A SHORT-WAVE CONVERTER FOR THE £4 SUPERHET 4 — SEE PAGE 551

Practical and Amateur Wireless

3D EVERY WEDNESDAY

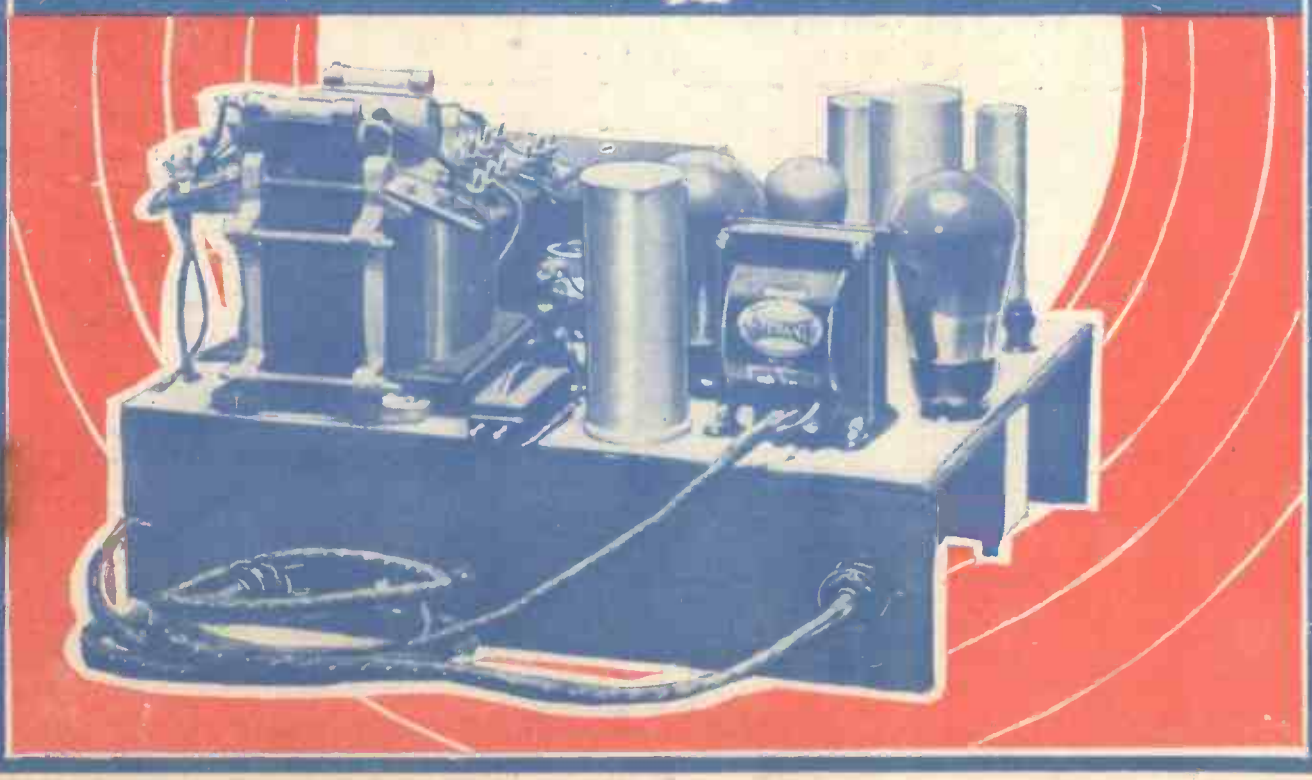
Edited by F. J. CAMM

A GEORGE NEWNES Publication

Vol. 7. No. 174. January 18th, 1936.

AND PRACTICAL TELEVISION

Building a PARAPHASE AMPLIFIER



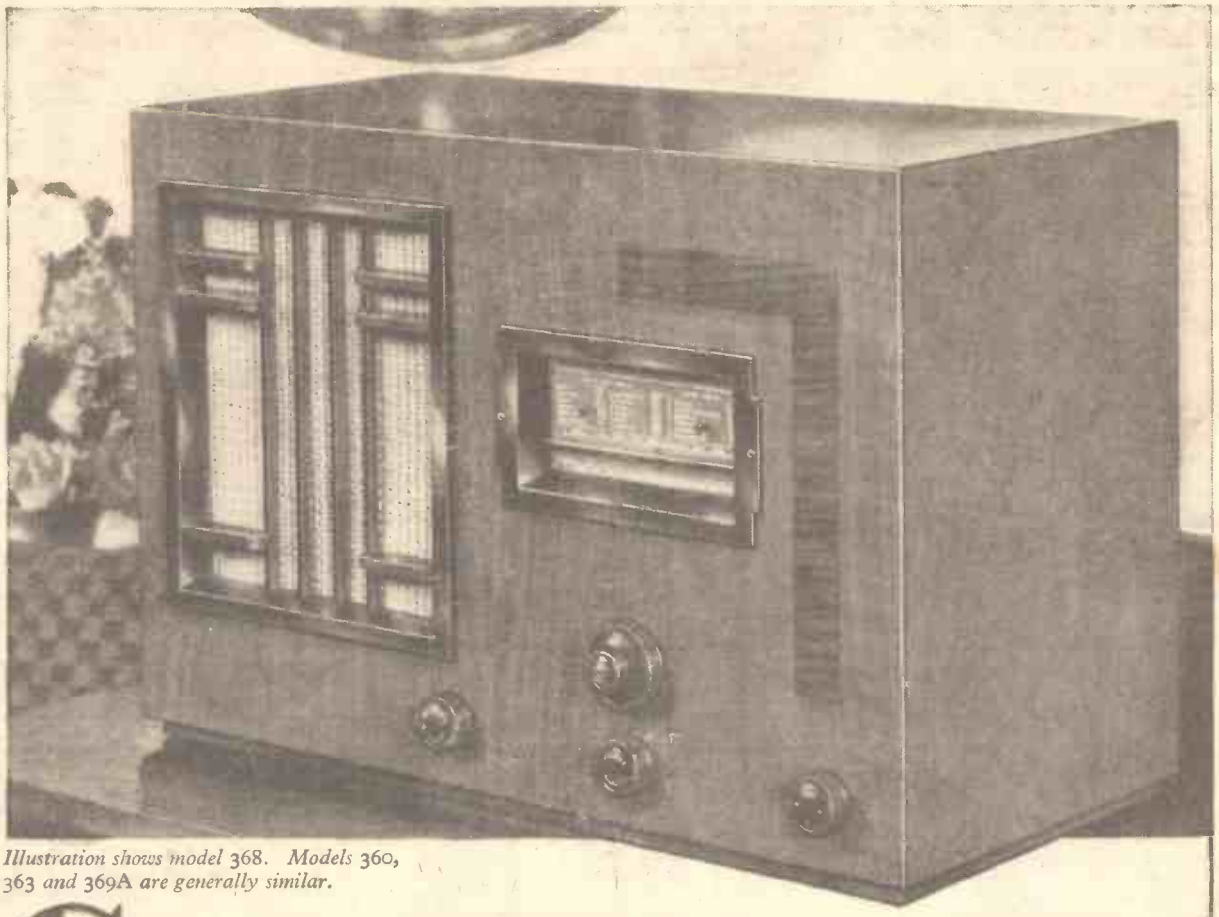


Illustration shows model 368. *Models* 360, 363 *and* 369A *are generally similar.*

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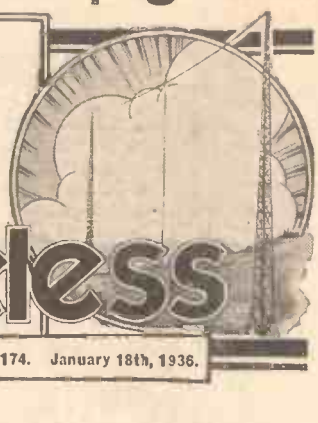
MODERN COIL CONNECTIONS See page 555

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. VII. No. 174. January 18th, 1936.



ROUND *the* WORLD *of* WIRELESS

Progress in British India

ACCORDING to the latest statistics, in British India forty thousand people possess wireless receivers, the number having increased by one hundred per cent. in one year. Much of this is due to the fact that the installation of powerful medium- and short-wave transmitters enables owners of radio sets to listen to programmes from foreign countries.

Oriental Broadcasts

WITH the opening of the New Year, Radio Maroc (Rabat) on 499.2 metres (601 kc/s) is offering to its Arab listeners two concerts by native musicians daily—namely, between G.M.T. 14.00–14.30 and again between 19.30–20.30. The latter may be picked up at good volume in the British Isles, as the power of the station has been increased to 25 kilowatts.

A Good Second

ALTHOUGH Great Britain still holds the lead in the licensed listeners' race, Germany during the past few months has been making great strides. On December 1 last, her figure was 6,990,741, an increase of 175,232 over the previous month.

Japan's Two Super-power Stations

AS a result of successful experimental broadcasts carried out by J2JE, Tokyo, on 50 kilowatts, the Japanese Broadcasting Company is installing two 150 kilowatt stations. JOAK-1, to be built at Kawaguchi, Saitama, will operate on 508.5 metres (590 kc/s), and JOAK-2, under construction at Hatogaya, Saitama, will work on 340.7 metres (880 kc/s). For these transmitters 1,000ft. cantilever aerials of the most modern type are to be adopted.

Radio Kaunas

ALTHOUGH only rated at 7 kilowatts, the Kaunas (Kovno) broadcasting programmes on 1,935 metres (155 kc/s) are well heard between G.M.T. 20.00-22.00. Barring special occasions the station is seldom on the air later than 22.30, the main evening programme starting at about 19.30. Kaunas has a melodious interval signal played on a musical box.

Some Loud-speaker

WHAT is deemed to be the largest loud-speaker in the world is now being installed in the stadium of one of the largest parks at Leningrad. Its power is 20 kilowatts, and it is to be used for making announcements to the 100,000 spectators who can be accommodated for witnessing sporting displays in the giant arena.

Norway Abolishes its "One-horse" Stations

TO extend the area of the broadcasting service, the Norwegian authorities are gradually replacing the small relays by 10 and 20 kilowatt transmitters. New plants are being installed at Aalesund, Tromsö, Bodö and Randaberg. They are expected to take over their duties in the course of the year.

More Stations for India

IN addition to the transmitters which are being erected by the Indian State Broadcasting Service, the Hyderabad Government is installing broadcasting stations at Hyderabad, Aurangabad, Gulbarga and Warangal. They will work on respectively 319.1 metres, 411 metres, 291.3 metres and 260.9 metres. In view of the different languages used by the population, programmes will be broadcast according to area served in English and Urdu, Mahrati, Kanarese and Telegu.

For the Sake of Economy

IN accordance with the new regulations, which decree that all entertainments should be concluded at an earlier hour than hitherto, the Italian broadcasting stations are no longer on the air after G.M.T. 21.30. The main evening programme now starts at G.M.T. 18.30 or at latest 19.00, and the last news bulletin is given out at 20.45. A new transmitter, Rome II, operating on 245.5 metres, tests nightly between G.M.T. 18.20-19.30.

Finland Increases Power of Stations

PENDING the opening of the new high-power Lahti transmitter, a 10-kilowatt station has been opened at Oulu (Uleaborg), working on 696 metres (431 kc/s); another station of the same power is being erected at Vaasa, to take the Helsinki programmes.

Stamping the Receiver

IN order to check the growth of radio piracy in France, the authorities now insist on every licensed set bearing an officially-obliterated excise stamp to show that the listening tax has been duly paid.

Belgium Makes a Final Decision

OVER the past twelve months the question of the erection of high-power transmitters in the neighbourhood of Brussels has been discussed a number of times. It is now reported that the I.N.R. has definitely decided to reconstruct the two existing stations at Velthem, near Louvain, with a view to an increase in output to 100 kilowatts.

Midland Symphony Concert

THE pianist for this symphony concert by the City of Birmingham Orchestra, which is relayed from the Town Hall on January 23rd, is Frank Mannheimer. Leslie Heward conducts, and the part of the programme to be broadcast consists of the "Anacreon" overture by Cherubini, Weber's Concertstuck in F minor, and Rachmaninoff's symphonic poem, "The Isle of the Dead."

Pantomime Excerpts from Newcastle

ON January 25th Newcastle provides a double pantomime feature, half-hour long excerpts being relayed from "Dick Whittington" at the Theatre Royal, and "Cinderella" at the Empire. The cast of "Dick Whittington" includes Dorothy Ward (principal boy), Doris Bransgrove (principal girl), and Jack Edge; "Cinderella" features Audrey Acland (principal boy), Helene Cooney (principal girl), and Frank E. Franks.

ON OTHER PAGES

ROUND the WORLD of WIRELESS (Contd.)

European Concert

THE fourth of the series of concerts arranged by the International Broadcasting Union will be relayed from Leipzig on January 17th. The Leipzig Symphony Orchestra will be conducted by Hans Weisbach. The soloist will be Professor Günter Ramin, a famous organist. The programme will include Bach's Toccata in D minor, with Ramin at the organ; an overture, "Kätchen von Heilbronn," by Hans Pfitzner; and Handel's Concerto No. 10 in D minor for organ and orchestra. The soloist has been for many years organist at the church of St. Thomas, in Leipzig, and is therefore steeped in the Bach tradition.

INTERESTING and TOPICAL PARAGRAPHS

TWO PAIRS OF ATTRACTIVE TWINS

Dick Henderson's twin crooning daughters with their twin Pye receivers.

"Echoes of Ulster"

ANOTHER edition of "Echoes of Ulster" will be given on January 18th. As most listeners know, this is a sort of local "In Town To-Night," in which people with strange tales to tell, or unusual jobs to describe, are brought to the microphone.

The House Next Door

THIS new series of talks, commencing from the Midland Regional on January 20th, will present—naturally under fictitious names—actual Midland households of various types. The parallel of "Street Scene" and "If Four Walls Told" springs to mind, but truthfulness rather than dramatic effect is here the aim. The speaker is Moore Raymond, a former radio critic, who is now doing literary and dramatic work in the Midlands. He wrote the burlesque, "The Marmalade Mystery," which was recently broadcast. The address of the house chosen for his first talk is "142, Skillideane Street, West Bridgford."

Pantomime Parade

EXCERPTS from three Midland pantomimes will be relayed on January 25th in a programme, lasting an hour and a half, compered by Dorothy Summers, the well-known Midland radio artist. Two of the pantomimes—the Julian Wylie show, "Puss in Boots," at the Theatre Royal, Birmingham, and the Bertram Montague pantomime, "Cinderella," at Coventry Hippodrome—have been the subject of O.B.'s before. The third is the Prince Littler pantomime, "Humpty, Dumpty," at the Theatre Royal, Hanley, the chief centre of entertainment in the Potteries. In this show the principal artists are Nancy Brown, Fred Morant, Betty Hamilton, and Pell and Little. There has been no previous pantomime relay from the Theatre Royal, Hanley.

Rawicz and Landauer

RAWICZ and Landauer, who appeared with such striking success in the November Gala Variety (November 23rd), will give a fifteen minute recital of their brilliant two-piano virtuoso act in the Regional programme on January 28th.

"The Barretts of Wimpole Street"

AMONG Sir Barry Jackson's most notable successes in the theatre since the war has been Rudolf Besier's play, "The Barretts of Wimpole Street," and it is natural that the Birmingham Repertory Company should choose it for performance in the second series of broadcasts of plays representing Midland Repertory. Under the direction of Herbert M. Prentice they give it in the Birmingham studio on January 19th, in a radio version lasting an hour and a half. Elspeth March plays Elizabeth; Stephen Murray, Mr. Moulton-Barrett, her father; and Donald Eccles, Robert Browning. Owen Reed is the producer.

Variety from Doncaster

IN the Northern Regional programme on January 23rd, an excerpt from the variety bill will be relayed from the Grand Theatre, Doncaster. The names of the artists actually broadcasting are not yet available, but the bill includes Harry and Burton Lester (comedians), David Stone (ventriloquist), Graves and Lee (comedy duo), Roy Davey (boy xylophonist) and Kethleen (Irish flower girl singer).

George Robey Production

A GEORGE ROBEY special production is billed for January 21st (National) and January 24th (Regional). The great comedian will expound the story of his life in this broadcast. He started as an engineer, eventually became an amateur mandolin player. At one of his performances, he was asked to sing because another performer was absent. He gave the only song he knew at that time, but it brought down the house. Thus began his career as a comedian. The material for the production has been collected by Rupert Hazell, who intends to make of the story a ramble through Robey's forty years before the footlights. Linking narrative will be provided by Rupert Hazell, and, starting with a comic song, the broadcast will finish up with Shakespeare. Elsie Hay, the other half of the Rupert Hazell combination, will take part; also Mario de Pietro. The Variety Orchestra will be conducted by Ernest Longstaffe, and Gordon McConnel, B.B.C. producer, is collaborating in the presentation.

"On First Acquaintance"

"MICROPHONE BOWS" in 1936 is to appear under a new name: "On First Acquaintance." It will continue to be a Variety show of West Country variety acts appearing for the first time before the microphone, and the first show will be given on January 21st from the Western Regional.

SOLVE THIS!

PROBLEM No. 174

Rolland built a three-valve straight type short-wave set, but could not pick up any stations, and no reaction could be obtained. He tested the components, batteries and valves and found them to be in order. He eventually decided to take the set to his friend's house for a test out, and was surprised to find that satisfactory reception could be obtained. Why couldn't Rolland pick up stations at his home? Three books will be awarded for the first three correct solutions opened. Address your envelopes to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2. Envelopes must be marked Problem No. 174, in the bottom left-hand corner, and must be posted to reach this office not later than the first post on Monday, January 20th, 1936.

Solution to No. 173

The oscillator section of the frequency changer did not function on the long wave-band owing to a break in the long-wave grid winding or in the reaction winding of the oscillator coil.

The following three readers successfully solved Problem No. 172, and books are accordingly being forwarded to them: W. A. O'Brien, 26 Mess, Fort Blockhouse, Gosport, Hants; W. Cruickshank, 37, Urquhart Rd., Aberdeen; A. Baker, 168, Cairnfield Ave., Neasden, N.W.2.

F. J. Camm's Short-wave Converter

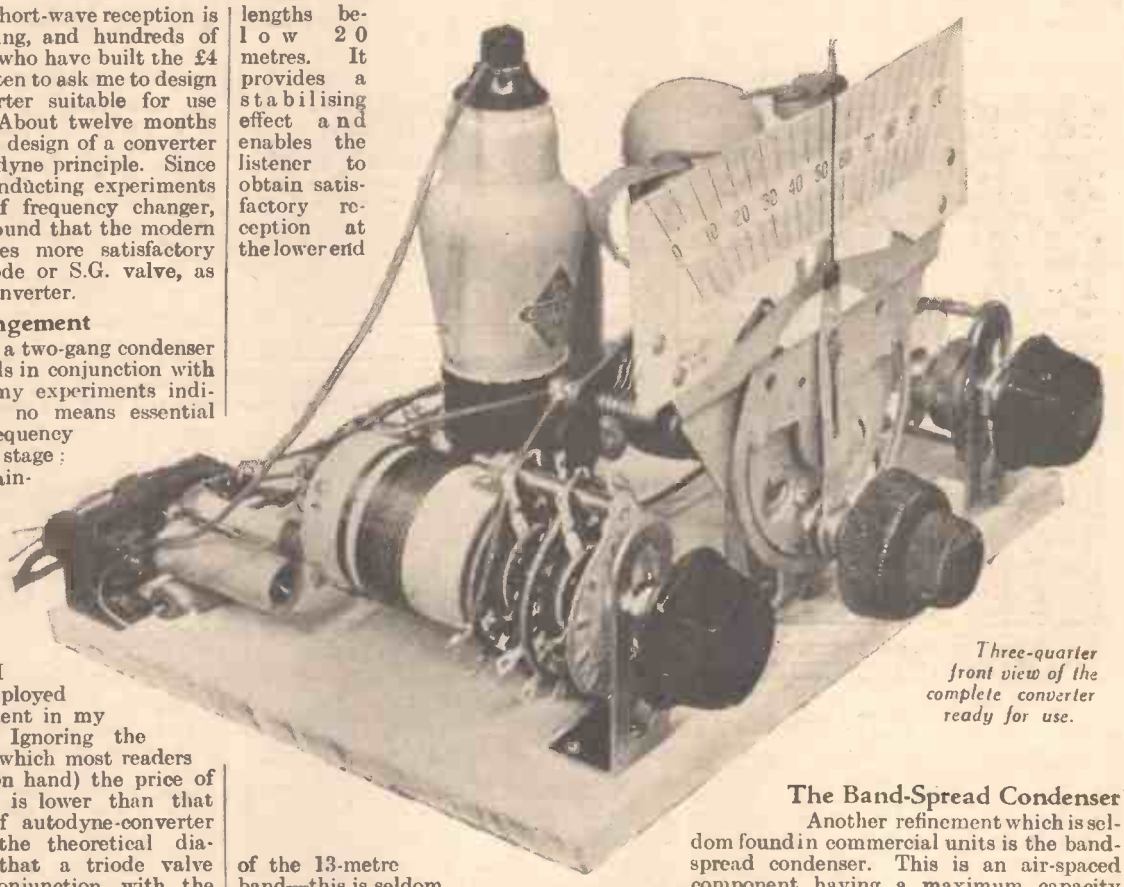
for his £4 SUPERHET 4

Constructional and Operating Details of an Efficient Short-wave Converter Designed for Use in Conjunction with the £4 Superhet 4 and also Suitable for Use with Straight Receivers

THE interest in short-wave reception is steadily growing, and hundreds of those readers who have built the £4 Superhet 4 have written to ask me to design a short-wave converter suitable for use with this receiver. About twelve months ago we published the design of a converter working on the autodyne principle. Since then I have been conducting experiments with various forms of frequency changer, however, and have found that the modern pentagrid valve gives more satisfactory results than the triode or S.G. valve, as used in the earlier converter.

The Circuit Arrangement

Some designers use a two-gang condenser and two matched coils in conjunction with the pentagrid, but my experiments indicated that it is by no means essential to precede the frequency changer with a tuned stage: good results are obtainable with an untuned aerial stage having a reliable short-wave choke connected across the aerial and earth terminals. In the interests of simplicity of operation and economy I have therefore employed this circuit arrangement in my new converter unit. Ignoring the price of the valves (which most readers will probably have on hand) the price of the necessary parts is lower than that of the older type of autodyne-converter unit. A study of the theoretical diagram will indicate that a triode valve is being used in conjunction with the pentagrid, its anode-grid circuit being connected across the anode-grid circuit of the oscillator section of the pentagrid. This valve is not essential, but its incorporation is advisable if best results are to be obtained on wavelengths below 20 metres. It provides a stabilising effect and enables the listener to obtain satisfactory reception at the lower end of the 13-metre band—this is seldom obtainable on the older type of converter unit. The only extra component which the use of this second valve necessitates is the valve-holder, however, and therefore its inclusion was thought to be desirable.



Three-quarter front view of the complete converter ready for use.

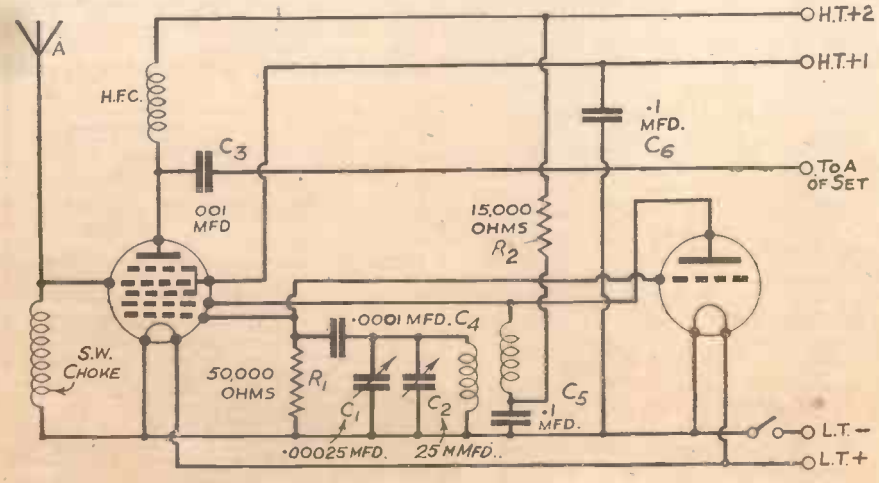
The Band-Spread Condenser

Another refinement which is seldom found in commercial units is the band-spread condenser. This is an air-spaced component having a maximum capacity of 25 m.mfd., which will be found very useful when searching for transmissions on the amateur bands. Listeners who are not accustomed to short-wave reception should ignore this control at first; it should be set at minimum (moving vanes unmeshed) and tuning effected by means of the main tuning control. The anode of the pentagrid is connected by means of a reliable H.F. choke to H.T.+, and *via* a .001 mfd. fixed condenser to the output lead. This method of connection makes the unit suitable for use in conjunction with any receiver having an I.F. or an H.F. stage. When the unit is coupled to a superhet receiver, double-frequency changing occurs, as the frequency is changed by the unit pentagrid and also by the frequency-changing valve in the receiver. Good reception is obtainable in this manner, and although it is permissible to couple the output lead of the unit to the first I.F. valve instead of to the aerial terminal of a superhet, the latter method of connection gives the most satisfactory results in most cases.

