is an important point I want to cut down to the very minimum the parts needed. I have several odds and ends at home, but I should like a really efficient circuit. What may be regarded as the minimum number of valves to build a superhet of the type I require? Is your £4 Superhet 4 the best in this respect?"—I. L. A. (Hampton).

THE minimum number of valves to employ the superhet feature is one, and a circuit showing the arrangement was given in our issue dated February 8th last. We have also described a two and a three-valve superhet. None of these employed A.V.C., however, and as you are anxious to build the most efficient type of circuit you may wish to include this feature. In that case three valves could be used, and the first could be the frequency changer and mixer (using either a pentagrid or triode-pentode or similar type of valve) and the intermediate-frequency stage could utilise a pentode. You could then utilise Westectors for 2nd detector and A.V.C., followed by a pentode output valve, or a double-diode-pentode for these three purposes.

Short-wave Damping

"I have built a home-designed two-valve short-wave set, in which I am using coils wound on commercial coil formers. I find, however, that when I tune to 20 metres I seem to have reached the lower limit of working on this set as nothing of any kind can be heard below this, no matter what coil I plug in. The aerial is 20ft., horizontal, seven-strand cable, thoroughly insulated, and the earth wire is 5ft. long, joined to a four-by-two sheet of copper gauze. I do not know how to improve this, but should like to get lower down the scale. Can you help me, please?"—B. R. (Salisbury).

THE trouble may be due to the design of the tuning coils you are using. No matter how efficient the aerial-earth system, the damping imposed on the grid coil may easily prevent the valve from oscillating. Even when a pre-set condenser is joined in series this may not prove effective, and a loose-coupled aerial coil winding should be adopted. Even a single turn may prove effective and will enable the valve to oscillate and thus produce the desired result. Try different types of winding, arranged in different positions on your coil until you obtain the desired result, but generally speaking the coupling should be quite loose.

Control Knobs

"I have built your £4 Superhet and am delighted with the performance, but not with the appearance. The components which were specified and which are mounted on the panel are all supplied with different knobs, and in one case I have a walnut colour and in the others they are black. Is it not possible to standardise these parts or can I get new knobs so as to make the set look neat from the panel?"—D. G. F. (Perth).

IT is not possible to standardise control knobs as various people have different ideas as to the best type. However, your difficulty may be overcome quite easily by obtaining replacement knobs from Messrs. Bulgin. If you obtain a copy of their catalogue you will see reproductions of twenty-eight different knobs and will no doubt find a pattern which will suit your particular cabinet or other furnishings. The knobs range from simple walnut round models to black and chromium domed types.

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RADIOMART. Smoothing chokes, 20 by 120 ma., 3/11; 100 ma., 2/11; 40 ma., 1/11. Telsen Ace transformers, 1/11. Radiogrands, RG48, 2/9. BTH speaker, 2/11.

RADIOMART. Varley iron-cored, 10/6. Bifocal dual-range coils. Very selective, 2/11; matched pair, 5/3.

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RADIOMART. Igranic midget jacks, 3d. Milliammeters, 25 ma. upwards, 5/9; super 6/9.

RADIOMART. Telsen H.F. chokes, 1/11; screened 1/11. Utility 1936 SL wavelength dials, 3/11.

RADIOMART. Lissen 3-gang superhet kit coils, two I.F.'s ganged condenser, ditto Bandpass, ditto 2-gang all wave, 10/- kit.

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RADIOMART. Famous continental A.C. valves, 4/6. American Durtron, etc. All types, 3/6. Battery from 2/3.

RADIOMART. Utility 8/6, microdisc dials, 3/11. Radiophone .00016 short-wave condensers, 3/6. Series gap twin, 3/9.

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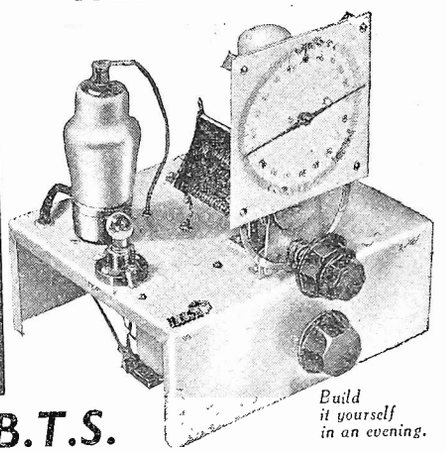
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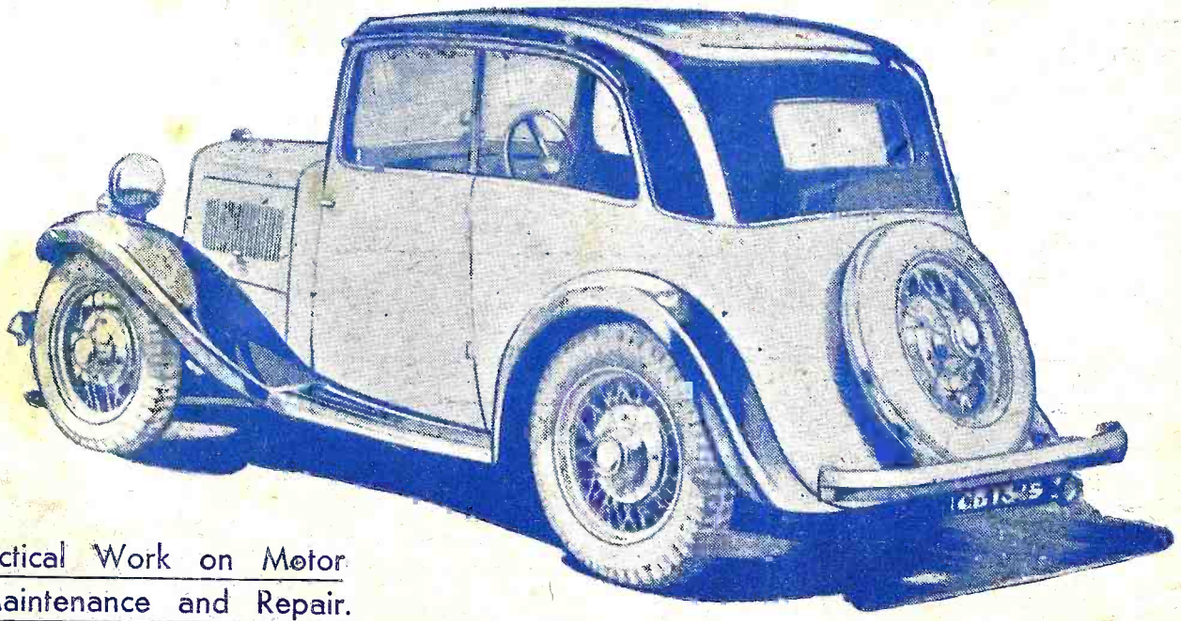
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