Simple Construction

The construction of this simple unit should not present any difficulty, as the wiring is clearly shown on the wiring diagram and the accompanying photographs. In the interests of simplicity

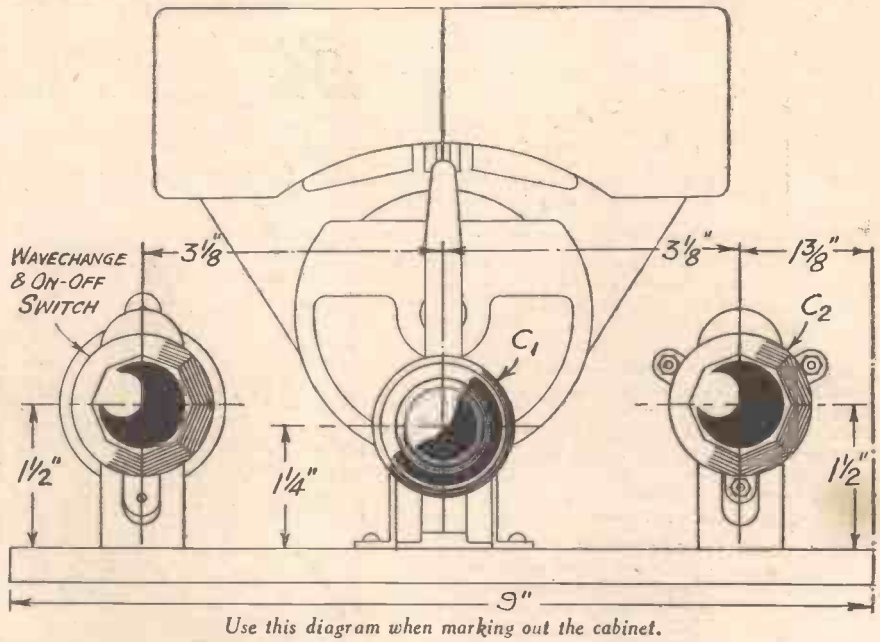
THEORETICAL DIAGRAM OF THE CONVERTER



INSTANTLY CONVERTS YOUR SET FOR THE SHORT

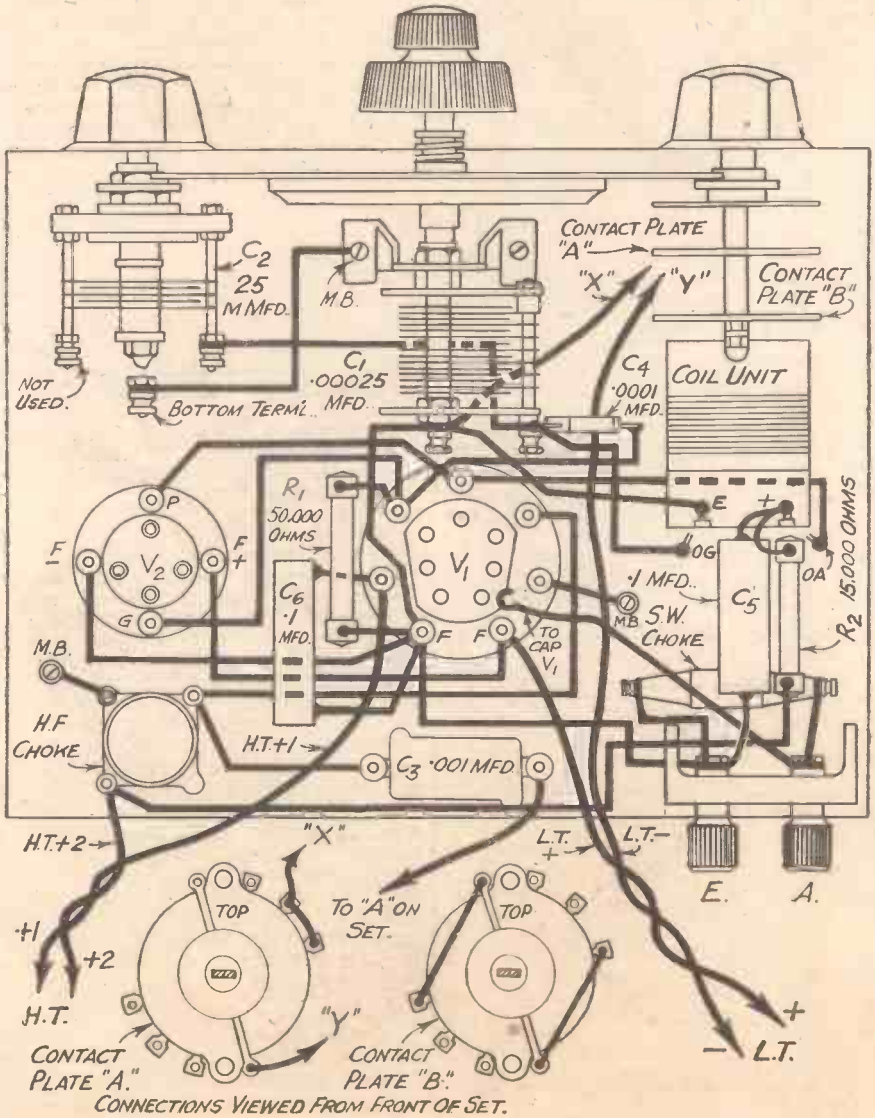
and economy a baseboard was chosen in preference to a chassis, a metallised type being specified in order that earth return may easily be provided. The metallised coating also provides an effective H.F. screen between the unit components and the receiver components if the unit is placed on top of the broadcast set. It is not necessary to mount the parts in any particular sequence as all the wiring is easily accessible; all the parts, except the condenser drive, may be screwed down before wiring is commenced. The mounting brackets can be screwed tightly to the metallised surface of the baseboard, as the spindles of the two condensers and the coil chassis are at earth potential. It is advisable to use fairly thick wire in order to keep resistance as low as possible, and the layout shown on the wiring diagram should be adhered to as this has been carefully thought out with a view to keeping leads as short as possible.

After the constructional work has been completed and the wiring carefully checked, the valves may be inserted in their respective sockets and the various leads joined up. The H.T.2 lead should be plugged into the 120-volt socket of the receiver



Use this diagram when marking out the cabinet.

WIRING DIAGRAM OF THE S.W. CONVERTER



Connections Viewed From Front of Set.

H.T. battery, and H.T.1 lead into the 60- or 72-volt socket—the 60-volt socket should be used if economy of H.T. current is of major importance. The L.T.+ and L.T.— spades should be attached to the accumulator supplying the broadcast receiver, the unit valves being switched off when broadcast reception is desired by rotating the switch attached to the coil to its maximum anti-clockwise setting.

Operating Notes

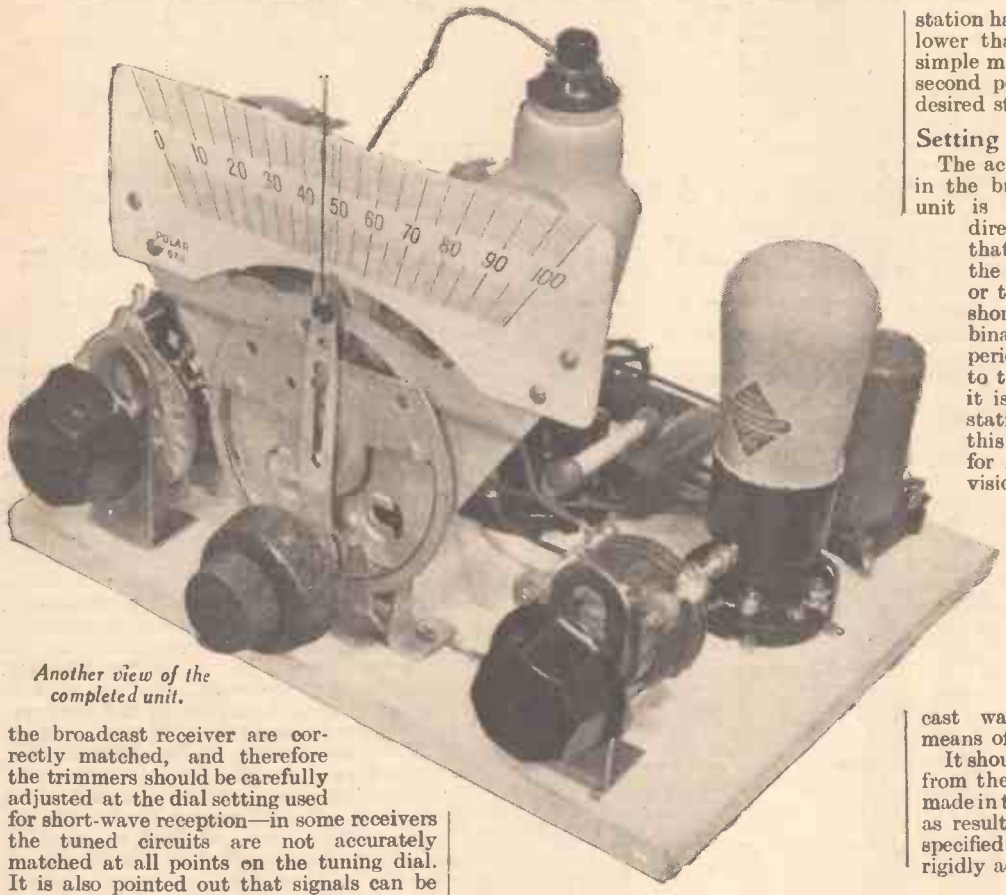
The terminal marked A should be joined to the aerial lead, but it is unnecessary to use the E terminal on the unit if the broadcast receiver is provided with an efficient earth connection as the earth circuit will be completed through the L.T.—lead. The output lead of the unit (joined to the .001 mfd. condenser) should be plugged into the aerial socket of the broadcast receiver, the aerial lead having been previously transferred to the A terminal of the unit, as mentioned above. To obtain short-wave reception it is only necessary to set the receiver tuning control to a position where no broadcast reception is obtained—preferably near the maximum setting on the long waveband—and tune in the short-wave stations by means of the tuning control on the unit.

It is emphasised that best results cannot be obtained unless the tuned circuits of

LIST OF COMPONENTS

One two-range coil with switch (B.T.S.).
One .00025 mfd. tuning condenser (B.T.S.).
One micro-drive horizontal (Polar).
One 25 m.mfd. Microdenser with knob (Eddystone).
Four fixed condensers: two .1 mfd. tubular, one .001 mfd. type 670, one .0001 mfd. type 665 (Dubilier).
Two fixed resistances: one 50,000 ohms, one 15,000 ohms, 1 watt type (Dubilier).
Two H.F. chokes: one type H.F.P., one Type H.F.3 (Wearite).
Two valve-holders: one 7-pin, one 4-pin; baseboard type (Wearite).
One terminal block, A E (Belling Lee).
Three plugs: H.T.1, H.T.2, A (Belling Lee).
Two spades: L.T.+, L.T.— (Belling Lee).
Two component brackets (Peto-Scott).
Metallised baseboard 9in. by 7in. (Peto-Scott).
Two valves: X21, L2.

WAVES—SIMPLE TO BUILD—SIMPLE TO USE!



Another view of the completed unit.

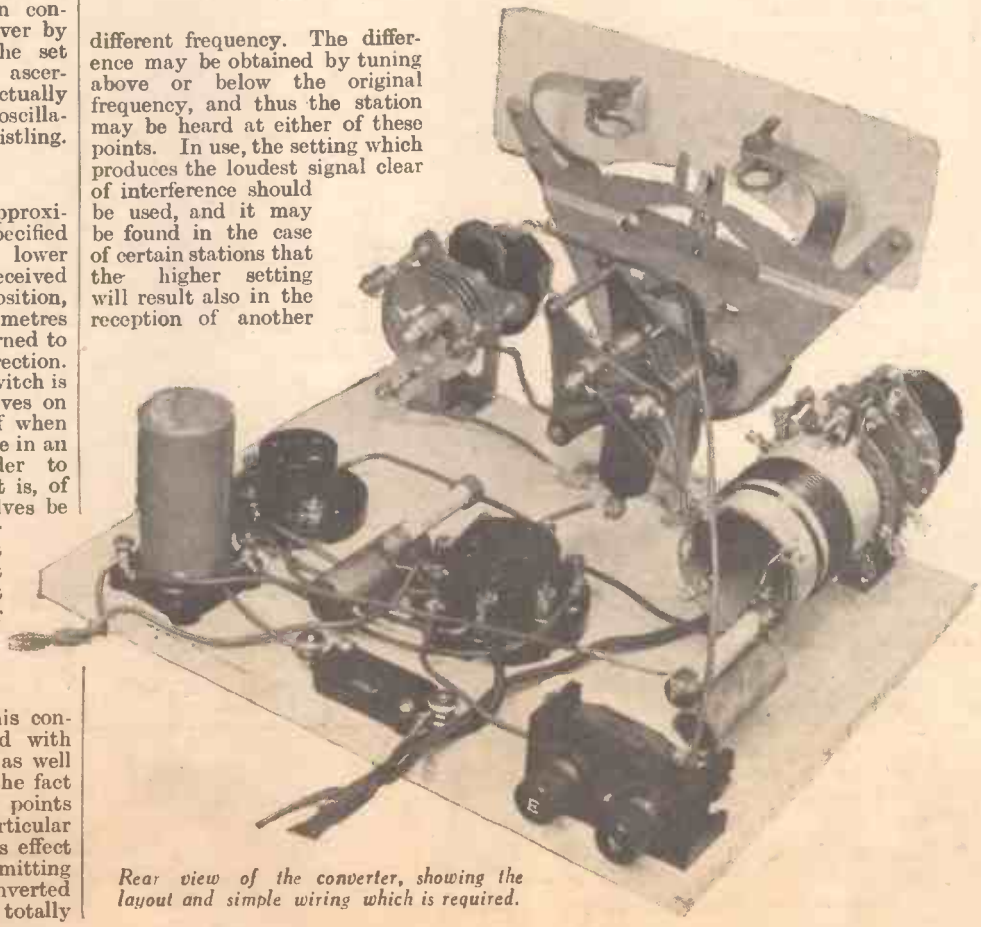
the broadcast receiver are correctly matched, and therefore the trimmers should be carefully adjusted at the dial setting used for short-wave reception—in some receivers the tuned circuits are not accurately matched at all points on the tuning dial. It is also pointed out that signals can be boosted when the unit is used in conjunction with a straight H.F. receiver by setting the reaction control of the set near its oscillation point, carefully ascertaining that oscillation is not actually taking place, of course; receiver oscillation will be indicated by excessive whistling.

Wavebands

The unit covers a waveband of approximately 13 to 70 metres if the specified tuning condenser is used. The lower band of 13 to 29 metres will be received when the coil switch is in its centre position, and stations between 29 and 70 metres will be tuned in with the switch turned to the third position in a clockwise direction. As previously mentioned, the coil switch is also used for switching the unit valves on and off, the L.T. being switched off when the switch is turned as far as possible in an anti-clockwise direction. In order to economise H.T. and L.T. current it is, of course, important that the unit valves be switched off when changing over from the short to the broadcast band, and it is pointed out that the receiver L.T. switch does not switch off the valves in the converter unit.

Operating Hints

One peculiarity of the use of this converter, and one which is obtained with many types of short-wave receiver as well as with adaptors or converters, is the fact that stations will be heard at two points on the tuning dial. In this particular combination the explanation of this effect is that the received station is transmitting at one frequency, and this is converted on the superhet principle into a totally different frequency. The difference may be obtained by tuning above or below the original frequency, and thus the station may be heard at either of these points. In use, the setting which produces the loudest signal clear of interference should be used, and it may be found in the case of certain stations that the higher setting will result also in the reception of another station having a similar frequency difference lower than the incoming signal. It is a simple matter in such a case to turn to the second position on the dial and hear the desired station clear of interference.



Rear view of the converter, showing the layout and simple wiring which is required.

Setting of Tuning Circuits

The actual setting of the tuning circuits in the broadcast receiver with which the unit is used will affect results in this direction, and care should be taken that these circuits are not adjusted to the wave-length of a long-wave station, or this may be heard through the short-wave signal. Once the combination has been tried out for a short period it will be found just as easy to tune in the short-wave stations as it is to receive the standard broadcast stations, and the combination of this converter and the £4 Superhet 4, for instance, will result in the provision of a really efficient all-wave superhet for use on every occasion.

If desired, Messrs. Peto-Scott can supply a cabinet for this converter which will match that specified for the above-mentioned receiver, and thus the two units may be combined and used as a complete receiver, the change-over from short to broadcast wavelengths being carried out by means of a suitable switch.

It should be emphasised that no departure from the published specification should be made in the case of this particular converter, as results will not be obtained unless the specified parts, and construction, are rigidly adhered to.

CURIOUS RECEIVER FAULTS

By Studying a Few of the Ordinary Faults it is Possible to Extend One's Knowledge for Future Fault Diagnosis

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

FAULTS in radio receivers, and particularly in home-built sets, can be divided into many different classes. There are, for example, those faults the symptoms of which are so well known and distinctive that the cause of the trouble is at once obvious, and the radio detective can usually "touch the spot," so to speak, at the first shot. Then there are others which, from their symptoms, may be due to any one of a hundred causes, and these call for careful and systematic isolation on a stage-by-stage basis.

The First Case

An instance occurred to me a short time ago when visiting a friend, for during the evening he mentioned that his set had developed a curious fault. It appeared that no signals were obtained in the ordinary way, but that if he placed his fingers on the grid terminal of the H.F. valve, the local stations could be received with fairly good quality but slightly-reduced volume.

The set proved to be a straightforward combination of screened-pentode H.F. amplifier with bandpass input, a power-grid detector, and pentode output, using ordinary indirectly-heated valves operating on A.C. mains. On examination, the owner's statement proved to be correct, and, moreover, local station reception was also obtained when a direct earth connection was made to the grid of the H.F. valve. From a casual observation of the components and wiring the circuit appeared to be quite in order, and the fact that the H.F. valve filament was alight, and that the same symptoms appeared when a spare valve was substituted in that position, showed that it was not valve trouble. The automatic bias resistance was of the correct value and, besides, the receiver had previously functioned perfectly.

Location

Now it so happened that the H.F. valve was one having the grid connection to a metal top thimble cap, and I noticed when touching it that it was distinctly hotter than one usually finds such a valve to be. This was a clue—excessive heat means excessive anode current (not having any instruments with me I could not measure it) and excessive anode current probably meant insufficient or no grid bias. In this set the grid circuit was completed, so far as bias is concerned, by a 1,000-ohm resistance shunting the bottom coupling condenser of the bandpass arrangement (see Fig. 1), and thence *via* the grid coil. Had this resistance broken down? Short-circuiting it failed to make any difference, so that the resistance was beyond reproach. Clearly, then, the trouble was in the tuning coil—a type of component which seldom gives cause for complaint. A more detailed examination, indeed, showed that one end of the medium-wave winding had become detached from the tag of the terminal. A temporary repair was effected by cutting out the coil entirely and using the input coil of the bandpass pair as a single grid coil. Selectivity was, of course, not so good, but the set was perfectly workable while the faulty coil was being properly repaired.

A Wrong Chassis

Another interesting feature about trouble-hunting is the ease with which quite obvious causes of faults can be overlooked. Two instances came to my notice recently where errors of the grossest kind, due either to carelessness or ignorance on the part of the amateur constructors, were entirely overlooked for quite a long time, simply because one would not dream that mistakes so elementary could be made. In the first place a friend complained that his newly-completed set gave nothing but the most appalling hum; the circuit was quite correct, all the specified components had been used, and the assembly and wiring instructions had been most faithfully followed.

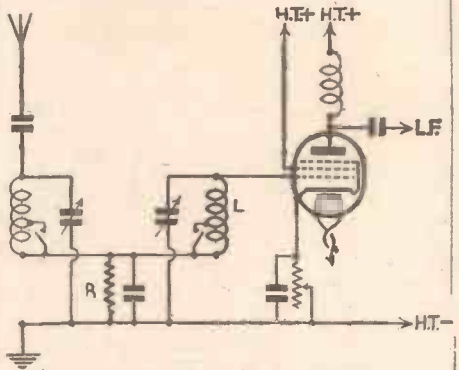


Fig. 1.—The fault described could have been in the resistance R, or the coil L.

But not a single station could be heard for the terrific hum. Naturally, an open grid circuit was suspected, but tests on individual components revealed no fault. I had not troubled to look at the H.T. smoothing, for there was a choke of reputable make and two electrolytic condensers which should have been good enough for anything.

On turning the set over to have a final look at the under-chassis wiring, the cause of all the bother suddenly revealed itself. The original design had specified a metal chassis, but my friend had substituted a wooden one. And the earth wire which was connected to all the points in the set which had to be earthed, was also soldered to tags clamped between the fixing nuts of the electrolytics and the wood of the chassis! There was no smoothing at all—and I had looked at the set for half an hour and had not spotted it!

A Reaction Fault

In the other case, an ordinary H.F.-detector-output arrangement failed to give any signals, although the gramophone section was perfectly satisfactory. Once again nothing abnormal could be discovered by a casual overhaul of the wiring, and I was assured that each of the components had been separately tested for continuity. Transferring the aerial connection to the detector certainly produced signals, but the detector reaction was quite inoperative. Overhauling the reaction circuit, I discovered what should have been noticed earlier, namely that the connection to the reaction coil had been taken from the H.T. side of the H.F. choke, and not from the anode side—a mistake so elementary that the bare idea of it had never entered my head. When this fault was rectified the detector circuit functioned perfectly, and the aerial was retransferred to the H.F. valve. Practically nothing in the way of signals could be heard. But then, profiting from my experience with the detector, I had a look at the H.F. anode circuit and there, sure enough, the same mistake had been made, and the connection from the anode circuit *via* the coupling condenser had been taken from the top end of the H.F. choke (see Fig. 2). It was but the work of a moment to change the lead over and leave the set working correctly.

Quite a number of amateurs' troubles are the result of using components which happen to be on hand without giving

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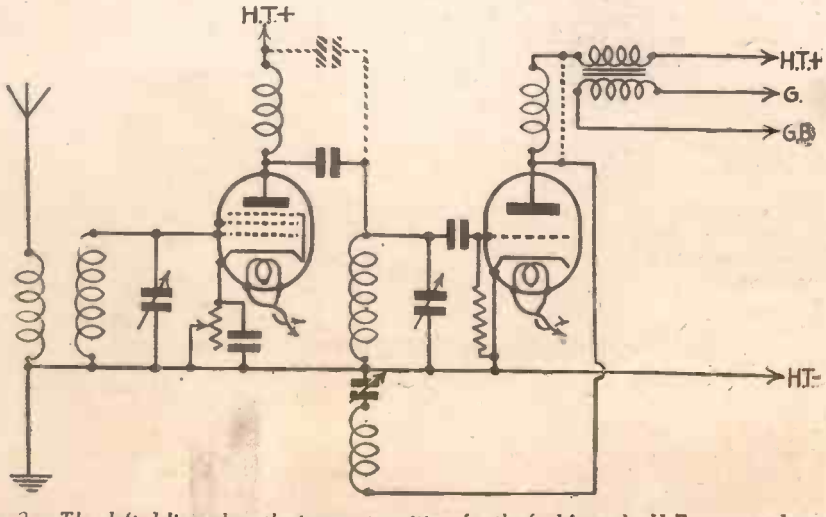


Fig. 2.—The dotted lines show the incorrect positions for the feed from the H.F. stage to detector, and from detector to reaction.

Modern Coil Connections—3

In this Third Article of the Series, Iron-cored Tuning Units are Discussed

By G. V. COLLE

THE history of iron-cored tuning units dates back about three years, and that of the iron cores themselves about sixteen years, and it is interesting to realise that these coils were introduced too late for sets to be built "around them," merely because they represented a new line of research. Undoubtedly their appearance on the radio market created quite a furore at the time, but it would not seem they are accepted purely on their technical merits.

A previous analysis showed that iron-cored units were employed in 27½ per cent. of 40 commercial receivers made in 1934. The percentage is steadily rising and appears to be coincident with improvements to the iron cores and, to a smaller extent, to the general coil construction.

Powder Iron Cores

Readers are doubtless aware that iron cores were originally made for telephone repeater work, as certain void Standard Telephone patents prove. Methods of constructing the cores disclosed in those early patents still offer a guide to modern versions. Apart from their use in high-frequency circuits, compressed powder iron cores are used to-day for low-frequency (L.F.) transformers, relays, and, even more important, for the magnet systems of meters which can be used for measuring A.C. and D.C. voltages with an equal degree of accuracy.

From a technical aspect iron-core construction still offers considerable scope for research. This was clearly indicated in the summary of the special report No. 14, compiled by the Department of Scientific and Industrial Research. The report, entitled "Magnetic Materials at Radio Frequencies" is available, 7d., post free, from the above Dept. at 16, Old Queen Street, Westminster, London, S.W.1.

Nearly two years have elapsed since the report was published (it appeared in January, 1934), although it can still be recommended as a basis for discussion and a starting-point for those interested in the subject. It is understood a further report, No. 17, has since appeared.

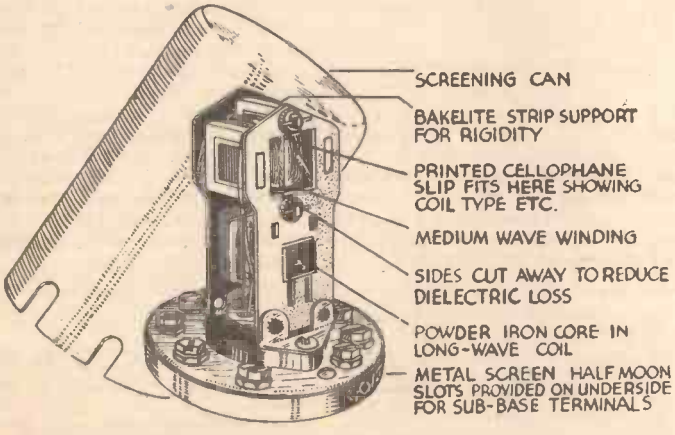
Numerous patents have been granted on improved powder iron-core materials, and coil and set manufacturers have not only a choice of a range of shapes and sizes, but also of various grades. The four principal makers of cores in England are:—Standard Telephones and Cables, Aladdin Radio Industries, Salford Electrical Instrument Co., and Ashley Wireless Telephone Co. Each of their products are named Permalloy, Polydoroff, Ferrocart, and Atmalloy, respectively.

It is not clear that the name Permalloy strictly applies to the bar radio cores produced by Standard Telephones, because Permalloy B and C grades, described in Bulletin No. 606, are supplied essentially for interstage and output L.F. transformers and measuring instruments. Presumably the iron cores for radio purposes are grade A. (?), being square bars .33in. square by 1.09in. long, and with a permeability of 11 to 13 between 250 and 1,500 kc/s.

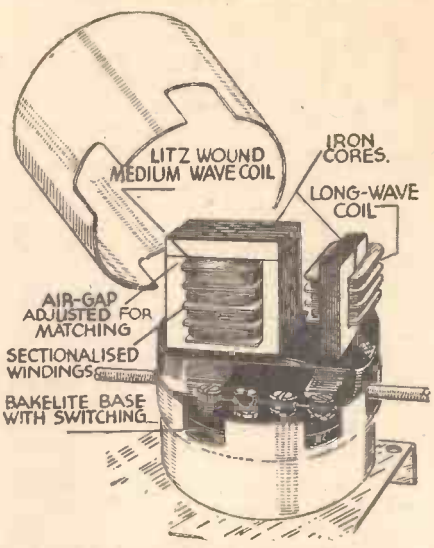
The radio cores due to Aladdin Radio Industries under Polydoroff patents are made in four grades A, B, C, and D, with apparent permeabilities of 14, 16, 20, and 14, respectively. Each core consists essentially of a cylindrical plug ⅜in. diameter by 1 to 1⅛ in. long. For I.F.T. units the length can be halved.

The makers show that the use of a square or round bar core provides a coil construction which develops an external magnetic field, not necessarily of the same intensity as that due to an air-cored coil, but requiring a screening can of reasonable dimensions to prevent eddy current losses. By using a return magnetic yoke of E shape, with half-rounded ends to fit to the cylindrical plug, the effect is to close the magnetic field and thereby allow a much closer fitting screening can.

It can be concluded that the advantage lies in a more compact coil construction rather than a noticeable improvement in efficiency. The point is worthy of note, because extravagant claims have been made for closed cored coil constructions, whereas at the most the improvement is only 15 per cent., against which must be placed the higher cost of the core.



The Goltone iron-cored tuning unit is of novel construction. A minimum of dielectric material is used, the coils being mounted between bakelised strips.



The construction of the Colvern iron-cored tuning unit is clearly shown in this illustration. The wave-band switching and filter coupling coils are contained within the bakelite base.

Short-wave Coils

Polydoroff-Aladdin cores Grade A are intended for short-wave coils and to replace those wound with Litz wire on glass formers (such as in Phillips receivers). Grade B material is more suited for medium- and long-wave tuning units covering 500 to 1,500 kc/s and for I.F.T.s of 465 and 450 kc/s. For use at lower radio frequencies, such as I.F.T.s of 110, 126 kc/s, etc., telephone loading units, permeability tuning and high-grade L.F. components, the Grade C core is recommended. Finally, in the same range, Grade D offers the same advantages as Permalloy B previously mentioned.

Ferrocart iron-cored coils, due to Hans Vogt, made by Colverns, the laminated iron sheet and cores supplied by Salford Electrical Instruments (a subsidiary company of Ferrocart, Ltd., now deals with production), are too well known to readers to need extensive description here. Improved methods of manufacturing the laminated core material prevents disintegration in hot climates and allows the sheets to be stamped and worked to various shapes not only for cores for tuning coils, but additionally for industrial electrical purposes. Compressed powder iron, square-bar and E-shaped cores of various sizes and permeability factors are also available from the above-mentioned company.

None of the iron cores mentioned have provision for inductance matching. So far coil makers have arranged on the coil assemblies means to slide the cores in and out of the bobbins in the case of square or round bars, or, where I and E cores are used, to close or separate the core pieces. For instance, by inserting a square bar core .33in. square by 1.09in. long in a medium-wave coil bobbin ⅜in. long, and commencing with one end of the core flush with one coil cheek, a variation of about 7 per cent. in the inductance can be achieved merely by sliding the core to a more central position. A greater core movement is, of course, possible, except that the constructor would not care to purchase tuning units with the cores projecting half-way out from the bobbins, assuming inductance matching necessitated this course.

Matching Iron-cored Units

Present methods of matching iron-cored units as described cannot be adversely

(*Continued overleaf*)

MODERN COIL CONNECTIONS

(*Continued from previous page*)

criticised where the tolerance of error is predetermined. The tendency of receiver design is to more accurate calibration of stations and greater selectivity. Hence the usual tolerance of plus or minus .25 per cent. in inductance matching is becoming unacceptable in the more accurately calibrated receivers.

Allowing for the fact that the onus of providing a closer degree of accuracy is equally on the variable condenser manufacturer (as well as lower dielectric losses by the use of ceramic insulation), it is incumbent upon the coil maker to allow for nearly dead accurate matching without unduly increasing the cost of the coil units.

To achieve this object, a major requirement is that the permeability of the cores shall remain substantially constant for different values of operating and superimposed direct current. Furthermore, there is the necessity for a low change of permeability with change of temperature. The most important feature is for fine—one might say, micrometer—movement of the core, or part of the core, in a mechanical sense.

It is impossible to guard against changes of temperature except in conditioned buildings, but the selection of cores from single batches made under identical conditions will ensure a uniform change of permeability throughout the coils in any one set. Standard Telephone cores, as an example, do not change in permeability more than —.03 per cent. per 1°C. rise. Possible variations due to superimposed D.C. can generally be avoided by working coils in a pure high-frequency state by parallel-feed couplings.

The main question of fine adjustment of the core for critical inductance matching appears to be one which has not yet received the full attention of designers in this country. Recently the writer was privileged to examine some cores made on the Continent and which incorporated all the desirable mechanical features. Altogether about a dozen samples were inspected, all of which were characterised by the provision of a screwed powder iron plug engaging with the main core, which is drilled and tapped.

Inductance Tests

The process of matching similar coils incorporating these cores is a very simple one, as the main core plus its plug (which is ready screwed about half-way in the main core) is inserted in the coil and positioned to give the usual close matching effect. An adhesive, such as bakelite varnish or hard wax then secures the core firmly in position, the coil being put on one side for the adhesive to harden.

A further inductance test is then made later, the plug being screwed either further

Part-sectional view of the Varley iron-core tuning coil showing its construction. Note the unusual positions of the coils to prevent interaction between them.

in to increase the permeability of the core, or to reduce it by unscrewing. No doubt a similar effect could be achieved with a single round type of core, screwed like a large sized grub screw, and the coil bobbin moulded in cellulose acetate with a corresponding female thread.

The former method, of course, has the advantage in that the main core is normally set in the same relative position, giving each coil a definite self-capacity, which the plug should not upset.

Correct tracking and operation of the oscillator circuit in a superhet necessitates not only critical values of inductance, but also a definite intensity of oscillation. Iron-cored coils with cores having fine adjustment will satisfy one condition, but means for varying the position of the reaction windings relative to the tuned oscillator windings are equally desirable. Split coil-formers, or single formers with movable walls are suggested. If a short iron core is used to match the oscillator tuned winding, a further small movable core could be employed inside the reaction winding to link and vary the coupling. These suggestions are by the way, and are mentioned because in the experience of the writer critical oscillator matching can be more difficult with iron-cored units than with air-cored versions.

Merits of Iron-cored Coils

There are several ways of considering the merits of the units under discussion, and these may be summarised in the following manner:—(1) With iron-cored coils it is possible to obtain a much larger degree of amplification with the same degree of selectivity as with the usual air-cored equivalent; (2) By the use of suitable low tapping points iron-cored units will exhibit greater selectivity at similar signal strength on the same comparative basis; (3) Greater accuracy and easier methods of inductance matching; (4) Iron-cored coils can be made of *equal* efficiency to selected air-cored units, but with considerably smaller physical dimensions. It is also possible to design *closed* iron-cored units of much smaller dimensions than air-cored units to have a greater degree of amplification; (5) The smaller field of even open bar type iron-cored coils allows much closer screening without a large decrease of inductance. A screening can with an annular air gap of ½in. surrounding an air-cored coil reduces the medium-wave inductance by 14 per cent., and on long waves by 10 per cent. A similar air-gap between the metal can and an iron-cored unit reduces the medium-wave inductance by 2 per cent., and on long waves by 1 per cent.

Readers will have gathered from the foregoing that iron-cored coils are capable of meeting the most exacting demands of receiver manufacturers. Should any constructor consider the information given irrelevant to a practical journal, it must be remembered that iron-cored coil home construction is either not justified or alternatively offers certain difficulties with the tools usually available. Apart from the attempt to make these notes of general interest, constructors should be placed in a better position to discriminate between good, indifferent, or bad coils when building future set designs.

PROGRAMME NOTES

Variety from the London Regional

FOR this Variety Hour, which will be given on January 22nd, Ernest Longstaffe has collected, with one notable exception, a cast all of whom are new to the microphone. The exception is Edwin Lawrence, whose brilliantly funny monologues will ensure the rapt attention of listeners. The newcomers include a close harmony trio of astonishingly talented artists, who call themselves "The Three Herons"; Harry Chapman, who appeared in "More Light Fare" on December 2nd, has collected for this programme a novel and curious combination of players who will be known as "The Busking Broadcasters." The combination consists of a harp, that rare instrument the English concertina, a dulcimer, and a violin. Another microphone débutante is Marjorie Holmes, a soubrette, who is possessed of extraordinary verve, and should have no difficulty in expressing her vivid and compelling personality through the unfamiliar medium of the microphone. Finally, come Beck and Aston, whose clever and extremely broad Lancashire cross-talk has long been popular in the halls.

Granada Theatre Organ, Bedford

FOR the first time the organ of the Granada Theatre, Bedford—an eight-rank Wurlitzer—will be heard in the Midland programme on January 21st. The organist there is Harry Farmer, who is a native of Walsall. His first broadcast was as a pianist at Birmingham when he was only twelve. He deputised for Frank Newman when he was sixteen, and he also studied under Reginald Dixon, his plan being to blend their styles with his own.

"Barnet's Folly"

JAN STEWER will be heard in his original part of George Growsell in his own play "Barnet's Folly," which has been adapted for the microphone by Cyril Wood and will be produced by him in the National programme this week. The play was first produced in Plymouth at the Repertory Theatre in 1931 with the Repertory Theatre cast. Later it went to Birmingham Repertory Theatre and toured for a time. Last February it was produced at the Haymarket. The cast of "Barnet's Folly" will be a hundred per cent. Devonshire. George Growsell, as played by Jan Stewer, is described as a near relation of Churdles Ash. Barnet's Folly, which gives its name to the play, is the local name for a factory erected by an ambitious builder in an attempt to use modern business methods for selling farm products, but although the venture threatens the happiness of nearly all the characters in the play, it does not spoil the rural atmosphere, for all three acts are presented from Melston Farm.

The New Constructor's GUIDE to SET BUILDING

Practical Details are Given Concerning the Superhet Conversion Dealt With Last Week, and Particulars are Given for the Application of Variable-Mu Control to the Pentagrid, as well as for the Addition of Band-pass Tuning. By FRANK PRESTON

GENERAL details were given last week of the three-valve superhet circuit, and we can now proceed to consider the constructional work in greater detail, whilst for the benefit of those who are unable to follow the circuit diagram given, a pictorial circuit is shown in Fig. 1 on this page. There may be some who would prefer above- and below-chassis wiring plans of the set, but it is scarcely practicable to give these in view of the fact that alternative components may be used; because of this the plans would vary to a certain extent according to the particular parts used.

Mounting the I.F.'s

The outline plan of the chassis given last week indicated the positions of the largest of the new components—the third coil and I.F. transformers—but the actual method of mounting the latter depends upon the type of transformers employed. For example, if Varley or Wearite transformers are used they should simply be attached to the upper surface of the chassis by means of ordinary wood screws, but if the Bulgin or Eddystone transformers are used the procedure is modified. In the case of the Bulgin transformers, 1¼in. holes must be made through the chassis by means of a brace and suitable centre or expanding bit. When using the Eddystone components four ⅛in. holes must be made through the chassis before mounting each of the transformers; these are the holes through which the flexible leads must be passed before the component is finally screwed down.

As to the other parts, the majority are supported in the wiring and can be so arranged that the connecting leads to them are as short as possible, and in conformity with the general rules laid down in the first two articles of this series. The pre-set condenser (.0001-mfd.) should, of course, be mounted on top of the chassis where it is perfectly accessible, and it should be situated as near as convenient to terminal No. 4 on the oscillator coil—that is the terminal to which it must be connected.

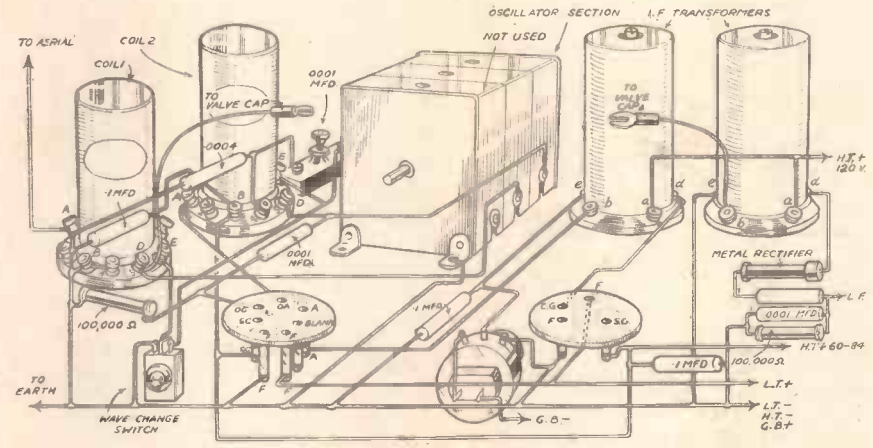
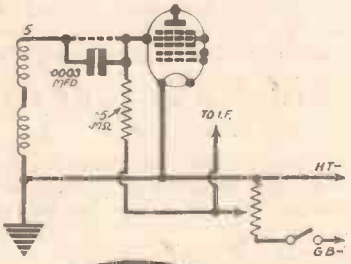


Fig. 1.—This pictorial circuit will make the wiring of the frequency-changer, I.F. amplifier and second detector quite clear to those who were not able to follow the theoretical diagram given last week.



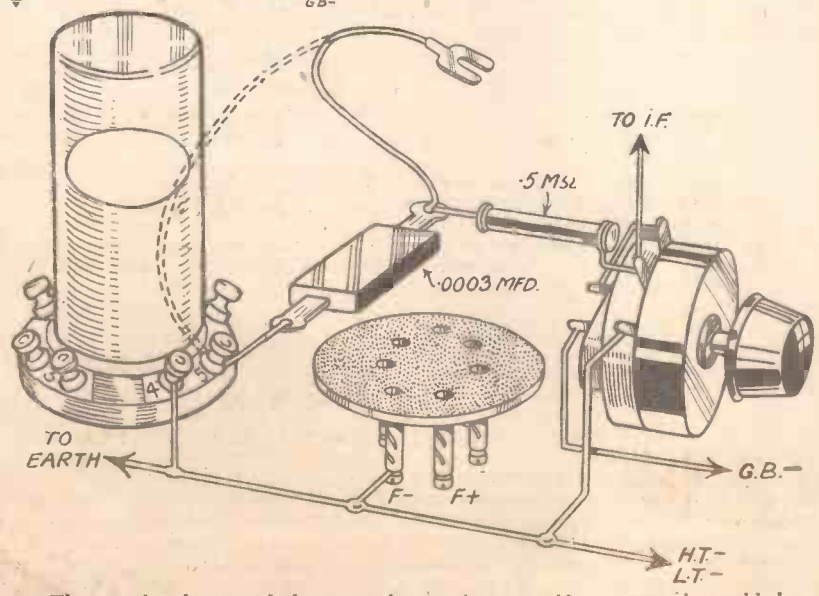


Fig. 2.—Theoretical and pictorial diagrams showing how variable-mu control is added to the pentagrid valve. The lead shown by broken lines is removed.

It was mentioned last week that in the preliminary arrangement only a single coil will be used in the aerial circuit. Thus, only one of the two-point switches is required, and this is used for wave-changing with both coils in use. When band-pass is added later the second switch will be brought into use again.

In passing, it should be mentioned that the L.F. stage is not shown in Fig. 1, since this remains unaltered, and is wired exactly as shown two weeks ago. The connections to the "Westector" also remain practically unchanged, since the only difference is that an I.F. transformer is used in place of the second tuning coil.

Setting the Trimmers

After completing the wiring the preliminary trimming adjustments can be made, and it is worth while to take particular care in carrying out this part of the work, because the set can never operate at maximum efficiency if the trimming is not done thoroughly. The first step is to tune to a station on about 250 metres, and

then to reduce signal strength by means of the volume control until the transmission is only just audible. After that, the trimmers on the gang condenser can be set. Start with that on the oscillator section and turn the screw very slightly, first in one direction and then in the other. It will be found that the setting of this is extremely critical, and it will probably be noticed that any alteration from the original setting will cause a reduction in signal strength, due to the fact that the operation of the main tuning knob was originally dependent upon this condenser section.

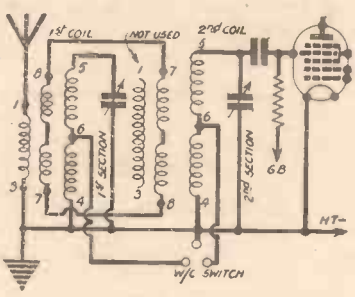
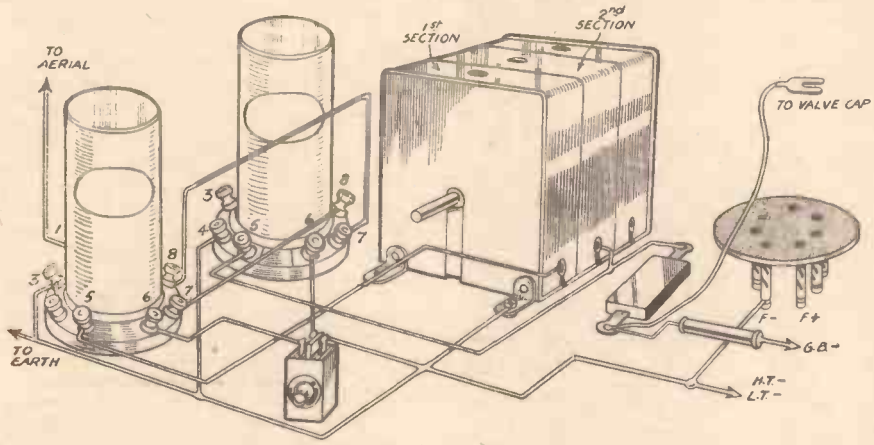


Fig. 3.—Theoretical and pictorial diagrams showing how the third coil is wired so as to form an inductively coupled band-pass filter.



Next, repeat the process on the middle trimmer, but do not touch the condenser knob at all during the process. Although the adjustment is not likely to prove very delicate, it should be found that there is one particular position of the screw at which signal strength is greatest. When satisfied that the two trimming condensers are adjusted to their optimum positions at the particular wavelength in use, tune to another station on about 500 metres, and repeat the adjustments just described, taking care to move the trimming screws as little as possible. Should it be found that an appreciable alteration is required, it may be assumed that there is a fault either in a component or in the wiring, and this should be looked for. As an additional test, it is desirable to tune to a third station near the centre of the medium-wave band and repeat the adjustment in order to secure the best "average" settings.

I.F. Trimming

The next step is to adjust the trimming screws on the I.F. transformer, commencing with that transformer which is nearest to the pentagrid valve. The actual method of adjustment depends upon the make of transformers employed. All except the Varley are similar in that two adjusting screws are accessible through holes in the top of the screening case; one screw is for the condenser across the primary winding, and the other is for that in parallel with the secondary. In the case of the Varley, there is a hexagon nut which operates one trimmer, and a grub screw concentric with this which operates the other.

Using a long screwdriver nicely ground (if necessary) to fit the screws exactly, turn first one and then the other very slightly backward and forward until the best setting is found. When using the Varley transformers first turn the nut with a suitable well-fitting spanner, and then the grub screw with the screwdriver. Repeat the process exactly on the second transformer, after which the set should be perfectly "tuned-up" for medium-wave reception.

Long-wave Tracking

When the wave-change switch is turned to the long-wave position it might be found that signal strength is at first very poor, this indicating that the long-wave pre-set padding condenser requires adjustment. After tuning to a station near the middle of the range slowly turn the adjusting knob of this condenser with a long screwdriver until the best setting is found. If signal strength is still unsatisfactory it might be necessary slightly to readjust the trimmers on the I.F. transformers and on the gang condenser, but these adjustments should not be made unless they are found to be absolutely essential. If alterations *have* to be made it will be desirable, if not essential, once again to repeat the trimming on medium waves.

V.M. Volume Control

In the receiver as it now is, variable-mu control is applied only to the H.F. pentode valve in the I.F. amplifier, and the control cannot thus be fully effective. In order to make it so, variable grid bias must also be applied to the pentagrid, and there are two or three possible alternative methods of providing for this. The simplest, and that which is recommended, is illustrated in Fig 2, where it will be seen that the lead from terminal 5 of the centre coil to the control grid of the pentagrid is broken, a .0003-mfd. fixed condenser being inserted, and a lead taken from the grid to a .5-megohm grid leak, the other end of which is connected to the slider of the potentiometer. In making this simple alteration it is important that the grid leak should be placed as near as possible to the valveholder, so that it acts as an effective "stopper" or decoupling resistance, preventing unwanted coupling between the grid circuit and other parts of the set. When this variable-mu control has been added it should be found that the volume of the most powerfully-received transmission can be cut down to a whisper or even eliminated entirely.

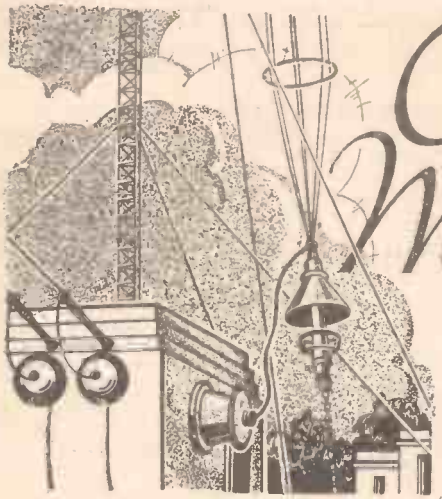
Band-pass Tuning

The only trouble which might possibly be experienced now is that a few "chirps" may be heard when tuning the set. These will be most pronounced when the receiver is used in conjunction with a long aerial situated within a few miles of the local station. In any other circumstances, it is most probable that there will be no interference whatever, since the circuit is similar in many respects to that of the "£4 Superhet," which is almost entirely trouble-free in this respect. In any case, however, any little trouble which is experienced can be completely eliminated by changing over to band-pass tuning in the input circuit. This simply involves the connection of the "spare" coil which is mounted nearest to the front edge of the chassis. The easy connections are shown in Fig. 3, from which it will be seen that the coupling between the two tuned circuits is on the "inductance" principle, the coupling windings in each of the two B.P.80 coils being joined together—terminals 7 and 8 of the first coil are connected to terminals 8 and 7 respectively of the second. Additionally, of course, terminal 5 of the first coil must be connected to the first section of the three-gang condenser, and the aerial must be transferred from terminal 1 on the second coil to the corresponding terminal on the first. When this is done the loose-coupled aerial winding in the second coil is not used. One of the three-point wave-change switches is used to operate on both band pass coils, the second switch being used with the oscillator coil only.

Final Adjustments

After this alteration has been made it will be necessary to set the trimmer on the first section of the gang condenser, and it might be necessary very slightly to modify the setting of the second trimmer to compensate for the slightly modified characteristics of the second tuned circuit when the aerial "load" has been removed.

The method of applying automatic volume control will be described in the next and concluding article of this series. The modification is of a simple nature, and does not necessarily involve the use of additional components.



On Your Wavelength

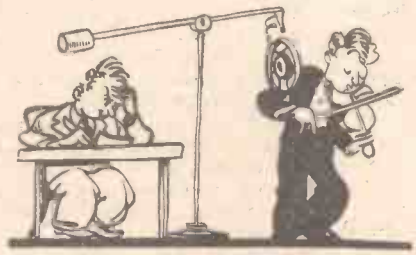
By Thermion

Hot Words on the Radio

I HEAR that wireless listeners on the East Coast are complaining that the B.B.C. programmes are being interrupted by certain trawlers whose skippers make too free use of the vernacular of the sea. I imagine that every reader will now endeavour to listen in on those wavelengths in the hope of picking up a snatch of nautical conversation containing a diadem of humour such as that which is causing all this pother. You know what sailors are! All the same, I recommend you to do so using a pair of headphones, for the lingo will be most disconcerting if you reproduce it through the loud-speaker in the presence of ladies.

Between Items

I SEE that an announcer at Budapest spends the time between announcing long items in writing his memoirs. This answers a problem which has troubled me



An announcer in Budapest fills in the time between long items by writing his memoirs.

for a long time, for I have often wondered how announcers fill in their time, *and manage to keep awake* during some of the long items, which are as sleep-inducing as some powerful injection. There are, of course, other items which make you sit up and take notice, and send your temperature and blood pressure rising. Some of the propaganda broadcasts from Moscow are in this class.

Orchestral Balance

I REPRODUCE below a paragraph I read in one of our daily papers. I give it without comment. It is too good to miss :—

"The responsibilities of radio balance-engineers are engaging the attention of musicians. Orchestral tones range from *ppp* to *fff* or from 1 to 1,000,000 frequencies. The microphone, however, can only transmit from 10 to 10,000 frequencies, or from *pp* to *ff*, about ten times less volume. If the *pp* is exceeded, background noises, atmospherics, and 'mush' supervene; if the *ff* is exceeded, the loud-speaker may be overloaded and 'blasting' set in. . . . Dr. Adrian Boult points out that electrical reproduction is not able to take the full range of tone, but he is satisfied that the control engineers of the B.B.C. are thoroughly capable musicians, and able to look after this."

Why Not Expand the Medium Waveband?

IT has always seemed to me that the only solution to the interference problem (I am not, of course, referring to electrical interference) is to move the commercial transmissions, which at present occupy wavebands ranging from 600 metres to 950 metres, into the long waveband somewhere between 1,000 and 2,000 metres. As the greatest number of stations operate at present between 200 and 600 metres, this will enable a wave-length reshuffle to take place so that each station can clearly be separated. This would, of course, mean a radical change in receiver design, particularly in the tuning coils and variable condensers. Far too many stations are crowded together, and as with ordinary vehicular traffic the roads of the ether must be widened. As it is illimitable it is a comparatively easy matter to do this.

My Home Recorder

I HAD a home recording set given me for Christmas, and as the only time I sing is in the bath, I fixed it up there to record my Neptunal vocal efforts. Having heard the results I have decided to sing no more, and my neighbours; they have suffered my late night and early morning wireless experiments. They must have been annoyed by my early wireless receivers, and by the very poor quality of my early loud-speakers.

Critics Want the Whole Woiks

I HEAR some radio critics are complaining that the stamping of the cold feet of the spectators should have been allowed to reach the commentators' box and mike during the New Zealand versus the London match on Boxing Day. These sounds may lend atmosphere and help to make such broadcasts a success. Personally, I always listen to running commentaries sitting on a plank supported by two piles of bound volumes of PRACTICAL AND AMATEUR WIRELESS and wearing a hat, coat, and muffler. If I can get the correct atmosphere in this way why should not other listeners; and what does the listener want, the commentary on the match, or the miserable sensations attendant upon watching it?

Absurd Pots pourri

I DISLIKE intensely those trios who give the sort of programmes designed to please everybody. You know the sort of thing. Selection from Wagner, and Overture to Zampa sandwiched in between "My Sweety Don't Care for Me," and "Lovely Lou Lou Loves me Now"; with a crooner thrown in as well, my misery is complete.

Television Announcements

THE latest tarradiddle in the television tangle states that the first programme will go out on May 1st. The expected opposition from the film interests has caused the B.B.C. to state that it will make its own films. Let us hope that it seizes the opportunity to clean up that aspect of the

I recorded my "Song of the Bath."

film industry—I might say the most disgusting aspect of the film industry—which I believe is technically known as Credit Titles. I give an example of the sort of thing below :—

JOSEPH BLOGGSKI
PRESENTS
NATALIE NITWIT
IN
AL BOLENEY'S
VERSION OF
"AS YOU LIKE IT"

PRODUCED BY
SAM STINKSKI

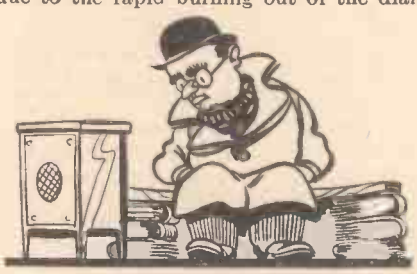
DRAMATISED BY
PAUL PUNK

From the play by
William Shakespeare

Not only is a good deal of this sheer arrogance, but it is also an inversion of the apportionment of credit. When you go to the films you find that some foreign-sounding name appears first. Apparently he is the man who has put up the money and is determined to let you know it. Next come the names of the producer, the distributor, the actors, the photographers, the office boy, and usually, for a fleeting frame or two, the name of the author in the smallest possible type. I hope the B.B.C. will remember that old adage "The play is the thing," and give the author credit, and the other people associated with the production such credit as they are entitled to. Most of the people connected with the film industry are addle-pated nitwits who, without the slightest degree of histrionic or educational merit batten themselves like barnacles on to some poor author's scenario, and "stars" make thousands of pounds a year for appearing for a few minutes on the screen, whilst the author is lucky to get £50 or so. It's wrong, dead wrong, and it isn't white, man, it isn't done.

Dial Lights

I HAVE recently run across not a few constructors, as well as users of commercial receivers, who have had trouble due to the rapid burning out of the dial-



You must get atmosphere to listen to running commentaries.

light bulb. In most cases the set has been of the A.C. type, the bulb being fed from the 4-volt supply used also for the valve heaters. And, since the particular transformer winding is rated at 4 volts, it seems natural to suppose that a suitable bulb would have the same rating. When such a bulb is used, however, it very soon burns out, and it is invariably better to use a bulb rated at not less than 6 volts. The reason for this is that the maximum or peak voltage attained is greater than 4, 4 volts being the mean or average value. At least that is the reason generally ascribed, but I believe that vibration of the filament is just as important a point. The filament of a 4-volt flash-lamp bulb is slender and when made white hot is comparatively delicate, so that it breaks easily due to the slight vibration caused by the A.C. supply. A 6-volt bulb is not run at "full load" and therefore the filament does not reach a maximum temperature. Consequently it is more robust and well able to withstand vibration.

An alternative method is to wire two 3.5-volt bulbs in series, this often being an advantage when a long horizontal or arcuate tuning scale is employed.

In the case of a battery set a 2.5-volt bulb is most suitable, but the position is a good deal different in a universal receiver. Occasionally it is possible to use a lamp in series with the heater circuit, but in most instances the best arrangement is to connect a 5-watt lamp, of voltage rating appropriate to the mains supply, direct to the mains socket. Due to the low current consumption, the lamp does not become very hot, and can be placed fairly near to the celluloid scale with safety.

Using the Eliminator

THERE are many constructors who attempt to operate a battery-type receiver from a mains unit (either D.C. or A.C.) and experience various difficulties, principally instability. They seek for all kinds of faults in the receiver, but do not suspect the mains unit. Although such a unit may function perfectly satisfactorily with one receiver, it is no guarantee that it will also operate in the same manner on another set, and this causes difficulty in view of the fact that constructors often get the unit tested by a friend when they are in difficulty. It is generally found that the trouble occurs in an S.G.-detector type of receiver where the screening grid of the H.F. valve and the detector anode are both intended to be operated from a 60- to 80-volt tapping. On the mains unit there is generally a point marked S.G. or 80 volts, and this is sometimes provided with a variable control in order that certain scope is provided at this tapping. It may be found desirable in such a case to operate only the screening grid from this point, and to connect the detector anode through a decoupling resistance to H.T. positive (maximum), with a fixed condenser between earth and the junction of the original detector H.T. lead and the decoupling resistance. In many cases of difficulty it is found that the most effective measure is to rearrange the H.T. leads in the receiver so that only one H.T. lead is brought out for connection to the mains unit, and this is taken to the maximum voltage tapping. All the intermediate voltages in the receiver are then obtained by means of voltage-dropping decoupling resistances, with the usual decoupling condenser included to complete the circuits.

Extension Speakers

A CASE of difficulty was encountered the other day in which a reader was using an extension speaker with a commercial receiver. Terminals were provided on this receiver for the purpose, but when the extra speaker was connected in circuit very weak signals were obtained. The speaker was tested and sent back to the makers and found quite in order, yet the results were very poor. As a final test, the listener called in a service agent of the firm, who tested the circuit and found it in order, and even connected to the receiver a speaker which he happened to bring with him and which gave very good signals. After some discussion, the service agent removed the back of the speaker which was being employed by the listener and found that it was quite a good standard commercial model, but, and here the point might seem surprising to some readers, it was a high-resistance model, whereas the output circuit of the receiver necessitated a low-resistance speaker. The external connections were in parallel with a 1-ohm speech coil in the receiver and thus the external speaker was being effectively short-circuited. This proves the value of a special extension speaker which is provided with a matching transformer giving both high and low ratios.

Berlin's Television Service

WE understand that the twin ultra-short-wave sight and sound television transmitter, which takes the place of the one destroyed during the exhibition fire, is now in operation.

The German Post-Office and the Telefunken Company have worked with extreme celerity, as it is a most difficult matter to complete two 16 kW anode dissipation transmitters in three months. This station supplies a power of 1.5 kW in aerial at the aerial on the top of the Witzleben tower. Definition still remains at 180 lines with 25 frames-per-second.

Empire Broadcasting

ACCORDING to a B.B.C. report, 1935 has been a year of steady expansion in the Empire Broadcasting Service. Hours of transmission and the scope of the programmes have increased with a parallel growth of interest overseas. The correspondence from abroad has more than doubled, while many Colonies have taken steps to install wireless exchanges or re-broadcasting equipment, so as to make wider use of the short-wave service from Daventry.

At the beginning of July, a new Transmission—Number 6—was inaugurated as a regular daily feature, after tests which started in March. This programme is broadcast normally from 3.0 to 4.0 a.m., and is intended primarily for reception in Western Canada on the preceding evening. In practice, it has proved a very useful service, in the morning hours in India and East Africa, and at varying times of day in many other parts of the world. Constant experimenting has improved conditions of transmission and reception, and the Empire broadcasts have been better and more consistently heard than before.

The Empire News service has been extended and seven Bulletins are now broadcast each day from Daventry. The Empire Orchestra is firmly established and

I dislike trios.

plays an important part in the programmes, especially at hours when there is no broadcasting in the National and Regional programmes. Notable broadcasts to the Empire during the year have included the Jubilee celebrations, the Conference of the Empire Parliamentary Association, Lord Jellicoe's funeral, the South African Cricket and the New Zealand Rugby Tours, and the General Elections in the United Kingdom and in Canada and New Zealand.

Television Programmes from Paris !

ACCORDING to a recent report the British public may be able to receive television programmes from Paris in the near future, thanks to sunspots. These broadcasts will be given from the Eiffel Tower, and the power of this station is being increased from four to twenty kilowatts. The transmissions from this station on a wavelength of eight metres usually has a range of only 20 to 25 miles, but recently, owing to sunspot activity, wireless experimenters have achieved remarkable results in long-distance reception on these wavelengths.

"SERVICING SETS FOR PROFIT" FOR THE EXPERIMENTER

Using the Universal Test Meter for Reading A.C. Voltages and for Measuring the Capacity of Fixed Condensers

THE last article in this series gave all the necessary information to enable readers to construct a rectifier unit for use with the Universal D.C. Test Meter and also outlined some of the uses to which the completed instrument might be put. In this connection it should be noted that the switch on the panel of the D.C. meter should *always* be placed in the 1 m/A position before the A.C. unit is connected and used. If the switch is in any other position, no damage will be done either to

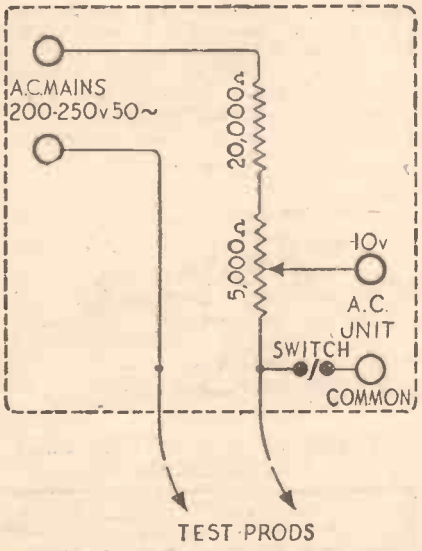


Fig. 1.—The theoretical circuit.

the meter or to the rectifier, but erroneous readings will be obtained. Also, make certain that the correct range is used for A.C. measurements, as the rectifier unit may easily be damaged by overload and, in this respect, is not so robust as the meter movement.

Where A.C. mains of known voltage are available we have at hand a very convenient method of checking the 500-volt range of the A.C. meter, and the 4-megohm parallel resistance on this range may be reduced to give the correct deflection when the mains voltage is measured. In some instances a reduction of this resistance to a value of 3 or 2.5 megohms has been found to be necessary, though the reason for this is not readily apparent. Of course, care must be taken to disconnect the mains from the instrument while adjustments are made.

The voltages are indicated on the 0—1 m/A scale in precisely the same way as when the meter is used for D.C. measurement, i.e., on the 10-volt range all readings should be multiplied by 10, on the 100-volt range by 100, and on the 500-volt range by 500. For example, using the 500-volt A.C. range a reading of 0.2 milliamp will equal 0.2 x 500, or 100 volts.

There is no easy method of extending the current ranges of our A.C. instrument, and the construction of suitable transformers for this purpose I consider is rather beyond the capabilities of the reader. However, the occasions on which A.C. current measurements need to be taken for receiver diagnosis are fortunately rare, and the omission of extended current ranges need not be considered a very great drawback, or one which unduly restricts the scope of our meter.

Measurement of Capacity

There is, however, one very useful type of measurement which can be made with our A.C. unit and that is the measurement of capacity. For this purpose it is necessary that a source of A.C. is available, and A.C. mains will usually be accessible to those readers who have constructed the rectifier unit. In this connection it is assumed that the mains to be used are 200-250 volts 50 cycles, but any other voltage or periodicity can equally well be accommodated by suitable modifications to the meter.

It will be seen from the circuit diagram (shown diagrammatically in Fig. 1, and pictorially in Fig. 2) of the additions to be made to the unit, that the A.C. mains are fed to a voltage divider, formed by a 20,000 ohm fixed resistor and a wire-wound potentiometer of 5,000 ohms, across which the 10-volt range of the A.C. unit is connected, and the condenser under test. The switch is included in the leads to the meter to serve the double purpose of disconnecting the capacity measuring circuit and preventing damage to the meter when adjusting the meter for full-scale deflection before taking capacity measurements. From the foregoing it will be clear that although the illustrations to this part show the capacity unit as a separate piece of apparatus, the inclusion of the extra components can conveniently be made in the same box as the A.C. unit described in my last article. If made up as a separate unit, providing the switch is in the "off" position after capacity measurements have been taken, there is no necessity to disconnect the unit in order to use the remainder of the apparatus.

The inclusion of insulated test prods is another very necessary precaution because unless these are connected together or bridged across a condenser, fairly high A.C. voltages are present and there is a possi-

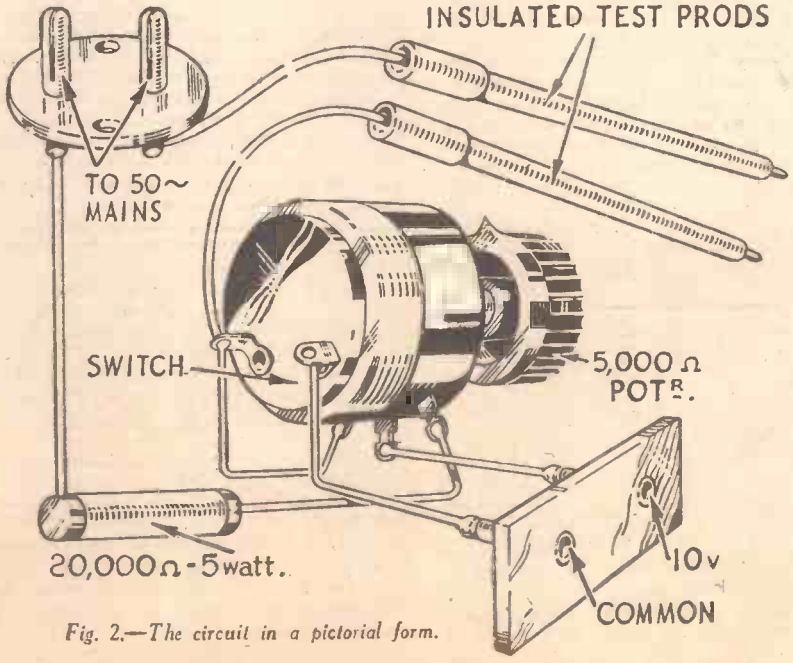


Fig. 2.—The circuit in a pictorial form.

bility of an unpleasant shock being sustained if bare test prods are carelessly handled. The type of test prod in which the connecting plunger is spring-controlled will be found to be the most suitable, as there are no exposed metal parts unless readings are being taken.

As I explained to readers when the A.C. unit was constructed, a condenser will permit a flow of alternating current, and the amount of current passed will depend on the capacity of the condenser, the voltage applied to it, and the periodicity of the supply. This is the principle governing the capacity measurements which we propose to make, and I shall first explain how the meter is wired and then proceed to the actual calibration.

Mounting the Components

No difficulty should be experienced in mounting the components in the box and the wiring is quite straightforward and may be followed easily from the drawings, with special reference to Fig. 4. Make sure that the 5,000-ohm potentiometer and switch are constructed in such a manner that the switch is "off" when the knob is rotated fully in an anti-clockwise direction and that all joints in the wiring are sound. The potentiometer shown in the illustration is the Bulgin, Type No. V.S.44 and this will be found to be eminently suitable.

Now connect the units together as shown in Fig. 3, short-circuit the test prods by extending their points, locking them and clamping them together in a crocodile clip, and rotate the 5,000-ohm potentiometer until the switch is "off." Plug into the A.C. mains and rotate the potentiometer until the switch "makes." The meter should now show a small deflection and further rotation of the potentiometer will increase this until a full-scale deflection is obtained. We are now ready to commence calibration.

Those readers who have a large assortment of fixed condensers of known capacity will be able to calibrate their meter directly by disconnecting the mains, removing the short-circuit from the test prods, reconnecting the mains, and then touching the test prods to the terminals of the condensers and noting the deflection given by the meter.

The larger the capacity of the condenser the higher will be the reading given by the meter and, with the circuit as shown, capacities between .001 mfd. and 1.0 mfd. will give readable deflections of the meter. A chart showing the deflections of the meter for various capacities can then be prepared on the lines of the one illustrated in Fig. 5, cut out and pasted inside the lid of the D.C. meter for ready reference.

Calibration Chart

This procedure, however, will not assist the reader who has not ready access to suitable condensers, but a calibration chart may be prepared by calculation by the following method.

The formula for calculating the reactance of a condenser is Reactance $= \frac{10^6}{2\pi fC}$, where $\pi = 3.14$, f = frequency of the supply, and C = the capacity of the condenser in micro-farads. If we select, for example, a condenser of 0.1 mfd. capacity we find, on inserting the values in the above formula, that Reactance $= \frac{10^6}{2 \times 3.14 \times 50 \times 0.1}$ or 32,000 ohms. At first we should be led to assume that we had merely to add this value to the 25,000 ohms already across our mains supply, which we will assume is 250 volts, and apply Ohm's Law to give us the current flowing round the circuit. We should, however, be wrong, because we had forgotten that the current flowing through a condenser is 90° out of phase with the current flowing through a resistance connected in series with it and therefore we must use a further formula to enable us to add the reactance to the resistance. This formula we have already used when constructing the 10-volt range of our A.C. meter and, you will remember, is Impedance $= \sqrt{(\text{Reactance})^2 + (\text{Resistance})^2}$. Re-writing this with our values inserted we find that Impedance $= \sqrt{(32{,}000)^2 + (25{,}000)^2}$ or 41,000 ohms approximately. Now we can apply Ohm's Law and find that the current flowing round the circuit $= \frac{\text{Mains Voltage} \times 1{,}000}{41{,}000}$ or 6.1milliamps. We know that we have set our meter to read 1 milliamp with 10 milliamps flowing round the external circuit, so that our meter will read 0.61 milliamps and this is actually the reading obtained when a condenser of 0.1 mfd. capacity is connected to our test prods.

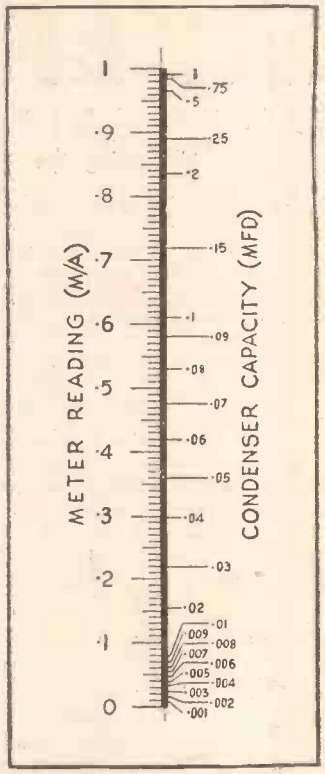


Fig. 5. — The calibration chart showing meter readings and condenser capacities.

Reactance Values

The calculation of reactances and the transference of the values obtained to the scale of the meter is rather a laborious process, so for the guidance of constructors I have compiled the following list of the more usual capacities showing the meter reading obtained, and although these values may vary slightly with different mains voltages they may be relied on for the purpose of reference and will be found sufficiently accurate for all normal uses.

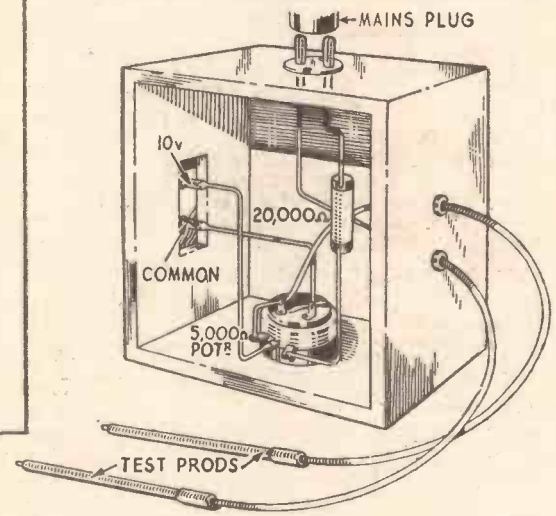


Fig. 4.—The completed unit ready for calibration.

TABLE OF CAPACITIES AND METER READINGS

Capacity (mfd.)	Reactance at 50 cycles.	Reactance + 25,000 ohms summed at 90°	Meter Reading.
1.0	3,200 ohms	25,200 ohms	.99 m/A.
.75	4,300 ,,	25,360 ,,	.985 ,,
.50	6,500 ,,	25,800 ,,	.965 ,,
.25	13,000 ,,	28,200 ,,	.89 ,,
.20	16,500 ,,	29,900 ,,	.835 ,,
.15	22,000 ,,	34,800 ,,	.718 ,,
.10	32,000 ,,	41,000 ,,	.61 ,,
.09	35,000 ,,	43,000 ,,	.58 ,,
.08	40,000 ,,	47,180 ,,	.53 ,,
.07	45,000 ,,	51,400 ,,	.485 ,,
.06	54,000 ,,	59,500 ,,	.42 ,,
.05	65,000 ,,	69,600 ,,	.36 ,,
.04	80,000 ,,	83,700 ,,	.30 ,,
.03	110,000 ,,	112,800 ,,	.22 ,,
.02	160,000 ,,	161,800 ,,	.155 ,,
.01	320,000 ,,	320,700 ,,	.078 ,,
.009	354,000 ,,	354,100 ,,	.07 ,,
.008	398,000 ,,	398,000 ,,	.063 ,,
.007	455,000 ,,	455,000 ,,	.055 ,,
.006	531,000 ,,	531,000 ,,	.047 ,,
.005	637,000 ,,	637,000 ,,	.039 ,,
.004	797,000 ,,	797,000 ,,	.031 ,,
.003	1,061,000 ,,	1,061,000 ,,	.0236 ,,
.002	1,580,000 ,,	1,580,000 ,,	.0157 ,,
.001	3,200,000 ,,	3,200,000 ,,	.008 ,,

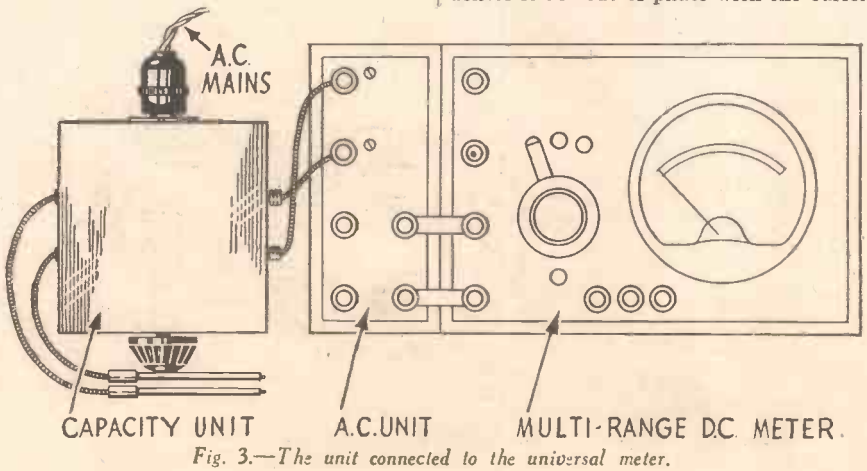


Fig. 3.—The unit connected to the universal meter.

(Continued on page 569)

A PAGE OF PRACTICAL HINTS

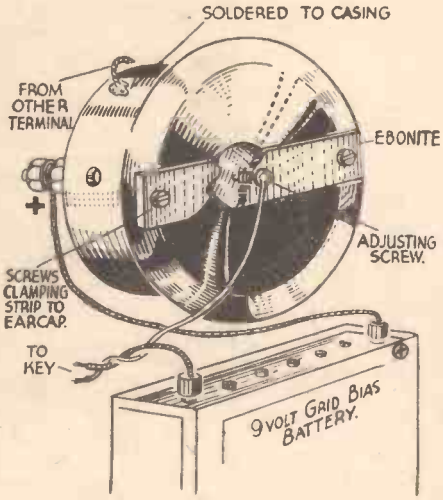
SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

A High-pitched Buzzer

THE accompanying sketch shows a high-pitched buzzer made from an old earphone, and which I use regularly for morse practice. A strip of ebonite, about ⅜in. wide and equal in length to the diameter of the earphone, is screwed to the ebonite cap, as shown. In the centre of the strip a hole is drilled and tapped to take a screw to make contact with the diaphragm. The enamel should be removed from round the edge of the diaphragm so as to make contact with case of the earphone. The enamel is removed from the centre of the diaphragm so that the adjusting screw can make contact with it. One terminal is connected to the case of earphone, and the other terminal to the battery; the other side of the battery is connected to the screw making contact with the diaphragm. Make sure the current is flowing in the right direction when testing.—J. WILKIE (Perth).



A high-pitched buzzer made with an old earphone.

Variable Aerial Coupling Device

POSSESSING rather a long aerial I sought for an inexpensive and simple means of variable coupling between it and the aerial coil of my short-waver. The following scheme was evolved. A piece of brass or aluminium, about 20 s.w.g., is cut into a spade shape as shown in Fig. 1, the spade end being about 1½in. in length and the remainder about ⅜in. wide. A hole is drilled in the thin end and about ½in. of the strip is bent at right angles. This piece of metal is then fixed on a midget stand-off insulator so that the broad end of the metal covers part of the aerial winding on the coil. The aerial lead is taken to the terminal on the stand-off insulator. By bending the strip the distance between it and the aerial coil can be varied, and the coupling reduced or increased as required. An improvement on this device is shown in Fig. 2. Here the spade-shaped piece is soldered to an angle piece of stout metal. A hole is drilled in the vertical limb of the thicker piece, and a nut soldered on. Through this nut a short length of screwed brass rod is threaded, having a knob on the end. The spade piece is bent so that its own spring tends to keep it away from the coil, but by turning the knob the distance may be lessened as required.

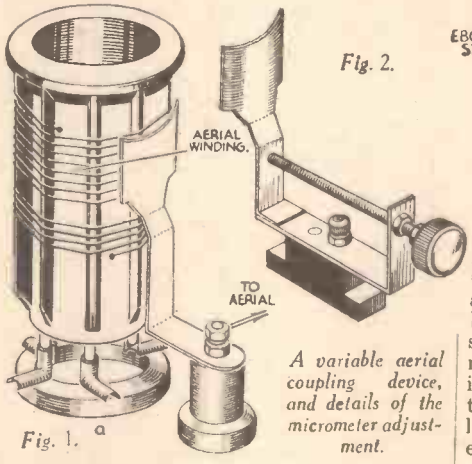


Fig. 1. a

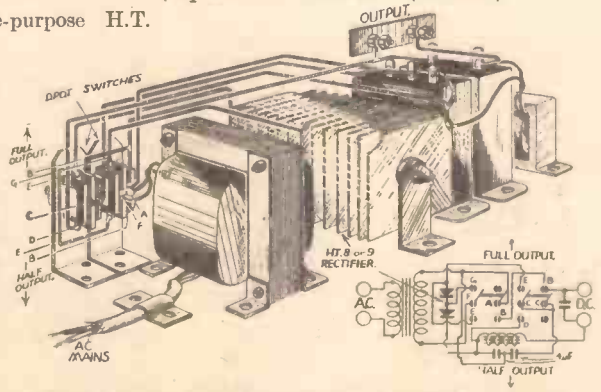
Fig. 2.

A variable aerial coupling device, and details of the micrometer adjustment.

The fitting is mounted on a piece of ⅜in. ebonite which in turn may be screwed to the baseboard. Either of those methods form an efficient substitute for the usual neutralising condenser.—JOHN HADDON (Glasgow).

A Dual Output H.T. Unit

A VERY useful double-purpose H.T. unit is shown in the accompanying diagram. The switching enables the user to obtain either full volts and current or approximately half volts and current. The switches may be of either the miniature panel open type or of the Q.M.B. type (as shown). If of the former pattern they should be covered, after using, to avoid accidental shorting of the contacts with probable damage to components.—L. W. HEASMAN (Bexhill-on-Sea).



Theoretical and pictorial diagrams of a dual output H.T. unit.

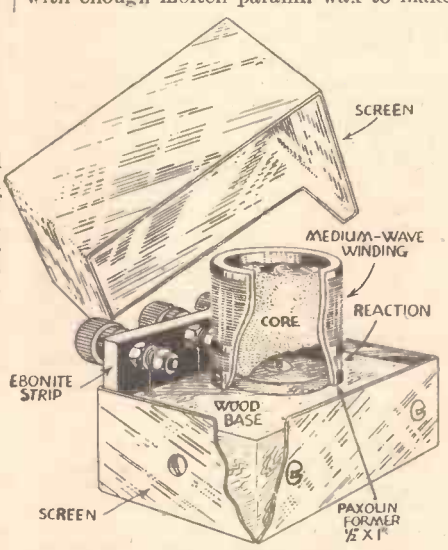
THAT DODGE OF YOURS!

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.

Home-made Iron-core Coils

WHEN iron-core coils were first introduced I thought I would experiment with a view to making my own. The coils I made have proved successful. For the core I obtained 1oz. of iron dust (reduced from the oxide with hydrogen). I mixed it with enough molten paraffin wax to make it pourable, and after making sure the dust was not in lumps, I poured the mixture into a tube of paxolin (½in. by 1in.), fixed to a base as shown in the sketch. The wax soon set and formed a good core insulator. The number of turns required depends on the individual set and aerial, but fifty turns for the medium wave and 250 to 300 for the long-wave band will serve as a basis for experiment. The wire used was silk-covered copper.

The reaction windings can be wound (twenty-five turns for medium wave and 100 turns for long wave), as indicated in the sketch. The medium-wave and long-wave windings are best wound on separate formers. With screening the whole coil need only measure about 2in. high by 1½in. square.—A. ROBINSON (Stafford).



A simple method of making iron-core coils.

Building OUR SPECIAL *HIGH-FIDELITY*

A Suitable Radio-unit, Designed for Use in Conjunction with this Amplifier, will be Described in Next Week's Issue—Order Your Copy Now!

THE "fidelity" of an amplifier may be defined as the degree with which it accurately reproduces at its output the waveform of the signal impressed at the input. "Fidelity" and "quality" are not, as might be supposed, synonymous terms, as "quality" implies the acceptability of reproduction to a listener, whereas "fidelity" implies definite comparison with "perfect reproduction." The latter has been aimed at in designing this amplifier, and constructors may themselves alter the "quality" to suit their own particular requirements by means of a suitable tone-control system.

The amplifier has a uniform frequency response from 20 to 10,000 cycles, while harmonics, amplitude distortion, etc., are greatly reduced, both by the use of the "push-pull" system and resistance-capacity coupling.

The maximum output of the amplifier is five watts, which is necessary for high-fidelity reproduction, not because the *average* volume need be set at a high level, but simply to avoid overloading and distortion on loud passages.

The Circuit

Fig. 1 shows the theoretical circuit, from which it will be seen that the amplifier consists of a push-pull output stage, resistance-capacity fed from a single input valve and a separate phase reversal valve V.2. This method gives a minimum of phase distortion, linear and distortion-free reproduction, and is simple and inexpensive.

The reverse-phase feed to the grid of valve V.2 is obtained from the potentiometer R.8 in the anode circuit of valve V.1. This potentiometer is adjusted by connecting a pair of 'phones through a transformer in the H.T. lead to the output transformer and applying a constant-frequency input to the grid of valve V.1. R.8 is then adjusted until the sound in the 'phones is at a minimum, giving accurate push-pull operation and a balancing out of second harmonic distortion.

Parasitic oscillation in the output stage is avoided by including resistances R.11 and R.12 of 5,000 ohms each in the grid circuits.

It is not necessary to match the output valves, since each heater is fed from a separate L.T. winding on the main transformer, and the bias voltages are independent, thus allowing each valve to set itself at the correct optimum point on its characteristic. In practice it will be found that the anode current of the two output valves varies but slightly, certainly not more than by two or three milliamps.

Since we are, for the sake of safety, unable to use a large value of grid leak with the output valves, it has been necessary to use a fairly large coupling condenser to obtain good low-frequency response. C.3 and C.6 are, therefore, of 0.1 mfd. capacity each, and mica condensers must be used in these positions, since they have a high insulation resistance, and little leakage takes place. Should leakage occur, the grids of the output valves would have a positive bias applied and this would be very harmful and probably considerably lessen their life.

No volume control has been incorporated, this being carried out on the pick-up or in the H.F. stages when the amplifier is being worked from a radio receiver.

The Response Curve

The overall response of the amplifier is largely governed by the characteristics of the output transformer, which must have a primary inductance of not less than forty henries if the low-frequency response is to be maintained. Further, the leakage inductance and the resistance must be kept low and we have, therefore, carefully chosen the output transformer and do not recommend any alternative.

So far as the loud-speaker is concerned, it is necessary to use one of the larger class with a cone of large diameter freely suspended. We have tested out a number of such speakers and were particularly impressed with the new Rola G.12, which was found to be very satisfactory. If the full bass response is to be realised in practice, a large baffle 1in. thick must be used. One 3ft. square will be found to be satisfactory.

A Westinghouse metal rectifier, style H.T.11, is used in the "power pack" and is worked with a lower input than usual, viz., 275 instead of 300 volts. With this input, the rectified unsmoothed output is about 520 volts at 94 m/A. The smoothing circuits, including the loud-speaker field, drop about 240 volts, leaving a total of 280 volts for anode and grid-bias supplies. The H.T. feed to the output valves is

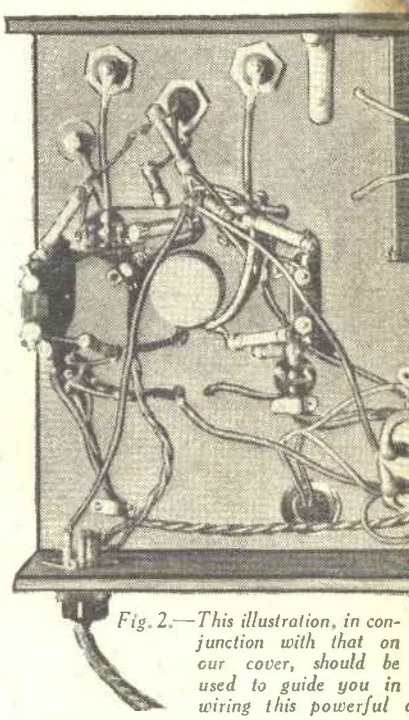


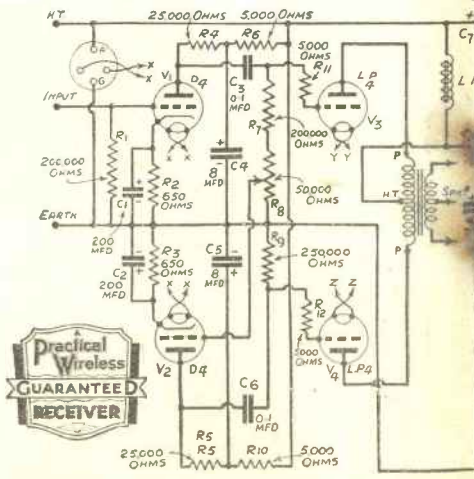
Fig. 2.—This illustration, in conjunction with that on our cover, should be used to guide you in wiring this powerful

smoothed by the choke L.F.C.2, the loud-speaker field, the 4 mfd. condenser C9, and the 8 mfd. condenser C.8. From this

AMPLIFIER

5 5-pin valve-holders, Belling-Lee type 1136/S.
2 250,000 ohm half-watt resistances, R.1 and R.9, Ferranti G.5.
2 650 ohm 1-watt resistances, R.2 and R.3, Dubilier.
2 25,000 ohm 1 watt resistances, R.4 and R.5, Dubilier.
2 5,000 ohm 1-watt resistances, R.6 and R.10, Dubilier.
2 5,000 ohm ½-watt resistances, R.11 and R.12, Ferranti G.5.
1 200,000 ohm ½-watt resistance, R.7, Ferranti G.5.
1 50,000 ohm volume control R.8, Dubilier type B.
2 750 ohm 2-watt resistances, R.13 and R.14, Dubilier.
2 200 mfd. dry electrolytic condensers, 10v. working, C.1 and C.2, Dubilier type 0283.
2 0.1 mfd. MICA condensers, C.3 and C.6, Dubilier type B.770.
2 8-8 mfd. dry electrolytic condensers, C.4 and C.5 and C.7 and C.8, Dubilier 9203 E. (Case negative.)
2 50 mfd. dry electrolytic condensers, C.12 and C. 13, 50-volt working, Ferranti C.E. 92.
2 terminals, Input and Earth, Belling-Lee type B.
1 4-pin output plug and cable, Goltone.
1 output transformer, Ferranti type O.P.M.6C
1 wooden chassis, 16in. x 12in. x 3½ in.
1 sheet aluminium 16in x 12in.

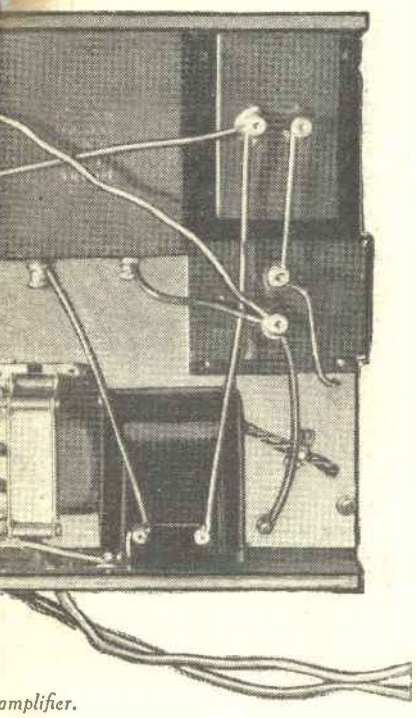
Theoretical Circ... of Com...



A Powerful High-quality Mains-operated Amplifier and Mains Unit for Use on Radio or Gramophone. Wiring Diagram appears on page 568

PARAPHASE AMPLIFIER

point, a tapping is made to feed the two D.4 valves V.1 and V.2, and this is still further smoothed by the choke L.F.C.1 and the 8 mfd. condenser C.7. The anode



amplifier.

circuits of these two valves are also thoroughly decoupled by the resistances R.6 and R.10 of 5,000 ohms each, and the 8 mfd. condensers C.4 and C.5. The "hum level" of the amplifier is very low indeed and no hum is distinguishable at a distance of three feet from the speaker.

Three L.T. windings are provided on the mains transformer, one each of 4 volts 2 amps. for the output valves, and one of 4 volts 5 amps. for V.1 and V.2 and up to three other valves in the earlier stages when an H.F. and detector unit is added.

An H.F. Mains Filter

It will be noticed that an H.F. filter, consisting of the double choke H.F.11 and the 0.1+0.1 mfd. condenser C.14, has been included in the mains input. This will not be necessary when the amplifier is used for gramophone work alone, but is desirable to reduce modulation hum when a radio unit is added.

No mains switch has been included, as this is usually to be found in the H.F. stages, being combined with the volume control. A Bulgin on/off toggle switch can, of course, be connected in one of the mains leads if considered necessary.

The High Fidelity Paraphase Amplifier meets the requirements of the most exacting critic of musical reproduction and enables both radio and gramophone to be reproduced with excellent purity.

Construction

There is nothing in the construction of the amplifier to occasion any difficulty. The chassis should be assembled and the holes for the valve-holders and electrolytic condensers drilled. These may then be fixed in position, followed by the coupling condensers C.3 and C.6 and the L.F. smoothing chokes, fuses, etc. The rectifier, mains transformer, and condensers C.9, 10, and 11 are best left till last on account of their weight. Wire up the first stages of the amplifier, then add the mains components and complete the wiring.

Condensers C.4 and C.5 consist of two 8 mfd. condensers in the one case. The two red wires are the positive connections and the case the common negative. Make sure that the case makes good contact with the aluminium covering the baseboard. The same remarks apply to condensers C.7 and C.8.

No wires need to be screened, but the heater connections should either be twisted together or bound in pairs, and kept as far away from the grid circuits as possible to reduce the chance of electrostatic pick-up.

A 4-pin valve-holder is fixed at the back of the chassis and the heater connections to valves V.1 and V.2 continued and joined to the heater terminals on this valve-holder. A connection is also made from the anode pin to the main H.T. supply, while the grid is joined to the earth connections on the baseboard. With the aid of a 4-pin plug and cable, this gives a neat and easy method of connecting the heater supply, H.T., and "earth" to a radio unit.

Testing

When the wiring is finished and carefully checked, the valves should be inserted and the speaker connected. For a speaker having a speech-coil impedance of 10 to 15 ohms, the ratio of 22.5/1 provided on the output transformer will be found suitable, but for different values of speech coil impedance this can be altered to 15/1 or 45/1. The correct ratio is found from the formula :—

$$\text{Ratio} = \sqrt{\frac{\text{Twice optimum load of valve}}{\text{Speech coil impedance.}}}$$

The optimum load of a single L.P.4 valve is 4,000 ohms, so that the correct ratio required for the Rola G.12 speaker is 25/1 or 22.5 nearest.

Join the earth terminal to a good earth and connect the amplifier to the mains, having first made sure that the correct tapping for the mains supply available is being used on the mains transformer. Switch on. The valves will take a minute to heat up, after which a very faint hum should be heard in the speaker. If any of the fuses blow, don't run risks by replacing by copper wire, but search for the fault and replace the fuse by another.

Potentiometer R.8 should now be adjusted for accurate push-pull operation, as already described. If a radio receiver using reaction is available, the input terminal of the amplifier should be connected to the anode of the detector valve through a condenser of about 0.05 mfd. capacity, and the detector valve made to oscillate by increasing reaction. Connect the primary of an L.F. transformer in the H.T. lead to the output transformer, and join a pair of 'phones across the secondary of the L.F.

(Continued overleaf)

uit and Full List ponents

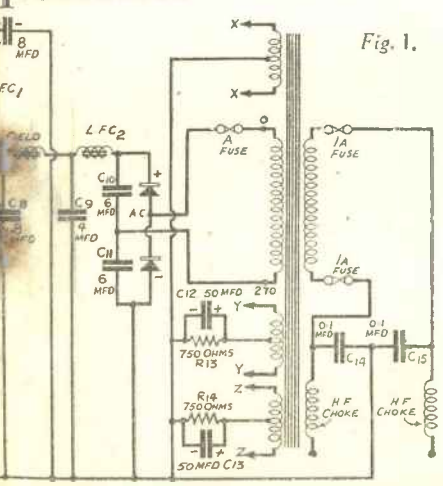


Fig. 1.

VALVES

2 Ferranti D.4.
2 Ferranti L.P.4.

MAINS UNIT

1 mains transformer, 200-250 volts input, 275 volts 550 m/A, 4 volts 2 amps., 4 volts 2 amps., 4 volts 5 amps., output. London Transformer Products, L.T.P. Works, Cobbold Estate, Cobbold Road, Willesden, N.W.10.
1 Westinghouse style H.T.11 metal rectifier.
1 mains input connector, Belling-Lee type 1114.
1 single safety fuse holder and 1 amp. fuse, Belling-Lee type 1045.
1 4mfd. condenser, 900 v. working, Dubilier type L.S.G. (C.9).
2 6mfd. condensers, 650 volt working, Dubilier type L.E.G. (C.10 and C.11).
1 0.1+0.1 mfd. condenser, 500 volt A.C., C.14, Dubilier BE31L.
1 twin mains H.F. choke, inductance 2,000 mH, Wearite type H.F.11.
1 L.F. smoothing choke, LFC.1, 20hy. 400 ohms, 25m/A, Wearite H.T.12.
1 L.F. smoothing choke, LFC.2, 20 hy. 250 ohms, 140 m/A, Varley DP.10.

RECOMMENDED ACCESSORIES

1 Mains energised moving-coil loud-speaker, 2,000 ohms field, without speech coil matching transformer, Rola G.12.
B.T.H. piezo-electrical pick-up.

(Continued from previous page)

transformer. The oscillation will be heard in the 'phones and R.8 should be adjusted for minimum response. It will be found that the setting of R.8 is very critical.

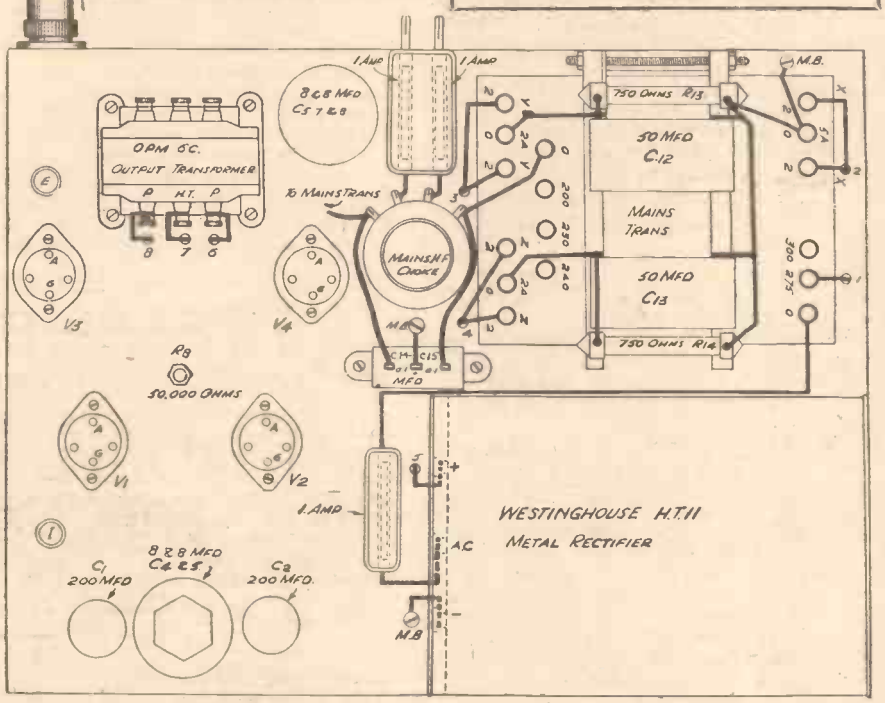
If no such receiver is available, a pick-up may be connected to the amplifier and R.8 adjusted for minimum response. This is not so satisfactory, however, since the audio output of the pick-up is varying.

Once this adjustment has been carried out, no further attention is necessary, and the amplifier will give years of satisfactory service.

VALVES, VOLTAGES AND CURRENTS.

Valve.	Anode volts.	Anode current.	Grid bias.
V.1, D.4	130	3.5 m/A	2.2 volts
V.2, D.4	132	3.8 m/A	2.4 volts
V.3, L.P.4	235*	43.5 m/A	34.0 volts
V.4, L.P.4	235*	43.0 m/A	34.0 volts

Total voltage across C.8 283 volts, across C.9 500 volts.
Total output of rectifier 520 volts.
*Taken from anode to positive end of bias resistance.



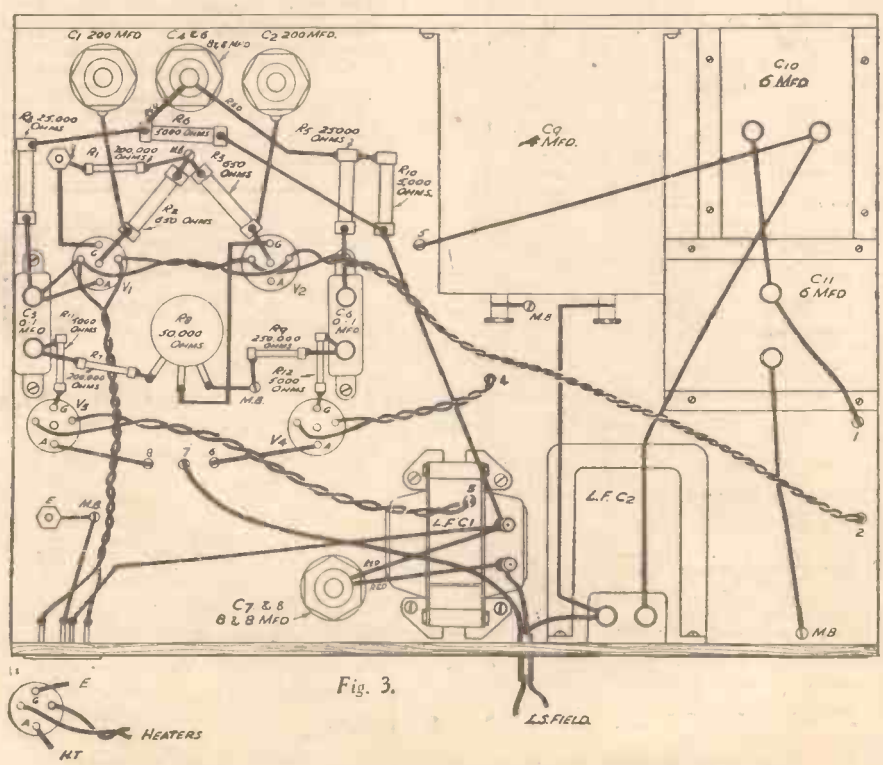


Fig. 3.

WIRING DIAGRAM OF THE PARAPHASE AMPLIFIER

Report of the £4 Superhet 4 FROM A BOLTON READER

"A NEW broom sweeps clean"; how very true this was, in the case of the Mr. Camm's £4 Superhet 4, which acted as my broom. Its demand cleared my shelves of components, valves, and speakers; only the designer's choice items, too.

The amazing demand for this kit so intrigued me that I finally decided to build it myself and see if it was all Mr. Camm claimed.

After disposing of thirty-one complete kits of parts, I found time to commence assembling. This done, and from the admirable blue print and host of tips provided, I had no trouble in completing and surveying my handiwork in one hour.

With various thoughts flashing through my mind (and perhaps with a slight bias) I coupled up the batteries. I connected as my speaker the £2 2s. W.B. Stentorian. Then I switched on. Oh my! What a set, what a speaker, what radio! and after trimming up, which is definitely not difficult even for the beginner, I was truthfully amazed at what were revelations to me in this order: selectivity, tone, and range. Then, putting the set to a rigid and vigorous test to see its real capabilities, I became so excited that my elbow caught the baffle on my W.B. Stentorian Senior speaker, which crashed to the floor; fortunately the leads were long and only moved the set. Silence; with great trepidation I picked it up, and after searching feverishly, I found the H.T. negative plug had come out of the battery; once inserted, music recommenced; I then tried all the tappings on my W.B., but with a delighted feeling now within me—my speaker was made of stern stuff and refused to be put out of commission by a mere fall. So much for W.B. Stentorian speakers.

Well after almost three-quarters of an hour I logged thirty-seven good stations, having no background, none of the usual noisy reproduction and tone cutting, so evident to-day.

From a cynic I have changed to a "Cammite."

Believe me, what does amaze me, is how Mr. Camm has attempted to make a superhet for a meagre £4 and SUCCEEDED.

If anyone has need of a set with the qualities I have mentioned, he will, if he uses the designer's choice, be the possessor of an accurately tested and high-grade series of components, and a good set.

My only complaint is that the spraying on my baseboard was rather skimped, but did not detract from the exceptionally meritorious performance of this epoch-making set.

I congratulate Mr. Camm on having studied the limited pocket and enlarged desires of the vast army of constructors, particularly those in Bolton whom I number among my acquaintances, and whose zeal and keenness is second to none in the country.

May PRACTICAL AND AMATEUR WIRELESS and its staff experience a happy and successful 1936."

RONALD DAULBY,
Grad. I.E.E., M.Tech.I. (Bolton).

FOR THE EXPERIMENTER

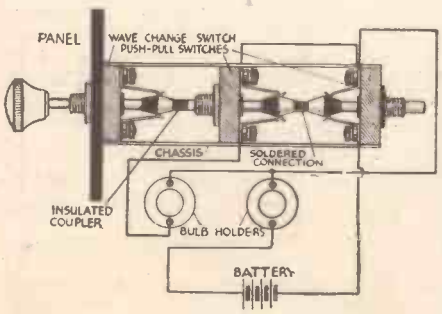
(*Continued from page 564*)

The range of capacities covered by our unit is necessarily restricted, and some readers may wish to extend this range to suit their own needs. The methods by which the range described has been prepared are perfectly suitable for calculating different ranges and the main point to be noted is this: If measurement of larger capacities is to be made the current through the circuit must be increased, and if a smaller capacity range is required the current must be reduced. This is most easily done by variation in the values of the fixed resistor and potentiometer, and if any reader requires a special range I shall be pleased to supply suitable values to be allotted to these components. However, it is felt that the present range covers the most useful values of condensers and will prove a valuable adjunct to the amateur or serviceman's equipment.

In the next article I shall summarise the matter contained in this and the previous ones, and give practical examples of the apparatus in use, but in a subsequent part of this series I shall describe the construction and calibration of that extremely useful instrument, a valve voltmeter, in which our universal meter provides the voltage indication, together with some uses of the valve voltmeter as a servicing and testing instrument.

A NOVEL WAVE-CHANGE SWITCH LIGHT

INEXPERIENCED wireless listeners sometimes find difficulty in telling if they should read the long- or short-wave figures on the dial. The simple device described below will overcome this difficulty. The wave-change light consists of two "two point" pull switches, some scrap metal, and two coloured bulbs and holders.



This diagram shows how the switches are modified.

The switch is made for the push-pull type of wave-change switch, and the construction is as follows:

Take a horizontal or similar dial, and fasten a piece of tin along the thick line between the metres and kc/s. Next, mount the two holders, one on either side of the tin, and box in the whole dial. Now take the two push-pull switches and solder the two contact knobs together and mount them so that when one switch is engaged the other is disengaged. Join one of the handles of the two-point switch to the end of the wave-change switch with an insulating coupler, and wire it up, as shown in the diagram. Thus, when one wave is switched on the appropriate light illuminates the necessary half of the dial.—P. M. HOLLINGDALE (Newport, Mon.).

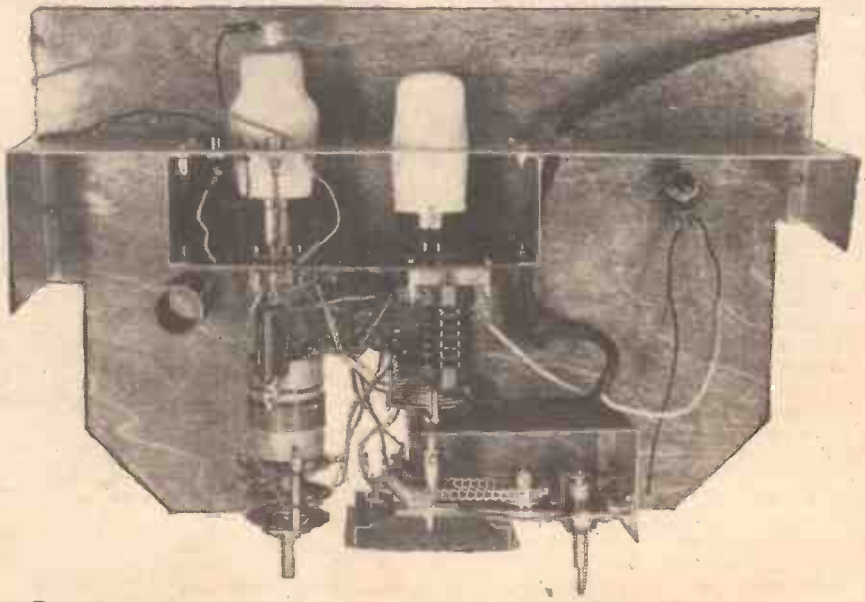
The B.T.S. Adaband Short-wave Converter

MANY constructors are now finding the increased interest which is obtainable in short-wave reception, and at this time of the year conditions are admirable for this type of work. As we have pointed out on many occasions, there are two systems by means of which an ordinary broadcast receiver may be adapted for use on these short wavelengths, and many constructors have built such a unit to take advantage of the combination. From British Television Supplies comes the announcement that a special adapter has been designed and is now obtainable for use with any receiver—either home-made or purchased—and this has been built into a cabinet in keeping with the majority of cabinets now obtainable and the illustrations on this page show both the completed apparatus and the chassis complete with valves. It is intended that the existing receiver be stood upon this small unit.

The complete Battery Adaband Converter.

Specification

The circuit employed in the converter utilises two valves—one a heptode and the other a triode, and they are mounted in such a manner that they may be instantly replaced or tested without removing the chassis from the containing cabinet. A full-vision tuning dial is fitted to the special short-wave condenser, and this is operated through a chain drive giving a slow-motion operation which greatly facilitates tuning operations. A dual control knob is fitted to this condenser drive so that fast or slow motion is available, and the coil is divided to provide two separate wavebands, and the switch control for changing from one band to another is provided with additional contacts so that when desired the unit may be by-passed and the ordinary broadcast receiver employed. This avoids all difficulties connected with the change-over of the aerial lead, and no connections have to be made or broken when passing from one waveband to another. The two short-wave ranges are from 13 to 29 metres and from 30 to 71 metres. A universal mains model is also available, and this contains its own rectifier unit for the provision of the necessary voltages. The price of the battery model is £4 4s., and the mains model costs £6 12s. 6d. complete with B.V.A. valves. The dimensions of the cabinet are 17in. long by 11¼in. wide, and the overall height is 6in.



The chassis of the battery model, with valves in position, showing the neat arrangement of the components and wiring.

Short-Wave Notes

The 50-metre Band

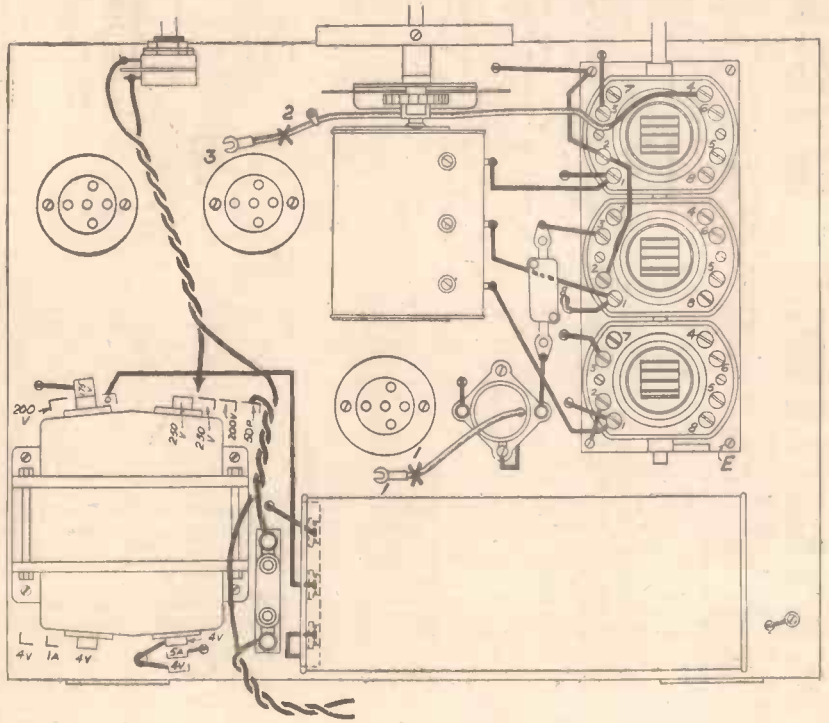
Although I seldom search for any short-wave transmissions on channels above 50 metres, I am told that from time to time it is worth while turning one's attention to this portion of the band. A correspondent informs me that CT2AJ, Ponta Delgada, Sao Miguel, Azores, on 75 metres (4,002 kc/s), has raised its power to 1 kilowatt, and that he recently logged the station at G.M.T. 23.00 (Sunday). The call in Portuguese is: *Ponta Delgada pela estacao de radiodiffusao CT2AJ*, the letters being pronounced: *say-tay-doix-ah-hota*, but it is also given in English. The distance from London is, roughly, 1,660 miles, so with a power of 1 kilowatt the signals should be easily captured.

If you have logged both Moscow RW59, and HVJ, Vatican, in the 50-metre band, you might do worse than spend a little time in exploring this section, as it contains a fair number of stations which are now beginning to be heard. TGW, Radiodifusora Nacional, of Guatemala, on 6,000 kilocycles, is on the air daily (except Sundays) between G.M.T. 23.30-00.30, and again from 02.00-04.00; on Sundays from 17.00-18.00. HIX, Santo Domingo (Dominican Republic), operated by the Ministry of Labour and Communications, works on 50.17 metres (5,980 kc/s) nightly between G.M.T. 02.00-03.00, and XECW, Mexico, sharing the same channel, broadcasts a special concert every Sunday morning between G.M.T. 04.00-04.30. On 50.59 metres (5,930 kc/s), HJ4ABE, Medellin (Colombia), *La Voz de Antioquia*, has been recently logged giving an orchestral concert from midnight on Sundays. An English talk is advertised at about G.M.T. 03.15, and every Monday a special feature, *The Theatre of the Air*, is transmitted between G.M.T. 02.00-03.00. HRN, Tegucigalpa (Honduras), on 50.93 metres (5,890 kc/s), *La Voz de Honduras*, which spells out its call letters in English (*e.g.*, "N" as in Navy), also works nightly and in their Sunday transmissions, namely, G.M.T. 03.00-04.30 (Monday in the British Isles), broadcasts a concert for the English-speaking listeners. Similar to COCD, Havana (Cuba), on 48.94 metres, the studio closes down with the *Goodnight Melody* (Ted Lewis), a tune familiar to most of us. YV8RB, Barquisimeto (Venezuela), on 51.02 metres (5,880 kc/s), has also been recently captured at good strength, earlier in the evening, at G.M.T. 23.30. In its call it gives its slogan: *La Voz de Lara*. Also, YV5RMO, Maracaibo (Venezuela), on 51.28 metres (5,850 kc/s), logged on the same date, would appear to have adopted a woman announcer. Announcements are in both Spanish and English, and items are followed by one stroke on a gong, somewhat in the manner adopted by Radio-Toulouse.

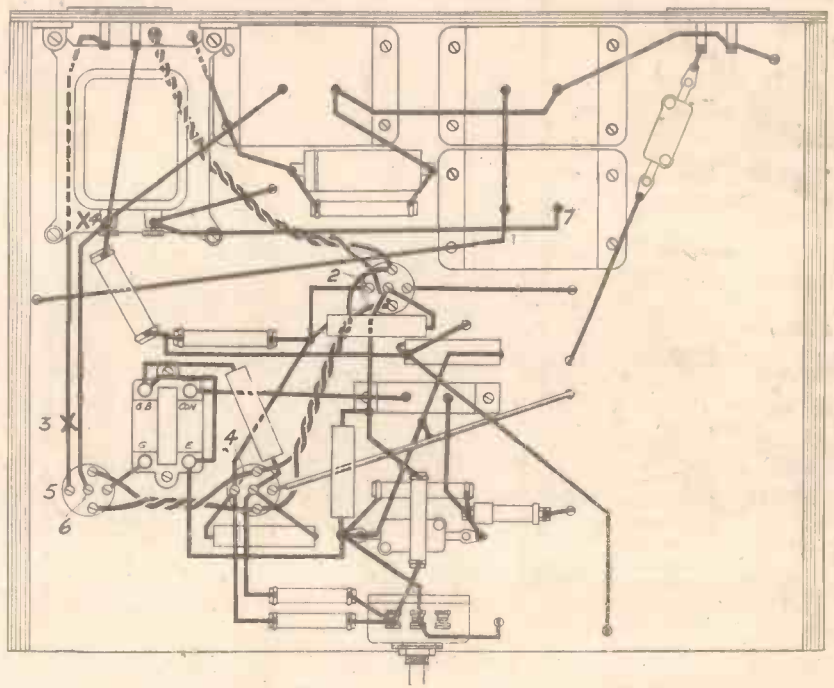
German Wavelengths

Germany, for its Zeesen and Koenigs Wusterhausen transmitters, already possesses twelve wavelengths, and in addition is bringing other stations into operation; and Rome has also a round dozen. With the development of the French Empire broadcasts, a further batch of frequencies will also be needed in the 25, 30, 42, 49, and 50-metre bands, with the result that the Continental powers, in the course of the next twelve or eighteen months, will also be heard at many points on the condenser dial.

Practical and Amateur Wireless SERVICE DATA SHEET No. 16 FOR THE A.C. 1936 SONOTONE



Top of Chassis View



Underside of Chassis

Approximate Voltage Readings

Voltmeter—to E

„ +to 1=200 volts.
„ +to 2= 70 volts.
„ +to 3=200 volts.
„ +to 4= 70 volts.
„ +to 5=200 volts.
„ +to 6=220 volts.
„ +to 7=260 volts.

Approximate Current Readings

Milliammeter connected at ×1= 5 m.A.
„ „ „ ×2= 5 m.A.
„ „ „ ×3=33 m.A.
„ „ „ ×4=55 m.A.

Approximate Resistance Measurements

Coils

Ohmmeter connected across 1 and 2=1 ohm (med. wave).
Ohmmeter connected across 1 and 2=8½ ohms (long wave).
3 and 4=1½ ohms (med. wave).
„ 3 and 4=6 ohms (long wave).

L.F. Transformer

Ohmmeter connected E and Con=750 ohms.
„ „ G and GB=2,250 ohms.

SHORT WAVE SECTION

COMPACT ASSEMBLY

The Importance of Short Connecting Leads and Compact Arrangement of Components is Stressed, and Suggestions Made for Ensuring the Most Efficient Layout.

CONVENTION plays an important part in the design of a number of modern receivers, and it has become usual to follow certain rule-of-thumb schemes without considering whether or not they may be improved. In many cases it would be difficult to find any particular layout which would tend to provide more efficient designs, but there is ample scope for the constructor to show his originality when building the simpler type of short-wave set. When using a simple detector-L.F. receiver it is necessary that the set should function at maximum efficiency if it is to provide the best possible reception, and the detector stage in particular has to be well planned to avoid all losses

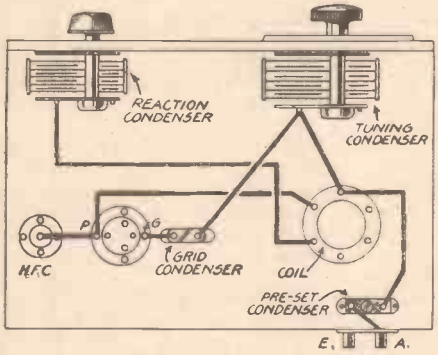


Fig. 1.—A conventional lay-out in which the leads are unnecessarily long. Only a few components and leads are shown, so as to keep the illustration simple.

and to compensate for the absence of normal high-frequency amplification.

The word "normal" is used because the average regenerative detector does actually amplify to a certain extent at both high and low frequency, besides acting as a demodulator or rectifier. It is a fact that a modern detector stage for short-wave reception can be made so low-loss that it is capable of providing long-distance reception very nearly equivalent to that available when a superhet of comparatively complicated type is employed.

Spacing of Components

To ensure best results there are certain components which should be placed as closely together as possible, whilst others must be reasonably well spaced; the designer and builder should be able to differentiate between the various parts with this idea in mind. It has frequently been pointed out in these pages, and most readers probably know, that the leads in the grid, tuning, and anode circuits of the detector should be short and rigid. The reason for rigidity is that if the leads were able to move appreciably, that movement—it may be little more than vibration where ultra-short waves are concerned—would affect tuning by changing the capacity of the circuits.

The Usual System

It is quite commonplace to arrange the principal parts as shown diagrammatically in Fig. 1, and although this arrangement looks well and renders all the terminals easily accessible, it is far from ideal. Look, for example, at the grid circuit: there is a lead from the aerial terminal through a pre-set condenser to the grid terminal of the coil, whence a wire goes to the fixed vanes terminal of the tuning condenser, back to the grid condenser, from which a connection is made to the valve-holder. In the same manner, the reaction leads are much longer than they need be, for a wire goes from the anode terminal of the valve to the reaction winding on the coil, the other end of which is returned to the fixed vanes terminal of the reaction condenser.

An Improvement

Notice the difference in the layout suggested in Fig. 2, where the coil is mounted, with its axis horizontal, on a wooden bracket, and the valve-holder is between the coil and the panel, the two condensers being one on each side of the coil. When using this layout a mere couple of inches of connecting wire is needed to connect the coil to the condensers, whilst the lead to the grid terminal of the valve-holder can consist of the grid condenser itself, provided that this component has wire or tag ends.

The general layout described and illustrated could be used even when the condensers were operated through extension spindles, and in this case it would be satisfactory to use a metal panel. If extension spindles were not employed, a metal panel *could* be used, but there would be some slight danger of impairing the efficiency of the coil due to slight damping.

Other Layouts

An alternative layout is that shown in Fig. 3, where the coil is a home-made one

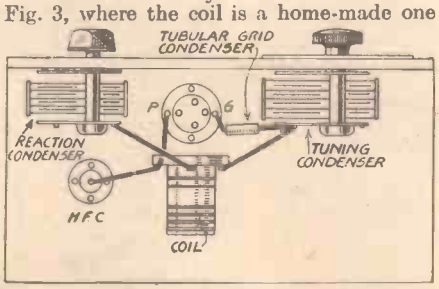


Fig. 2.—An improvement on the layout shown in Fig. 1. Here the leads are very short.

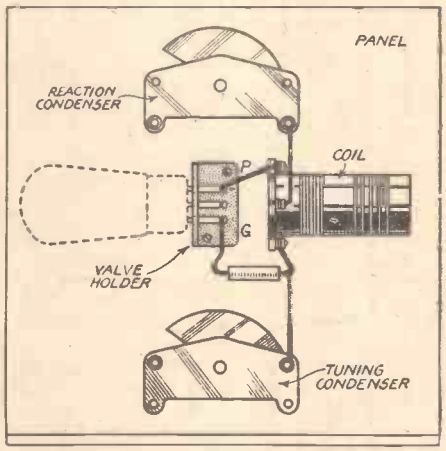


Fig. 4.—In this arrangement the coil and valve-holder are mounted on brackets attached to the panel.

mounted horizontally on two pillars, and having leads taken direct from the windings instead of using base terminals. This is a still more efficient system in many ways, especially if the valve-holder is mounted on pillars, so that its terminals are more or less on a level with the terminals of the condensers.

Yet another compact detector arrangement is shown in Fig. 4, where the condensers are placed one above the other, the coil and valve being mounted horizontally. The valve-holder is parallel to the base of the coil and a few inches away, so that connecting leads between the two, where used, are very short, and so that the grid condenser alone may again form the only connection between the coil and the valve-holder. There is no difficulty in mounting the components in the positions indicated, but if metal brackets are used to support the coil and valve-holder they should be of brass, and of light construction so that their damping effect is negligible. A slight rearrangement which might be desirable when using some components could be made by placing the coil in an upright position between the condensers and

(*Continued overleaf.*)

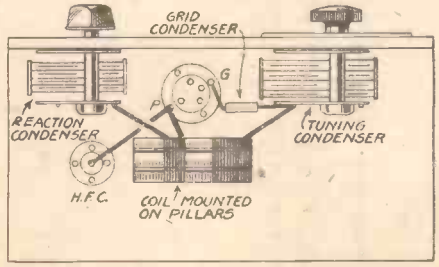


Fig. 3.—An alternative layout in which a home-made coil is employed.

SHORT-WAVE SECTION

(*Continued from previous page*)

mounting the valve-holder on a bracket (a strip of three-ply with a 1-in. hole is suitable) so that its plane is parallel to that of the panel. In this case the coil should be one in which the connections are taken directly from the windings.

Shun Convention

Sufficient has probably been written to give an idea of the lines on which the constructor should work, for, after all, a good deal depends upon the design of the particular components employed. The main point is that convention should be forgotten, and every effort made to place the important parts in such positions that the shortest of connections are possible. Do not worry too much about the appearance, for that is of little importance when real efficiency is the main object.

It might in many cases be desirable to carry out a few experiments before finally settling the positions, but this will be justified by the improvement obtained. The improvement will probably not only be with regard to the range of reception, but also with regard to the nicety of control which follows the re-design.

The L.F. Portion

So far no mention has been made of the L.F. amplifier, but the only really important point here is that the transformer and valve-holder should be kept at least 4in. away from the tuning coil. It is wise to consider the detector and amplifier separately and to deal with each as a unit, although both are mounted on the same chassis or baseboard. The main point to bear in mind is that the detector is of chief importance, and that this stage should be planned irrespective of the amplifier. It is wise, however, to include a "stopper" resistance in the grid lead to the L.F. valve.

Leaves from a Short-wave Log

German Transmissions

CONSIDERABLE activity is prevailing in the German short-wave network, and a number of new stations have been heard testing recently; some of these have already been brought into daily operation. Amongst those logged were: DJR, Zeesen, 19.56 m. (15,340 kc/s), 50 kw, heard working between G.M.T. 06.30-08.30; DJP, Zeesen, 25.31 m. (11,855 kc/s), 50 kw, and DJL, 19.85 m. (15,110 kc/s), 5 kw, which relay the first transmission of the German special programme broadcast at G.M.T. 08.45. DJJ on 29.87 m. (10,042 kc/s) was also testing towards G.M.T. 19.30, and asked for reports from listeners; DJI, a new 40-kilowatter which has been used for transmissions to Africa, is also taking the programme nightly between G.M.T. 23.00 and 01.00, on 31.01 m. (9,675 kc/s). Other stations which are also to be used for the German world service are DJO, Zeesen, 50 kw, 25.43 m. (11,795 kc/s); DJS, 24.73 m. (12,130 kc/s); DJQ, 19.63 m. (15,280 kc/s); and DJT, 19.53 m. (15,360 kc/s). For the coming Olympic Games, I understand that in addition to DJR, DJP, and DJO, already mentioned, transmissions will also be made through DJM, 49.35 m. (6,079 kc/s). From this we may gather that during this period of sports Germany will occupy a great number of channels in the waveband.

Italy, with its numerous claims for transmissions to Libya and Eritrea, has also been trying out new wavelengths. IRY, Roma-Torrenova, 20 kw, on 18.61 m. (16,120 kc/s), has been logged on several occasions between G.M.T. 10.30-12.30 with calls to Asmara, following which a series of operatic musical records were broadcast; another station, IQA on 20.37 m. (14,732 kc/s), was carrying out similar experiments at about the same time.

Warsaw

A short-wave European station to which little attention has been drawn, but which is now operating regularly between G.M.T. 16.30-17.30, is SPW, Warsaw, on 22 m. (13,635 kc/s). On most days it relays the main Warsaw programme, and the quality of the transmission is very good. Announcements are given out at frequent intervals in Polish, English, German, Italian, and French. Until a more powerful transmitter has been erected for the purpose, the existing station—a 10-kilowatter—at Balice will continue to carry out these duties. Two directional aerials are utilised—namely, one for China and Manchuria, to which parts many Poles have emigrated, and another to South America. It is also proposed to transmit programmes to North America, in particular to the United States. When not monopolised by broadcasting, SPW may be heard almost daily in communication with Brazil.

Monte Grande

So far, in the Argentine Republic, the only short-wave station which has been logged as relaying programmes from Buenos Aires has been LSX, Monte Grande, on 28.98 m. (10,350 kc/s), which, however, has more important duties to fulfil. Since the advent of LRI, *Radio el Mundo*, the new 50-kilowatt medium-wave station in that city, I am informed that steps are to be taken to relay its programmes as a daily feature through LRX and LRU, Buenos Aires, respectively on 31.32 m. (9,580 kc/s) and 19.62 m. (15,290 kc/s), in the near future. In the meantime, occasional tests may be made through LSK3, Hurlingham (Buenos Aires), on 29.27 m. (10,250 kc/s).

San Paulo

From Brazil comes the news that we may shortly expect to tune in another transmission from San Paulo, *i.e.* PRG6, on 20 m. (15,000 kc/s). PRA8, Pernambuco, which for some months was such a good signal on 49.5 m., then later on 49.67 m., is now barely clear of GSA, Daventry, having moved to 6,048 kc/s. Moreover, lately the programme times have been very irregular. When on the air, it is said to work from G.M.T. 20.00-00.30. PRF5, Rio de Janeiro, on the other hand, has considerably developed its schedule, and in addition to its ordinary radio entertainments for South America it transmits a special *Brazilian Hour* in the English language every Monday at G.M.T. 22.30. The call is alternately given as (phonetic): *Pay-air-effe-sinko, La Voz do Brasil*, and when destined to English-speaking nations: *This is PRF5, the short-wave station of the Government of Brazil*. As interval signal you will hear a three-note gong.

Dominica

Of the Santo Domingo (Dominican Republic) stations, the only one picked up recently was HIZ on 47.48 metres (6,315 kc/s). It announces itself in Spanish, phonetically as: *Achay-ee-zed en Santo Domeengo*, and calls itself: *La Voz de los Muchacos*, which, I take it, means "The Voice of the Boys!" The interval signal picked up was a siren followed by four notes on gongs—a sort of chime. The schedule advertised is Sundays G.M.T. 04.00-06.00, and weekdays from G.M.T. 22.00-23.00. On this occasion the broadcast was logged at G.M.T. 21.30—so the hours are fairly elastic.

The same evening brought in good signals from YV6RV, Valencia (Venezuela) on 46.01 metres (6,520 kc/s), at G.M.T. 22.30. In this case the station is said to broadcast daily from G.M.T. 21.30-02.40, and even later at times. Chimes have also been adopted to bridge intervals between items; they consist of five notes, and the call is repeated, American fashion, every fifteen minutes.

An acquaintance of mine who makes a practice of listening on channels between 100 and 200 metres, tells me that he has frequently heard police radio calls from the U.S.A. New York monopolises three call signs: WPEE, WPEF, and WPEG, and uses 122.4 metres (2,450 kc/s); Chicago, WPDB, WPDC, and WPDD, on 175.2 metres (1,712 kc/s). Most of the other police headquarters in the U.S.A. cities and towns have been given channels between 174.6 metres (1,718 kc/s)-195.4 metres (1,535 kc/s), and between 123.7 metres (2,425 kc/s) and 132.7 metres (2,260 kc/s), but following a successful series of tests, many are adopting much higher frequencies.

Canada and U.S.A.

At this season when the north-west provinces and the Far North outposts of Canada are frozen out, United States and Canadian stations usually carry out special broadcasts, in the course of which special news bulletins and private messages are transmitted for the benefit of the trappers, police, missionaries, seal hunters, and other members of the community, who are cut off during several months from the South. Every Sunday at G.M.T. 04.30, both VE9DN, Drummondville, on 49.96 metres (6,005 kc/s) and CJRO, Winnipeg, on 48.78 metres (6,150 kc/s), make a special feature of these broadcasts to Canadian settlers living within the shadow of the North Pole.

Another Canadian station, of which mention is not frequently made, but which broadcasts regularly, is VE9HX, Halifax (Nova Scotia), the short-wave outlet of CHNS. It is on the air daily from G.M.T. 14.00-17.30, and again from 21.00-04.00. The wavelength is 49.1 metres (6,110 kc/s). Although possessing no interval signal it gives at the opening of each programme the national song, "O Canada." The power is 500 watts, and on some nights the signals are strong and clear. It is reported that the call sign will be changed to CHNX.

During the next month or so we shall find many alterations in the list of Colombian short-wave stations; new ones will crop up and some of the older ones may disappear. Possibly also other channels may be adopted. I learn that a law was recently passed by which the power of the short-wavers in future must exceed 500 watts, failing which they must work in the ordinary broadcast band.

(Continued from page 554)

sufficient care to ascertaining whether they are entirely suitable. For example, a listener complained that a set which he was sure was properly wired with the correct components gave no signals. The circuit was a conventional one, with input volume control by a potentiometer connected across the tuner, the connection to the aerial being from the slider of the potentiometer. Unfortunately, however, the potentiometer had an uninsulated spindle and was mounted on a metal chassis, with the obvious result that the aerial was shorted to earth permanently. The provision of a small insulated sub-panel for the volume control put matters right at once.

Hum

Hum is always a bugbear in amateur-made sets, and although good workmanship and faithful adherence to the specification will ensure freedom from internal hum when building a set to a published design, it is not so simple to obtain a hum-free layout if you design the set yourself. Putting aside all the obvious and well-known rules for avoiding hum, and the equally well-known tips for isolating and curing the causes, here are two cases in which a complete cure was effected without too much difficulty.

In the first case there appeared to be no reason why there should be any hum, for the layout seemed ideal, decoupling was adequate, and a potentiometer across the filament winding had been included. As a last resort, the connections to the secondary of the intervalve transformer—a fairly old model, but used in a resistance fed circuit—were reversed, and the hum disappeared entirely.

Decoupling Efficiency

The second case was not quite so simply dealt with. The set had been built up gradually, and on most haphazard lines as far as layout was concerned. Decoupling was adequate—even liberal—in quantity, but the decoupling components had been put in here and there, just where room could be found, and a straggly network of earth wires was the result. First of all, the owner was recommended to disconnect all his decoupling, and reinstall it with the decoupling components close to the circuit section they were intended to decouple. Then a direct wire was to be taken from the earth end of each decoupling condenser straight to a stout main earth wire running along the back of the set. It worked admirably, for every trace of hum vanished.

Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

Ferranti Receiver List

A NEW list has been issued by Messrs. Ferranti, containing details of the whole range of Ferranti receivers, including consoles, radiograms, and battery sets. The leaflet is particularly comprehensive and the reference number is Rc100. It may be obtained free on request to either the London Office, Bush House, W.C.2, or from the Radio Works, Moston, Manchester 10.

New Mervyn Microphone

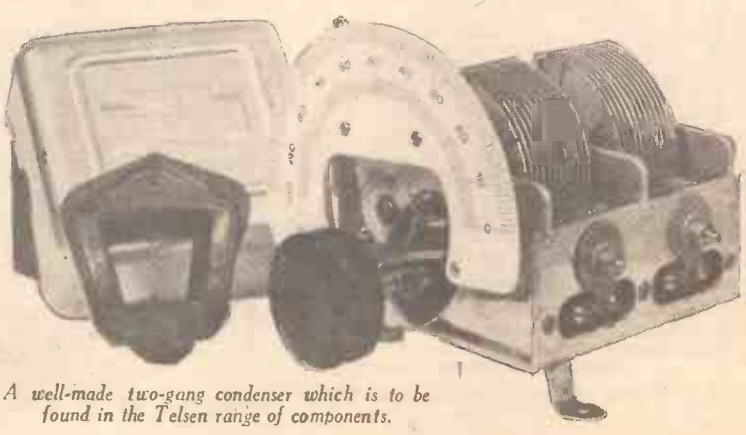
A NEW high-fidelity microphone is announced by the Mervyn Sound and Vision Company, to be released shortly. This is of the transverse current type and may be supplied with or without a suitable matching transformer. It may be used as a table model or, if required, the makers can supply a stand or suspension cords. The microphone is housed in a circular case designed for mounting in a ring holder, and it is available in nickel or black oxidised. The price is 25s.

Osram MH40 Valve

A NEW valve is announced by the Osram Company and is intended for use with microphone amplifiers. This valve is of the indirectly-heated 4 volt 1 amp. type designed for use with an anode voltage of 200 (max.) and an anode current of only 2.7 m.A. The amplification factor is 40 and the impedance is 16,700 ohms. Due to the special design a very low order of microphony is obtained and there is a negligible background. The Steatite electrode insulators play a great part in obtaining this performance and a small amplifier is thus possible for use with microphones of the condenser, ribbon or velocity type, giving great amplification. The price is £2 10s., and a standard 5-pin base is fitted.

Telsen Ganged Condenser

THERE are a number of essential points to be watched in a condenser designed for use in tuning a number of circuits, and these are well exemplified in the Telsen component which is shown below. Firstly, it is essential that the rotors shall all be rigidly held upon the common spindle in order that there shall be no side-play which would introduce slight capacity changes across a circuit and thereby upset ganging. Secondly, it is essential that each section shall be accurately matched, not only so far as the total capacity is concerned, but also at every part of the setting from minimum to maximum capacity. Thirdly, external trimmers must be provided in order to assist in balancing out inter-circuit capacities introduced by wiring and other leads. The mounting method must be rigid and must not introduce distortion to the main frame which would negative any adjustment carried out at the manufacturers' testing department, and dust must be excluded in order to prevent noisy working. All of these points are covered in this Telsen component and the main casing is built up from pressed plates of great rigidity, and the rotor, as well as the stator, plates are let into one-piece high-pressure die castings to avoid movement and changes in capacity. To balance the various sections throughout their entire tuning range slit end plates are provided, and these are adjusted at the works to provide an equal capacity change at all parts of the dial setting. The trimmers have mica dielectric and may be comfortably adjusted whilst the dust cover is in position on the condenser. The component is sold complete with disc drive, dust cover, escutcheon plate, pilot light holder, and control knob. The two-gang condenser illustrated (Type W.427) costs 9s. 6d., and a triple-gang condenser (Type W.428) costs 14s. The condenser is rated with a maximum capacity of .0005 mfd. and actually has a total capacity of .00053 mfd.



A well-made two-gang condenser which is to be found in the Telsen range of components.

"Avo" Capacity Meter

A NEW measuring instrument is shortly to be released by the Automatic Coil Winder and Electrical Equipment Company, makers of the well-known range of Avo meters. This new instrument is an accurate, direct reading capacity meter in which the capacity values are marked direct on a calibrated dial. It will measure over six ranges from a few micro-microfarads to .1 mfd. with an inaccuracy of less than one per cent. The system used is the R.F. resonance method, and a meter is provided to give a visual indication of resonance, the capacity of the condenser under test then being read off from the dial when the meter has indicated maximum deflection. Changes in battery voltage or other variations may be compensated for by a zero adjuster. The price has not yet been announced.

LETTERS FROM READERS

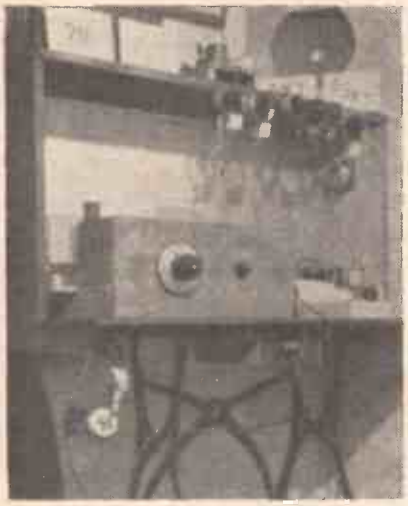
The Editor does not necessarily agree with opinions expressed by his correspondents.

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

A Short-Wave Log from Bath

SIR,—As a regular reader of your excellent paper, I have not yet noticed any short-wave logs from Bath. I am, therefore, sending a few of my latest interesting DX captures on 'phones recently.

My set is a home-made 4-valver of my own design, using a screen-grid valve as buffer in the aerial. With this idea all



A corner of Mr. C. A. Clare's short-wave receiving station.

blind spots are eliminated whilst tuning, and is a great boon. It also increases signal strength considerably, and I shall be glad to let any interested reader have a copy of the circuit.

I enclose a photo of a corner of my den.

Sunday, December 1st, 1935. (On 14 mc/s), W1KJ, W2GMC, W1FHY, W1AJA, W3EHS, W2FHS, W1AKZ, W1KUZ, W1WK, W1AF, W1HPM, W2HFS, W3MD, W3VER, W1GJX, W2EDW, W2BS, W3CAU, W9PET, W5ACS, W3CM, W2BSB, W1SJZ, F8DR, W6KA, W3EOZ, W5AXA, W3AM.

Sunday, December 8th, 1935 (14 mc/s), W4DBC, EA3ER, W2EDW, W1CMD, HB9AT, W1AF, VE1DR, W3CSJ, W4QDQ, W3EOZ, W3AER, W1AF, W3TC, W3WJ, W3QD, W3CSJ, W3LN, W3ESJ.

Sunday, December 15th, 1935 (14 mc/s), W3CC, W3FDS, W3FFJ, W3BNC, W3AC, W3MD, W1KC, W9HI, LO2Z, W3CFJ, W9RGH, W1KK, W9RBG, W2CLS, W2GYM. W2KI, W4ALG, W2OV, G6TO, W2FYD, W3CAT, W1FHH, W1ESU, W2ADJ, W2AZD, W1CHG, W2FYD, W2FLO.

Saturday, December 7th, 1935 (3.5 mc/s), W2VO, W3MG, ON4ZA, W1LI, VE1EI, G5W.—C. A. CLARE (Bath).

Avoiding L.T. Problems

SIR,—With reference to the letter on this subject which was published in the December 21st issue of PRACTICAL AND AMATEUR WIRELESS, I have used the Ever-ready cycle lamp battery No. 800 on several occasions with 3 and 4-valve sets both at home and in camp. The result is quite good. I cannot state, however, how long such a battery would last, because I only use it in cases of emergency. I do not think it would be economical to use them instead of the ordinary L.T. supply, although for camp use with a 2-valve S.W set they may be all right for week-end use.—JAMES E. COTTER (Cork, I.F.S.).

S.W. Logs and Reports

SIR,—I was very interested to read Mr. F. W. Benson's letter in a recent PRACTICAL AND AMATEUR WIRELESS, and heartily second the suggestion that a page be devoted to short-wave reports, logs and views.

I consider that such a section, compiled from readers' reports, would not only be more interesting, but much more helpful to all short-wave listeners.—G. COLLETT (Lincoln).

A Short-wave Log (Forty-metre Band)

SIR,—Being a regular reader of PRACTICAL AND AMATEUR WIRELESS and interesting myself in short-wave working, I am enclosing a log which I think would interest other readers who are short-wave enthusiasts. I should like to hear from anyone who happens to be included in this log. Most of these stations were R7/F/X, according to my reception. An outdoor aerial was used (seven-strand) about 20ft. long, and 30ft. high. My set is an H.F. Pen. Det. Pen. output. All these stations were logged on Sunday, December 15th, 1935, on the 40-metres band: G5TT,

(Continued overleaf)

LETTERS FROM READERS.

(Continued from previous page)

G5YV, G5CC, LK1 (Norway), G2HV, G6AO, G6FH, G5MG, G5GL, EI7G (Ireland), G5CW, G5PP, EIHG (Ireland) G5RO, G2IC, G5CV, G2SY, G5US, G6RK, G2LD, G5AY, G5CB, G6FC, G6AG, G5YY, G2DL, G5IL, G6DH, G2HD, G6NF, G5CJ, G2OC, G2QH, G2PX, G5XG, G6OX, G5RV, G5GC, G5RE, G5BB, G5WK, G2ZT, G5MR, PNORP (?), G2SM, G2MV, UTZ (? Japan), G6TR, G6DE, F8FA (French), 2BN (Spanish).—F. J. WEBB (Leamington Spa).

A Supreme Superhet

SIR,—I should very much like to see a set designed as suggested by J. E. Higgins, Kings Langley.

I have a mains unit with an output of 500 volts, 120 mA., and a speaker energised by 12 volts, 1 amp. and have been waiting to see a set published to suit the above.—A. J. BASHFORD (Thornton Heath).

SIR,—As a reader of your excellent paper since your first issue, and a keen constructor, I am always interested to see letters from other readers requesting high quality sets. I notice in a recent issue a letter from J. E. Higgins, and I, for one, would greatly appreciate a set as described by him, and especially to incorporate a paraphase amplifier, as described in your issue of June 5th, 1935. (*See also this week's issue.*—ED.)

Hoping my observations will be accepted especially as regards the amplifier, and thanking you for your excellent "fare" issued to a really appreciative reader.—E. W. M. (Thatcham, Berks.).

Club Membership Sought

SIR,—I shall be pleased to hear from the Secretaries of any Short-Wave Clubs in North London.—E. JACKSON, 86, High Road, Tottenham, N.15.

[*Will local club Secretaries please note.—Ed.*]

CUT THIS OUT EACH WEEK.

Do you know

—THAT the wavelength in metres may be ascertained by dividing 300,000,000 by the frequency in cycles per second.
—THAT a coil or similar component is not necessarily screened when a metal cylinder is placed over it.
—THAT for the above condition to hold good the base must also be of metal soundly earthed.
—THAT the actual speech output of a valve may be measured by means of an A.C. voltmeter.
—THAT a lead-in wire should be spaced away from a wall, metal pipes and other earthed objects to avoid losses.
—THAT a microphonic valve may often be used without difficulty if the glass bulb is tightly wrapped with insulation tape.
—THAT the majority of modern valves are so built that microphony is not experienced.
—THAT care must be exercised in using an extension speaker with a commercial receiver, and the makers' instructions must be followed in this respect.

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

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

RADIO CLUBS AND SOCIETIES

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

SHORT-WAVE CLUB FOR SALISBURY

IT has been suggested by a number of short-wave enthusiasts in this district that a Short-wave Club should be formed in Salisbury, and should there be any interested PRACTICAL AND AMATEUR WIRELESS readers in the locality I shall be glad if they would get in touch with me, at the address given below.—C. A. Harley, 85, Fisherton Street, Salisbury, Wilts.

WEST LONDON RADIO SOCIETY

THE inaugural meeting of this society will be held in the Lecture Room of the Town Hall, Ealing, W.5, on Wednesday, January 15th, at 8.30 p.m. A warm welcome is extended to all wireless enthusiasts, and an interesting evening is assured. Hon. Sec. (*pro tem*): H. S. Williamson, 22, Camborne Avenue, West Ealing.

SPHERE SHORT-WAVE CLUB

THE above club had another interesting evening on Friday, January 3rd, when 2BRT gave another of his interesting lectures. We are glad to note an increase in membership during the last two or three weeks. Will any prospective member please communicate with the Secretary, G. Walker, 33, Napier Road, Thornbury, Bradford, Yorks?

THE CROYDON RADIO SOCIETY

THE second half of the session, beginning with the New Year, is now well under way, and the following is a brief summary of forthcoming events:—

Jan. 21st: "Voigt Reproduction," by Mr. P. G. A. H. Voigt.
„ 28th: "Television and Short Waves," by Mr. E. N. Shaw.
Feb. 4th: "Amphion" of the *Croydon Advertiser* discusses the composer at work.
„ 11th: "Valves"—the Marconiphone Co., Ltd.
„ 18th: Lecture demonstration on Baker Loud-speakers.
„ 25th: "Reproduction"—Purley Radio, Ltd.
Mar. 3rd: Loud-speaker Night.
„ 10th: The President, Mr. H. R. Rivers-Moore, B.Sc., discusses further aspects of the work of amateur musicians.
„ 17th: "Hartley Turner Reproduction," by Hartley Turner Radio, Ltd.

PRACTICAL AND AMATEUR WIRELESS readers are invited to any of these meetings. Full programmes up to the end of the session are published in the new fixture card, a copy of which will be sent to any interested reader. Hon. Publicity Sec., E. L. Cumber, Maycourt, Campden Road, S. Croydon.

PETERBOROUGH SHORT-WAVE SOCIETY

AT a meeting of the Peterborough and District Short-Wave Society, held at the Bedford Hotel, on Wednesday, January 1st, Mr. P. Day (G6PD), who was home for the Christmas vacation from Nottingham University, gave the address. Mr. Day spoke on artificial aerials, the electromagnetic spectrum, skip distance, and fading. He also dealt with various radiations, their wavelengths, uses, and applications, and gave particulars of recent experiments in the production of short wavelengths of the order of one centimetre in length. Questions were asked and answered at the close of the meeting. Hon. Secretary, Mr. H. E. Daft, 31, Eastfield Road, Peterborough.

BOOKS RECEIVED

RADIODIFFUSION

A NEW publication of the International Broadcasting Union, "Radiodiffusion," a half-yearly review of broadcasting problems, aims at presenting various angles of broadcasting from an international point of view. Articles appear in either English, French, or German, with a précis in the other two languages. The first issue contains articles by a number of men who have carried out pioneer work, both in national and international broadcasting. Readers in this country will be particularly interested in an article by Admiral Sir Charles Carpendale, who was for ten years President of the Union, on "Dix Années . . ." Radio engineers will be interested in the articles by Monsieur Braillard, Director of the U.I.R. International Checking station at Brussels.

RADIO AS A CAREER

WE have just received a handy booklet describing the T.C.R.C method of specialised correspondence training whereby the student can study in the privacy of his own home. No matter whether you are engaged in the radio industry, or are only interested in radio solely as a hobby, you will find the contents of this booklet of interest. The Technical and Commercial Radio College, Cromwell House, High Holborn, London, W.C.1, have a range of courses, including a technical course, and a complete technical, service, and commercial course. These courses, which cover a wide field and embrace all phases of radio technique, are designed to give the student a thorough knowledge of radio, and to teach him how to apply his knowledge to practical money-earning advantage. The fees are moderate, and they can be paid in monthly instalments if the student so desires. The principal of the T. and C.R. College is Mr. R. Heath Bradley.

"SQUADRONS OF THE R.A.F." *by Major F. A. deV. Robertson, V.D., M.A. Published by Flight Publishing Co. Price 7s. 6d., 130 pp.*

A WONDERFUL record of the life of the various squadrons of the Royal Air Force has been produced under the above title by Flight Publishing Company, Dorset House, Stamford Street, London, S.E.1. In addition to a brief history of the R.A.F., this deals in detail with the history and activities of note of all the Squadrons, and includes War history and the Squadron Insignia. The book is lavishly illustrated with remarkable pictures of various craft in flight, and the pictures alone are well worth the price of the book. Much of the information which is given has hitherto been unobtainable and has now been given by courtesy of the Air Ministry. The book measures 8in. by 12in., and an interesting foreword is given by the Rt. Hon. Sir Philip Cunliffe Lister, C.B.E., M.C., Secretary of State for Air.

"LIGHT AND SOUND." *Price 2s. 3d. (bound in full cloth 2s. 6d.). By H. G. Lambert, B.Sc., A.I.C., and P. E. Andrews, B.A., B.Sc. 180 pages. 150 illustrations. Published by University Tutorial Press, Ltd., High Street, New Oxford Street, London.*

THIS interesting volume is intended as a first course in light and sound for the lower science forms of public and secondary schools. Written in simple language, it will give pupils a thorough grounding in the fundamentals of the subject. To this end the authors have carefully selected the experiments described and they can be easily understood and performed by the average boy. To give reality to the subject, and to maintain the interest of the reader, applications of the scientific facts involved, to examples with which the pupil is familiar in everyday life, are discussed where possible. A three-page index is also given at the back of the book.

"TELEVISION UP-TO-DATE." *Price 2s. 6d. By R. W. Hutchinson, M.Sc. 184 pages. 134 illustrations. Published by University Tutorial Press, Ltd., High Street, New Oxford Street, London.*

AS a result of the tremendous advances which have recently been made in the science of Television, and of the fact that it is about to become an important public service, there is an urgent need for an unbiased account of what television is, what it can do to-day, how it does it, and what are its possibilities for the future. In the above book this need is supplied in a simple and interesting way. No previous knowledge of electricity, wireless, or television on the part of the reader is assumed, yet all explanations are based on sound and modern scientific principles.

REPLIES IN BRIEF

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

E. J. E. (Ipswich). The indication is that your earth is very inefficient, or that your aerial circuit is not ideal. We have no details of a converter using the parts in question.

E. D. (Renfrew). We have no details of the coil and cannot suggest the appropriate connections for the circuit in question.

H. Y. (Queens Park). We regret the coil differences are not clear to us. If you can obtain a circuit of the coil from the makers you should be able to incorporate this in your set, but we cannot advise the change without re-designing the receiver in view of the possibility of instability, etc.

F. N. (Gloucester). Coils of the type you outline are obtainable from Messrs. Bulgin. No self-contained switch is fitted, however, but the makers supply a suitable component for the purpose.

C. W. (Leicester). In view of your locality and the simple type of the circuit used, a Droitwich suppressor is your easiest and most effective solution. Your local dealer should be able to supply one of these.

C. S. (Arkengales). We regret that we have no blueprint suitable for your use. It would be preferable to dispose of the receiver in a complete form and obtain new parts for a circuit chosen from our list of blueprints.

E. H. (Abington Pigotts). A suitable transformer may be obtained from Messrs. Heayberd, of 10, Finsbury Street, London, E.C.2.

D. C. (Barking). The coil is no longer on the market, but any good modern coil could be incorporated in the receiver. We suggest you inquire of your local dealer for details of the various coils and select one to suit your requirements.

T. H. (Sandwich). Your suggestion for charging is quite in order provided that the battery delivers sufficient current and that the internal resistance is high.

S. A. A. (N. Kensington). The receiver was not designed by us and we are therefore unable to help you. We suggest you communicate with the designer or the editor of the paper in which the design appeared.

R. H. (Erith). We regret that we no longer include station identification in our Queries service.

C. F. W. (Stockwell). It would appear that the pentagrid stage is unstable, probably on account of an excessive voltage applied to the oscillator anode. We suggest that you check all voltages before going further with the trimming adjustments.

R. C. C. (South Molton). We suggest the Hall-Mark Four for your particular case. The blueprint is obtainable from this office, price 1s.

W. H. S. (Downderry). We have no details of such a set as you outline. Our £4 Superhet 4 is the nearest but no A.V.C. is incorporated.

S. W. D. (Crathie). The firm in question has now gone out of business and the parts are no longer obtainable. Similar items may, however, be obtained from No. 95, Dean Street, London, W.1.

R. S. (Abbotskerswell). We suggest you communicate direct with the makers or their service agent. The address is 24, Thames Street, Kingston-on-Thames, Surrey.

W. J. A. H. (Kingston). The coils may be fitted to any receiver, and the makers supply a circuit diagram with them which will be of assistance to you.

G. F. (Burnley). Any good modern coil may be used. Your local dealer will be able to show you a range or you may select a coil from the advertisements included in our pages.

E. L. (Mile End). The reason for your difficulty is to be found in the impedance of the detector valve. This differs from the original valve and thus you have modified the entire circuit. You may remedy matters by increasing the H.T. applied to the valve or by modifying the capacity of the reaction condenser. The former is preferable.

L. G. (Onllwyn). The receiver is a commercial model and we suggest that you communicate with the makers. The address is Portadyne Works, Gorst Road, North Acton, London, N.W.10.

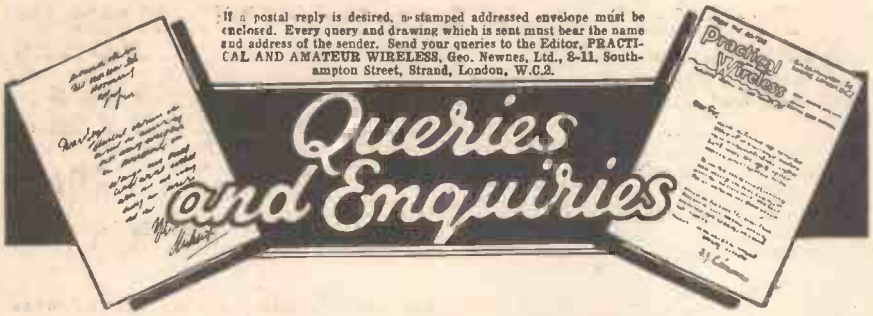
F. S. (Worcester Park). We regret that we cannot supply a diagram of a transmitter.

G. R. C. (Norwich). You enclosed no envelope for the purpose of sending you plans. In any case, we regret that we have no blueprint or other details suitable for your particular requirements, but recommend the amplifier described in this issue.

D. W. (Sawbridgeworth). It would appear that there is a serious H.T. leak, but we cannot help you without further details.

D. P. (Epping). The circuit is not suitable for your purpose and should not be made up without first obtaining a Post Office transmitting licence.

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



SPECIAL NOTE

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

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

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

Matching Coils

"I have an old set of coils which have been in use for some time and which do not appear to be matched. When I removed the can I found that the end turns on both coils had become loose and were not close against the remainder of the coil. The cement on the coil former appears to indicate by the marks that the coils were never close together at the end and, in order to maintain the matching, I should like to know whether this is so, or whether all turns must touch."—G. H. (Kettering).

THERE are certain types of coil which employ the spaced turns principle for matching, but, generally speaking, only the end three or four turns are so spaced. It would be preferable in your case to place one coil with the turns touching and stick them in place, and then to adjust the turns on the remaining coil in an endeavour to obtain a matched pair. This will not be a simple matter if you have no good test equipment, although by tuning to opposite ends of the scale it may be found possible to effect a good compromise. The turns should be moved with a long, insulated instrument to avoid changes due to hand-capacity.

Interference Suppressor

"I get a lot of interference on my mains and should like to build a suppressor. Is it necessary to use an ordinary condenser or will a bakelite dielectric do? I have a number of plug-in and dual-range coils and should like to use these if possible. I have tried the simple wave-trap, but should like something more elaborate as this does not work very well."—G. Y. (Watford).

IT would appear that you are confusing the two types of interference remover. One type is intended for removing noises carried by the electric supply mains, and the other is intended for removing station interference. In the latter case a simple wave-trap device should be quite satisfactory, but for the former type of interference special apparatus must be connected across the mains input. Usually, two fixed condensers are employed, but an elaboration consists of special H.F. chokes in each lead with a condenser network across the mains leads and to earth. Perhaps you could be more explicit regarding the type of interference which you wish to remove.

Using an Eliminator

"My set is the standard S.G. detector and power, with two H.T. leads. One is marked H.T.2 and supplies all the anodes except the detector, whilst H.T.1 supplies the detector anode and the S.G. of the first valve. I have been given an A.C. battery eliminator which has two output terminals, one marked Max and one marked S.G. Can I use the latter for my H.T.1 tapping without damage to the detector valve, and if not, what alterations must be made?"—D. R. A. (Penge).

THE usual method of marking the output from a small H.T. battery eliminator is to show that a low-voltage supply is available for such purposes as feeding the screening grid or detector stage. Generally, this supply ranges from 40 to 80 volts, and thus should be suitable for supplying the H.T.1 lead in your receiver. In some units, however, the internal arrangement for obtaining this low voltage is such that instability would be experienced in a receiver of your type, and the only satisfactory method of using the unit then would be to fit a voltage dropping and decoupling resistance between the anode circuit of the detector valve and H.T.2, and between the screening grid and H.T.2 with the usual fixed condenser between these points and earth. The tapping on the mains unit would not then be employed. This arrangement should always be adopted when instability is experienced with a small mains unit.

Earth Loops

"I should like to raise a point concerning the methods adopted in wiring your receivers. I notice that you always employ a metal chassis (or what is, in effect, a metal chassis) and take various earth leads direct to an anchor bolt on this chassis. Thus there are a number of separate earth loops formed and there is no direct continuity between all the H.T.—leads and earth. I should have thought that such a scheme would have led to peculiar tuning effects and losses, and should be glad to hear your views on this point."—B. T. (Harrogate).

THE method of construction adopted by us has been well tested and found satisfactory. We should not employ this scheme if there were any possibility of introducing troubles as outlined by you. It must be remembered that all the points which are marked M.B. on a wiring plan are in direct connection through the metal surface of the chassis, and there is surely no difference between this and the running of a wire from each of these points to a single earth terminal. On the other hand, the latter scheme might lead to difficulties, as it would indeed form loops to earth in various parts of the circuit, whereas when the chassis is earthed, the loops are removed and all "earthed" points are at the same potential. This point does not apply, of course, if the earth connections are bad, due to dirt, etc., and then instability might be experienced.

Switching

"I attach a sketch of a receiver which I propose to build, and it will be seen that I wish to use it for short as well as broadcast wavebands and for gramophone record reproduction. I am not certain whether the 8-point switch I have fitted is to be desired and whether any further screening is desirable in this circuit. Can you please advise me on this point?"—B. W. (Shudehill).

THE use of a switch of this type is not recommended for the purpose shown by you. Apart from losses on the short-wave bands due to the crowding of wires, there is certain to be instability due to the grid wiring for pick-up switching to this switch. Although of low self-capacity and possessing good contacts, this particular component is very compact and thus the wires will be very crowded. It will be found preferable to employ the separate switch arrangements as used by us in the A.C. Superformer, where small toggle switches are mounted beneath the chassis and operated by a spindle passing through them. Any number of switches may be used in this way, and each may be placed in the most convenient position to avoid long wiring and interaction. The parts are obtainable from Messrs. Bulgin.

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

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 1/3, 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) ..	14.10.33	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
Alpha Q.P.P. Three (D,Q.P.P.) ..	25.3.33	PW14
Ferrocart Q.P.P. Hi-Mag Three (SG, D, Q.P.P.)	25.3.33	PW15
Sixty-Shilling Three (D, 2 LF (R.C. & trans))	2.12.33	PW34A
Leader Three (SG. D, Pow.) ..	3.3.34	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.))	23.3.35	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	PM1
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
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)	2.2.35	PW46
F. J. Camm's Superformer (SG, SG, D, Pen)	12.10.35	PW57
Mains Operated		
Two-valve: Blueprints, 1s. each.		
A.C. Twin (D (pen), Pen) ..	22.4.33	PW18
A.C.-D.C. Two (SG, Power) ..	7.10.33	PW31
Selection A.C. Radiogram Two (D, Pow.)	29.4.33	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)	16.9.33	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
"Allwave" 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)	25.2.33	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	10.2.34	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 4 ..	16.11.35	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)	15.12.34	PW44
F. J. Camm's A.C. £4 Superhet 4	7.12.35	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	W38A
Three-valve: Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Power)	23.9.33	PW30A
PORTABLES.		
Three-valve: Blueprints, 1s. each.		
Atom Lightweight Portable (SG, D, Pen)	2.6.34	PW36
Four-valve: Blueprints, 1s. each.		
Featherweight Portable Four (SG, D, LF, Cl. B)	6.5.33	PW12

MISCELLANEOUS.

S.W. Converter-Adapter (1 valve)	23.2.35	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE.

CRYSTAL SETS.

Blueprints, 6d. each.		
Four-station Crystal Set	—	AW427
1934 Crystal Set	4.8.34	AW444
150-mile Crystal Set	—	AW450

STRAIGHT SETS. Battery Operated.

One-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)	17.6.33	AW392
Iron-core Two (D, Trans) ..	—	AW395
Iron-core Two (D, Q.P.P.) ..	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D, Trans)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans) ..	—	AW338A
Lucerne Minor (D, Pen)	—	AW426
Three-valve: Blueprints, 1s. each.		
P.T.P. Three (Pentode-Triode-Pentode)	*June* '35	WM389
Class-B Three (D, Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-Built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans) ..	2.12.33	AW412
1934 Ether Searcher: Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher, Chassis Model (SG, D, Pen)	3.2.34	AW419
Lucerne Ranger (SG, D, Trans)	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
P.W.H. Mascot with Lucerne Coils (D, RC, Trans)	17.3.34	AW337A
Mullard Master Three with Lucerne Coils	—	AW424
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All Britain Three (HF, Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.1.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple tune Three (SG, D, Pen)..	*June,* '33	WM327
C.B. Three (D, LF, Class B) ..	—	WM333
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)	*Oct.* '34	WM371
Graduating to a Low-frequency Stage (D, 2LF)	*Jan.* '35	WM378
Four-valve: Blueprints, 1s. 6d. each.		
65/- Four (SG, D, RC, Trans) ..	—	AW370
"A.W." Ideal four (2SG, D, Pen)	10.9.33	AW402
2 H.F. Four (2SG, D, Pen) ..	—	AW421
Crusaders' A.V.C. 4 (2HF, D, QP21)	18.8.34	AW445
(Pentode and Class-B Outputs for above: blueprints 6d. each) ..	25.8.34	AW445A
Quadradyne (2SG, D, Pen) ..	—	WM273
Calibrator (SG, D, RC, Trans) ..	*Oct.* '32	WM300
Table Quad (SG, D, RC, Trans) ..	—	WM303
Calibrator de Luxe (SG, D, RC, Trans)	*Apr.* '33	WM316
Self-contained Four (SG, D, LF, Class-B)	*Aug.* '33	WM331
Lucerne-Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2LF)	*Feb.* '35	WM381
The H.K. Four	*Mar.* '35	WM384
Five-valve: Blueprints, 1s. 6d. each.		
Super-quality Five (2HF, D, RC, Trans)	*May* '33	WM320

Miscellaneous Advertisements

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

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THE Following Types, 5/6 each; 350v. 120 m.a., full wave rectifiers, 500v. 120 m.a., full wave rectifiers, 2½ watt indirectly heated pentodes.

2-VOLT H.F., L.F., 2/3; power, low consumption power, super power, 2/9; screen grid, variable mu screened grid, 5- or 4-pin pentodes, V.M.H.P., H.F.P., Class B, 5/-.

THE Following American Types, 4/6; 250, 210, 245, 47, 46, 24, 35, 51, 57, 58, 55, 37, 80, 6A7, 2A7, 27, 77, 78, 2A5, 281; all other American types, 6/6 each.

RELIABLE Soldering Irons, 200-250 volts, 2/6, consumes 0.2 amps.

PREMIER, Short-wave Tuning Condensers (S.L.F.), complete, ceramic insulation, silver sprayed, brass vanes, noiseless pigtail, 0.00015, 0.00016, 0.0001, 2/9; double spaced 0.00005, 0.000015, 0.000025, 3/- each.

BRASS Reaction Condensers (S.L.C.), with integral slow-motion, 2/9; mica condensers, 0.00002, 0.00005, 6d.

PREMIER Short-wave Coils, with circuit, 4- and 6-pin type, set of 4, 13-170 metres, 7/-; for either type; Lowloss formers, 4- and 6-pin ribbed, 1½in. diameter, 1/-; short-wave valveholders, 4-, 5- and 7-pin chassis type, 6d.

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12-2,000 metres, without coil changing. Lissen All-band 2-gang screened coils, for screened grid H.F. stage (tuned), screened grid detector type receiver, circuit supplied, giving complete details, 12/6.

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1,000 Ohm 150 milliamp., semi-variable resistance, 2/-; 1,000 ohm, 50 milliamp., tapped for any number 0-18 valves, 3/6. 800 ohms 350 m.a., tapped, 2/-.

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(*Continued at top of column three*)

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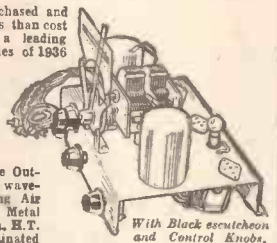

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(*Continued from foot of column one*)

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